Pennsylvania State University Soil Characterization Laboratory Database System Documentation

by

Edward J. Ciolkosz

Agronomy Series Number 145

April 2000

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INTRODUCTION

Soils have been sampled and analyzed in Pennsylvania for characterization since 1954. The initial sampling was done by the USDA Soil Conservation Service (SCS) now known as the USDA Natural Resources Conservation Service (NRCS). Subsequent samplings have been done by the Penn State Soil Characterization Laboratory, US Environmental Protection Agency (EPA), and the NRCS. Presently, 949 pedons (profiles) have been collected and analyzed. An account of the history of the sampling is given in Ciolkosz (1998). Initially the data (site, horizon, and laboratory) was available in hard copy printed form. Since the development of the computer, particularly the PC with large data capacities, the Pennsylvania analysis system and data have been computerized (see Ciolkosz, 2000; Ciolkosz and Thurman, 1992, 1994; Thurman et al., 1994). In order for a computer system to have longevity as it is modified and updated by computer programmers, the data system must be documented. Thus, the objective of this publication is to document the Penn State University Soil Characterization Laboratory Database System.

DOCUMENTATION

The Penn State Soil Characterization system is written in Clipper 5.2d. Clipper is a compiler of a Superset of the dBase language. The product formerly from Nantucket is now maintained and distributed by Computer Associates. The data files are in dBase III & dBase IV format with the exception of the HORZTEMP.DBF file which is in Clipper format which allows more that 254 fields. With 949 pedons of data, the system takes up 14 megabytes of disk space.

The main or entry program is MENU.PRG.

Clipper provides a MAKE facility called RMAKE and a Linker called RTLink. To compile the program, the user simply needs to type RMAKE MENU while in the subdirectory containing the program files (C:\PEDON\PROGRAMS). The make file is MENU.RMK and the link file is MENU.LNK.

The program is run from the C:\PEDON subdirectory by typing MENU. The MENU.EXE must be in the C:\PEDON subdirectory or on the DOS Path. To simplify the development cycle the MENU.EXE was kept in the C:\PEDON\PROGRAMS subdirectory, and that directory was added to the path.

1 Data Files

1.1 PEDON---All the data files common to the entire system

1.1.1 SYSTEM

This file is used to store current printer settings.

1.1.2 SOILNAME

This file is a list of all unique soilnames in the system. It is used to load an array at system startup. This array is used to provide a pop-up list of soilnames available when editing the site data.

1.1.3 CLASCODE

This file contains a variety of classification codes and descriptions for those codes. The descriptions are used during the report generation of Site, Horizon and Lab reports.

1.1.4 HORICODE

This file contains several horizon codes and descriptions for those codes. The descriptions are used for the Horizon and Lab reports.

1.1.5 VEGCODE

Vegetation codes and corresponding descriptions

1.1.6 MUNSCODE

The MUNSCODE file contains the Munsel color codes and descriptions for those codes. The descriptions are used in the generation of Horizon reports.

1.1.7 PACLASS

The PACLASS file contains the Pennsylvania Parent Material classification codes and descriptions for those codes. The descriptions are use in the generation of Site reports.

1.1.8 SS&D

The SS&D file is taken from the SITEDATA.S&D file which describes all the data elements in the SITEDATA.DBF file. It is used by the data export procedures (found in STATS.PRG) to generate a description file to accompany any exported data files.

1.1.9 LS&D

The LS&D file is taken from the LABDATA.S&D file which describes all the data elements in the LABDATA.DBF file. It is used by the data export procedures (found in STATS.PRG) to generate a description file to accompany any exported data files.

1.1.10 MS&D

The MS&D file is taken from the HORIDATA.S&D file which describes all the data elements in the HORIDATA.DBF file. It is used by the data export procedures (found in STATS.PRG) to generate a description file to accompany any exported data files.

1.1.11 STRFILE

The STRFILE file contains the field descriptions of the Clipper format (up to 1000 fields) HORZTEMP file. When the HORZTEMP file is missing, the system creates it from the STRFILE using a CREATE FROM statement.

1.2 \PEDON\SOILCHAR -- The main body of data

1.2.1 SITEDATA

The SITEDATA file contains data that is global to the site.

This field list was taken from SITEDATA.S&D as of 02-03-2000. For the most recent listing of field names and descriptions see SITEDATA.S&D.

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
NUMBER	C	9	0	State, County (001 to 067) and pedon number (sequential within a county)
NUMBERFIPS	C	9	0	State, County (Federal number system using only odd numbers 001,003 etc.) and pedon number
SERIESNAME	C	18	0	Current soil series name
SAMPLEDBY	C	4	0	Group that sampled the soil (PSU,NRCS,EPA)
CLASSTAX	C	1	0	Taxadjunct or variant (T or V code)
DATE	C	8	0	Date described
STATE	C	2	0	State abbreviation(PA,NY,NE etc.)
COUNTY	C	3	0	County code number(001 to 067 for PA)
UNIT	C	3	0	Pedon number within the county(001 to 999)
SUBUNIT	C	1	0	Unique subdivision
HORIZCOUNT	N	2	0	Number of horizons in the pedon
MLRA	C	3	0	Major land resource area number
MLRASUB	C	1	0	Major land resource area number subscript
LATITUDE	C	7	0	Latitude in degrees, minutes, seconds; direction
LONGITUDE	C	8	0	Longitude in degrees, minutes, seconds; direction
SURVEYID	C	3	0	Soil survey area identification number
MAPUNITSYM	C	5	0	Map unit symbol for map unit where pedon was collected
NOTEID	C	5	0	Identification number for notes
TRANSECTID	C	5	0	Identification number for transect data stop; number of transect; actual interval between transects
YIELDID	C	5	0	Identification number for yield data
PHOTONUM	C	5	0	Aerial photograph number
LABSAMPLE	C	13	0	Soil Characterization laboratory sample storage number
DESCTYPE	C	2	0	Code for the reason for the description
PEDONTYPE	C	2	0	Code for what the pedon represents
PREVSNAME1	C	18	0	Series name when sampled
PREVSNAME2	C	18	0	Series name after first name change
PRCNTSLOPE	C	3	0	Percent slope at this site
SLOPESHAPE	C	2	0	Code for shape of the slope up and down and across slope
GEOMORPCO	C	1	0	Code for geomorphic slope component
HILLSLOPEC	C	1	0	Code for hillslope component
SLOPEASPCT	C	3	0	Slope aspect (0 to 360 degrees)
SLOPLNGABV	C	4	0	Slope length from crest to site (meters)
SLOPLNGTOT	C	4	0	Total slope length (meters)

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
MICROREKND	C	1	0	Code for kind of microrelief
MICROREAMT	C	1	0	Code for vertical change in microrelief
MICROREPAT	C	1	0	Code for pattern of microrelief
PDNPOSITON	C	1	0	Code for relative position of the site on slope
REGNLPHYS	C	2	0	Code for major landform
LOCALPHYS	C	2	0	Code for local landform
ORDER	C	1	0	Code for soil taxonomy order
SUBORDER	C	2	0	Code for soil taxonomy suborder
GREATGROUP	C	2	0	Code for soil taxonomy great group
SUBGROUP	C	4	0	Code for soil taxonomy subgroup
PARTSIZECL	C	3	0	Code for soil taxonomy particle size class
MINERALOGY	C	2	0	Code for soil taxonomy mineralogy class
ACTIVITY	C	4	0	Code for soil taxonomy activity class
REACTION	C	2	0	Code for soil taxonomy reaction class
TEMPERATUR	C	2	0	Code for soil taxonomy temperature regime
OTHER	C	2	0	Code for soil taxonomy other family type
DATECORREL	C	8	0	Date soil name correlated
PERSCORREL	C	20	0	Name of person who did the soil name correlation
PRECIPCM	C	3	0	Annual precipitation at site in centimeters
WATERDEPTH	C	3	0	Depth of water table when described in centimeters
WATERDAYS	C	3	0	Duration of water table in days
WATERKIND	C	1	0	Code for kind of water table
LANDUSE	C	1	0	Code for kind of landuse
STONINESS	C	2	0	Percent surface cover of rocks or stoniness class code
HYDRALCOND	C	1	0	Code for hydraulic conductivity class
PERMEABLTY	C	1	0	Code for permeability class
DRAINAGE	C	1	0	Code for drainage class
ELEVATION	C	5	0	Elevation above mean sea level in meters
ELEVATDEM	C	5	0	Elevation calculated from a DEM model in meters
ELE_ELEDEM	C	5	0	Elevation difference between estimated and DEM model in meters
PM1WEATHER	C	1	0	Code for parent material weathering intensity
PM1MODEDEP	C	1	0	Code for parent material mode of deposition
PM1ORIGIN	C	2	0	Code for bedrock source of parent material
PM2WEATHER	C	1	0	Code for parent material weathering intensity
PM2MODEDEP	C	1	0	Code for parent material mode of deposition
PM2ORIGIN	C	2	0	Code for bedrock source of parent material
PM3WEATHER	C	1	0	Code for parent material weathering intensity
PM3MODEDEP	C	1	0	Code for parent material mode of deposition
PM3ORIGIN	C	2	0	Code for bedrock source of parent material
PM4WEATHER	C	1	0	Code for parent material weathering intensity
PM4MODEDEP	C	1	0	Code for parent material mode of deposition
PM4ORIGIN	C	2	0	Code for bedrock source of parent material
BEDRCKDIP	C	2	0	Bedrock dip in degrees (from horizontal; 0 to 90)
BEDRCKSTRK	C	3	0	Bedrock strike in degrees (0 to 360)
BEDRCKFRAC	C	1	0	Code for bedrock fracture
AIRTMPANN	C	4	1	Average annual air temperature degrees C
AIRTMPSUMR	C	4	1	Average summer air temperature degrees C
AIRTMPWNTR	C	4	1	Average winter air temperature degrees C
TEMPANNUAL	C	4	1	Average annual soil temperature degrees C
TEMPSUMMER	C	4	1	Average summer soil temperature degrees C
TEMPWINTER	C	4	1	Average winter soil temperature degrees C
MOISTUREGI	C	2	0	Code for soil taxonomy moisture regime
WTHRSTATN	C	6	0	U.S. weather station number for representative weather station

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
CONTRLSECT	C	6	0	Particle size control section upper and lower depth in centimeters
WATEROSION	C	1	0	Code for water erosion
RUNOFF	C	1	0	Code for runoff
DH1DEPTH	C	6	0	Soil taxonomy diagnostic horizon - depth in cm
DH1KIND	C	1	0	Soil taxonomy diagnostic horizon - kind
DH2DEPTH	C	6	0	Soil taxonomy diagnostic horizon - depth in cm
DH2KIND	C	1	0	Soil taxonomy diagnostic horizon - kind
DH3DEPTH	C	6	0	Soil taxonomy diagnostic horizon - depth in cm
DH3KIND	C	1	0	Soil taxonomy diagnostic horizon - kind
DH4DEPTH	C	6	0	Soil taxonomy diagnostic horizon - depth in cm
DH4KIND	C	1	0	Soil taxonomy diagnostic horizon - kind
DH5DEPTH	C	6	0	Soil taxonomy diagnostic horizon - depth in cm
DH5KIND	C	1	0	Soil taxonomy diagnostic horizon - kind
FLOODFRQ	C	2	0	Code for frequency of flooding
FLOODMONTH	C	2	0	Beginning month of flooding
FLOODDAYS	C	2	0	Duration of flooding in days
PONDFRQ	C	2	0	Code for frequency of ponding
PONDMONTH	C	2	0	Beginning month of ponding
PONDDAYS	C	2	0	Duration of ponding in days
VEG1SPECIE	C	6	0	Code for vegetation species
VEG2SPECIE	C	6	0	Code for vegetation species
VEG3SPECIE	C	6	0	Code for vegetation species
VEG4SPECIE	C	6	0	Code for vegetation species
VEG5SPECIE	C	6	0	Code for vegetation species
VEG6SPECIE	C	6	0	Code for vegetation species
VEG7SPECIE	C	6	0	Code for vegetation species
VEG8SPECIE	C	6	0	Code for vegetation species
VEG9SPECIE	C	6	0	Code for vegetation species
VEG10SPEC	C	6	0	Code for vegetation species
ASSOCSOIL1	C	16	0	Name of associated soil on landscape
ASSOCSOIL2	C	16	0	Name of associated soil on landscape
ASSOCSOIL3	C	16	0	Name of associated soil on landscape
ASSOCSOIL4	C	16	0	Name of associated soil on landscape
DSCRBRSNMS	C	150	0	Names of describers
LOCATION	C	254	0	Location of pedon, free form description
NOTES1	C	254	0	Free form site notes
NOTES2	C	254	0	Free form site notes
NOTES3	C	254	0	Free form site notes
QUADSHEET	C	20	0	USGS 7 1/2 minute topographic map name
TOWNSHIP	C	20	0	Township name
PAPARMAT	C	5	0	Code for Penn State soil char lab parent material
PLOWED	L	1	0	Code for was the soil plowed (Y yes : N no)
SOILTYPE	C	36	0	Soil type (surface texture)
PERCO1	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO2	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO3	C	6	0	Percolation rate (in?hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO4	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO5	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
PERCO6	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO7	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCO8	C	6	0	Percolation rate (in/hr) see Matelski (1975) Pa Expt Sta Progress Rept 345
PERCOAVG	C	6	2	Average percolation rate (in/hr)

1.2.2 HORIDATA

The HORIDATA file contains data for each layer of soil observed at a site. These records contain all information recorded in the field.
HORIDATA.S&D   02-03-2000

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
NUMBER	C	9	0	State, County (001 to 067) and pedon number (sequential within a county)
NUMBERFIPS	C	9	0	State, County (Federal number system using only odd numbers 001,003 etc.) and pedon number
SERIESNAME	C	18	0	Current soil series name
SAMPLEDBY	C	4	0	Group that sampled the soil (PSU,NRCS,EPA)
CLASSTAX	C	1	0	Taxadjunct or variant (T or V code)
HORIZONNUM	N	2	0	Horizon number (sequential from surface down)
UDEPTH	C	3	0	Upper depth of horizon (centimeters)
LDEPTH	C	3	0	Lower depth of horizon (centimeters)
HORDISCONT	C	1	0	Horizon lithologic discontinuity
MASTERLETT	C	3	0	Horizon master letter
HORISUFFIX	C	4	0	Horizon suffix
LATERALEXT	C	2	0	Volume percent laterally that the horizon features occupies
TOTALEXTNT	C	2	0	Total volume percent of feature in horizon
AVGTHICKNS	C	3	0	Average thickness of horizon in cm
MAXTHICKNS	C	3	0	Maximum thickness of horizon
MINTHICKNS	C	3	0	Minimum thickness of horizon in inches
DRYCLR1LOC	C	1	0	Location of dry color
DRYCLR1PER	C	2	0	Percent of the matrix occupied by color
DRYCLR1HUE	C	5	0	Munsell dry color hue
DRYCLR1VAL	C	1	0	Munsell dry color value
DRYCLR1CHR	C	1	0	Munsell dry color chroma
DRYCLR2LOC	C	1	0	Location of dry color
DRYCLR2PER	C	2	0	Percent of the matrix occupied by color
DRYCLR2HUE	C	5	0	Munsell dry color hue
DRYCLR2VAL	C	1	0	Munsell dry color value
DRYCLR2CHR	C	1	0	Munsell dry color chroma
DRYCLR3LOC	C	1	0	Location of dry color
DRYCLR3PER	C	2	0	Percent of the matrix occupied by color
DRYCLR3HUE	C	5	0	Munsell dry color hue
DRYCLR3VAL	C	1	0	Munsell dry color value
DRYCLR3CHR	C	1	0	Munsell dry color chroma

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
WETCLR1LOC	C	1	0	Location of moist color
WETCLR1PER	C	2	0	Percent of the matrix occupied by color
WETCLR1HUE	C	5	0	Munsell moist color hue
WETCLR1VAL	C	1	0	Munsell moist color value
WETCLR1CHR	C	1	0	Munsell moist color chroma
WETCLR2LOC	C	1	0	Location of moist color
WETCLR2PER	C	2	0	Percent of the matrix occupied by color
WETCLR2HUE	C	5	0	Munsell moist color hue
WETCLR2VAL	C	1	0	Munsell moist color value
WETCLR2CHR	C	1	0	Munsell moist color chroma
WETCLR3LOC	C	1	0	Location of moist color
WETCLR3PER	C	2	0	Percent of the matrix occupied by color
WETCLR3HUE	C	5	0	Munsell moist color hue
WETCLR3VAL	C	1	0	Munsell moist color value
WETCLR3CHR	C	1	0	Munsell moist color chroma
TXTR1CLASS	C	4	0	Textural class USDA
TXTR2CLASS	C	4	0	Textural class USDA
TXTR1MODIF	C	3	0	Texture modifier
TXTR2MODIF	C	3	0	Texture modifier
STRUC1GRAD	C	1	0	Grade of structure unit
STRUC1SIZE	C	2	0	Size of structure unit
STRUC1SHAP	C	3	0	Shape of structure unit
STRUC2GRAD	C	1	0	Grade of structure unit
STRUC2SIZE	C	2	0	Size of structure unit
STRUC2SHAP	C	1	0	Grade of structure unit
STRUC3SIZE	C	2	0	Size of structure unit
STRUC3SHAP	C	3	0	Shape of structure unit
CONSISTDRY	C	3	0	Dry consistence
CONSISTMOS	C	3	0	Moist consistence
CONSISTOTH	C	3	0	Other consistence
STICKINESS	C	2	0	Stickiness, wet consistence
PLASTICITY	C	2	0	Plasticity, wet consistence
CEMENTATIN	C	1	0	Cementation agent
RUPTURERES	C	2	0	Rupture resistance
MICROPENT	C	2	0	Penetrometer resistance
MOTT1ABUND	C	2	0	Percent of matrix mottle occupies or abundance class
MOTT1SIZE	C	2	0	Size of mottle
MOTT1CONTR	C	1	0	Contrast of mottle
MT1HUE	C	5	0	Munsell color hue of mottle
MT1VAL	C	1	0	Munsell color value of mottle
MT1CHR	C	1	0	Munsell color chroma of mottle
MOTT2ABUND	C	2	0	Percent of matrix mottle occupies or abundance class
MOTT2SIZE	C	2	0	Size of mottle
MOTT2CONTR	C	1	0	Contrast of mottle
MT2HUE	C	5	0	Munsell color hue of mottle
MT2VAL	C	1	0	Munsell color value of mottle
MT2CHR	C	1	0	Munsell color chroma of mottle
MOTT3ABUND	C	2	0	Percent of matrix mottle occupies or abundance class
MOTT3SIZE	C	2	0	Size of mottle
MOTT3CONTR	C	1	0	Contrast of mottle
MT3HUE	C	5	0	Munsell color hue of mottle
MT3VAL	C	1	0	Munsell color value of mottle
MT3CHR	C	1	0	Munsell color chroma of mottle
SURFEA1KND	C	1	0	Kind of coat or surface feature code

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
SURFEA1AMT	C	2	0	Percent of the surface covered by coat or abundance class
SURFEA1CN	C	1	0	Continuity of coat
SURFEA1DIS	C	1	0	Distinctness of coat
SURFEA1LOC	C	1	0	Location of coat
SURFEA1HUE	C	5	0	Munsell color hue of coat
SURFEA1VAL	C	1	0	Munsell color value of coat
SURFEA1CHR	C	1	0	Munsell color chroma of coat
SURFEA2KND	C	2	0	Percent of the surface covered by coat or abundance class
SURFEA2CN	C	1	0	Continuity of coat
SURFEA2DIS	C	1	0	Distinctness of coat
SURFEA2LOC	C	5	0	Munsell color hue of coat
SURFEA2VAL	C	1	0	Munsell color value of coat
SURFEA2CHR	C	1	0	Munsell color chroma of coat
SURFEA3KND	C	1	0	Kind of coat or surface feature code
SURFEA3AMT	C	2	0	Percent of the surface covered by coat or abundance class
SURFEA3CN	C	1	0	Continuity of coat
SURFEA3DIS	C	1	0	Distinctness of coat
SURFEA3LOC	C	1	0	Location of coat
SURFEA3HUE	C	5	0	Munsell color hue of coat
SURFEA3VAL	C	1	0	Munsell color value of coat
SURFEA3CHR	C	1	0	Munsell color chroma of coat
BOUNDRYTOP	C	1	0	Boundary topography
BOUNDIST	C	1	0	Boundary distinctness
EFFERVCLAS	C	1	0	Effervescence class
EFFERVAGNT	C	1	0	Effervescence agent
EFFERVEXTN	C	1	0	Effervescence extension
FLDPRP1KND	C	2	0	Kind of field measured property
FLDPRP1AMT	C	3	0	Value or amount of field measured property
FLDPRP2KND	C	2	0	Kind of field measured property
FLDPRP2AMT	C	3	0	Value or amount of field measured property
FLDPRP3KND	C	2	0	Kind of field measured property
FLDPRP3AMT	C	3	0	Value or amount of field measured property
FLDPRP4KND	C	2	0	Kind of field measured property
FLDPRP4AMT	C	3	0	Value or amount of field measured property
FLDPRP5KND	C	2	0	Kind of field measured property
FLDPRP5AMT	C	3	0	Value or amount of field measured property
FLDPRP6KND	C	2	0	Kind of field measured property
FLDPRP6AMT	C	3	0	Value or amount of field measured property
SOILWATER	C	1	0	Wetness class
HYDRALCOND	C	1	0	Hydraulic conductivity class for horizon
PERMEABLTY	C	1	0	Code for permeability class
ROOTS1QUAN	C	2	0	Number of roots per unit area (see pores for unit area) or class
ROOTS1SIZE	C	2	0	Size of roots
ROOTS1LOC	C	1	0	Location of roots
ROOTS2QUAN	C	2	0	Number of roots per unit area (see pores for unit area) or class
ROOTS2SIZE	C	2	0	Size of roots
ROOTS2LOC	C	1	0	Location of roots
ROOTS3QUAN	C	2	0	Number of roots per unit area (see pores for unit area) or class
ROOTS3SIZE	C	2	0	Size of roots
ROOTS3LOC	C	1	0	Location of roots
PORES1SHAP	C	2	0	Shape of soil pores
PORES1QUAN	C	2	0	Number of pores in a unit area (1 sq. cm for fine or very fine and 10 sq. cm for coarser pores) or class
PORES1SIZE	C	2	0	Size of pores

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
PORES1CONT	C	2	0	Continuity of pores
PORES2SHAP	C	2	0	Shape of soil pores
PORES2QUAN	C	2	0	Number of pores in a unit area (1 sq. cm for fine or very fine and 10 sq. cm for coarser pores) or class
PORES2SIZE	C	2	0	Size of pores
PORES2CONT	C	2	0	Continuity of pores
PORES3SHAP	C	2	0	Shape of soil pores
PORES3QUAN	C	2	0	Number of pores in a unit area (1 sq. cm for fine or very fine and 10 sq. cm for coarser pores) or class
PORES3SIZE	C	2	0	Size of pores
PORES3CONT	C	2	0	Continuity of pores
CONCEN1KND	C	2	0	Kind of soil body code
CONCEN1QUA	C	2	0	Quantity of soil body in volume percent of matrix occupied or class
CONCEN1SHP	C	1	0	Shape of soil body
CONCEN1SIZ	C	2	0	Size of soil body
CONCEN2KND	C	2	0	Kind of soil body code
CONCEN2QUA	C	2	0	Quantity of soil body in volume percent of matrix occupied or class
CONCEN2SHP	C	1	0	Shape of soil body
CONCEN2SIZ	C	2	0	Size of soil body
CONCEN3KND	C	2	0	Kind of soil body code
CONCEN3QUA	C	2	0	Quantity of soil body in volume percent of matrix occupied or class
CONCEN3SHP	C	1	0	Shape of soil body
CONCEN3SIZ	C	2	0	Size of soil body
ROCKTKIND	C	2	0	Bedrock source code for majority of total rock fragment kind
ROCKTPERCN	C	2	0	Volume percent for total rock fragment content
ROCKTRND	C	1	0	Roundness code for majority of total rock fragment content
ROCKTSIZE	C	1	0	Size code for majority of total rock fragment content
ROCK1KIND	C	2	0	Bedrock source code for rock fragment
ROCK1PERCN	C	2	0	Volume percent of rock fragments
ROCK1RND	C	1	0	Roundness code of rock fragment
ROCK1SIZE	C	1	0	Size code of rock fragment
ROCK2KIND	C	2	0	Bedrock source code for rock fragment
ROCK2PERCN	C	2	0	Volume percent of rock fragments
ROCK2RND	C	1	0	Roundness code of rock fragment
ROCK2SIZE	C	1	0	Size code of rock fragment
ROCK3KIND	C	2	0	Bedrock source code for rock fragment
ROCK3PERCN	C	2	0	Volume percent of rock fragments
ROCK3RND	C	1	0	Roundness code of rock fragment
ROCK3SIZE	C	1	0	Size code of rock fragment
ROCK4KIND	C	2	0	Bedrock source code for rock fragment
ROCK4PERCN	C	2	0	Volume percent of rock fragments
ROCK4RND	C	1	0	Roundness code of rock fragment
ROCK4SIZE	C	1	0	Size code of rock fragment
ROCK5KIND	C	2	0	Bedrock source code for rock fragment
ROCK5PERCN	C	2	0	Volume percent of rock fragments
ROCK5RND	C	1	0	Roundness code of rock fragment
ROCK5SIZE	C	1	0	Size code of rock fragment
ROCK6KIND	C	2	0	Bedrock source code for rock fragment
ROCK6PERCN	C	2	0	Volume percent of rock fragments
ROCK6RND	C	1	0	Roundness code of rock fragment
ROCK6SIZE	C	1	0	Size code of rock fragment

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
RFRAGTV	C	2	0	Rock fragments total (>2mm) percent by volume, estimated in the field)
RFRAG1V	C	2	0	Rock fragments (>250mm [10 in.] percent by volume, estimated in the field)
RFRAG2V	C	2	0	Rock fragments (250 to 76mm [10 to 3 in.] percent by volume, estimated in the field)
RFRAG3V	C	2	0	Rock fragments (76 to 19mm [3 to 0.75 in] percent by volume, estimated in the field)
RFRAG45V	C	2	0	Rock fragments (19 to 2mm [0.75 in. to 2mm] percent by volume, estimated in the field)
NOTES	C	254	0	Horizon note, free form grammatically correct

1.2.3 LABDATA

The LABDATA file contains data for each layer of soil from a site. It is made up of laboratory analysis and calculated values based on that analysis.
LABDATA.S&D   02-03-2000

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
NUMBER	C	9	0	State, County (001 to 067), and pedon number (sequential within a county)
NUMBERFIPS	C	9	0	State, County (Federal number system using only odd numbers 001,003 etc.) and pedon number
SERIESNAME	C	18	0	Current soil series name
SAMPLEDBY	C	4	0	Group that sampled the soil (PSU.NRCS,EPA)
CLASSTAX	C	1	0	Taxadjunct of variant(T or V code)
HORIZONNUM	N	2	0	Horizon number (sequential from surface down)
UDEPTH	N	3	0	Upper depth of horizon (centimeters)
LDEPTH	N	3	0	Lower depth of horizon (centimeters)
HORDISCONT	C	1	0	Horizon lithologic discontinuity
MASTERLETT	C	3	0	Horizon master letter
HORISUFFIX	C	4	0	Horizon suffix
RF1WTP	N	4	1	Rock fragments (>250mm [10 in.] weight percent)
RF2WTP	N	4	1	Rock fragments (250 to 76mm [10 to 3 in.] weight percent)
RF3WTP	N	4	1	Rock fragments (76 to 19mm [3.0 to 0.75 in.] weight percent)
RF4WTP	N	4	1	Rock fragments (19mm to 4.7mm [0.75 in. to 4.7mm] weight percent)
RF5WTP	N	4	1	Rock fragments (4.7 mm to 2.0 mm fraction, weight percent)
RFTWTP	N	5	1	Rock fragments total weight percent of <2mm + >2mm material
LT2MMWTP	N	5	1	Less than 2mm weight percent of total soil material (<2mm + >2mm)
VCSAND	N	4	1	Very coarse sand (2.0 to 1.0 mm fraction, percent by weight of < 2.0 mm material)
CSAND	N	4	1	Coarse sand (1.0 to 0.5 mm fraction, percent by weight of 2.0 mm material)
MSAND	N	4	1	Medium sand (0.5 to 0.25 mm fraction, percent by weight of < 2.0 mm material)
FSAND	N	4	1	Fine sand (0.25 to 0.10 mm fraction, percent by weight of < 2.0 mm material)

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
VFSAND	N	4	1	Very fine sand (0.1 to 0.05 mm fraction, percent by weight of < 2.0 mm material)
VFSAND1	N	4	1	Very fine sand (0.10 to 0.07 mm fraction, < 2 mm material)
VFSAND2	N	4	1	Very fine sand (0.07 to 0.05 mm fraction, percent by weight of < 2.0 mm material)
TSAND	N	5	1	Total sand (2.0 to 0.5 mm fraction, percent by weight of < 2.0 mm material)
TSILT	N	5	1	Total silt (0.05 to 0.002 mm fraction, percent by weight of < 2.0 mm material)
TCLAY	N	5	1	Total clay (< 0.002 mm fraction, percent by weight of < 2.0 mm material)
CSILT	N	4	1	Coarse silt (0.05 to 0.02 mm fraction, percent by weight of < 2.0 mm material)
CMSILT	N	4	1	Coarse + Medium silt (0.05 to 0.005 mm fraction, percent by weight of < 2.0 mm material)
MSILT	N	4	1	Medium silt (0.02 to 0.005 fraction, percent by weight of < 2.0 mm material)
MFSILT	N	4	1	Medium + Fine silt (0.02 to 0.002 fraction, percent by weight of < 2.0 mm material)
FSILT	N	4	1	Fine silt (0.005 to 0.002 mm fraction, percent by weight of < 2.0 mm material)
TCLASSL	C	4	0	Textural class (determined in the laboratory)
TCLASSF	C	4	0	Textural class (estimated in the field)
BDMCLWRF	N	4	2	Bulk density moist clod with rock fragments (g/cc , 1/3 atmosphere moisture)
BDMLT2MM	N	4	2	Bulk density moist less than 2mm material (g/cc, 1/3 atmosphere moisture)
BDMLT2UC	N	4	2	Bulk density moist less than 2mm material (core uncorrected for rock fragments; g/cc 1/3 atmos)
BDDLT2MM	N	4	2	Bulk density dry less than 2mm material(g/cc , oven dry)
BDGT2MM	N	4	2	Bulk density greater than 2mm material (rock fragments, g/cc, oven dry)
BDTSOIL	N	4	2	Bulk density total soil(g/cc ,<2mm + >2mm material, 1/3 atm. moisture)
BDMETH	C	1	0	Bulk density method (C = clod method, R = core method)
RFTVP	N	5	1	Rock fragments total volume percent (calculated from weight & BD data)
PORETSOIL	N	2	0	Porosity total soil (rock fragments + fine earth) volume percent
PORELT2MM	N	2	0	Porosity less than 2mm basis (fine earth basis only, rock fragments not included) volume percent
COLELT2MM	N	5	3	Coefficient of linear extensibility of less than 2mm material
M03ACLWTP	N	5	1	Moisture content 1/3 atmosphere clod with rock fragments, weight percent
M03ALT2WTP	N	4	1	Moisture content 1/3 atmosphere less than 2mm weight percent
M03ALT2UC	N	5	1	Moisture content 1/3 atmosphere less than 2mm weight percent (core uncorrected for rock fragment)
M15ALT2WTP	N	4	1	Moisture content 15 atmosphere less than 2mm weight percent
M3LT2BUWTP	N	4	1	Moisture content 1/3 atmosphere less than 2mm bulk sample (not from clod or core) weight percent
AWLT2MMWTP	N	5	1	Available water less than 2mm weight percent
AWLT2MMVP	N	5	3	Available water less than 2mm volume basis (cm/cm)

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
AWTSOILWTP	N	5	1	Available water total soil(rock fragments + less than 2mm, weight percent)
AWTSOILVP	N	5	3	Available water total soil(rock fragments + less than 2mm, volume basis(cm/cm)
KSLT2MM	N	7	3	Calculated saturated hydraulic conductivity (<2mm) Ahuja et al (1992) USDA ARS GPSRU Tech Rept #2
KSTSOIL	N	7	3	Calculated saturated hydraulic conductivity (<2mm + >2mm rock frags) Ahuja et al (1992)
KUNSLT2MM	N	7	3	Calculated unsaturated hydraulic conductivity (<2mm) Ahuja et al (1992)
KUNSTSOIL	N	7	3	Calculated unsaturated hydraulic conductivity (<2mm + >2mm rock frags) Ahuja et al (1992)
PHWL	N	3	1	pH (1:1 water, lab)
PHWF	N	3	1	pH (1:1 water, field)
PHKCLL	N	3	1	pH (1:1 KCl, lab)
PHKCLF	N	3	1	pH (1:1 KCl, field)
PHCACL2L	N	3	1	pH (1:1 CaCl2, lab)
PHCACL2F	N	3	1	pH (1:1 CaCl2, field)
OCWTP	N	5	2	Organic carbon weigh percent(< 2 mm material)
OCMETH	C	1	0	Organic carbon method (W = Walkly-Black; C = combustion)
TN	N	5	2	Total nitrogen (Kjeldal method)
CN	N	6	2	Carbon/nitrogen ratio
CACO3EQ	N	5	1	Calcium carbonate equivalent (percent < 2 mm material)
CA	N	4	1	Calcium exchangeable (meq/100g)
MG	N	4	1	Magnesium exchangeable (meq/100g)
NA	N	5	2	Sodium exchangeable (meq/100g)
K	N	5	2	Potassium exchangeable (meq/100g)
TB	N	5	1	Total bases exchangeable (meq/100g)
CAMG	N	5	1	Calcium/Magnesium Ratio
ALKCL	N	4	1	Aluminum exchangeable with 1N KCL (meq/100g)
ALCBD	N	5	2	Aluminum extractable with CBD (percent)
MNCBD	N	5	2	Manganese extractable with CBD (percent)
EXACID	N	5	1	Extractable acidity (meq/100g)
CECSUM	N	5	1	Cation exchange capacity sum of cation method (meq/100g)
CECNH4	N	5	1	Cation exchange capacity ammonium acetate method (meq/100g)
BSSUM	N	5	1	Base saturation sum of cations method(percent)
BSNH4	N	5	1	Base saturation ammonium acetate method(percent)
FE2O3	N	4	1	Iron oxides (percent < 2 mm material)
ACIDSOLK	N	6	1	Acid soluble potassium (pounds/acre K; 1.0 N HNO3 method)
KAOL	C	2	0	Kaolinite (percent < 2 um clay)
ILL	C	2	0	Illite (percent < 2 um clay)
VERM	C	2	0	Vermiculite (percent < 2 um clay)
MONT	C	2	0	Montmorillonite (percent < 2 um clay)
CHLOR	C	2	0	Chlorite (percent < 2 um clay)
INTER	C	2	0	Intergrade (percent < 2 um clay)
QUARTZ	C	2	0	Quartz (percent < 2 um clay)
TSULFWTP	N	5	3	Total sulfur weight percent (< 2 mm material)

1.2.4 PEDNUM

The PEDNUM file contains a listing of all the pedons in the system. It is used to load up arrays which are then used to provide pop-up choices for selecting multiple sites during the reporting procedure.

FIELDNAME	TYPE	WIDTH	DECIMALS	DESCRIPTION
NUMBER	C	9	0	State, County (001 to 067), and pedon number (sequential within a county)
PEDNUM	C	46	0	'S',Year Sampled, State, County, Pedon Number
NUMORDER	N	4	0	Numeric order - used for array indexing during report Selections

1.2.5 HORZTEMP

This file is used to combine the information from the HORIDATA and LABDATA files for a single pedon during the editing process. Since the number of fields of HORIDATA and LABDATA combined would exceed the maximum number of fields permitted in a dBase IV file, a Clipper structure file is used instead. There is no need for access to this data file except by the program during the editing process.

1.3 \PEDON\SERVICE

A second body of soil data used for other purposes (i.e. consulting) but not a part of the main system. The structure in these files is identical to that of the \PEDON\SOILCHAR area.

2 Program File Descriptions

2.1 PRG Files

MENU.PRG - This is the Main or Root program of the system.
PROCS.PRG - A number of Procedures and Functions callable from anywhere in the system

2.2 XTRA.LIB

XTRA.LIB - A small library of Procedures and Functions callable from anywhere in the system.

The functions and procedures provided by XTRA.LIB are:

2.2.1 OPENWINDOW()

Syntax:
   OPENWINDOW(name,top,left,bottom,right,regcolor[,edge])

Purpose:
   To create a window on the screen

Arguments:
    name   is a string of characters containing the name of the window to be created
    top   the top row of the window to be created
    left   the left most row of the window to be created
    bottom   the bottom row of the window to be created
    right   the right most row of the window to be created
    color   is a character string indicating the color of the window and it's border
    edge   is a number indicating the edgetype of the border a 2 indicates a double line edge,
               any other number (or not passing this parameter)causes a single line edge to be
               drawn

Returns:
    there is no return value

Usage:
    OPENWINDOW() is used to simplify the creation of a window and can be used with
    CLOSEWINDOW() also found in this file

Library:

2.2.2 CLOSEWINDOW()

Syntax:
    CLOSEWINDOW(name)

Purpose:
    To remove a window on the screen previously created by OPENWINDOW()

Arguments:
    name   is a string of characters containing the name of the window created by
           OPENWINDOW()

Returns:
    there is no return value

Usage:
    CLOSEWINDOW() is used to simplify the removal of a window and should be used with
    OPENWINDOW() also found in this file

Library:

2.2.3 WINDOW()

Note: WINDOW is a newer version of OPENWINDOW and CLOSEWINDOW
Syntax:
    WINDOW(action,top,left,bottom,right,regcolor[,edge][,shadow][,explode])

Purpose:
    To create a window on the screen and close it when done

Arguments:

action   is a string of characters containing the name of the action OPEN or CLOSE

top   the top row of the window to be created

left   the left most row of the window to be created

bottom   the bottom row of the window to be created

right   the right most row of the window to be created

color   is a character string indicating the color of the window and it's border

edge   is a number indicating the edge type of the border a 2 indicates a double line edge, any other number (or not passing this parameter)causes a single line edge to be drawn

shadow   is a logical variable .T. or .F. indicating whether or not the window has a shadowed border creating a sort of 3D effect. .T. causes the window to have a shadow, .F. causes the window to have no shadow

explode is a logical variable .T. or .F. indicating the wayin which a window opens and closes. .T. means the window will 'explode' open and 'implode' shut. .F. causes the window to simply appear and disappear with no special effects.

Returns:

there is no return value

Usage:

OPENWINDOW() is used to simplify the creation of a window and can be used with CLOSEWINDOW() and SCROLLPICK() also found in this file

Library:

2.2.4 YesNoBox()

Syntax:

YesNoBox (boxstring, default, color, top, left)

Purpose:

To create a window on the screen which asks a yes/no question and waits for a response

Arguments:

boxstring   is a string of characters to be placed in the yes no box a semicolon will cause a new line

default   either 'Y' or 'N' which will be the response initially highlighted

color   the color to be used on the yes/no box

top   the top row of the yes no box (this is optional-if omitted the box will be centered vertically)

left   the left column of the yes no box (this is optional-if omitted the box will be centered horizontally)

Returns:

an integer   - 1 for Yes
              - 2 for No
              - 0 if ESC is pressed

Example:
    mYN=YesNoBox ('Do you wish to add; this new data?','N','W+/BR,N/W')
    The variable mYN will be assign the return value
    A box looking something like:
            ****
            * Do you with to add   *
            * this new data?   *
            *   *
            * Y N   *
            ****
    The N will be highlighted

Since we didn't pass TOP and LEFT parameters the box will be centered on the screen

Library: XTRA

2.2.5 MsgBox()

Syntax:
    MsgBox (openclose, boxstring, color, delay, top, left)

Purpose:
    To create and remove a message box on the screen

Arguments:
    openclose 'OPEN','CLOSE' or 'BOTH' which indicate whether to open the message box,
               close the previously opened message box or to open the message box, prompt user
               to hit a key then close the message box
    boxstring a string containing the information to be displayed in the message box, a
               semicolon ';' indicates a new line
    color   the color to use for the message box
    delay   'WAIT' or 'NOWAIT' Wheth er or not to prompt the user to hit a key before
               proceeding
    top   the top row of the message box (this is optional-if omitted the box will be
               centered vertically)
    left   the left column of the message box (this is optional-if omitted the box will be
               centered horizontally)

Returns:
    there is no return value

Example1:
    MsgBox ('BOTH','Time Card has; been added','W+/BR','WAIT')
    A box looking something like:

```
        ************************
        * Your data has        *
        * been added           *
        *                      *
        * any key to continue  *
        ************************
```
when the user hits a key the box will vanish

Example2:
    MsgBox ('OPEN','The current Record; is being deleted;;PLEASE
    WAIT','W+/BR','NOWAIT')
    delete
    pack
    MsgBox ('CLOSE')

```
        A box looking something like:
        ********* **************
        * The current record   *
        * is being deleted     *
        *                      *
        * PLEASE WAIT          *
        ************************
```
will appear; the current record will be marked for deletion
the file will be packed
then the window will vanish

Since we didn't pass TOP and LEFT parameters the boxes in the above examples will be centered on the screen

Library: XTRA

2.2.6 GENERICDEL()

Syntax:
    GENERICDEL()

Purpose:
    To simplify prompting a user for approval to delete a record

Arguments:
    None

Returns:
    there is no return value

GENERICDEL will prompt the user for approval to delete a record. Upon approval the record will be deleted and the database packed.

Library: XTRA

2.2.7 GENERICNXT()

Syntax:
    GENERICNXT()

Purpose:
    Skip forward one record and sound a tone if EOF is reached.

Arguments:
    none

Returns:
    there is no return value

Library: XTRA

2.2.8 GENERICPRV()

Syntax:
    GENERICNXT()

Purpose:
    Skip backward one record and sound a tone if BOF is reached.

Arguments:
    none

Returns:
    there is no return value

Library: XTRA

HYDRAULIC CONDUCTIVITY CALCULATIONS

Hydraulic conductivity data in the database is calculated using the model of Ahuja et al. (1992).
It was calculated as follows:

Ksat = 764.5 (porosity – 0.3 atmosphere volume water content) $^{3.29}$

Ksat = saturated hydraulic conductivity in cm/hr
764.5 = soil texture factor of Ahuja et al. (1992)
Porosity = a Penn State database value calculated from soil bulk density

0.3 atmosphere volume water content = a Penn State value calculated from moisture tension values and bulk density

3.29 = an Ahuja et al. (1992) exponent calculation factor

The Ksat values were calculated on a basis of the < 2 mm material (fine earth) and on a < 2 mm + > 2 mm total soil basis (fine earth plus rock fragments). Data fields were set up to also calculate Kunsat (unsaturated hydraulic conductivity), but it was not deemed feasible to make these calculations at this time.

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