SOUTH FLORIDA WATER MANAGEMENT DISTRICT

VEGETATION COMMUNITIES WITHIN THE LOXAHATCHEE SLOUGH

A GIS-BASED ANALYSIS OF BASELINE CONDITIONS (1995-2000) BEFORE THE CONSTRUCTION AND OPERATION OF THE G-160 STRUCTURE

WATER SUPPLY DEPARTMENT
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

TECHNICAL PUBLICATION WS-18B

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Technical Publication WS-18B

By

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Water Supply Department

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EXECUTIVE SUMMARY

A vegetation monitoring plan was developed as part of the permitting process for the G-160 water control structure, which is being constructed in the C-18 Canal in the Loxahatchee Slough Natural Area. The purpose of this monitoring plan is to characterize vegetation communities within the Loxahatchee Slough Natural Area prior to construction and after operation of the G-160 Structure. This monitoring plan is designed to determine the effectiveness of the first tier of improvements completed under the North Palm Beach County Comprehensive Water Management Plan (Northern Plan) and represents a key component of the Minimum Flows and Levels Recovery Plan for the Loxahatchee River. The results are expected to provide the South Florida Water Management District (SFWMD or District) with beneficial information that will allow adjustments to the operation of the G-160 Structure to effectively meet the Northern Plan objectives, including restoration of a more natural hydroperiod to the Loxahatchee Slough Natural Area and enhanced dry season flows to the Loxahatchee River. The work includes two approaches to monitoring vegetation-- a field-based, site-specific component and a GIS-based, landscape-level analysis of current and historic vegetation communities. This document presents the findings of a baseline (pre-construction/operation) analysis of the extent of major vegetation types within the Loxahatchee Slough Natural Area.

TABLE OF CONTENTS

INTRODUCTION

The extant natural areas of the present-day Loxahatchee Slough are composed of approximately 14,000 acres of pine flatwoods, swale, wet prairies, hydric hammock, strand swamp, slough, dome swamp, depression marsh, and disturbed areas within the Hungryland Slough Natural Area (approx. 3,000 acres) and the Loxahatchee Slough Natural Area (approx. 11,000) (**Figure 1**). Palm Beach County owns and manages both of these natural areas. The slough represents the headwaters of the Loxahatchee River, Florida's first federally designated Wild and Scenic River. The site is the single most ecologically diverse tract of protected land in Palm Beach County, including nine distinct habitat types, the largest oak hammock and swale/slough in the County and 63 federally or state-listed species of plants and animals (Gann et al. 2002).

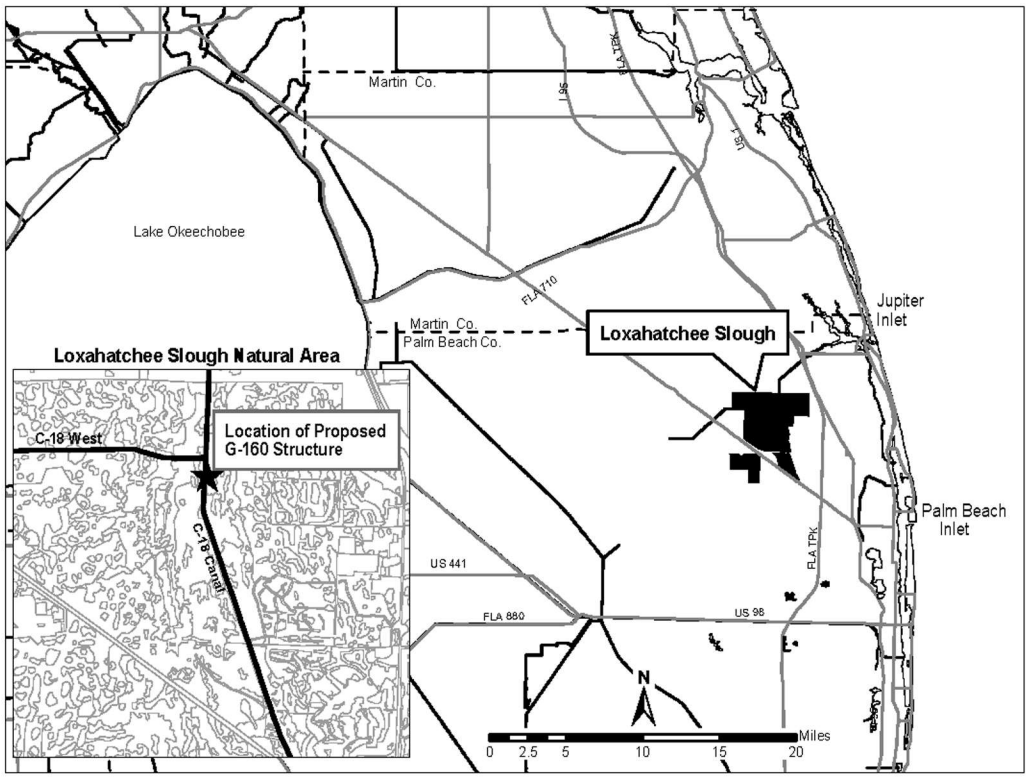


Figure 1. Location of the Loxahatchee Slough Natural Area.

Within the Loxahatchee Slough, land elevations vary from 14 to 19 feet National Geodetic Vertical Datum (NGVD), while the surrounding area surface elevations range from 20- to 23 feet NGVD. The unperched groundwater table ranges in elevation from a low of approximately 13 feet NGVD near the C-18 Canal to a western high of approximately 21 feet NGVD. The groundwater table in this area is relatively shallow and varies significantly due to changes in rainfall and canal operation. The hydrology of the slough has been severely altered through the construction of drainage canals, flood protection berms and fragmentation of the watershed by road construction. Overdrainage

and hydroperiod alterations have supported the establishment of invasive exotic plant species, such as melaleuca (*Melaleuca quinquenervia*), Old-world climbing fern (*Lygodium microphyllum*) and Brazilian pepper (*Schinus terebinthifolius*), decreasing habitat quality for native flora and fauna.

In 2002, a mutual agreement was reached between Palm Beach County's Department of Environmental Resources Management (County) and the South Florida Water Management District (District) with regard to execution of the Loxahatchee Slough Restoration and G-160 Structure Monitoring Plan (Monitoring Plan). The Monitoring Plan was developed to assess the effects of the G-160 water control structure (and subsequent raising of water elevations) on the vegetation structure and composition within the slough, and to determine if wetland restoration goals are achieved. The results are expected to provide the District with beneficial information that will allow adjustments to the operation of the G-160 Structure to effectively meet management goals. This monitoring effort will characterize vegetation communities within the Loxahatchee Slough Natural Area prior to construction and after operation of the G-160 Structure and will include both field studies and landscape-level analysis. This monitoring plan is designed to determine the effectiveness of the first tier improvements completed under the Northern Plan and represents a key component of the Minimum Flows and Levels Recovery Plan for the Loxahatchee River. The G-160 project is also being implemented, in part, as mitigation for adverse wetland impacts that will result from the construction of the Mirasol project, as authorized under District permit # 50-04118-P and the corresponding U.S. Army Corps of Engineers permit.

Proposed G-160 Structure

The proposed G-160 Structure will be a water control structure within the C-18 Canal upstream (south) of its junction with the western leg of the C-18 Canal (C-18 W) as shown in **Figure 1**. The purpose of this structure is to provide for a more natural hydroperiod to the Loxahatchee Slough Natural Area and to enhance dry season and base flows to the Northwest Fork of the Loxahatchee River (Northwest Fork), while maintaining the existing level of flood protection for the developed areas within the C-18 basin. A groundwater recharge benefit may also be realized resulting from the G-160 operation. The operation of the C-18 Canal, along with adjacent land development activities, has caused the surface water levels within the slough to be maintained at lower than historic (pre-development) levels.

Construction of the structure will take place entirely within the existing 300 feet wide right-of-way of the C-18 Canal. Approximately 10,370 cubic yards of soil will be excavated from the levee (upland) for the construction of a bypass channel on the east side of the canal, with the excavated material placed north and south of the channel on the existing levee and stabilized with siltation fencing. The structure itself will traverse the canal and encompass an area 50 feet long, with 20 feet of stone protection upstream and downstream of the facility.

The proposed structure will provide both water supply and drainage benefits, with a primarily environmental water supply component. This structure will be capable of

producing up to 65 cubic feet per second (cfs) for base flow augmentation to the Northwest Fork during the dry season. Discharges through the structure are expected to range from 65 to 700 cubic feet per second (cfs) during the wet season. Water supply releases to the Northwest Fork would range from 0 to 100 cfs during the dry season, depending on water availability. The District intends to provide a base flow of 50 cfs whenever water is available. With rainfall and runoff, the hydraulic heads across the G-160 structure will be controlled at 0.5 feet to provide flood protection to private landowners at the existing (pre-construction) level. The structure is designed to accommodate a maximum discharge rate of 1890 cfs. However, the likelihood of such a storm event is minimal. Water levels upstream of the proposed structure will have a sustained target ranging from 16.0 to 17.5 feet NGVD, though with rainfall and runoff the maximum water level may be allowed to reach 17.8 feet NGVD. The maximum discharge rate will be used when stages exceed 17.70 feet NGVD.

Water levels in the C-18 are currently controlled with the operation of the S-46 structure, a concrete gated spillway with three vertical lift gates, located approximately 2,400 feet east of Florida's Turnpike. This structure is operated to maintain an optimum headwater elevation of 14.8 feet, when available. During major storm events, the gates are operated manually to lower water levels and maintain a stage of 12.8 feet NGVD.

Vegetation Monitoring Plan

The Monitoring Plan (**Appendix A**) requires that Palm Beach County conduct field (site specific) vegetation and hydrological monitoring within the Loxahatchee Slough Natural Area (slough) (**Figure 1**). The District will conduct a GIS-based analysis of vegetation communities within the slough utilizing the Florida Land Use, Cover and Forms Classification System (FLUCCS) developed by the Florida Department of Transportation, 1995 update.

Primary vegetation communities in the Loxahatchee Slough study area include wetlands (palustrine and lacustrine) along with uplands (pine flatwoods). There is also a ridge of hydric hammock that contains a mix of temperate (e.g., oaks) and tropical upland (e.g., stopper and wild coffee) species. Hydroperiod improvements expected from the G-160 Structure should be most evident in wetlands adjacent to, and east of, the C-18 Canal. Some wetlands within the slough are generally of good quality, historically comprised of a matrix of cypress and sloughs. In other areas, shrubby vegetation (e.g., wax myrtle) has invaded the slough and melaleuca is widespread in much of the southern areas. Non-forested wetlands (pickerel weed-*Sagittaria* marsh and *Eleocharis* flats) west of the C-18 Canal have been marginally affected by reduced hydroperiod because of drainage practices in the basin. This can be observed as an increase of non-native or nuisance plant species, as well as a decrease in the distribution and abundance of aquatic invertebrates and vertebrates. In addition, decreased hydroperiod can disrupt organic decomposition rates, nutrient cycling and thus affect primary and secondary production. Restoring a more natural hydroperiod with wet and dry cycles is expected to counteract the effects of the reduced hydroperiod in these wetlands.

METHODS

Literature Search and Review to Determine Historical Vegetation

A literature search was conducted to identify other documentation or studies of historical (pre-drainage) vegetation within the Loxahatchee Slough. Relevant data sets and GIS coverages were compiled and reviewed, and results were compared with current conditions.

GIS Analysis of Current Conditions

As part of the Monitoring Agreement (**Appendix A**), the District has agreed to analyze aerial photography from 1995, 2000, 2005 and 2010. Aerial photography taken before the construction and operation of the G-160 structure (1995 and 2000) will be compared with those taken after (2005 and 2010). This information, together with field monitoring studies, will be used to gauge the success of achieving improved hydroperiods within the slough. Digital Orthophoto Quad (DOQ) aerial photography from the U.S. Geological Survey, available every 5 years, will be used as the base GIS coverage. (*Author's note: the District, U.S. Army Corps of Engineers and other state Water Management Districts are currently considering alternative sensors and cameras as sources of digital orthophotography; U.S. Geological Survey/NAPP data, the current source maps for the DOQs, may not be the source of future DOQs obtained by the District. Hence, an alternative source of base photography may be used in future analyses.*)

Presented in this report are the methods and results of an analysis of 1995 and 2000 DOQs, determining the extent of existing vegetation communities. The FLUCCS (1995) classification system was followed to a minimum of "Level 3" interpretation in defining landscape features. In some instances, a Level 4 interpretation was used where necessary and appropriate. The specific methodology, standards and guidelines used in the photointerpretation and geographical referencing process can be found in the metadata for these GIS coverages (**Appendix B**). GIS coverages were developed for each aerial photo set. From these coverages, the extent (area) of each land use category was calculated. Maps were printed and included in this document. The next update to this document (expected by 2007) will include a section detailing the G-160 structure operation, and changes in hydrology and vegetation resulting since its operation.

RESULTS

Pre-Development Vegetation within the Loxahatchee Slough

The first known map indicating the location and generalized shape of the Loxahatchee Slough is most likely that published by William de Brahm in 1770 (de Vorsey 1971). De Brahm was commissioned by the King of England to survey the southern region of North America and his report shows a map of the "Grenville Inlet", now known as the Jupiter Inlet. The map shows five major branches of the (Loxahatchee) river with two of these branches (present day Southwest Fork and Northwest Fork) originating from a marshy land to the west and southwest (the Loxahatchee Slough) (**Figure 2**). Later illustrations of this area include military maps from 1839 (USACE 1839) (**Figure 3**) and 1856 (Ives 1856) (**Figure 4**), which show the Loxahatchee Slough in relation to the Loxahatchee River, but these do not provide reliable depictions of vegetation community types.

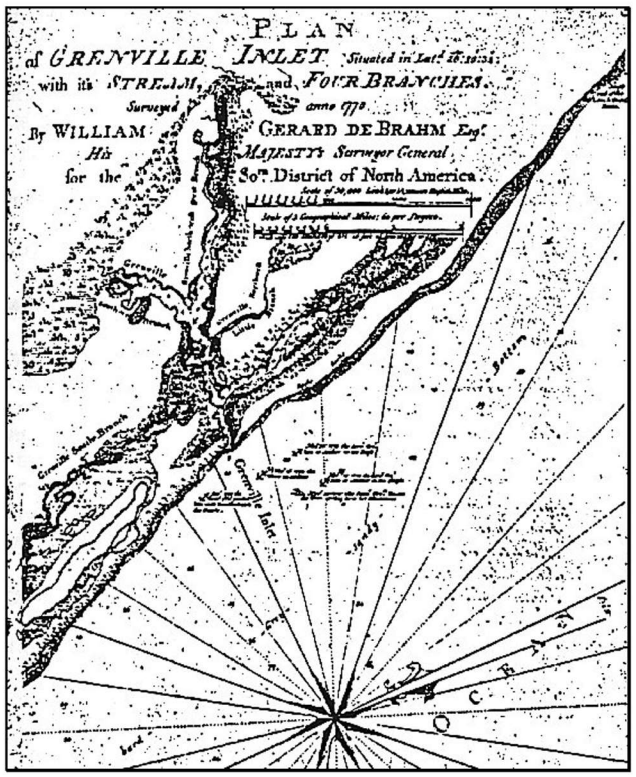


Figure 2. William de Brahm's 1770 Map of the Loxahatchee ("Grenville") River and Slough Area (from de Vorcy 1971).

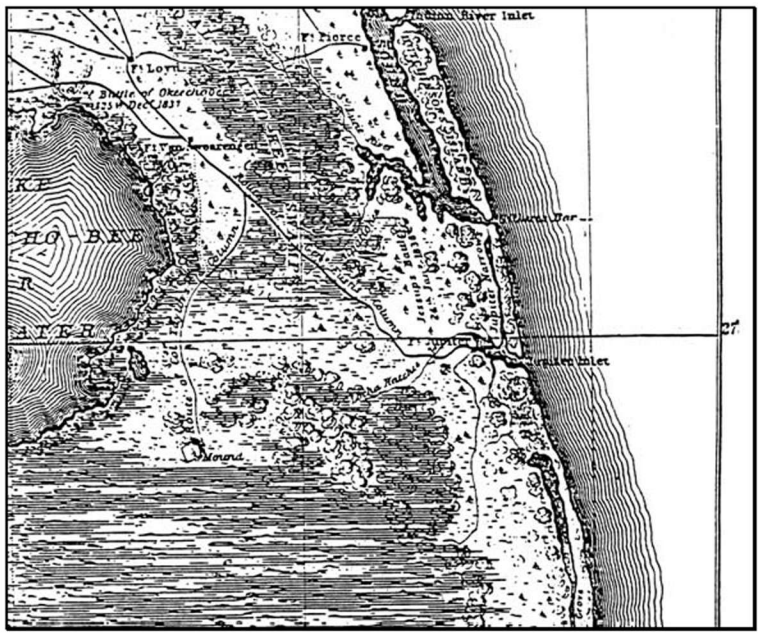


Figure 3. 1839 Military Map of the Loxahatchee Slough Area (USACE 1839).

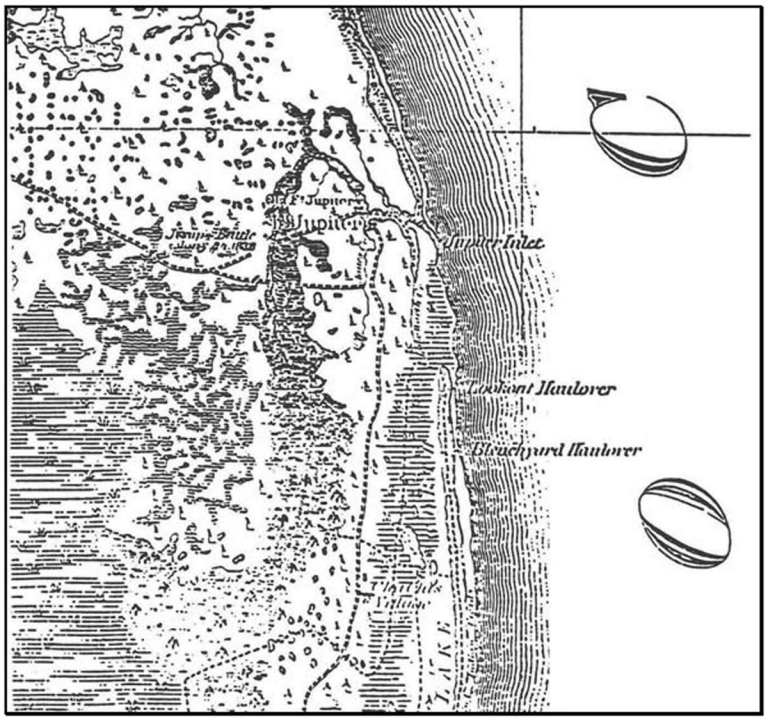


Figure 4. 1856 Military Map of the Loxahatchee Slough Area (Ives 1856).

The earliest map providing details of the vegetation communities within the slough is most likely from the original General Land Survey Office's (GLO) Survey of

Township and Range Boundaries during the mid-1800s (GLO 1845). **Figure 5** shows a composite of five township/range maps and includes the area from the central embayment of the Loxahatchee River to the upstream reaches of the Loxahatchee Slough. The area adjacent to and upstream from the C-18 and C-18 West intersection in present-day Loxahatchee Slough Natural Area is located in Section Township 41S, Range 42E. Field notes (**Appendix C**) generally describe the area near the present C-18 Canal as an "...inundated swamp mostly scrubby cypress mixed with saw grass ponds impassable." In fact, seven sections within this township/range were not included in the original May 1845 (GLO 1845) survey because of the difficulty in accessing the site. These sections were later surveyed in 1907.

The first known aerial photography available for the Loxahatchee Slough area is from 1940 (Richardson 1977), taken by the United States Department of Agriculture. **Figure 6** shows a section of this photography. Hohner (1994) conducted an in-depth GIS analysis of this aerial photo from the area of the Loxahatchee Slough. Results from Hohner's analysis (**Figure** 7) indicated that, in 1940, the slough was dominated by non-forested wetlands (69 percent of the study area; e.g., marsh, non-vegetated wetlands and wet prairie) and forested wetlands (22 percent of the study area; mostly bald cypress swamp).

Analysis of Current (1995, 2000) Conditions

District staff completed Photointerpretation of 1995 and 2000 DOQs in 2002. The extent of general land use categories within the study area of the Loxahatchee Slough Natural Area are shown in **Table 1** and **Figure 8**. The most extensive land use type was wetlands, which accounted for approximately 67 percent of the study area. Upland forest, consisting of mostly pine flatwoods, accounted for approximately 22 percent of the study area. The remaining area (approximately 11 percent) was associated with disturbed lands (i.e., urban, agricultural and man-made water bodies). A more detailed description of the natural vegetation community types identified in this study is presented in **Table 2**. For the most part, there were no large changes between 1995 and 2000 in the total area for most community types. There was a small decrease (1.2 percent in pine forest and a small (0.5 percent increase in wetland community types during this period, perhaps resulting from above average rainfall experienced throughout most of the 1990s (**Figure 9**). However, these small changes were within the error associated with photointerpretation (+/- 30 feet for a polygon line, **Appendix B**, Metadata).

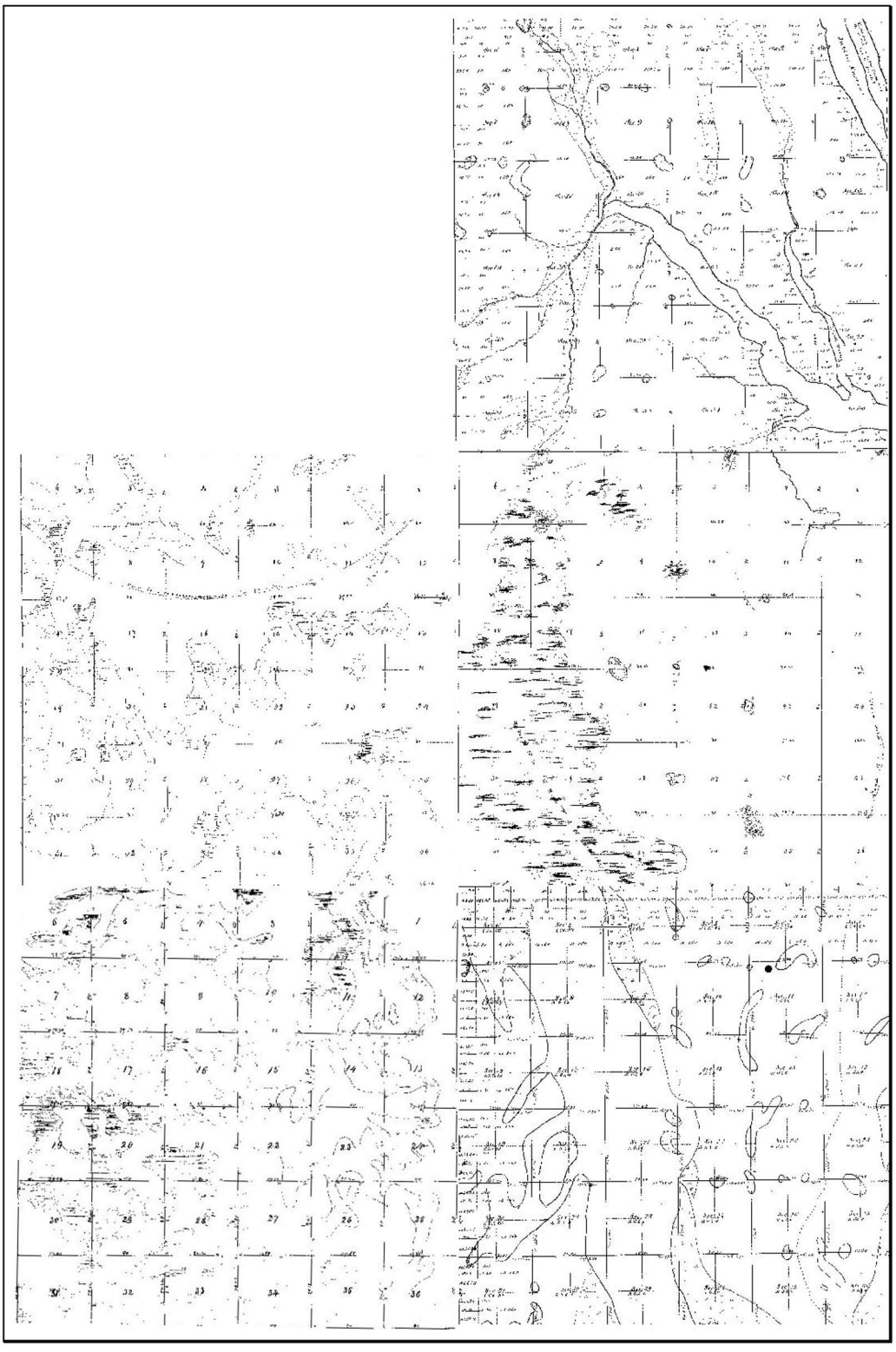


Figure 5. 1845 Survey Maps of the Loxahatchee River and Slough Area (source: GLO 1845), Shown Above is a Composite of Five Township-Range Areas.

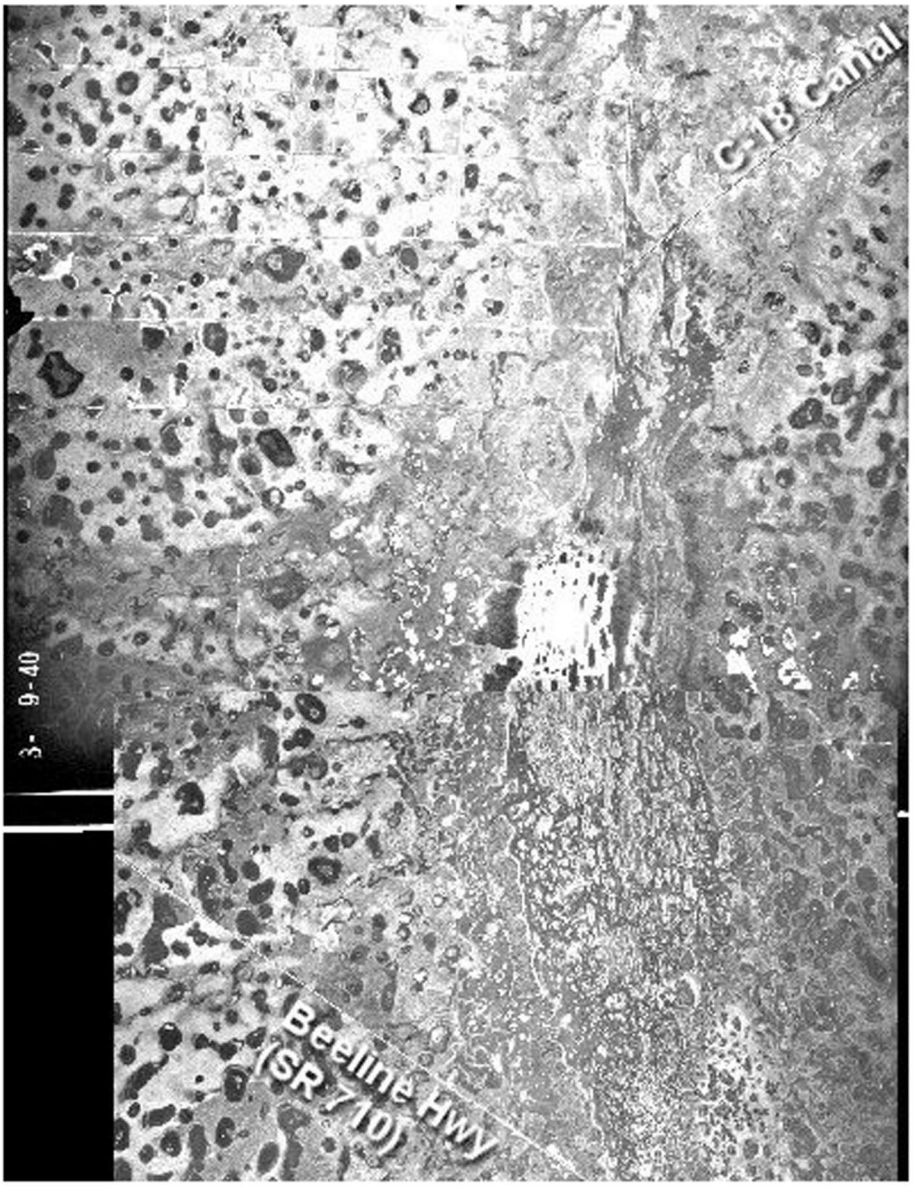


Figure 6. 1940 Black and White Aerial Photograph of the Loxahatchee Slough Area (source: Hohner 1994).

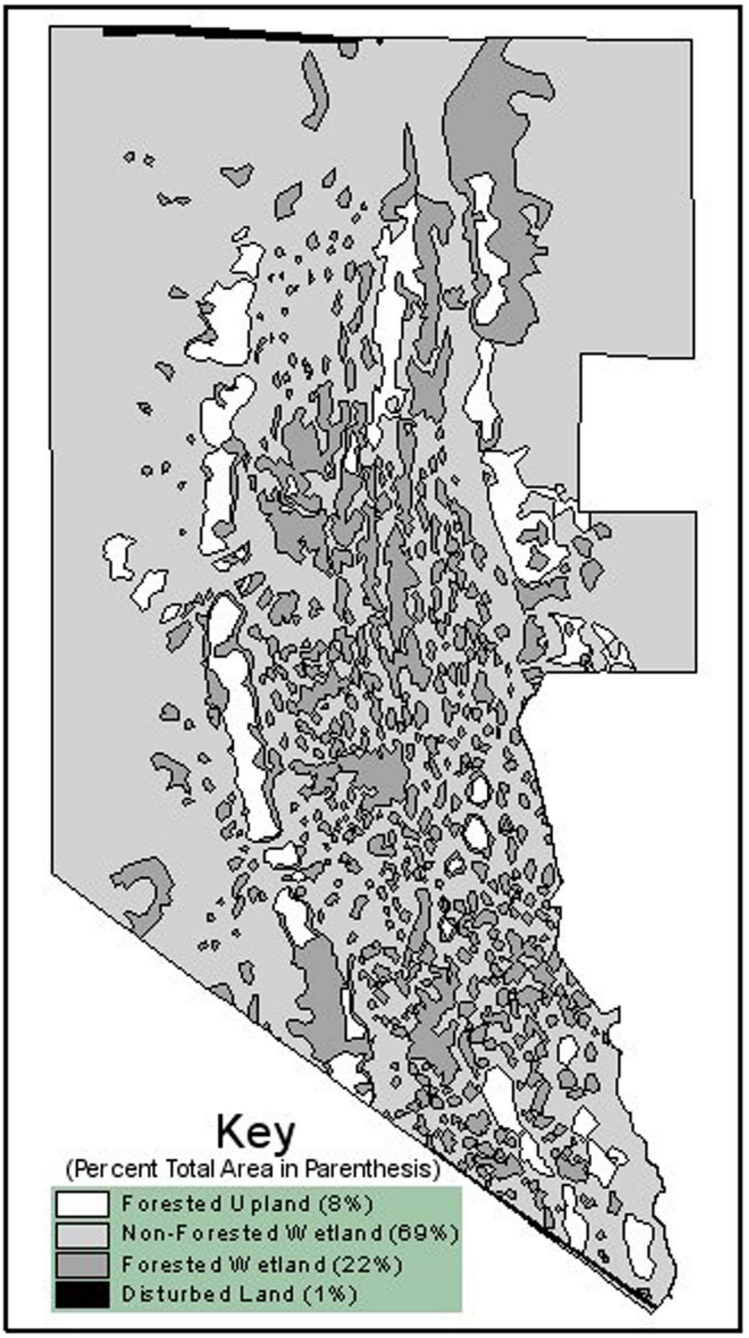


Figure 7. Extent of Major Vegetation Types within the Loxahatchee Slough in 1940 (source: Hohner 1994).

Table 1. Major Land Use Categories within the Loxahatchee Slough Natural Area.

Land Use Description	Land Use Code (FLUCCS[1])	1995 Area (Ha)	2000 Area (Ha)	Change From 1995 to 2000
Urban & Built Up	100	5.89 (total)	5.89 (total)	None
Low Density Residential	*110*	*0.10*	*0.10*	
Medium Density Residential	*120*	*0.59*	*0.59*	
Open Land	*190*	*5.20*	*5.20*	
Agriculture	200	378.66 (total)	378.66 (total)	None
Cropland & Pastureland	*210*	*378.66*	*378.66*	
Upland Forests	400	1108.86 (total)	1095.51 (total)	-13.35 (total)
Coniferous Forests[2]	*410*	*986.96*	*973.61*	*-13.35*
Hardwood Forests	*420*	*121.90*	*121.90*	*None*
Water	500	95.59 (total)	93.53 (total)	-2.06 (total)
Streams & Waterways	*510*	*63.09*	*61.03*	*-2.06*
Reservoirs	*530*	*32.50*	*32.50*	*None*
Wetlands	600	3411.67 (total)	3427.07 (total)	+15.40 (total)
Hardwood Forests	*610*	*60.30*	*62.51*	*+2.21*
Coniferous Forests[3]	*620*	*2259.36*	*2269.26*	*+9.9*
Forested Mixed	*630*	*276.66*	*278.72*	*+2.06*
Vegetated Non-Forested	*640*	*815.35*	*816.58*	*+1.23*
Barren Land	700	89.71 (total)	89.71 (total)	None
Disturbed Land	*740*	*89.71*	*89.71*	

[1] Florida Land Use, Cover and Forms Classification System (1995)
[2] Slash pine is the dominant upland conifer
[3] Bald cypress is the dominant wetland conifer

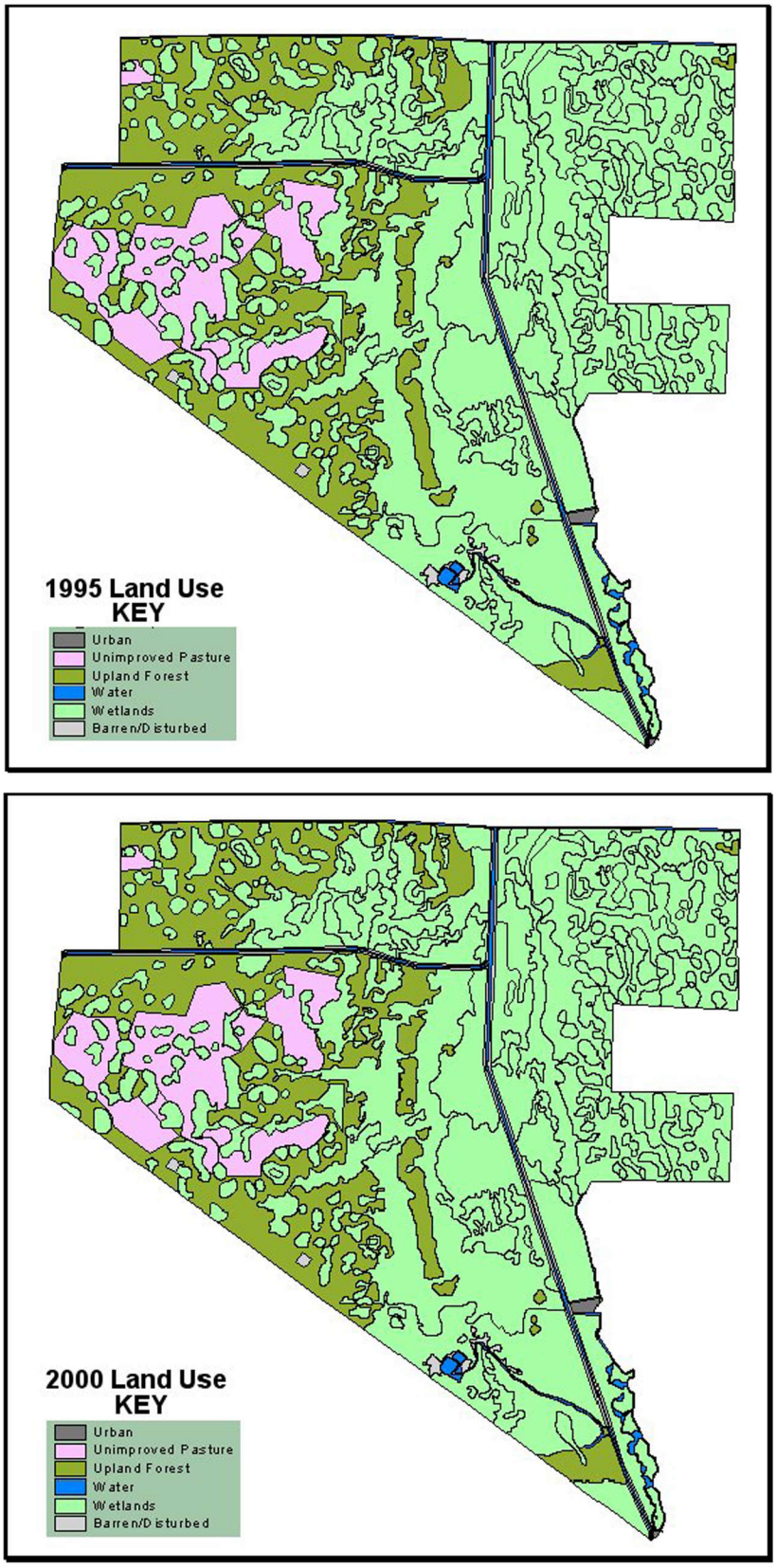
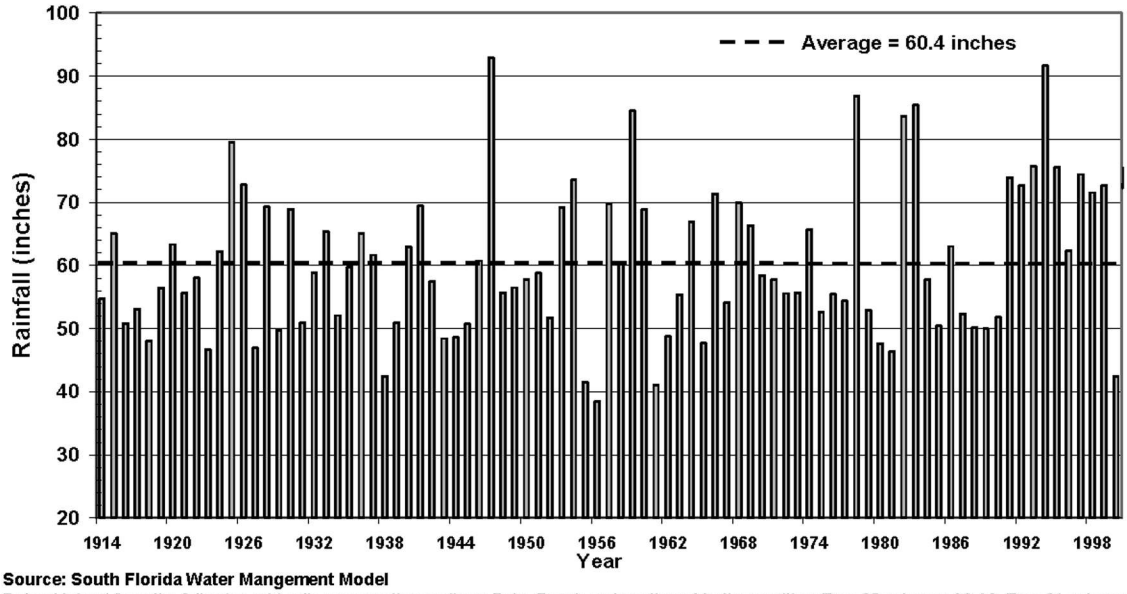


Figure 8. Land Use Categories from the 1995 and 2000 DOQs.

Table 2. Extent of Major Vegetation Communities within the Loxahatchee Slough Natural Area; from Aerial Photointerpretation of 1995 and 2000 USGS DOQs.

Natural Community Type	Land Use Code (FLUCCS[1])	1995 Area (Ha)	2000 Area (Ha)	Percent Change[2]
Upland Pine Flatwoods	411	986.96	973.61	-0.26 %
Upland Melaleuca	424	42.61	42.61	0
Upland Cabbage Palm	428	79.28	79.28	0
Wetland- Mixed Hardwood Shrubs	6172	40.46	42.67	+0.04
Wetland Melaleuca	6191	19.83	19.83	0
Wetland Cypress Forest	621	111.02	111.02	0
Wetland Cypress & Mixed Hardwoods	6216	288.09	299.77	+0.23
Wetland Cypress & Pines	6217	4.22	4.22	0
Wetland Cypress & Melaleuca	6218	535.87	535.87	0
Wetland Cypress with Wet Prairies	6219	887.97	887.97	0
Wetland Cypress, Pine & Cabbage Palm	624	59.26	59.26	0
Wetland Pine (Hydric Pineland)	628	372.93	371.16	-0.03
Wetland Mixed Forest	630	276.66	278.72	+0.04
Freshwater Marsh	641	641.53	642.77	+0.02
Sawgrass Marsh	6411	12.53	12.53	0
Cattail Marsh	6412	1.06	1.06	0
Wet Prairie	643	72.14	72.14	0
Wet Prairies with Pine	6439	88.09	88.09	0

[1] Florida Land Use, Cover and Forms Classification System (1995)
[2] Changes are percent of total area; values of less than 1% should be considered as insignificant as they within the error associated with photointerpretation is +/- 30 ft for a polygon line (**Appendix B**, Metadata)



Source: South Florida Water Mangement Model
Data obtained from the following grid cells representing northern Palm Beach and southern Martin counities: Row 65 columns 32-38, Row 64 columns 30-38, Row 63 columns 30-38, Row 62 columns 30-38, Row 61 columns 30-37, Row 60 columns 31-37, Row 59 columns 32-37, Row 58 columns 33-

Figure 9. Long-term Annual Rainfall for Northern Palm Beach and Southern Martin Counties (1914–2000).

The extent of melaleuca-infested land use categories was calculated and summed in **Table 3** and shown in **Figure 10**. The greatest concentration of melaleuca appeared to be in the southern and southeastern section of the slough. This corresponds to the area most impacted by reduced surface water levels. Currently, an eradication program is being conducted by the county and the classification of these areas in later surveys will likely change.

Table 3. Extent of Melaleuca-invaded Communities within the Loxahatchee Slough Natural Area.

Land Use Description	Land Use Code (FLUCCS[1])	1995 Area (Ha)	2000 Area (Ha)	Change From 1995 to 2000
Melaleuca (upland)	424	42.61	42.61	None
Melaleuca (wetland)	6191	19.83	19.83	None
Cypress-Melaleuca Infested	6218	535.87	535.87	None
Total		*598.31*	*598.31*	*None*

[1] Florida Land Use, Cover and Forms Classification System (1995)

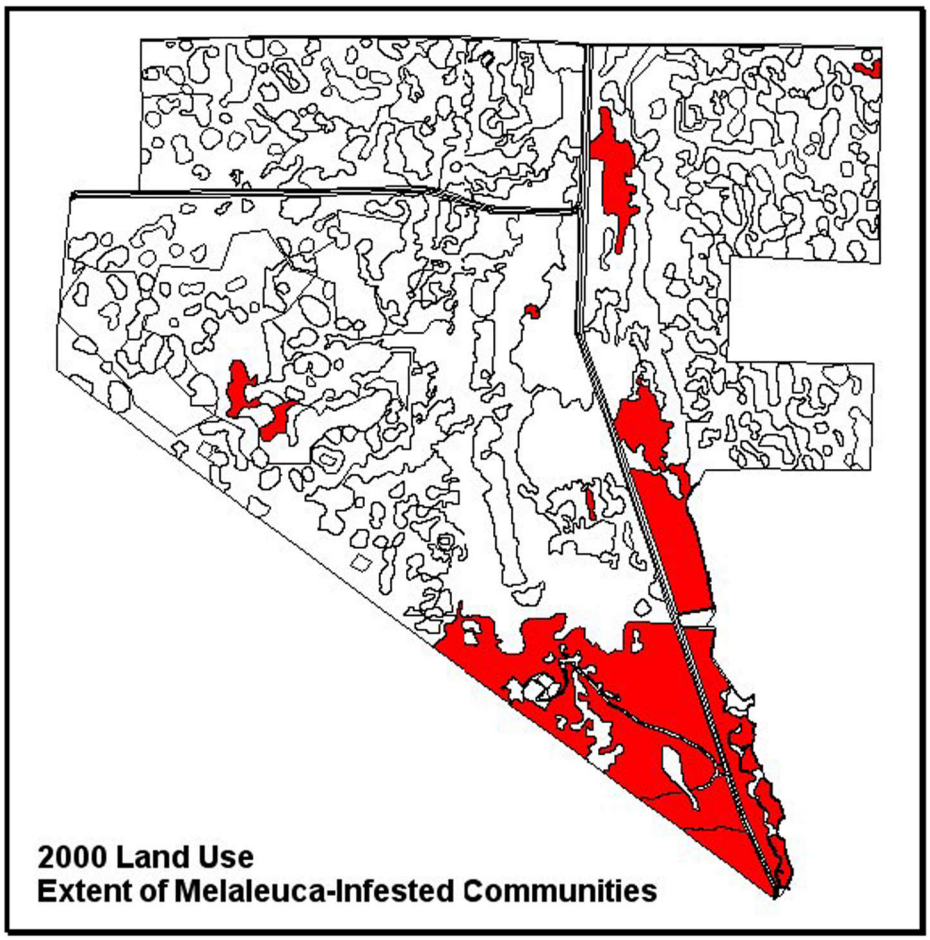


Figure 10. Map Indicating Extent of Melaleuca-Infested Communities (from 2000 Land Use Analysis).

Comparison of Historic and Current Vegetation

As mentioned in a previous section, the 1845 General Land Office survey contains the earliest reliable vegetation descriptions of the Loxahatchee Slough. Vegetation descriptions along the borders of section plats are available for most of the study area and may be used as vegetation transects to compare changes through time. The outlines of section boundaries were overlaid on the 2000 land use map developed for this study. Vegetation communities along a section boundary line from 2000 (where a section boundary line crossed a vegetation type) were compared with vegetation descriptions from the same boundary line from the 1845 survey. Results from this analysis can be found in **Appendix D**. In order to compare changes in vegetation from 1845 to 2000, differences in vegetation types at each section boundary were generally categorized as increases or decreases of pineland (generally upland), swamp (forested wetland), marsh (non-forested wetland) and ponds (open water communities) (**Table 4**).

Results from this study found no general or consistent trend within all transects. The extent of ponds (open water sloughs) decreased along five section boundary

transects, most of which were located within the area around the junction of the C-18 and C-18 West Canals, and indicates a reduction in groundwater levels due to canal construction and drainage. This area is near the location of the proposed G-160 Structure, which is expected to provide some hydroperiod enhancement benefits once the structure is operational. Results also show an increase in the extent of pineland, which may be associated with reduced water tables and decreased hydroperiod. This was representative of those transects found in the western area of the Loxahatchee Slough Natural Area and corresponded to lands that were once ditched for use as rangeland.

Table 4. Comparison of 1845 and 2000 generalized vegetation community descriptions along section boundary transects within the Loxahatchee Slough Natural Area. "+" indicates an increase in this vegetation type, "-" indicates a decrease in this vegetation type.

Transect-Range-Section	Pineland	Swamp	Marsh	Ponds	No Change
41-41-23/24		+			
41-41-24, 41-42-19	-	+			
41-42-20/21		-	+		
41-41-26/27					x
41-41-25/26				-	
41-41-25, 41-42-30	+			-	
41-42-28/29	+	-			
41-41-35/36		+	-	-	
41-41-36, 41-42-31		+		-	
41-42-31/32					x
41-42-32/33					x
42-41-1, 42-42-6					x
42-42-5/6		+			
42-42-7/8	-				
41-41-26/35				-	
41-41-25, 41-41-36					x
41-41-36, 42-41-1					x
41-42-19, 41-42-30	+				
41-42-30, 41-42-31					x
41-42-31, 42-42-6	+				
42-42-6/7		+			
41-42-20/29					x
41-42-29/32					x
41-42-32, 42-42-5					x
42-42-5/8			-		
42-42-8/17	-				
41-42-21/28					x

Hohner (1994) conducted an in-depth GIS analysis of historical aerial photography available for the slough. She examined black-and-white aerial photos from 1940 and 1979, and a false-color SPOT image from 1989. Results from her time series

analysis (1940–1989) indicated a general increase in forested wetlands, a decrease in non-forested wetlands and an increase in upland forest cover (**Table 5**). From this information, it was deduced that surface and groundwater levels have been lowered since the 1940s, causing a reduction of hydroperiods. As a result, the extent of upland forest increased and some long hydroperiod non-forested wetlands changed to shorter hydroperiod forested wetlands. Additional losses to the extent of natural areas were due to the increase in the extent of disturbed land. The shift to vegetation associated with shorter hydroperiods was most evident in the area to the east of the C-18 Canal from 1940 to 1979.

Table 5. Change in Land Cover Types by Year (from Hohner 1994); Units are Percent of Total Area of Coverage.

CLASS	1940	1979	1989
Forest Land	8.33	16.57	22.82
Forested Wetland	21.88	22.51	29.05
Non-forested Wetland	69.15	48.31	39.74
Disturbed	0.65	12.60	8.39

DISCUSSION

Comparison of Historical and Current Vegetation Communities

The original GIS coverages developed by Hohner were acquired and compared with the current (2000) land use map. The extent of major community types was compared between 1940, 1979 and 2000. Results (**Table 6**) indicate a significant decrease in the extent of non-forested wetlands and a large increase in the extent of forested wetland. This change is clearly visible in the aerial photos. From 1940 to 1979, the total extent of non-forested wetlands within the study area decreased approximately 20 percent; from 1940 to 2000, the decrease was approximately 60 percent. In contrast, little increase in the extent of forested wetlands was noted from 1940 to 1979, however forested wetlands increased by almost 50 percent between 1940 and 2000.

Table 6. Comparison of Extent of Major Vegetation Types from 1940 (from Hohner 1994) to 2000; Percent of Total Area is Indicated in Parenthesis.

	1940 Area (Ha)	1979 Area (Ha)	2000 Area (Ha)
Non-Forested Wetland	2377.91 (73%)	1672.63 (51%)	387.39 (12%)
Forested Wetland	629.09 (19%)	648.54 (20%)	2290.38 (70%)
Upland	252.58 (8%)	524.04 (16%)	414.72 (13%)
Disturbed Lands	12.32 (<1%)	426.69 (13%)	179.42 (5%)

The large changes in extent of forested and non-forested wetlands suggest that stabilized water level fluctuations and a lowered water table have provided the conditions for expansion of forest cover. South Florida slash pines do not tolerate flooding well, so are common but never dominant in Florida swamps (Ewel 1990). When pines invade a wet prairie or other non-forested wetland, it is often an indication of a decrease in hydroperiod. Hence, an increase in forested swamp and a decrease in non-forested wetland could be the result of invasion of pines. However, it could also be caused by a reduction in fire frequency, which is required to eliminate hardwood species from pineland and prairie communities.

Other factors that could contribute to the apparent increase in forested wetland coverage include differences in photointerpretation methods. In the 2000 analysis, hydric pineland and wetland melaleuca forest types were included in the "forested wetland" category. Wet (hydric) pinelands have species characteristic of both upland and wetland habitats, but may have been included in the "upland" category used by Hohner (1994). Another factor may be the spread of the non-native, invasive melaleuca tree that tends to become established in non-forested wetland sites. Some areas that were formerly wet prairie could have been converted to melaleuca. There has been an increase in the extent

of upland and disturbed land (generally associated with upland sites). This would tend to indicate a reduction in groundwater table as a factor in the changes found in this analysis. Note that the reduction in disturbed land from 1979 to 2000 can be attributed to the recovery of vegetation over a disturbed site adjacent to a drainage ditch in the southern section of the coverage.

Field Vegetation Monitoring Sites

The field vegetation monitoring sites are located in three representative community types (open water slough, hydric hammock and pine flatwood). Three monitoring sites are located in open water sloughs (Sites 1, 2 and 3), two on either side of the C-18 Canal south of the proposed G-160 Structure and one north of the structure (**Figure 11**). Site 4 is within a hydric hammock and Site 5 is within a pine flatwood community.

Determination of historic (pre-drainage) vegetation in the area of the field monitoring sites relied upon obtaining the earliest reliable description or documentation of the Loxahatchee Slough area. The GLO field survey notes provide descriptions of the pre-drainage vegetation around the present-day monitoring sites. **Figure 11** shows the Township/Range/Section map for the area containing the field monitoring sites. All field sites are within Township 41 S Range 42 E, and four of the five sites lie very close to a section boundary. Field Site 1 is along the western boundary of Section 31, and Sites 3, 4 and 5 are along the northern boundary of Section 29. Descriptions of the vegetation along the section boundary transects from the original field survey notes could have been useful to ascertain pre-drainage vegetation at these locations, however these sections were left unsurveyed due to inaccessibility of the area. The section boundaries were extended in 1907, but field notes describing vegetation along the boundary lines could not be located. Fields notes from the original survey (GLO 1845) does describe this entire area as "inundated swamp, mostly scrubby cypress mixed with sawgrass ponds; impassable."

Aerial photography from 1940 and 2000, including the locations of field monitoring sites, are shown in **Figures 12a** and **12b**. This is useful to compare vegetation community types before the construction of the C-18 canal with current (2000) conditions. Examination of these photos indicates two trends that suggest an altered hydroperiod. The first is an expansion of forest cover, much of which is visible on aerial photography as slash pine. The slough is most impacted by a reduced hydroperiod in the section east of the C-18, which can be seen in an increase in pineland invasion into historically open wetlands (**Figure 12a**, note area around Site 5) and a "filling in" of marsh communities between tree islands (**Figure 12b**, note area around Site 2). A second trend that can be seen from 1940 to 2000 is a decrease in open-water communities (see area around Sites 1 and 2), which may reflect the increase in shrubby vegetation and non-native species (i.e., melaleuca).

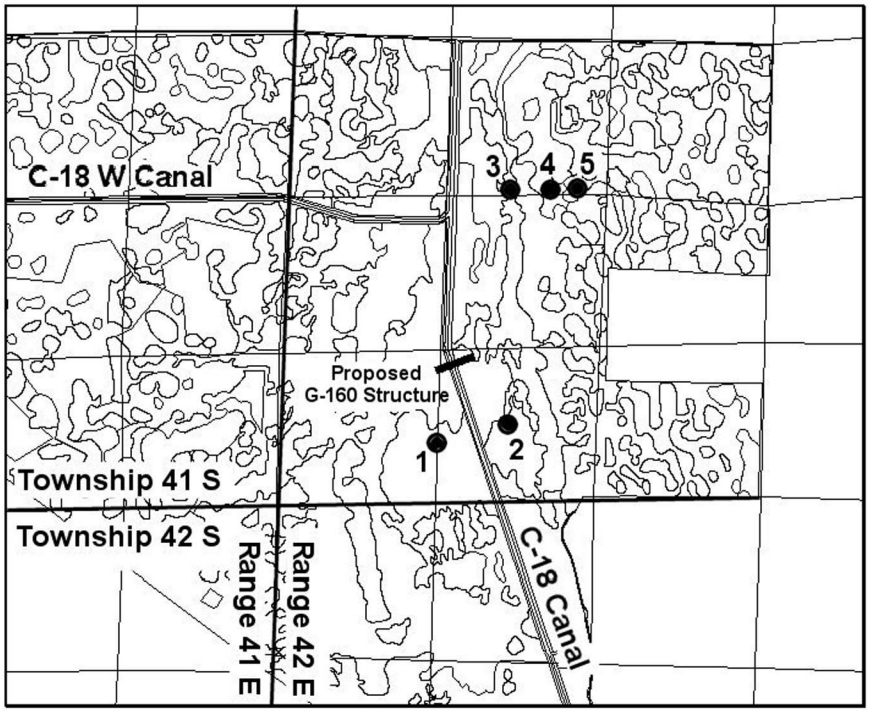


Figure 11. Map of Township/Range/Section Lines and Location of Field Monitoring Sites within the Loxahatchee Slough Natural Area.

The reasons for the observed changes in vegetation since 1940 may be due to a primary factor, such as reduced hydroperiod, or a combination of factors. For instance, the conversion of non-vegetated or non-forested wetlands to forested wetlands or pinelands (**Figure 12a**, note area around Site 5) could be the result of a decreased hydroperiod, but may also indicate a "flattening" of the range of water level fluctuations. Widely fluctuating water levels (extremes of flooding and drying) would support the open, sandy wetlands visible in the area around Site 5 in 1940. In the area around Sites 1 and 2, there appears to be an invasion of forest/shrubby vegetation into areas that were formally open water wetlands. This too could be the result of a lowered water table, but a suppression of fire and invasion of non-native species (melaleuca and climbing fern) could also account for some of the observed change since 1940. Hence, using aerial photographic studies without appropriate field data (e.g., long-term water levels) makes interpretation of cause-effect relationships difficult to discern and document. Interestingly, although changes from 1940 to 2000 are obvious from these photos, the shapes of the tree islands and open water areas remains generally unchanged.

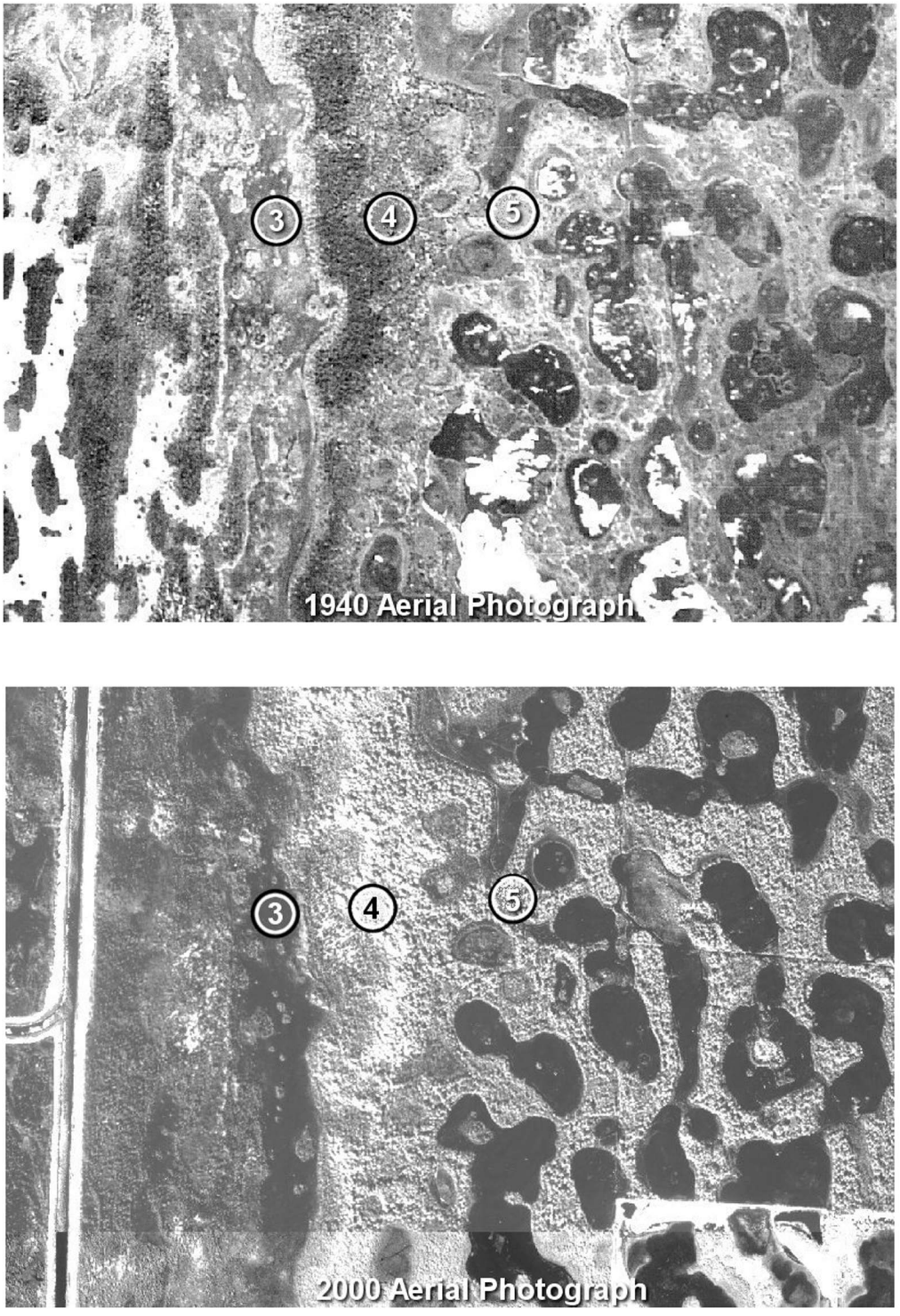


Figure 12a. Comparison of Aerial Photos (1940, 2000) of Field Vegetation Monitoring Sites.

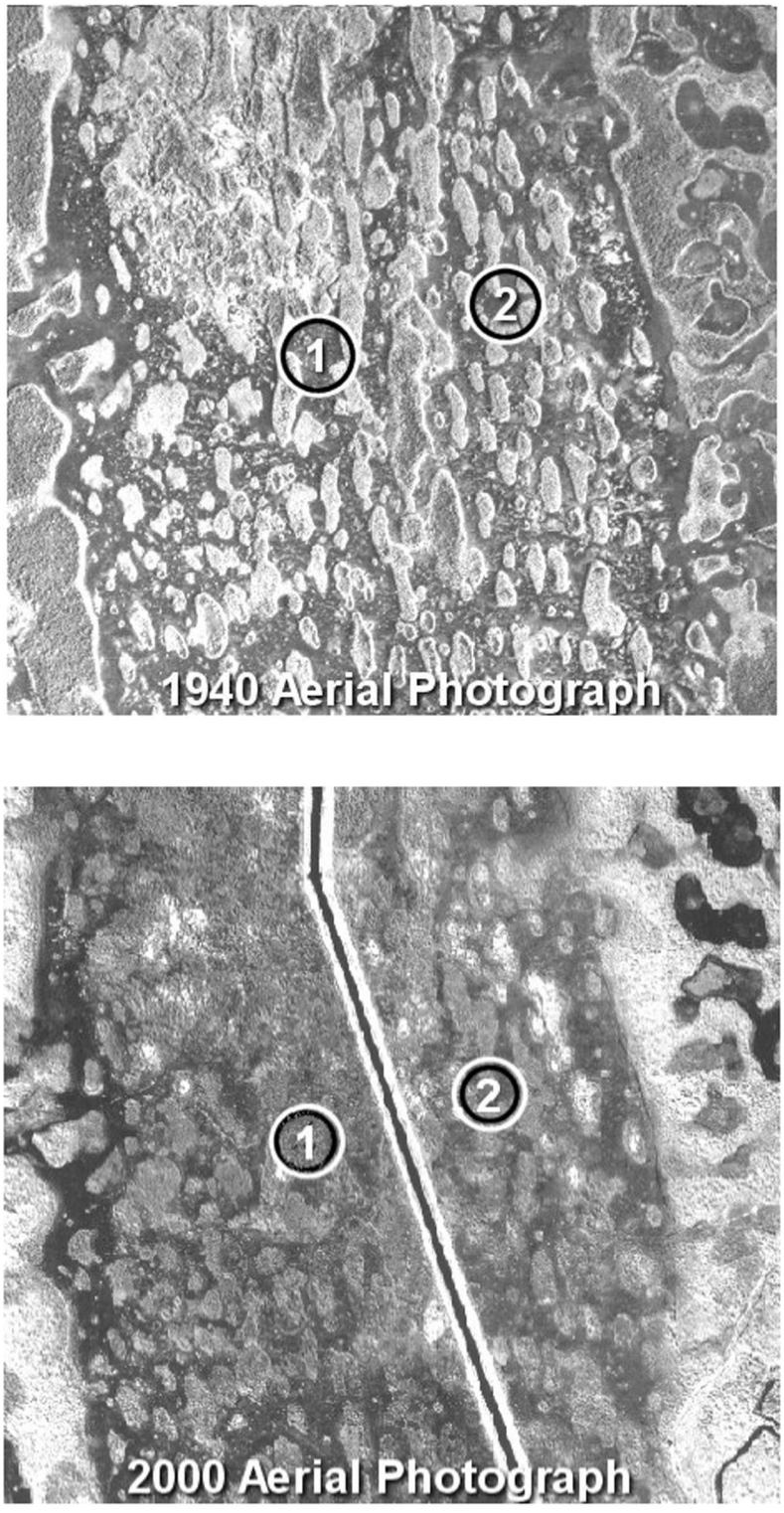


Figure 12b. Comparison of Aerial Photos (1940, 2000) of Field Vegetation Monitoring Sites.

CONCLUSIONS

Reviews of current and historic data from the area now contained within the Loxahatchee Slough Natural Area were used to determine changes to vegetation communities that have occurred in the past century and a half. The General Land Office conducted the first surveys in 1845 and their field notes provide descriptions of vegetation along the Township, Range and section boundaries. A GIS analysis of 1940, 1995 and 2000 aerial photography was used to create vegetation maps. Comparing the data from the earliest known field survey (1845) and 1940 aerial photography with current (2000) community types provided an indication of the changes that have occurred since major development of the local area has occurred.

An analysis of current conditions indicates that the largest land use type was wetlands, which accounted for approximately 67 percent of the study area. Upland forest, consisting of mostly pine flatwoods, accounted for approximately 22 percent of the study area. The remaining area (approximately 11 percent) was associated with disturbed lands (i.e., urban, agricultural and man-made water bodies). The greatest concentration of melaleuca appeared to be in the southern and southeastern section of the slough.

A comparison of the extent of vegetation communities determined from 1845 surveys and current (1995 and 2000) vegetation maps indicates that the extent of ponds (open water sloughs) decreased along the area adjacent to the junction of the C-18 and C-18 West Canals. This is probably the result of a reduction in groundwater levels due to canal construction and drainage. This area is near the location of the proposed G-160 Structure, which is expected to provide some hydroperiod enhancement benefits once the structure is operational. Results also show an increase in pineland habitat in the western area of the Loxahatchee Slough Natural Area and corresponding to lands that were once ditched for use as rangeland.

This report lays the foundation for future monitoring efforts within the Loxahatchee Slough Natural Area. The next GIS analyses is expected to occur in 2007 and will be added to information contained within this document to determine the success of restoration efforts.

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APPENDIX A

MONITORING AGREEMENT BETWEEN PALM BEACH COUNTY DEPARTMENT OF ENVIRONMENTAL RESOURCES MANAGEMENT AND THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Loxahatchee Slough Restoration and G-160 Monitoring Plan

Objective

The purpose of this proposed monitoring plan is to conduct baseline (current) and post-construction/operation (G-160 Structure) vegetation and hydrological monitoring within the Loxahatchee Slough. This monitoring plan is designed to determine the effectiveness of the first tier improvements completed under the North Palm Beach County Comprehensive Water Management Plan. The results are expected to provide the South Florida Water Management District (SFWMD) with beneficial information that will allow adjustments to the operation of the G-160 Structure to most effectively meet the Plan's objectives. The work includes two approaches to monitoring vegetation, a field-based site-specific component and a GIS-based landscape-level analysis.

Component 1: Field-based Monitoring

Field-based monitoring will be conducted in fifteen vegetation survey plots at five sites within the Loxahatchee Slough (**Figure A-1**). Sites will be chosen within representative (dominant) communities currently found within the Slough (i.e. bald cypress strand, wet prairie). Within each site, three plots will be established to monitor vegetation community change through time. Field data will be collected twice annually over a period of five years and will commence in August – September 2002.

Task 1-1. Establishment of Monitoring Sites

Establish vegetation monitoring sites at the five mutually agreed upon locations indicated on **Figure A-1**. Each site will be surveyed and permanently marked prior to initiating the August – September 2002 vegetation survey (see Task 1-4). The average ground elevation (NGVD) within each site shall be delineated.

Task 1-2. Installation of Staff Gauges

Install staff gauges to measure water depth at each site prior to the initiating the August – September 2002 vegetation survey (see Task 1-4). Monitoring crew will record the date, time, and water depth during each field-monitoring event. Water elevation at the C-18 canal staff gauge will also be recorded.

Task 1-3. Establishment of Vegetation Monitoring Plots

Establish three 3m by 3m plots at each site. Plots will contain a representative plant community for that site and shall be dominated by non-tree species. Each monitoring plot will be permanently marked prior to initiating the August – September 2002 vegetation survey (see Task 1-4).

Task 1-4. Baseline (pre-construction/operation) Vegetation Survey

Monitoring crew will begin a baseline vegetation survey within the established plots (see Task 1-3) in the fall of 2002. Vegetation survey will include water depth in the plot, a characterization of the macrophyte species that are present and their relative abundance, using actual counts or a standard comparative index (whichever is appropriate to that species). This baseline monitoring shall be conducted once during the wet season (between August 1 and September 15) in 2002 and once during the dry season (between February 1 and March 15) in 2003.

Task 1-5. Semi-Annual Vegetation Monitoring

The monitoring crew will conduct a vegetation and hydrological monitoring survey twice per year, once during the dry season (between February 1 and March 15) and once during the wet season (between August 1 and September 15). This monitoring is to begin after the completion of the baseline vegetation survey in the spring of 2003 (Task 1-4) and will be carried out four years thereafter. The vegetation survey will include water depth in the plot, a characterization of the macrophyte species that are present and their relative abundance, using actual counts or a standard comparative index (whichever is appropriate to that species).

Task 1-6. Vegetation Plot Photography

The monitoring crew will photograph each monitoring plot during each survey event. These photographs are to be taken during each sampling event from the same angle, location, and perspective.

Task 1-7. Annual Report.

A report of the findings from the vegetation surveys will be compiled and distributed to each participating Agency (Palm Beach County ERM and SFWMD) each year. The final version of the annual report will be completed and distributed to the participating agencies each year (2002-2007) before January 1st following completion of the August – September monitoring event, with the first report due before January 1, 2003. This annual report will contain an executive summary, introduction, methods section, summary of data, and discussion of findings. Field data will be included in an appendix. The report will be subject to the review processes of each participating Agency before being released for public distribution. This report will be combined with the summary report prepared as part of Task 2-2.

Component 2: Landscape-level Monitoring

Landscape-level analysis of the changes to Slough vegetation through time will be conducted using aerial photography from Digital Orthographic Quad (DOQ) photos, purchased every five years by the SFWMD. A comparison of changes in the extent of vegetation communities will be documented using GIS analysis.

Task 2-1. GIS Analysis of Long-Term Vegetation Changes

Staff will conduct a GIS-based analysis of the extent (acres) of major vegetation communities within the Loxahatchee Slough (e.g. bald cypress swamp, wet prairie, sloughs, etc.). Digital Orthophoto Quad (DOQ) aerial photography from the U.S. Geological Survey, which is available every 5 years, will be used as the base coverage. The 1995 and 2000 DOQs will be analyzed for the extent of existing vegetation communities in 2002. The 2005 and 2010 DOQs, when available, will be similarly analyzed and compared with the results from the baseline photography (1995, 2000). This survey will allow landscape-level vegetation monitoring over the long term.

Task 2-2. Reporting of Findings

A report outlining the findings from the GIS analysis will be compiled and distributed to participating agencies (Palm Beach County ERM and SFWMD) each year following completion of three 5-year monitoring cycles (i.e. 2002, 2007, 2012). The first report will contain results from the 1995 and 2000 DOQ analysis and will serve as baseline data and is due before January 1, 2003. This report will include an introduction, methods, results, and discussion section. Accessory data and information will be included in an appendix. This report will pass through the appropriate review process of the participating Agencies before being released for public distribution. This report will be combined with the annual report prepared as part of Task 1-7.

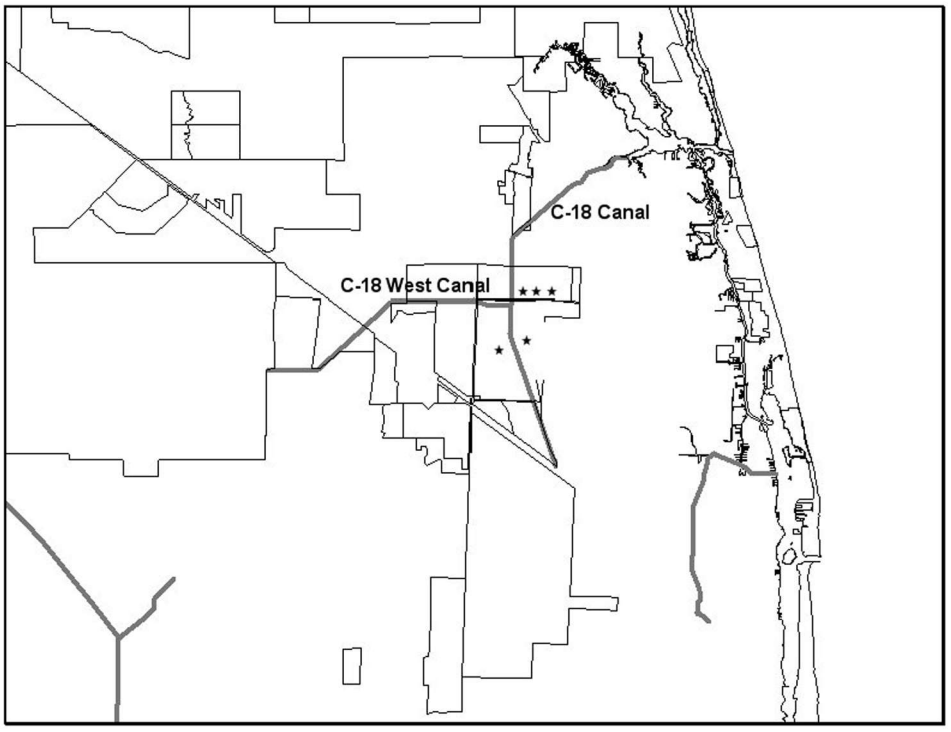

Figure A-1. Location of proposed vegetation monitoring sites (indicated by a star *).

APPENDIX B

METADATA FOR LAND USE COVERAGES DEVELOPED FROM 1995 AND 2000 AERIAL PHOTOGRAPHY

METADATA for 1995 DOQ Land Use Analysis

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APPENDIX C

GENERAL LAND OFFICE 1845 – 1858 SURVEYS FROM TOWNSHIP/RANGES WITHIN THE LOXAHATCHEE SLOUGH NATURAL AREA

518

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Boundaries & Subdivisions	Surveyors	Vol.	Date
Exteriors			
N. W. E.	Geo. Houston	80	1845
S.	A. H. Jones	75	1845
Subdivisions			
All	W. I. Reyes	191	1854-5
Meanders	Geo. Houston	85	1845

T. 41 S., R. 42 E.

Boundaries & Subdivisions	Surveyors	Vol.	Date
Exteriors			
N. S. E.	A. H. Jones	75	1845
W.	Geo. MacKay	84	1845
Subdivisions			
All except 19, 20, & 29 to 33	A. H. Jones	111	1845
Plat 1907			

T. 42 S., R. 42 E.

Boundaries & Subdivisions	Surveyors	Vol.	Date
Exteriors			
N. S. E.	A. H. Jones	75	1845
W.	Geo. MacKay	84	1845
S. E.	W. I. Reyes	208	1858
Subdivisions			
All	W. I. Reyes	208	1858

T. 43 S., R. 42 E.

Boundaries & Subdivisions	Surveyors	Vol.	Date
Exteriors			
N. S. E.	W. I. Reyes	208	1858
N. S. E.	A. H. Jones	75	1845
W.	Geo. MacKay	84	1845
Subdivisions			
All	W. I. Reyes	208	1858

Figure C-1. Field Notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area.

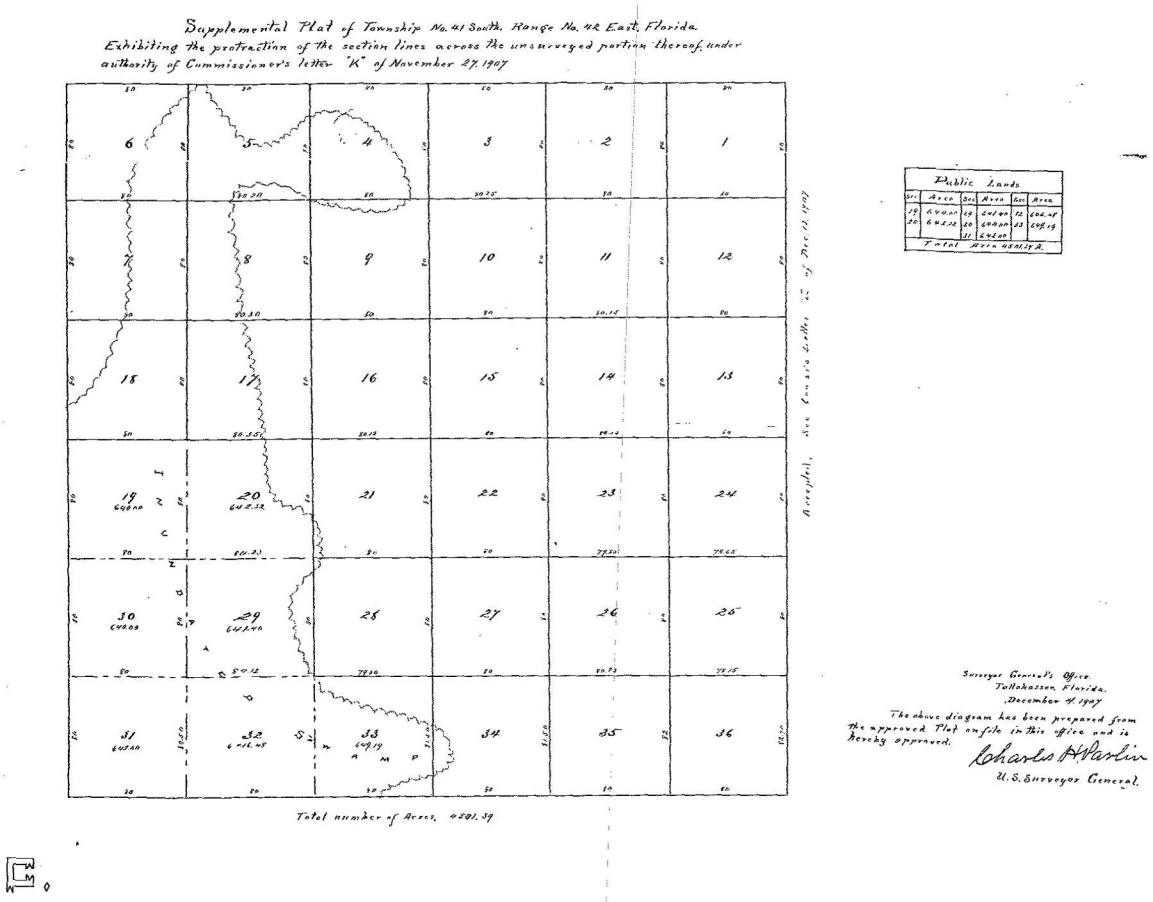


Figure C-2. Field map from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

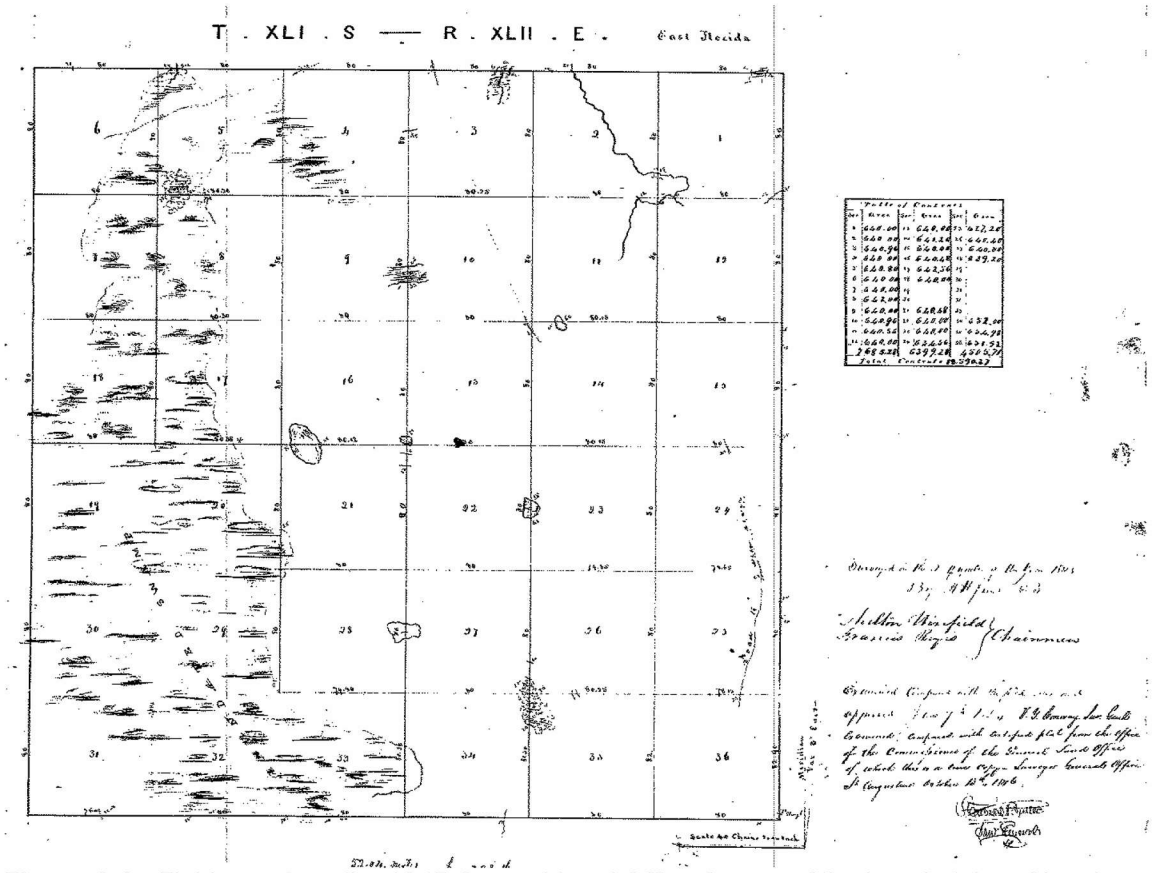


Figure C-3. Field map from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

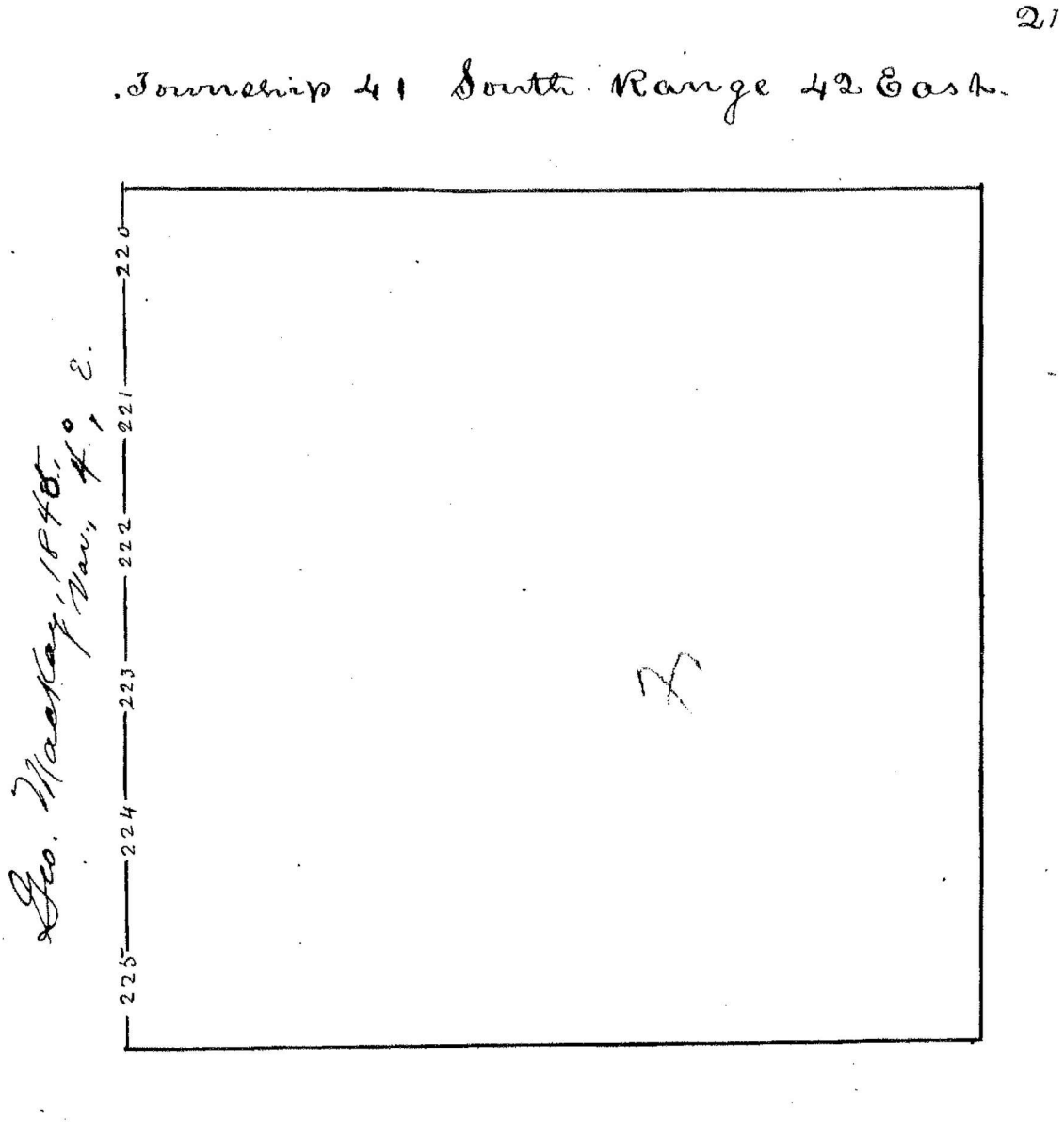


Figure C-4. Field map from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

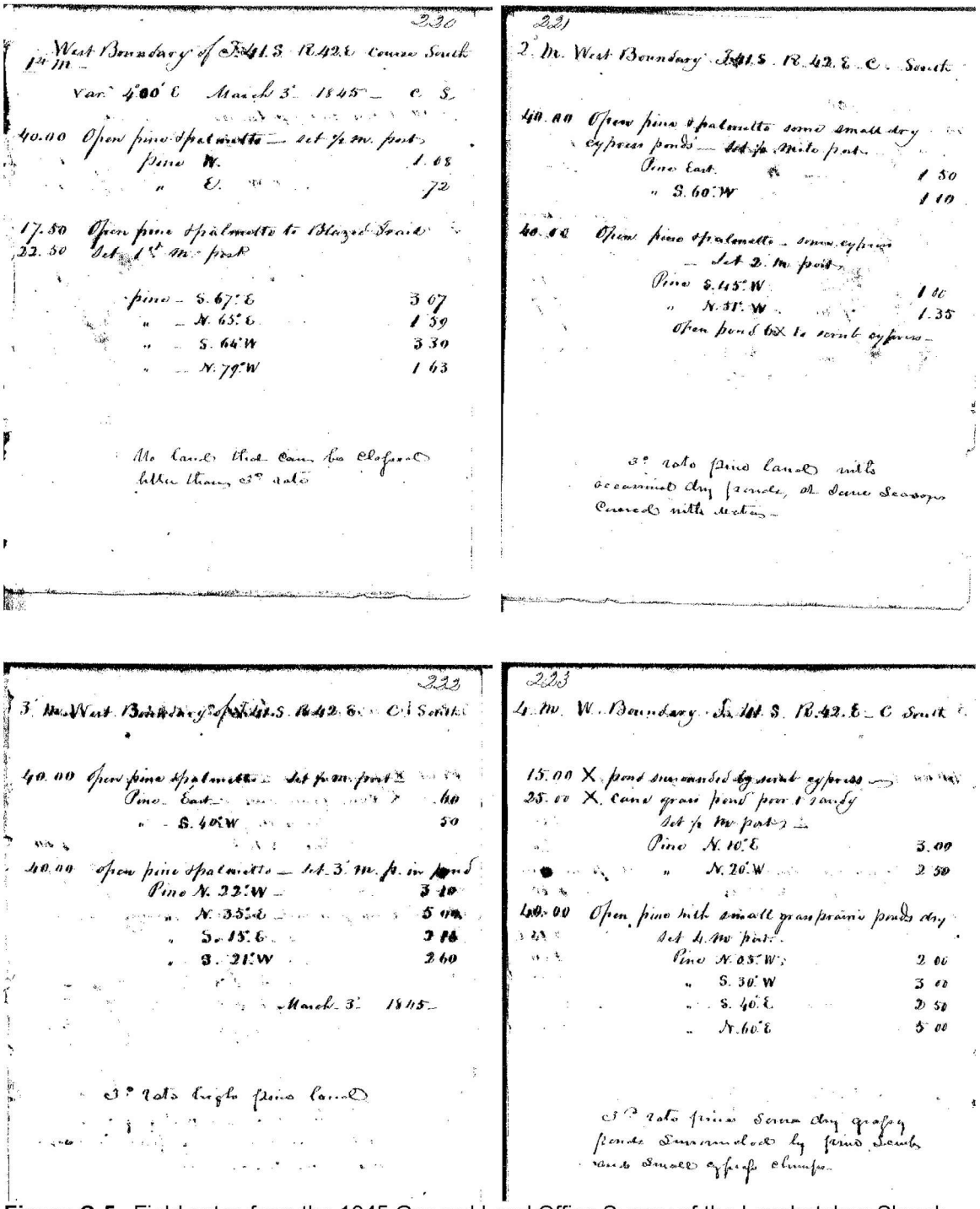


Figure C-5. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

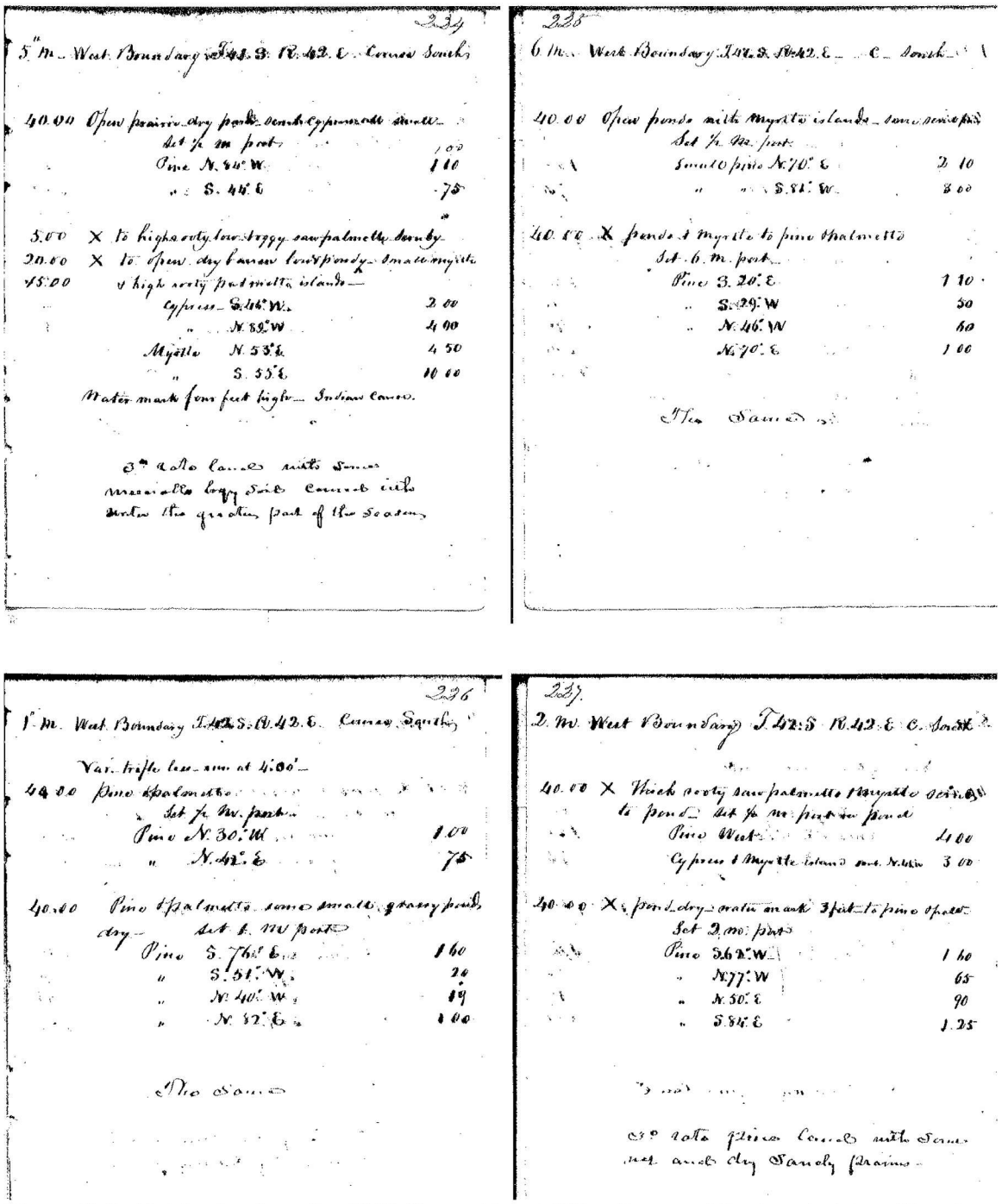


Figure C-6. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

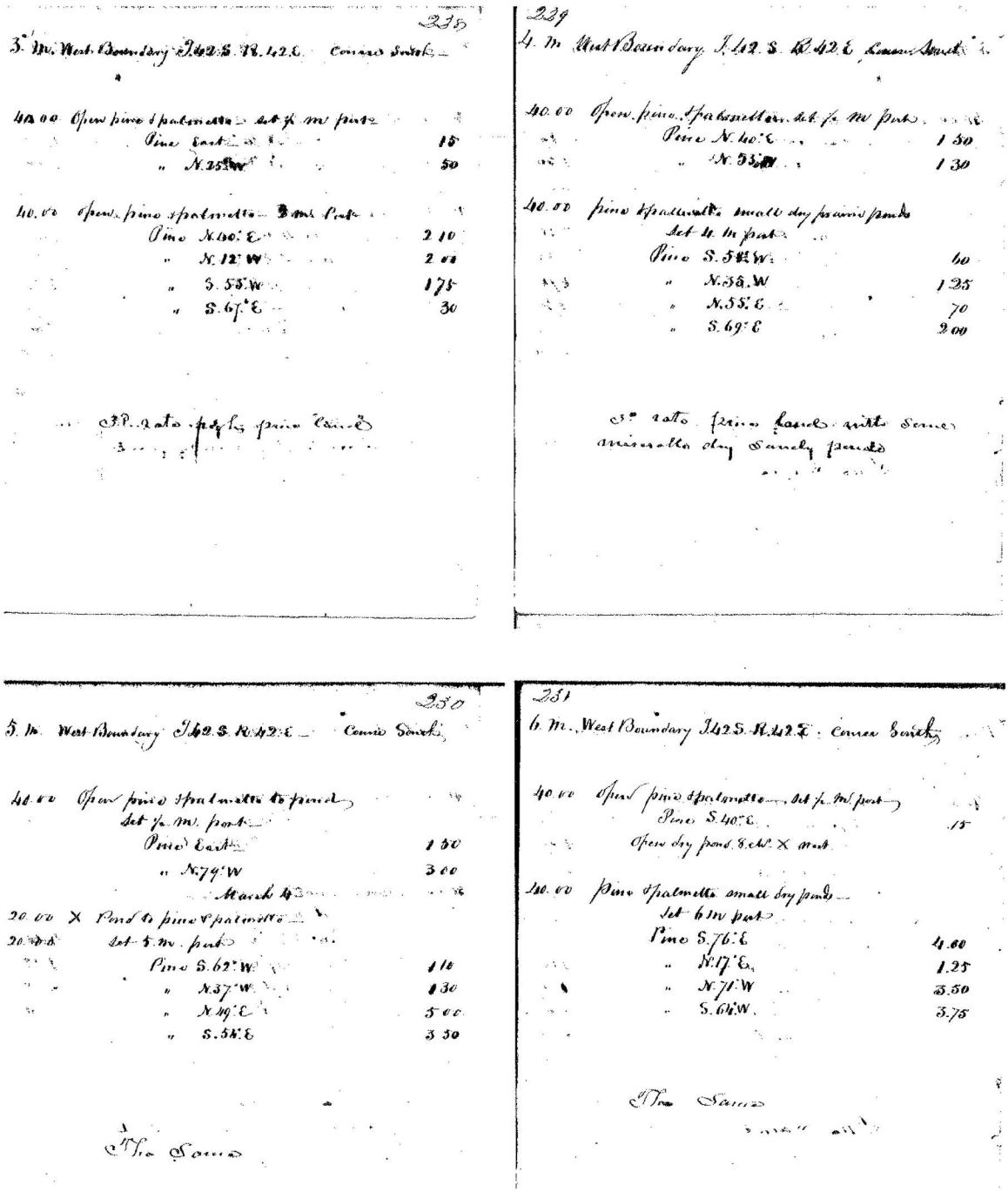


Figure C-7. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

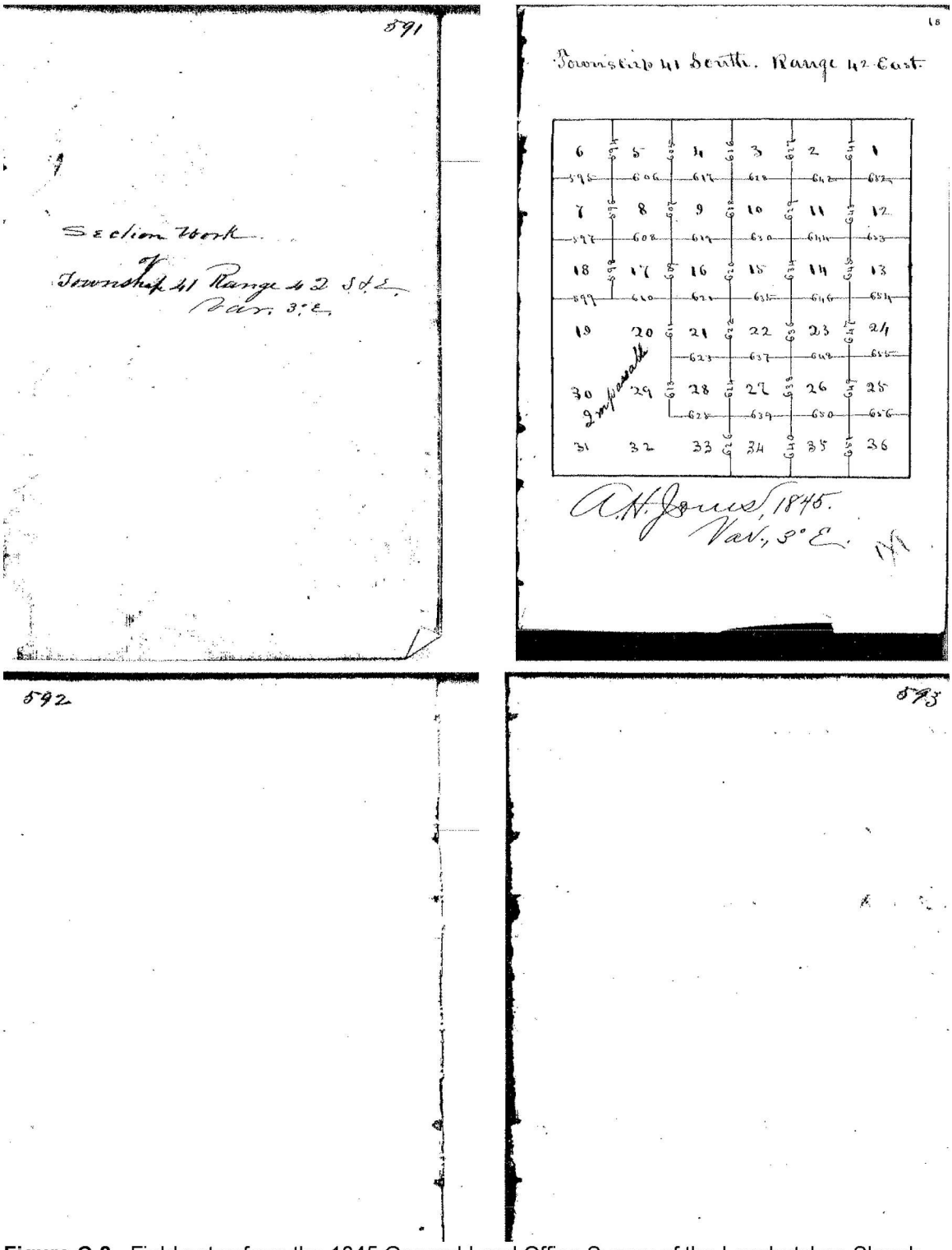


Figure C-8. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

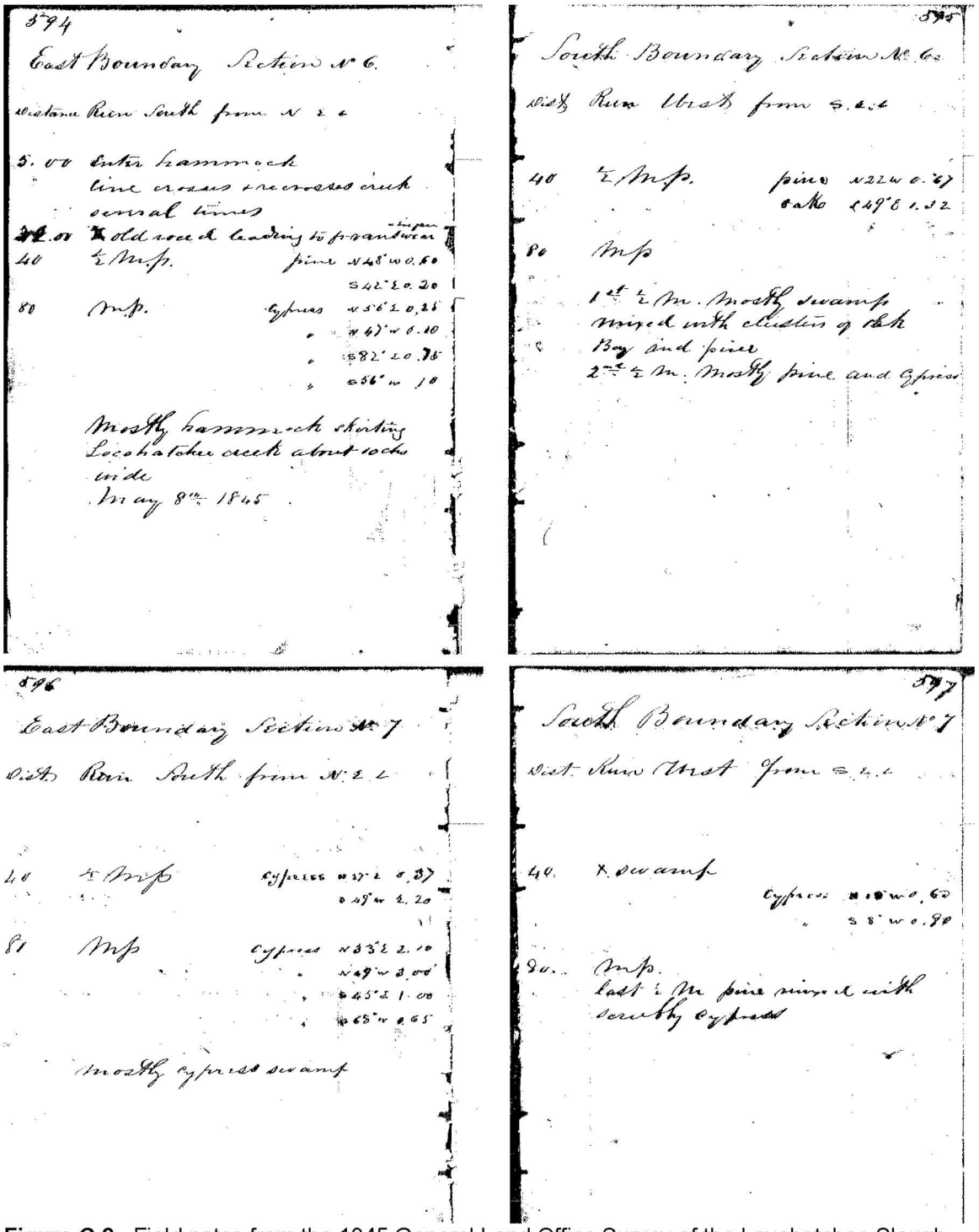


Figure C-9. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

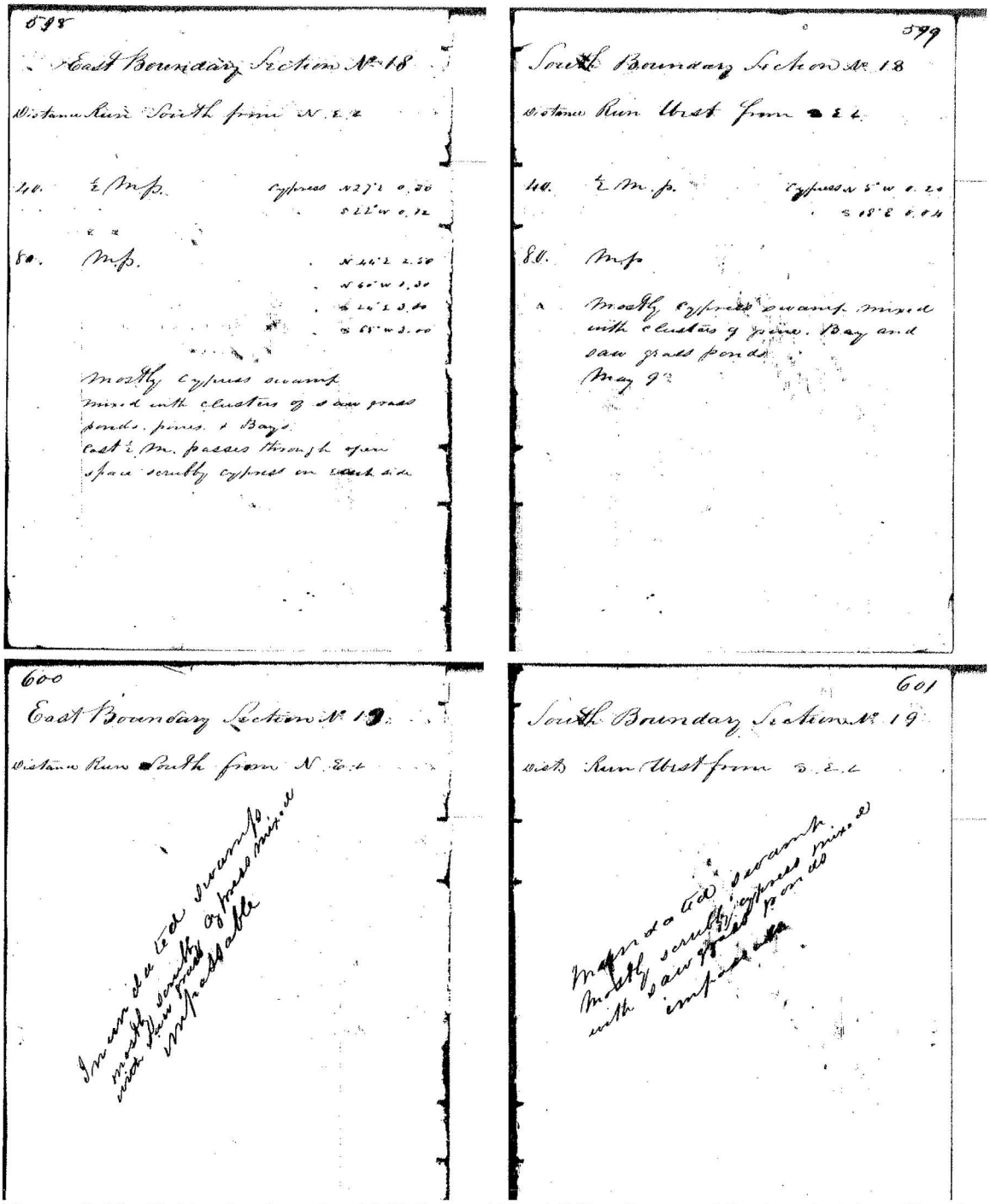


Figure C-10. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

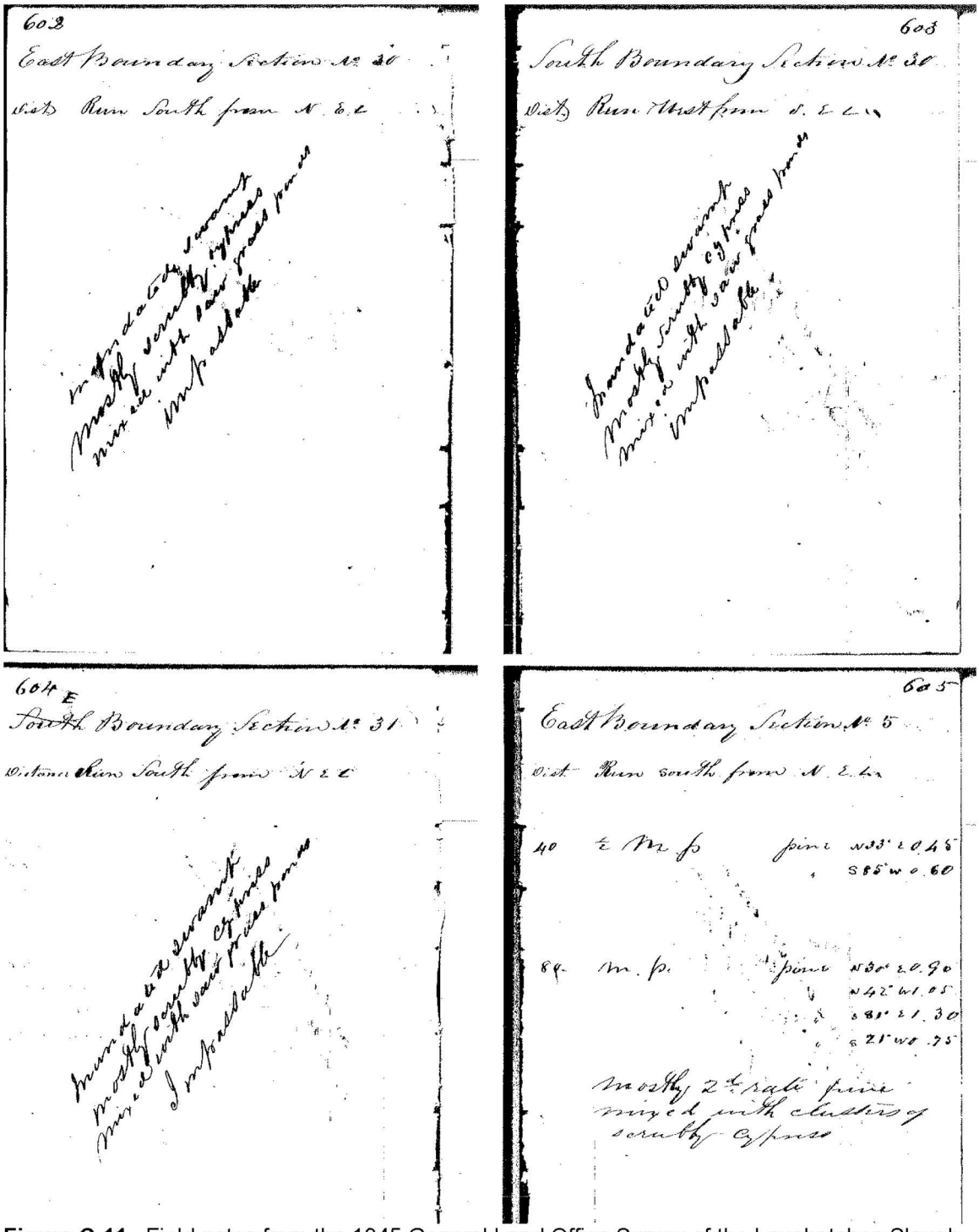


Figure C-11. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

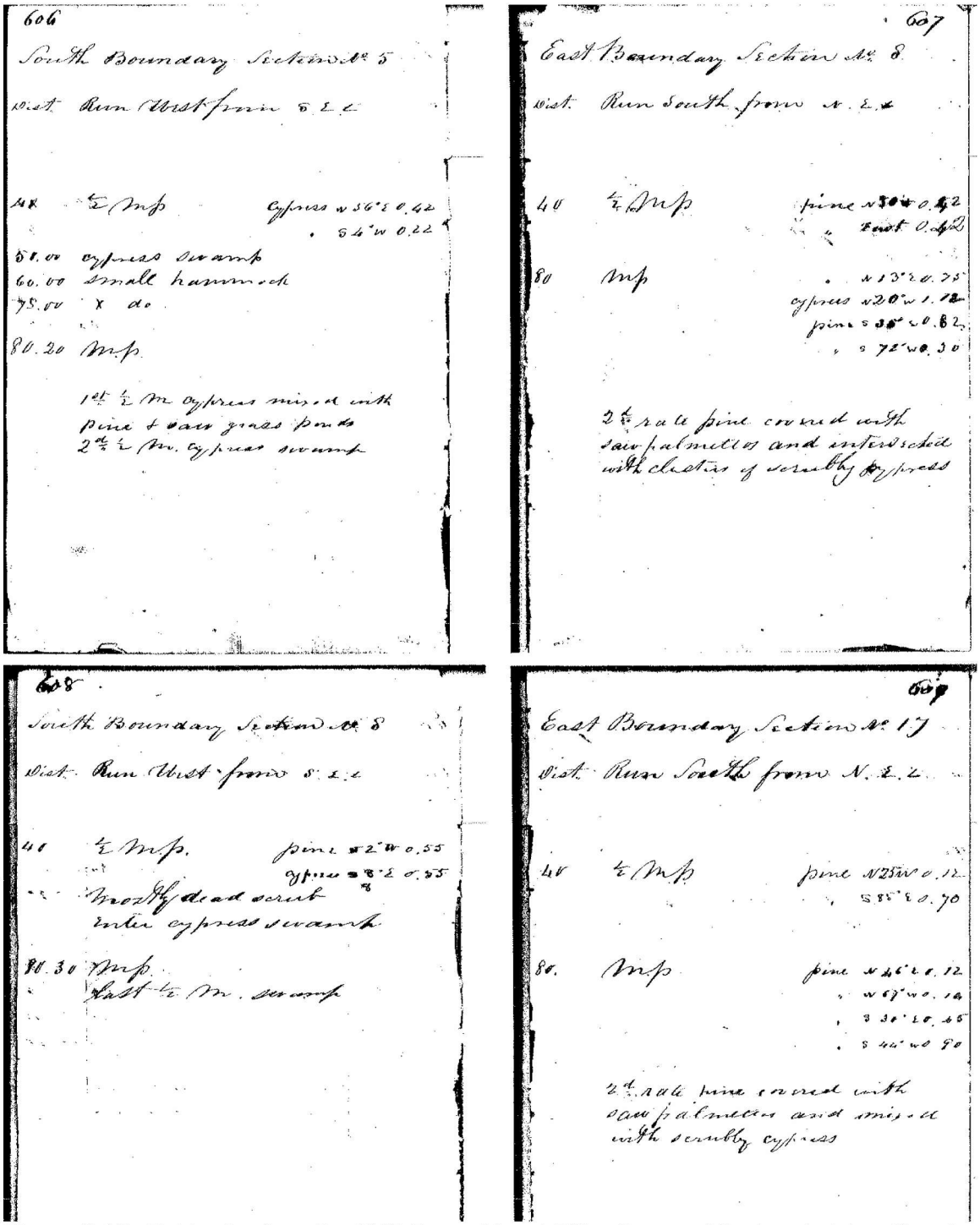


Figure C-12. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

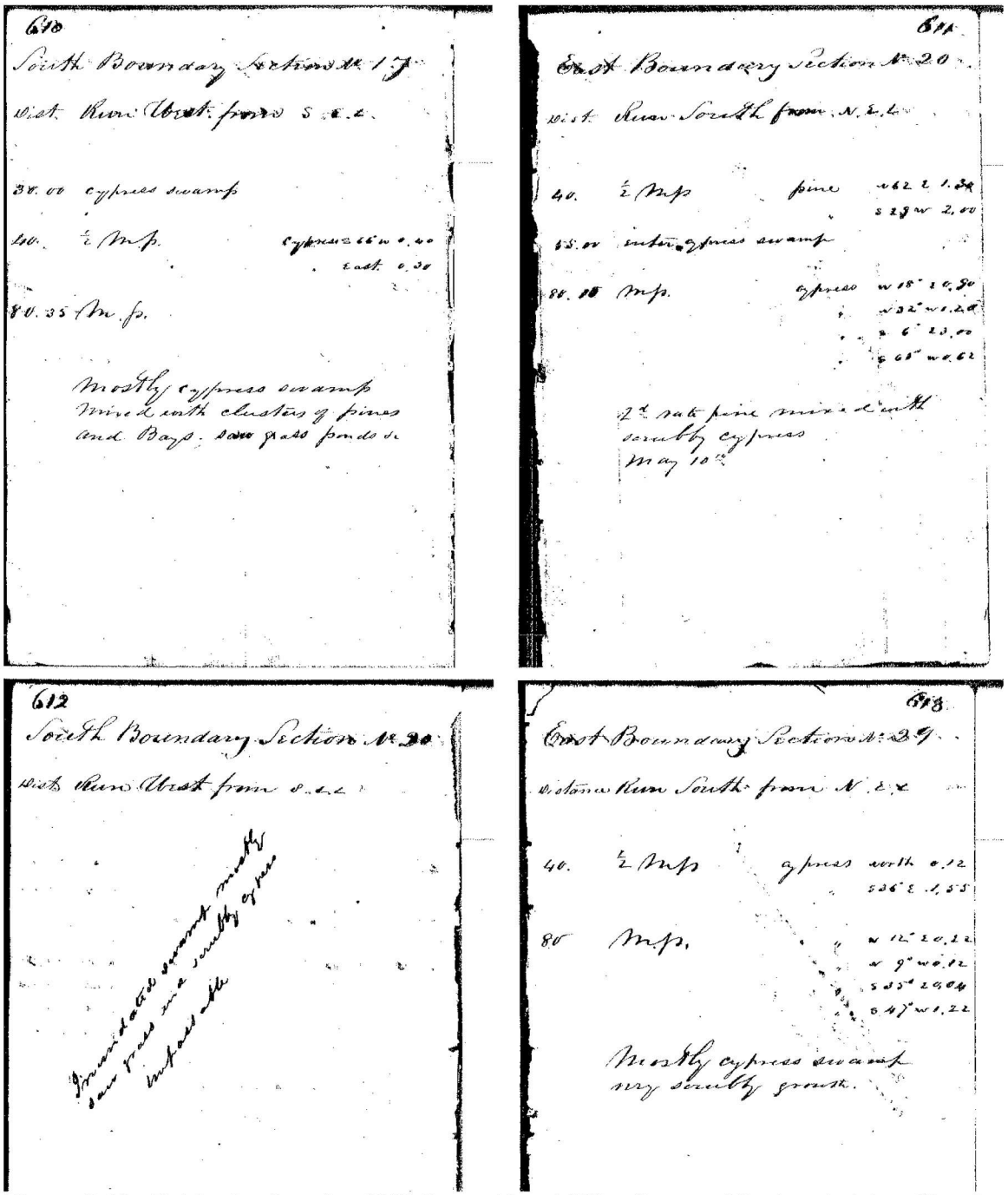


Figure C-13. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

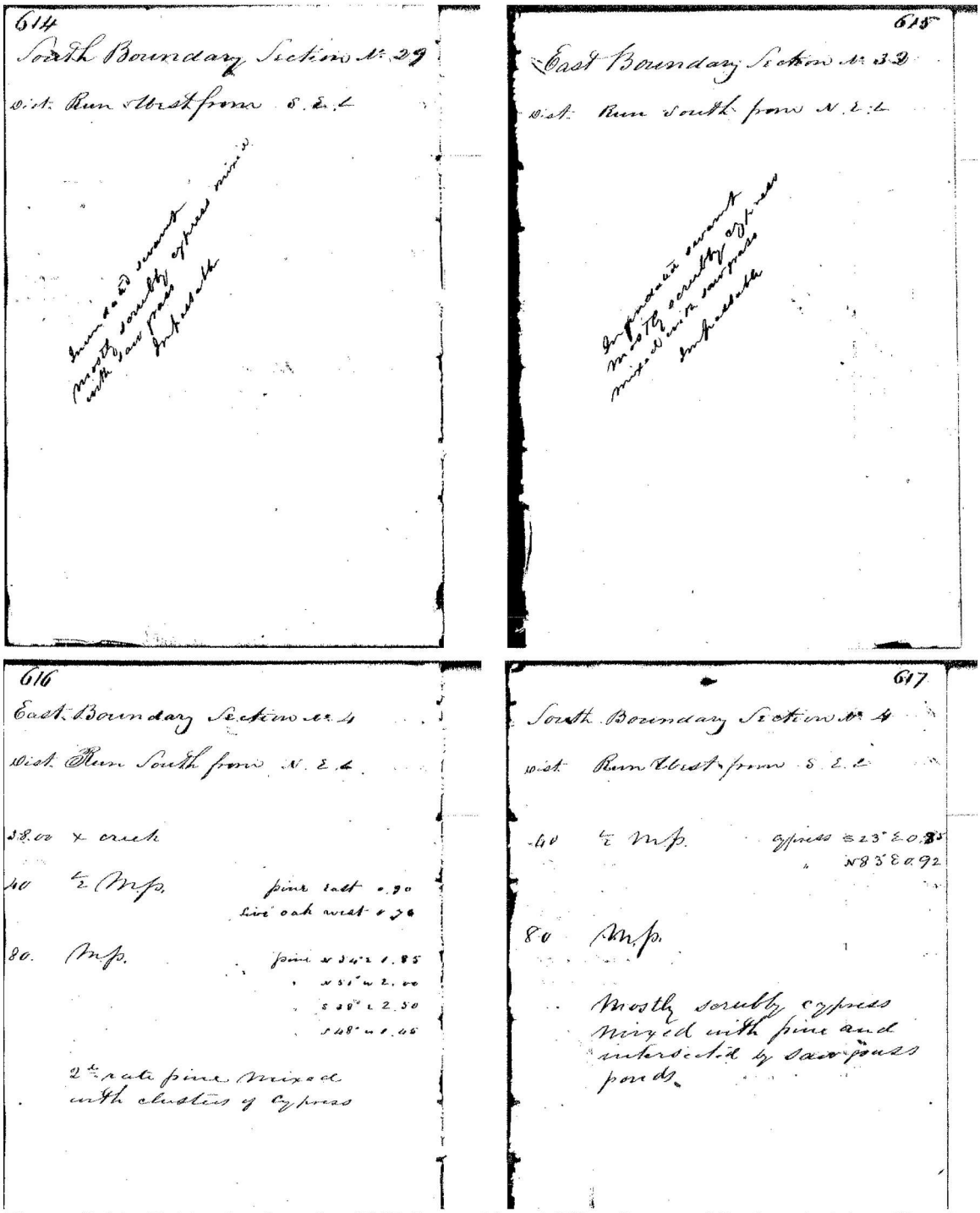


Figure C-14. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

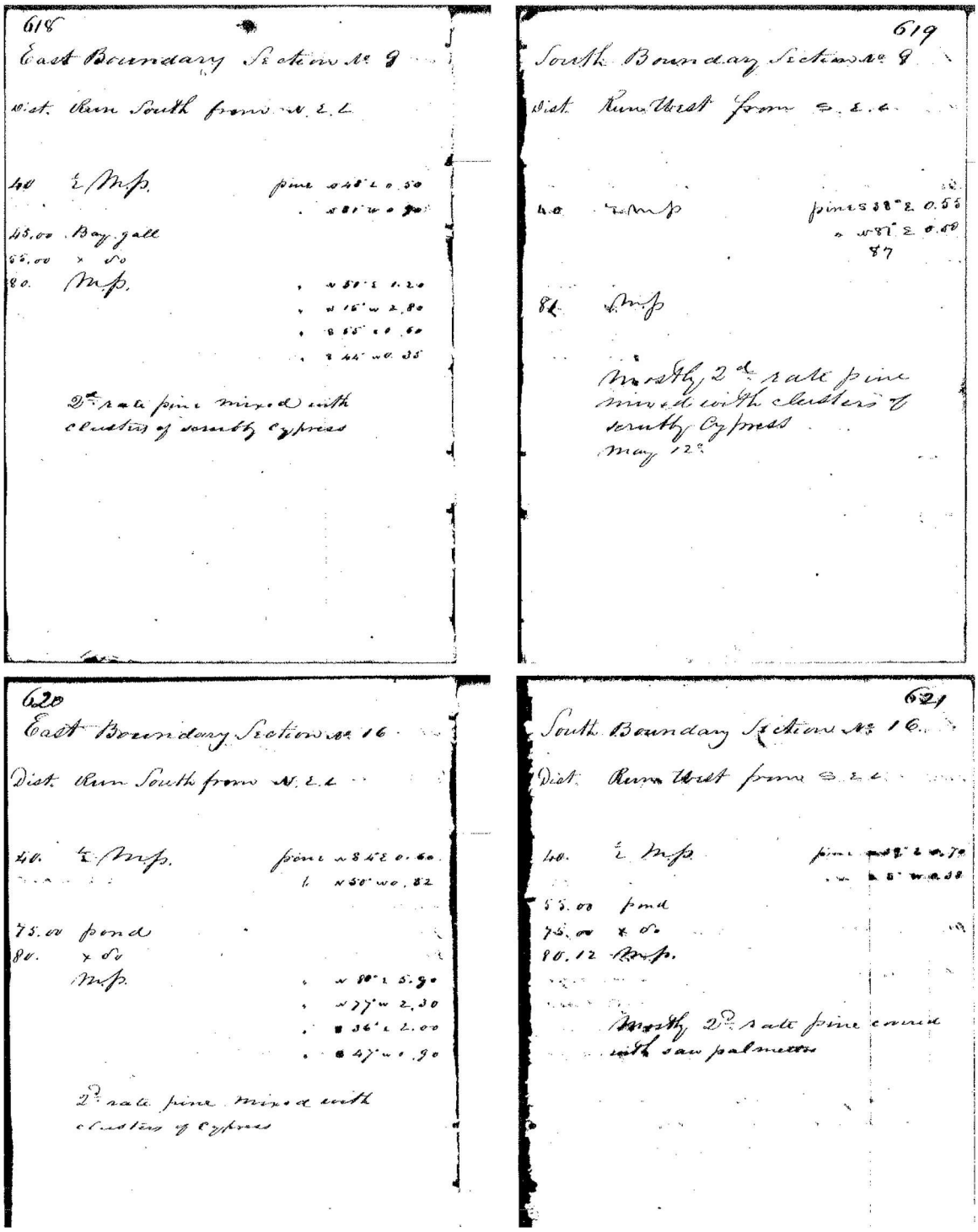


Figure C-15. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

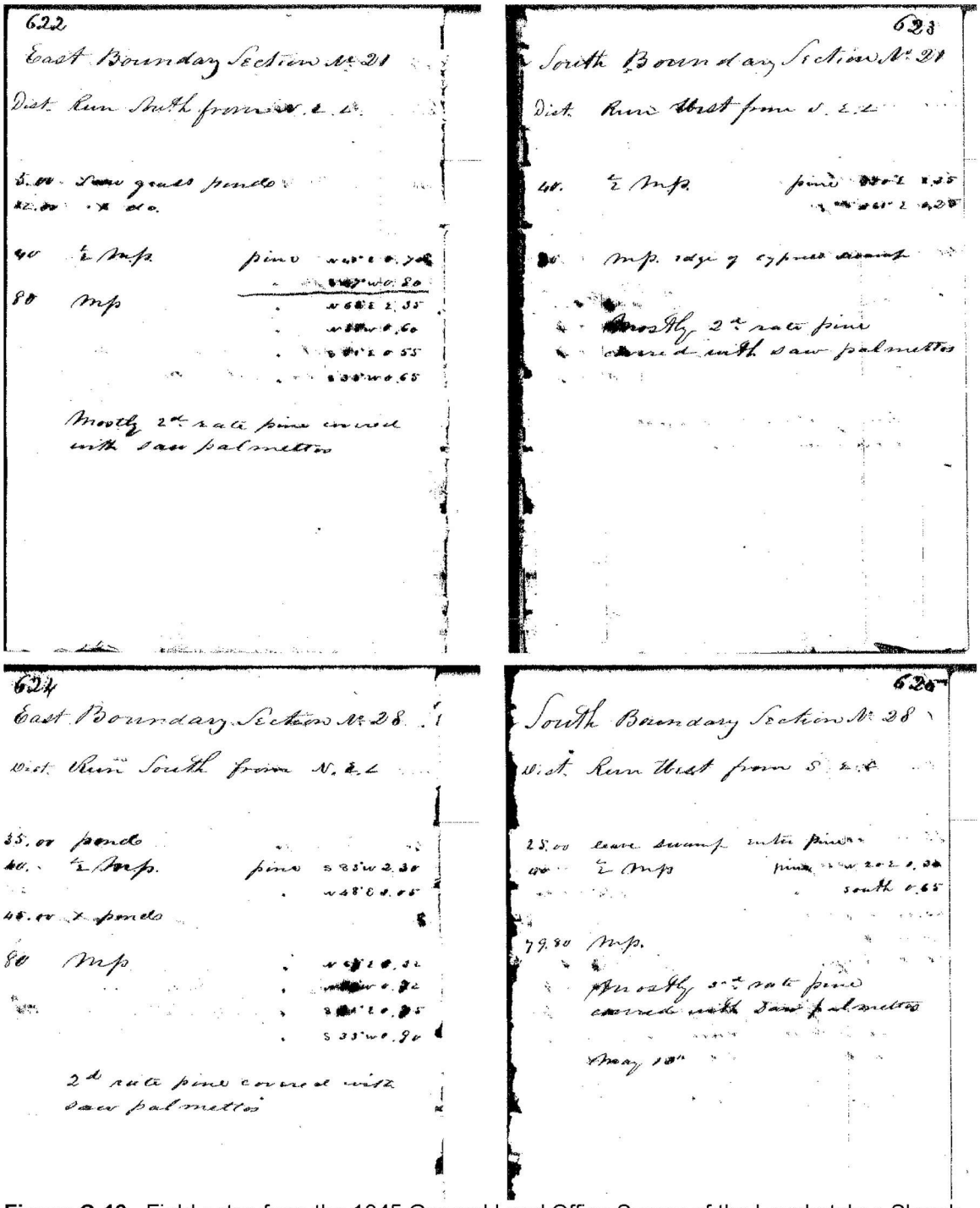


Figure C-16. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

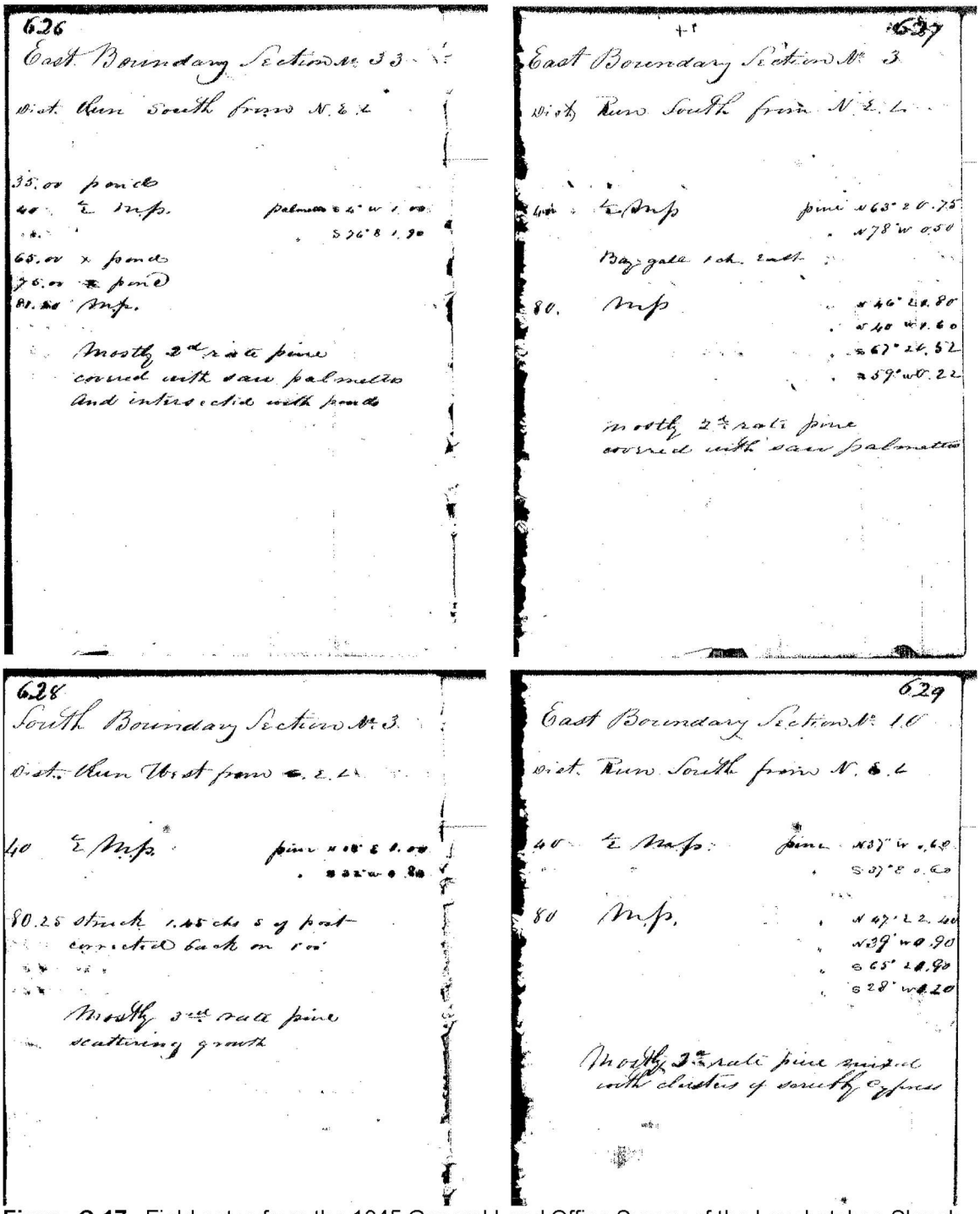


Figure C-17. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

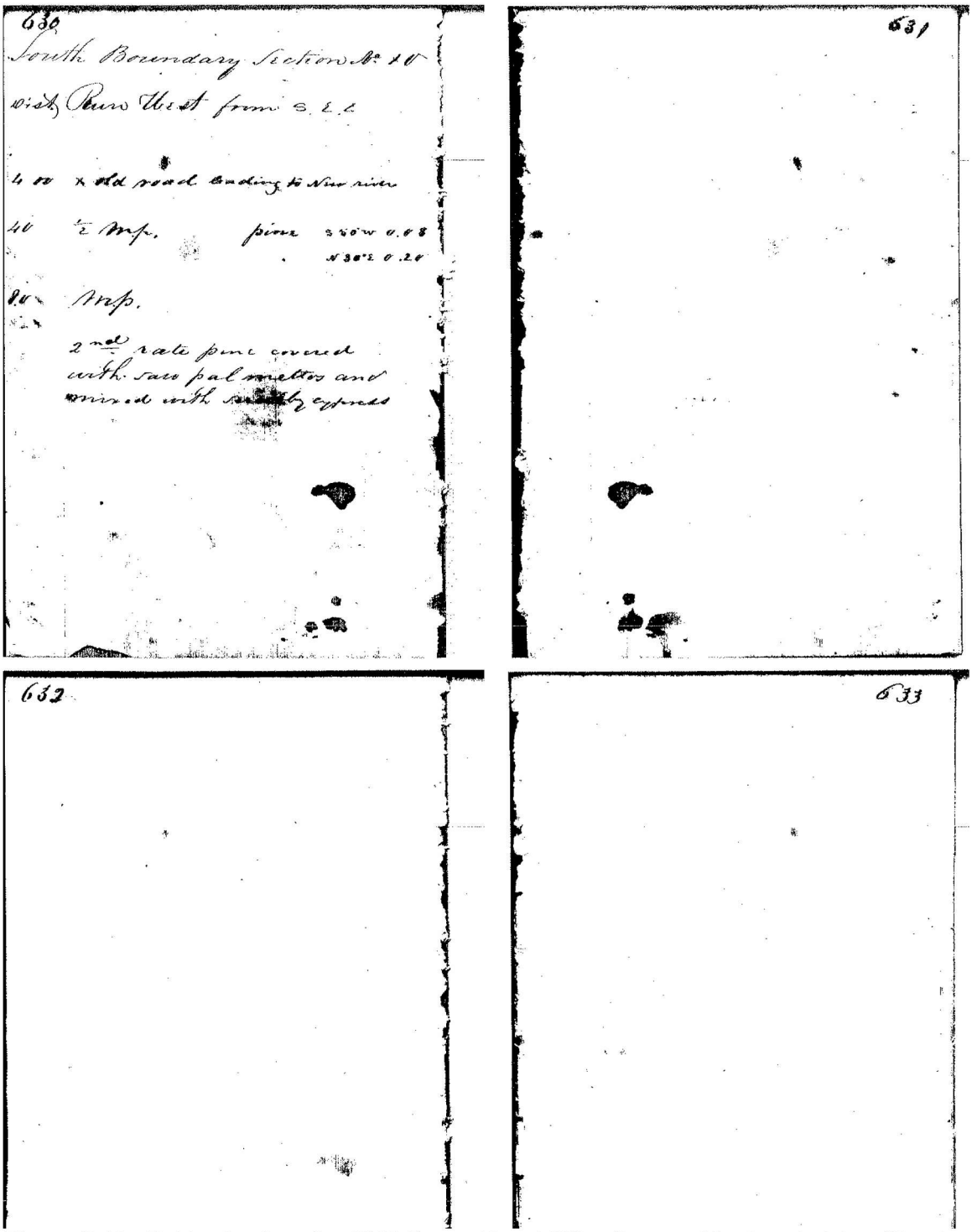


Figure C-18. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

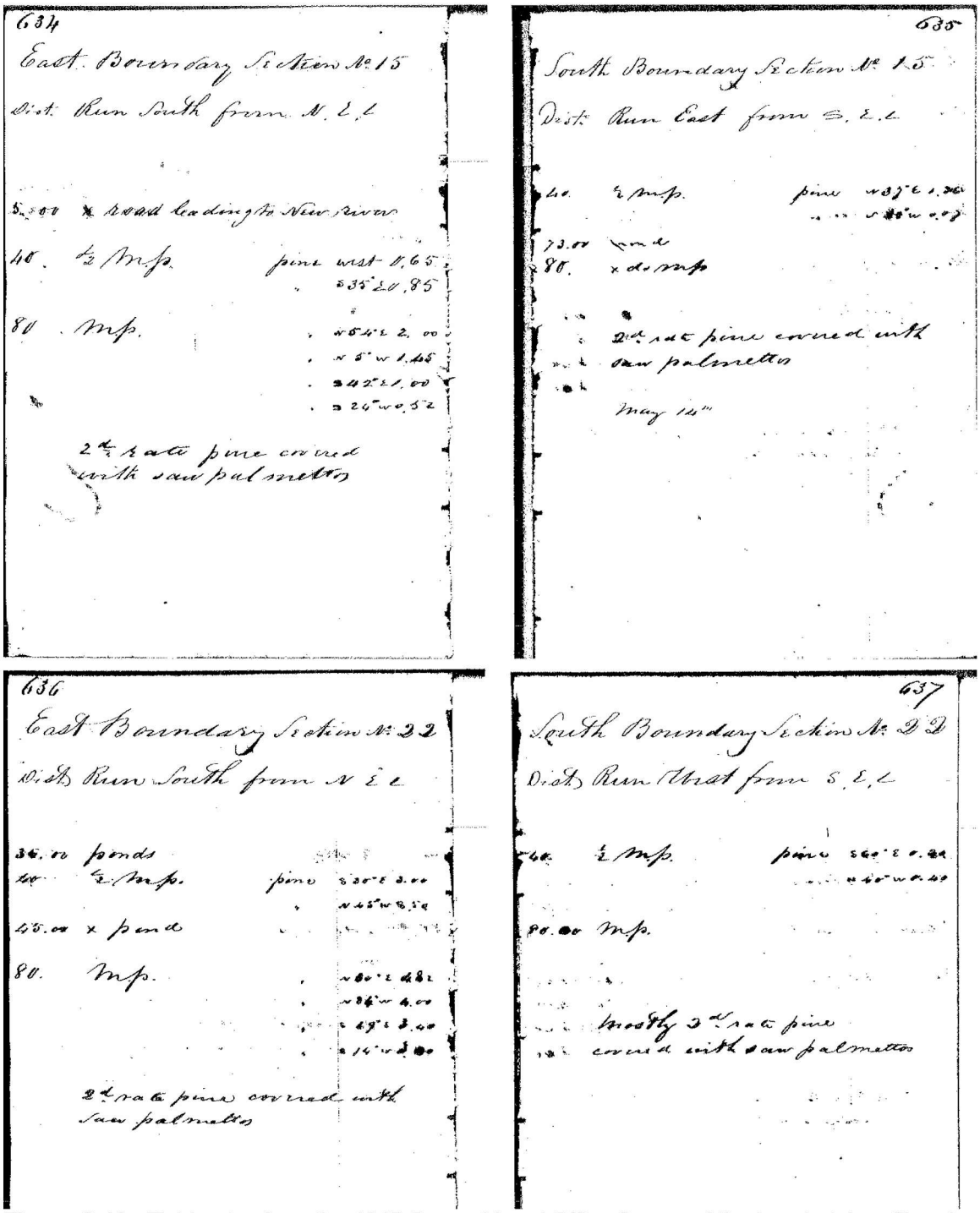


Figure C-19. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

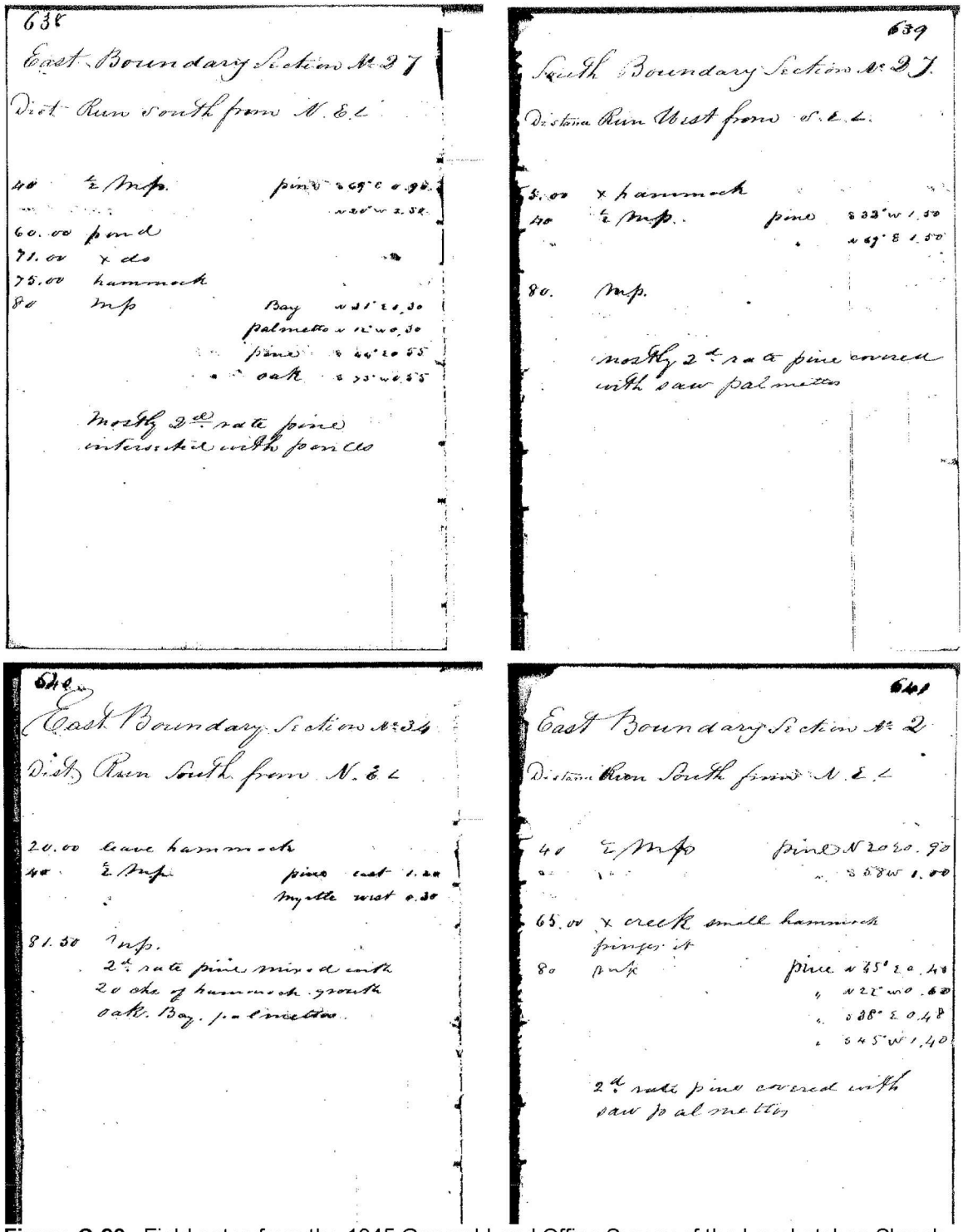


Figure C-20. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

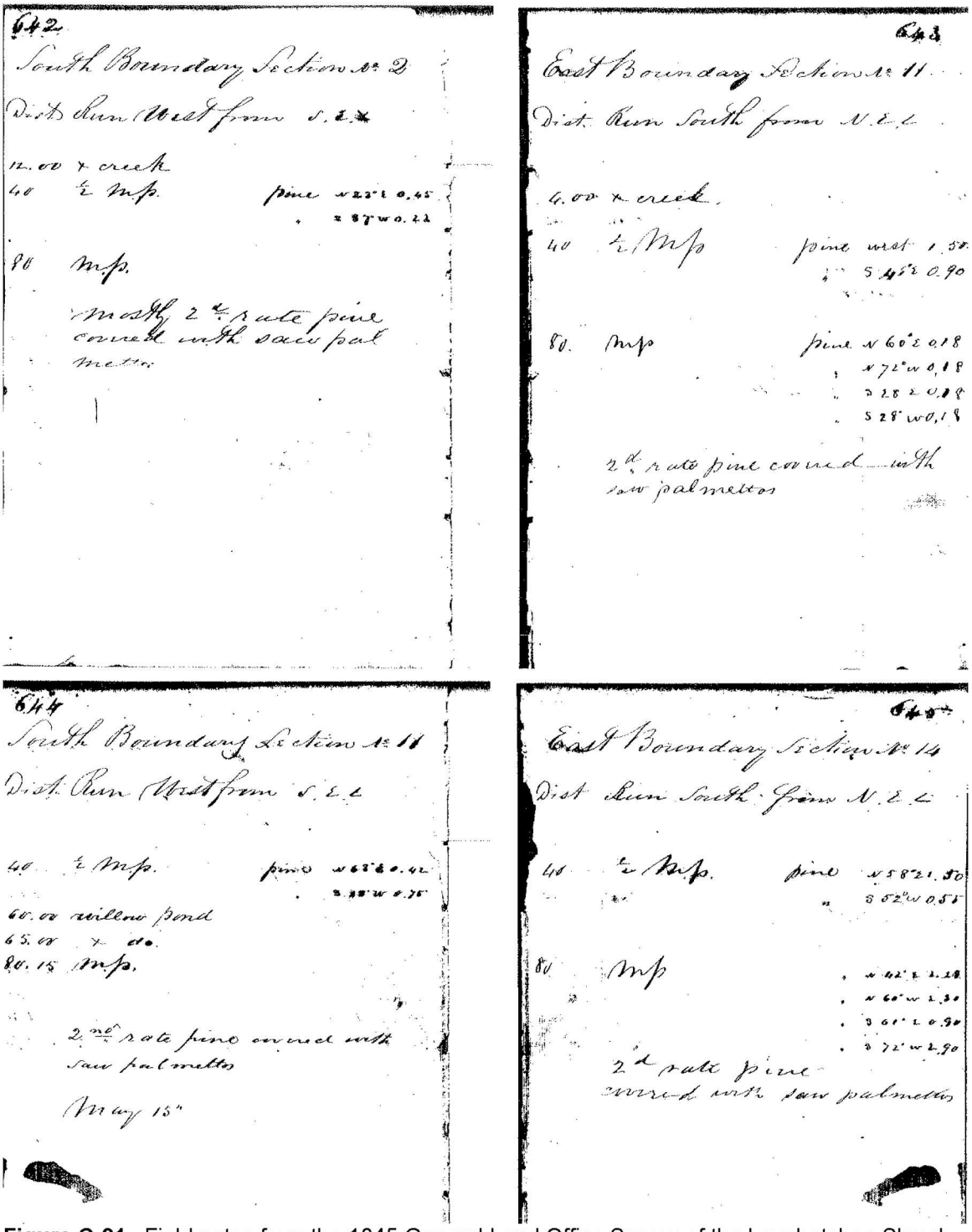


Figure C-21. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

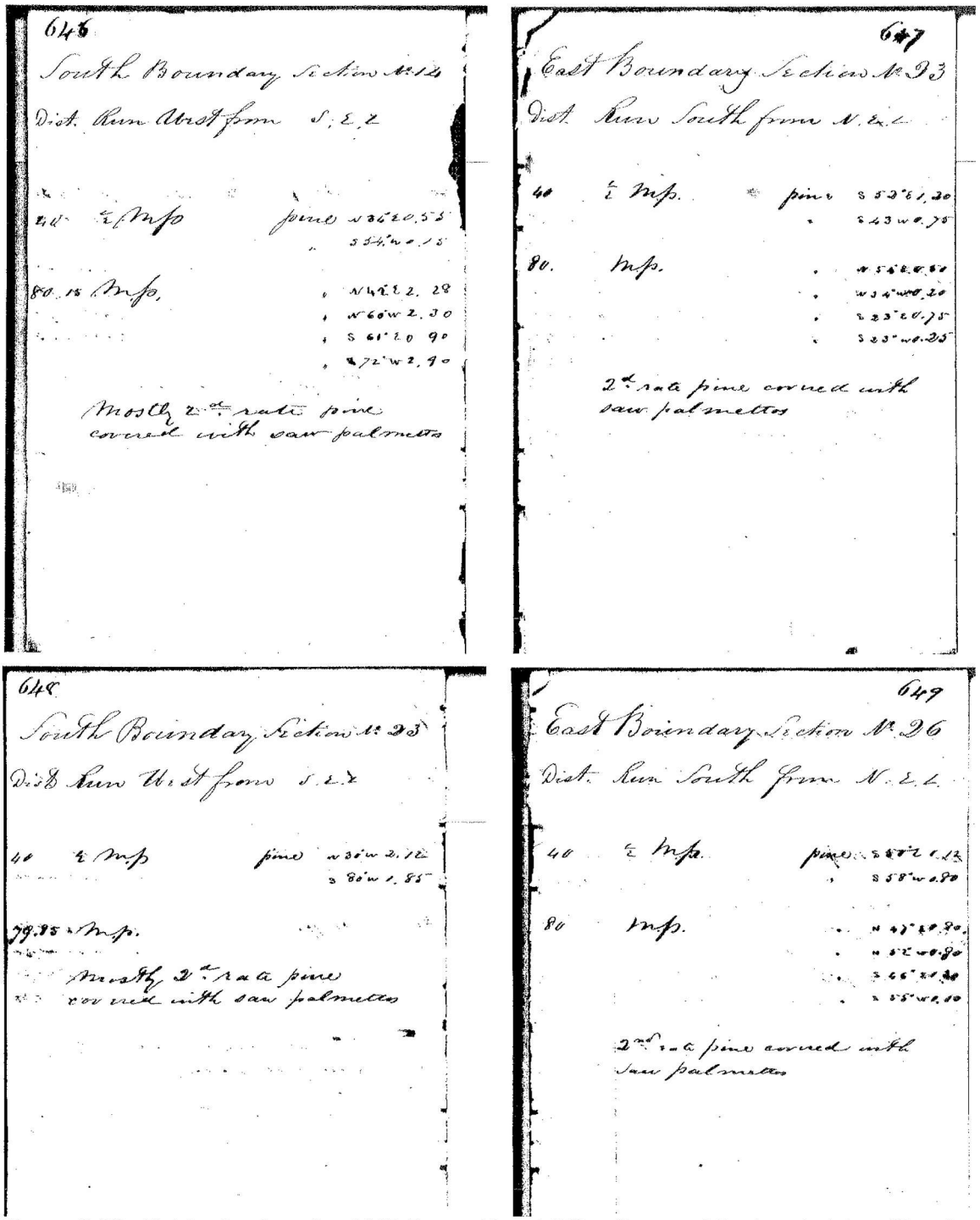


Figure C-22. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

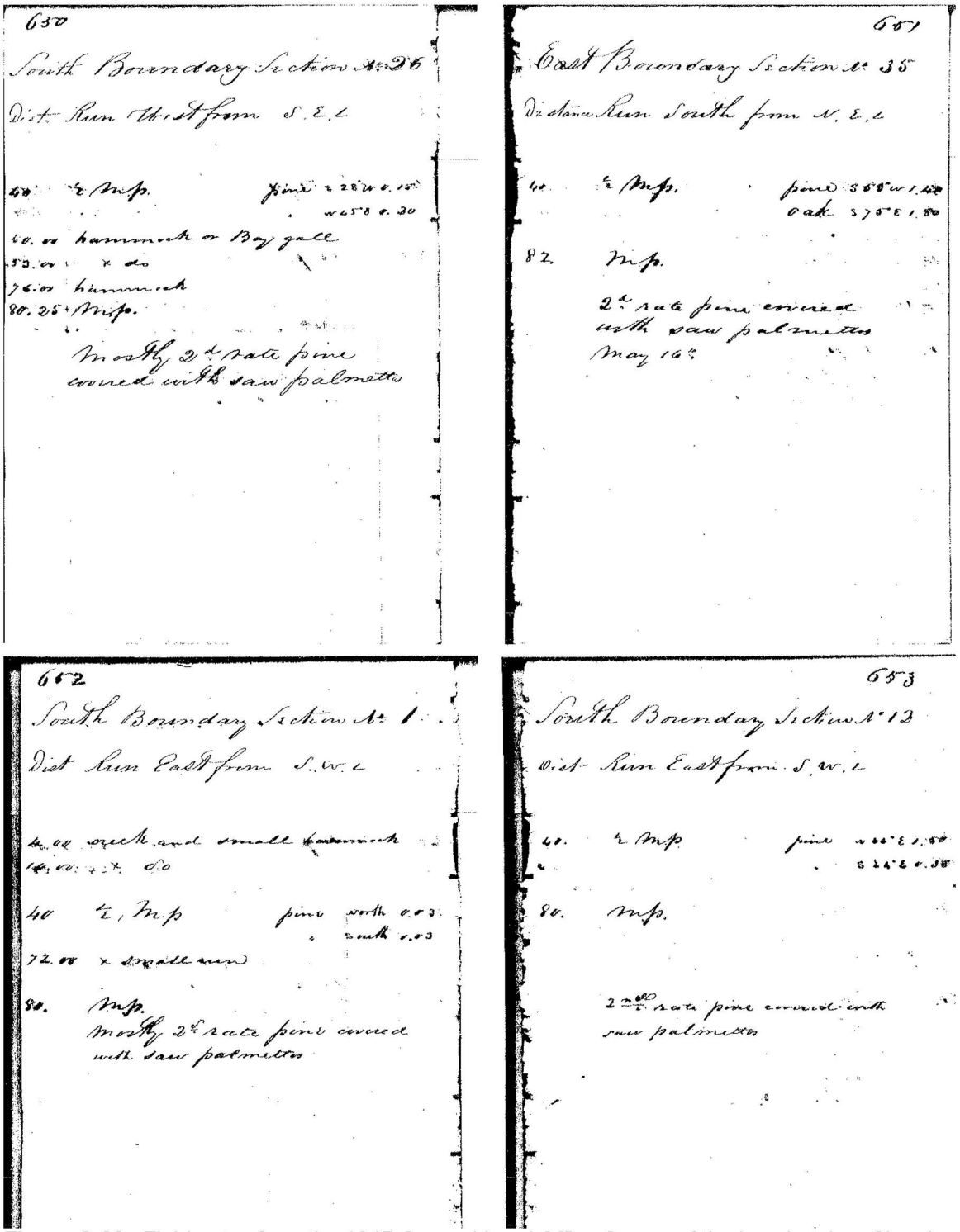


Figure C-23. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

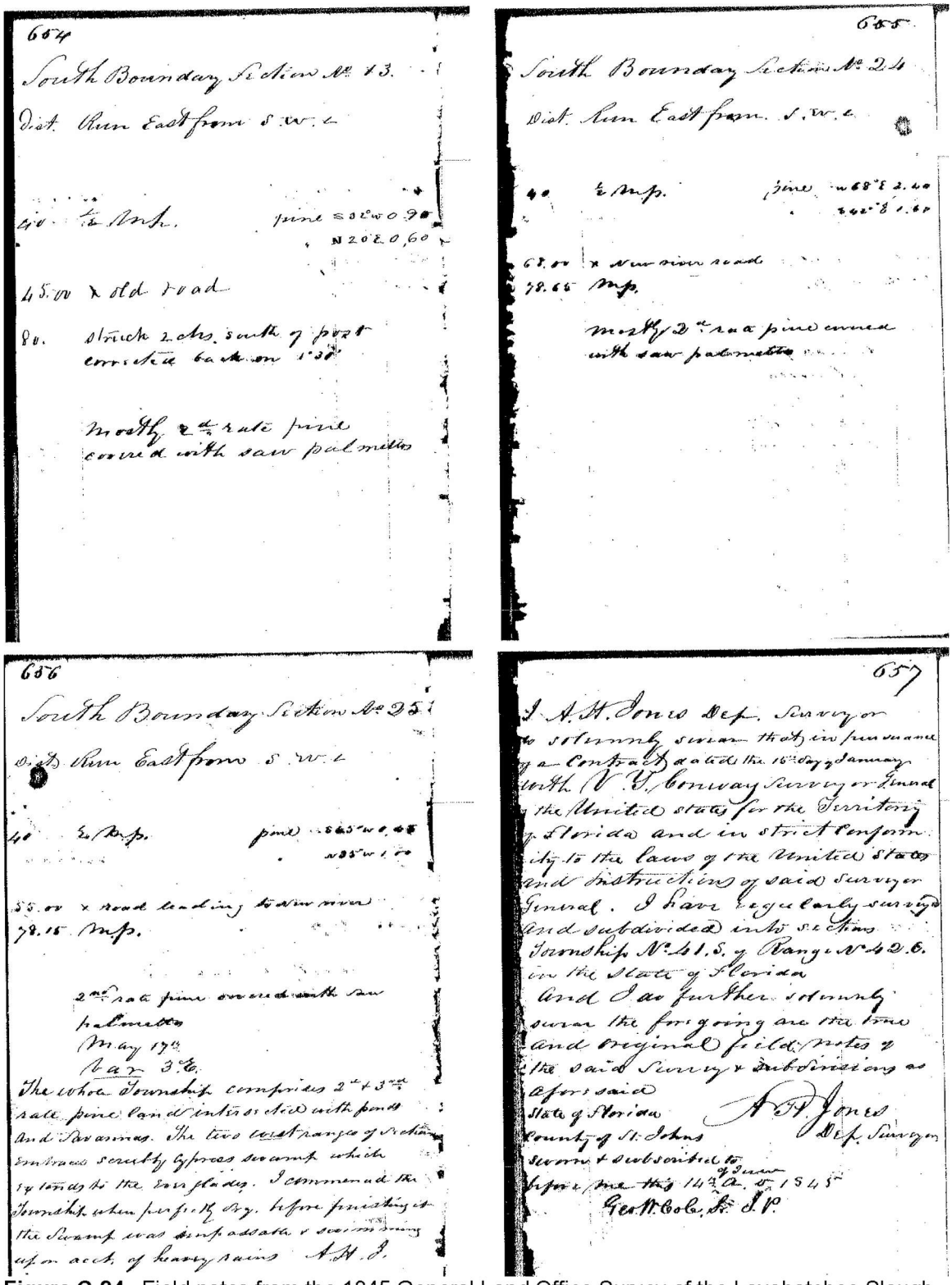


Figure C-24. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 42 East.

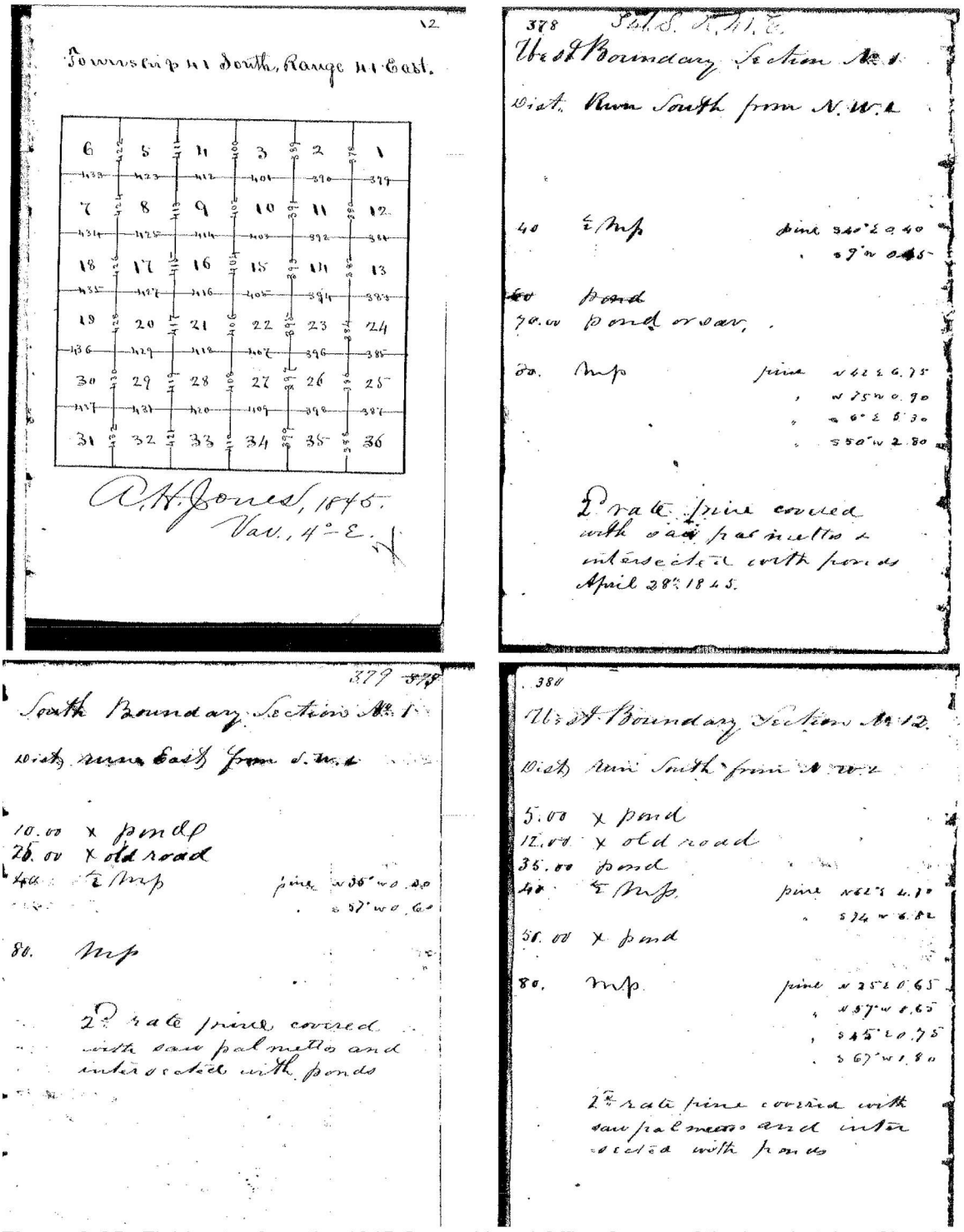


Figure C-25. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

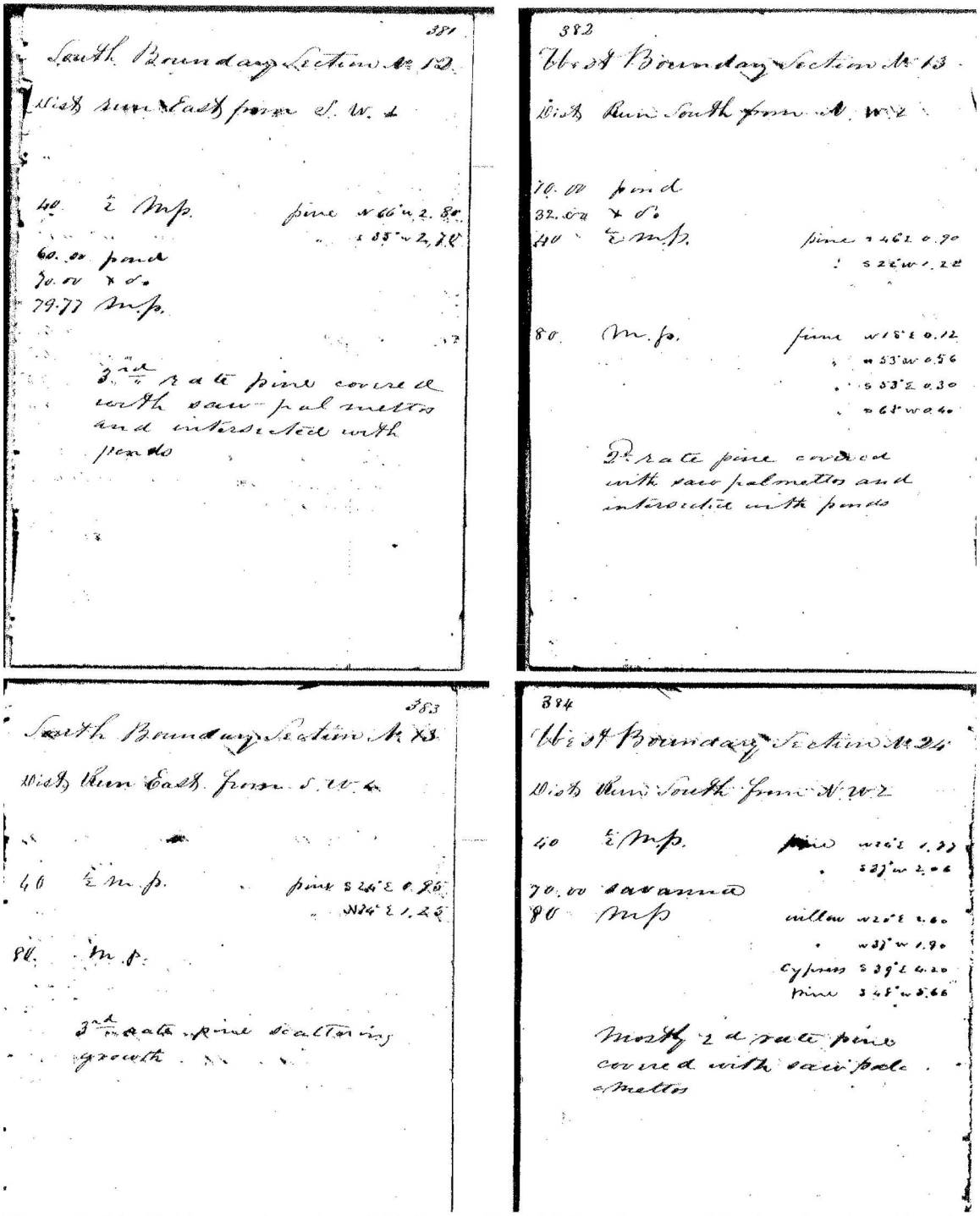


Figure C-26. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

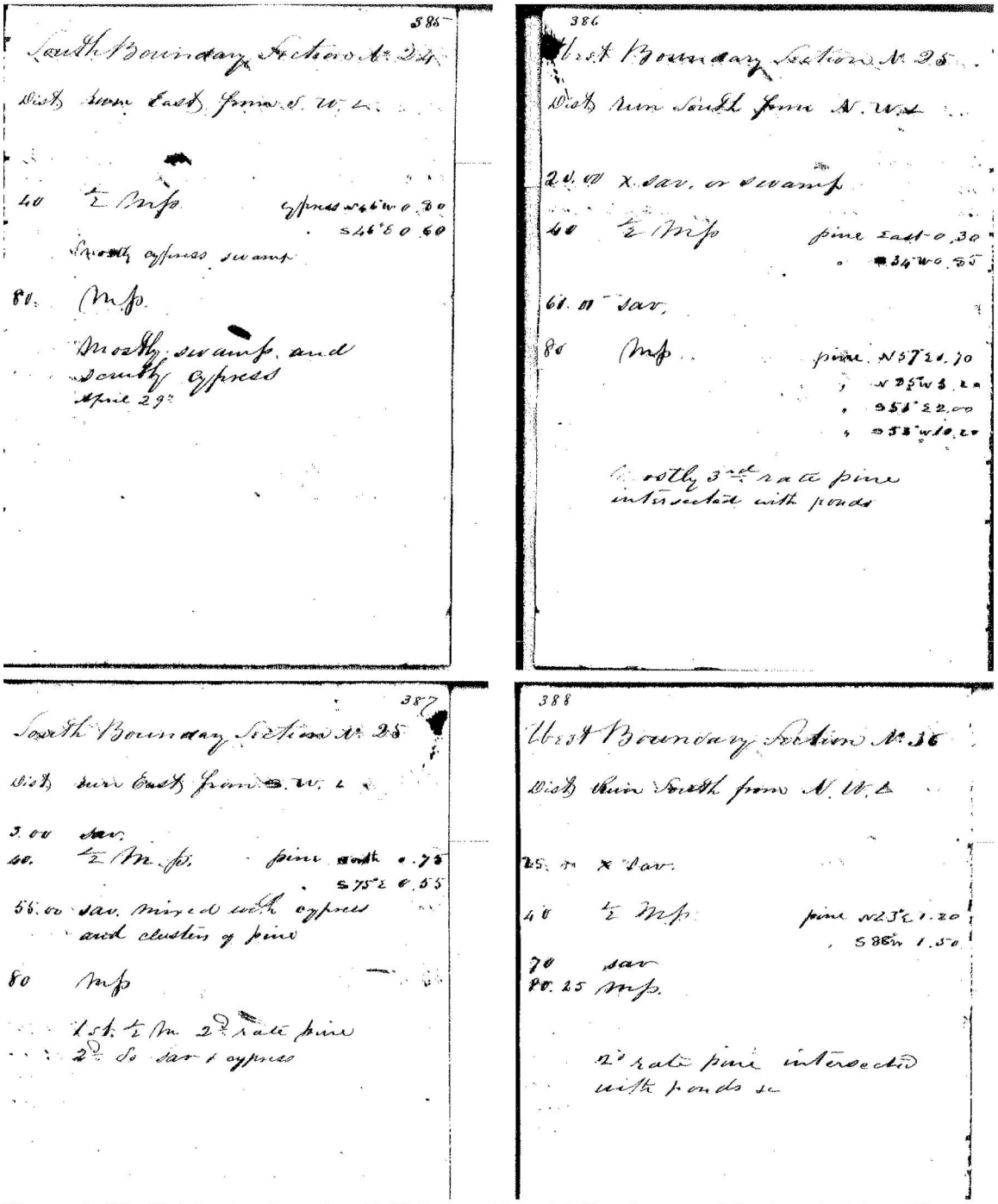


Figure C-27. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

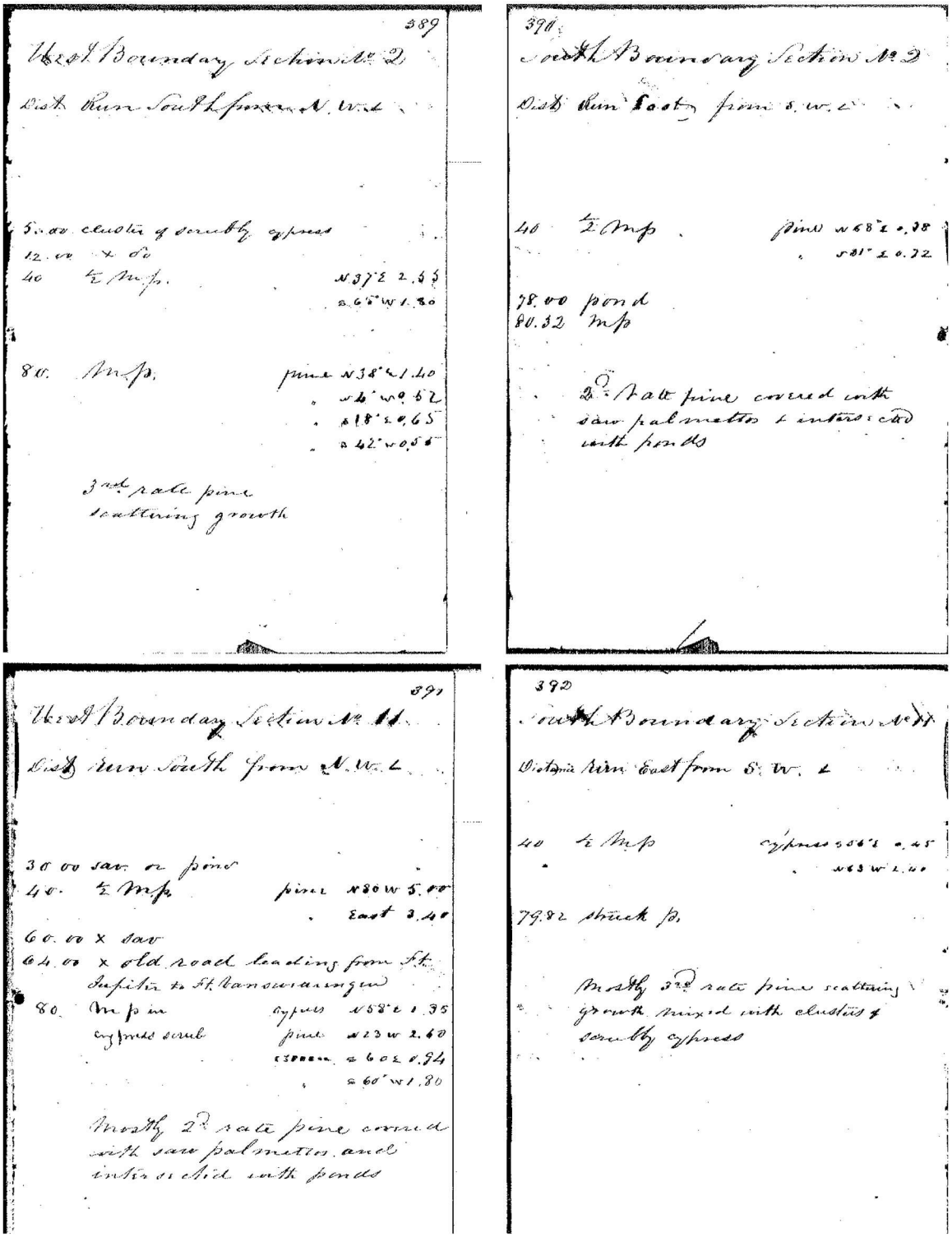
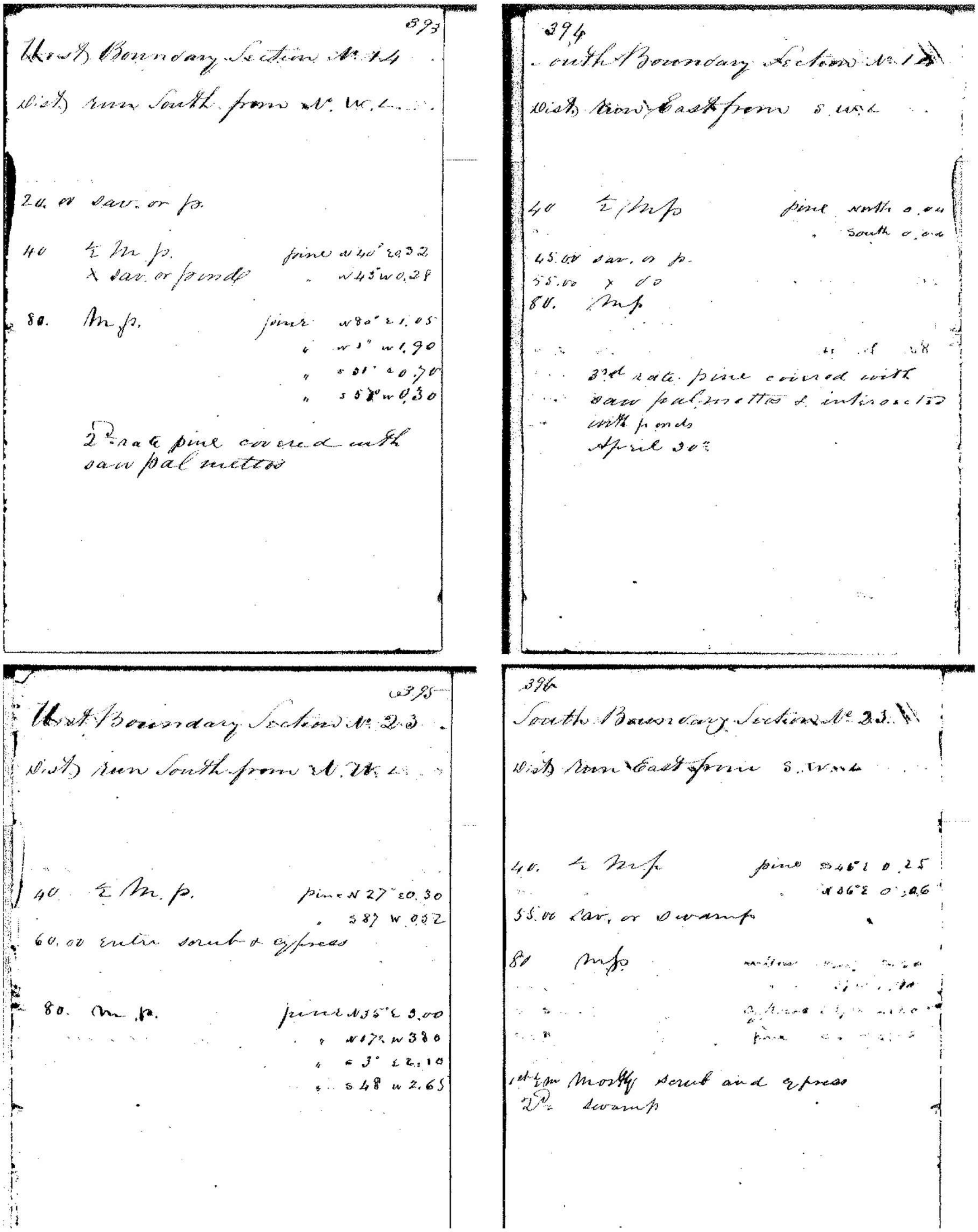


Figure C-28. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.



393

West Boundary Section No. 14

Dist. run South from N. W. C.

20.00 sav. or p.

40 ¼ M. p. pine N 40° E 0.32
X sav. or ponds " N 45 W 0.28

80. M. p. pine N 80° E 1.05
" N 3° W 1.90
" S 81° E 0.70
" S 58° W 0.30

2nd rate pine covered with
saw palmettos

394

South Boundary Section No. 14

Dist. run East from S. W. C.

40 ¼ M. p. pine North 0.04
" South 0.04

45.00 sav. or p.

55.00 X do

80. M. p.

3rd rate pine covered with
saw palmettos & intersected
with ponds
April 30th

395

West Boundary Section No. 23

Dist. run South from N. W. C.

40 ¼ M. p. pine N 27° E 0.30
" S 87 W 0.52

60.00 enter scrub & cypress

80. M. p. pine N 35° E 3.00
" N 17° W 3.80
" S 3° E 2.10
" S 48 W 2.65

396

South Boundary Section No. 23

Dist. run East from S. W. C.

40. ¼ M. p. pine S 45° E 0.25
" N 86° E 0.06

55.00 sav. or swamp

80 M. p.

1st ½ m. mostly scrub and cypress
2nd ½ swamp

Figure C-29. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

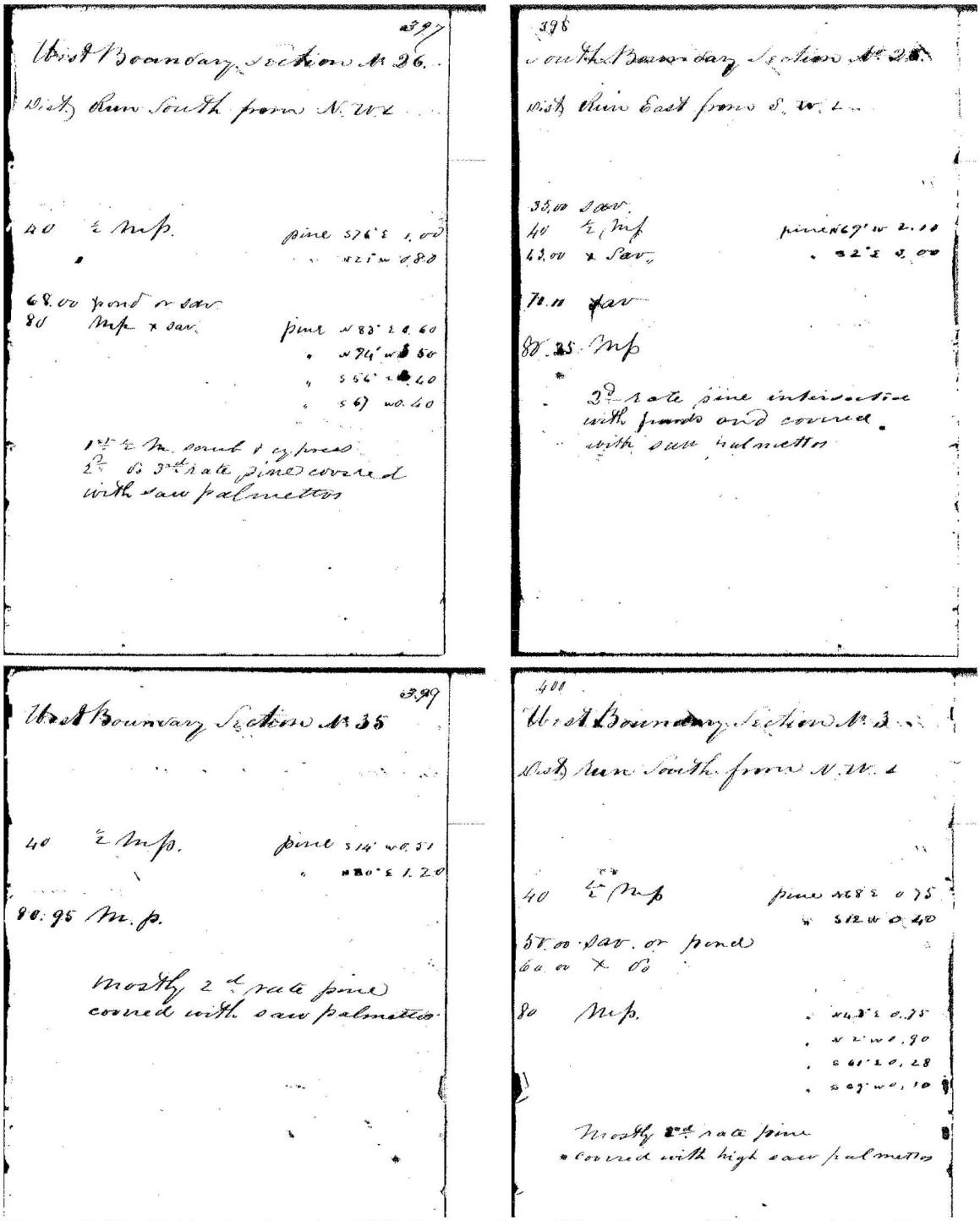


Figure C-30. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

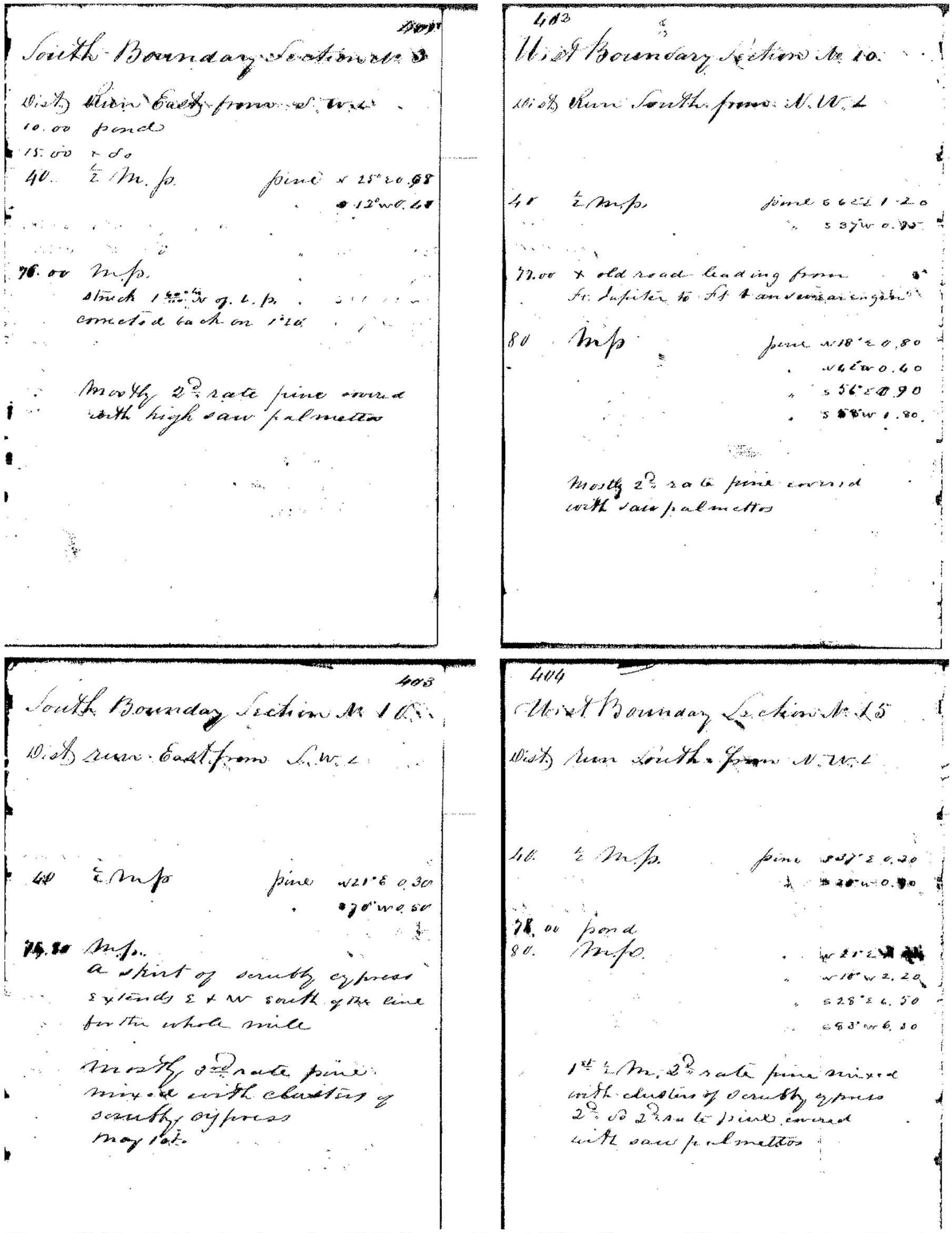


Figure C-31. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

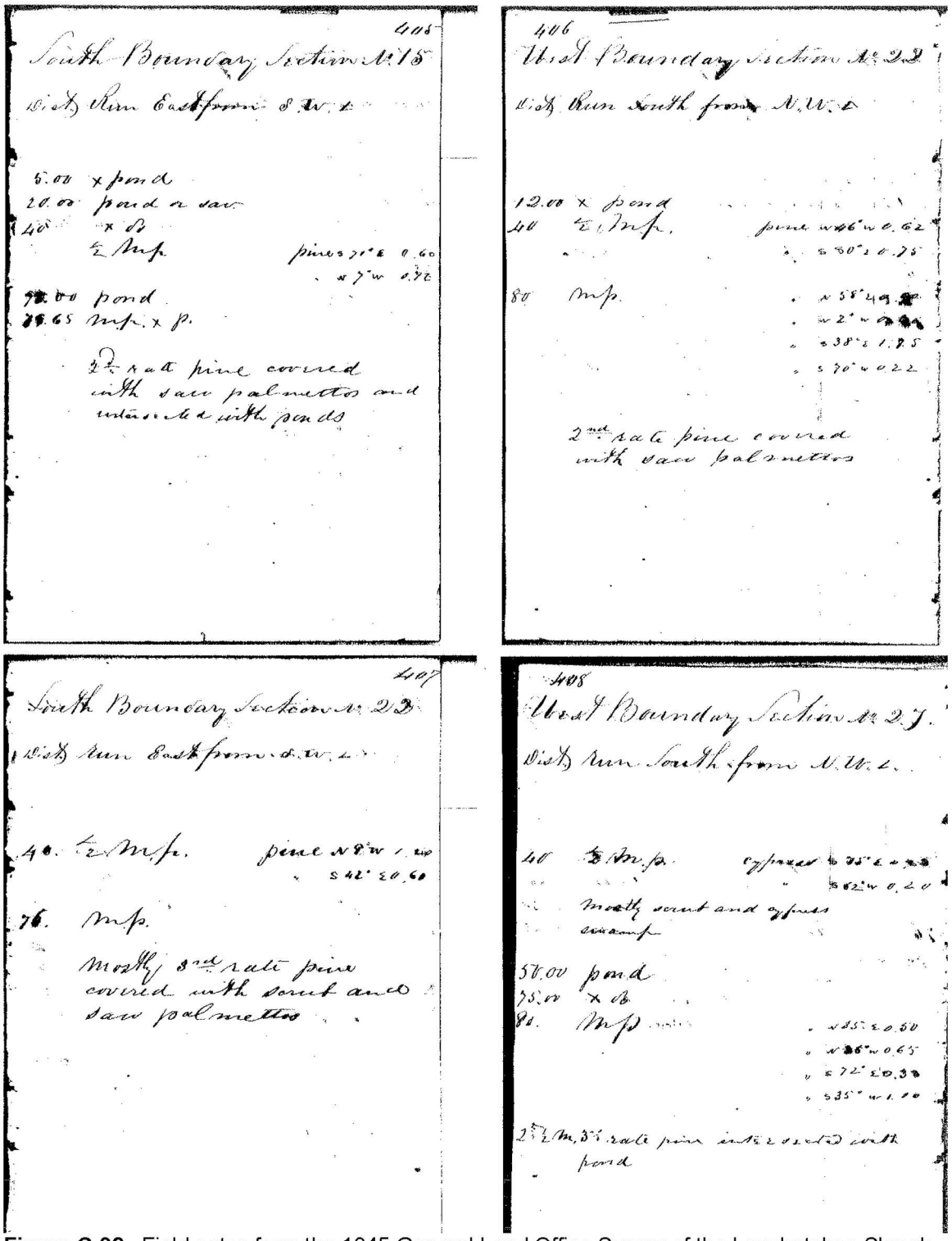


Figure C-32. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

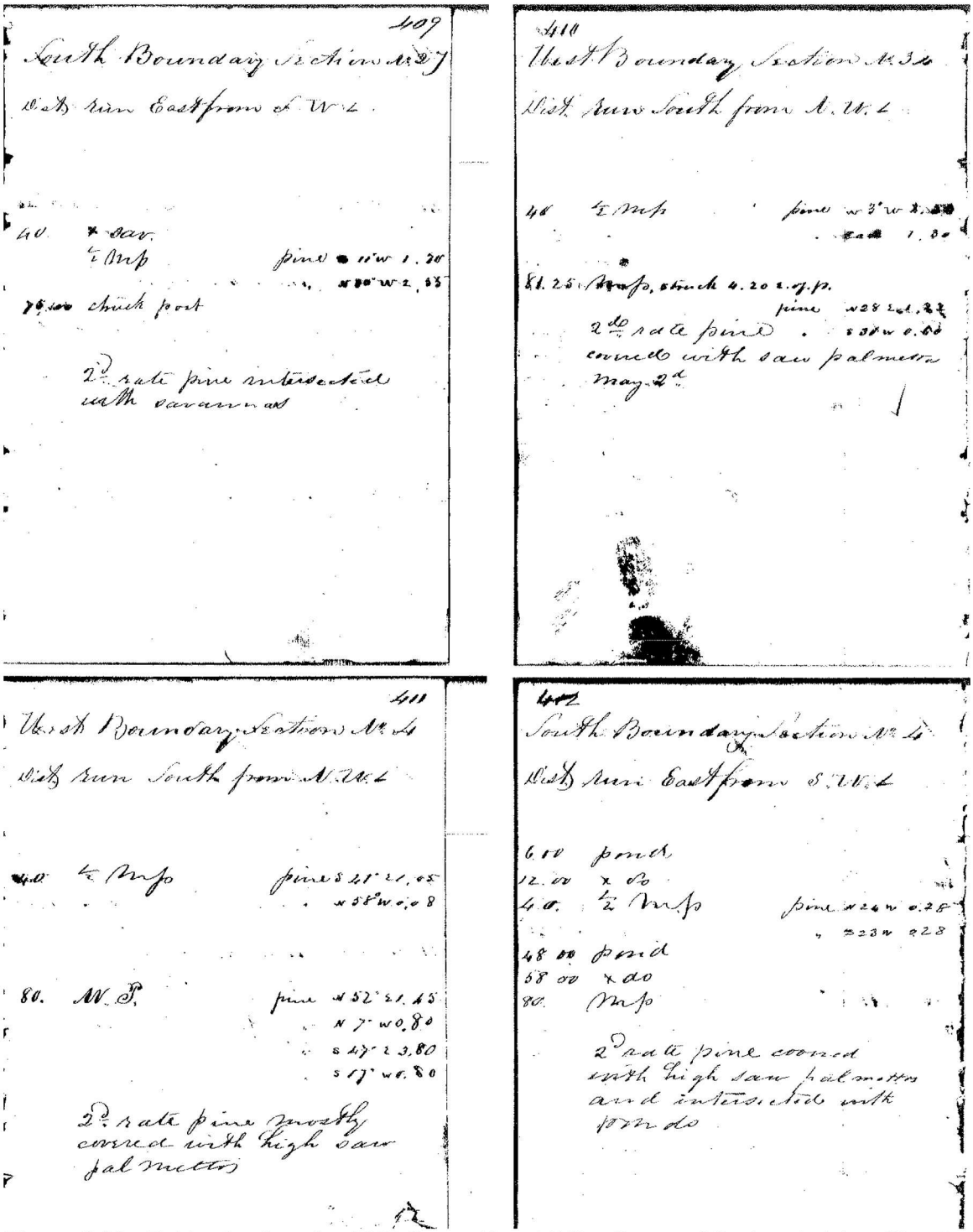


Figure C-33. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

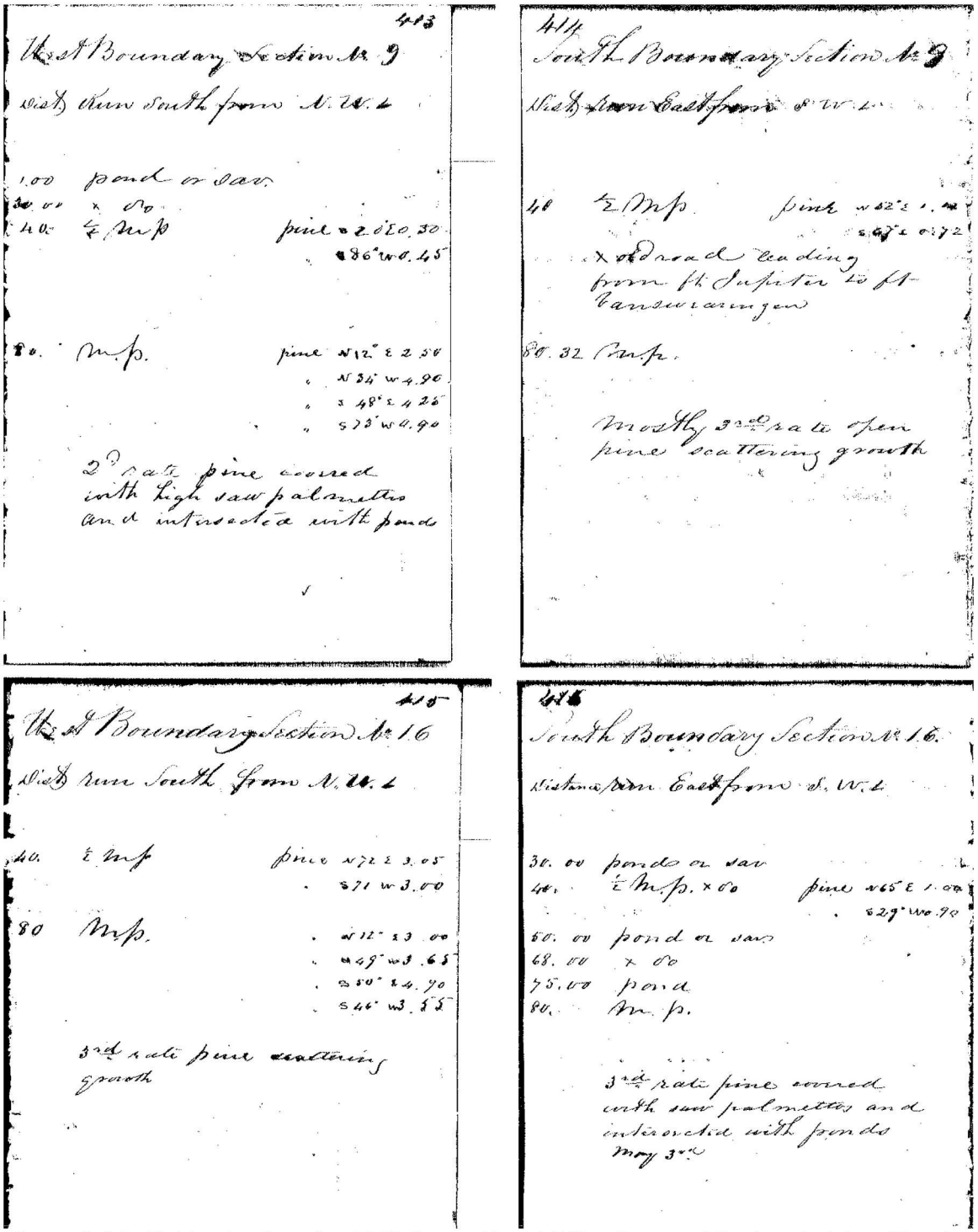


Figure C-34. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

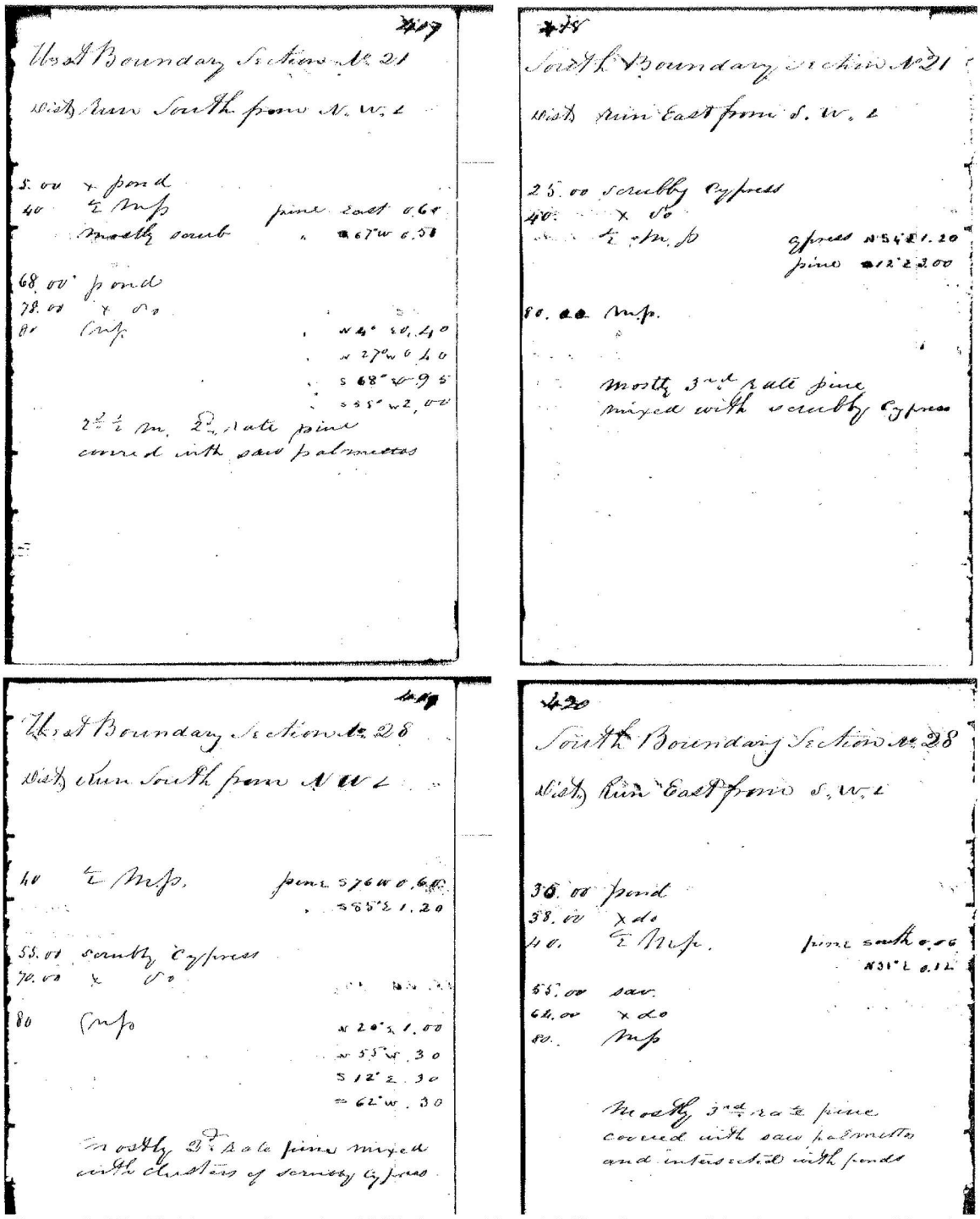


Figure C-35. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

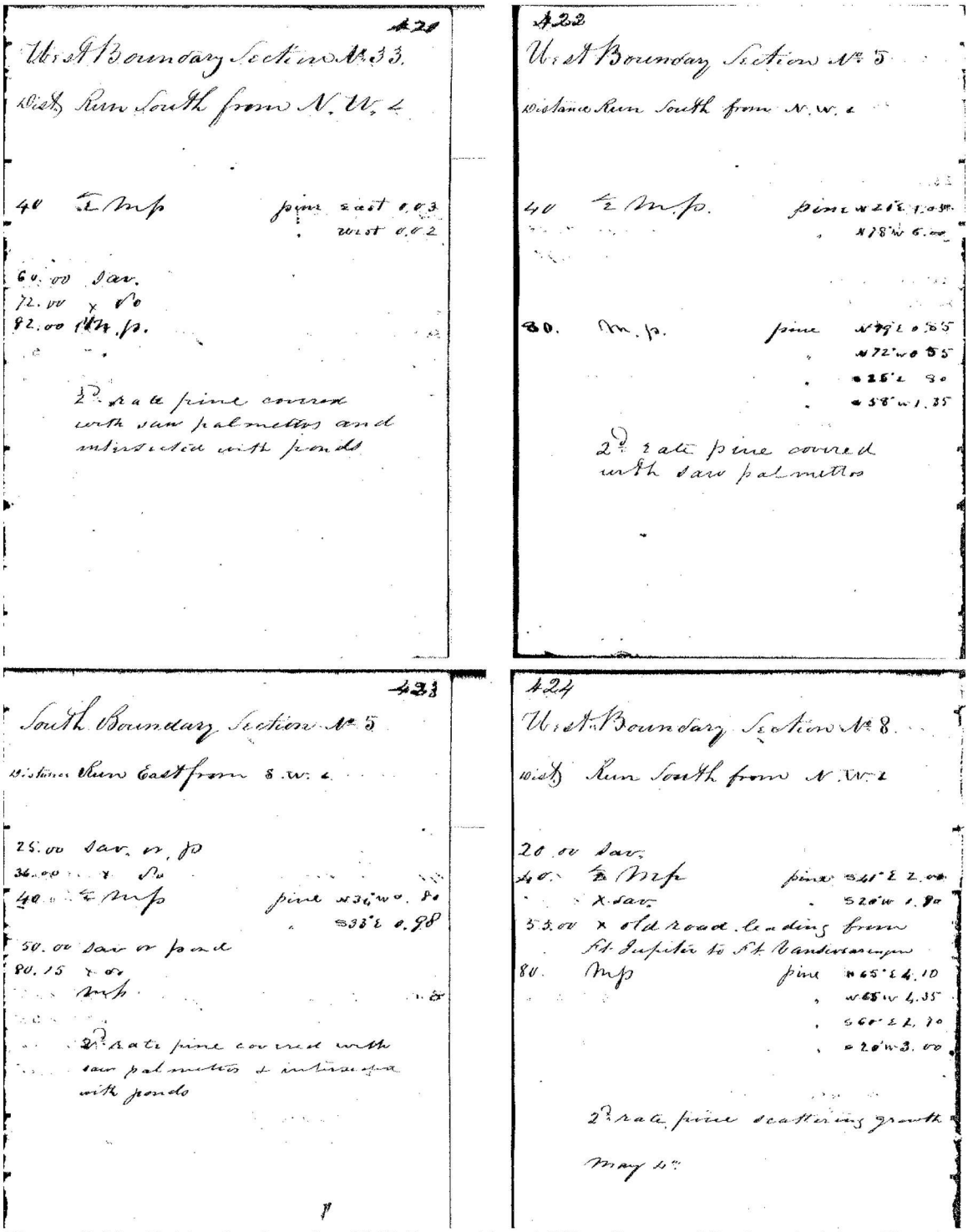


Figure C-36. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

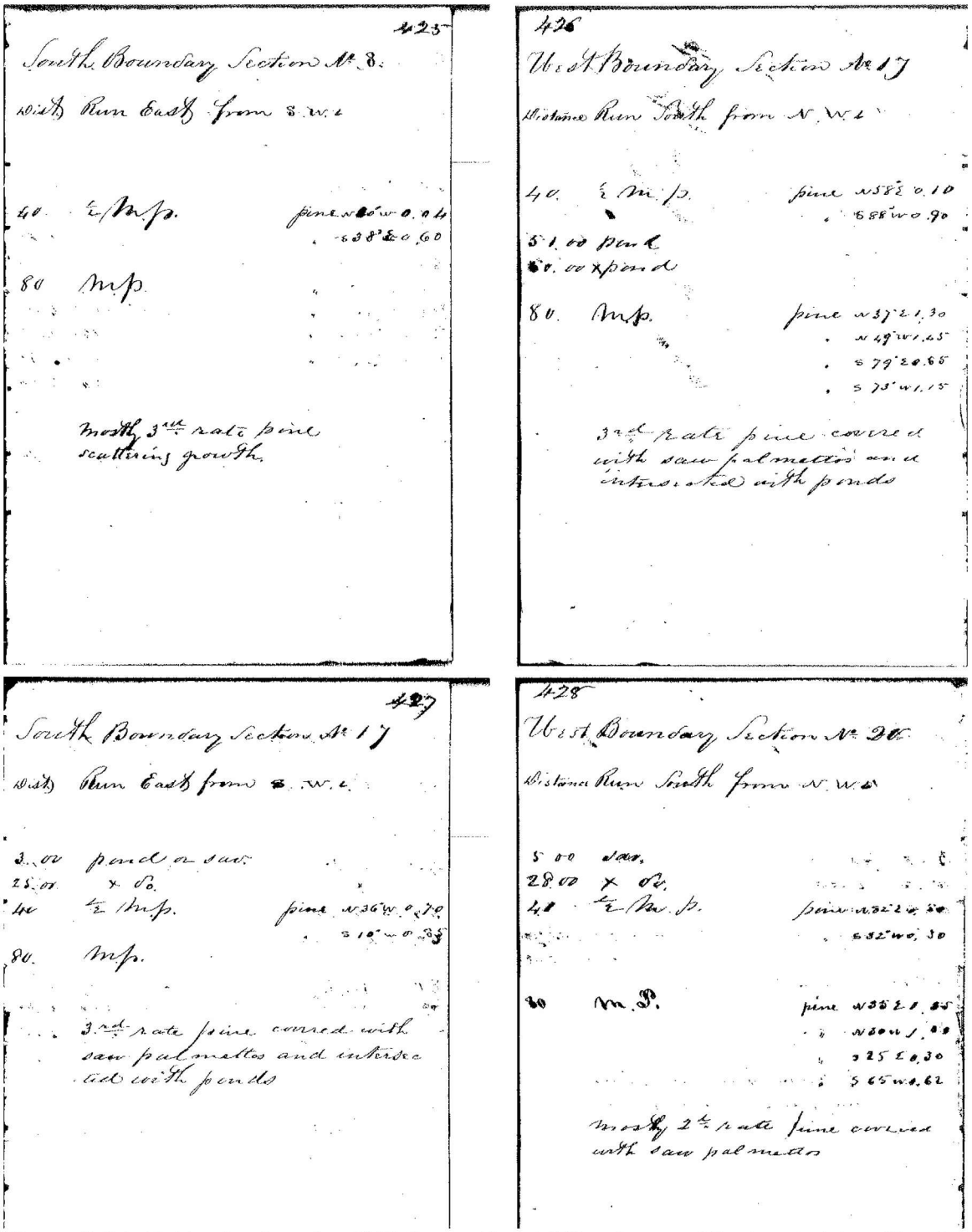


Figure C-37. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

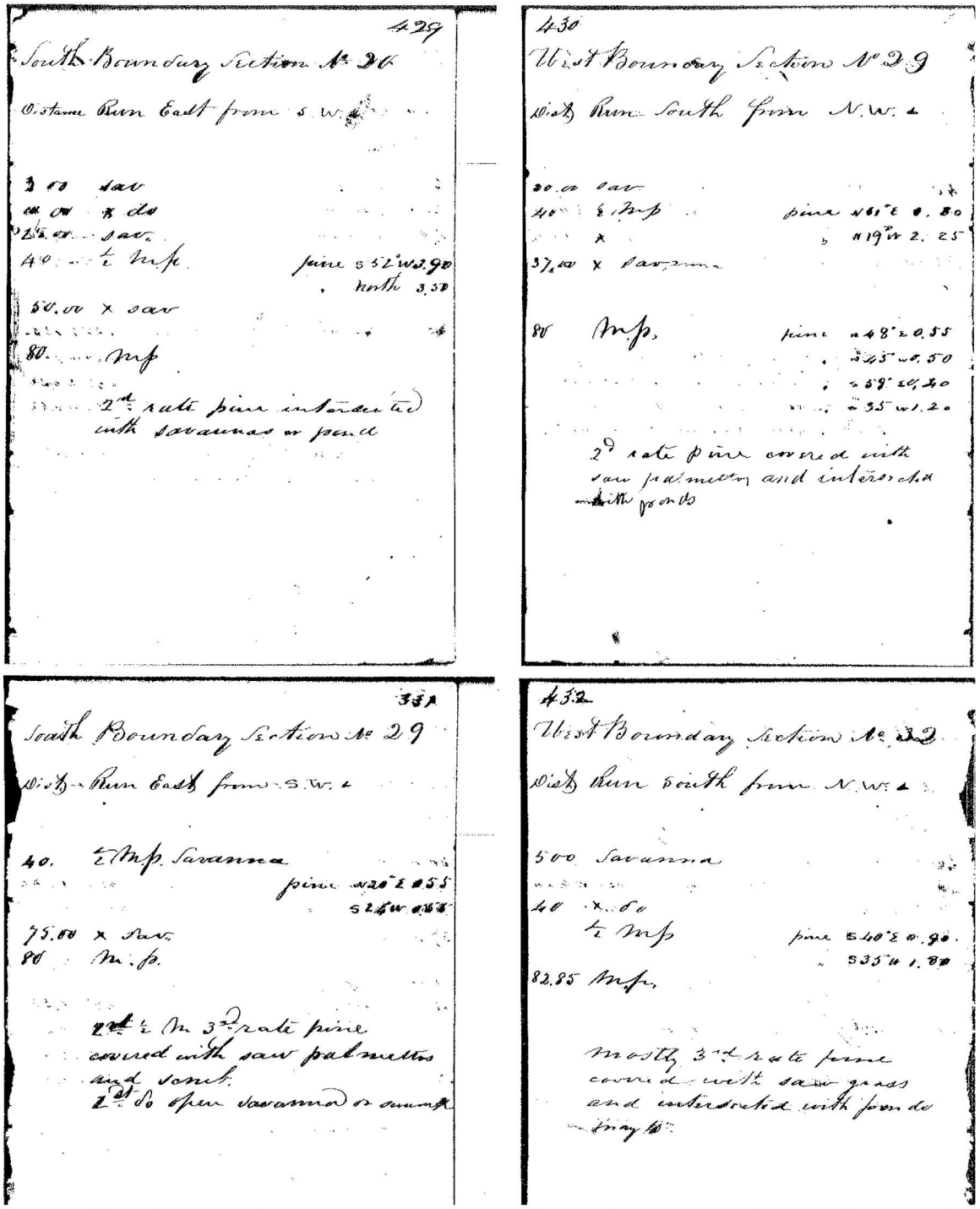


Figure C-38. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

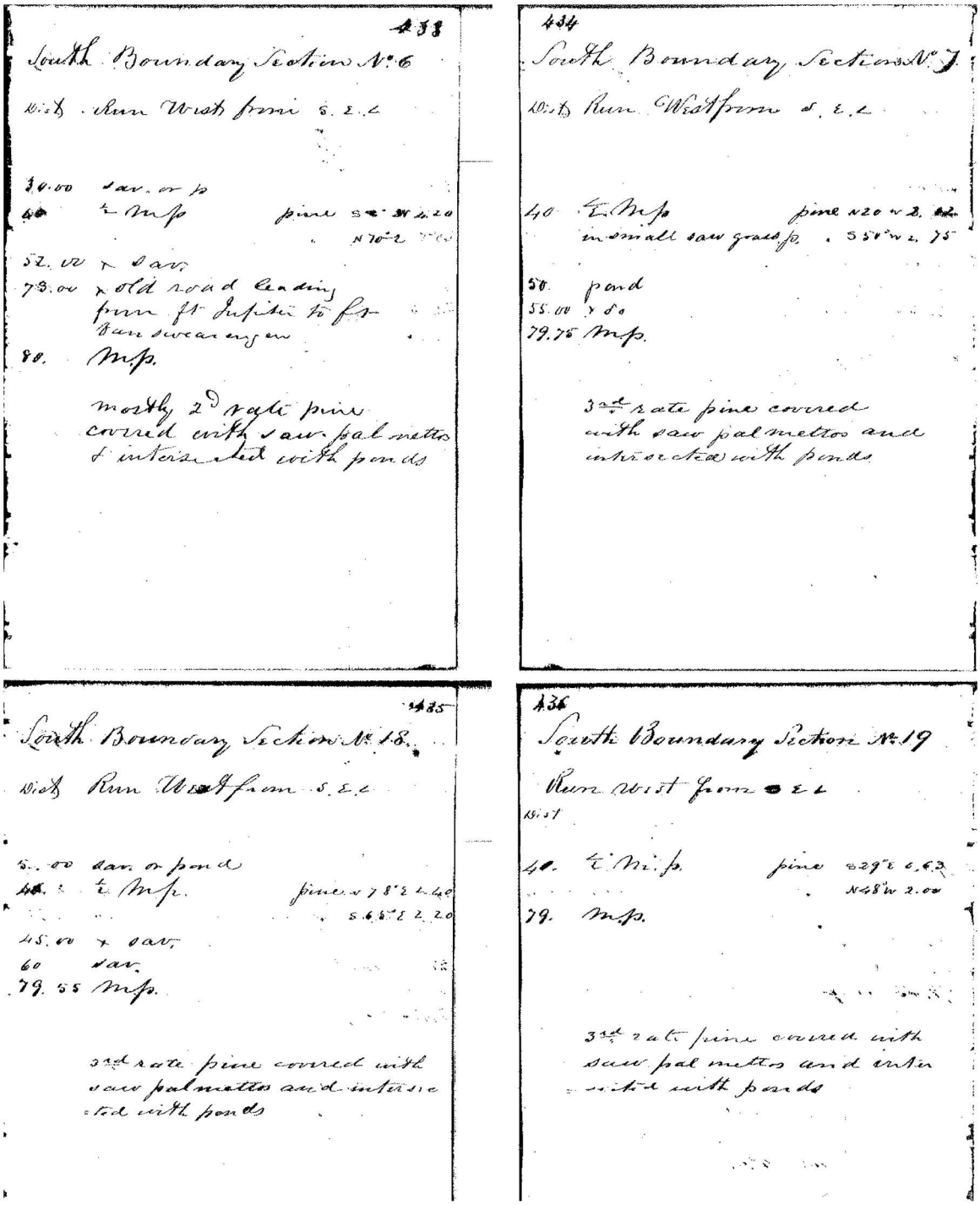
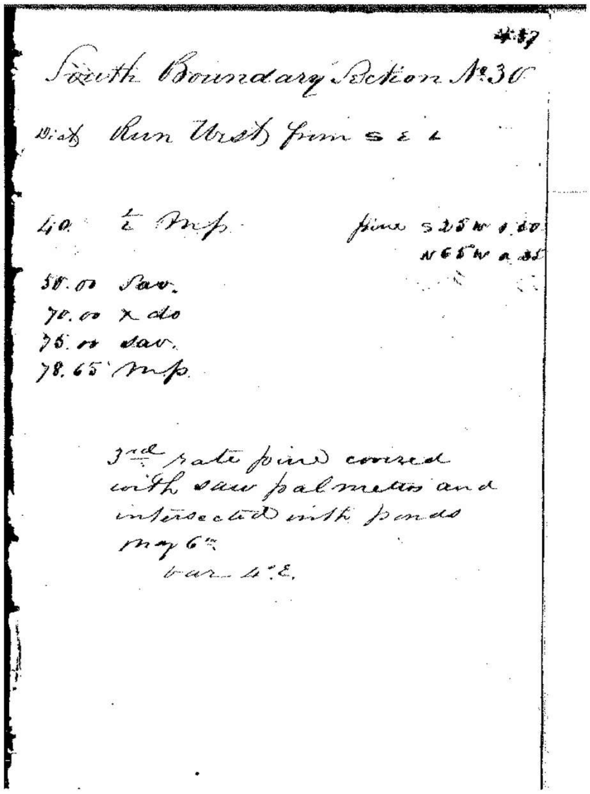
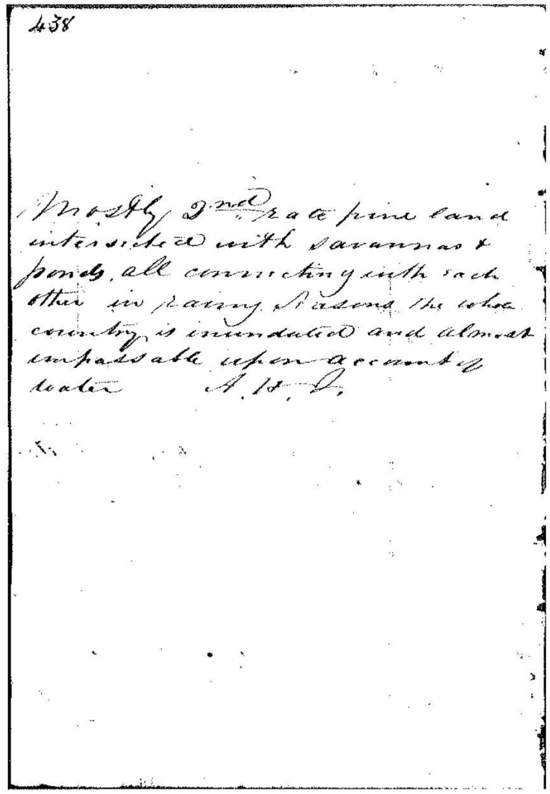


Figure C-39. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.


437
South Boundary Section No 30
Dist Run West from S E C
40. ¼ Mp. pine S 25 W 1.60
N 65 W a 35
58.00 Sav.
70.00 x do
75.00 Sav.
78.65 Mp.
3rd rate pine covered
with saw palmetto and
intersected with ponds
May 6th
Var. 4° E.


438
Mostly 2nd rate pine land
intersected with savannas &
ponds, all connecting with each
other in rainy season the whole
country is inundated and almost
impassable upon account of
water A.H.J.

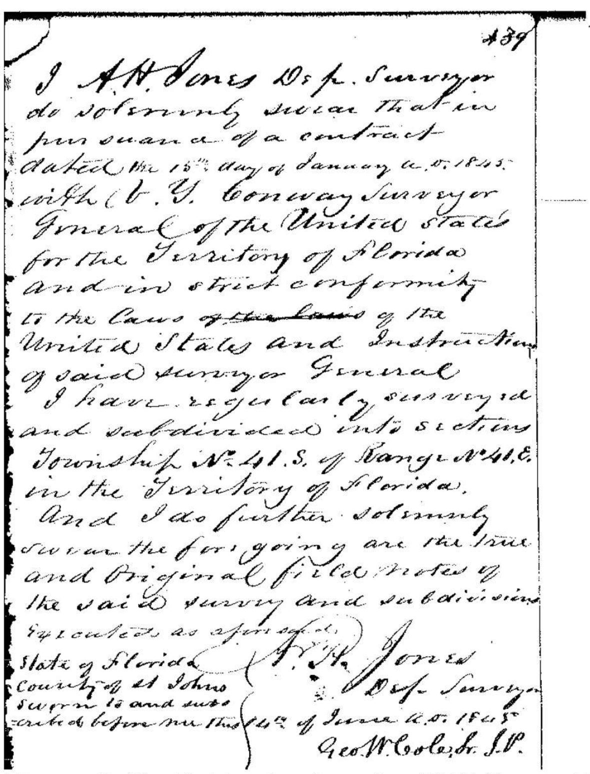

439
I A.H. Jones Dep. Surveyor
do solemnly swear that in
pursuance of a contract
dated the 15th day of January A.D. 1845
with V. Y. Conway Surveyor
General of the United States
for the Territory of Florida
and in strict conformity
to the laws ~~of the laws~~ of the
United States and Instructions
of said Surveyor General
I have regularly surveyed
and subdivided into sections
Township No 41 S. of Range No 41 E.
in the Territory of Florida.
And I do further solemnly
swear the foregoing are the true
and Original field notes of
the said survey and subdivision
executed as aforesaid.
State of Florida A.H. Jones
County of St Johns Dep. Surveyor
Sworn to and subs-
cribed before me this 14th of June A.D. 1845
Geo W. Cole Jr. J.P.

Figure C-40. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 41 South, Range 41 East.

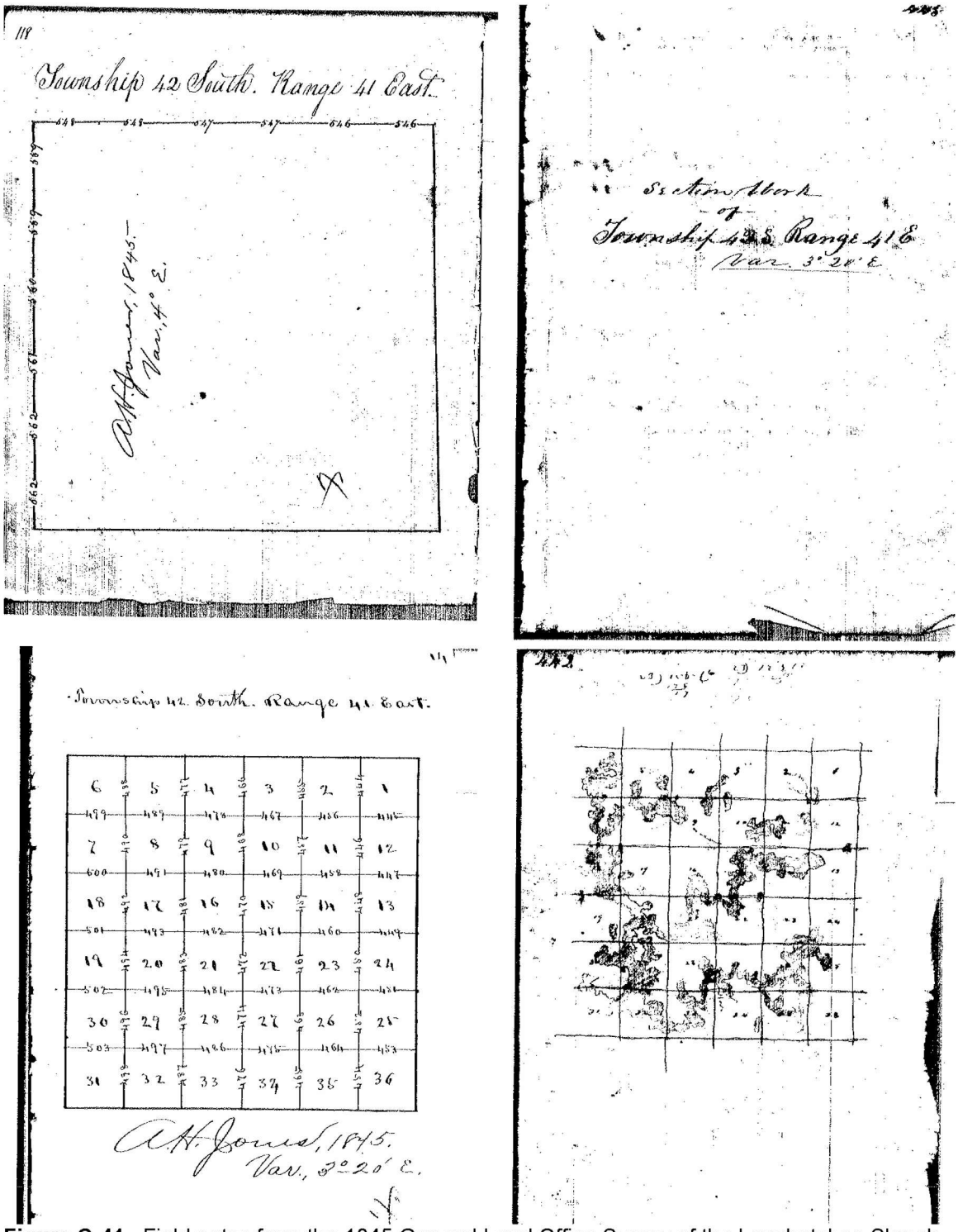


Figure C-41. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

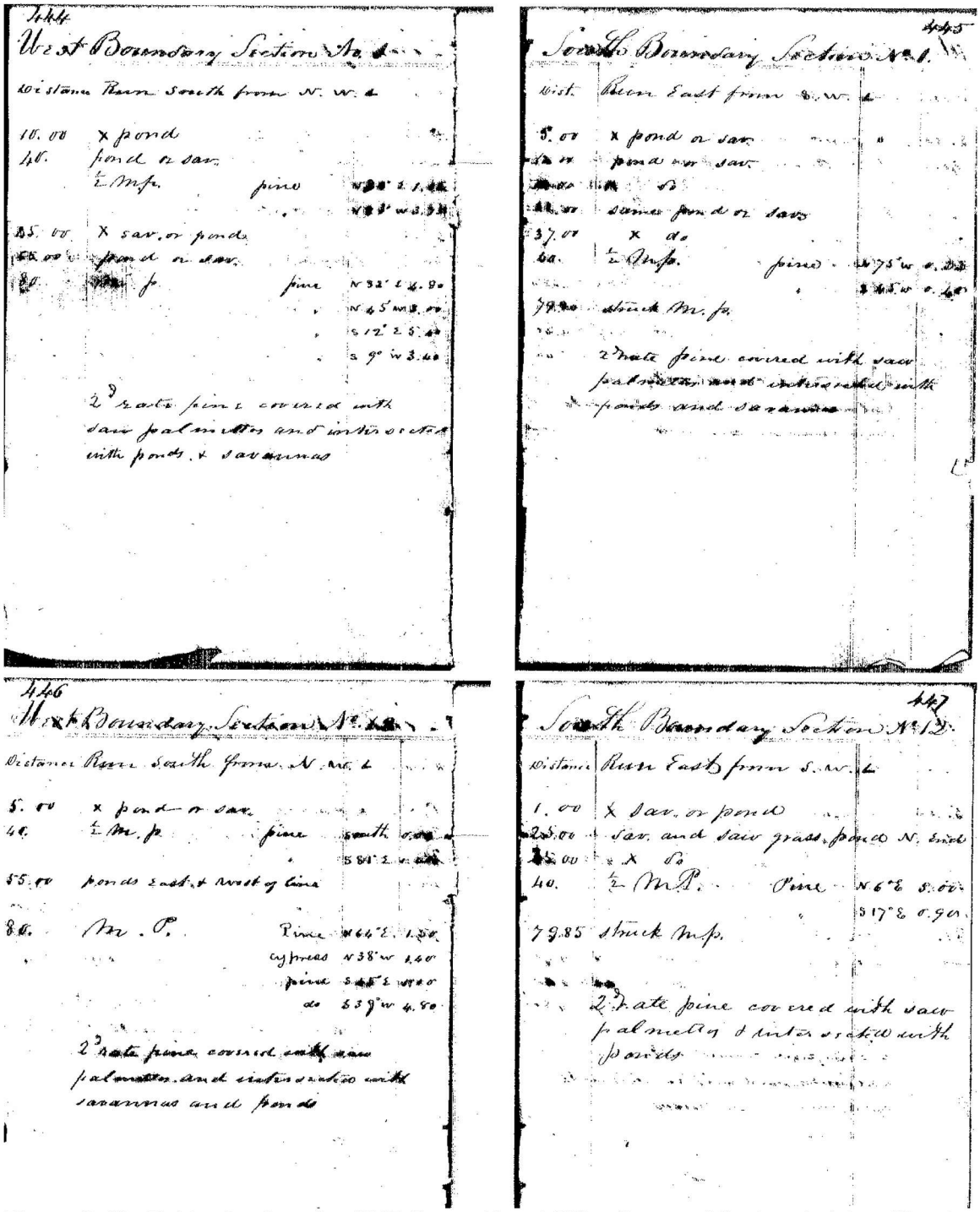


Figure C-42. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

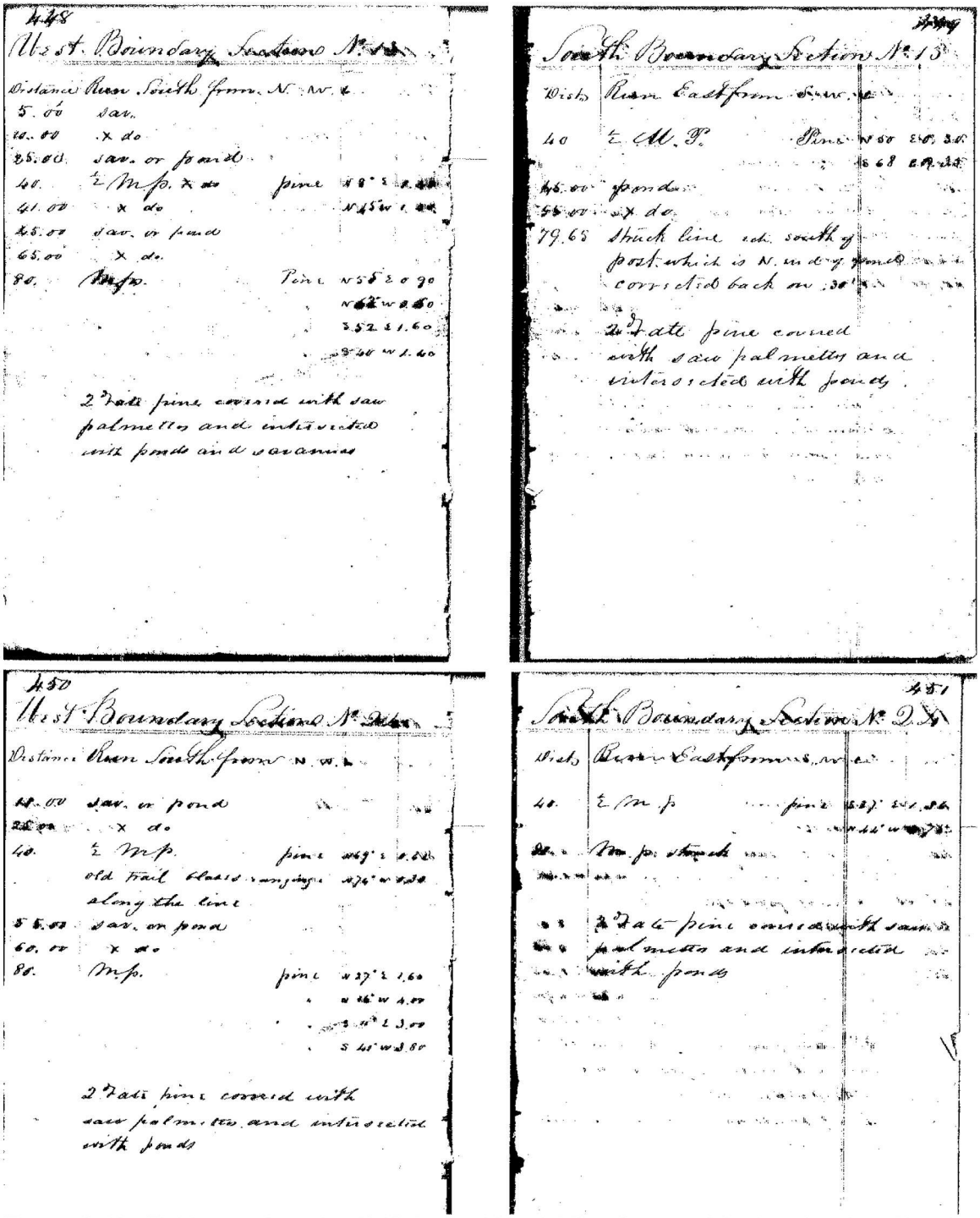


Figure C-43. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

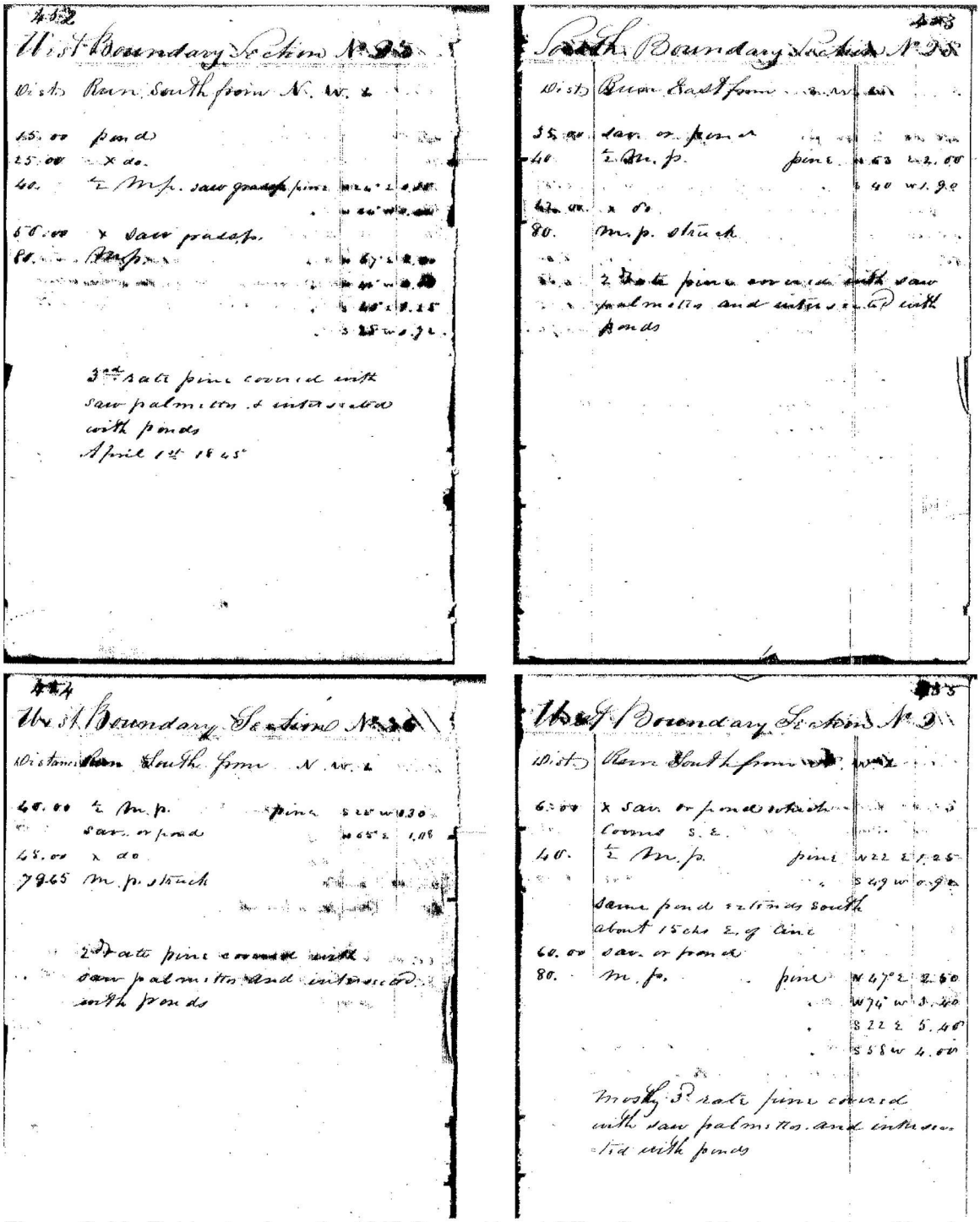


Figure C-44. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

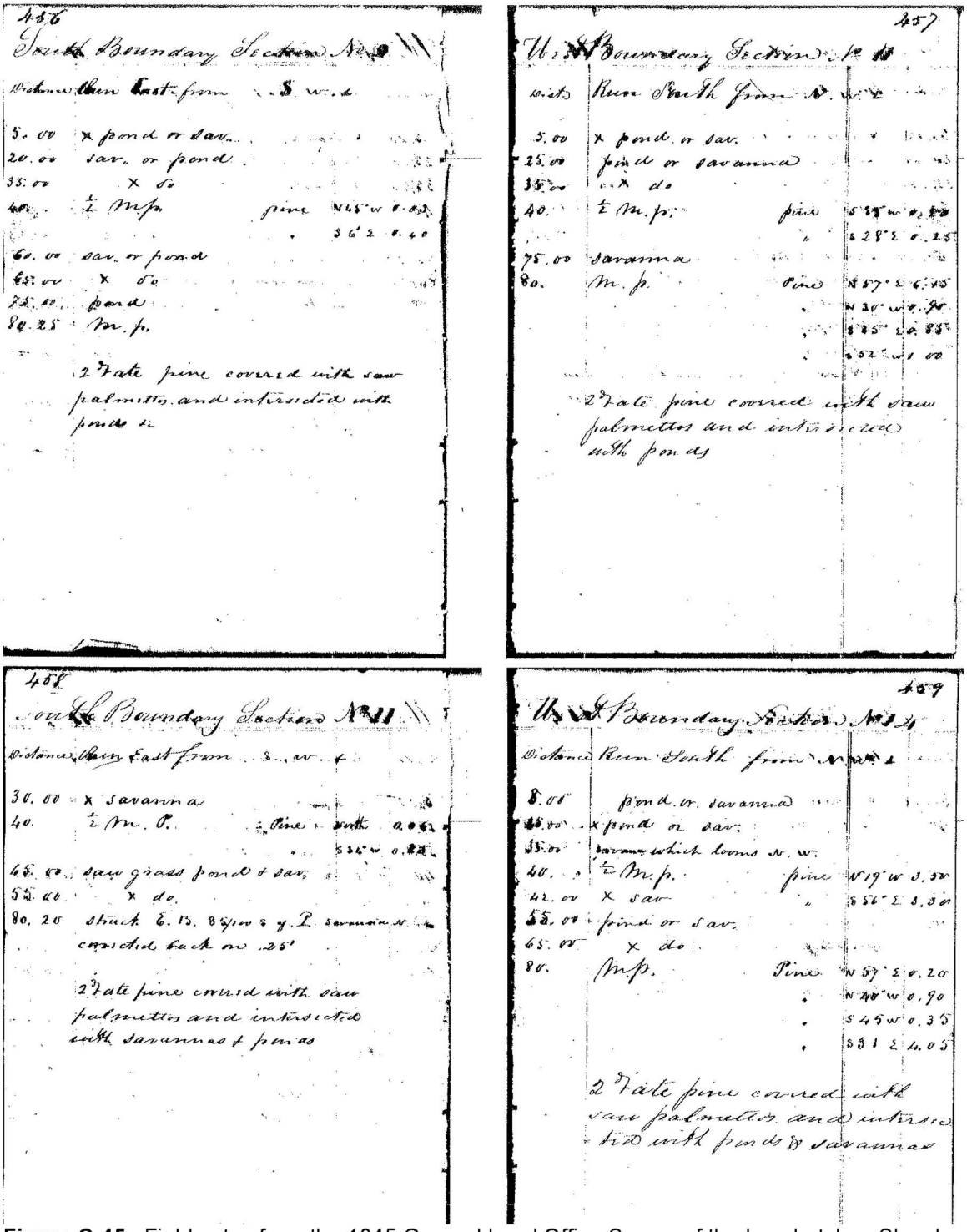


Figure C-45. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

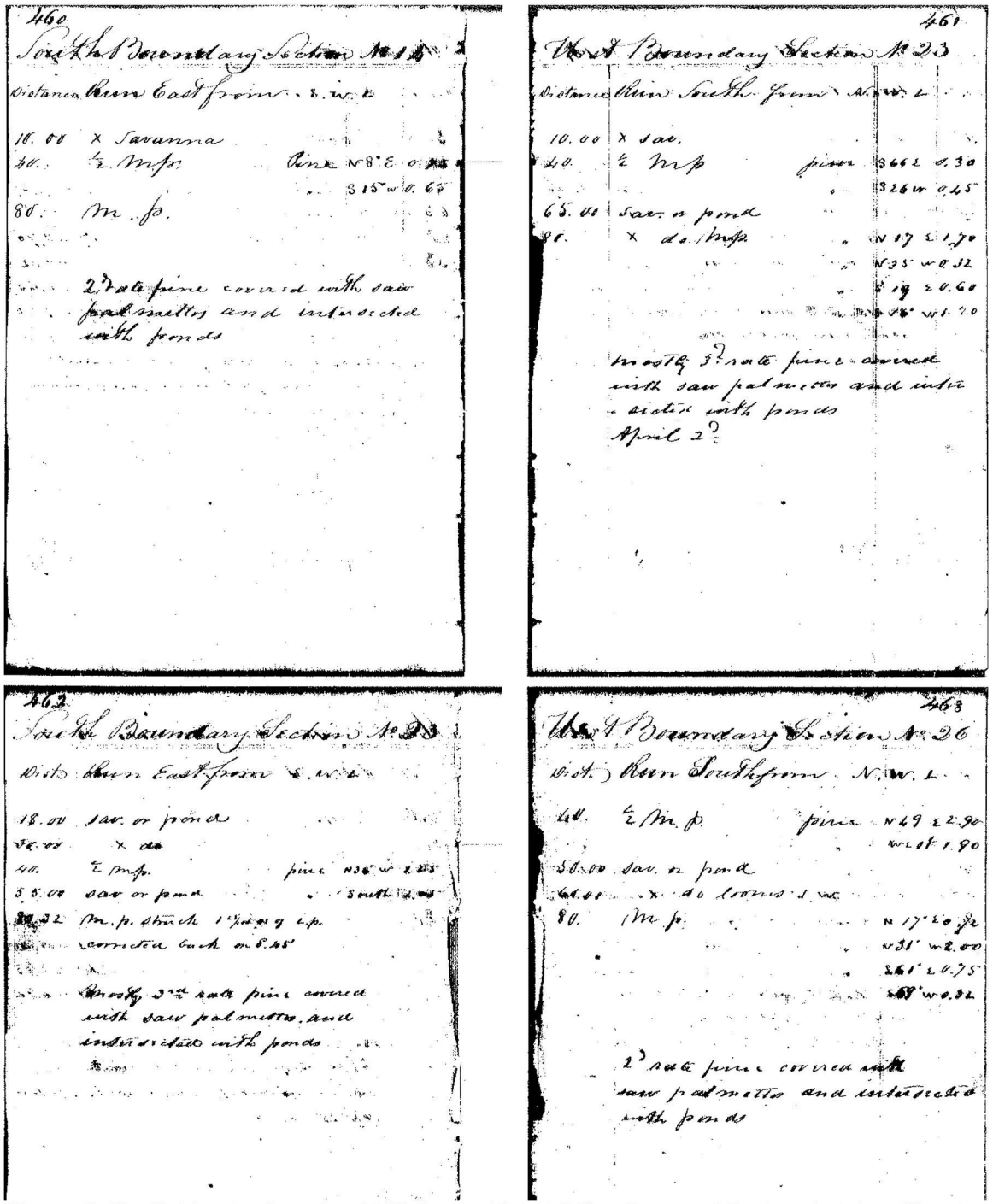


Figure C-46. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

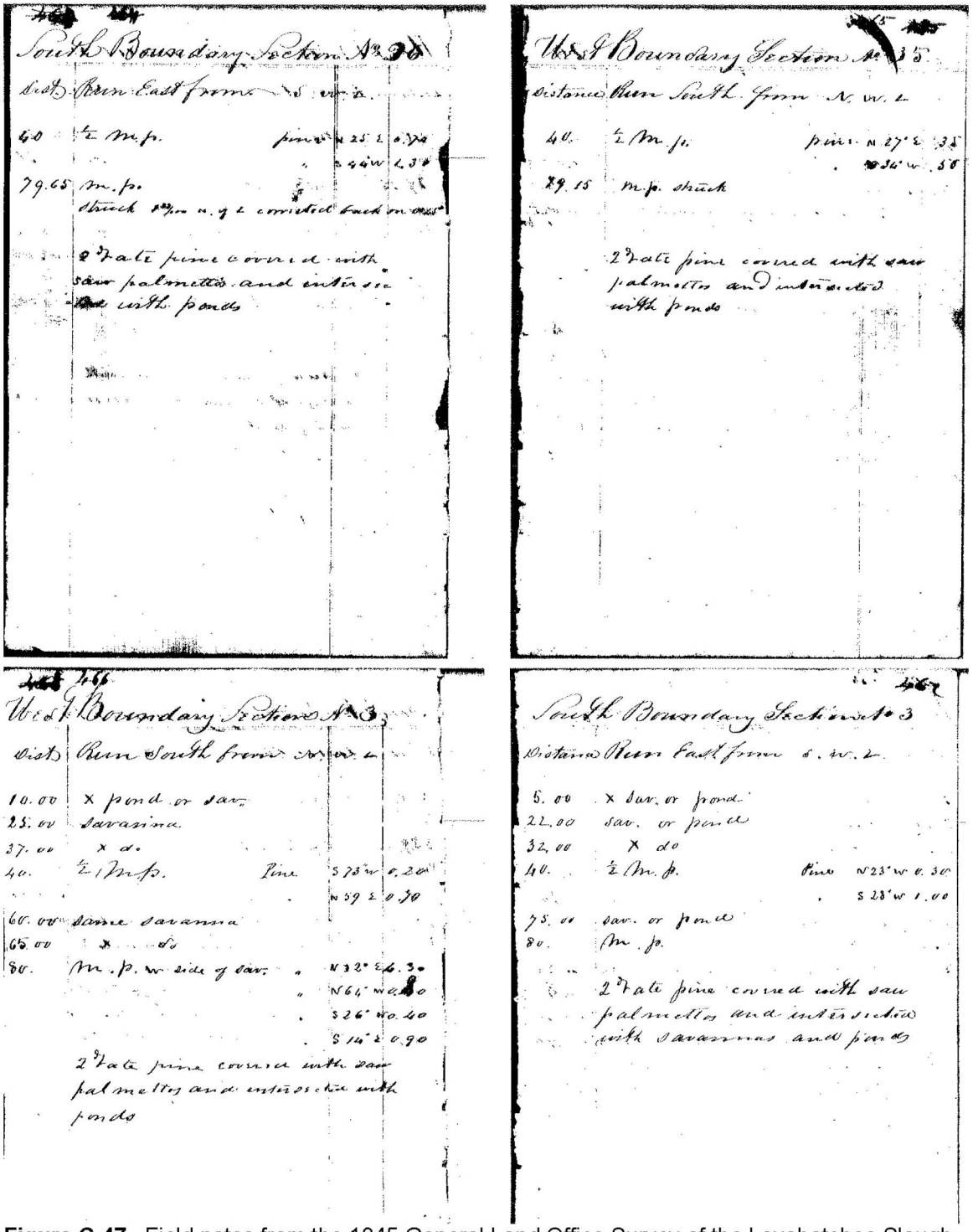


Figure C-47. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

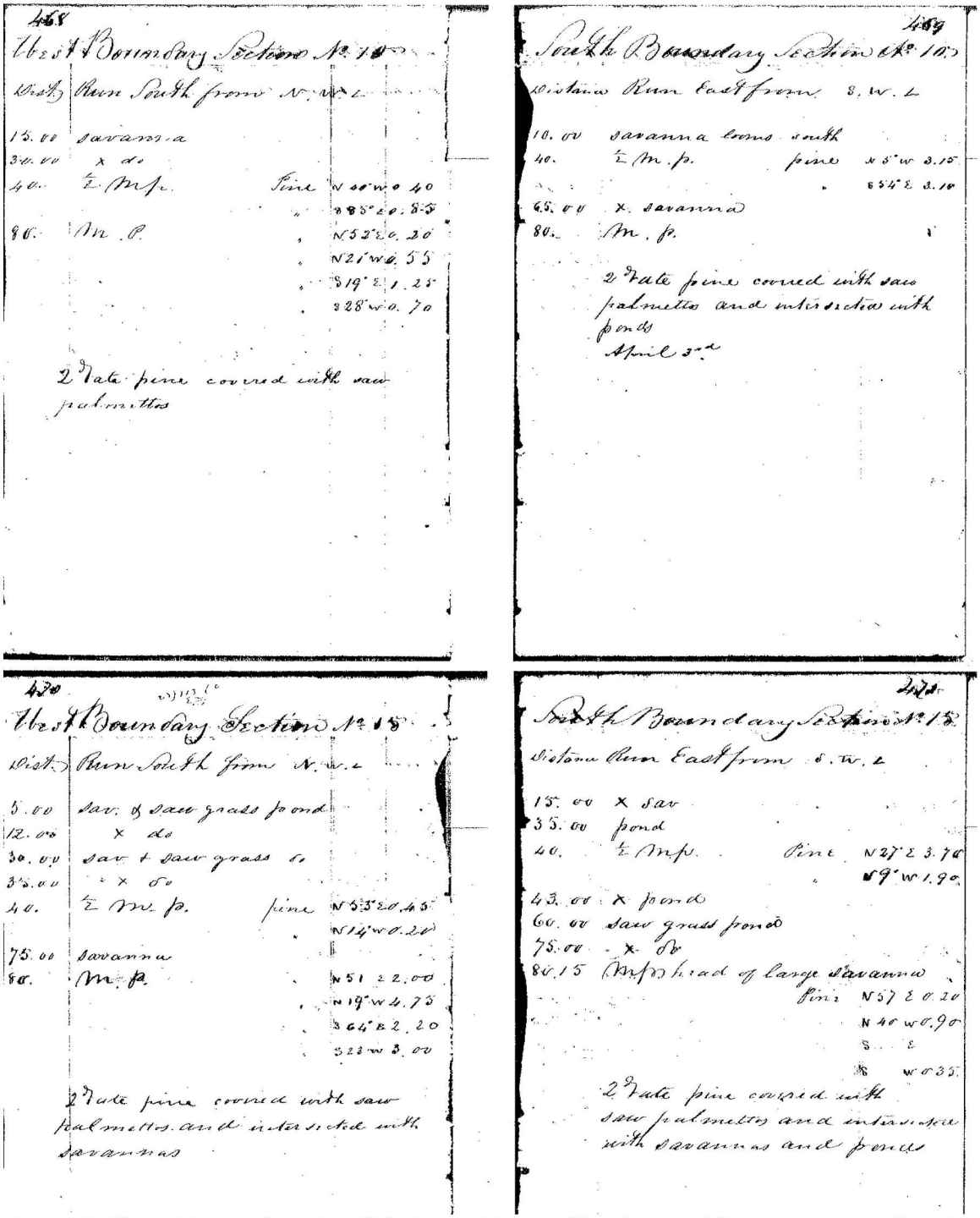


Figure C-48. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

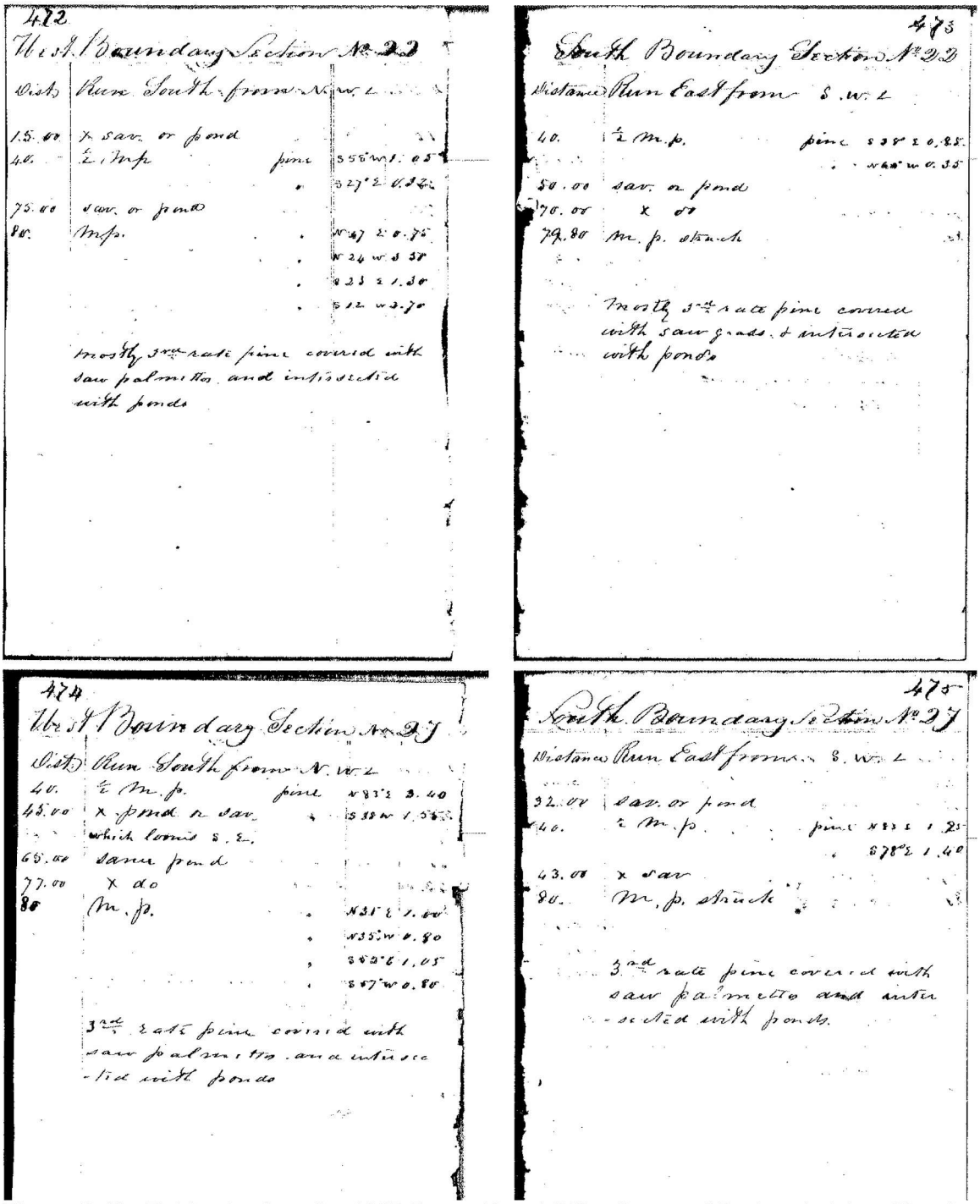
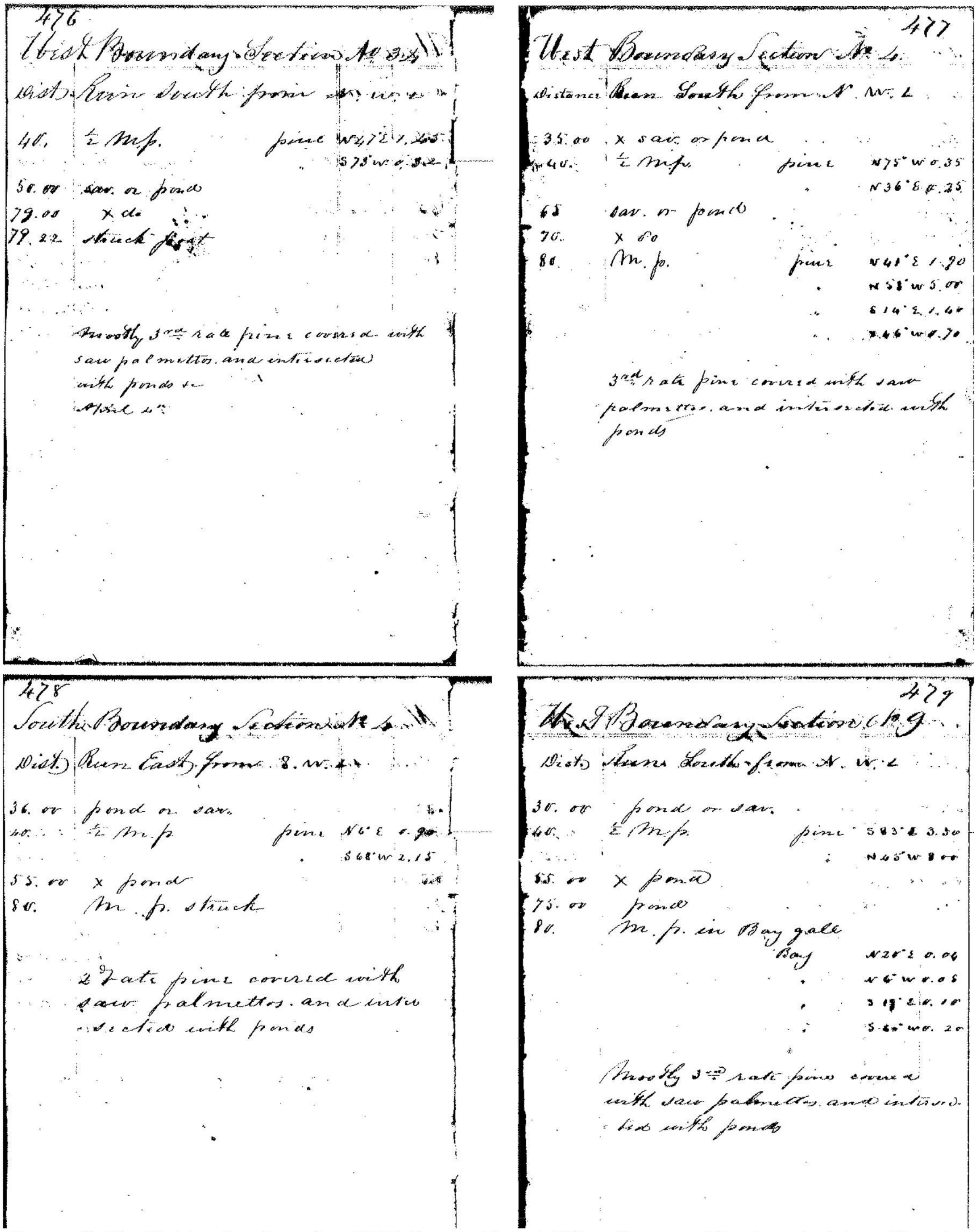


Figure C-49. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.



476

West Boundary Section No 3

Dist. Run South from N. W. c.

40. ½ M.p. pine N47°E 1.25 S73°W 0.3

50.00 sav. or pond

79.00 X do

79.22 struck post

Mostly 3rd rate pine covered with saw palmetto, and intersected with ponds &c

April 4th

477

West Boundary Section No 4.

Distance Run South from N. W. c.

35.00 X sav. or pond

40. ½ M.p. pine N75°W 0.35 N36°E 0.25

65 sav. or pond

70. X do

80. M.p. pine N41°E 1.90 N58°W 5.00 S14°E 1.40 S46°W 0.70

3rd rate pine covered with saw palmettos, and intersected with ponds

478

South Boundary Section No 4.

Dist. Run East from S. W. c.

36.00 pond or sav.

40. ½ M.p. pine N6°E 0.90 S68°W 2.15

55.00 X pond

80. M.p. struck

2d rate pine covered with saw palmettos, and intersected with ponds

479

West Boundary Section No 9.

Dist. Run South from N. W. c.

30.00 pond or sav.

40. ½ M.p. pine S83°E 3.50 N45°W 8.00

55.00 X pond

75.00 pond

80. M.p. in Bay gall Bay N20°E 0.04 N6°W 0.05 S19°E 0.10 S60°W 0.20

Mostly 3rd rate pine covered with saw palmettos and intersected with ponds

Figure C-50. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

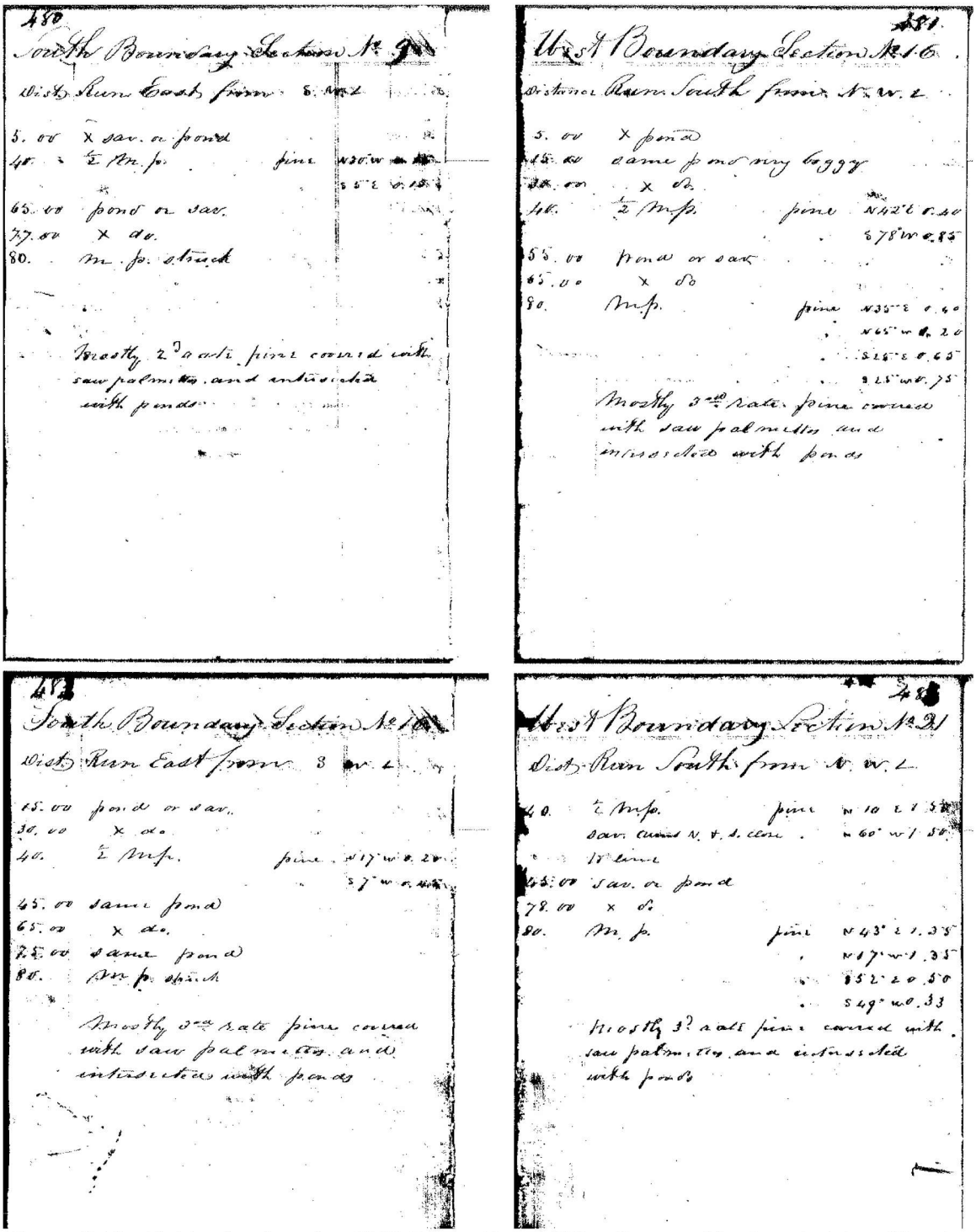


Figure C-51. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

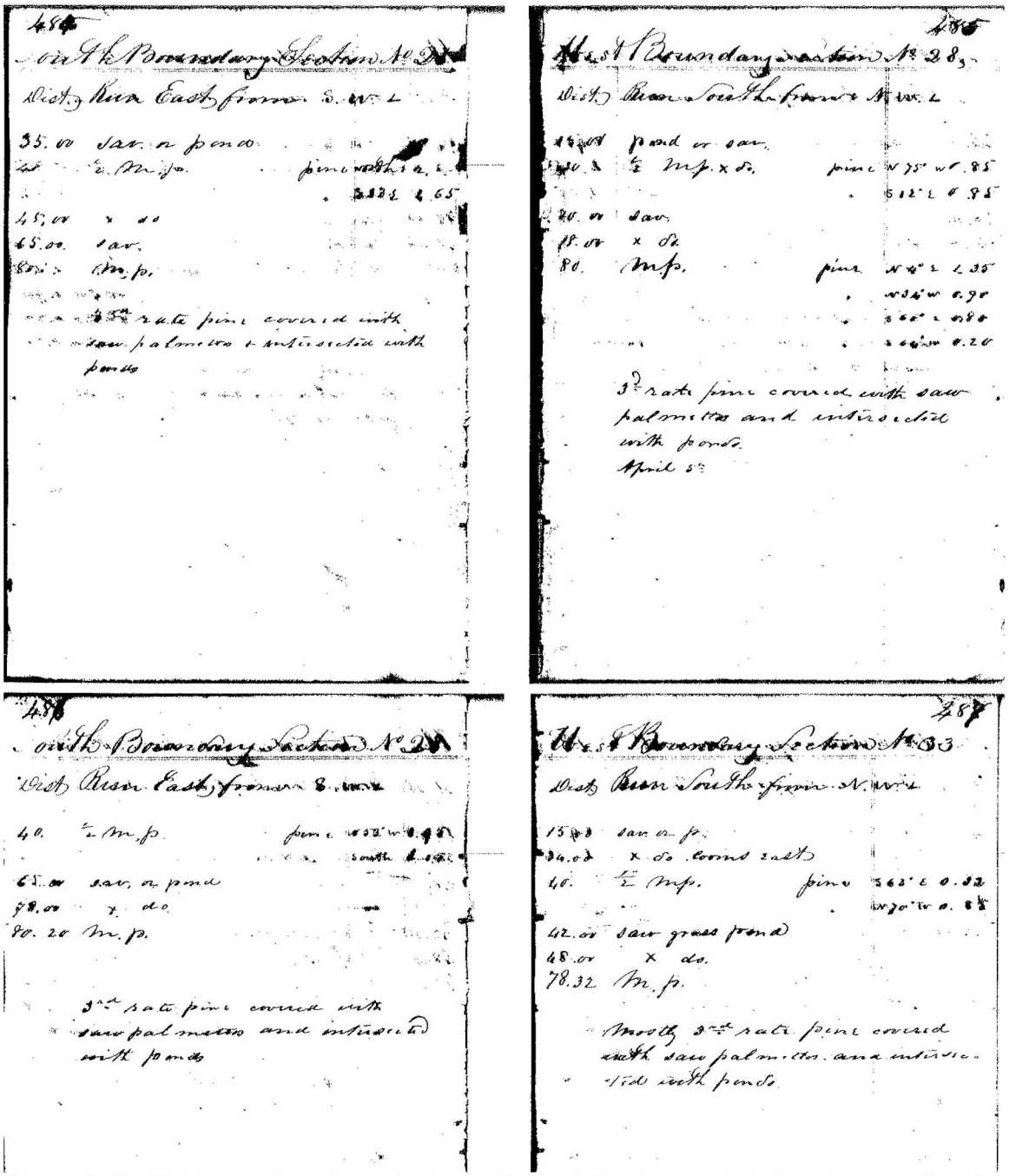


Figure C-52. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

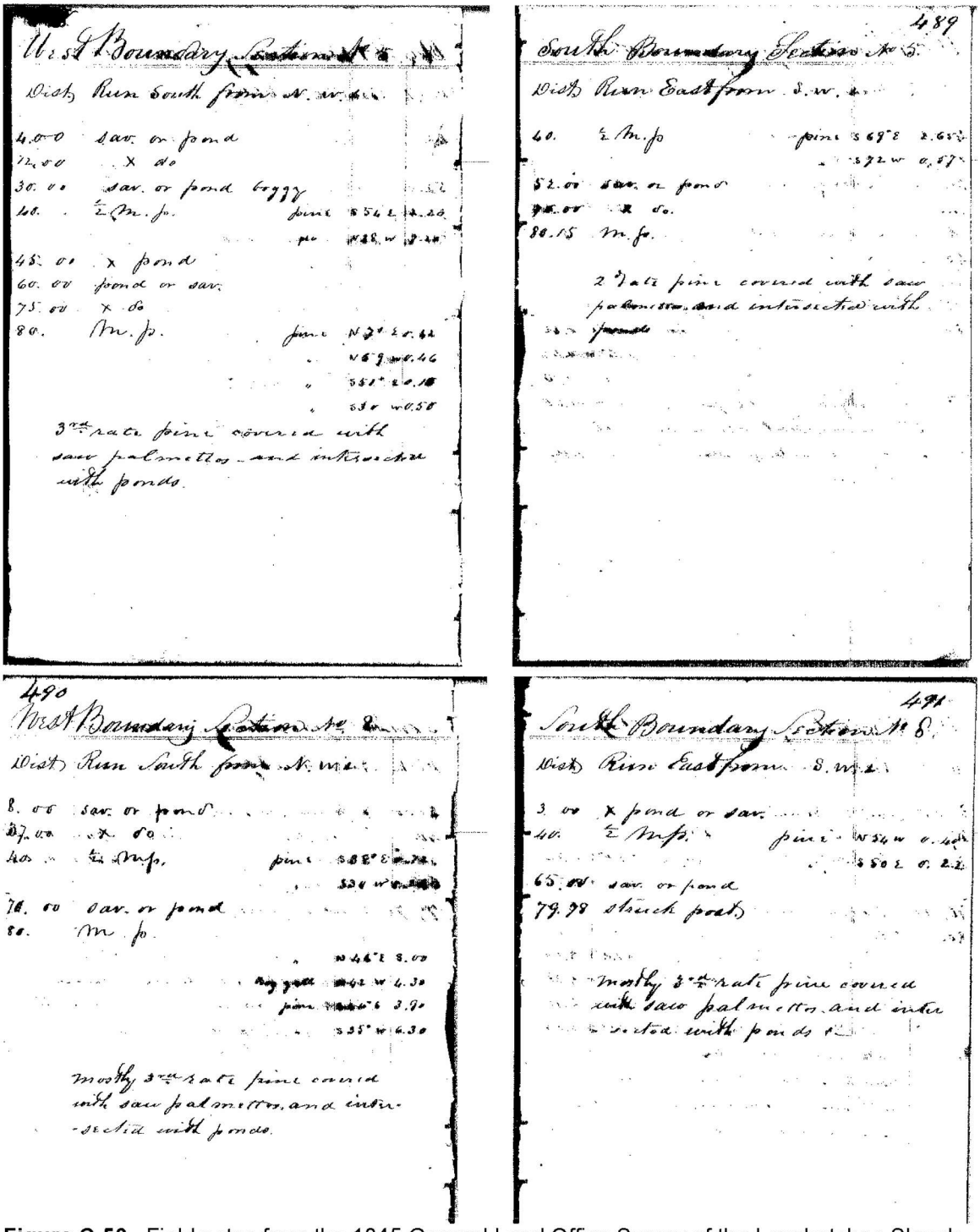


Figure C-53. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

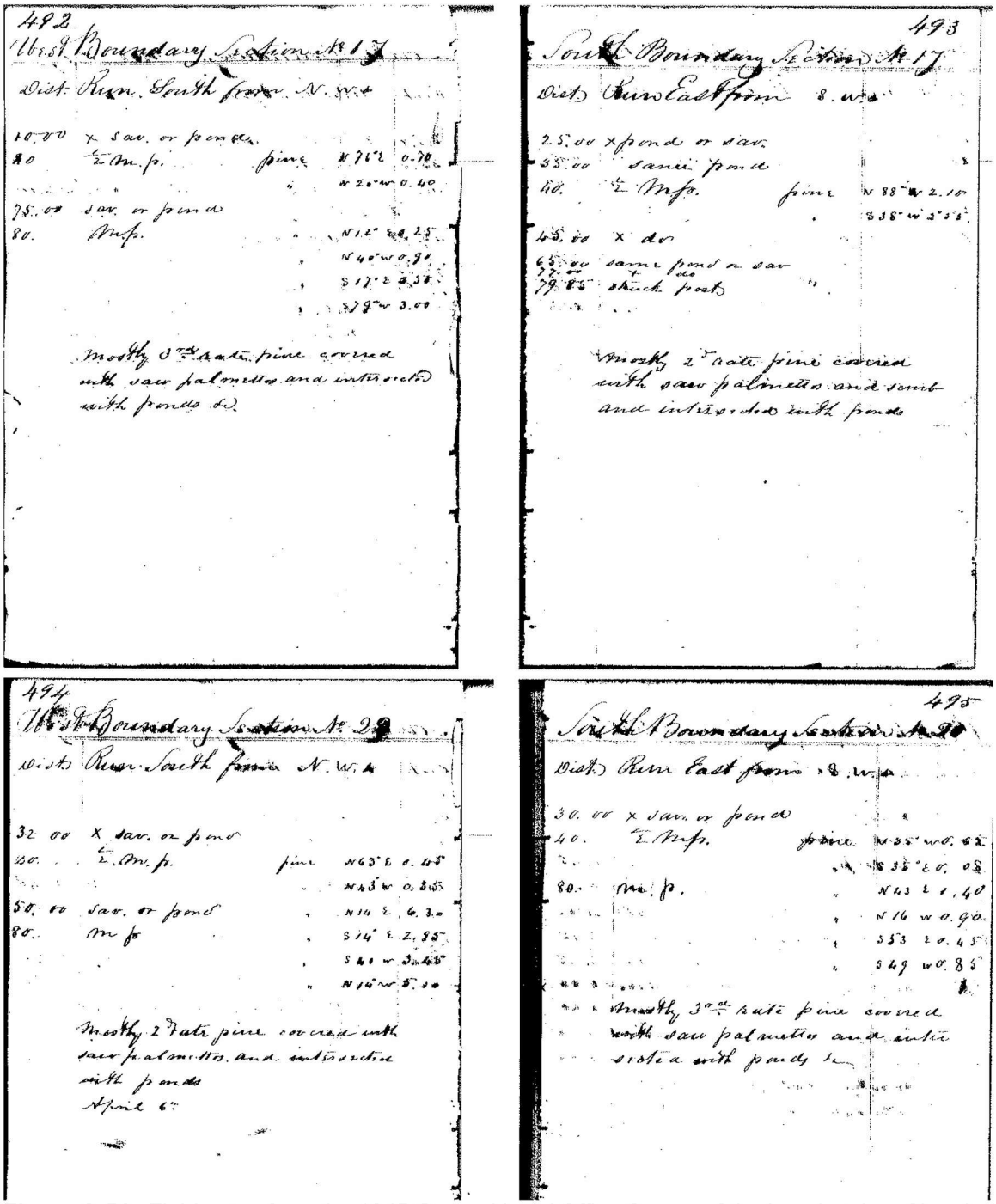


Figure C-54. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

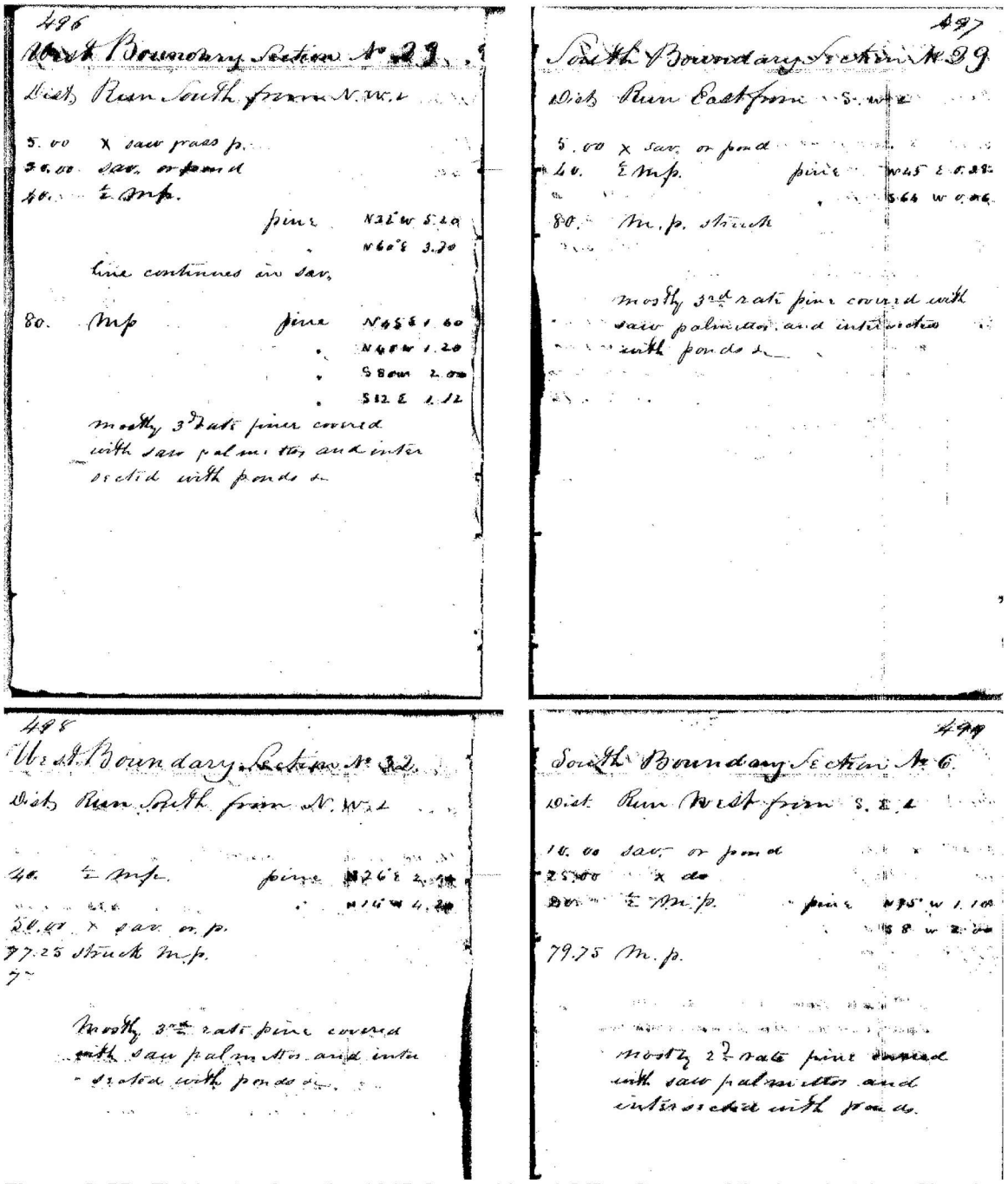


Figure C-55. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

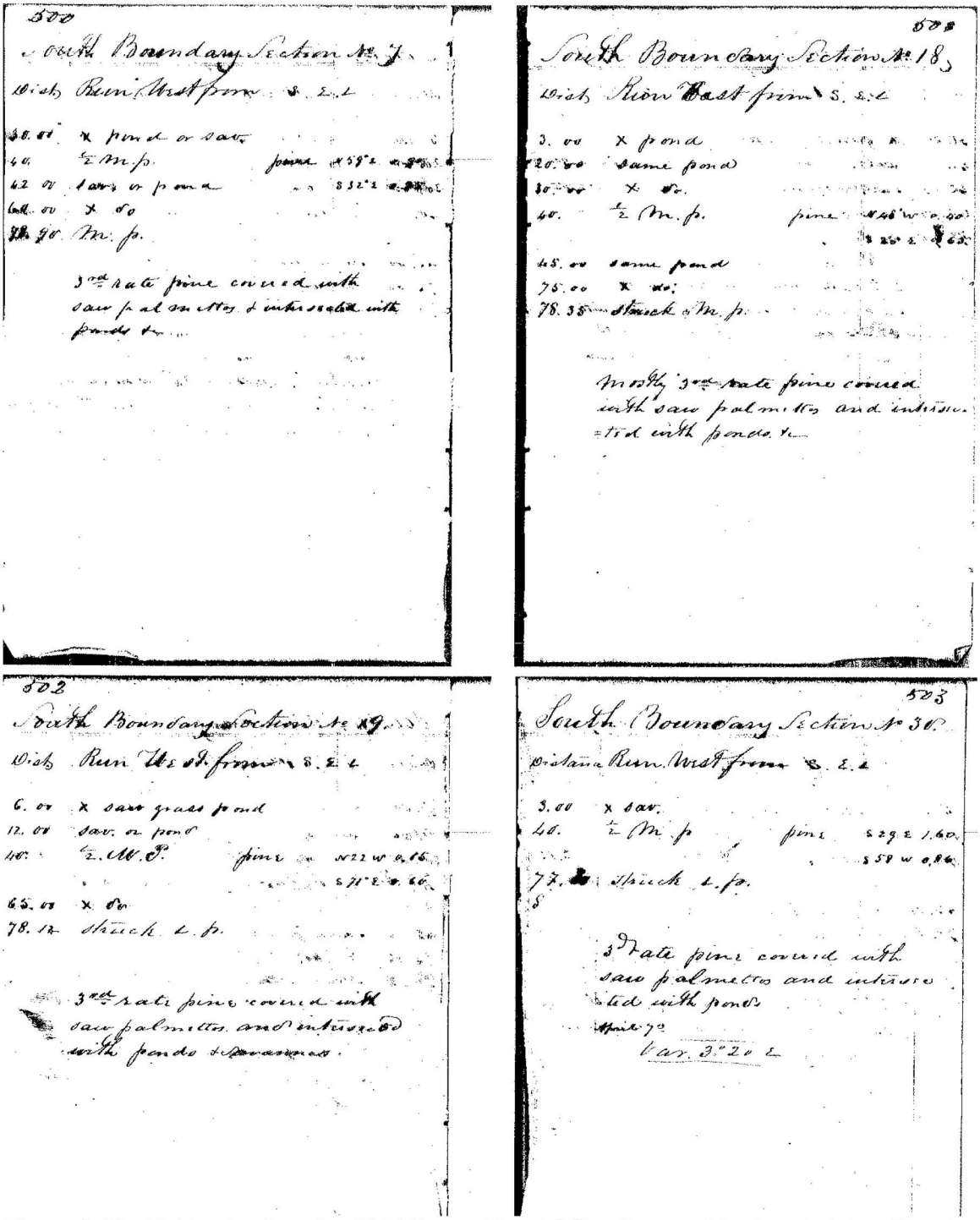
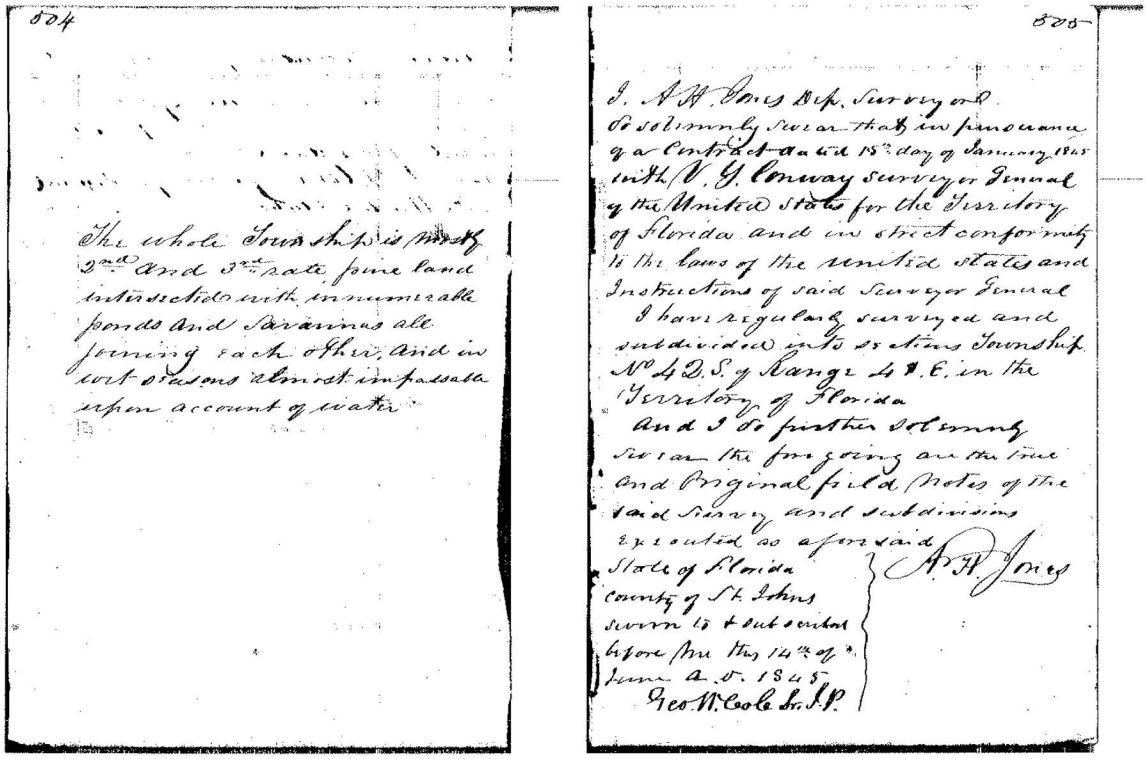


Figure C-56. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.



504

The whole Township is mostly 2nd and 3rd rate pine land intersected with innumerable ponds and Savannas all joining each other, and in wet seasons almost impassable upon account of water

505

I, A. H. Jones Dep. Surveyor do solemnly swear that in pursuance of a Contract dated 15th day of January 1845 with V. G. Conway Surveyor General of the United States for the Territory of Florida and in strict conformity to the laws of the united states and Instructions of said Surveyor General I have regularly surveyed and subdivided into sections Township No 42 S. of Range 41 E. in the Territory of Florida

And I do further solemnly swear that the foregoing are the true and Original field Notes of the said Survey and subdivisions executed as aforesaid

A. H. Jones

State of Florida
County of St Johns
Sworn to & subscribed before me this 14th of June A. D. 1845

Geo. M. Cole Jr. J.P.

Figure C-57. Field notes from the 1845 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 41 East.

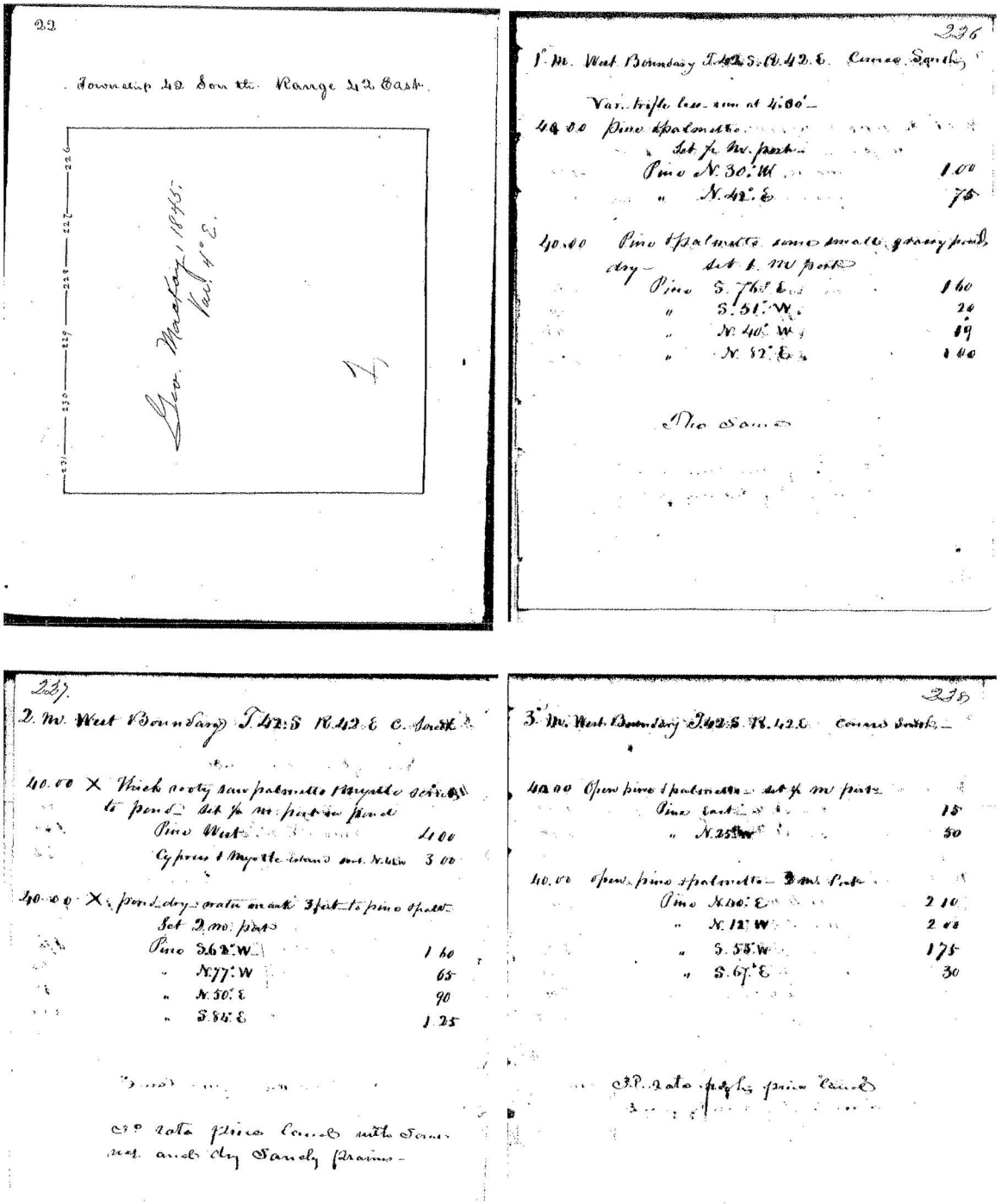


Figure C-58. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.

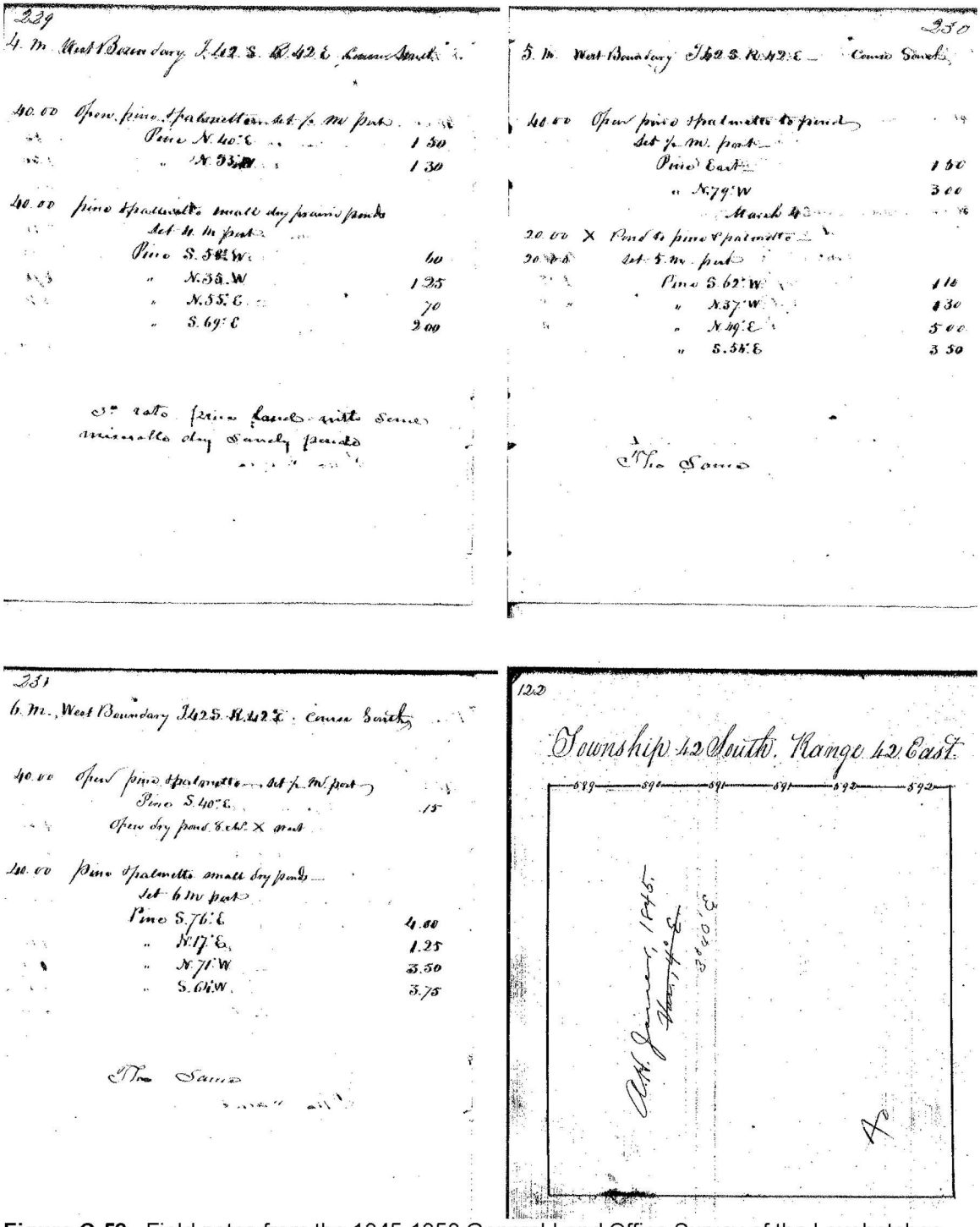
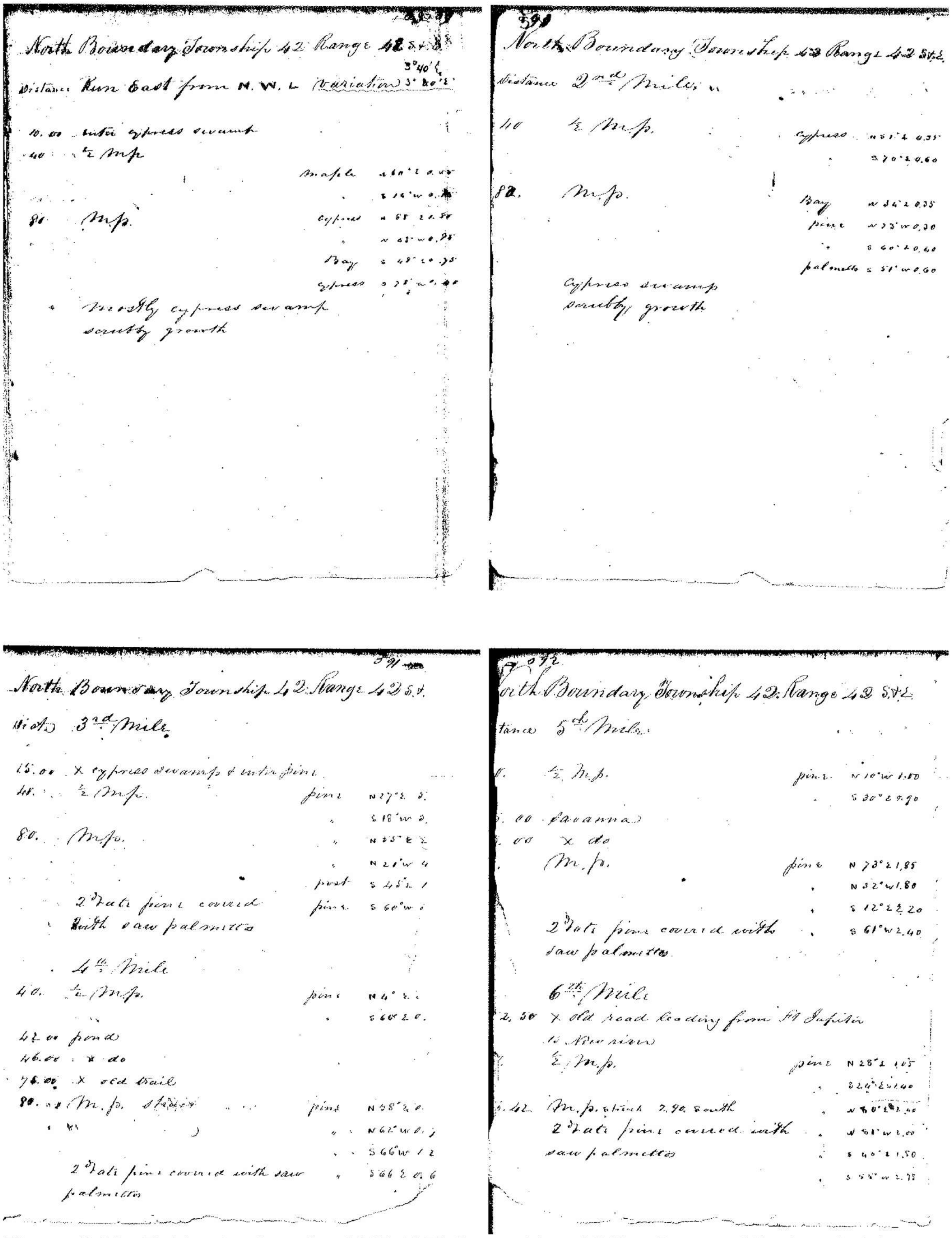


Figure C-59. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.


North Boundary Township 42 Range 42 S+E
Distance Run East from N.W.C. Variation 3°40'E

10.00 enter cypress swamp
40 ½ M.p. maple
80 M.p. cypress
Bay
cypress

mostly cypress swamp
scrubby growth

North Boundary Township 42 Range 42 S+E
Distance 2nd Mile

40 ½ M.p. cypress N 81°E 0.35 / S 70°E 0.60
80 M.p. Bay N 56°E 0.35
pine N 33°W 0.30
S 60°E 0.40
palmetto S 51°W 0.60

Cypress swamp
scrubby growth

North Boundary Township 42 Range 42 S+E
Distance 3rd Mile

15.00 X cypress swamp & enter pine
40 ½ M.p. pine N 27°E 5 / S 18°W 5
80 M.p. N 55°E 2 / N 21°W 4
post S 45°E 1
pine S 60°W

2nd rate pine covered
with saw palmetto

4th Mile
40 ½ M.p. pine N 4°E / S 66°E
42.00 pond
46.00 X do
76.00 X old trail
80.00 M.p. pine N 58°E / N 62°W / S 66°W 1 2 / S 66 E 0.6

2nd rate pine covered with saw
palmetto

North Boundary Township 42 Range 42 S+E
Distance 5th Mile

½ M.p. pine N 10°W 1.50 / S 30°E 0.90
.00 Savanna
.00 X do
M.p. pine N 73°E 1.85 / N 32°W 1.80 / S 12°E 2.20 / S 61°W 2.40

2nd rate pine covered with
saw palmetto

6th Mile
2.50 X old road leading from Ft Jupiter
to New river
½ M.p. pine N 28°E 1.05 / S 24°E 1.40
.42 M.p. struck 2.90 South
2nd rate pine covered with
saw palmetto

Figure C-60. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.

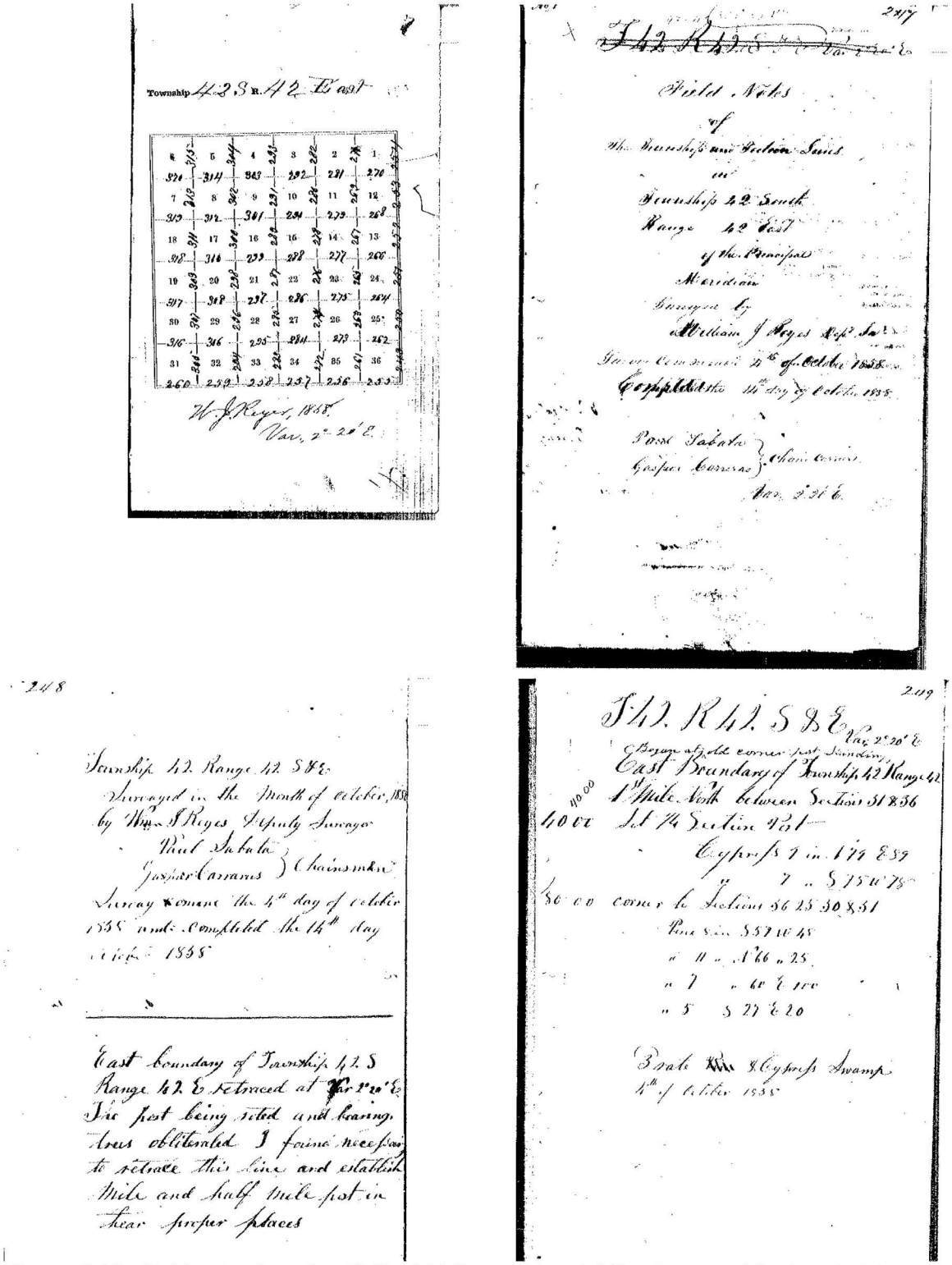


Figure C-61. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.

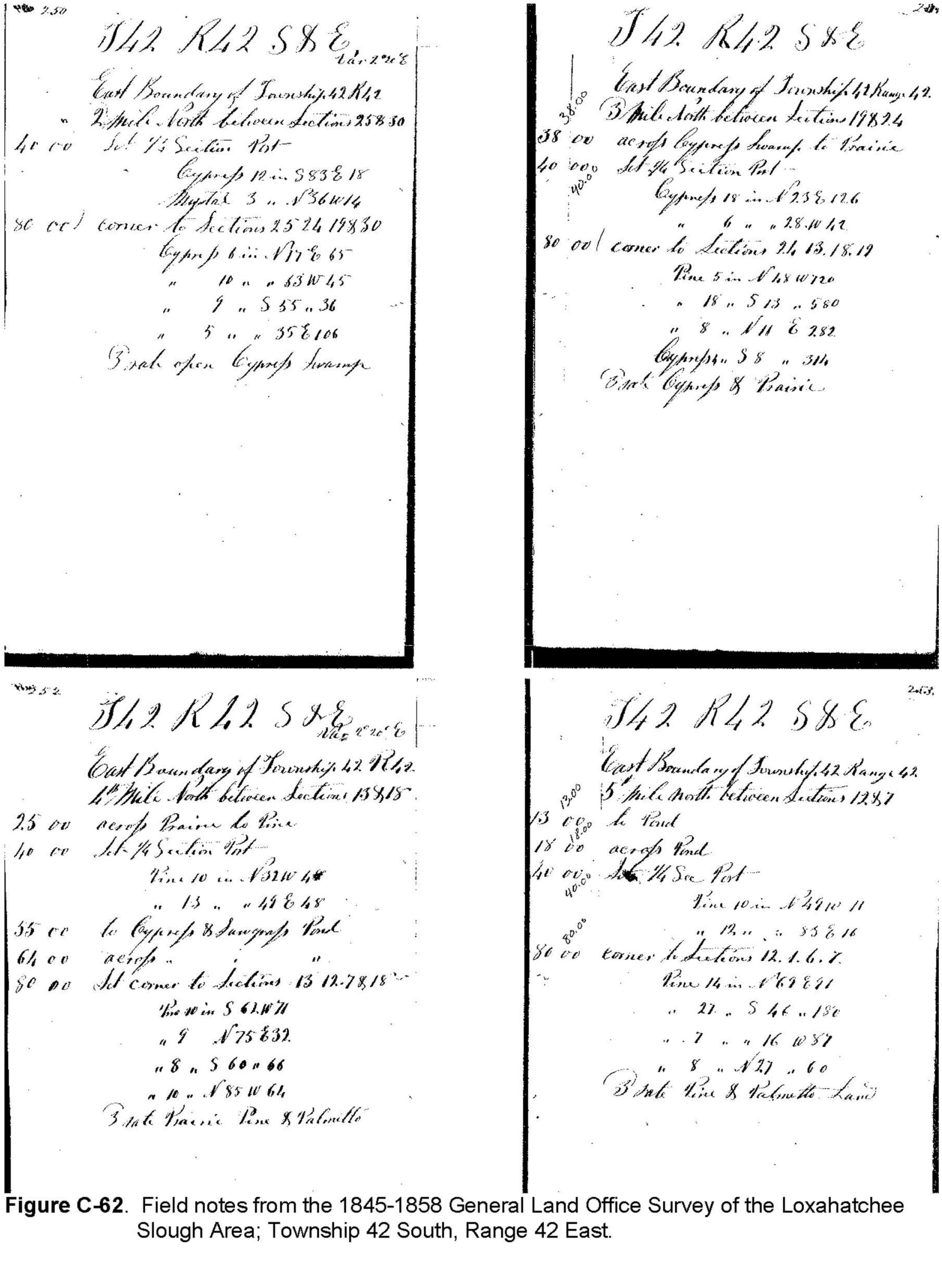
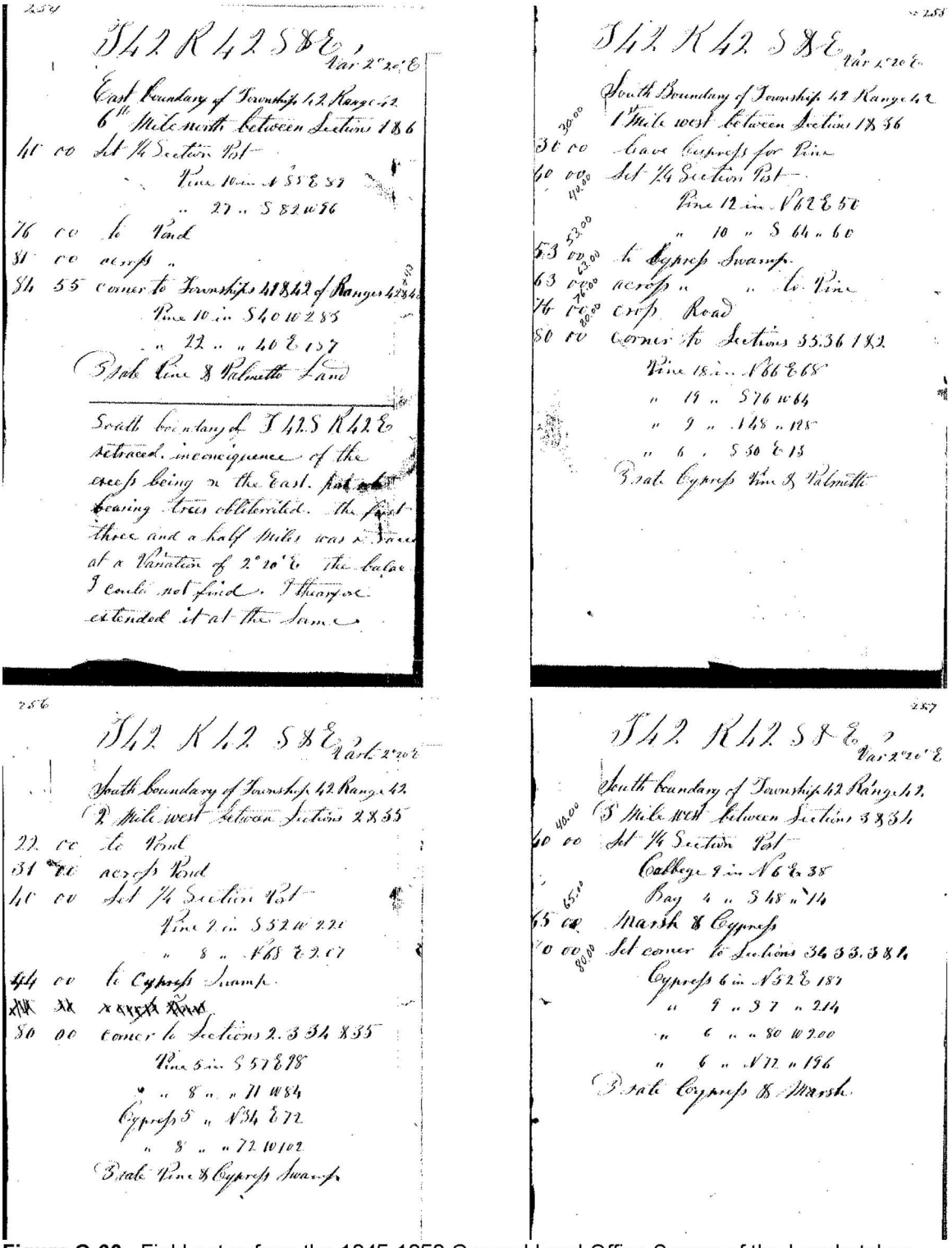


Figure C-62. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.



T42 R42 S&E Var 2°20'E

East Boundary of Township 42 Range 42
6th Mile north between Sections 1 & 6

40 00 Set 1/4 Section Post
Pine 10 in. N 55 E 84
" 27 " S 82 W 36
76 00 to Pond
81 00 across "
84 55 corner to Townships 41 & 42 of Ranges 42 & 43
Pine 10 in. S 40 W 285
" 22 " " 40 E 157
Stake Pine & Palmetto Land

South boundary of T 42 S R 42 E retraced, in consequence of the creek being on the East. first and bearing trees obliterated. the first three and a half Miles was run at a Variation of 2°20'E the balance I could not find. I therefore extended it at the same.

T42 R42 S&E Var 2°20'E

South Boundary of Township 42 Range 42
1 Mile west between Sections 1 & 36
30 00 Cave Cypress for Pine
40 00 Set 1/4 Section Post
Pine 12 in. N 62 E 50
" 10 " S 64 " 60
53 00 to Cypress Swamp
63 00 across " " to Pine
76 00 cross Road
80 00 Corner to Sections 35 36 1 2
Pine 18 in. N 66 E 68
" 19 " S 76 W 64
" 9 " N 48 " 178
" 6 " S 50 E 13
Stake Cypress Pine & Palmetto

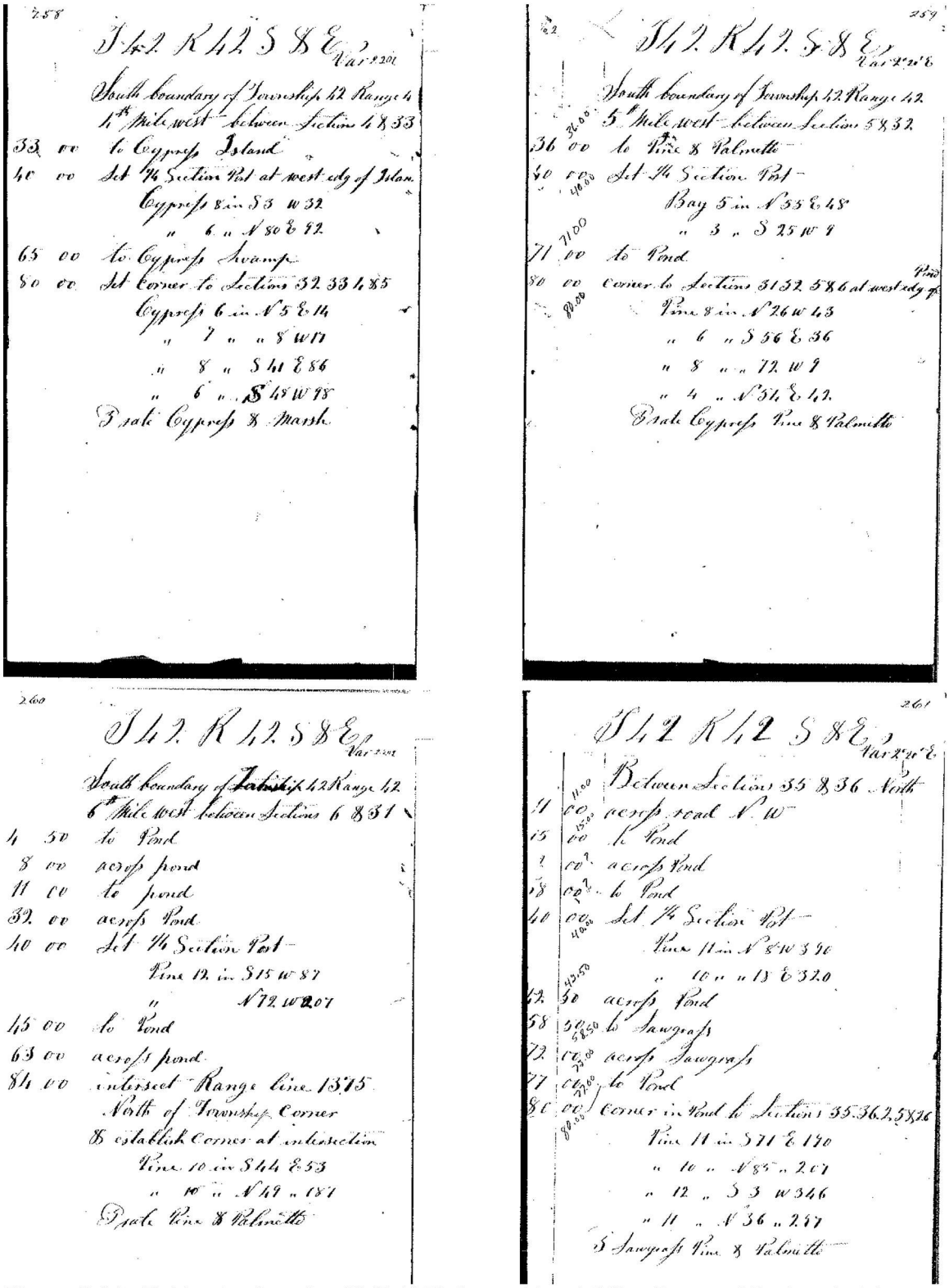
T42 R42 S&E Var 2°20'E

South Boundary of Township 42 Range 42
2 Mile west between Sections 2 & 35
22 00 to Pond
31 00 across Pond
40 00 Set 1/4 Section Post
Pine 9 in. S 52 W 220
" 8 " N 65 E 207
44 00 to Cypress Swamp
xxx xx xxxxx xxxx
80 00 Corner to Sections 2. 3 34 & 35
Pine 5 in. S 57 E 78
" 8 " " 11 W 84
Cypress 5 " N 34 E 72
" 8 " " 72 W 102
Stake Pine & Cypress Swamp

T42 R42 S&E Var 2°20'E

South boundary of Township 42 Range 42
5 Mile West between Sections 3 & 34
40 00 Set 1/4 Section Post
Oak 9 in. N 6 E 38
Bay 4 " S 48 " W
65 00 Marsh & Cypress
80 00 Set corner to Sections 34 33 3 & 4
Cypress 6 in. N 32 E 187
" 9 " 3 7 " 214
" 6 " " 80 W 200
" 6 " N 72 " 196
Stake Cypress & Marsh

Figure C-63. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.



T 42 R 42 S & E Var 2201

South boundary of Township 42 Range 4
1st Mile west - between Sections 4 & 33

33 00 to Cypress Island
40 00 Set ¼ Section Post at west edg of Islan.
Cypress 8 in S 3 W 32
" 6 " N 80 E 92
65 00 to Cypress Swamp
80 00 Set Corner to Sections 32 33 4 85
Cypress 6 in N 5 E 14
" 7 " " 8 W 11
" 8 " S 41 E 86
" 6 " S 45 W 98
Dead Cypress & Marsh

259

T 42 R 42 S & E Var 2206

South boundary of Township 42 Range 42
5th Mile West - between Sections 5 & 32

36 00 to Pine & Palmetto
40 00 Set ¼ Section Post -
Bay 5 in N 55 E 48
" 3 " S 25 W 9
71 00 to Pond
80 00 corner to Sections 31 32 5 6 at west edg of Pond
Pine 8 in N 26 W 43
" 6 " S 56 E 36
" 8 " " 72 W 9
" 4 " N 54 E 42
Dead Cypress Pine & Palmetto

260

T 42 R 42 S & E Var 2208

South boundary of Township 42 Range 42
6th Mile West between Sections 6 & 31

4 50 to Pond
8 00 across pond
11 00 to pond
32 00 across Pond
40 00 Set ¼ Section Post -
Pine 12 in S 15 W 87
" N 72 W 207
45 00 to Pond
63 00 across pond
84 00 intersect Range line 1375
North of Township Corner
& establish Corner at intersection
Pine 10 in S 44 E 53
" 10 " N 49 " 181
Dead Pine & Palmetto

261

T 42 R 42 S & E Var 2206

Between Sections 35 & 36 North

11 00 across road N W
15 00 to Pond
1 00 across Pond
18 00 to Pond
40 00 Set ¼ Section Post -
Pine 11 in N 8 W 3 90
" 10 " " 15 E 32 0
42 50 across Pond
58 50 to Sawgrass
72 00 across Sawgrass
77 00 to Pond
80 00 corner in Pond to Sections 35 36 2 5 & 26
Pine 11 in S 71 E 170
" 10 " N 85 " 207
" 12 " S 3 W 346
" 11 " N 36 " 247
S Sawgrass Pine & Palmetto

Figure C-64. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.

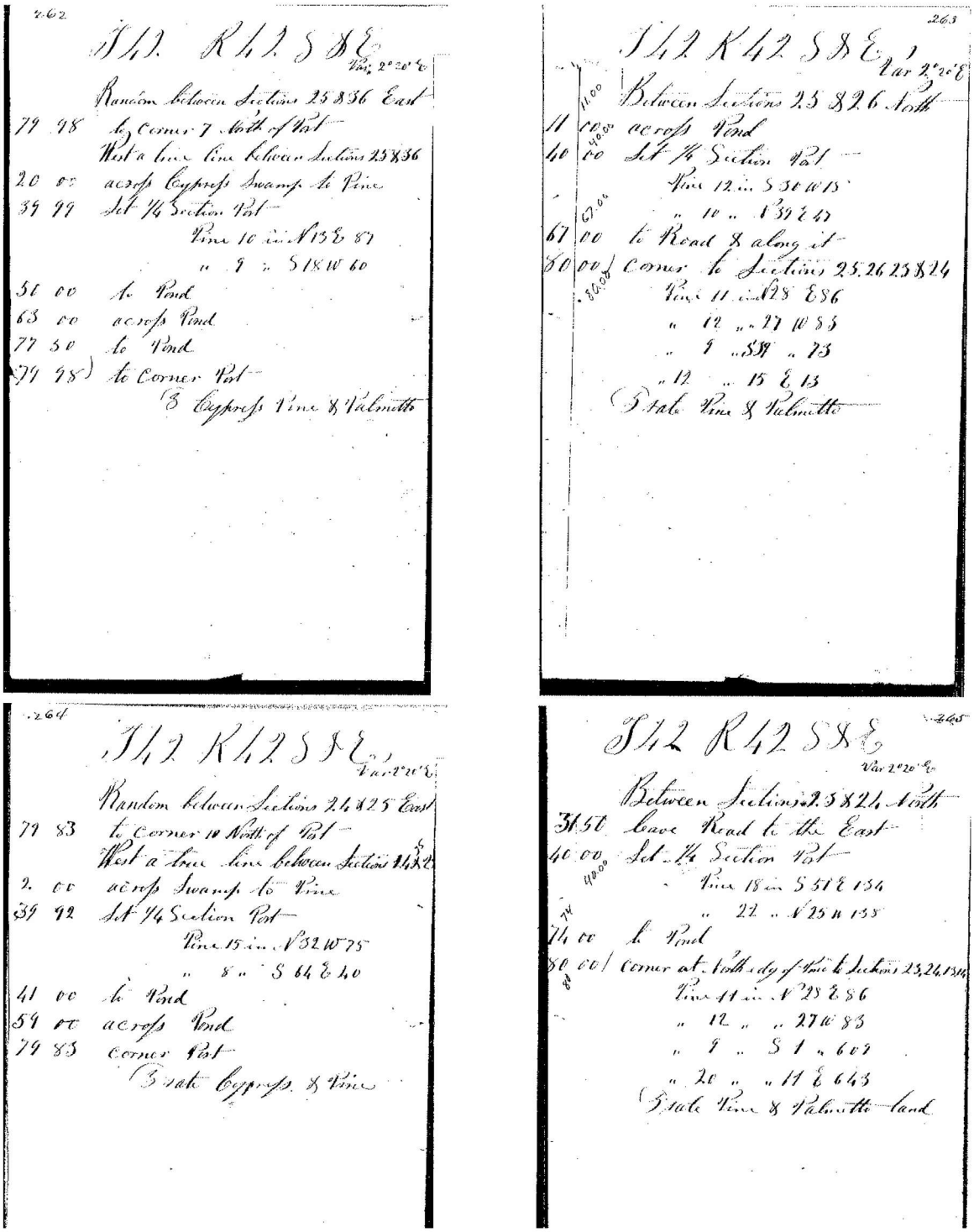
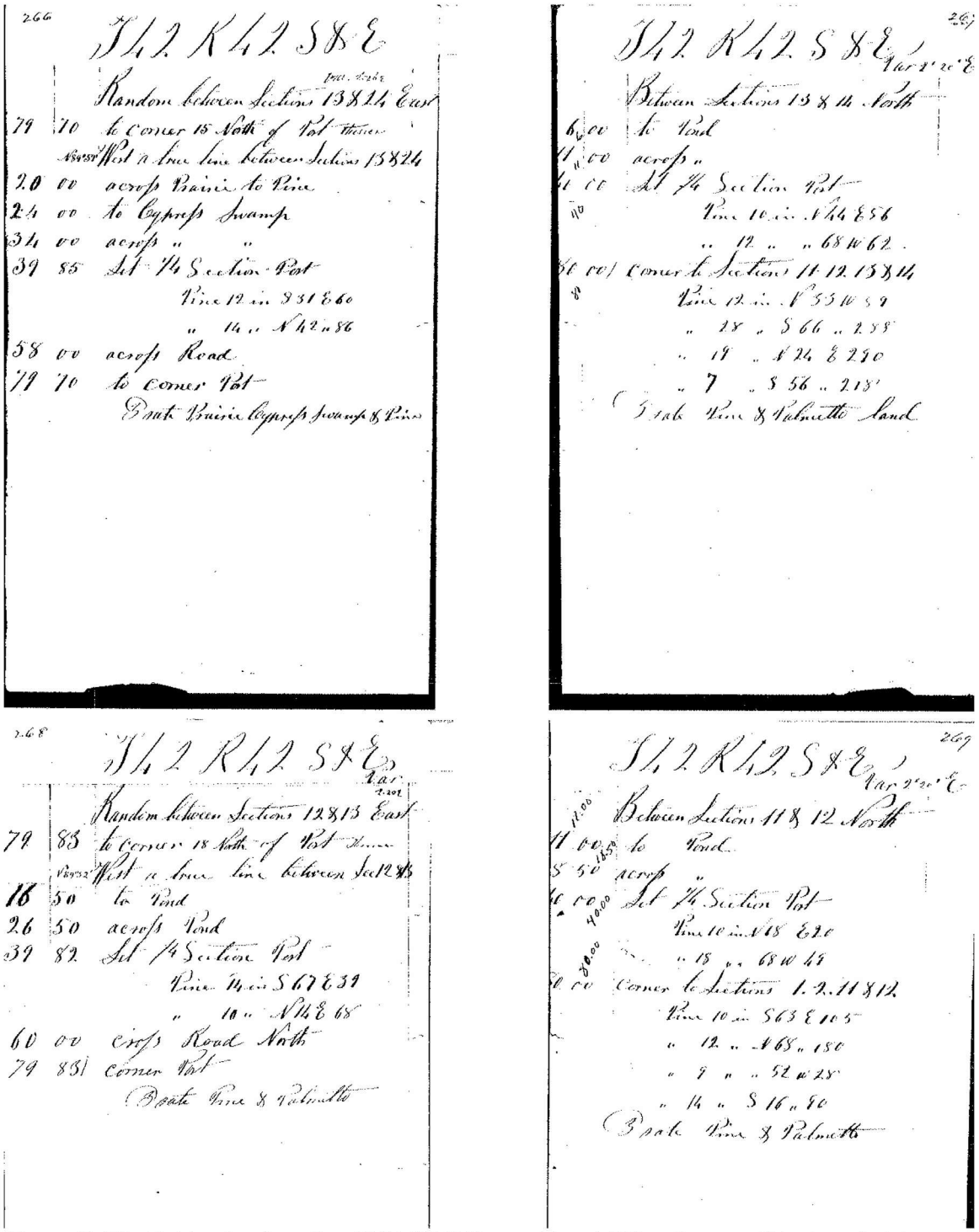


Figure C-65. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.



T. 42 R. 42 S. & E.

Random between Sections 13 & 24 East

79 70 to corner 18 North of Post thence West a true line between Sections 13 & 24

20 00 across Prairie to Pine

24 00 to Cypress Swamp

34 00 across " "

39 85 Set 1/4 Section Post
Pine 12 in. S 31 E 60
" 14 " N 42 W 86

58 00 across Road

79 70 to corner Post

Boats Prairie Cypress Swamp & Pine

T. 42 R. 42 S. & E. Var. 2° 20' E.

Between Sections 13 & 14 North

6 00 to Pond

11 00 across "

14 00 Set 1/4 Section Post
Pine 10 in. N 44 E 56
" 12 " " 68 W 62

80 00 Corner to Sections 11 12 13 & 14
Pine 12 in. N 35 W 89
" 18 " S 66 " 288
" 19 " N 24 E 290
" 7 " S 56 " 218

Soil Pine & Palmetto Land

T. 42 R. 42 S. & E. Var. 2° 20' E.

Random between Sections 12 & 13 East

79 83 to Corner 18 North of Post thence West a true line between Sec 12 & 13

16 50 to Pond

26 50 across Pond

39 82 Set 1/4 Section Post
Pine 14 in. S 67 E 31
" 10 " N 48 E 68

60 00 cross Road North

79 83 Corner Post

Boats Pine & Palmetto

T. 42 R. 42 S. & E. Var. 2° 20' E.

Between Sections 11 & 12 North

11 00 to Pond

5 50 across "

14 00 Set 1/4 Section Post
Pine 10 in. N 18 E 20
" 18 " W 40 43

80 00 Corner to Sections 1. 2. 11 & 12
Pine 10 in. S 63 E 105
" 12 " N 68 " 180
" 9 " " 52 W 28
" 14 " S 16 " 90

Boats Pine & Palmetto

Figure C-66. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.

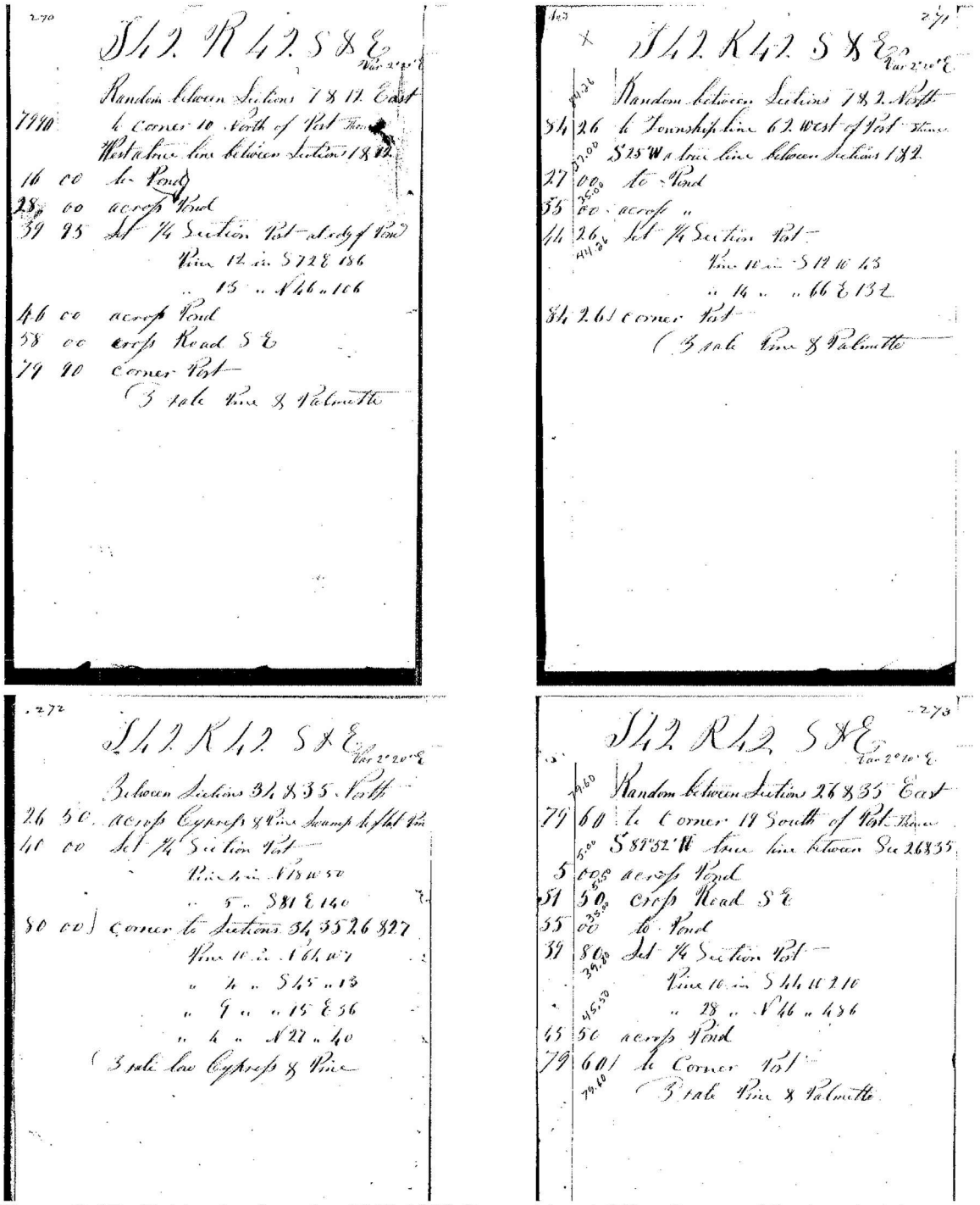


Figure C-67. Field notes from the 1845-1858 General Land Office Survey of the Loxahatchee Slough Area; Township 42 South, Range 42 East.