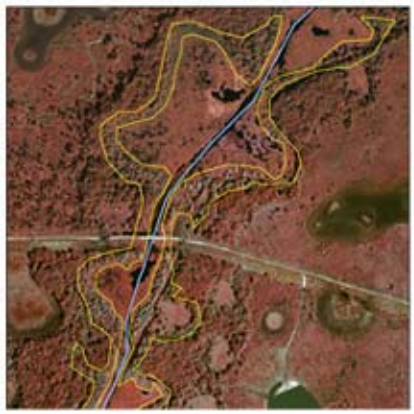

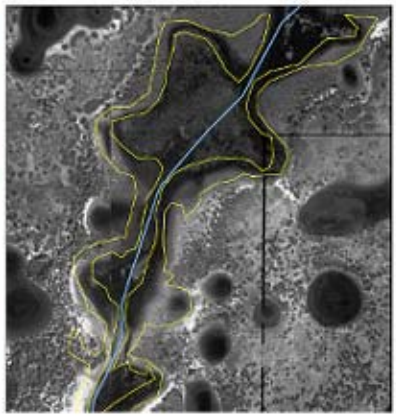

Deer Prairie Slough Restoration Project: Phase II Monitoring Report

Deer Prairie Slough Restoration Project: Phase II Monitoring Report

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April 10, 2004

The Deer Prairie Slough Restoration Project is dedicated to

Dr. Robin L. Hart

who passed away in December 2002.

We will truly miss Robin's leadership in our community and the lasting friendships she fostered. As a public servant and proactive citizen, her dedication to improving the natural environment in Sarasota County in sensible ways was an inspiration to all who knew her. During Robin's tenure with Sarasota County Government, her support for this project, her challenges to her staff, and her promotion of work excellence provided the guidance and leadership for one of the largest restoration projects ever conducted in this part of Southwest Florida.

Above all else, Robin will be remembered for helping her colleagues recognize the similarities between human nature and natural systems. She understood that both the development of mature professionals and the restoration of dynamic ecosystems require routine adjustments to maximize function and value. This report is testament to our philosophy of continuous improvement where we must study changes, learn from them, and adapt our thinking with renewed vigor.

Acknowledgements

The Deer Prairie Slough Restoration Project was completed with funding from the Southwest Florida Water Management District (SWFWMD) Manasota Basin Board, SWFWMD Surface Water Improvement and Management (SWIM) program, the Charlotte Harbor National Estuary Program, the Sarasota County Pollution Recovery Trust Fund, and Sarasota County Government.

The Project Managers would like to thank Jeff Banner, Mike Jones, Jennifer Ryan, Gary Comp, Joe Jacobson, Roland Habicht, Alissa Powers, Debbie Blanco, Jeff Weber, Mike Barker, Teri Owen, Chris Zieschlang, Casey West, Gayle Fosness, Steve Suau, Eric Sutton, and Rob Patten from Sarasota County for their assistance with monitoring, surveying, mapping, and guidance on this restoration project. Their cooperation and teamwork was instrumental to the success of this project. We also appreciate the administrative support from a truly inspiring leader, Francisco Domingo, P.E. who recognized the importance of continuing this important project and stayed the course when times were tough. We also recognize the flexibility granted to us by our funding partners project managers, Catherine Corbett with CHNEP and Denise Tenuto from the Southwest Florida Water Management District. Thanks to Aaron Chevalier, George Giovino, Peggy Curtin, and Heather Pratt for assistance in keeping track of the finances for this project. We also thank Michael, Al, and Bobbi Sandelli from Masters Group, Inc for doing a great job with the final earthwork on the project and EcoConsultants, Inc. for careful and conscientious planting of the Phase II area. Finally, a last minute thanks goes to Jacqueline Dracup for her tireless last-minute assistance with GIS data and graphics.

TABLE OF CONTENTS

LIST OF FIGURES

I. INTRODUCTION

The Deer Prairie Slough Restoration Project was designed to restore the historical conditions of Deer Prairie Slough, a large, herbaceous freshwater slough system with an approximate 12,000-acre watershed. Deer Prairie Slough, hereafter referred to as the Slough, empties into the Myakka River, approximately 10 miles upstream from the mouth of Charlotte Harbor (Figure 1). The Slough was ditched in the late 1940s and early 1950s to drain the area for agriculture. The restoration follows the established natural systems and wetland restoration guidelines and adaptive management approach formulated by the Society of Ecological Restoration (2000).

Impacts directly or indirectly related to historic ditching of the Slough are as follows:

- water level decreases in the surface water table and the surficial aquifer;
- fluctuations in wetland water levels uncharacteristic for local natural wetlands;
- increases in dry season water discharge;
- changes in the plant community to less hydrophytic plant species;
- changes from a herbaceous marsh to a woody-dominated upland community; and
- increases in monotypic patches of invasive/exotic plant species.

An evaluation of historic aerials indicated that the earliest ditching began at the southern, downstream end of the Slough. This ditching was the most damaging to the Slough because the ditches were deeper and the potential for erosion was greater in the downstream areas that receive significantly more water from the watershed.

The Deer Prairie Slough Restoration Project was designed to restore the natural functions of this impacted system through the removal of 8.4 miles of drainage ditches. The project was phased to allow for making adjustments in the design based on monitoring and evaluation of restoration objectives and outcomes. Phase I of this project included the backfilling wetland ditches with existing earthen berm fills and was completed by October 2001. Phase II earthwork, completed by October 2002, emphasized deeper ditches with more significant erosion at the downstream end of the project. Phase I areas with significant erosion were also incorporated into design modifications for Phase II from observations made after the 2001 wet season. To provide adequate fills for Phase II ditches, a borrow pit was created.

The restoration prescription for this site included 1) backfilling of ditches with available fills, 2) establishing natural grades, especially targeting ditches in more upland transitional wetland areas, 3) planning strategic erosion control focused on revegetating temporarily disturbed areas and fortifying problem areas with geoweb and other control measures, and 4) treating exotic and other nuisance plant species that would compete with desirable native vegetation. This monitoring report summarizes Phase I and Phase II construction efforts and environmental response to restoration activities.

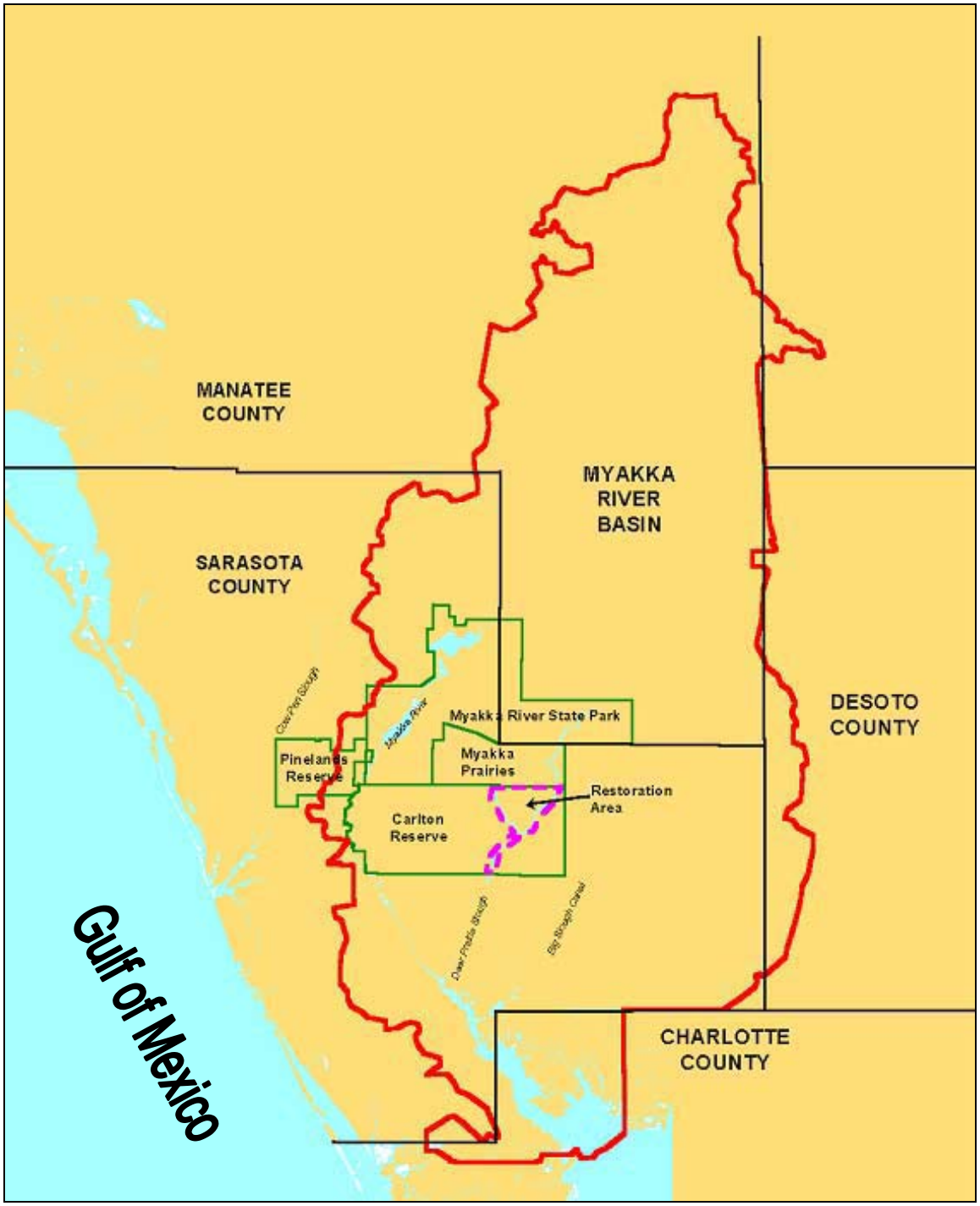


Figure 1. Project site location for the Deer Prairie Slough Restoration Project in the Myakka River Basin, Sarasota County, Florida.

II. RESTORATION ACTIVITIES

The restoration team used an adaptive management approach to address the dynamic nature of this project. This approach allowed the team to schedule restoration activities such as earthwork and planting during the most appropriate season to support re-colonization of the site with desirable wetland plants. The intent was to mobilize and perform earthwork during dry season conditions to facilitate equipment operation, accessibility, and grade control. However, the need to re-establish vegetative cover over disturbed areas required careful timing of planting and minimal disturbance to emergent seedlings following initial seed bank emergence. A phased project that targeted the dry season for most restoration prescription activities allowed an important evaluation period during the next six months for necessary design adjustments. To simplify discussion of this restoration project, a summary of restoration schedules, treatments, and prescription locations are provided in Figures 2a and 2b. Because the prescriptions were area specific, the Slough was divided into four areas (North Branch, West Branch, Phase I Main, and Phase II Main) to aid with discussion of restoration objectives and outcomes.

Permitting

All restoration work on the Slough was permitted through a cooperative effort with the Florida Department of Environmental Protection (FDEP). Sarasota County received a Noticed General Construction Environmental Resource Permit (No. 47022004.000) from the Southwest Florida Water Management District and a Nationwide Permit (No. 200101082) from the U.S. Army Corps of Engineers. Borrow pit construction and earthmoving required a governmental earthmoving exemption under Section 6.1, subsection G, of Sarasota County's Comprehensive Plan.

Contracting

All earthmoving for Phases I and II, including clearing and grubbing, borrow pit excavation, fill, and grading were contracted to the lowest bidder according to State of Florida procurement procedures. Following initial survey work and design, County staff prepared bid documents based on Florida Department of Transportation (FDOT) standards for a two part lump-sum bid, for Phase I and Phase II, respectively. FDOT-compliant Special Provisions and Technical Provisions are provided in Appendix A.

Earthmoving Phase I

The main objective of the Deer Prairie Slough Restoration Project Phase I was to backfill 6.7 miles of linear ditches (approximately 24 acres) on Deer Prairie Slough between the North and South Deer Prairie Slough Bridges. The maximum depth of the filled ditch was between 3 and 4 feet, and its width averaged 30 feet. The total volume of fill moved was approximately 135,000 cubic yards. The contractor backfilled the ditch with fill material from the old spoil piles, which in most places had been colonized by weedy upland herbaceous plants and woody shrubs. Extensive woody vegetation dominated by wax myrtle and laurel oak was removed from existing spoil. The contractor created natural grades similar to those from the surrounding wetlands. In some locations, the contractor scraped the adjacent soils approximately 50 feet on both sides of the channel to provide

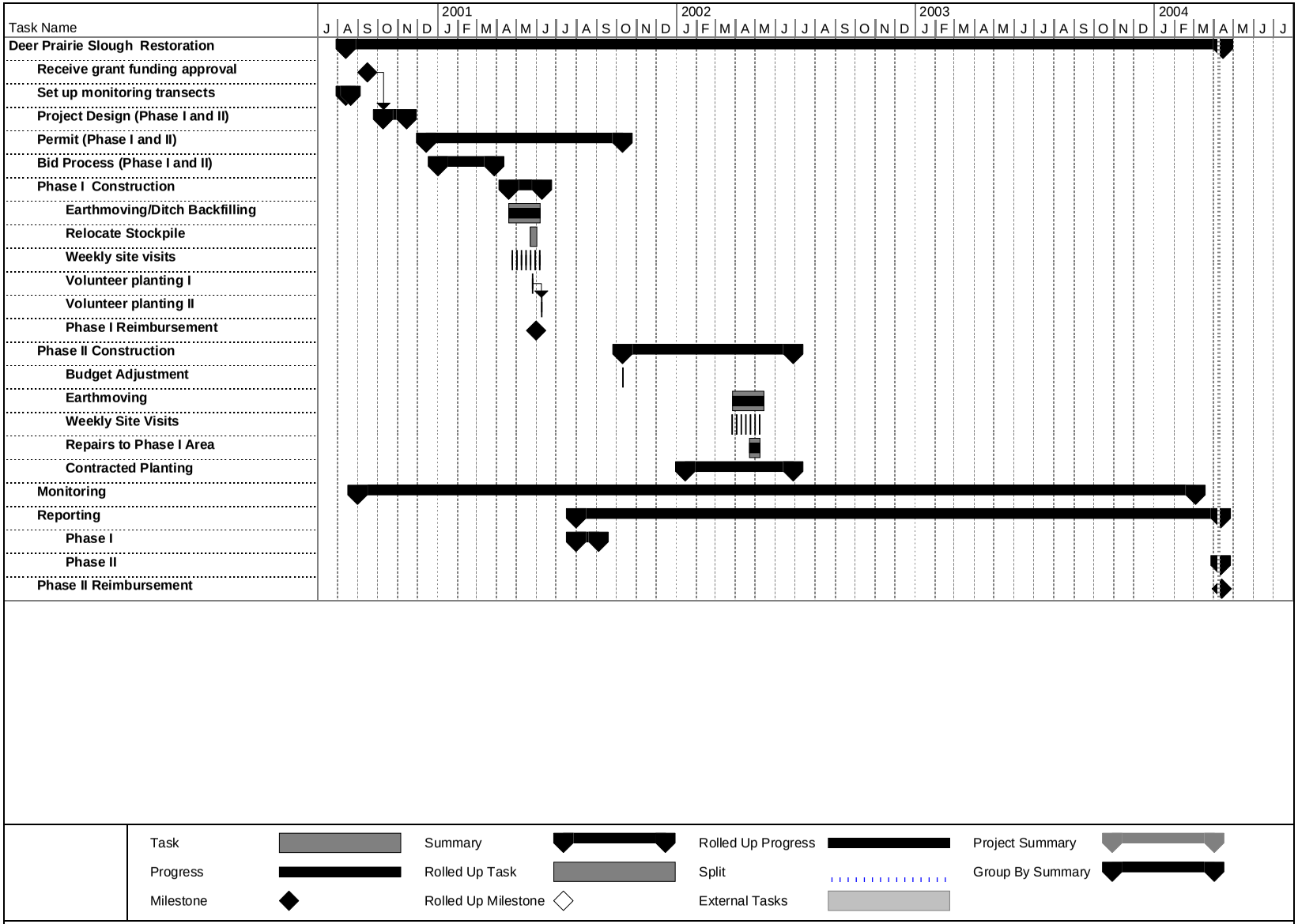
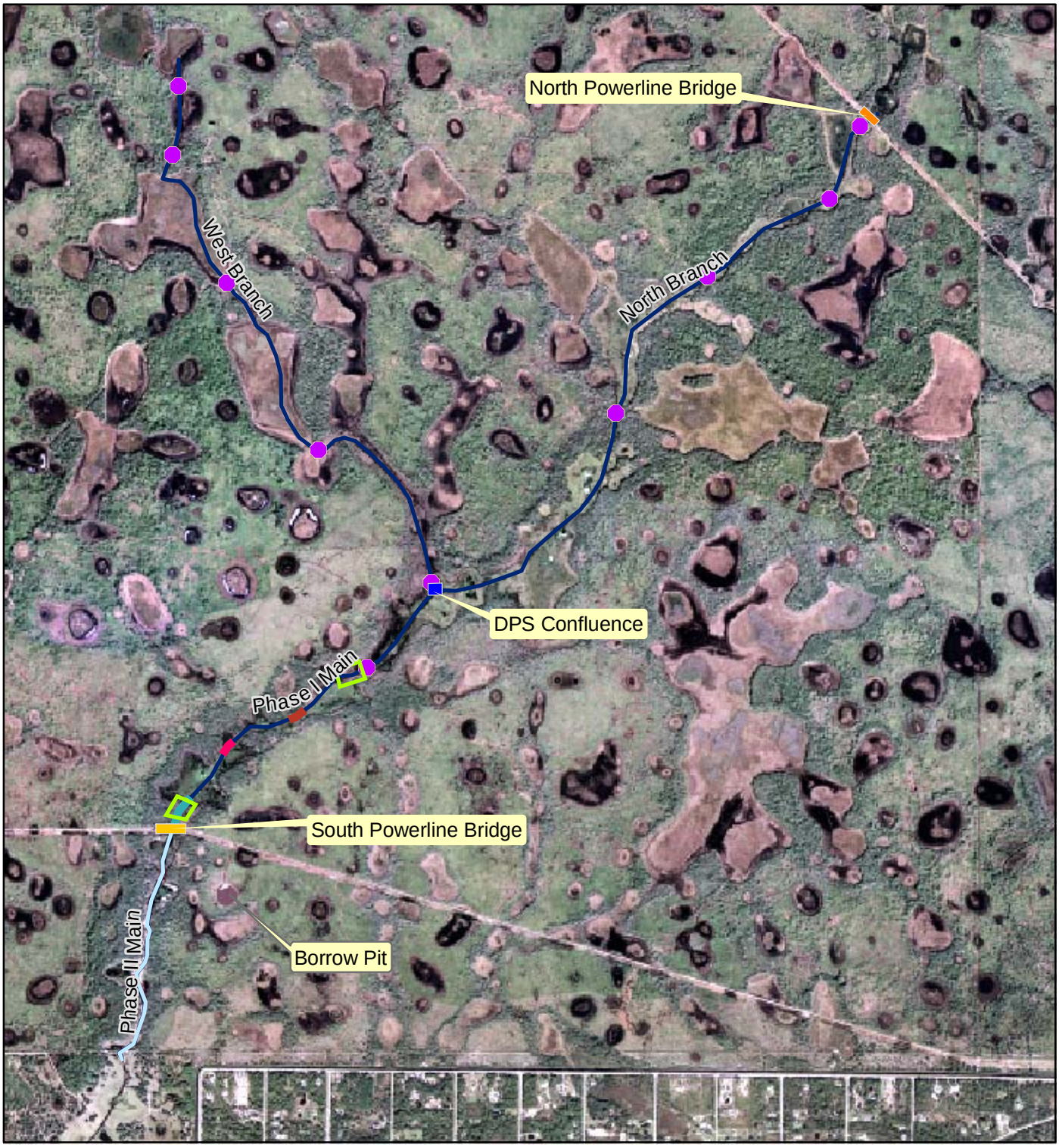


Figure 2a. Deer Prairie Slough Restoration Project compressed gantt chart for phased management, indicating dates for major activities from 2000-2003.



Legend

2,500 1,250 0 2,500 5,000 Feet

- P1 Ditch Backfill
- P1 Fill from Stockpile
- P2 Ditch Backfill
- P2 Repair Area A
- P2 Repair Area B
- P2 Repair Area C
- Volunteer Planting Areas (P1)

N

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Figure 2b Restoration Treatments in the Deer Prairie Slough Project for Phase I (P1) and Phase II (P2).

adequate fill for the ditch and gradual slopes from the adjacent areas. The contractor was directed to minimize the area that needed to be graded while still obtaining the required slopes.

Transitional wetland areas at higher elevations between adjacent wetlands on the Slough were prioritized as recipient sites for available fills. In addition, the project team coordinated with Westra Construction, Inc., a pipeline construction contractor for the Peace River Water Supply Authority for the Carlton-Peace River Pipeline Project, to provide additional fill for areas needing fill to establish natural grades. Westra stockpiled approximately 6,000 yards of fill near the South Bridge. Fill from this stockpile was then relocated to strategic locations along the channelized corridor (Figure 2b).

All earthwork for Phase I was completed during a nine-week period between April 2001 and June 2001. The contractor started work in April 2001 and produced final grades at the North Branch by May 2001. The West Branch was completed by the end of May 2001, and the South Branch by mid June 2001.

Earthmoving Phase II

Phase II earthmoving proceeded in March 2002 and was completed by May 13, 2002. Extensive woody vegetation dominated by wax myrtle and laurel oak was removed from existing spoil. Because fill volumes from the berms were minimal in Phase II Main, a borrow pit was created to provide the balance of fill required. The original spoil comprising the banks of the channel in the Phase II area had largely been largely eroded over the last sixty years and was not relied upon as the major fill source. Following removal of heavy woody vegetation and distribution of the on-site spoil in the Phase II area, the borrow pit was created. All borrow material from this pit was hauled to the Slough ditches to provide the majority of the fill, estimated at 25,000 cubic yards. An additional 5,200 cubic yards of fill from the borrow pit were excavated and transported north into the Phase I repair areas. Gradual natural slopes were established with small bulldozers.

Equipment utilized in both phases of the restoration consisted of a long-reach excavator for borrow-pit excavation and truck loading, 40-cubic-yard off-road dump trucks, and assorted small bulldozers for fill distribution and final grading (Figure 3).

Exotic Control

Exotic and nuisance plant removal and preventative maintenance was an important component of the restoration plan. Prior to any restoration earthwork, the West Branch, North Branch, and Phase I Main sections of the Slough were treated for exotic/nuisance species in a series of events targeting torpedo grass (*Panicum repens*), water lettuce (*Pistia stratiotes),* and water hyacinth (*Eichornia crassipes*). Torpedo grass was most prevalent in the North Branch and Phase I Main, while floating exotics were dominant at the confluence and in Phase I Main. Following restoration earthwork in Phase I, four exotic treatment events targeted alligator weed (*Alternathera philoxeroides*) on the North Branch, and West-Indian marsh grass (*Hymenachne amplexicaulis*), water lettuce and

a.

b.

Figure 3. Deer Prairie Slough Restoration Earthwork: a. Long-reach excavator extracting fill material from borrow pit area. b. Placement and distribution of fill with off-road truck and bulldozer

water hyacinth. These maintenance events focused primarily on the DPS Confluence and Phase I Main.

Phase II exotic plant maintenance included problematic areas throughout the Deer Prairie Slough project site. Two comprehensive exotic treatment events were performed in Summer and Fall 2002, targeting floating exotics such as water lettuce and water hyacinth along Phase I Main and the North Branch. Specific events carried out in Summer 2003 targeted bladder-pod (*Sesbania vesicaria*) at the DPS Confluence and Phase I Main, punk tree (*Melaleuca quinquenervia)* along the West Branch, and torpedo-grass and West-Indian marsh grass along Phase I Main and the North Branch.

Planting

Boy Scout David Groom, III selected the Deer Prairie Slough Restoration Volunteer Planting for his official Eagle Scout Project. Working in conjunction with County staff, he coordinated more than 50 volunteers. While most of the volunteers were from Sarasota Boy Scout Troop 23, many local environmental groups assisted with the planting projects on two Saturdays, May 26, 2001 and June 2, 2001. Representatives from Sarasota County Parks and Recreation, Sarasota County Stormwater, the Audubon Society, the Florida Native Plant Society, and local news reporters worked with Scouts to help relocate nearly 4000 native wetland plants in the temporarily disturbed corridor. A number of sponsors, including Subway, Publix, Albertsons, Manhattan Bagel, Einstein Bros Bagels, Rita's Italian Ices, and South Street Steaks, provided food for the two volunteer events.

While revegetation in Phase I of the project was expected mostly from native seed bank material, Phase II earthwork consisted primarily of borrow material and was not expected to have a seed source. In an effort of promote rapid revegetation of the Phase II corridor and the Phase I repair areas, a contractor was hired to harvest and transplant selected native species from adjacent wetlands. Transplant species included maidencane (*Panicum hemitomon*), sand cordgrass (*Spartina bakeri*), smartweed (*Polygonum punctatum*) and arrowhead (*Sagittaria lancifolia*). This transplant effort revegetated approximately 10 acres of disturbed corridor, with plantings on 3-foot centers.

III. MONITORING

The monitoring plan for this restoration project was designed to evaluate any reversal of soil, water, and vegetation impacts of the historical drainage. To provide meaningful results applicable to future phases of this project and other restoration projects, the data were placed within an appropriate geographical, temporal, and climatological context. General trends and conclusions regarding precipitation and water levels for the entire T. Mabry Carlton, Jr. Memorial Reserve area are referenced from Water Use Permit

analyses performed annually as a requirement under (WUP) No. 208836.004. (Vanasse Hangen Brustlin Inc. 2003). The hydrologic monitoring for this restoration project was intended to take advantage of the WUP monitoring program, including historical data for surficial aquifer water levels, wetland water levels, and surface water flows.

Aerial Photography

Aerial photography and Geographical Information Systems (GIS) analysis for the restoration project area were used to document corridor recolonization and large-scale plant community changes. As part of the WUP, high resolution (1-ft pixel resolution), ortho-rectified aerial photos were available for Deer Prairie Slough and the rest of the Carlton Reserve. These color aerial images were used to analyze selected wetlands representative of West Branch, North Branch, and Phase I Main for corridor width and post-restoration revegetation. Scanned, ortho-rectified aerial photography from 1948 allows for an excellent reference for historical conditions before drainage impacts.

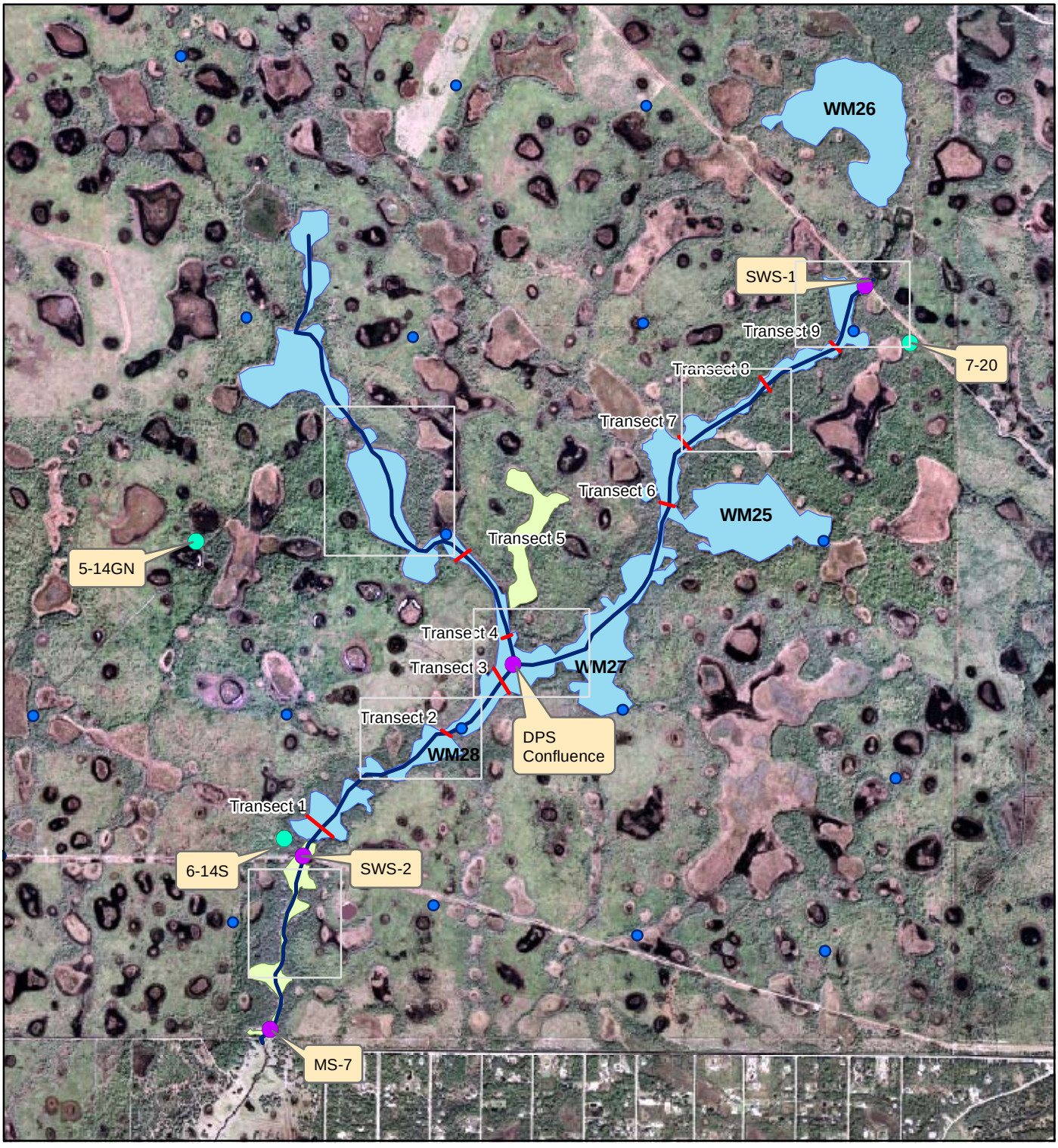
Hydrology

One of the desired outcomes of this project was to induce recharge to the surficial aquifer. Over 40 surficial aquifer monitoring sites were utilized to compare the end of the dry season (May) and the end of the wet season (September) potentiometric elevations for 2001 and 2002. Specific attention was given to changes in the eastern part of the Carlton Reserve, within and adjacent to the Deer Prairie Slough watershed.

The Deer Prairie Slough Restoration Project was also intended to decrease surface water discharge from the Slough by increasing the water storage capacity and water retention period of wetlands. More water was expected to be stored on-site during the dry season as a direct result of this restoration. Slough water flow is measured via a telemetry system at two locations: the northern end of the restoration area (SWS-1) and the downstream southern end (SWS-2) (Figure 4). When expressed as flow data, the values presented are derived from telemetered stage data and rating curves for the individual monitoring station. In cases where restoration earthwork altered topography and consequent rating curve validity, raw stage data are intended to be representative of relative flow.

The Deer Prairie Slough Restoration Project was expected to directly increase average water depths and hydroperiods in Slough wetlands affected by the ditches. Monthly water levels were manually monitored at rim and interior piezometers in Wetland Monitoring sites WM 25, WM 26, WM 27, and WM 28 (Figure 4).

Rainfall is measured at 12 telemetered rainfall sites distributed throughout the Carlton Reserve and the Myakka Prairies public land on the northern boundary of the Carlton Reserve. Telemetry station MS-7, located in the restoration project area, was used to evaluate long-term monthly trends and hourly responses in wetland water levels. Additional precipitation data are discussed as summarized by Vanasse Hangen Brustlin, Inc. (2003) referencing a National Oceanic and Atmospheric Administration (NOAA) rainfall station at Arcadia, approximately 25 miles NE of the restoration site.



Legend

- VegetationTransects
- Restored Slough Channel
- Phase I Wetlands
- Phase II Wetlands
- Surface Water Telemetry
- Surficial Aquifer
- USGS Wells

2,500 1,250 0 2,500 5,000 Feet

N

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Figure 4 Deer Prairie Slough Restoration Area and Monitoring Locations.

Wetland Vegetation
The main biological goal of the restoration project was a shift to a more hydrophytic plant community, results of longer, more natural hydroperiods. Specific outcomes included a reduction in seasonal coverage of upland or disturbance plant species. Because changes in plant species composition in herbaceous wetlands like those found in the project site are usually more dependent on dry seasonal rainfall amounts and patterns than on wet season conditions, dry season changes in herbaceous cover were emphasized in analyses of vegetation community changes.

County staff conducted quantitative vegetation monitoring from nine transects and a total of 59 1-m^2 quadrats twice annually from 2000 through 2003. The sampling locations, shown in Figure 4, reflect a variety of wetlands along a north-south gradient. To capture changes in the heterogeneity within wetlands, sampling included the transitional and interior wetland zones. Species present in quadrats were assigned independent cover values as percentages, allowing for percentages within quadrats to exceed 100%. Plant dominance was determined for each transect, based on frequency and percent cover. Additionally, qualitative evaluations of corridor colonization, large-scale plant community changes, and exotic plant coverage were recorded, based on aerial photography and direct observations.

Wildlife
Restoring the Slough was intended to improve wildlife habitat. While this specific outcome was not quantitatively measured, County staff made an effort to document wildlife utilizing the restoration project. These habitat function benefits of the project are briefly summarized.

IV. RESULTS AND DISCUSSION

Earthwork
The most important component of the restoration prescription was establishing natural wetland grades. Both phases of the restoration were successful in eliminating ditched areas and raising the outfall elevations of individual wetlands along the Slough from north to south. The restoration design called for minimizing the disturbed corridor during construction to promote revegetation of the area following restoration. The width of the corridor was successfully limited to an average of 70 feet. In cases where a wider area of disturbance was necessary to generate adequate fill for gradual contours, the corridor of earthmoving was extended to up to 120 feet. Consequently, the temporarily disturbed area was reduced from the permitted area of 132 acres to approximately 81 acres.

The earthmoving results for the North Branch, West Branch, Phase I Main, and Phase II Main were considered separately because the inherent differences in soils, degree of

wetland impacts, and position within the watershed. To assist with evaluating earthwork restoration targets for the entire area, a series of aerials are provided in Appendix B. Aerials from 1948 represent desirable conditions before most impacts, and those from 2002 reflect a period months after completion of Phase II. The 2002 aerials also reflected the extent of the earthmoving disturbance corridor, subsequent vegetative colonization, and post-restoration erosion within the Phase I and Phase II areas of the Slough.

Inspection of general water depths from the 1948 aerials indicates that most of the wetlands in the restoration area had intact transitional zones that isolated standing water in different wetlands. Attempts to re-create this effect are described in the Restoration Activities, Earthmoving Phase I section. Aerials for part of Phase I Main (Appendix B, Sheet 2a) represent the success of re-creating transitional areas between slough wetlands. Site inspections following Phase I and Phase II verified the success of this method for re-creating transitional zones.

North Branch Earthmoving

The ditches along the North Branch were characterized by shallow, heavily eroded, vegetated ditches bordered on either side by displaced spoil. Visual observations indicated that minimal erosion had occurred within the ditch and spoil following initial ditching. The ditch in the North Branch connected isolated wetlands with Floridina and Gator depressional soils across extensive transitional wetland areas of Felda fine sands depressional soil. Small inclusions of Gator mucks were found in the Floridina and Gator depressional areas, but these areas of mucks were away from ditched areas. Earthwork in the North Branch was the earliest completed restoration. Backfilled ditches and fill materials remained stable and no erosion was observed.

West Branch Earthmoving

The West Branch ditch drained large wetlands of Delray fine sands depressional soils and Floridina and Gator depressional soils, across transitional wetland areas of Holopaw fine sands depressional soils. These ditches were heavily vegetated and often colonized along spoil banks with floating vegetation mats where Floridina and Gator and Delray depressional soils were bisected. Ditches within the areas of Holopaw fine sands generally exhibited sparse wetland vegetation yet very little erosion. Pre-restoration velocities along the West Branch ditches were likely very low.

Earthwork in the West Branch was accomplished primarily via bulldozing, with additional transitional area fill targeted near a single off-road trail culvert crossing where upland cut portions of the Slough were visually apparent. Backfilled ditches and fill material remained stable and no erosion was observed.

The DPS confluence, where the West Branch and North Branch meet, is best characterized as a large wetland of Delray fine sands depressional soils surrounded by a fringe of Felda fine sand depressional soils. Earthwork at the confluence remained stable following restoration.

Phase I Main Earthmoving

The ditch in Phase I Main passed through wetland areas similar to those described above in the North Branch, with additional inclusions of Delray fine sands depressional soils. Immediately south of the DPS Confluence, the ditch was characterized by steep, square banks, eroded spoil, and sparse vegetation. This was indicative of high velocities and fluctuating water levels.

Restoration areas with Phase I Main exhibited sections of current scouring and deposition following earthwork. The temporary downstream plug installed between Phase I Main and Phase II Main failed during the wet season between the two phases, resulting in extensive erosion immediately north of the South Bridge, and deposition into deep areas within the Phase II Main ditch.

Repairs to Phase I Main were successful and relatively stable, with minimal scouring and deposition once again occurring just south of the DPS Confluence. All erosion problems in the Phase I area were resolved during Phase II work, as borrow material was placed in eroded areas and deposition areas were contoured. Further, Phase II Main channel fill slowed velocities exiting Phase I Main, limiting the potential for further erosion in this area.

Phase II Main Earthmoving

Phase II ditches exhibited the highest degree of erosion prior to restoration, evidenced by extensive erosion, bank undercuts, rills along ditch banks, an absence of spoil, sparse ditch vegetation, and extensive flood-pulse deposition buildup in the southernmost wetland. Soils in the Phase II Main area were mapped as the same soil types within Phase I Main, however, all surface strata indicated a higher degree of oxidation. Borrow material from the created pit was composed of Eau Gallie and Myakka fine sands.

Phase II successfully eliminated large stretches of deep ditches and raised the discharge elevation of two large wetlands within the Phase II area. Substantial soil rework and localized sediment re-suspension was observed following rainfall events in 2002. Targeted, site specific erosion control measures such as silt fence and geosynthetic fabric met with limited success, with localized failures within the Phase II area resulting from high velocities during early wet season high rainfall events. Other erosion within the Phase II Main area coincided with 4WD trails.

The southernmost of the Phase II Main wetlands are shown in Appendix B, Sheet 1a. Current aerials show the extent of corridor disturbance during construction, as well as areas of erosional soil-rework and limited vegetation re-colonization. As shown in the 1948 aerials (Appendix B, Sheet 1b), this Phase II Main area was the earliest area to be ditched along the Slough, a possible explanation for the extensive soil oxidation, erosion, and plant community change from 1948 to pre-restoration conditions.

Hydrology

The amount and timing of rainfall are important factors when interpreting post-restoration hydrologic data. When evaluating the changes in post-restoration water levels it is important to understand that WY2002 is characterized as a relatively dry year (Figure 5). It would also be considered as the end of a three-year drought characterized by dry seasons (October through May) with extremely low rainfall. Although this extreme dry period afforded optimal conditions for the initial phase of the restoration work, the full hydrologic and biologic effects of the restoration will not be realized until weather conditions return to average.

Daily rainfall totals for the Slough project area are summarized in Figure 6, based on telemetered rainfall data from monitoring site at DPS Confluence. Figure 6 demonstrates the relationship between precipitation and hydroperiod variations from January 1997 through July 2003, based on monthly manual piezometer readings. This figure assumes continuous trends between monthly data points, limiting resolution regarding duration of inundation. The most extreme drawdown period on record for the Slough area is indicated in early Summer 2000 for all wetlands. This drawdown reflects a cumulative three-year drought and the effects of the historic ditching on the slough wetlands. Following both Phase I and Phase II, slough wetlands exhibited a longer period of inundation than any of the previous three years, 1998-2000, despite the drought conditions. The improved hydroperiod reflected in 2001 and 2002 data is most likely a direct result of decreased surface water discharge from the slough following restoration.

Water levels receded after the 2002 wet season at differing rates for different parts of the Slough. The northernmost wetlands (North Branch, WM25 and WM 26 and Phase I Main, WM 27) in the restoration area exhibited the most gradual drop in water levels following Phase I, indicating successful results from Phase I ditch backfilling. The retreat of wet season water levels in 2003, following Phase II, appears more gradual for all wetlands when compared to previous years' data. This visual trend in the rate at which wet-season water levels receded indicates that both Phase I and Phase II increased the hydroperiod of wetlands along the North Branch and Phase I Main. It may be assumed that this benefit extends to the wetlands along the West Branch.

Telemetered stage data for the slough corridor, measured at sites SR72, WM-26, DPS confluence, and MS-7 further resolve the more gradual drawdown following restoration, particularly following Phase II (Figure 7). Because this telemetered data was recorded at six hour intervals, the longer periods of inundation indicated on this figure are more significant than those implied by the manual monthly measurements. It should be noted that the hydroperiod improvements are more pronounced in the northern (upstream) telemetered sites, indicating that the downstream restoration performed during Phase II further improved the hydroperiod in Phase I wetlands.

While stream-flow was calculated from telemetered stage data for sites within Deer Prairie Slough, gaps in data resulting from equipment disturbance or malfunction

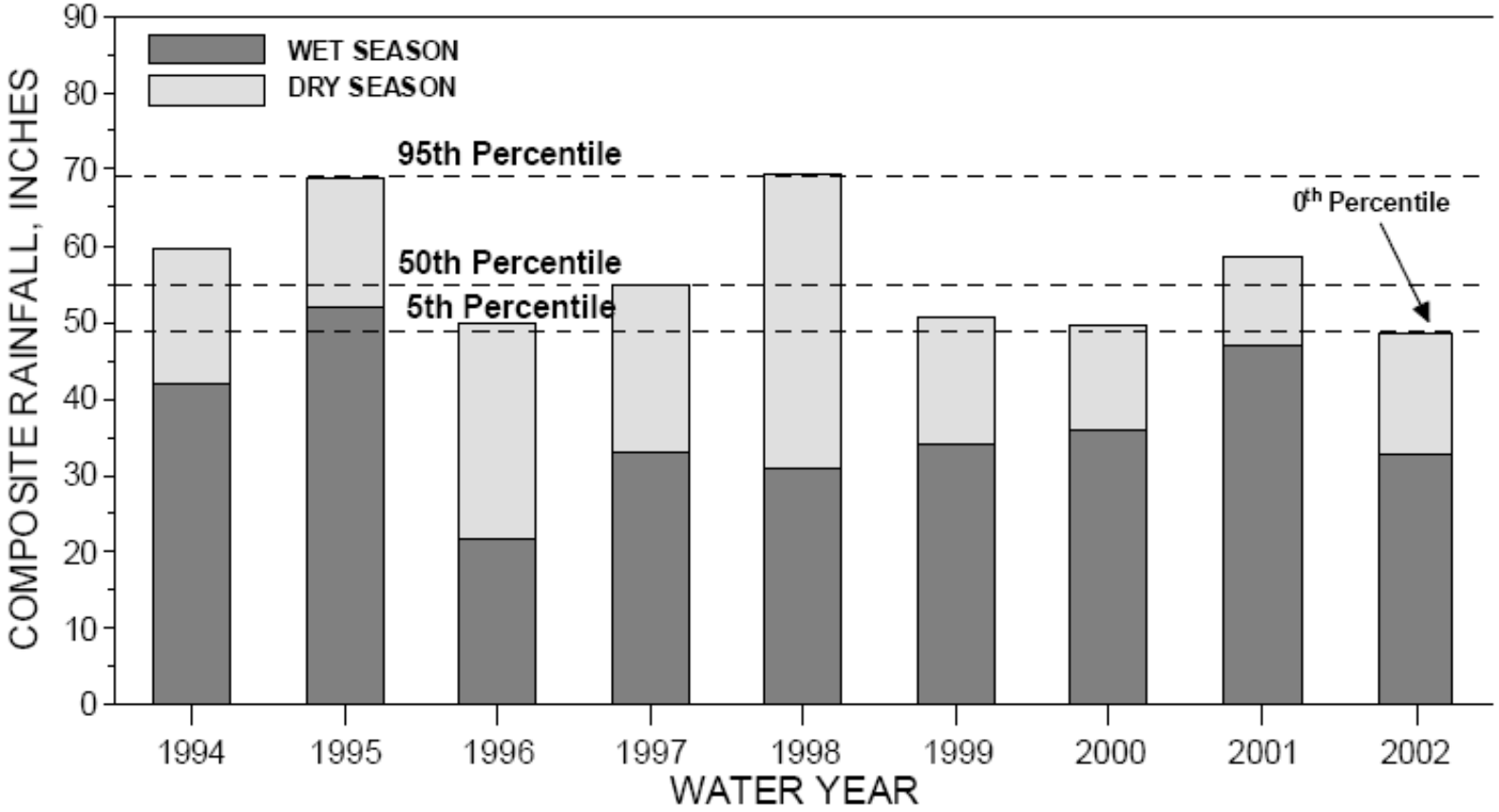

Figure 5. Annual composite rainfall at the Carlton Reserve from Water Year 1994 to Water Year 2002. Water year refers to the period from October through the following September. Adapted from Vanasse, Hangen, Brustlin, Inc., 2003.

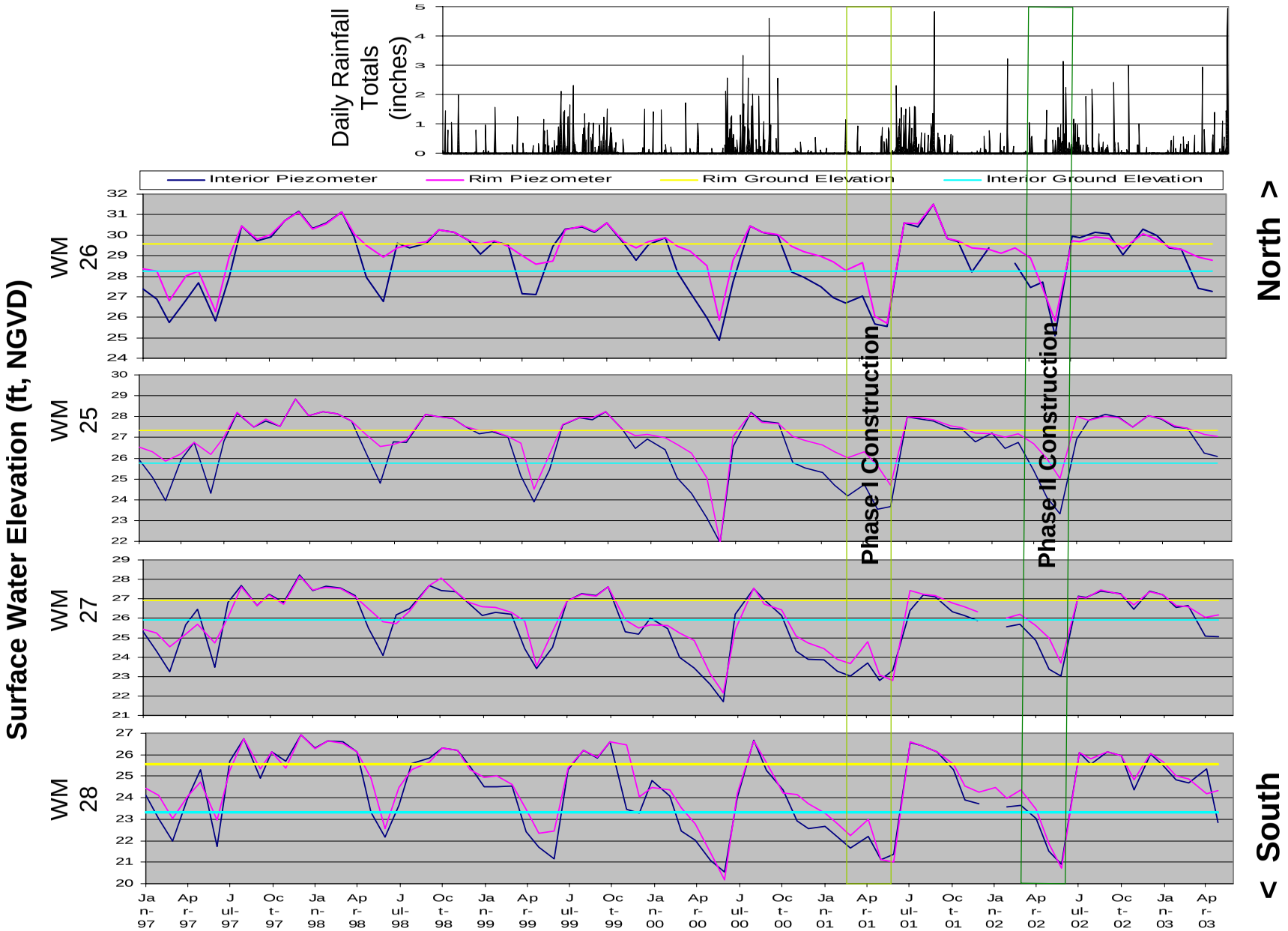

Figure 6. Daily rainfall totals and monthly surface water levels for wetlands WM25-WM28 on Deer Prairie Slough. Hydrographs are arranged from North to South. WM 25 and WM 26 are located in the North Branch, WM 27 and WM 28 are located in Phase I Main.

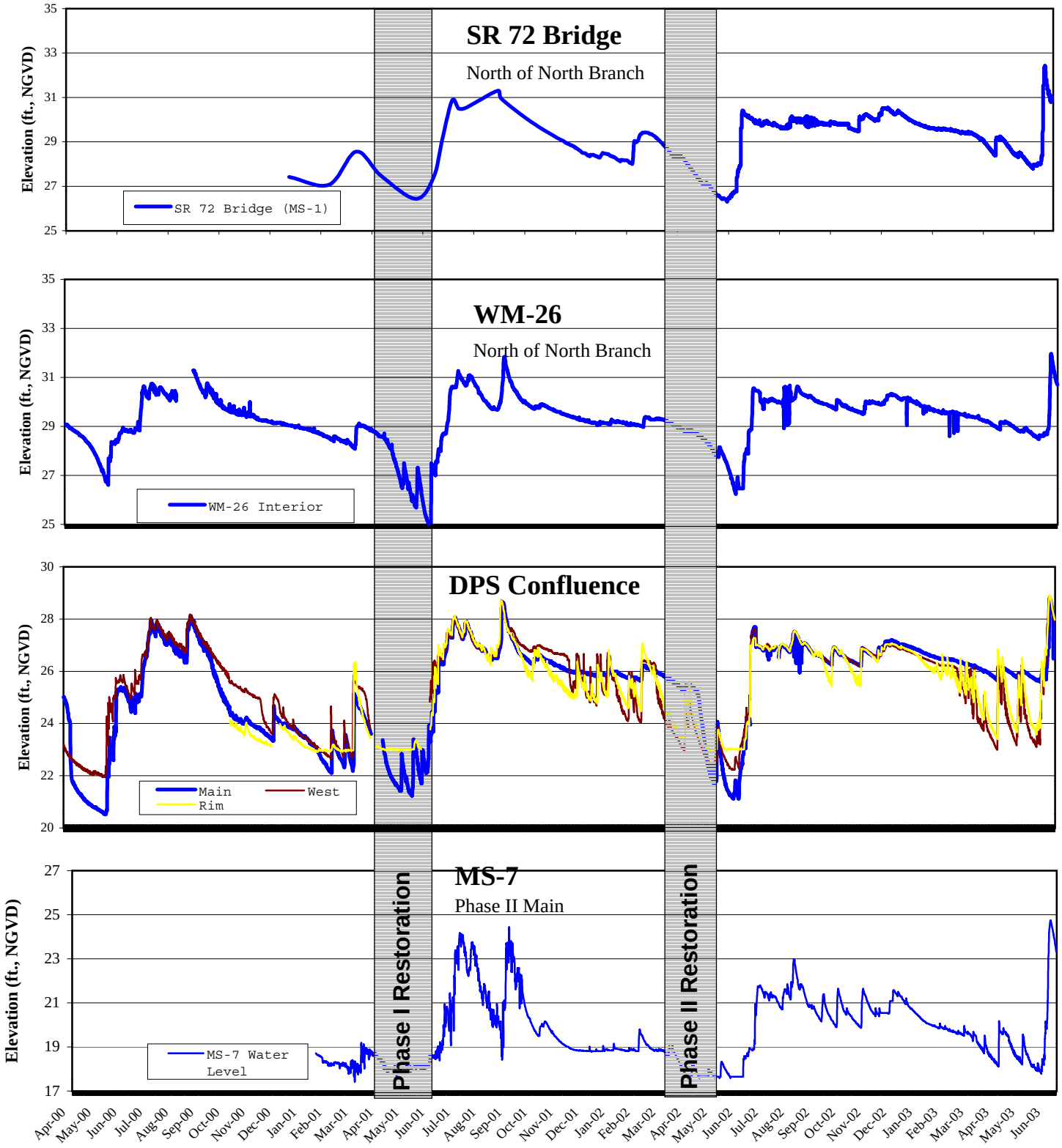

Figure 7. Deer Prairie Slough telemetry hydrographs, North to South.

precluded continuous, reliable data for pre- and post-restoration comparisons of streamflow. Another confounding factor in interpreting stage-derived streamflow was the change in topography associated with restoration earthwork. For the gaging station at the South Bridge, it is likely that earthmoving in the area was sufficient to invalidate pre-restoration rating curves. Because of this, streamflow calculations based on WY 2001 and WY 2002 data accurately reflect differences in pool elevation but may have only minimal correlations with actual streamflow.

Figures 8 and 9 compare period of record, calculated streamflow data for the North and South Bridge gaging stations, adapted from Vanasse Hangen Brustlin, Inc (2003.) The streamflow histograms group water years into percentile calculations based on data for the entire period of record. While most water years are comparable for the two stations, WY 2002 shows flows into the North Branch (North Bridge gaging station) within the 25^{th} percentile, while flows out of the Phase I Main area (South Bridge gaging station) are grouped into the 0^{th} percentile. This significant difference in calculated streamflow indicates that the relationship between flows into the North Branch and flows out of the Phase I Main was altered from its period-of-record pattern. The altered rating curve is not a likely contributor to this pronounced change, because the topographical changes (higher ground elevation and wider flow-way) observed adjacent to the South Bridge gaging station would have likely resulted in a false increase in calculated flow, not a decrease. This change in percentile groupings for flows from North to South along the Slough is attributable to successful elimination of ditches, resulting in an increased retention time and likely increased evapotranspiration (volume) with longer hydroperiods. Another possible contributing factor could be localized variations in rainfall patterns significantly altering flow contributions from the West branch, which is not gaged for flow but does contribute to the South Bridge flows.

Potentiometric contours for the Deer Prairie Slough area are shown in Figures 10 and 11. These figures reflect the seasonal change in surficial aquifer levels in 2001 and 2002, representing aquifer levels during May and September for those years.

The potentiometric contours for May 2002 (Figure 10) represent an apparent increase in aquifer levels extrapolated near the DPS confluence area from 2001 to 2002. This indicates a possible decrease in the aquifer slope, or a leveling of the surface water table, resulting from Phase II restoration work and repairs to Phase I Main. Overall, the estimated water table for the Slough and surrounding area was at a higher elevation in May 2002 than in May 2001. Figure 10 contour lines also suggest that West Branch restoration efforts have further prevented seasonal surface water drawdown in the disjunct marsh system immediately south of the West Branch.

While data for September 2002 indicates a higher groundwater table surface than September 2001 (Figure 11), most markedly in the Slough restoration area, future data will assist in determining if this apparent recharge is occurring as a result of the restoration.

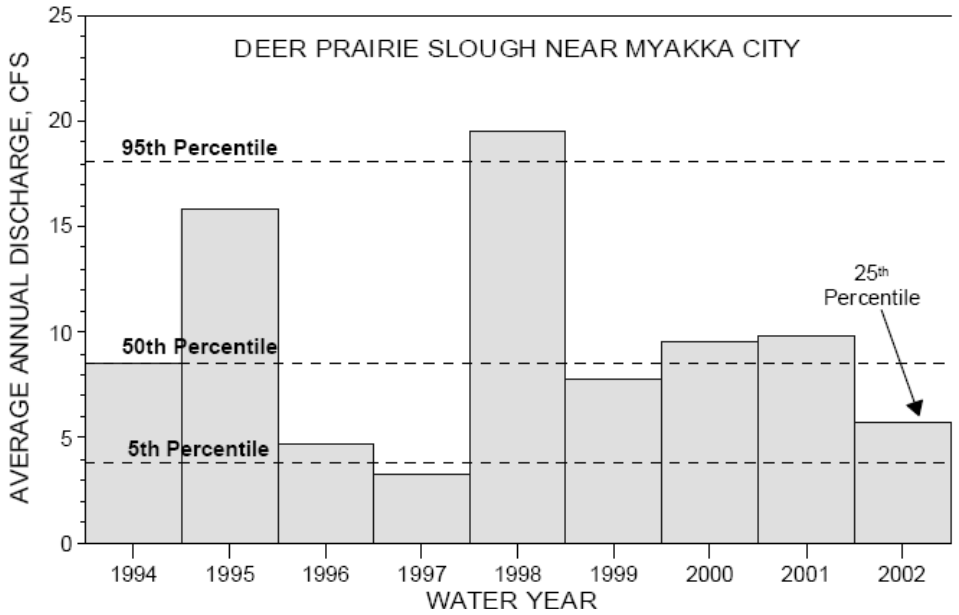

Figure 8. Period-of-Record Stream Flow at the Deer Prairie Slough North Powerline Bridge Gaging Station from WY 1994 through WY 2002. Adapted from Vanasse Hangen Brustlin, Inc., 2003.

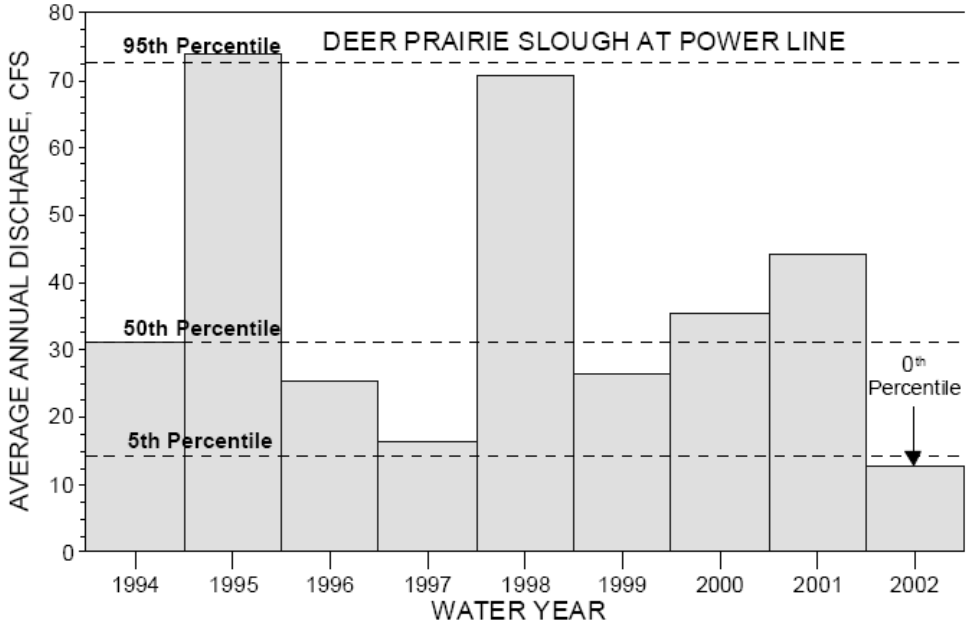

Figure 9. Period-of-Record Stream Flow at the Deer Prairie Slough South Powerline Bridge Gaging Station from WY 1994 through WY 2002. Adapted from Vanasse Hangen Brustlin, Inc., 2003.

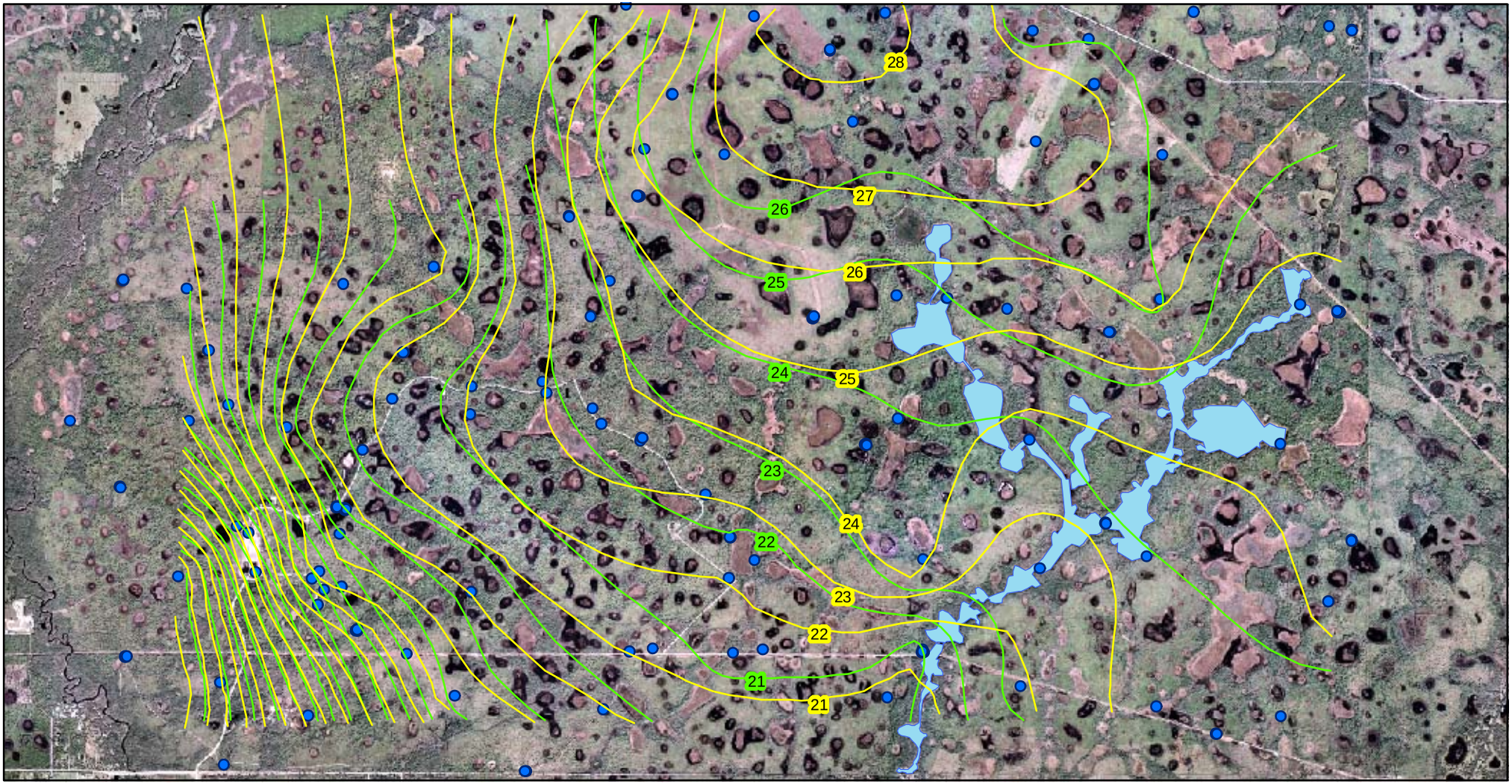

Figure 10 Surficial aquifer potentiometric contours in the Deer Prairie Slough area, May 2001 and 2002. Contour Interval = 1ft

N

4,900 2,450 0 4,900 9,800 Feet

Legend

- Wells
- May 2001
- May 2002
- DPS Restoration Area

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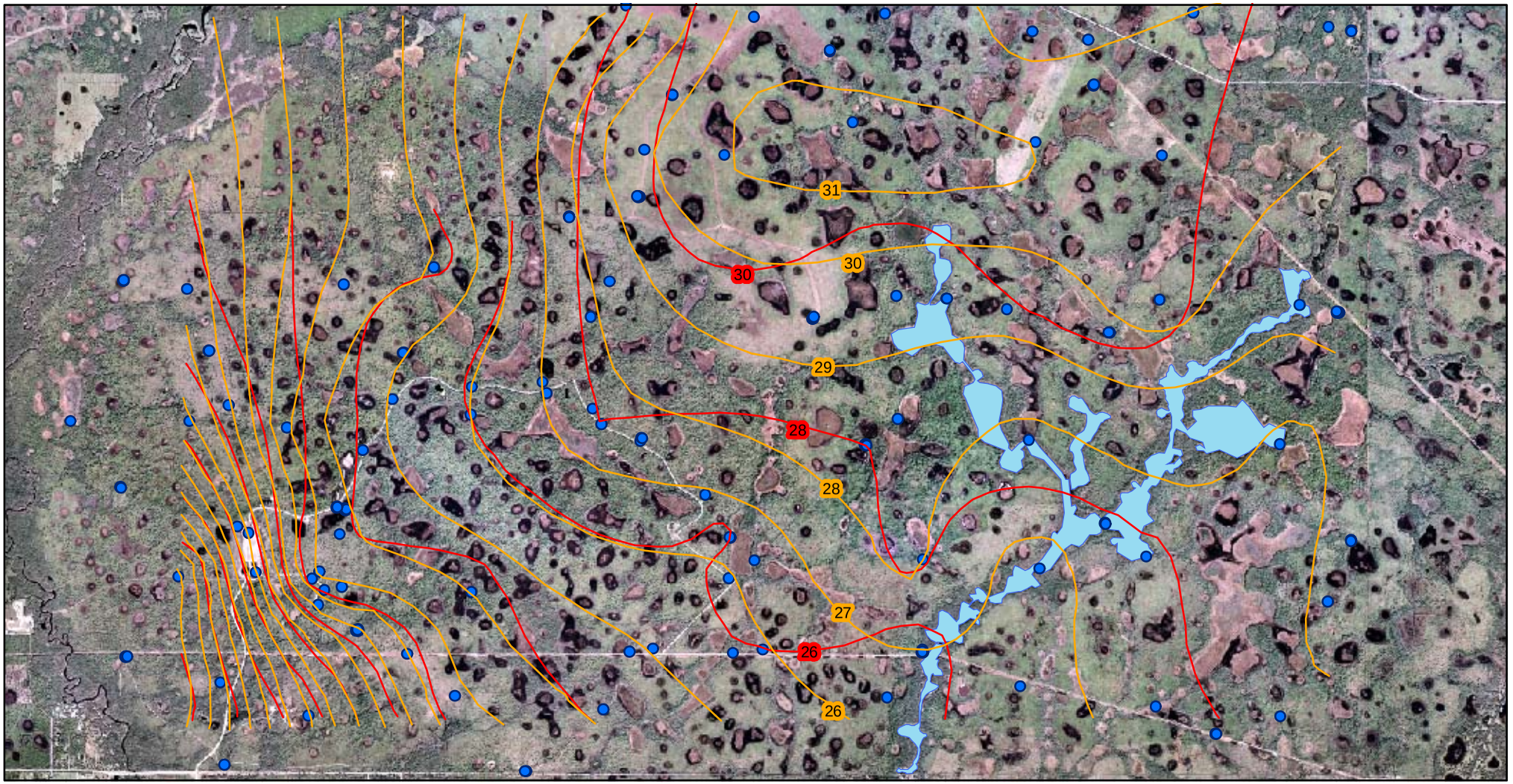

Figure 11 Surficial aquifer potentiometric contours in the Deer Prairie Slough area, September 2001 and 2002.

N

5,000 2,500 0 5,000 10,000 Feet

Legend

- Wells
- September 2001 - Contour Interval 2ft
- September 2002 - Contour Interval 1ft
- DPS Restoration Area

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Vegetation

Disturbed Corridor

Some changes in plant communities were not captured in herbaceous transect data, but deserve some discussion. Based on qualitative observations and field notes made immediately following earthwork, corridor revegetation progressed through regular and rapid succession, following seedling emergence in dry soils through long-term inundation with the onset of post-earthwork rains. The typical pattern occurred on a temporal scale not captured in regular monitoring events, and is summarized as follows:

An escaped prescriped burn near the West Branch in May 2001 spread southeast across the confluence and Phase I Main, and resulted in the newly restored corridor being utilized as a patrol road. Much of the newly emergent corridor vegetation was impacted by fire suppression equipment traversing the road. Subsequent re-growth of vegetation in the corridor progressed slowly following the onset of the wet season 2001. By July 2002, evidence of the West Branch, North Branch, and Phase I Main ditches was masked by vegetation on the ground, and the corridor was visible only from aerial photography.

Path and spike rushes (*Eleocharis baldwinii* and *Eleocharis vivipara*) emerged most rapidly and provided the most extensive coverage within the corridor along the West Branch, North Branch, Phase I Main, and Phase II Main. Smartweeds (*Polygonum* spp.), Mock Bishops-weed (*Ptilimnium capillaceum*), and panic grasses (*Panicum* spp.) regularly emerged following initial rains but prior to wet season inundation. Following inundation in the temporarily disturbed corridor, significant changes in the plant community were observed, most likely associated with inundation and water depth tolerance. Phase I Main, North Branch, and Phase II Main succeeded to communities dominated by maidencane, *Sagittaria subulata* and *Pontederia cordata*. Phase I Main and North Branch experienced a temporary increase in bladder-pod coverage following Phase I earthwork, but in each case this bladder-pod did not re-emerge the following season.

Transitional areas throughout Phase I Main, North Branch, and West Branch colonized with emergent *Sagittaria* sp. and extensive spikerush mats. The edges of these transitional areas and 4 wheel drive trails provided source for continuing colonization of the restored corridor by torpedo-grass. The West Branch differed primarily in that the sandy soils of this branch supported a variety of dense *Juncus* spp. and *Rhyncospora* spp. stands, ultimately interspersed with *Hypericum fasciculatum* seedlings. West Indian marsh grass appeared immediately prior to Phase II restoration activities, and has spread rapidly in the Phase I and Phase II Main areas despite continued treatment.

North Branch

Revegetation of the disturbed corridor following earthwork was rapid in the North Branch. Initial emergence of *Eleocharis* spp., *Polygonum* spp., and grass seedlings occurred uniformly throughout the North Branch prior to the start of the 2001 wet season.

Quantitative changes in herbaceous transects were summarized by dominance within transects. Table 1 provides a summary of changes for transects within the Northern Branch from pre-restoration to August 2003, most notably exhibiting new occurrence of *Micranthemum* sp. (Transect 8) and increased dominance for *Polygonum punctatum*. These changes may be interpreted as an indicator of longer hydroperiods; more species with greater inundation tolerances exist in post- than in pre-restoration dominant vegetation of *Panicum* spp., *Spartina bakerii*, and *Mikania scandens.*

West Branch

Documented changes within West Branch transects were not as pronounced (Table 2), but reveal a post-restoration absence of *Eupatorium* spp. and the appearance of *Rhyncospora inundata* and *Bacopa caroliniana*. In general, ditched areas of the West Branch exhibited a post-restoration trend towards a more hydrophytic and stable plant community.

Phase I Main

Most notable among vegetation changes for Phase I Main transects is the reduced importance of *Spartina bakerii* and the appearance of *Utricularia foliosa* and *Limnobium spongia*, once again reflecting a change towards a more hydrophytic plant community (Table 3). This table also documents the prevalence of West Indian marsh grass within Transect 2 of the Phase I Main area. Further, Table 3 demonstrates a post-restoration absence of *Eupatorium* spp.

General Trends

Quantitative vegetation monitoring revealed seasonal variations in slough plant communities, shown in the species richness curve in Figure 12. Total alpha diversity (species richness for the entire site for all monitoring events) for vegetation within monitoring transects totaled 96, while no more than 56 species were documented in any single monitoring event. Pre-restoration monitoring in August 2000 yielded 46 species; the most recent vegetation monitoring event in August 2003 yielded 41 species. This seasonal variability and continuous temporal change in plant community within a freshwater slough system demonstrates the degree of pre-restoration disturbance, drought effects, and restoration effects on the herbaceous plant community. Because only 22 species were shared between these pre- and post- restoration plant communities, we conclude that major changes in the herbaceous plant community have occurred. Some of this variation may be attributable to spatial and temporal patterns in precipitation extending beyond the period of record, as indicated by a Busch, et al. study in 1998 revealing interannual cyclic patterns over a decade of study in the southern Everglades.

The prevalence of key indicators of disturbance and extreme hydrologic fluctuations was expected to decrease following successful restoration. Dog-fennel (*Eupatorium capillifolium, Eupatorium leptophyllum*) has often been considered indicative of disturbed areas or wetlands with altered hydrology (Zaftke, 1983, Jacobs, et. al., 2002). Figure 13 documents the reduction in relative cover (C_1/C_{total} X 100) of dog-fennel within the slough area. This indicates a successful restoration, and to some degree, a more

Table 1. Dominant species by transect, in order of decreasing dominance, for the North Branch of the Deer Prairie Slough Restoration Project.

	Pre-restoration		Post-restoration
Transect #	August 2000	March 2001	August 2003
6	*Polygonum punctatum* *Panicum hemitomon* *Mikania scandens* *Spartina bakeri* *Eupatorium capillifolium*	*Panicum hemitomon* *Polygonum punctatum* *Centella asiatica* *Lippia nodiflora* *Andropogon virgnicus*	*Panicum hemitomon* *Polygonum punctatum* *Spartina bakeri* *Hydrocotyl umbellata* *Amaranthus* sp.
7	*Panicum hemitomon* *Panicum repens* *Sparina bakeri* *Andropogon virginicus* *Hypericum fasciculatum*	*Panicum hemitomon* *Panicum repens* *Centella asiatica* *Andropogon virgnicus* *Lippia nodiflora*	*Polygonum punctatum* *Panicum hemitomon* *Panicum repens* *Ludwigia repens* *Spartina bakeri*
8	*Panicum hemitomon* *Myrica cerifera* *Mikania scandens* *Centella asiatica* *Andropogon virginicus*	*Panicum hemitomon* *Ptilimnium capillaceum* *Eupatorium capillifolium* *Centella asiatica* *Lippia nodiflora*	*Polygonun punctatum* *Panicum hemitomon* *Panicum repens* *Spartian bakeri* *Micranthemum* sp.
9	*Panicum hemitomon* *Polygonum punctatum* *Andropogon virginicus* *Panicum repens* *Sacciolepis striata*	*Panicum hemitomon* *Polygonum punctatum* *Lippia nodiflora* *Eupatorium leptophyllum* *Galium tinctorium*	*Polygonum punctatum* *Panicum hemitomon* *Alternathera philoxeroides* *Panicum repens* *Pistia stratiotes*

Table 2. Dominant species by transect, in order of decreasing dominance, for the West Branch of the Deer Prairie Slough Restoration Project.

	Pre-restoration		Post-restoration
Transect #	August 2000	March 2001	August 2003
4	*Polygonum punctatum* *Panicum hemitomon* *Lippia nodiflora* *Eupatorium capillifolium* *Pontederia cordata*	*Panicum hemitomon* *Eupatorium leptophyllum* *Pluchea odorata* *Myrica cerifera* *Andropogon virginicus*	*Spartina bakeri* *Panicum hemitomon* *Rhyncospora inundata* *Phyla nodiflora* *Myrica cerifera*
5	*Polygonum punctatum* *Panicum hemitomon* *Mikania scandens* *Sacciolepis striata* *Pluchea odorata*	*Panicum hemitomon* *Spartina bakeri* *Proserpinaca pectinata* *Mikania scandens* *Eupatorium leptophyllum*	*Panicum hemitomon* *Spartina bakerii* *Bacopa caroliniana* *Sagittaria lancifolia* *Mikania scandens*

Table 3. Dominant species by transect, in order of decreasing dominance, for the Phase I Main transects along the Deer Prairie Slough Restoration Project.

	Pre-restoration		Post-restoration
Transect #	August 2000	March 2001	August 2003
1	*Spartina bakeri* *Panicum hemitomon* *Andropogon virginicus* *Sacciolepis striata* *Amphicarpum muhlenbergianum*	*Spartina bakeri* *Panicum hemitomon* *Eupatorium capillifolium* *Echinochloa crusgalli* *Ptilimnium capillaceum*	*Panicum hemitomon* *Polygonum punctatum* *Cephalanthus occidentalis* *Utricluaria foliosa* *Limnobium spongia*
2	*Panicum hemitomon* *Panicum repens* *Spartina bakeri* *Andropogon virginicus* *Hypericum fasciculatum*	*Echinochloa crusgalli* *Spartina bakeri* *Panicum hemitomon* *Ptilimnium capillaceum* *Centella asiatica*	*Echinochloa crusgalli* *Panicum hemitomon* *Andropogon virginicus* *Hymenachne amplexicaule* *Spartina bakeri*
3	*Panicum hemitomon* *Polygonum punctatum* *Mikania scandens* *Panicum repens* *Lippia nodiflora*	*Panicum hemitomon* *Ptilimnium capillaceum* *Eupatorium capillifolium* *Centella asiatica* *Lippia nodiflora*	*Panicum hemitomon* *Polygonun punctatum* *Mikania scandens* *Pontederia cordata* *Phyla nodiflora*

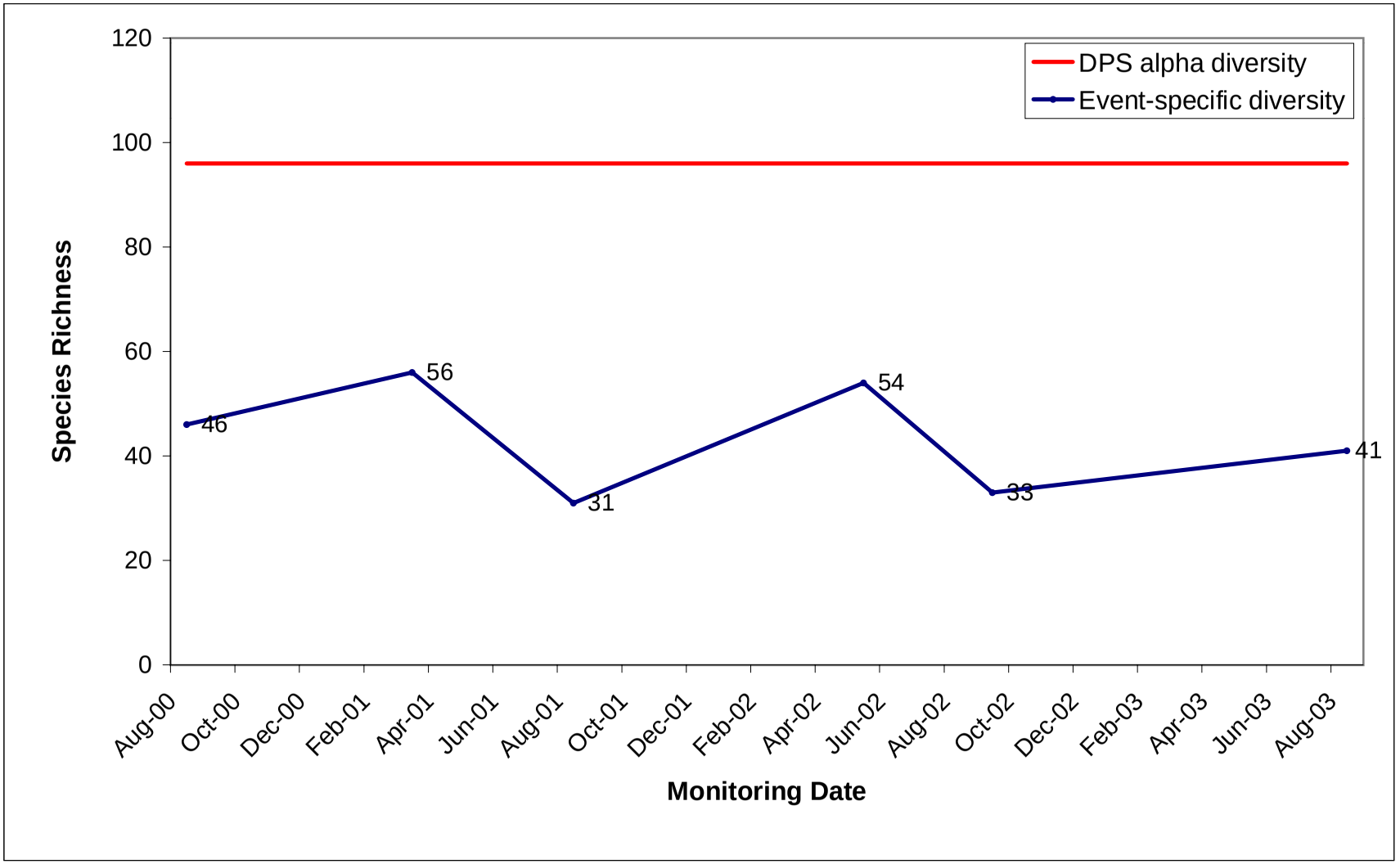

Figure 12. Species richness for the Deer Prairie Slough restoration area, total alpha diversity and richness recorded for each monitoring event.

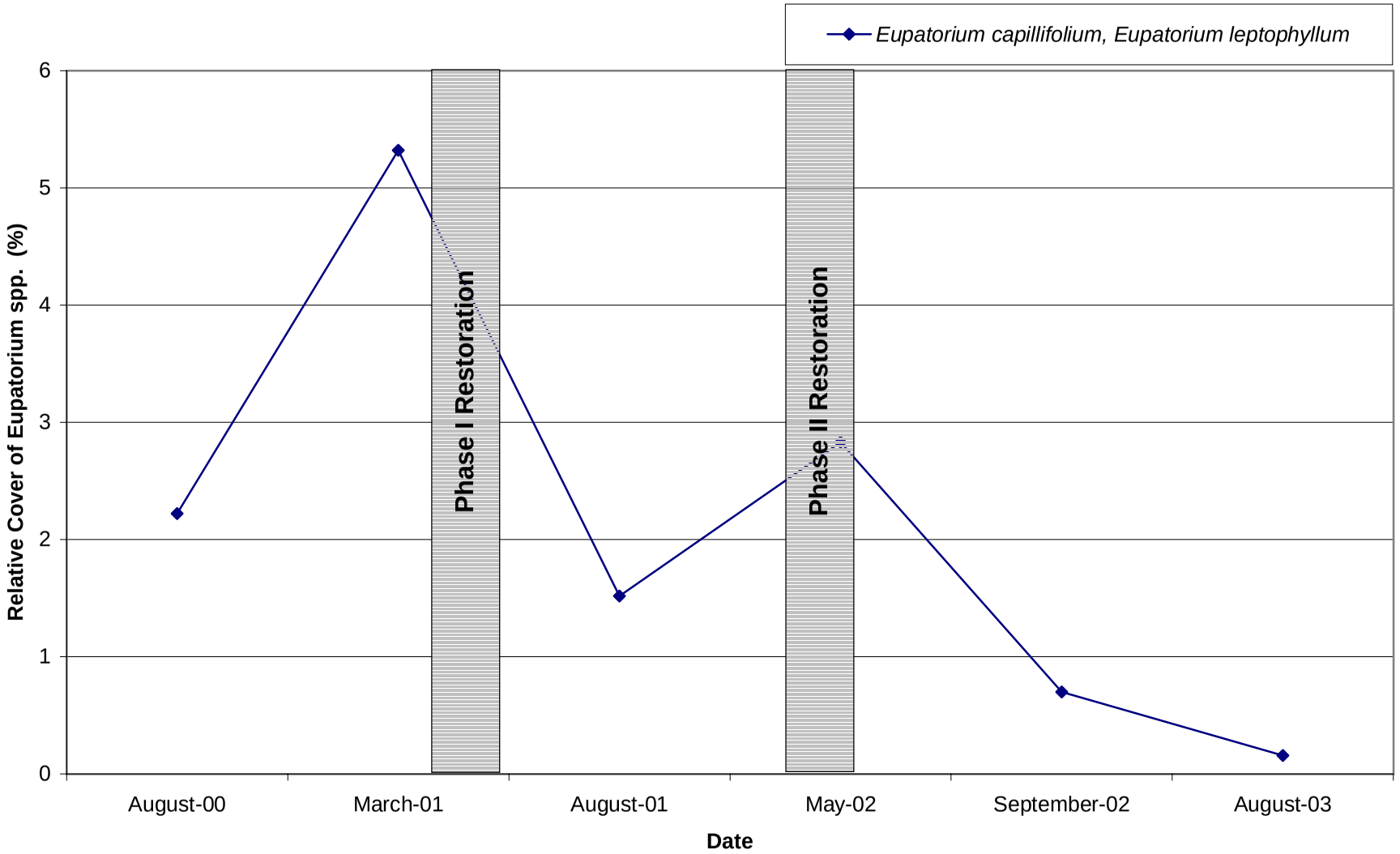

Figure 13. Change in relative cover of dog-fennel (*Eupatorium capillifolium*, *Eupatorium leptophyllum*) in Deer Prairie Slough vegetation monitoring transects.

natural hydroperiod and reflects significant progress toward the stated goal of reduced seasonal coverage of upland or disturbance species.

Analysis of large scale canopy changes within the Slough restoration area, based on aerial photo interpretation, are set in a context of historical anecdotes and surveys in related, undisturbed areas. Vince, et al. (1989) performed studies of hammock plant community expansion in the nearby Myakka State Park. Figure 14 shows their schematic of transitional plant community composition for hammocks versus a revised schematic for the pre-restoration condition of hammocks on Deer Prairie Slough. Most significant of the differences between the schematic by Vince, et al. (1989) and that of the Slough are the proximity of pine flatwoods, the absence of hardwood swamp species, and obviously encroaching laurel oak and wax myrtle within the impacted Deer Prairie Slough. Immediately following restoration activities in Phase I, evidence of laurel oak and wax myrtle mortality was observed during the wet season. This impact of restored hydroperiod within the encroaching hammock was more pronounced following Phase II. Figure 15 illustrates this steady decline of transitional area laurel oaks following restoration activities. This series of photos were taken of the Phase I and Phase II Main areas from the South Bridge. This effect was also observed in other areas of the Slough, in particular at Phase I Main, North Branch just north of the confluence, and the northernmost wetland of Phase II Main. These trees, estimated as a variable age hammock stand from 10 to 50 years old, are characterized by extreme stress and, in many cases, tree death.

Infrared aerial photographs from 2003 provide an aerial view of this laurel oak mortality. As one of the most significant indicators of a successful restoration, Figure 16 shows that laurel oak mortality is confined to areas which were visible as open wetlands on 1948 aerials. These trees represent the most recent encroachment of hammock plant community towards the interior of the historically impacted Slough wetlands. This trend in tree dieback is expected to continue as sequential years' inundation continues following restoration. This alteration to significant components of the Slough plant community will be quantifiably measured from aerial photography within 3-5 years following completion of restoration (Ewel, 1990.)

Smith, et al. (2002) contend that active vegetation management must accompany hydrologic vegetation in order to achieve reference or historic conditions. We believe that the response of the Slough vegetative community bears out this conclusion, and this will be an important factor as the herbaceous marsh expands into areas currently occupied by hammocks. The proposed Phase III of the restoration project and long-term management of the restoration area will require careful attention to exotic/nuisance control and an adaptive approach to re-introducing site-appropriate native plants when seed banks do not provide fast cover.

Finally, Figure 17 provides a photographic series of typical restoration effects looking north into Phase I Main from the South Powerline Bridge. Standing water, removal of vegetated spoil, laurel oak mortality, and corridor revegetation are all apparent. This

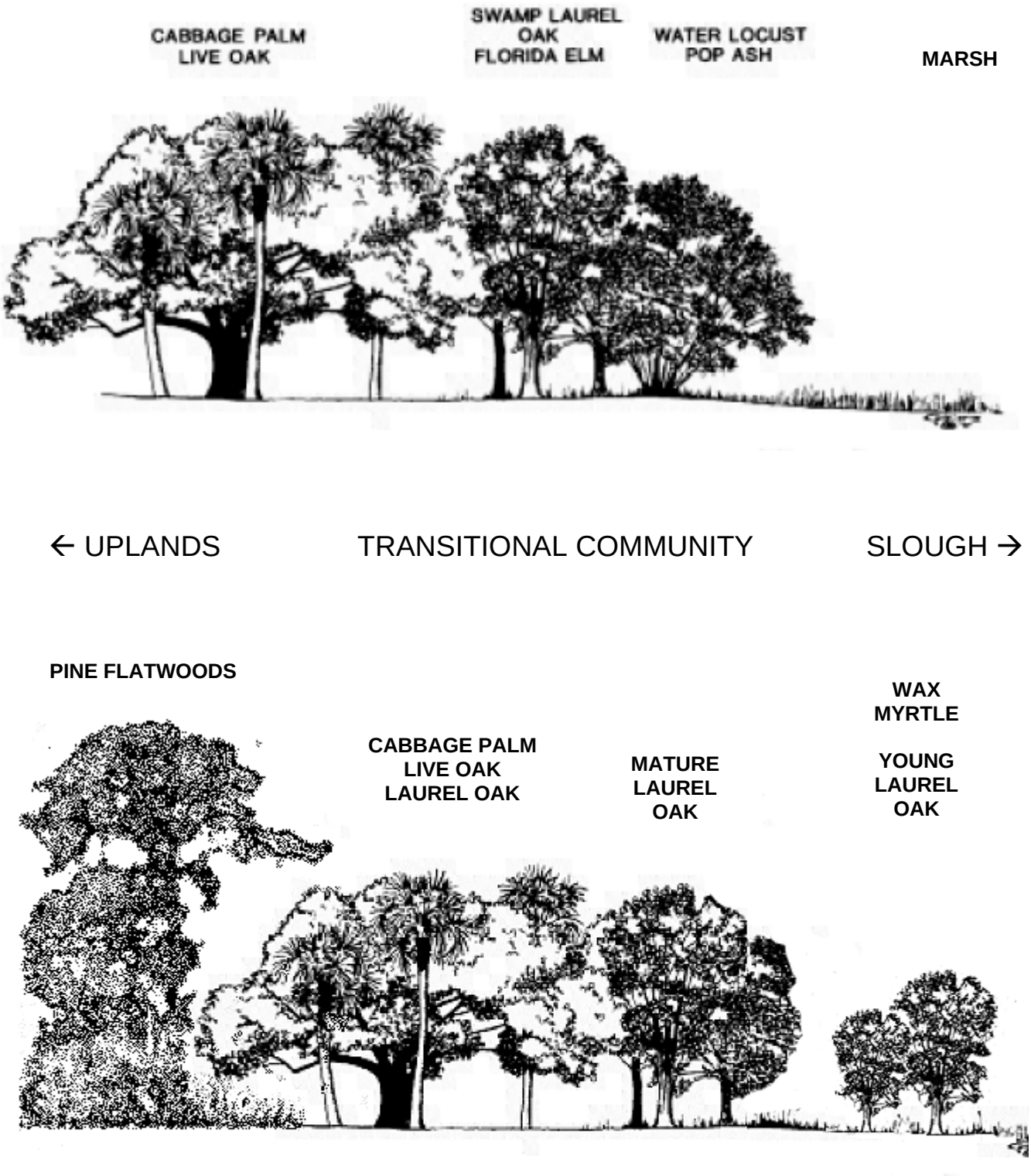

Figure 14. Schematic representation of plant community shift along Deer Prairie Slough as a result of historic ditching. Diagram at top taken from Vince, et al, 1989 from nearby Myakka State Park. Lower diagram is representative of pre-restoration plant community gradient.

Figure 15. Dying laurel-oak (*Quercus laurifolia*) fringe at Deer Prairie Slough following restoration. **A)** View west from Phase I Main. **B)** View northeast from Phase I Main. **C)** View northeast from South Powerline Bridge. **D)** View south from South Powerline Bridge

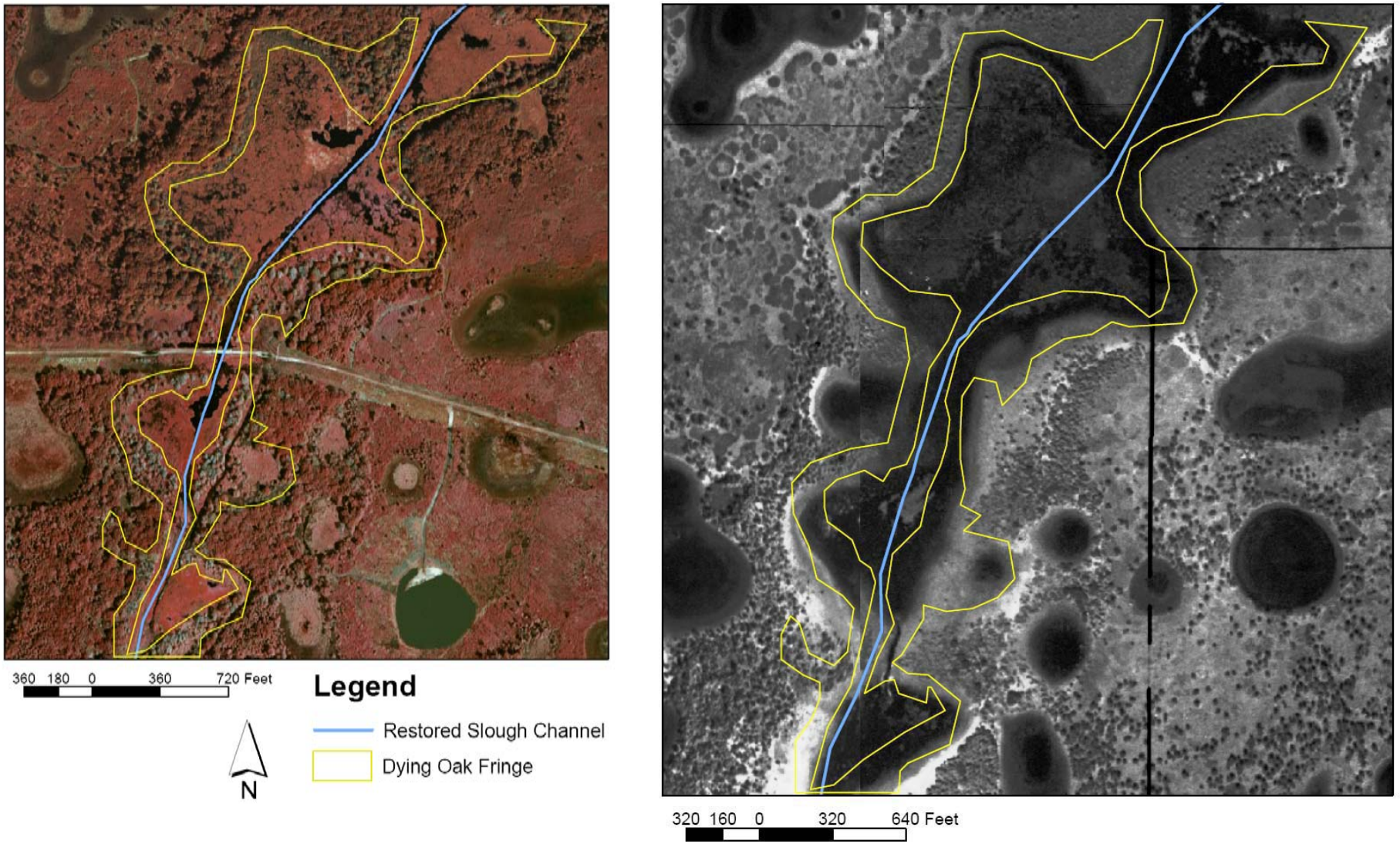

Figure 16. A comparison of Deer Prairie Slough hammock expansion zones at Phase I and Phase II main, 2003 and 1948. The post-restoration mortality of laurel oaks is apparent on the 2003 infrared aerial presented at left. Pre-impact 1948 aerial depicts a conspicuous lack of laurel oak hammock in the yellow highlighted area.

Figure 17. Photographic series of channel morphology, water levels, and tree canopy changes through Phases I and II of the Deer Prairie Slough Restoration Project, north from South Powerline Bridge.

series of photographs underscores the broad success of the Deer Prairie Slough restoration project.

Wildlife Observations

Observations of reptiles and amphibians within the Deer Prairie Slough area are presented in Table 4, below.

Table 4. Reptiles and Amphibians observed utilizing Deer Prairie Slough

Common Name	**Scientific Name**
American alligator	*Alligator mississippiensis*
banded water snake	*Nerodia fasciata*
barking treefrog	*Hyla gratiosa*
bullfrog	*Rana areolata*
cottonmouth	*Agkistrodon piscivorus*
eastern mud snake	*Farancia abacura abacura*
Florida cooter	*Pseudemys floridana*
Florida redbelly turtle	*Pseudemys nelsoni*
Florida softshell turtle	*Apalone ferox*
greater siren	*Siren lacertina*
green treefrog	*Hyla cinerea*
leopard frog	*Rana urticularia*
mud turtle	*Kinosternon baurii*
pinewoods treefrog	*Hyla femoralis*
stinkpot turtle	*Stenotherus odoratus*
striped crayfish snake	*Regina alleni*
two-toed amphiuma	*Amphiuma means*

Mammals observed within the Slough and surrounding transitional areas and hammocks are summarized in Table 5. The most commonly reported sightings of these species are the white-tailed deer, raccoon, gray squirrel, and bobcat. Florida panther tracks have been recorded on the powerline road near the Slough, as well as in areas of fresh earthwork shortly after Phase I restoration.

Table 5. Mammals observed utilizing Deer Prairie Slough and surrounding area.

Common Name	**Scientific Name**
bobcat	*Felis rufus*
cotton rat	*Sigmodon hispidus*
Florida panther	*Felis concolor*
Florida water rat	*Neofiber alleni*
gray squirrel	*Sciurus carolinensis*
marsh rabbit	*Sylvilagus floridanus*
opossum	*Didelphis virginiana*
raccoon	*Procyon lotor*
red fox	*Vulpes vulpes*
river otter	*Lontra canadensis*
white-tailed deer	*Odocoileus virginiana*

The most visible forms of wildlife utilizing the Deer Prairie Slough area are birds. The species commonly encountered in or near Deer Prairie Slough are summarized in Table 6. Even more interesting than the species richness observed during relatively short site inspections were the numbers of wading birds, especially white ibis, green backed heron, and yellow-crowned night heron, observed in the several hundreds. The created transitional areas showed extensive colonization by native vegetation and provided significant feeding opportunities for many of these migratory waterfowl during high water events. Waterfowl also utilized the isolated dry-season pools of shallow water created by the restoration efforts for foraging.

Many of these species depend heavily on systems like the Deer Prairie Slough and surrounding hammocks for their primary habitats. Several of the flora and fauna that utilize this corridor are listed at various levels of protection under state, federal, and even international restrictions based on their rarity. The wetland and hammock habitat enhancement afforded by the Deer Prairie Slough Restoration Project will go a long way toward ensuring the preservation and expansion of habitat for a large number of taxa, from endemics to wide ranging migratory fowl.

Table 6. Birds observed utilizing Deer Prairie Slough

Common Name	**Scientific Name**
American anhinga	*Anhinga anhinga*
bald eagle	*Haliaeetus leucocephalus*
barred owl	*Strix varia*
belted kingfisher	*Ceryle alcyon*
black vulture	*Coragyps atratus*
blue-winged teal	*Anas discors*
bobwhite quail	*Colinus virginianus*
brown thrasher	*Taxostoma rufum*
common flicker	*Colaptes auratus*
common moorhen	*Galinulla chloropus*
Eastern screech owl	*Otus asio*
great blue heron	*Ardea herodias*
great egret	*Ardea albus*
great horned owl	*Bubo virginianus*
green-backed heron	*Butorides striatus*
hooded merganser	*Lophodytes cucullatus*
little blue heron	*Egretta caerulea*
mottled duck	*Anas fulvigula*
osprey	*Pandion haliaetus*
pied-billed grebe	*Podilymbus podiceps*
pileated woodpecker	*Dryocopus pileatus*
red shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
roseate spoonbill	*Ajaia ajaja*
snowy egret	*Egretta thula*
swallow-tailed kite	*Elanoides forficatus*
turkey vulture	*Cathartes aura*
white ibis	*Eudocimus albus*
wild turkey	*Meleagris gallopavo*
wood duck	*Aix sponsa*
wood stork	*Mycteria americana*
yellow-crowned night heron	*Nyctanassa violacea*
yellow-rumped warbler	*Dendroica coronata*
yellow-throated warbler	*Dendroica dominica*

CONCLUSIONS AND RECOMMENDATIONS

The Deer Prairie Slough Restoration project has successfully shifted the hydrologic and vegetative parameters of the Slough towards expected, historic functions. The results indicate that the prescription for restoration improved wetland hydroperiods and water depths, reversing some of the historic impacts such as surface water level drawdown and extreme seasonal fluctuations. This improved hydrology, combined with planting and exotic plant treatment efforts has shifted plant community structure towards more hydrophytic vegetation and reduced seasonal coverage of upland and undesirable species. Preliminary changes in forested communities surrounding the Slough indicate that the restoration has initiated long-term expansion of the herbaceous marsh towards historic perimeters.

The authors find that the plant community responded rapidly to hydrologic change, and note the need for extensive aerial and wildlife monitoring as a follow-up on long-term changes to vegetation. While the results and discussion presented herein indicate successful restoration, long-term monitoring and data analysis will provide the basis for a thorough discussion of the ecological value and intense need for restoring public land holdings and large natural systems within Sarasota County.

Future work within this project site will include repair to eroded areas, with emphasis once again on an adaptive approach and "soft" engineering. Future efforts, proposed as a Phase III, will also focus on exotic vegetation reduction in an attempt to capitalize on existing native seedbanks and careful timing of planting during this documented period of extreme transition. Limiting exotic seed production and dispersal will be crucial to providing an opportunity for expansion of marsh species into the retreating hammocks.

By drawing upon an adaptive management approach and multiple monitoring techniques, this project has restored and documented valid techniques for restoration on public lands while minimizing impact. The techniques and successes of this project extend to future application in complex systems restoration and provide a template for future restoration projects within Sarasota County's public lands.

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APPENDIX A:
Special Provisions and Technical Specifications

SPECIAL PROVISIONS

Description of Project: The Deer Prairie Slough Restoration Project (DPSRP) is located in the Myakka River watershed. Deer Prairie Slough empties into the Myakka River, approximately 10 miles upstream from the mouth of Charlotte Harbor. This project includes the removal of 8.4 miles of channelized wetlands in the Slough. The project will be exclusively on the County-owned T. Mabry Carlton, Jr. Memorial Reserve, hereafter referred to as the Carlton Reserve. The restoration work is intended to be done before the wet season to minimize erosion control and water quality problems and to maximize natural revegetation of the disturbed corridor. The Project is divided into phases because grant funding for the Phase II (Option 1) has not yet been approved. If funding is not approved, this part of the contract will be eliminated.

The main objective of the DPSRP Phase I is to backfill 6.7 miles of linear ditches on Deer Prairie Slough between the North and South Deer Prairie Slough Bridges on the Carlton Reserve. The channel's maximum depth is between 3 and 4 feet, and its width averages 30 feet. The acreage of the channel to be restored is approximately 24 acres. The total volume of fill to be moved is approximately 135,000 cubic yards. A qualified contractor under the direct supervision of the Project Manager will perform all earthwork. The contractor will backfill the ditch with fill material from the old spoil piles, which in most places have been colonized by weedy upland herbaceous plants and woody shrubs. The contractor will take care to create natural grades that are characteristic of those from the surrounding wetlands. If necessary, the contractor will be responsible for scraping the adjacent soils approximately 50 feet on both sides of the channel to provide adequate fill for the ditch and gradual slopes from the adjacent areas. In areas where adequate volumes are unavailable, open water habitats will be left. These open water habitats will only be created upon approval by the Project Manager. Transitional wetland areas at higher elevation between adjacent wetlands on the Slough will be prioritized for available fills. All Phase I earthwork is expected to be complete within 90 days of Notice to Proceed for Phase I. If extreme weather causes uncharacteristically high water levels, the earthwork will be conducted during the next dry season.

The main objective of the DPSRP Phase II is to backfill 1.7 miles of linear ditches on Deer Prairie Slough in two separate areas. The first area, located north of the West Branch, will be treated similarly to those wetlands to be restored in Phase I. The first area is relatively shallow (approximately 2 feet average depth), and soils in adjacent areas will be available to fill in the ditch. The second area, mostly south of the South FPL Bridge, will be treated differently because it is much deeper (approximately 5 feet average depth). Soils from the berm and adjacent wetland areas will need to be supplemented with soils from a borrow pit to be created just east of the restored marshes and hammocks. Maximum depth is between 4 and 6 feet. The width of the channel averages 30 feet. The total volume of fill for this area to be moved is approximately 23,500 cubic yards. An estimate of approximately 10,000 cubic yards are available in the adjacent existing berms. Approximately, 13,500 cubic yards will need to come from other sources. A borrow pit, located east of this restored area, will be built by the contractor to provide the required fill. The contractor will also be responsible for installing two culverts under the South FPL road at an elevation specified by the Project Manager. All Phase II earthwork is expected to be complete within 90 days of Notice to Proceed for Phase II. If extreme weather

causes uncharacteristically high water levels, the earthwork will be conducted during the next dry season.

All surveying, supplemental planting, and geoweb, turbidity barriers, and silt fence installation will be conducted by Sarasota County. The contractor will assist the County with providing adequate fill for the geowebbed areas and with providing the required grade specified by the Project Manager. The contractor will also be responsible for verifying each day that the silt fences and turbidity barriers are still installed properly and consistent with best management practices for the life of the project.

All quantities referred to in this section are for reference purposes only. The contractor is responsible for estimating all quantities prior to submitting lump sum bids (see Section II, Paragraph IB-05 Interpretation of Estimated Quantities).

1. **Standard Specifications**: The Contractor will construct this project according to these specifications and FDOT's *Standard Specifications for Road and Bridge Construction*, dated 1991, hereafter called the Standard Specifications. These specifications include all cited or referenced specifications as though written herein. In case of conflict between the referenced FDOT specifications and the bid and Contract documents, the bid and Contract documents govern. Section X, Technical Provisions, includes modifications to FDOT specifications. Where FDOT specifications refer to the "Engineer", "Engineer of Tests", or "Division of Tests", it means the County Engineer or his authorized representative. Reference to "Department" shall mean the Sarasota County Public Works.
2. **Laboratory Testing**: The cost of the roadway base job mix design and asphalt concrete job mix design and asphalt testing, consisting of extraction, gradation, and Marshall results, is the Contractor's responsibility. The County is responsible for the cost of all other required laboratory testing unless otherwise specified in these specifications. The Contractor is responsible for all retesting due to defective materials or construction. The Contractor will test according to the applicable portions of the *Standard Specifications Section 6*.
3. **Measurement and Payment**: Unless otherwise shown on the plans or specified herein, the County will measure and pay for work under this Contract following: *Standard Specifications Section 9, Articles 9-1* and *-2*; General Provisions, Section VIII, GP-8.1, Measurement of Quantities; GP-8.3, Scope of Payment. The County measures for payment based on the work completed in strict accordance with the plans and specifications. The Contractor or his representatives will measure all work, in the presence of the Engineer or his representative, completed under this Contract. Authorized Contract amendments shown in the bid form will include alterations and changes as described in the General Provisions, GP-3.2 and -3.3. The amount shown in the bid form is a contingent amount; the County pays only amounts properly authorized and documented by the County Engineer. The County will deduct and retain from the total amounts determined as payable an amount equivalent to 10% of the whole until the Contract is acceptably completed. The County will certify the balance, an amount equivalent to 90% of the whole, less all previous payments, for payment. Satisfactory completion of the Project releases the 10% retainage. Retainage may be reduced upon issuance of the Certificate of Substantial Completion by the County, if, in the sole

opinion of the County, sufficient progress on the schedule has been accomplished, all Notices of Lien have been resolved and the County has retained adequate coverage for the Project through the achievement of Final Completion. The County shall inform the Contractor's Surety of any reduction in retainage. All retainage will be released upon satisfactory completion of the Contract. If Article VII of the construction Contract contains the provision that payment in a given fiscal year will not exceed a specified amount, then the partial payments described above will be subject to that limitation

4. **Interpretation of Estimated Quantities**: *Standard Specifications, Article 2-3*, is deleted and the following substituted:

   For those items which are to be constructed within authorized plan limits or dimensions, the quantities shown in the plans and in the proposal form are given as the basis of bid and also for final payment as limited by the provisions for the individual items. For those items having variable final pay quantities which are dependent on actual field conditions, use, and measurement, the quantities shown in the plans and in the proposal form are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. Where items are listed for payment as lump sum units and the plans show estimates of component quantities, the County's responsibility for the accuracy of those quantities is limited to the *Standard Specifications, Subarticle 9-3.3*. Where items are listed for payment as lump sum units and the plans do not show estimates of component quantities, the Contractor shall be solely responsible for his own estimates of such quantities.

   The County assumes no responsibility that the final constructed quantities will equal the estimated bidding quantities, nor shall the Contractor claim misunderstanding or deception because of the estimate. The County may increase, decrease, or omit, as provided herein, the estimated quantities.

5. **Common Carrier Freight Rates**: *Standard Specifications, Article 9-4*, is deleted; it will not apply to this work. Increases or decreases in common carrier rates or transportation costs on materials are not cause for allowances or deductions.

6. **Bituminous Material Payment Adjustment**: Changes in the asphalt index price will not cause adjustments in unit prices for items requiring bituminous material.

7. **Cooperation with Others**: The Contractor shall cooperate with the underground or overhead utility owners for removal and rearrangement operations so these operations may progress reasonably with no service interruptions.

   .

8. **Photographs**: The Contractor will provide 8"x10" color photographs of the project "just before construction" and for unusual conditions during construction. The photographs will show pertinent physical features along the entire line of construction before construction begins. The Contractor will furnish two copies of all pictures to the County's representative. Videotape is acceptable in lieu of photographs

   .

9. **Cooperation with Utilities**: The project scope includes coordination of the traffic signals and road improvement work with activities of the electric power utility, telephone utility, cable provider, and other utility franchises. The Contractor shall be responsible for coordination with the appropriate utility companies, cable provider, or utility franchise for utility adjustments required during the construction. No special investigations of underground utility locations have been made to ascertain the actual location of utilities on the work site. The Contractor shall contact gas, electric power, water, telephone, cable, or other utility companies before beginning work to determine the exact location and provide for the protection of all utilities that may be within the work limits. The Contractor must take every precaution to ascertain the location of utility installations before excavation or other operations that may endanger personnel or damage facilities. Attention is called to the *Florida Underground Facility Damage Prevention and Safety Act* defined in Florida Statute 556 (see Section XIII). This act provides for a "one-call toll-free" telephone number to be used by all parties doing excavation, demolition, or other underground construction. The Contractor shall provide pertinent information by telephone during business hours not less than two nor more than five business days before beginning any work as provided in this act. Telephone the Sunshine State One-Call Center at 1-800-432-4770. The Contractor shall cooperate with agents, employees, or owners of any underground or overhead utilities during their maintenance, repair, construction, or relocation operations, so these utilities may function in a reasonable manner and that services will not be unnecessarily interrupted. The Contractor shall not apply the surface course until all manholes, necessary to be reset, have been reset by the utility owners or otherwise directed by the County.

10. **Utility Adjustments**: The Contractor and utility companies shall closely coordinate the sequence of their construction operations. The Contractor shall schedule his work activities to accommodate utility company work activities as described below. The Contractor will receive no additional payment for delays caused by utility company work activities. Additional utility information is as follows:

    a. **Florida Power & Light Company**: John Moderacki, 941-739-3308.

    b. **GTE Florida Incorporated**: Bob Mewes, 941-952-5689.

    c. **Comcast Cablevision**: Gonzalo Rojas, 941-342-3578.

    d. **City of Sarasota Utilities Engineering**: Dale Haas, P.E., 941-955-2325.

    e. **Sarasota County Utilities Department**: Patrick Zoeller, 941-316-1593

    f. **Englewood Water District**: James Elder, P.E., 941-474-3217

    g. **Sprint Florida Inc.**: Mickey Butt,

    h. **TECO/Peoples Gas**: Ray Brand, 941-366-4277

11. **Shop Drawings**: The Contractor shall furnish shop drawings to the Engineer as required for the prosecution of the work in the shop and in the field. Shop drawings will include technical data where requisite to the design or its function, or as appropriate. The purpose of shop drawing submittals is to show that the Contractor understands the design concept by indicating equipment and material he intends to furnish, and the fabrication and installation methods he intends to use. Sufficiently detailed shop drawings, supplemental drawings, and

technical data shall be the means to this end. The Contractor will submit seven dated copies of shop drawings to the Engineer for approval. If deemed satisfactory, the Engineer will return all except three copies to the Contractor. If the Engineer does not approve the shop drawings, he will return all except one copy to the Contractor with appropriate markings or comments. The Contractor will resubmit the shop drawings until approved. The Engineer will review for general conformance with the design concept and Contract documents. The Engineer's markings or comments do not relieve the Contractor from compliance with the project plans and specifications. The Contractor remains responsible for details, accuracy, confirming quantities, correlating dimensions, selecting fabrication processes, techniques of assembly, construction, and for performing his work safely. The Contractor will not use the shop drawing submittal and approval procedure for deviations from the construction drawings and specifications when they require change orders. If the Contractor discovers conflicts between shop drawing submittals and the Contract documents, as construction drawings and specifications or otherwise, after submitting shop drawings for processing by the Engineer, the Contractor shall immediately advise the Engineer; in this event, the Contractor is responsible for resolving the situation through the Contract's provisions. The only exception to the above provisions for deviations and conflicts is for differences between shop drawings and construction plans/specifications deemed by the Contractor to be minor, not conflicting with the latter, nor involving cost differences of any kind. Then the Contractor shall include a written explanation with his submittal, citing the specific differences and why the Engineer should approve the submittal under these conditions. The Engineer's decision in this situation is final.

12. **Gasoline and Diesel Fuels Payment Adjustment**: The County will not adjust Contract prices to reflect increases or decreases in gasoline and diesel fuel prices from those in effect at time of bidding.

13. **Surface Requirements**: Surface requirements specified in Standard Specifications Section 330-12 will be strictly enforced. The Contractor will furnish a 15-foot manual straightedge available on the job site at all times during the paving operation for checking joints and surface irregularities. The County will reduce payment for deficiencies.

14. **Materials**: The Contractor shall submit letters from firms supplying bituminous hot mix listing the sources and descriptions of all materials used in the mix and certifying that those materials meet the specifications of the project.

15. **Backfill Testing**: Compaction and testing of drainage pipe backfill shall be performed according to *Standard Specifications Section 125-8.3.1*. There shall be one test for each one-foot of lift thickness per run of pipe, i.e., run being between structures (inlets, junction boxes, etc.), staggering the tests over the entire run. Compaction and testing of structure/inlet backfill shall be performed according to *Standard Specifications Section 125-8.2* with one density test for each eight-inch lift.

16. **Permit Requirements**: Permit requirements, not specifically identified as the sole responsibility of others, are considered a requirement of this Contract. Permit conditions identified as the responsibility of this Contract and the responsibility of others are the responsibility of both entities.

17. **Earthmoving Requirements**: All earthmoving associated with a County roadway or stormwater improvement project is authorized under an exemption after written notification to the Earthmoving Ordinance Administrator (Natural Resources General Manager). The Project Manager in Sarasota County Resource Management will obtain this exemption. The Contractor must provide the following information to the Project Manager prior to construction. This information includes at a minimum, the following:

    a. The locations of fill staging areas;

    b. The types of fill (e.g., clean, land clearing debris); and

    c. The potential locations for disposition of excess fill (if applicable).

    This information may be submitted prior to the preconstruction conference meeting. The following is a summary of the County's earthmoving requirements (Ordinance No. 81-60, as amended) associated with roadway or stormwater improvement projects:

    a. All stockpiles must be stabilized and secured;

    b. Temporary stockpiling of fill on private lands adjacent to the right-of-way or easement is authorized under the earthmoving exemption, contingent upon prior approval by the property owner and assurance from the Contractor that all stockpiled fill will be removed and original grade restored prior to completion of the roadway project. The property owner will be obligated to obtain an earthmoving permit or other authorization from the County to retain any remaining fill on-site. Other County authorization means obtaining construction plan approval or a building permit showing that the fill used would support structures.

    c. Stockpiling of fill on private lands requiring hauling from the right-of-way or easement would require an earthmoving permit or other authorization from the County.

    d. Temporary stockpiles of Type 'B' (concrete, rocks, and broken asphalt) and/or Type 'C' fill (land clearing debris) generated within the roadway project area are required to be removed and recycled within six months, unless otherwise authorized by the Ordinance Administrator. A burn permit may be obtained for the Type 'C' fill.

    e. No Type 'B' or 'C' fill is allowed to be buried. Type 'D' fill (garbage, construction and demolition debris) must be legally disposed of at a County landfill or recycling facility.

    f. Hauling of excess fill from the roadway project area is authorized under the earthmoving exemption. The Contractor, however, must request from the hauling Contractor or property owner proof of County authorization (earthmoving permit, building permit, or construction plan approval) for disposition of this fill onto private lands. The Contractor may be requested by the NSD staff to provide information on fill disposition locations to ensure compliance with the County's earthmoving requirements. For more information about earthmoving permits or exemptions, please contact NSD at 941-378-6113.

18. **Preparation of Bids**: The bids must be prepared in accordance with Section I, Instructions, Terms, and Conditions Construction and Other Sealed Bids. Additionally, a diskette is available upon request with your bid package to generate your bid form, if desired. The diskette and printed bid form shall be submitted with your bid. The diskettes are prepared for use by users of EXCEL. Please phone our office at 378-6142 if further clarification is needed about the diskette.

TABLE OF CONTENTS

TECHNICAL PROVISIONS

DEER PRAIRIE SLOUGH RESTORATION PROJECT

TECHNICAL PROVISION
TP 101
MOBILIZATION

The work specified in this Technical Provision consists of the preparatory work and operations in mobilizing for beginning work on the project and shall conform with the requirements of Section 101 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, dated 2000 except as amended hereinafter.

Measurement and Payment: If a payment item is listed on the Bid Form for work required under this Technical Provision, payment shall be as specified in the Bid Form.

The lump sum quantity for the item of mobilization shall be paid for at the Contract lump sum price. Article 101-2.2 of the Standard Specifications is deleted and the following is added:

> The lump sum price for mobilization will be payable with the first month's partial payment except that this initial payment will be limited to 6% of the total Contract amount. Any remaining amount will be paid when the value of completed work exceeds 50% of the total Contract amount.

When the work described as included in the work of this Technical Provision is not specifically listed in the Bid Form the cost of performing that work shall be included in the contract unit prices for the various items of work to which it is incidental.

If listed in the Bid Form, payment shall be made under one or more of the following items:

PAYMENT ITEM	DESCRIPTION	UNIT
101-1A	Mobilization (Phase I)	LS
101-1B	Mobilization (Phase II)	LS

End of TP-101

TECHNICAL PROVISION

TP 120

EXCAVATION, GRADING, AND OFFSITE BORROW

Excavation, embankment, offsite borrow, wetland topsoil, topsoil, final dressing and grading work shall conform to the requirements the permit conditions imposed by the Southwest Florida Water Management District, Florida Department of Environmental Protection, U.S. Army Corps of Engineers, and the Detailed Plans. All excavation, embankment, offsite borrow, grading, wetland topsoil, topsoil and final dressing work shall include excavating, removing, and satisfactorily disposing of various materials not encountered during Clearing & Grubbing within the limits as specified on the Detailed Plans; and shall include furnishing, delivery, unloading, grading, and compacting of suitable borrow material from off-site sources as needed to meet planned elevations. Excavation, grading, compacting, shaping, subgrades, shoulders, ditches, slopes, and approaches, shall also be included. All items and all work shall conform with the lines, dimensions, notes, alignment, grade and cross-sections as specified on the Detailed Plans.

The main objective of the DPSRP Phase I is to backfill 6.7 miles of linear ditches on Deer Prairie Slough between the North and South Deer Prairie Slough Bridges on the Carlton Reserve. The channel's maximum depth is between 3 and 4 feet, and its width averages 30 feet. The acreage of the channel to be restored is approximately 24 acres. The total volume of fill to be moved is approximately 135,000 cubic yards. The contractor under the direct supervision of the Project Manager will perform all earthwork. The contractor will backfill the ditch with fill material from the old spoil piles, which in most places have been colonized by weedy upland herbaceous plants and woody shrubs. The contractor will take care to create natural grades that are characteristic of those from the surrounding wetlands. If necessary, the contractor will be responsible for scraping the adjacent soils approximately 50 feet on both sides of the channel to provide adequate fill for the ditch and gradual slopes from the adjacent areas. In areas where adequate volumes are unavailable, open water habitats will be left. These open water habitats will only be created upon approval by the Project Manager. Transitional wetland areas at higher elevation between adjacent wetlands on the Slough will be prioritized for available fills.

The main objective of the DPSRP Phase II is to backfill 1.7 miles of linear ditches on Deer Prairie Slough in two separate areas. The first area, located north of the West Branch, will be treated similarly to those wetlands to be restored in Phase I. The first area is relatively shallow (approximately 2 feet average depth), and soils in adjacent areas will be available to fill in the ditch. The second area, mostly south of the South FPL Bridge, will be treated differently because it is much deeper (approximately 5 feet average depth). Soils from the berm and adjacent wetland areas will need to be supplemented with soils from a borrow pit to be created just east of the restored marshes and hammocks. Maximum depth is between 4 and 6 feet. The width of the channel averages 30 feet. The total volume of fill for this area to be moved is approximately 23,500 cubic yards. An estimate of approximately 10,000 cubic yards are available in the adjacent existing berms. Approximately, 13,500 cubic yards will need to come from other sources. A borrow pit, located east of this restored area, will be built by the contractor to provide the required fill. The contractor will also be responsible for installing two culverts under the South FPL road at an elevation specified by the Project Manager.

Borrow: All material brought onto the site will be compatible with existing materials, will be selected material obtained from an offsite borrow source, and will be free of hydrocarbons, rocks, and all other unsuitable substances. The borrow pit to be created for the second area in Phase II will be constructed by the contractor. The Contractor will be responsible for complying with the earthmoving exemption to be issued by Sarasota County Resource Protection Services. Sarasota County Resource Management will be responsible for applying and obtaining the required exemption. The Contractor will assist Resource Management with providing adequate grades and suitable fill material in areas designed for geoweb for both Phase I and II.

Excavation and Grading: The Contractor shall take due care to relocate organic and sandy soils to appropriate locations. The Contractor shall use the undisturbed adjacent wetland soils to determine the texture and type of soils and the appropriate grades. Sandy soils shall be relocated to higher wetland transitional areas with these type of soils. More organic soils shall be relocated to deeper interior wetland zones. Fill material shall be adequately compacted to simulate natural wetland zone conditions. The County shall be responsible for producing a final as-built survey.

Dewatering: The Project will be constructed during the end of the dry season (March to June) to minimize the amount of water that will need to be managed. If atypical or uncharacteristic flooding occurs (defined as Deer Prairie Slough water levels exceeding a five year high water event for that date), the project may be postponed upon mutual consent by the Sarasota County Project Manager and the Contractor. Sarasota County will be responsible for drafting, submitting and obtaining written approval of site specific dewatering permits by Southwest Florida Water Management District and shall be responsible for following all permit requirements relative to dewatering. Dewatering discharge shall be in accordance with Section 104 of Florida Department of Transportation Standard Specifications for Road and Bridge Construction. Sarasota County will provide adequate dewatering pumps for the project. The Contractor shall be responsible for operating and fueling the pumps. The Project Design for Phase I calls for a dewatering ditch at the north end of the project. If necessary, the Contractor will construct this ditch at his/her expense.

Method of Measurement

The Contract shall be paid lump sum prices for regular excavation, borrow excavation, lateral ditch excavation, channel excavation, embankment, offsite borrow, and grading, includes hauling, removal and off-site legal disposal or on-site utilization of all materials, structures, abandoned utilities, and obstructions, placing and compacting of all materials, furnishing borrow material, final dressing and all items of work described herein.

The estimated quantities of regular excavation, borrow excavation, lateral ditch excavation, channel excavation, embankment, offsite borrow, and grading as shown on the detailed plans is given for the bidders comparison of his calculations only. The figures do not include allowances for clearing loss, scalping before fill, losses resulting from removing vegetative material from the site, bulkage, shrinkage, swelling, topsoil, sodding, etc.

Basis of Payment: If a payment Item is listed on the Bid Form for work required under this Technical Provision, payment shall be as specified in the Bid Form.

The contract lump sum prices for regular excavation, borrow excavation, lateral ditch excavation, channel excavation, embankment, offsite borrow, and grading, measured as provided above includes: full compensation for all work described herein, and in Section 120 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, dated 2000.

If listed in the bid form, payment shall be made under one or more of the following Items:

PAYMENT ITEM	DESCRIPTION	UNIT
120-1	Regular Excavation/Grading (Phase I)	LS
120-2	Regular Excavation/Grading (Phase II)	LS
120-3	Borrow Excavation (Phase II)	LS

End of TP-120

APPENDIX B:
Representative Aerial Photography for the Deer Prairie Slough Restoration Area 1948 and 2002

Appendix B Key to Sheets

N

3,000 1,500 0 3,000 Feet

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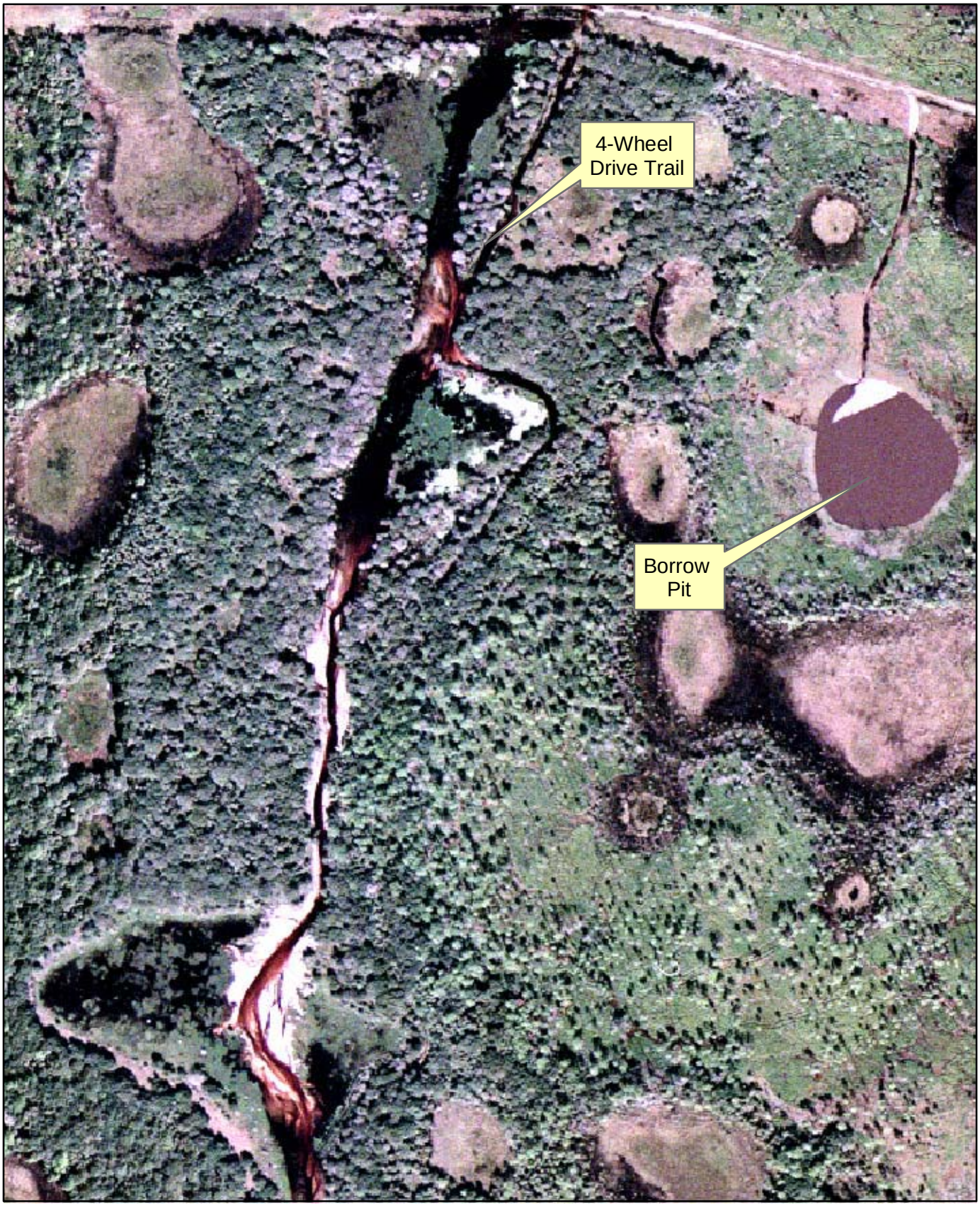
Permitting, Mitigation & Restoration
November 2003



Appendix B Sheet 1a
Phase II Main - Post Restoration

N

500 250 0 500 Feet

Random spot corridor width average (n=6): 80 ft.

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Improve Government Services

Photo Date 2002
1m-pixel resolution
ACA, Inc, Orlando, FL

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Permitting, Mitigation & Restoration
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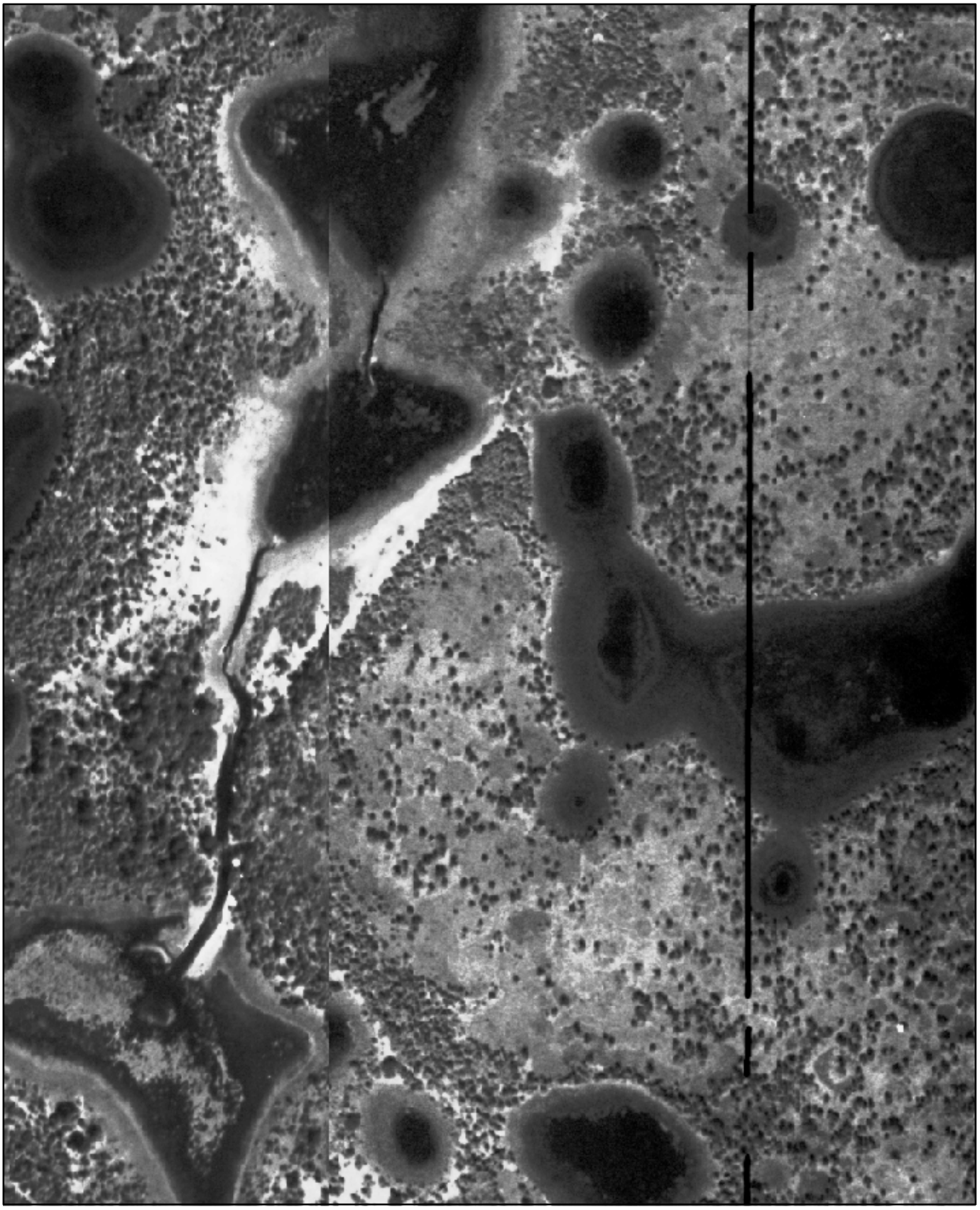

Appendix B Sheet 1b
Phase II Main - Historical Conditions

N

500 250 0 500 Feet

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Photo Date 1948

Appendix B Sheet 2a
Phase I Main - Post Restoration

Maximum corridor width: 120 ft
Random spot corridor width avearge (n=7): 66 ft.

N

500 250 0 500 Feet

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Photo Date 2002
1m-pixel resolution
ACA, Inc, Orlando, FL

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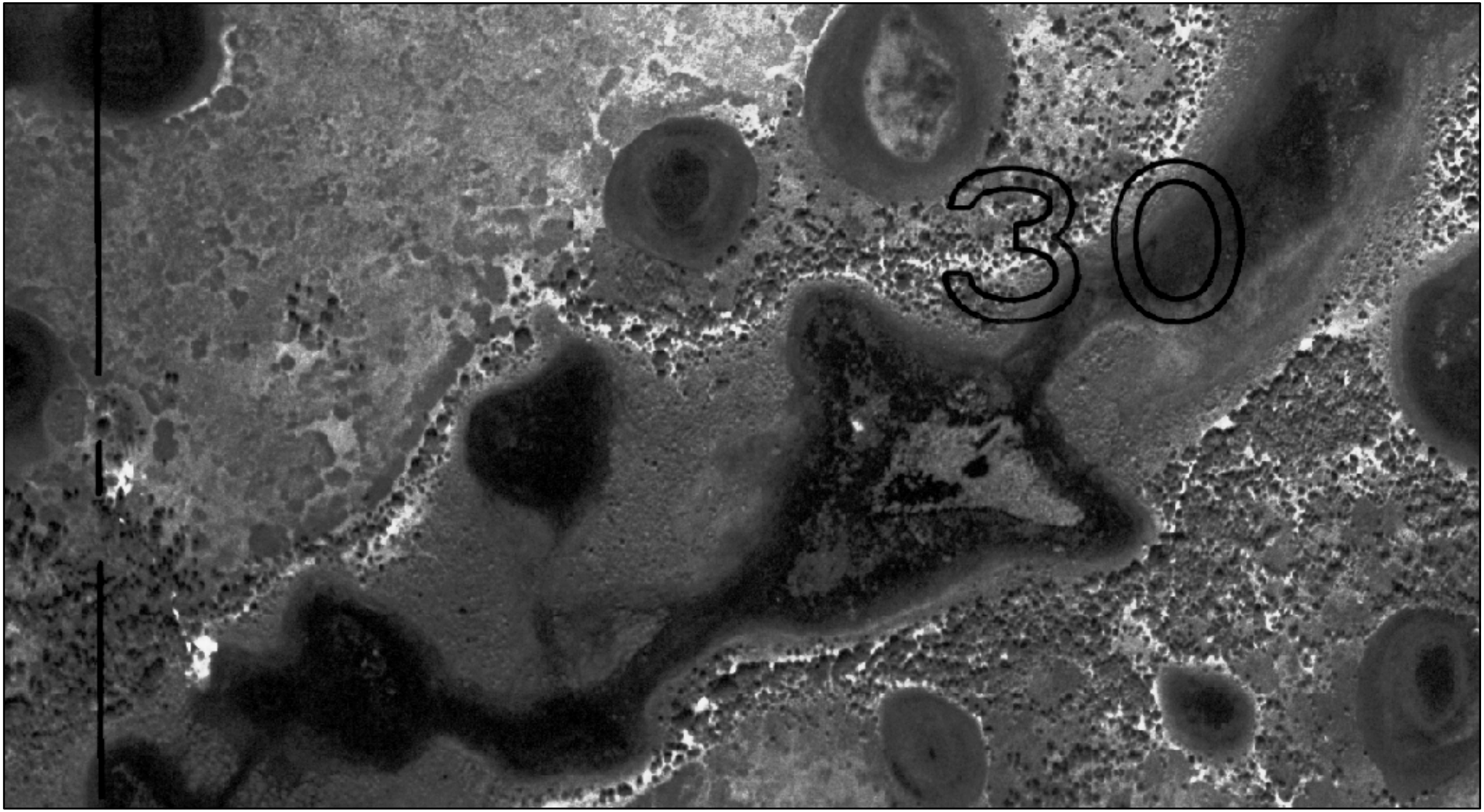
November 2003



Appendix B Sheet 2b
Phase I Main - Historical Conditions

N

500 250 0 500 Feet

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November 2003

Photo Date 1948

Appendix B Sheet 3a
DPS Confluence - Post Restoration

N

500 250 0 500 Feet

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Maximum corridor width: 130ft.
Random spot corridor width average (n=6): 61 ft.

Photo Date 2002
1m-pixel resolution
ACA, Inc, Orlando, FL

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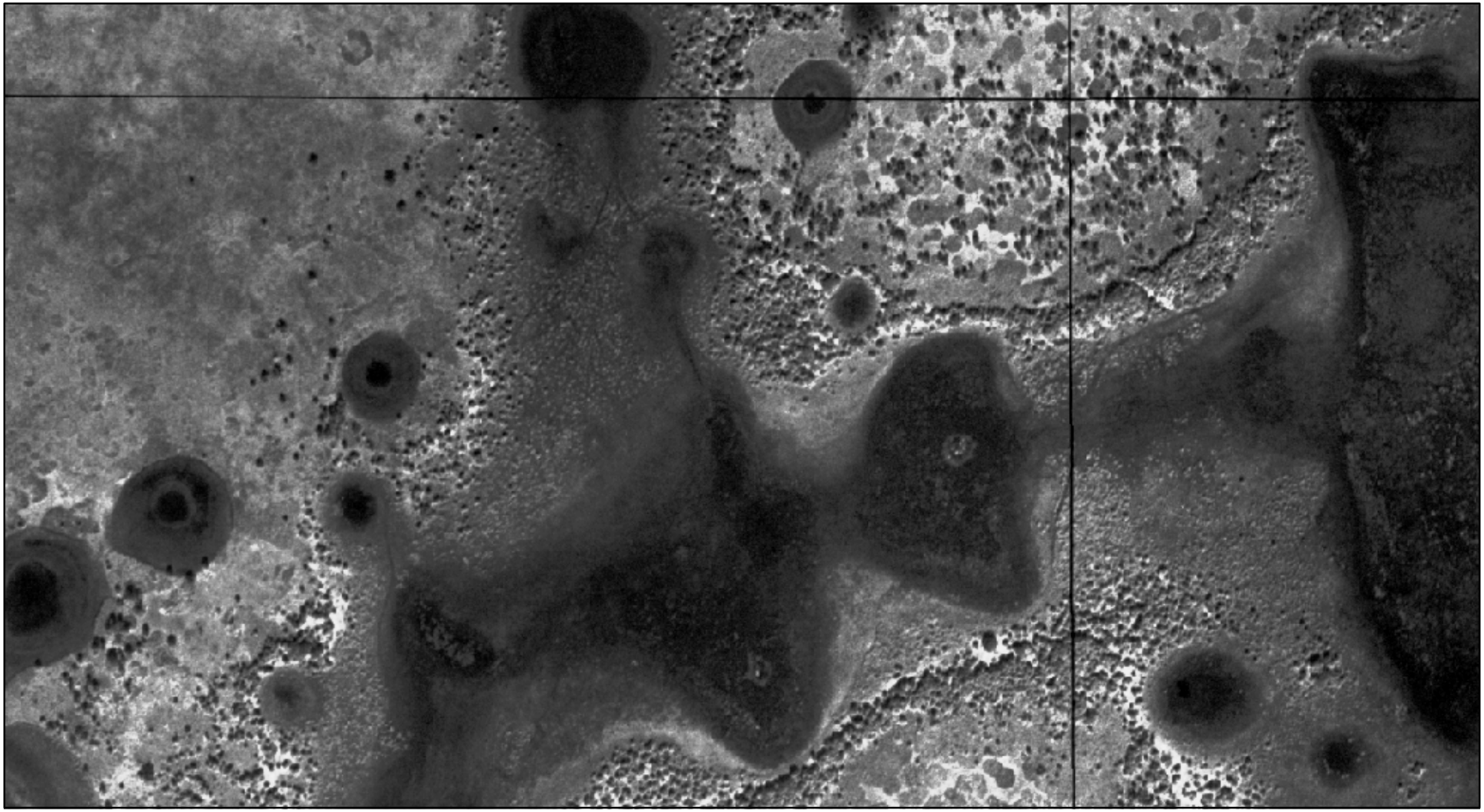
November 2003



Appendix B Sheet 3b
DPS Confluence - Historical Conditions

N

500 250 0 500 Feet

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Photo Date: 1948

Appendix B Sheet 4a
West Branch

N

500 250 0 500 Feet

Random spot corridor width average (n=4): 59 ft.

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Photo Date 2002
1m-pixel resolution
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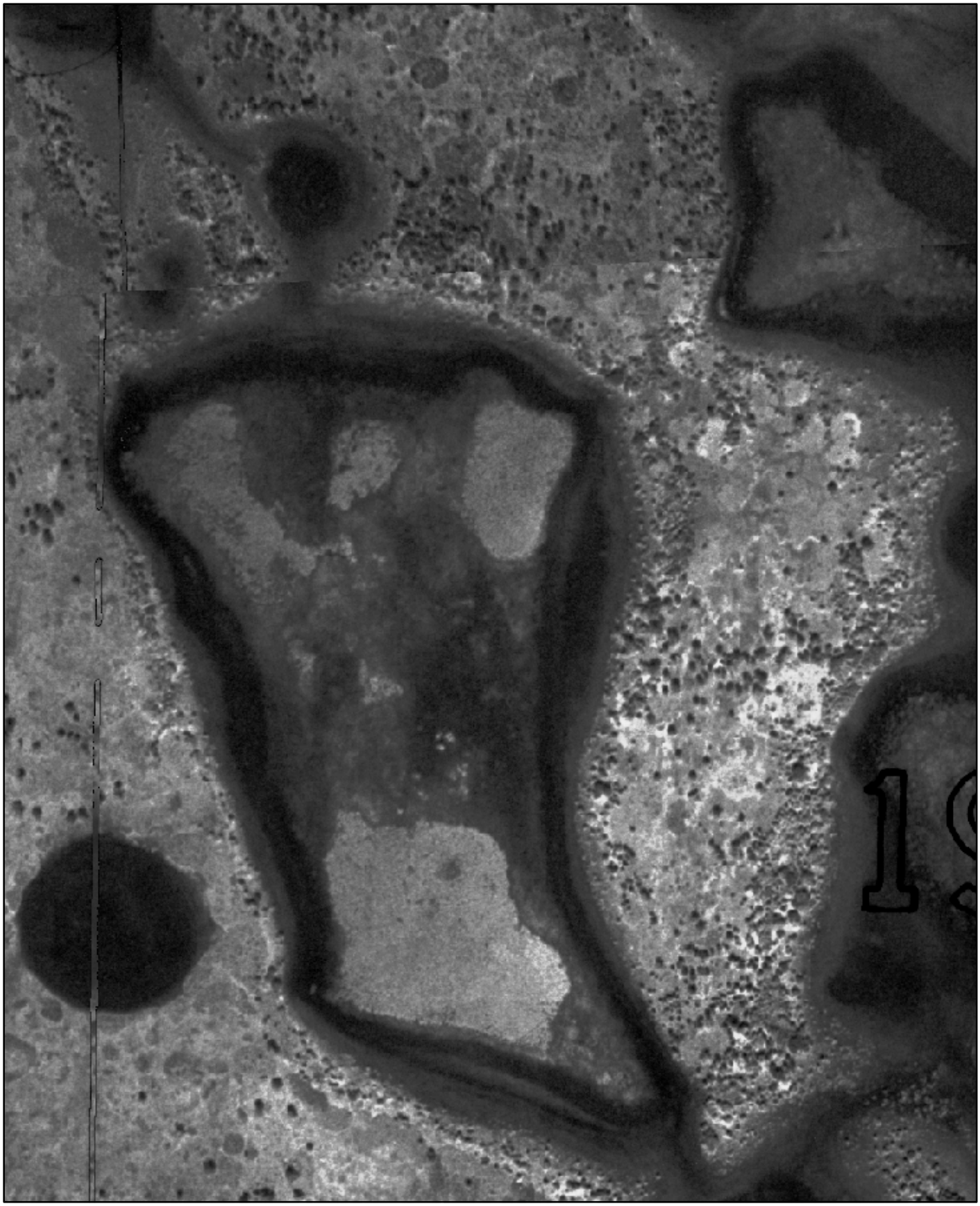

Appendix B Sheet 4b
West Branch - Historical Conditions

490 245 0 490 Feet

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November 2003

Photo Date: 1948

Appendix B Sheet 6a
North Branch Terminus - Post Restoration

N

500 250 0 500 Feet

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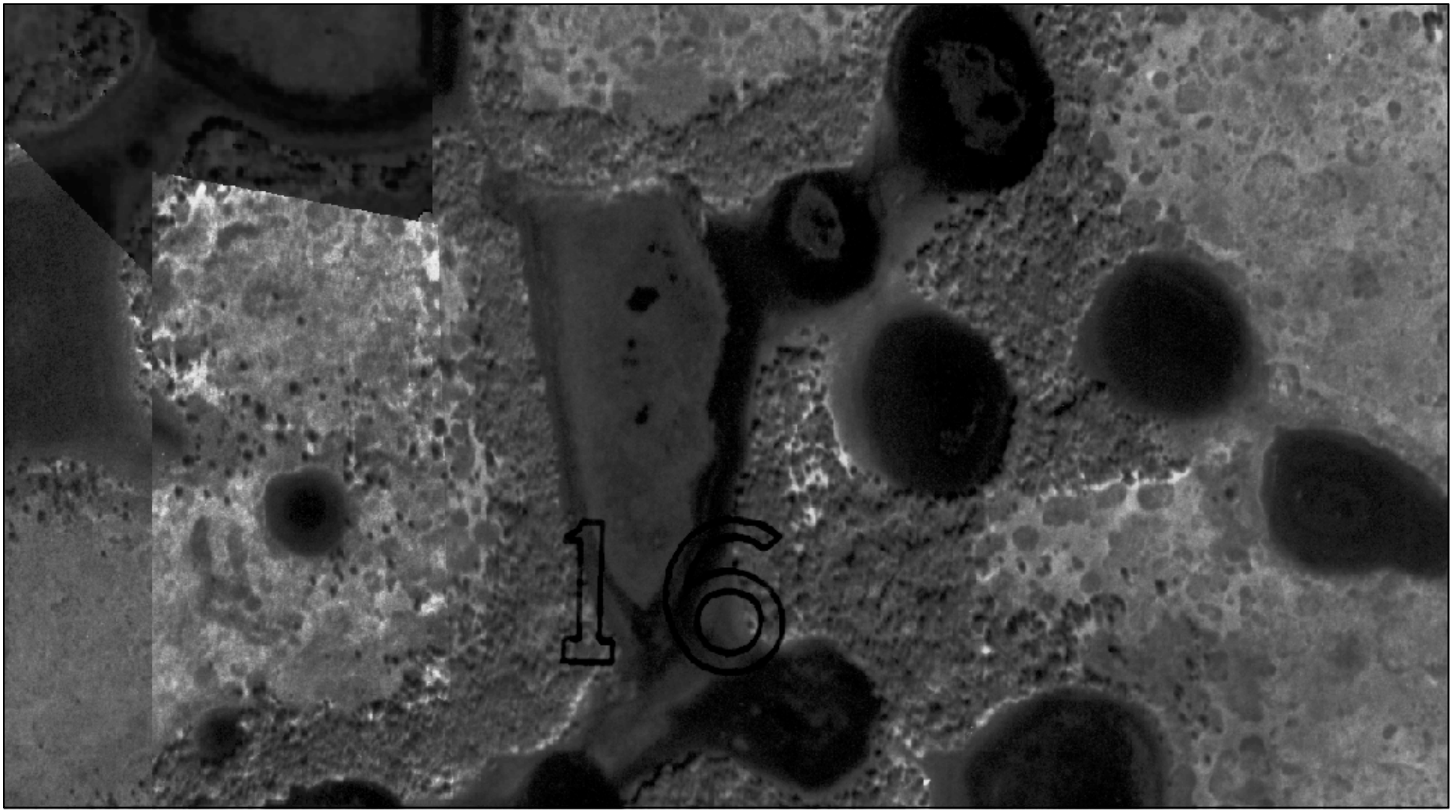
Photo Date 2002
1m-pixel resolution
ACA, Inc, Orlando, FL

PUBLIC WORKS
Permitting, Mitigation & Restoration
November 2003

Random spot corridor width average (n=8): 58 ft.



Appendix B Sheet 6b
North Branch Terminus - Historical Condtitions

N

500 250 0 500 Feet

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Photo Date: 1948