

Introduction

Although the ecological and functional value of wetlands in the landscape is well documented, there are still significant gaps in our knowledge of "isolated" wetlands, especially in regard to water quality and hydrology. The groundwater system serves as a hydrologic connection between isolated wetlands (IW) and traditionally navigable waters. Additionally, water quality transformations may occur between the surface and subsurface components of the IW. Understanding the impacts of alterations to IWs thus must be informed by an understanding of the role of groundwater.

As part of a multi-disciplinary investigation of IWs, USC and the NC Division of Water Quality are investigating the hydrology and water quality function of groundwater at eight IW sites in North Carolina and four in South Carolina. Results of this investigation show that all the wetlands in the study are connected to downgradient surface water (stream or wetland connected to a stream) via groundwater without significant impediment from intervening confining units or aquitards. Examination of the water quality data is underway to determine the chemical relationships and transformations between water that may occur in these systems.

This poster presents results of spatial and temporal dynamics of shallow groundwater from the IW to the nearby connected waterbody at the SC sites. There was a severe drought during the study and water table elevation was severely depressed but in most cases the subsurface connection did not break. The water table elevation rises rapidly in response to precipitation in the IW and the sandy upland soils of the Coastal Plain.

The final report for this project will be ready in a few weeks.



Isolated Wetlands – The Groundwater Connection



October 2012

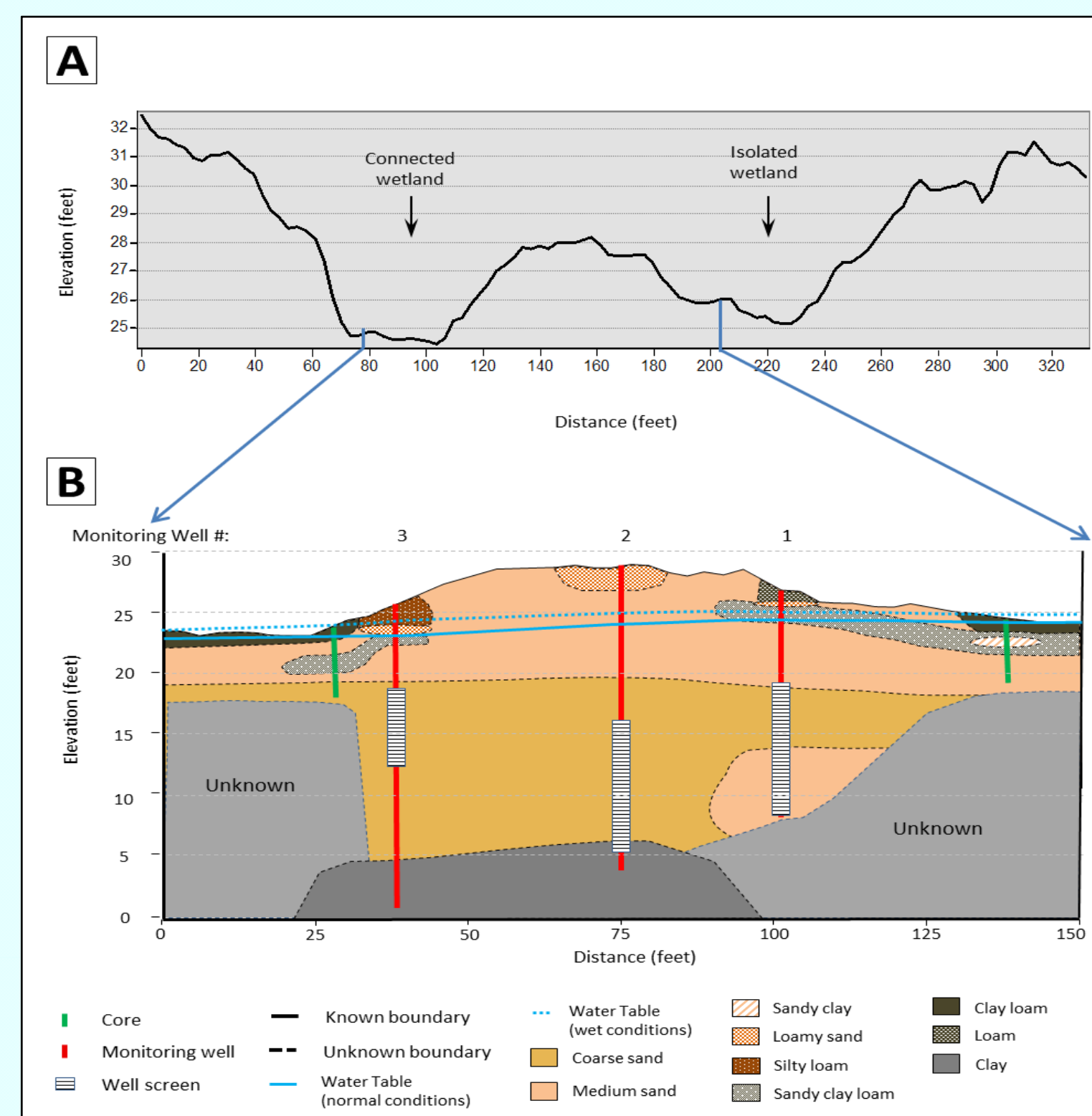
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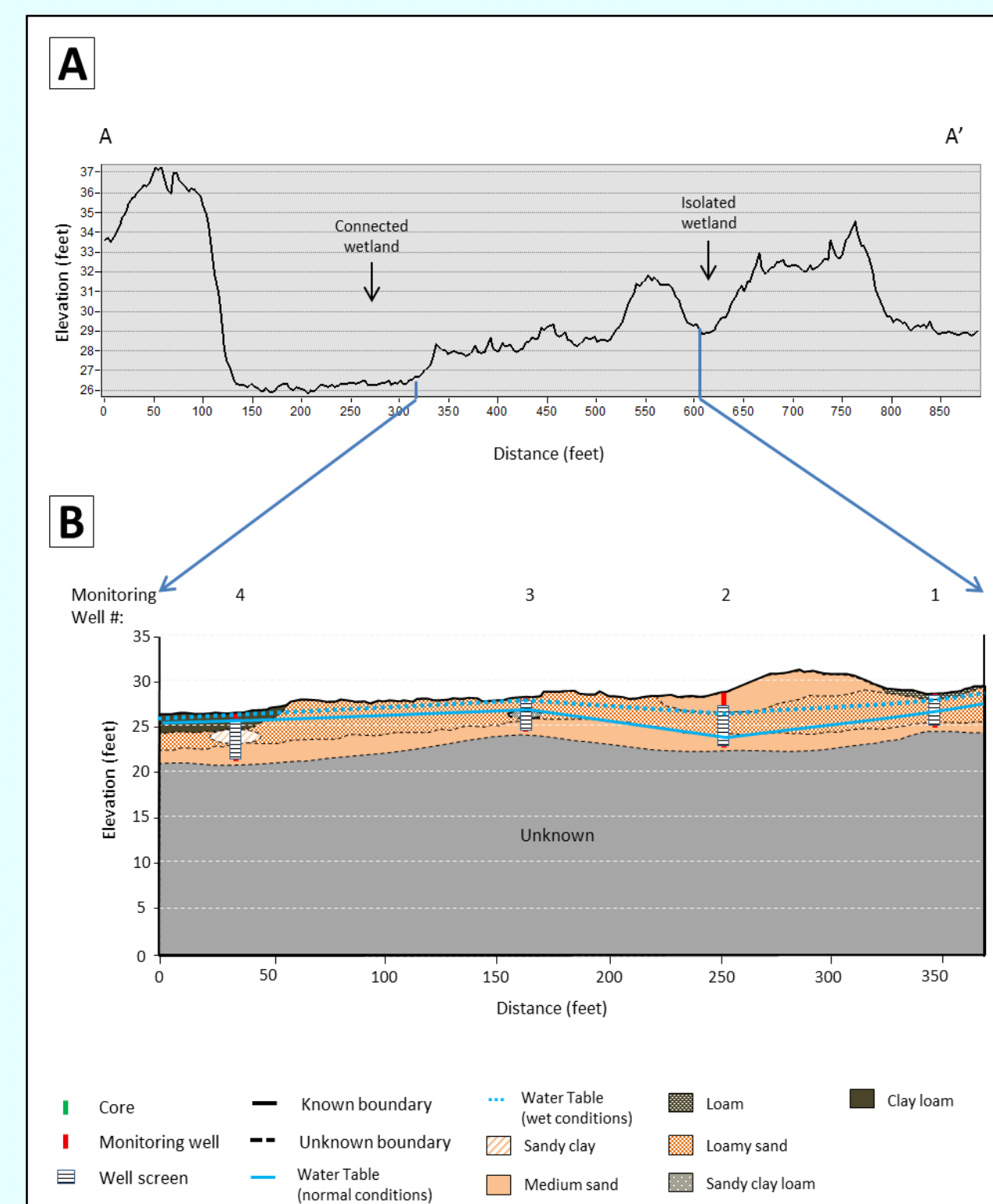
Location and size of the IWs in this study. Also the wetland type of the IW and the downgradient stream or connected wetland. Wetland type classification was made using the NC Wetland Assessment Method (NCWAM).

Site name	County, State	Area - ac	NCWAM Type	
			Connected	Isolated
MA	Marion, SC	1.33	Riverine Swamp Forest	Basin Wetland
MF	Marion, SC	2.06	Riverine Swamp Forest	Basin Wetland
LB	Horry, SC	4.19	Riverine Swamp Forest	Pocosin
Bladen 1	Bladen, NC	5.46	Stream	Basin Wetland
Bladen 2	Bladen, NC	0.63	Stream	Basin Wetland
Bladen 6	Bladen, NC	7.78	Stream	Pocosin
Bladen 7	Bladen, NC	6.77	Stream	Basin Wetland
Bladen 9	Bladen, NC	4.74	Stream	Basin Wetland
Bladen 17	Bladen, NC	1.65	Stream	Pocosin
GS1	Brunswick, NC	0.3	Basin Wetland	Basin Wetland
GS2	Brunswick, NC	0.45	Pocosin	Basin Wetland

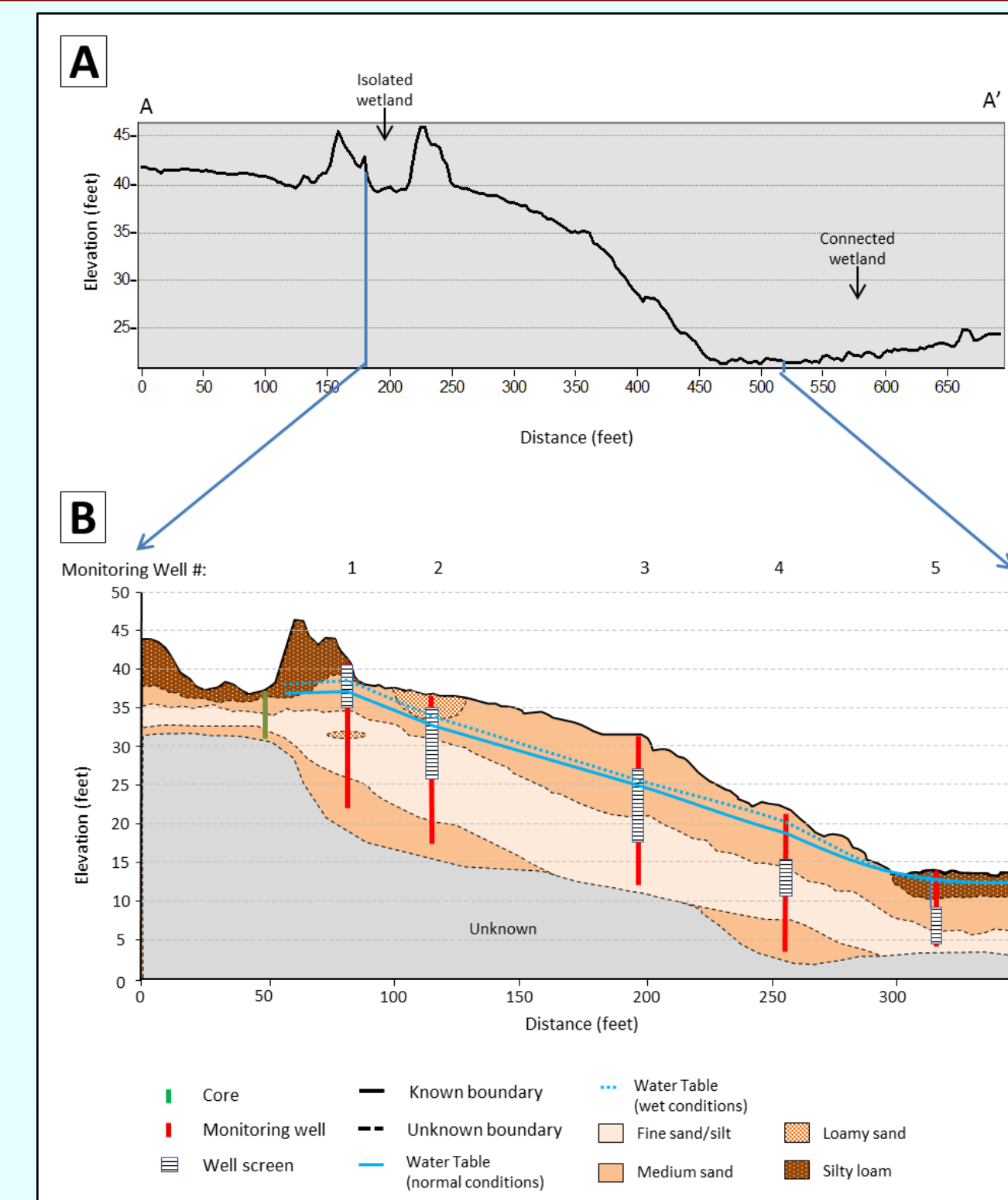
Results



Site MA. Topographic profile (A) and stratigraphic cross-section (B) from the IW to the connected wetland. Included is the measured water table elevation during wet and normal conditions during the study period.

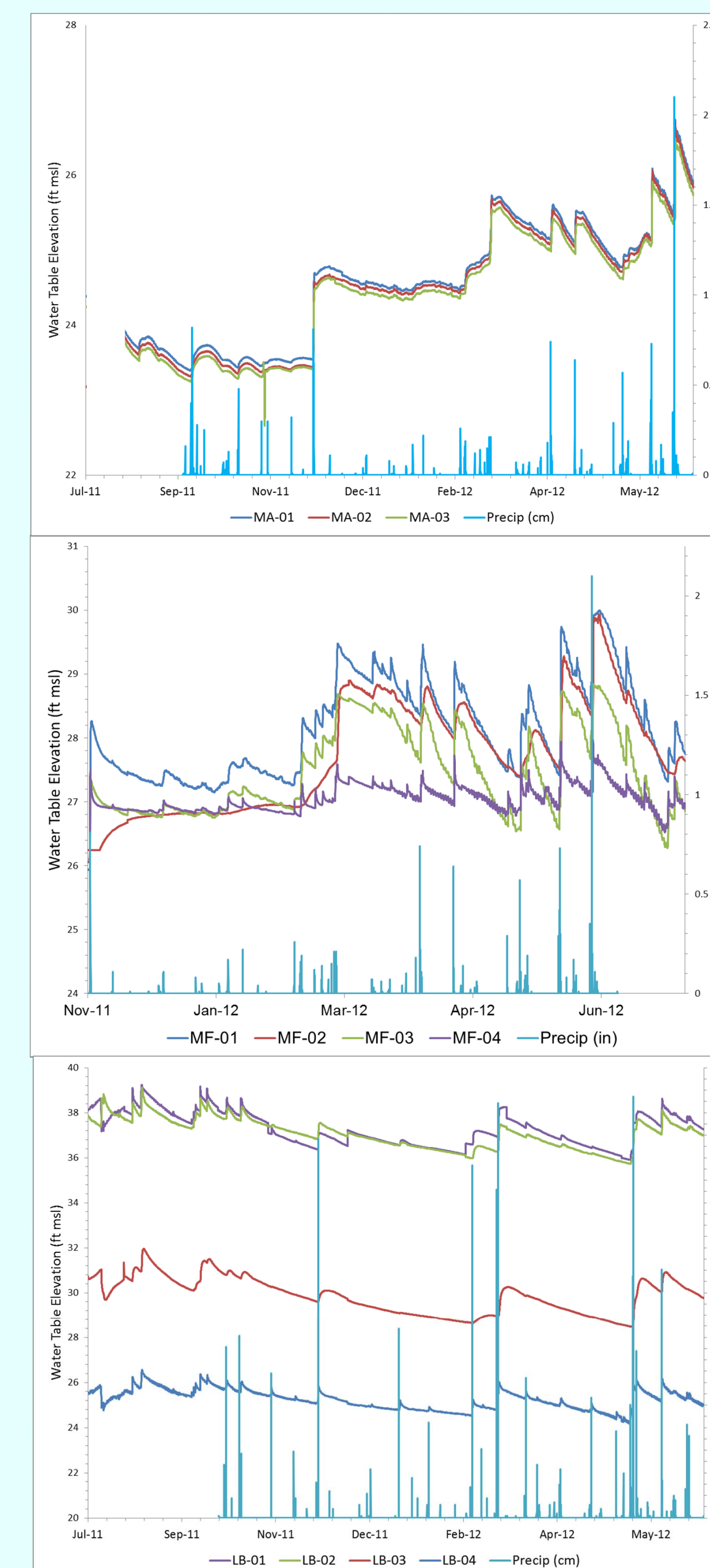


Site MF. Topographic profile (A) and stratigraphic cross-section (B) from the IW to the connected wetland. Included is the measured water table elevation during wet and normal conditions during the study period.



Site LB. Topographic profile (A) and stratigraphic cross-section (B) from the IW to the connected wetland. Included is the measured water table elevation during wet and normal conditions during the study period.

Precipitation response



Hourly precipitation and hydrographs of water table elevations from Site MA (top panel), MF (middle), and LB (bottom) during the study period. The numeric portion of the well number corresponds to the numbered wells in the stratigraphic cross-sections.

Results and Discussion

Groundwater flow direction is influenced by topography and underlying geomorphology. Analysis of the stratigraphy and soil composition of the South Carolina sites indicates a high sand content at the two sites located in Marion County, which facilitates infiltration, percolation, and groundwater movement within the surficial aquifer.

Soil composition at the MA site consists of layers of coarse and medium-sized sand with several areas of inclusions. Both the IW and the connected wetland contain a surficial layer of clay loam, which acts as an infiltration barrier and increases water retention within the wetlands.

The MF site contains a layer of medium grain-sized sand followed by a layer of sandy loam, and then another layer of medium grain-sized sand. Soil cores indicated the presence of sandy clay and sandy clay loam at the location of well 4 and well 3, respectively. A surficial layer of loam exists within the IW, while a surficial layer of clay loam exists within the connected wetland.

Soil profiles at the LB site in Horry County, SC indicate layers of medium grain-sized sand and fine grain-sized sand, with the presence of loamy sand inclusions. A silty loam layer exists at the surface within the connected wetland and the IW.

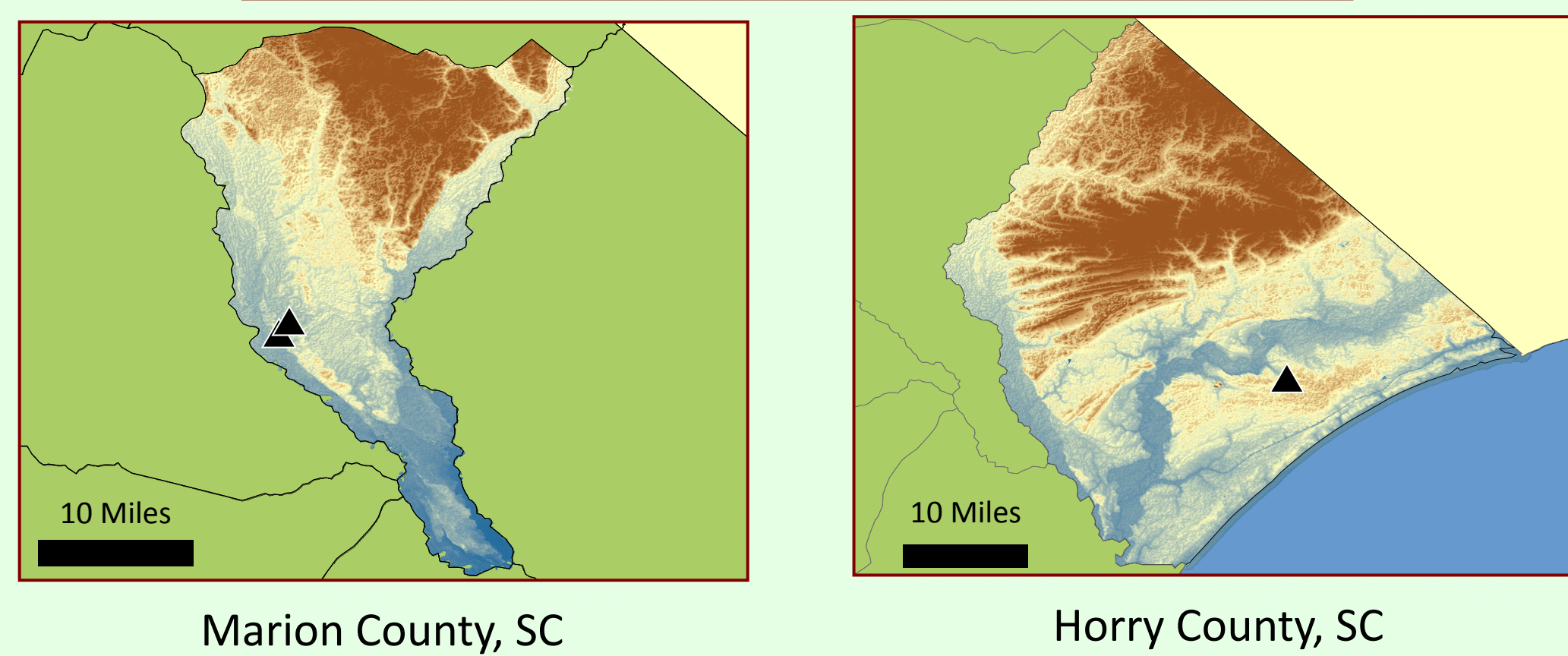
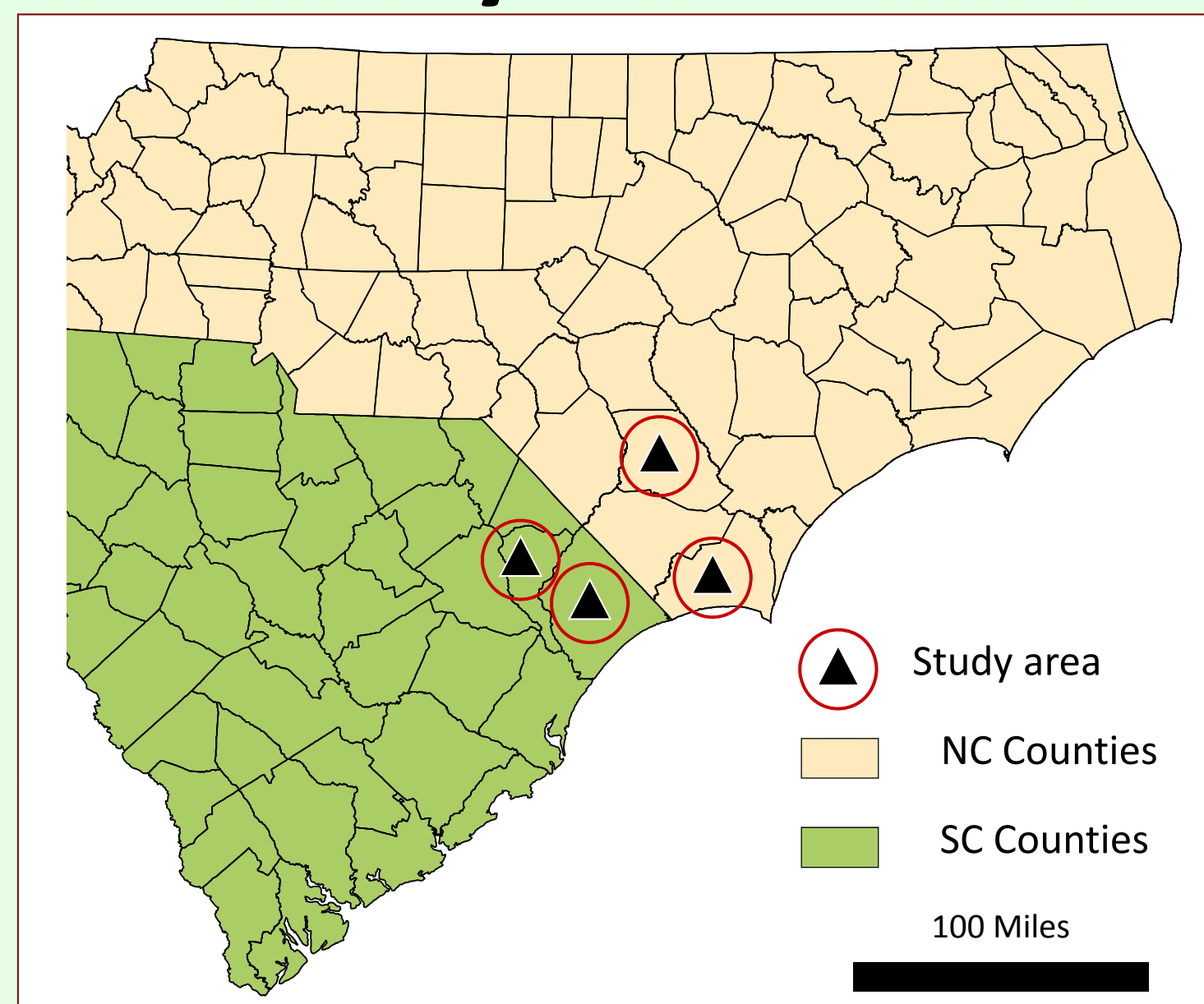
Water table elevations at the MF site show a rapid response to rain events in addition to water table seasonal responses. Water table elevation increased in December, but with a gradual recession rate, probably due to seasonal low rates of evapotranspiration. The rate of recession increased during March/April, when air temperature and evapotranspiration was high. The well located within the connected wetland (MF-04) was the only well that contained water throughout the study period, including during times of low water table elevation. The remainder of the wells began showing a water table response after a major rain event (>2 in) at the end of November 2011. More frequent and higher amounts of precipitation in April and May resulted in sustained relative high water table elevations through most of the summer months. When water was detected in all four wells, groundwater flowed from the IW (MF-01) to the connected wetland (MF-04).

Monitoring wells at the MA site also showed a rapid water table response to rain events. Water table elevations increased during winter months, when evapotranspiration was low, and persisted through the beginning of the summer months. Even as the groundwater elevation increased, relative water table elevations remained the same within the transect of monitoring wells. Throughout the study period the water table at the IW (MA-01) remained higher than the remaining wells, indicating that groundwater flowed from the IW to the connected wetland.

Water table elevations at the LB site in Horry County indicated no seasonal fluctuations, as water levels remained within a fairly consistent range in each of the monitoring wells. Rapid response to rain events occurred. During the driest periods, water table elevation at the IW (LB-01) and the adjacent upland area (LB-02) persisted at near-equal levels, and even reversed (water table elevation at LB-02 is higher than that at LB-01); however in higher flows, the water table within the IW remained at a higher elevation than the adjacent upland area. Flow reversal may be attributed to severe drought conditions in 2011 that continued to affect the water table until several rain events occurred in January 2012. Overall, groundwater at this site drained from the IW to the connected wetland, as seen in the other South Carolina sites.

- Acknowledgements**
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- Bladen Lakes State Forest
- Turnbull Creek Educational State Forest
- The Nature Conservancy
- South Carolina Department of Natural Resources

Study Locations



Data Collection



A Geoprobe drilling rig was used for coring and well installation – it is lightweight for use on soft soils, can access wooded areas, and allows for rapid assessment of geology.

- 8 sites in NC, 3 in SC
- 44 geologic cores, 20' to 60' in depth
- 90 monitoring wells
 - Monthly water level collection for one year at all wells
 - 43 automatic water level data-loggers for one year
 - Water quality analysis quarterly for one year for:
 - Nutrients
 - Metals
 - TOC, DOC
- 10 stream gages
- Aquifer tests at three sites

Typical Site

