

# Moore Property Monitoring Report FINAL Year 3 (2013)

Johnston County, North Carolina

USGS HUC: 03020201

EEP Project ID #725

EEP Project Manager: Jessica Kemp



Submitted to:



NCDENR-Ecosystem Enhancement Program

1652 Mail Service Center

Raleigh, North Carolina 27699-1652

Submitted January 2014

## **Executive Summary**

### **General**

The project site is located in the USGS Hydrologic Unit Code 03020201. In 2003, the restoration of the site was initiated by the North Carolina Department of Transportation (NCDOT), and the property owner (Michael Todd Moore) conveyed an 84.2 acre conservation easement in perpetuity to NCDOT in March 2003. NCDOT conducted a Mitigation Feasibility in May 2003, followed by a Mitigation Plan in January 2005.

Upon completion of the Mitigation Plan, the project was transitioned to the North Carolina Ecosystem Enhancement Program (EEP). Construction Plans were prepared by Kimley-Horn and Associates, Inc. (KHA) in March 2009, and Environmental Quality Resources, LLC (EQR) completed construction of the project in July 2011. During this time, in 2010, the property was conveyed from Mr. Moore, to Mr. Blackmon.

The primary goals for the Site were to restore wetland hydrology and an appropriate water table hydroperiod of the floodplain wetland (i.e. elevated water table levels and longer duration of saturation of the upper soil surface during the growing season) through the removal of drainage ditches and field crowns; re-vegetation of species to establish the native wetland, upland, and riparian vegetation communities; provide habitat protection for federally protected species in Swift Creek through the establishment of a permanent conservation easement along the west bank of Swift Creek through the project area; generally improve water quality and flood storage capacity functions within the restoration area by providing longer residence time and filtering for runoff through the wetland area prior to entering Swift Creek; and minimize permanent open water habitat to reduce avian hazards for the adjacent airport. These goals were accomplished through the following objectives:

- Re-graded the Site to remove the field crowns and drainage ditch system.
- Redistributed topsoil for wetland vegetation establishment.
- Planted riparian buffer and wetland vegetation to restore the area back to natural riparian floodplain and wetland communities.

The conservation area for riparian buffer along Swift Creek is 200 feet wide and measures from the top of the stream bank within the project area. The Site also contains two (2) distinct areas with two different primary hydrologic inputs. The eastern area nearest to Swift Creek (WED), is a likely historic remnant of Swift Creek and is now a wetter depression in the floodplain. The primary hydrologic inputs for this area will be backwater affect from Swift Creek and precipitation. The western area (TOM) is located further from Swift Creek along the toe of slope of the floodplain and receives hydrologic inputs from Swift Creek and runoff from the adjacent watershed area west of the Site (approximately 0.2 square miles). The following table lists the different assets included in the Site's restoration.

<b>Project Asset Table</b>		
Project Asset	Restoration Acreage	Mitigation Ratio
Riparian Wetland	51.5	1:1
Riparian Buffer Restoration	5.7	1:1

KHA performed wetland monitoring in the fall of 2013 for this Year 3 Monitoring Report with site visits occurring on April 18, July 31, August 21, November 6, November 8, and November 11. Site monitoring field work included Carolina Vegetation Survey (CVS) level 2 assessment, groundwater well data collection, and visual assessment of the vegetation and wetland restoration components of the project. The following table details the rainfall by month for the site for the 2013 monitoring year.

<b>Rainfall by Month for 2013 Monitoring Year (Year 3)</b>							
Month	Year	Rainfall* (in)	Average Rainfall** (in)	Month	Year	Rainfall* (in)	Average Rainfall** (in)
November	2012	0.71	3.14	May	2013	5.89	3.76
December	2012	4.46	3.15	June	2013	16.33	3.74
January	2013	3.07	4.17	July	2013	14.43	5.04
February	2013	4.12	3.66	August	2013	3.04	4.56
March	2013	1.91	4.23	September	2013	3.54	4.35
April	2013	3.85	3.00	October	2013	0.34	3.14
Total for Monitoring Year = 57.23 inches							
*Data from station CLA2 in Clayton, NC (5 mi. NW of site)							
**Historical period of record ranges from 1971-2000							

Summary information/data related to the occurrence of items such as encroachment and statistics related to performance of various project and monitoring elements can be found in the table and figures in the report appendices. Narrative background and supporting information is provided in the 2011 As-Built and Baseline Monitoring Report and in the 2008 Restoration Plan documents available on EEP's website ([www.nceep.net](http://www.nceep.net)). All raw data supporting the tables and figures in the appendices is available from EEP upon request.

## Hydrology

The restored wetland area was visually assessed and wetland gauge data was downloaded and analyzed as part of the Year 3 monitoring. The downloaded wetland gauge data is shown graphically against local precipitation data in Appendix E for monitoring locations shown in the Current Conditions Plan View (CCPV). As described in the 2008 Restoration Plan, success of the restoration of wetland hydrology will be determined by meeting U.S. Army Corps of Engineers (USACE) minimum criteria and providing water table at or near the surface consistent with frequency and duration of reference wetlands. For year's one (1) through three (3), minimum successful wetland hydrology is defined as less than or equal to 50% deviation in sustained water table levels near the surface compared to the reference wetlands. For year four (4) and beyond until the minimum success criteria is met, successful wetland hydrology is defined as less than or equal to 20% deviation in sustained water table levels near the surface

compared to the reference wetlands. The hydroperiod of the reference and site wetlands will be measured using groundwater gauges that record the water table elevation near the ground surface on a daily basis. The following observations were made regarding the hydrologic conditions during the Year 3 Monitoring site visit:

- While 2013 received above average rainfall (57” recorded against an annual average of 46”), the site did not experience any overbank floodwaters from Swift Creek this monitoring year. A significant tropical storm event in June, followed by higher than normal rainfall in July (286% of normal), provided multiple high flow events within Swift Creek which likely provided some flow from both the adjacent roadside ditch, and the outfall ditch as (Appendix B, Photo WP6).
- Ponded water was observed throughout the drainage swales, and within the lower elevations of the site at various times of the year during visual inspections and gauge data download field visits. The surface water that was observed was likely due to recent rainstorm events before the field visits. This indicates that water is remaining on the site for extended periods after significant rainfall events.
- The wetland appears to be continuing towards the design goals. The site was observed at the end of the growing season (beginning of the dormant season) and the site hydrology and vegetation community appeared to be functioning as intended.
- The crest gauge located in the outlet ditch for the wetland recorded at least two bankfull events in Swift Creek in the monitoring year (Appendix B, Photo WP1). It should be noted that the crest gauge was installed so that the bottom of the gauge was at the same elevation as the bankfull indicators located along the outlet ditch. The bankfull event occurring in June overtopped the crest gauge as evidenced by sediment staining on the banks (Appendix B, Photo WP2), so the exact height of the crest is not known.
- Significant beaver activity was observed both within the site and the adjacent area of the outlet ditch at the southern end of the site. The primary culvert outlet from the site was completely impounded by a beaver dam, holding water within the ditch. This may have contributed to the high crest gauge reading previously discussed (Appendix B, Photos WP3 and WP4).
- A US Geological Survey ambient water quality monitoring station is located approximately 6 miles upstream on Swift Creek at Barber Mill Road, in Clayton, NC (USGS 0208773375). During this monitoring year, the peak readings on the gauge on Swift Creek were 12.5’ in late spring (6/7/2013) and 8.3’ in early fall (9/23/2013). This indicates that while Swift Creek did have high flow events, they were lower than the flows experienced in previous years, and as stated above, peak flow events occurring in Swift Creek this monitoring year were not high enough to flood the site over the existing stream berm along the creek.
- During a site visit conducted on July 10, 2013, NC EEP staff observed a breach in the sand berm adjacent to Swift Creek (WP7 and WP8). Sand was deposited within the site

indicating overwash from Swift Creek, likely a result of the high-flow event recorded by the USGS gauge on June 7, 2013. Subsequent site visits were not able to locate similar breaches in this area, indicating no further overbank flow into the site at this location during the monitoring year.

Per the Natural Resource Conservation Service (NRCS) Johnston County Soil Survey, the growing season in Johnston County is from March 21 until November 16 (241 total days). Eleven of the sixteen groundwater gauges indicate that the wetland is exceeding the minimum success wetland hydrology criteria for the site. The gauges that did not meet minimum success criteria for wetland hydrology are D2, E2, F2, C4 and E4. Gauge F2 experienced a malfunction and did not log groundwater levels through the 2013 growing season. Three of the gauges that did not meet minimum criteria, D2, E2, and E4, are located along the wetland fringe adjacent to upland areas. Hydrology at these locations would be expected to be highly variable, both seasonally and year-to-year depending on rainfall and flood events from Swift Creek. (see Tables 10a and 10b for more detail). Gauge C4 is located on a slight topographic rise between two lower elevation swales in the southwestern quadrant of the site. Based on the microtopography in this area, surface water sheds away from this area, and is not likely to remain ponded at the gauge location following storm events like the lower areas of the site. This is reflected in the hydrology data at gauge C4 by more rapid water table recession after storm events compared to gauges B4 and D4. The gauge recorded a total of 66 days during the growing season with the water table within 12" of the surface, however due to water level fluctuation at this location, 10 days was the longest consecutive period with sustained water tables in the upper 12" and thus C4 does not meet wetland success criteria.

## **Vegetation**

The minimum success criteria has been established by EEP to verify that the re-established wetland and riparian buffer vegetation includes an appropriate species composition for the target wetland community type. In addition, the minimum success criterion includes the density and growth of characteristic forest species. For wetlands, a minimum mean density of 260 woody stems (planted and volunteer stems) per acre must be surviving for five years after initial planting, and an interim success criterion of 320 stem/acre in Year 3. For riparian buffers, a minimum mean density of 320 characteristic trees species (planted stems only) per acre must be surviving for five years after initial planting. These minimum requirements are according to the NCDENR DWQ Administrative Code 15A NCAC 02B.0242 (Neuse Buffer Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers). This site was instituted prior to October 2007 and, therefore, will generate Riparian Buffer Restoration credit within the conservation easement where planted hardwood stem density requirements are met AND there is a minimum of 50' and a maximum of 200' from the top of bank of Swift Creek. Herbaceous vegetation will be assessed visually during the initial assessment for ground cover and target species. Supplemental plantings will be performed as needed to achieve the vegetation success criteria.

During the monitoring process, KHA conducted a CVS Level 2 assessment of sixteen vegetation plots and a visual assessment of the vegetation community. Refer to the Appendices B and C of this report for the collected vegetation data and assessment summary data. The following

observations were made regarding the vegetation condition during the Year 3 Monitoring site visit on November 8 and November 11, 2013:

- Currently only one (VQ-16) of the four riparian vegetation plots (VQ-11, VQ-12, VQ-14, and VQ-16) are meeting the minimum success criteria of 320 planted stems/acre.
- Eight (VQ-1, VQ-2, VQ-4, VQ-5, VQ-6, VQ-10, VQ-13, and VQ-15) of the twelve wetland vegetation plots (VQ-1, VQ-2, VQ-3, VQ-4, VQ-5, VQ-6, VQ-7, VQ-8, VQ-9, VQ-10, VQ-13, and VQ-15) are meeting the minimum success criteria of 320 woody stems/acre.
- Of the seven vegetation plots that are not meeting the minimum success criteria, none are within 50 stems/acre of meeting the 320 stem/acre criteria. From visual observations, the plots that are not meeting the vegetation success criteria are generally dominated by herbaceous vegetation or are typically inundated throughout the year. Many of these plots, and areas around the plots, do include natural propagation of native woody species (i.e., river birch, sycamore, red maple, sweetgum, and loblolly pine).
- Based on the MY3 CVS assessment, the average woody stem count per acre for MY3 within the wetland area of the site is 361 stems/acre, and the total average for the riparian area of the site is 150 stems/acre.
- NC EEP contracted to have the supplemental planting of 1,220 woody stems conducted within seven targeted zones totaling 6.8 acres of the site on November 20, 2013. The planting was conducted after the conclusion of MY3 monitoring work, but the supplemental stems were marked with blue paint and they will be assessed as part of the MY4 data collection.
- As shown on the Current Conditions Plan View, cattails (*Typha latifolia*) have continued to establish in the vicinity of the wetland seep, the constructed wetland swale, and in the historic agricultural ditch location. Since MY2, the cattail populations have begun to merge into one large population.
- Lespedeza (*Lespedeza cantata*) remains established in the southwestern portion of the site, between vegetation plots 8 and 9.
- The herbaceous vegetation has vigorously propagated throughout the project site. Upon inspection, it appeared that most of the herbaceous vegetation was planted as part of the temporary or permanent seed mix, with the exception of the invasive or unfavorable species previously discussed.
- Dog fennel (*Eupatorium capillifolium*) is established throughout the upland areas of the site, and is propagating to the wetland areas, however due to the significant flood event recorded in June, the dog fennel has died back and was not found within the drainage swale on the west side of the upland area. Vegetation plot 2 however, remains dominated by dog fennel.
- Recent unauthorized activity on the site has resulted in the mechanized clearing (bush hogging) of a wildlife corridor from the access driveway on Swift Creek Road, along the perimeter of the site to the east, down to the southeastern corner of the site where a deer stand was erected. The clearing activities impacted vegetation plot 12 (VQ-12), of which

approximately half of the plot has been mowed, cleared, and seeded, destroying both the planted and naturally occurring vegetation within the plot. The rebar pins at both the origin (0,0) and the southeastern corner (0,10) have been removed or destroyed. These pins will be reset at the beginning of monitoring year 4. Due to the clearing and lack of locatable rebar pins, VQ-12 was not surveyed this year. NC EEP has been in coordination with the land manager to remove the hunting structures and prevent further clearing activities within the site. This area will be observed throughout the spring of MY4 to determine if the woody stems will re-sprout or if supplemental planting will be required to restore this riparian area. Any supplemental planting would be conducted during the dormant season of MY4.

### **Soils**

Hydric soils were present throughout the site during the site assessment. There are indicators of ponding and saturation at the surface and infiltration rates are low for several days after rain events as referenced in multiple groundwater monitoring wells.

### **References**

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

LeGrand, H.E. and S.P. Hall.

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation, All Levels of Sampling, Version 4.0.

SCO Station CLA2 – DAQ Clayton Profiler

Daily Precipitation Data

<http://www.nc-climate.ncsu.edu/cronos/?station=CLA2>

WETS Station CLAYTON 3 W, NC1820

Average Monthly Precipitation Data

[http://www.wcc.nrcs.usda.gov/climate/wets\\_doc.html](http://www.wcc.nrcs.usda.gov/climate/wets_doc.html)

## **TABLE OF CONTENTS**

### **EXECUTIVE SUMMARY**

### **APPENDIX A – PROJECT VICINITY AND BACKGROUND TABLES**

FIGURE 1	PROJECT SETTING
TABLE 1	PROJECT COMPONENTS AND SUMMATIONS
TABLE 2	PROJECT ACTIVITY AND REPORTING HISTORY
TABLE 3	PROJECT CONTACTS TABLE
TABLE 4	PROJECT ATTRIBUTE TABLE

### **APPENDIX B – VISUAL ASSESSMENT DATA**

FIGURE 2	CURRENT CONDITIONS PLAN VIEW
FIGURE 3	REFERENCE GAUGE LOCATIONS
TABLE 6	VEGETATION CONDITION ASSESSMENT

WETLAND PHOTO PAGES

VEGETATION PHOTO PAGES

### **APPENDIX C – VEGETATION PLOT DATA**

TABLE 7	VEGETATION PLOT CRITERIA ATTAINMENT
TABLE 8	CVS VEGETATION PLOT METADATA
TABLE 9	PLANTED AND TOTAL STEM COUNTS (SPECIES BY PLOT WITH ANNUAL MEANS)

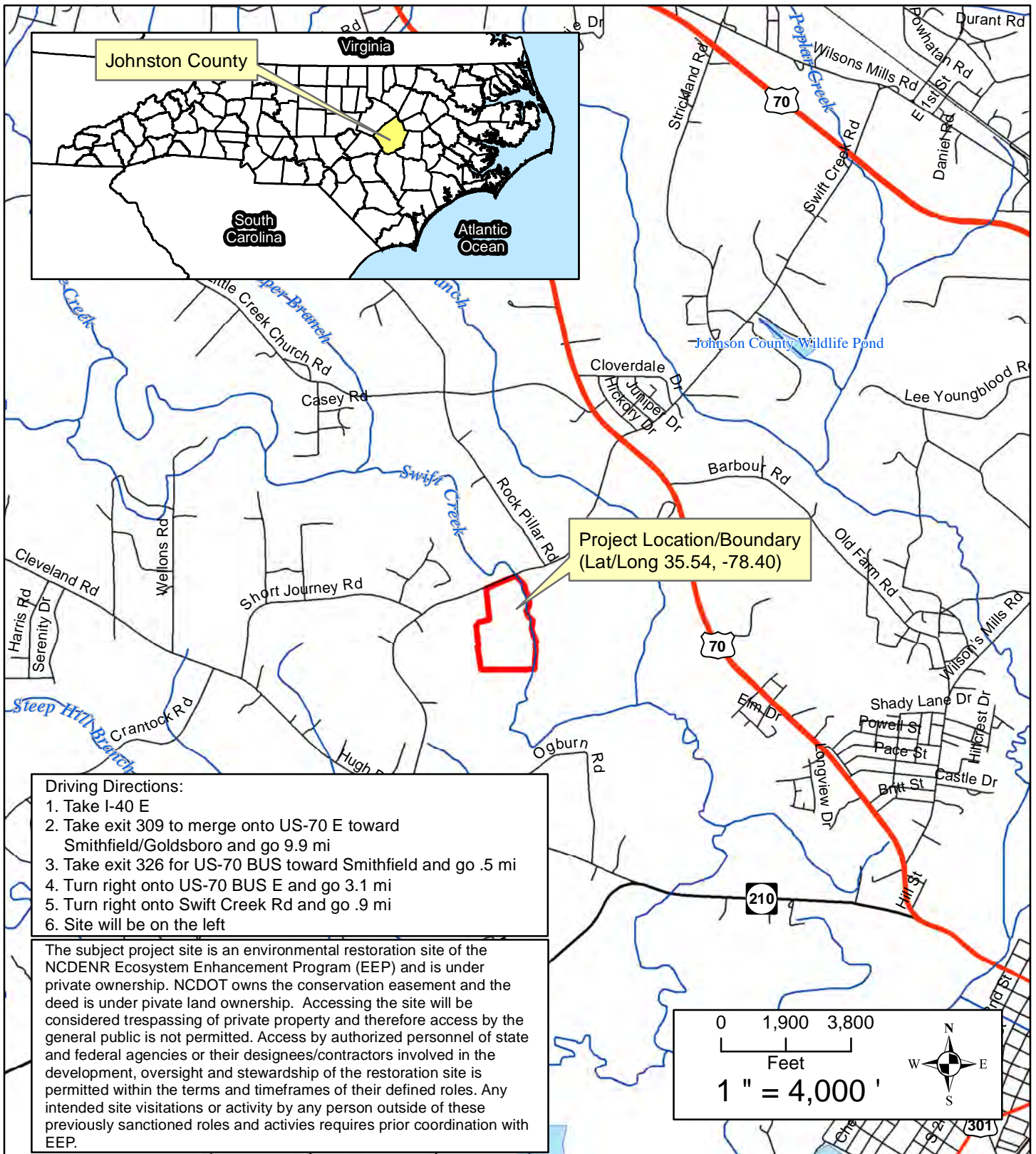
### **APPENDIX D – HYDROLOGIC DATA**


TABLE 12	VERIFICATION OF BANKFULL EVENTS
TABLE 13A	REFERENCE GROUNDWATER WELL SUMMARY
TABLE 13B	RESTORATION GROUNDWATER WELL SUMMARY

GROUNDWATER DATA ANALYSIS



**APPENDIX A**  
**PROJECT VICINITY MAP AND**  
**BACKGROUND TABLES**



Title		Vicinity Map		
Prepared For: 	<b>Project</b> Moore Property Monitoring (725) 2013 - Year 3 Johnston County, North Carolina	<b>Date</b> 05/07/2013		<b>KHA Project Number</b> 011795033
				<b>Figure</b> 1

**Table 1. Project Components and Mitigation Credits**

**Moore Property/725**

**Mitigation Credits**

Type	Stream		Riparian Wetland		Non-riparian Wetland		Neuse Riparian Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
	R	RE	R	RE	R	RE			
Totals			51.5	0			248,292		

**Project Components**

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage		Approach (PI, PII, etc.)	Restoration or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
RPN					Restoration	5.7	1:1
WED					Restoration	10.4	1:1
TOM-A					Restoration	39.8	1:1
TOM-B					Restoration	1.3	1:1

**Component Summation**

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration		51.5	0		248,292	
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						

**Table 2. Project Activity and Reporting History  
Moore Property/725**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	NA	March 2008
Final Design – Construction Plans	NA	May 2009
Containerized, bare root and B&B plantings	NA	January 2011
Construction	NA	July 2011
As-Built & Baseline Monitoring Report	January 2011	July 2011
Monitoring Year 1	November 2011	January 2012
Monitoring Year 2	October 2012	February 2013
Monitoring Year 3	November 2012	December 2013

- Bolded items are examples of those items that are not standard, but may come up and should be included
- Non-bolded items represent events that are standard components over the course of a typical project.
- The above are obviously not the extent of potential relevant project activities, but are just provided as example as part of this exhibit.

**Table 3. Project Contacts Table  
Moore Property/725**

<b>Designer</b>	Kimley-Horn and Associates, Inc. 3001 Weston Parkway Cary, NC 27513
Primary project design POC	Daren Pait (757) 355-6677
<b>Construction Contractor</b>	Environmental Quality Resources, LLC 1405 Benson Ct Arbutus, MD 21227
Construction contractor POC	John Talley (443) 304-3310
<b>Survey Contractor</b>	Turner Land Surveying, PLLC 3201 Glenridge Dr Raleigh, NC 27604
Survey contractor POC	David Turner (919) 875-1378
<b>Planting Contractor</b>	Natives, Inc. 550 E. Westinghouse Blvd Charlotte, NC 28273
Planting contractor POC	Gregg Antemann (704) 527-1177
<b>Seeding Contractor</b>	Natives, Inc. 550 E. Westinghouse Blvd Charlotte, NC 28273
Contractor point of contact	Gregg Antemann (704) 527-1177
<b>Seed Mix Sources</b>	Natives, Inc. Gregg Antemann (704) 527-1177
<b>Nursery Stock Suppliers</b>	Natives, Inc. Gregg Antemann (704) 527-1177
<b>Monitoring Performers</b>	Kimley-Horn and Associates, Inc. 3001 Weston Parkway Cary, NC 27513
Stream Monitoring POC	N/A
Vegetation Monitoring POC	Jason Hartshorn (919) 678-4155
Wetland Monitoring POC	Chad Evenhouse (919) 677-2121

**Table 4. Project Attribute Table  
Moore Property/725**

Project County	Johnston
Physiographic Region	Coastal Plain
Ecoregion	Rolling Coastal Plain
Project River Basin	Neuse
USGS HUC for Project (14 digit)	3020201110070
NCDWQ Sub-basin for Project	03-04-02
Within extent of EEP Watershed Plan?	No
WRC Hab Class (Warm, Cool, Cold)	Warm
% of project easement fenced or demarcated	100
Beaver activity observed during design phase?	No

**Restoration Component Attribute Table**


	RPN	WED	TOM	Swift Creek *
Drainage area	N/A	0.03 sq. mi.	0.2 sq. mi.	145.2 sq. mi.
Stream order	N/A	N/A	N/A	4th
Restored length (feet)	N/A	N/A	N/A	N/A
Perennial or Intermittent	N/A	N/A	N/A	Perennial
Watershed type (Rural, Urban, Developing etc.)		Rural	Rural	Developing
Watershed LULC Distribution (e.g.)				
Residential		2%	2%	20%
Ag-Row Crop		69%	69%	40%
Ag-Livestock		0%	0%	0%
Forested		29%	29%	40%
Etc.		0%	0%	0%
Watershed impervious cover (%)		0%	0%	15%
NCDWQ AU/Index number	N/A	N/A	N/A	27-43-(8)
NCDWQ classification	N/A	N/A	N/A	C; Sw; NSW
303d listed?	N/A	N/A	N/A	No
Upstream of a 303d listed segment?	N/A	N/A	N/A	Yes
Reasons for 303d listing or stressor	N/A	N/A	N/A	WS-III; NSW; CA
Total acreage of easement	84.2	84.2	84.2	N/A
Total vegetated acreage within the easement	84.2	84.2	84.2	N/A
Total planted acreage as part of the restoration	5.7	10.4	41.1	N/A
Rosgen classification of pre-existing	N/A	N/A	N/A	N/A
Rosgen classification of As-built	N/A	N/A	N/A	N/A
Valley type	N/A	N/A	N/A	N/A
Valley slope	N/A	N/A	N/A	N/A
Valley side slope range (e.g. 2-3.%)	N/A	N/A	N/A	N/A
Valley toe slope range (e.g. 2-3.%)	N/A	N/A	N/A	N/A
Cowardin classification	N/A	N/A	N/A	N/A
Trout waters designation	N/A	N/A	N/A	No
Species of concern, endangered etc.? (Y/N)	No	No	No	Yes
Dominant soil series and characteristics	Altavista	Wedhadkee	Tomotley	N/A
Series	AaA	Wt	To	N/A
Depth	60 inches	63 inches	60 inches	N/A
Clay%	10-35	5-20	5-35	N/A
K	0.24	0.24	0.2	N/A
T	5	5	5	N/A

Use N/A for items that may not apply. Use "--" for items that are unavailable and "U" for items that are unknown

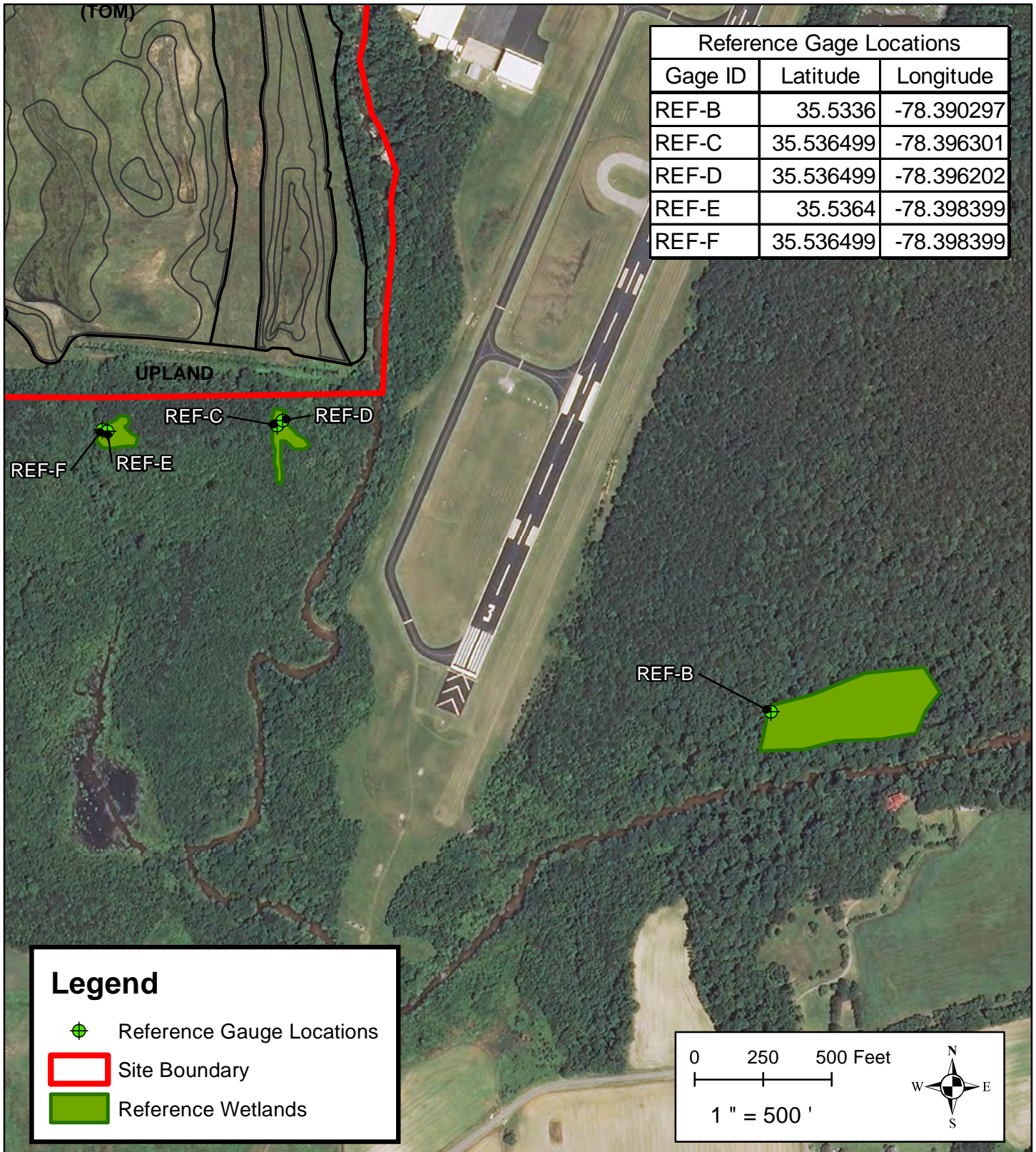
\*There is no restoration of Swift Creek involved with this project

**APPENDIX B**  
**VISUAL ASSESSMENT DATA**



<b>Title</b>	<b>Current Conditions Plan View (2012 NAIP Aerial)</b>		
<b>Prepared For:</b>	<b>Project</b>	Moore Property Monitoring (725) 2013 - Year 3 Johnston County, NC	
		<b>Date</b>	<b>KHA Project Number</b>
		1/06/2014	011795033
			<b>Figure</b> 2





**Title** Reference Gauge Locations (2012 NAIP Aerial)

Prepared For:



**Project**

Moore Property Monitoring (725) 2013 - Year 3  
Johnston County, North Carolina

**Date**

12/06/2013

**KHA Project Number**

011795033

**Figure**

3



PP1 (November 11, 2013)



PP2 (November 11, 2013)



PP3 (November 11, 2013)



PP4 (November 8, 2013)



WP1 (November 8, 2013)

Bankfull event recorded by crest gauge in wetland outlet ditch on November 8, 2013.



WP2 (July 31, 2013)

Sediment deposits indicating bankfull event surpassing the height of the crest gauge.



WP3 (July 31, 2013)

Beaver activity observed within site around the outlet ditch to Swift Creek.



WP4 (November 8, 2013)

Beaver impoundment constructed around site outlet connection near Swift Creek.



WP5 (July 31, 2013)  
Reference wetland D



WP6 (July 31, 2013)  
Drift deposits observed throughout the drainage swale flowing into the site near Swift Creek Road.



WP7 (July 10, 2013)

Sand deposition from overbank flow from Swift Creek into the site.



WP8 (July 10, 2013)

Sand deposition from overbank flow from Swift Creek into the site.



VQ1 (November 11, 2013)



VQ2 (November 11, 2013)





VQ3 (November 11, 2013)



VQ4 (November 11, 2013)



VQ5 (November 8, 2013)



VQ6 (November 8, 2013)



VQ7 (November 11, 2013)



VQ8 (November 11, 2013)



VQ9 (November 11, 2013)



VQ10 (November 8, 2013)



VQ11 (2013 photo not usable, MY2 shown)



VQ12 (November 8, 2013) – Plot was destroyed by unauthorized bush hogging, and boundary pins were destroyed or removed. Plot was not sampled this year, but pins will be re-set and sampling completed for MY4.



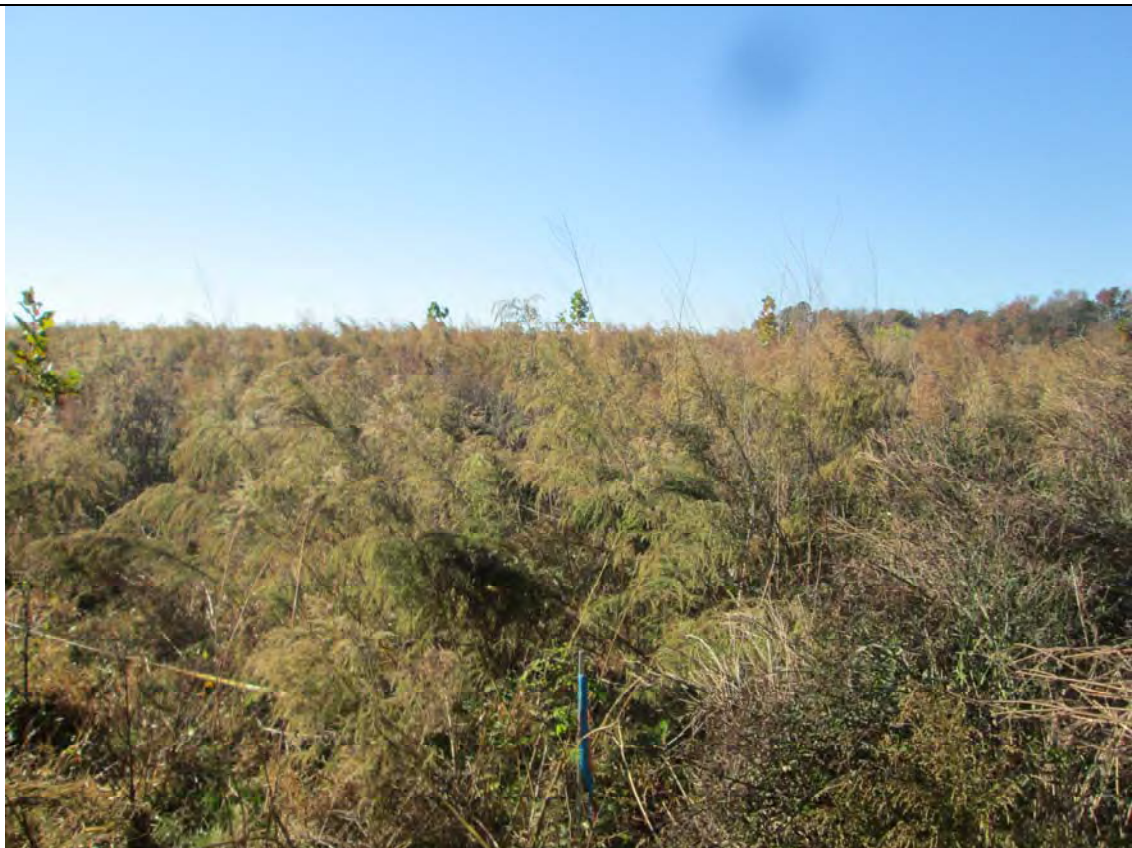
VQ13 (November 11, 2013)



VQ14 (November 11, 2013)



VQ15 (November 8, 2013)



VQ16 (November 8, 2013)

**APPENDIX C**  
**VEGETATION PLOT DATA**



**Table 7. Vegetation Plot Criteria Attainment  
Moore Property/725**

Vegetation Plot ID	Vegetation Community	MY1		MY2		MY3		MY4		MY5	
		Vegetation Survival Threshold (320 stems/acre) Met?	Tract Mean	Vegetation Survival Threshold (320 stems/acre) Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean
VQ11	Riparian	N	50%	N	50%	N	25%				
VQ12		Y		Y		Not Surveyed					
VQ14		N		N		N					
VQ16		Y		Y		Y					
VQ1	Wetland	N	67%	N	42%	Y	67%				
VQ2		N		N		Y					
VQ3		N		N		N					
VQ4		Y		Y		Y					
VQ5		Y		Y		Y					
VQ6		Y		Y		Y					
VQ7		Y		N		N					
VQ8		Y		Y		N					
VQ9		N		N		N					
VQ10		Y		N		Y					
VQ13		Y		Y		Y					
VQ15		Y		N		Y					

**Table 8. CVS Vegetation Plot Metadata  
Moore Property/725**

<b>Report Prepared By</b>	Jason Hartshorn
<b>Date Prepared</b>	11/27/2013 15:22
<b>database name</b>	Moore Property_cvs-eeep-entrytool-v2.3.1.mdb
<b>database location</b>	K:\RAL_Environmental\011795 Moore Property Monitoring\Vegetation Data
<b>computer name</b>	DD83305
<b>file size</b>	53,552 KB

**DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----**

<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.

**PROJECT SUMMARY-----**

<b>Project Code</b>	725
<b>project Name</b>	Moore Property
<b>Description</b>	Wetland Restoration
<b>River Basin</b>	Neuse
<b>length(ft)</b>	N/A
<b>stream-to-edge width (ft)</b>	N/A
<b>area (sq m)</b>	341,718 (0.13 square miles)
<b>Required Plots (calculated)</b>	30
<b>Sampled Plots</b>	16*

\* As approved by EEP

For projects using CVS, this table will be produced directly to the performer. For projects not using CVS this spreadsheet can be used/built upon to provide the desired format

Table 9 Planted and Total Stem Counts (Species by Plot with Annual Means)

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2013)																								Annual Means																				
			000-01-0001		000-01-0002		000-01-0003		000-01-0004		000-01-0005		000-01-0006		000-01-0007		000-01-0008		000-01-0009		000-01-0010		000-01-0011		000-01-0012		000-01-0013		000-01-0014		000-01-0015		000-01-0016		MY3 (2013)		MY2 (2012)		MY1 (2011)		MPO (2011)						
			ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T	ProLS	P-all	T			
<i>Acer rubrum</i>	red maple	Tree			1																																										
<i>Betula nigra</i>	river birch	Tree	1	1	18			2																																							
<i>Carpinus caroliniana</i>	American hornbeam	Tree	1	1	2																																										
<i>Carya aquatica</i>	water hickory	Tree																																													
<i>Cercis canadensis</i>	eastern redbud	Tree																																													
<i>Cornus amomum</i>	illy dogwood	Shrub																																													
<i>Clatargus phaeogynus</i>	Washington hawthorn	Shrub Tree																																													
<i>Diogyros virginiana</i>	common persimmon	Tree	1	1	1				6	6	2	9	9	9	1	1	1				2	2	2																								
<i>Fraxinus pennsylvanica</i>	green oak	Tree																																													
<i>Liquidambar styraciflua</i>	sweetgum	Tree																																													
<i>Nyssa aquatica</i>	water tupelo	Tree																																													
<i>Nyssa biflora</i>	swamp tupelo	Tree																																													
<i>Pinus taeda</i>	loblolly pine	Tree																																													
<i>Platanus occidentalis</i>	American sycamore	Tree																																													
<i>Populus deltoides</i>	eastern cottonwood	Tree																																													
<i>Populus californica</i>	Calley pop	Shrub																																													
<i>Quercus laurifolia</i>	laurel oak	Tree																																													
<i>Quercus lyrata</i>	overcup oak	Tree																																													
<i>Quercus michauxii</i>	swamp chestnut oak	Tree																																													
<i>Quercus nigra</i>	water oak	Tree																																													
<i>Quercus prinus</i>	white oak	Tree																																													
<i>Taxodium distichum</i>	bold cypress	Tree																																													
<i>Ulmus alata</i>	winged elm	Tree																																													
<b>Totals</b>			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	size (ares)		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02			
	Species count		3	3	7	1	1	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
	Stems per ACR		121.4	121.4	1173.8	85.9	85.9	404.1	80.0	80.0	80.0	283.3	283.3	393.3	364.2	364.2	404.1	364.2	364.2	364.2	80.0	80.0	80.0	0.0	0.0	200.0	121.4	121.4	181.0	283.3	283.3	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1	404.1			
	size (ares)																																														
	size (ACRES)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
	Species count																																														
	Stems per ACR																																														

\*Balded hardwood tree species are counted toward riparian buffer success criteria

Color Key for Density	
Exceeds requirements by more than 10%	Green
Exceeds requirements, but by less than 10%	Yellow
Fails to meet requirements, by less than 10%	Orange
Fails to meet requirements by more than 10%	Red

**APPENDIX D**  
**HYDROLOGIC DATA**

**Table 13a. Reference Groundwater Gauge Summary  
Moore Property/725**

	Ground Elevation*	2009	2010	MY1 2011	MY2 2012	MY3 2013	MY4 2014	MY5 2015	Notes
<b>Groundwater Gauge REF-B</b>	124'	34	29	44	2	35			Floodplain depression, depends on flood events from Swift Creek, which appears to have occurred at least once in 2013. Sediment deposits on vegetation along Swift Creek and tributaries in the vicinity of REF-B indicate overbank flow from Swift Creek.
Consecutive days within range <sup>1</sup>		14.11%	12.03%	18.26%	0.83%	14.52%			
% of growing season <sup>2</sup>		Y	Y	Y	N	Y			
Criteria met? <sup>3</sup>									
<b>Groundwater Gauge REF-C</b>	124'	35	30	45	2	33			Very dry after the end of 2012, with the water table reflecting rainfall events through June, peaking into the upper surface on multiple occasions. High rainfall events and/or overbank flow from Swift Creek in June and July appear to have inundated the wetland. The water table drops below 2' for much of the remaining growing season.
Consecutive days within range		14.52%	12.45%	18.67%	0.83%	13.69%			
% of growing season		Y	Y	Y	N	Y			
Criteria met?									
<b>Groundwater Gauge REF-D</b>	124'	43	--	--	22	62			Very dry through the end of 2012. Water table rises into the upper surface in January, peaking above the ground surface in correlation with rainfall events. The water table is drawn down through the growing season, but is inundated during June and July with high rainfall totals and/or overbank flow from Swift Creek. Water table drops below 12" for the majority of the growing season.
Consecutive days within range		17.84%	--	--	9.13%	25.73%			
% of growing season		Y	--	--	Y	Y			
Criteria met?									
<b>Groundwater Gauge REF-E</b>	123'	33	--	--	22	19			Very dry after the end of 2012 and into the 2013 dormant season. Water table begins to recharge in February, but does not occur in the upper surface until late February. Water level drops back below 24" by May, and only peaks above 12" a few more times in June and July before dropping remaining below 12" from August through the end of the growing season.
Consecutive days within range		13.69%	--	--	9.13%	7.88%			
% of growing season		Y	--	--	Y	Y			
Criteria met?									
<b>Groundwater Gauge REF-F</b>	123'	34	27	39	23	28			Very dry after the end of 2012. Water table peaks multiple times above the ground surface, but does not remain above 12" for multiple days until mid-March and early-April. The water table fluctuates in correlation with high rainfall events in June and July, before trending below 12" into early August. The well failed in early August, so no data was recorded from August to end of growing season.
Consecutive days within range		14.11%	11.20%	16.18%	9.54%	11.62%			
% of growing season		Y	Y	Y	Y	Y			
Criteria met?									
<b>Average reference hydroperiod</b>		36	29	43	15	36			
<b>Consecutive number of days needed to meet the 50% deviation success criteria</b>		18	15	22	8	18			
1- The Army Corps of Engineers states that the range is within 12 inches of the ground surface 2- The growing season for the site is 241 days long. 3- The minimum success criteria states that the water table must be within the USACE range for at least 5% (12 days) of the growing season consecutively. * Ground elevations recorded using county topographic GIS data.									

**Table 13b. Restoration Groundwater Gauge Summary  
Moore Property/725**

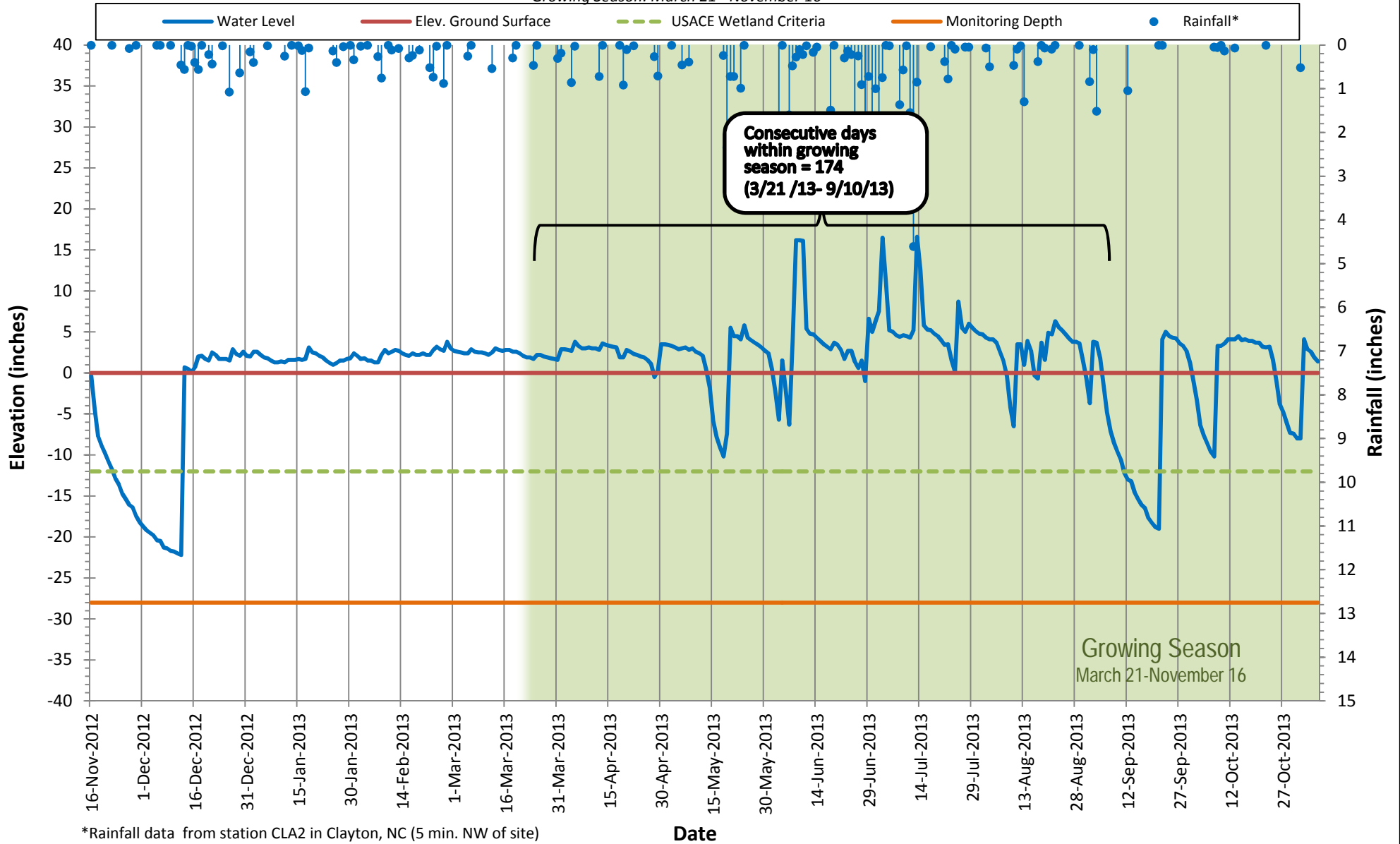
	Ground Elevation*	MY1 2011	MY2 2012	MY3 2013	MY4 2014	MY5 2015	Notes
Percentage of monitoring gauges with criteria met		50.00%	68.75%	68.75%			
<b>Groundwater Gauge B1</b>	124.1'						Gauge located in wet swale that receives runoff from upslope property and roadside drainage. Water level is sustained above the ground surface during the dormant season and rises above the surface in response to storm events during the growing season. Periods of low rainfall show a draw down in the water table.
Consecutive days within range <sup>1</sup>		68	89	174			
% of growing season <sup>2</sup>		28.22%	36.93%	72.2%			
Criteria met <sup>3</sup> ?		Y	Y	Y			
<b>Groundwater Gauge B2</b>	124.0'						Water level within 12" of the surface at the end of the dormant season and the early growing season, but is drawn down below 12" in May. The water table level correlates with rainfall events through August, but is below the upper 12" inches for the remainder of the 2013 growing season.
Consecutive days within range		50	27	39			
% of growing season		20.75%	11.20%	16.2%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge C2</b>	124.5'						Water levels are sustained above the ground surface during the dormant season in the beginning of 2013 and into the spring, only drawing down for short periods in April and May.
Consecutive days within range		47	28	91			
% of growing season		19.50%	11.62%	37.8%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge D2</b>	125.7'						Located near the wetland boundary along the upland ridge. Water levels are within the upper 24" during the growing season and peak in response to rainfall events, but does not occur within the upper 12 inches until high rainfall events in June and July.
Consecutive days within range		0	1	5			
% of growing season		0.00%	0.41%	2.1%			
Criteria met?		N/A	N	N			
<b>Groundwater Gauge E2</b>	124.8'						The water level at E2 responds quickly to rainfall events, and multiple peaks above 12" are recorded through the dormant season and into the spring of 2013. High rainfall events in June and July maintained the water table above the ground surface on multiple occasions. The water table was drawn down below monitoring depth in late August.
Consecutive days within range		0	1	7			
% of growing season		0.00%	0.41%	2.9%			
Criteria met?		N/A	N	N			
<b>Groundwater Gauge F2</b>	124.2'						Gage F2 indicated proper monitoring and data download through 2013, however data was not recorded through 2013 due to gage failure. Gage was replaced in August 2013, and shows water level trends at F2 are responsive to rainfall events.
Consecutive days within range		4	6	2			
% of growing season		1.66%	2.49%	0.8%			
Criteria met?		N	N	N			
<b>Groundwater Gauge A3</b>	123.8'						Water levels sustained above the ground surface for the entire year.
Consecutive days within range		103	93	231			
% of growing season		42.74%	38.59%	95.9%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge B3</b>	123.7'						Water level at gage B3 is responsive to rainfall events, with peaks recorded at or above the ground surface frequently throughout the growing season. B3 indicates significant draw down during the growing season, with the water table dropping below 12" multiple times.
Consecutive days within range		45	21	25			
% of growing season		18.67%	8.71%	10.4%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge A4</b>	124.6'						Water level is at or above the ground surface through mid-April, with peaks occurring in response to rainfall. Water table draw down occurs during periods of low rainfall.
Consecutive days within range		20	23	42			
% of growing season		8.30%	9.54%	17.4%			
Criteria met?		N	Y	Y			
<b>Groundwater Gauge B4</b>	123.0'						Water level is above the ground surface throughout the growing season except for a draw down point in late-May and another in late-September.
Consecutive days within range		75	82	178			
% of growing season		31.12%	34.02%	73.9%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge C4</b>	124.3'						Gage C4 is very prone to fluctuations in water table level based on rainfall events.
Consecutive days within range		20	8	10			
% of growing season		8.30%	3.32%	4.1%			
Criteria met?		N	Y	N			
<b>Groundwater Gauge D4</b>	123.3'						Water levels sustained above the ground surface for the entire growing season except for a brief period in late September.
Consecutive days within range		75	92	232			
% of growing season		31.12%	38.17%	96.3%			
Criteria met?		Y	Y	Y			
<b>Groundwater Gauge E4</b>	124.8'						The water table at gage F4 was below monitoring depth through the beginning of 2013, and appears to be highly reactive to rainfall events.
Consecutive days within range		4	3	8			
% of growing season		1.66%	1.24%	3.3%			
Criteria met?		N	N	N			
<b>Groundwater Gauge F4</b>	124.8'						Located on the wetland fringe, with water levels below the monitoring depth for most of the year.
Consecutive days within range		4	1	18			
% of growing season		1.66%	0.41%	7.5%			
Criteria met?		N	N	Y			
<b>Groundwater Gauge G4</b>	123.5'						Gauge G4 is heavily influenced by rainfall levels, and a significant draw down in water table depth was noted during April and May, but levels peaked above the surface through June and July with high rainfall events.
Consecutive days within range		11	8	25			
% of growing season		4.56%	3.32%	10.4%			
Criteria met?		N	Y	Y			
<b>Groundwater Gauge B5</b>	123.4'						Water levels sustained near the ground surface for most of the year except for brief periods during the growing season. Peaks were noted during June and July where the water level was maintained above the ground surface.
Consecutive days within range		6	26	66			
% of growing season		2.49%	10.79%	27.4%			
Criteria met?		N	Y	Y			

1- The Army Corps of Engineers states that the range is within 12 inches of the ground surface  
 2- The growing season for the site is 241 days long.  
 3- For year's one (1) through three (3), minimum successful wetland hydrology is defined as less than or equal to 50% deviation in sustained water table levels near the surface compared to the reference wetlands (see Table 10a).  
 \* Ground elevations recorded by KHA using a Trimble VRS unit. Elevations are not certified by a professional surveyor.

# Shallow Water Table Gauge B1

November 16, 2012 - November 6, 2013

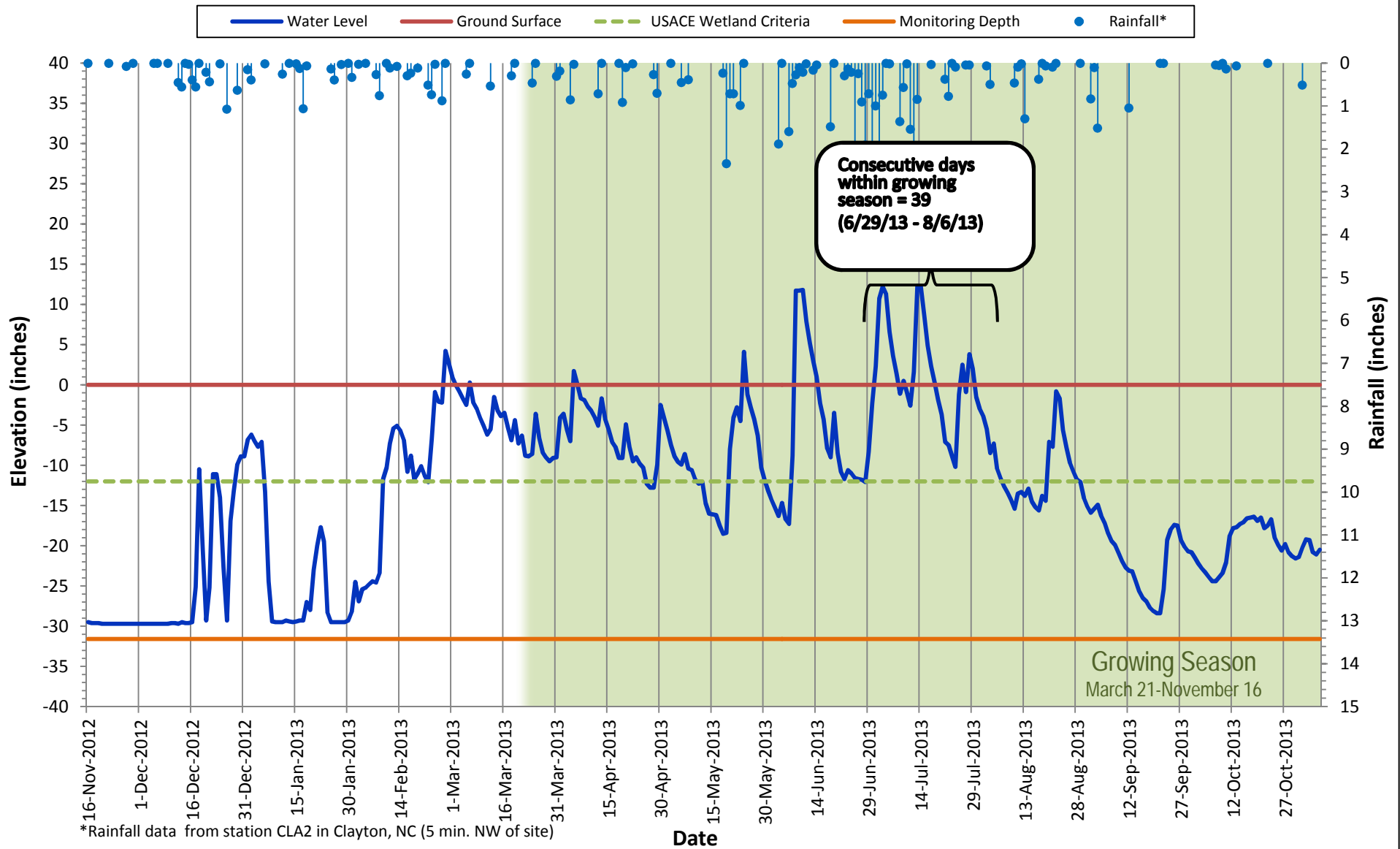
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

## Shallow Water Table Gauge B2

November 16, 2012 - November 6, 2013  
 Growing Season: March 21 - November 16

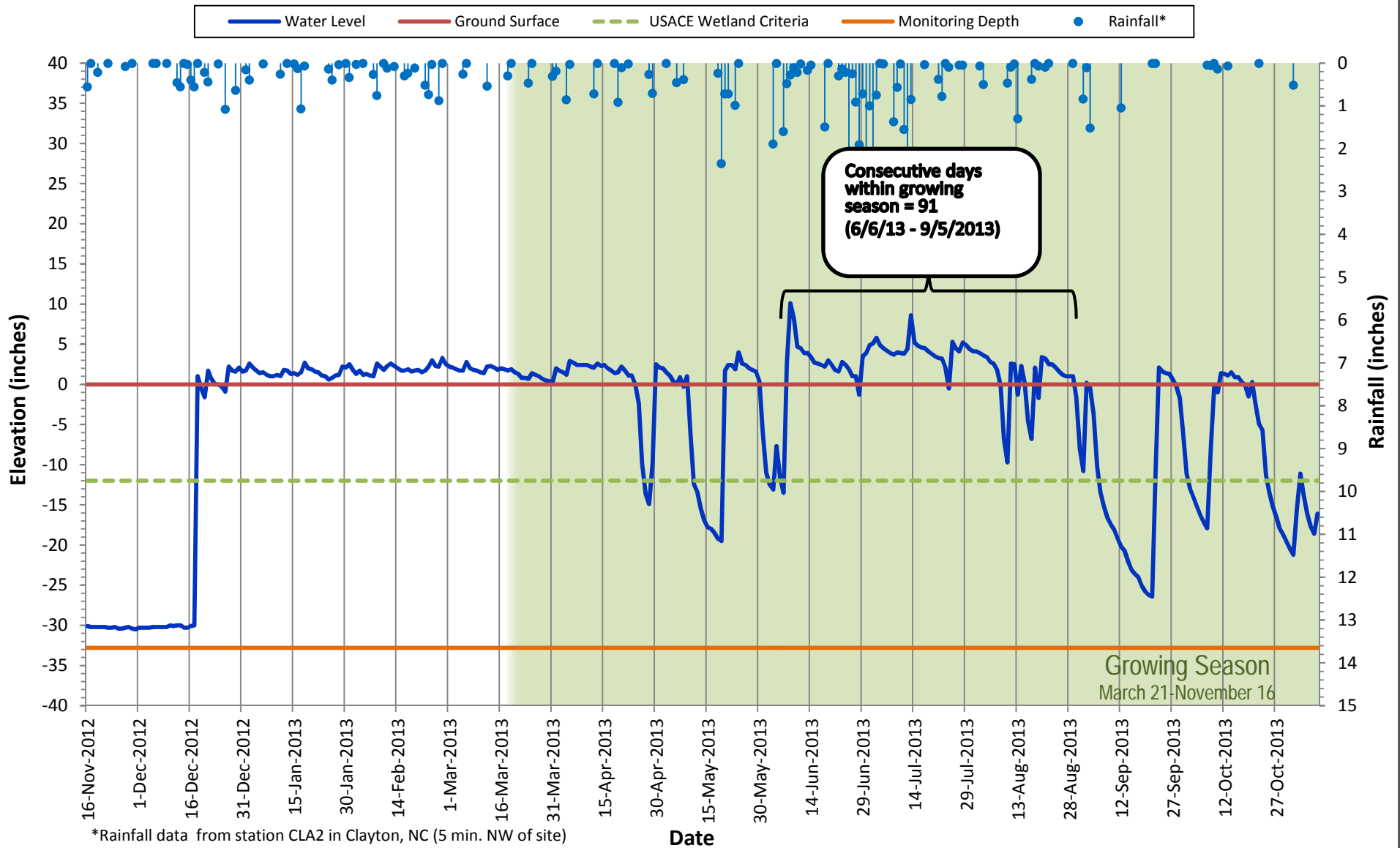


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)



# Shallow Water Table Gauge C2

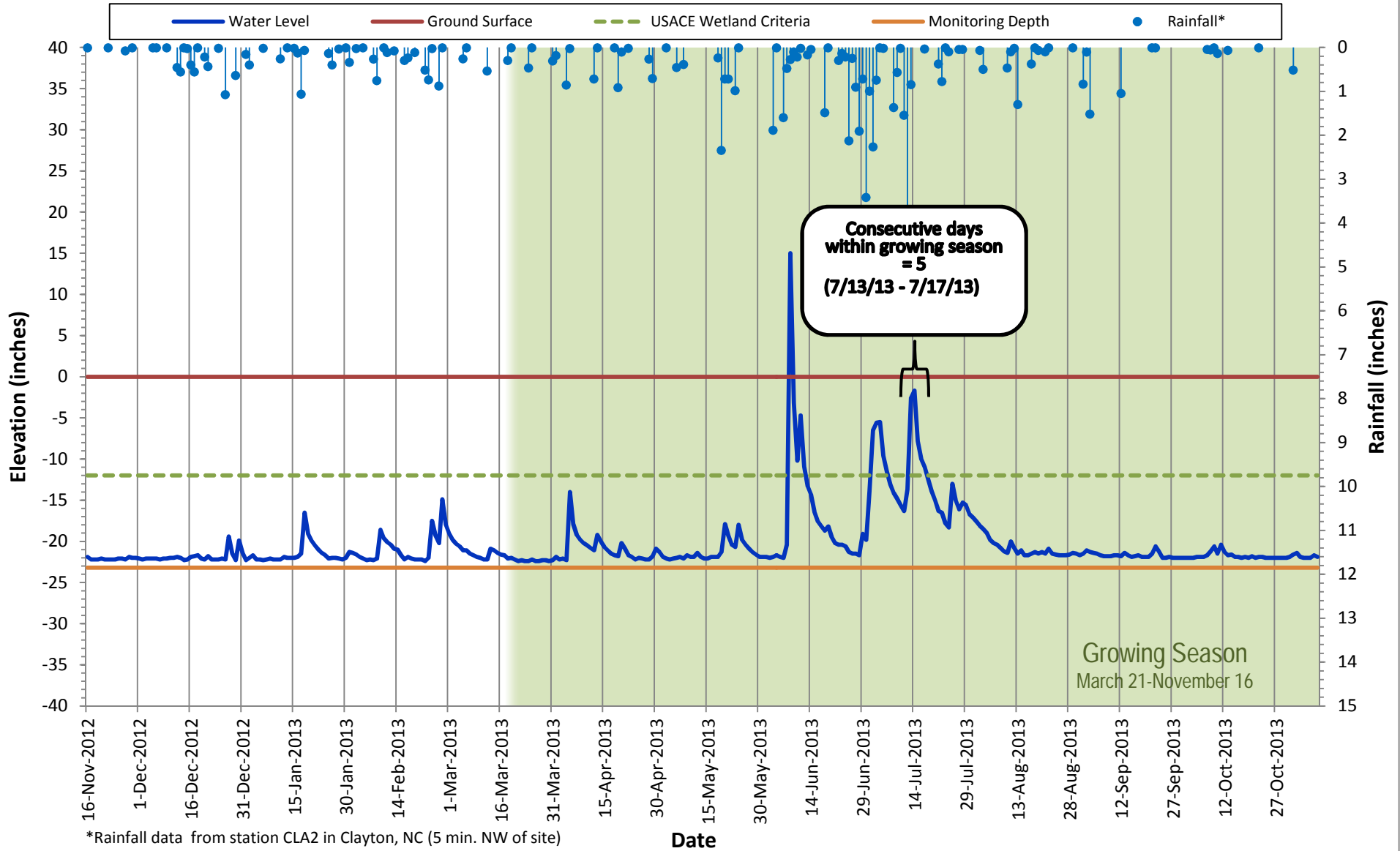
November 16, 2012 - November 8, 2013  
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge D2

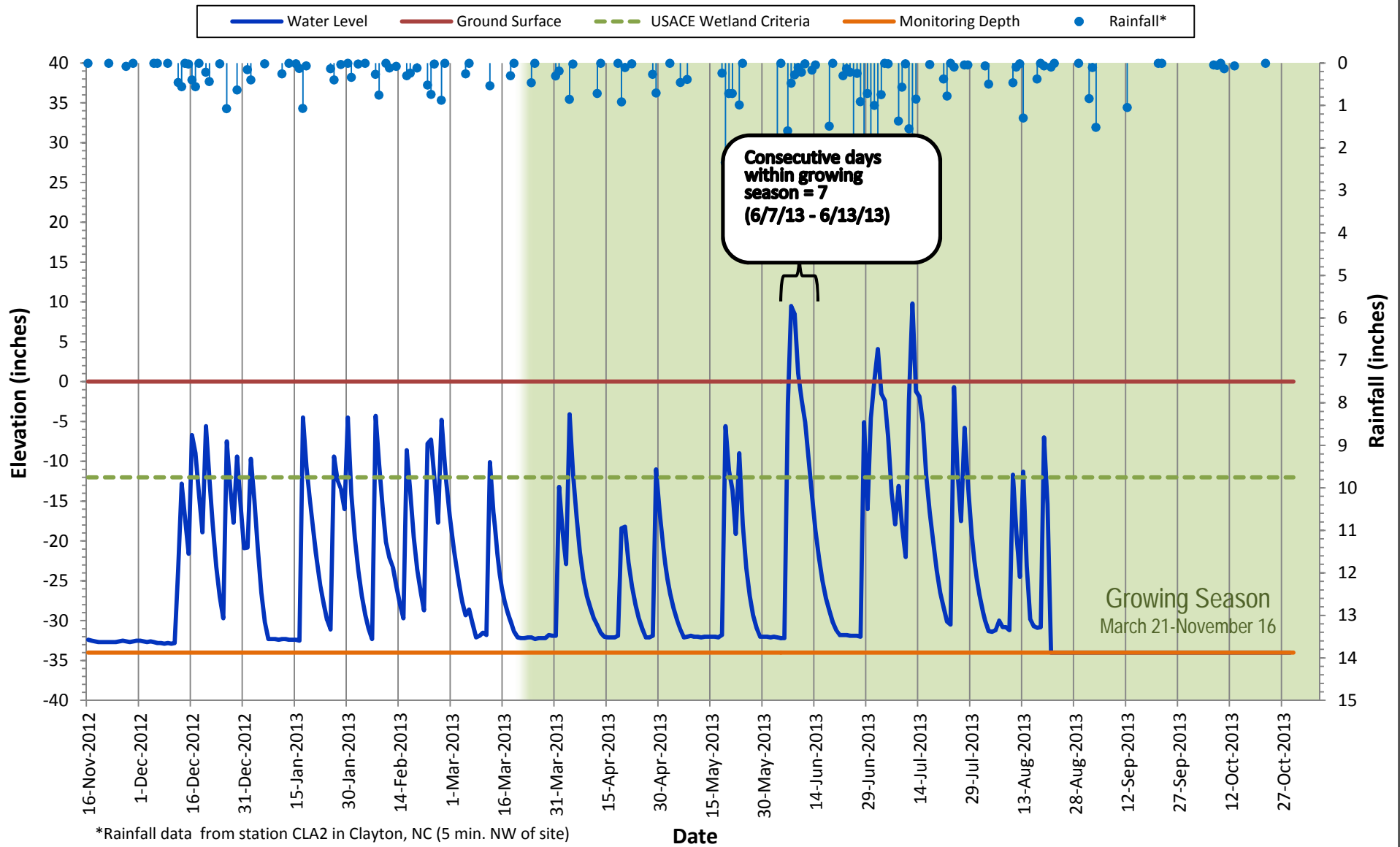
November 16, 2012 - November 8, 2013  
 Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

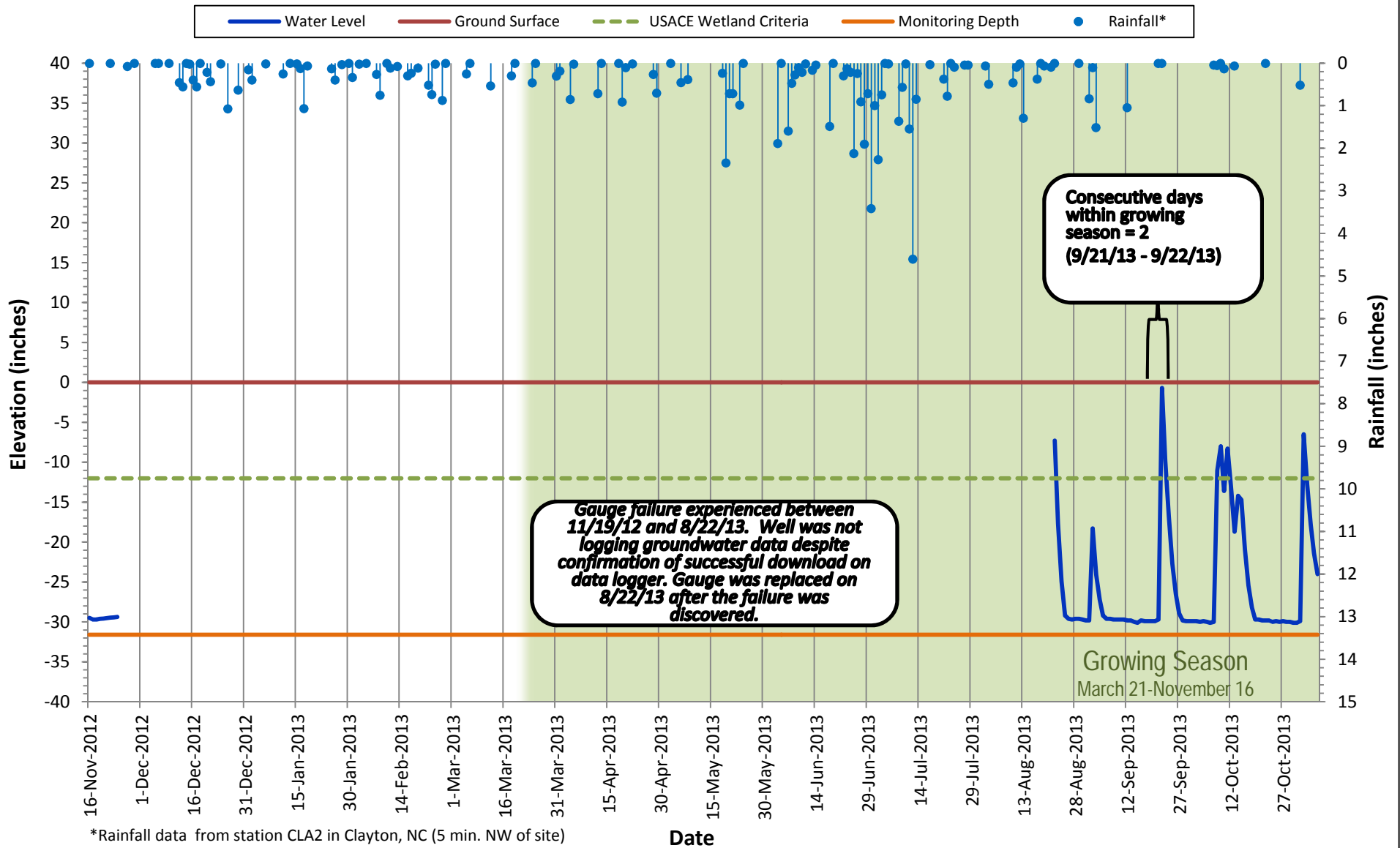
# Shallow Water Table Gauge E2

November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



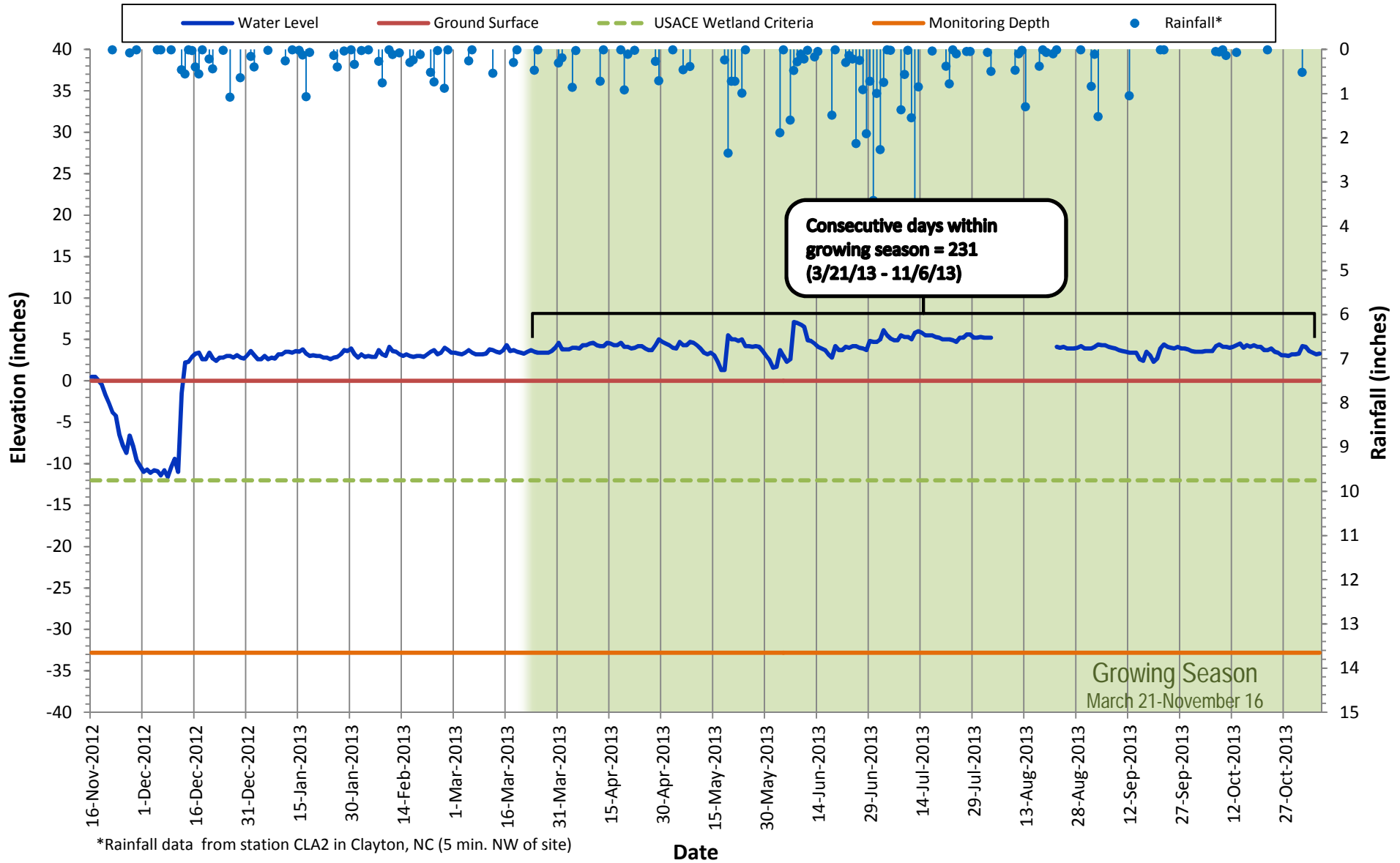
# Shallow Water Table Gauge F2

November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge A3

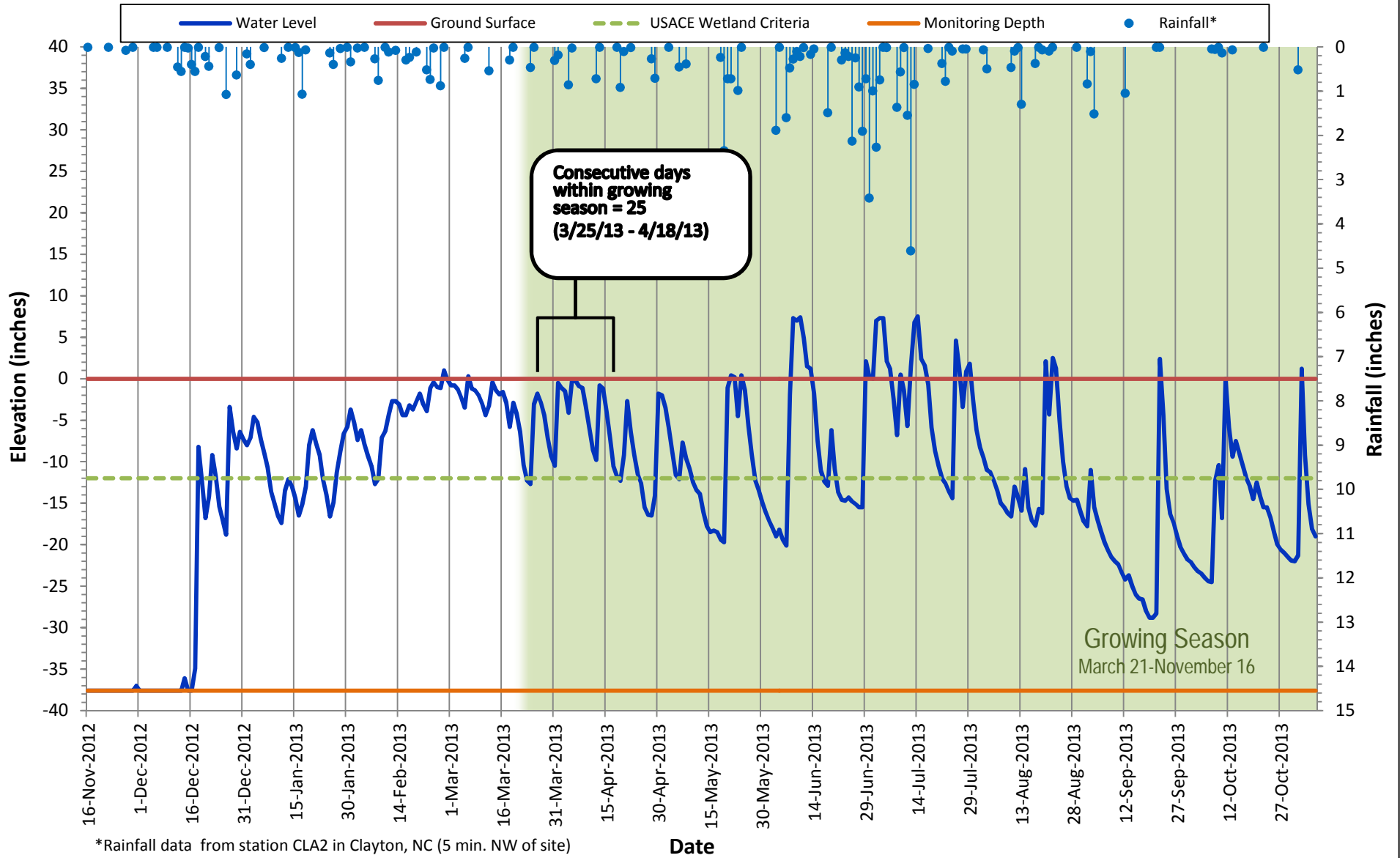
November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

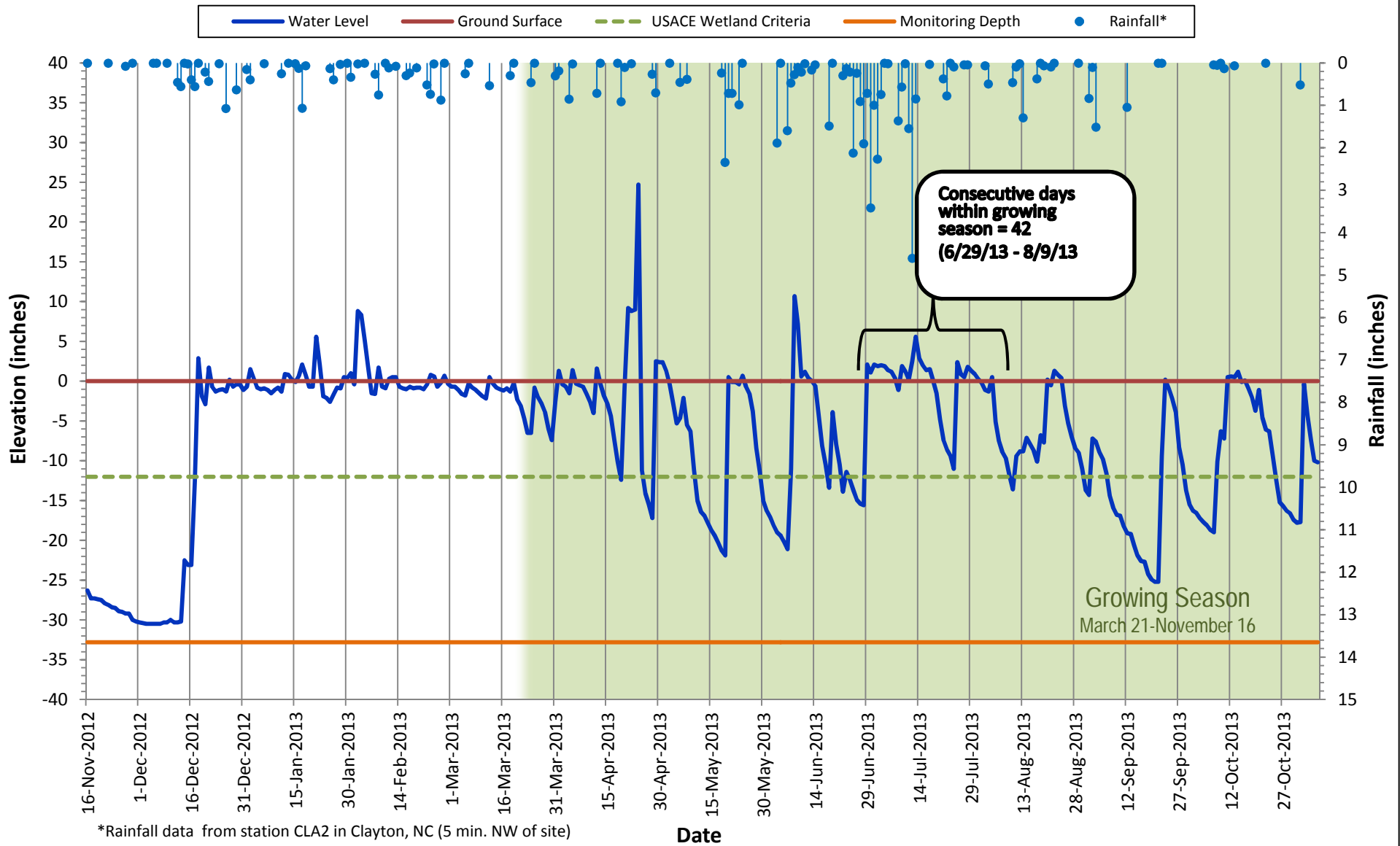
# Shallow Water Table Gauge B3

November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge A4

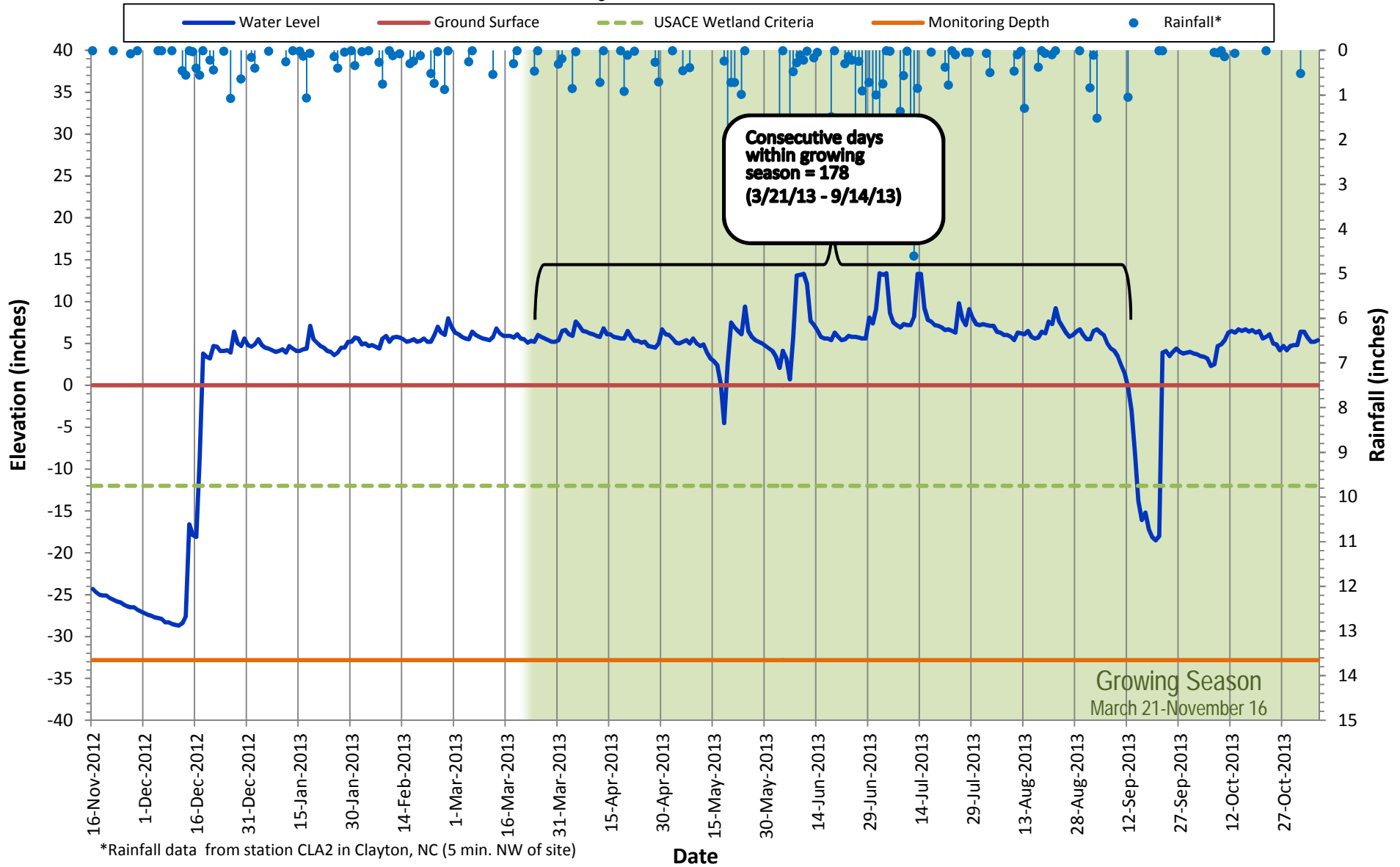
November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge B4

November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16

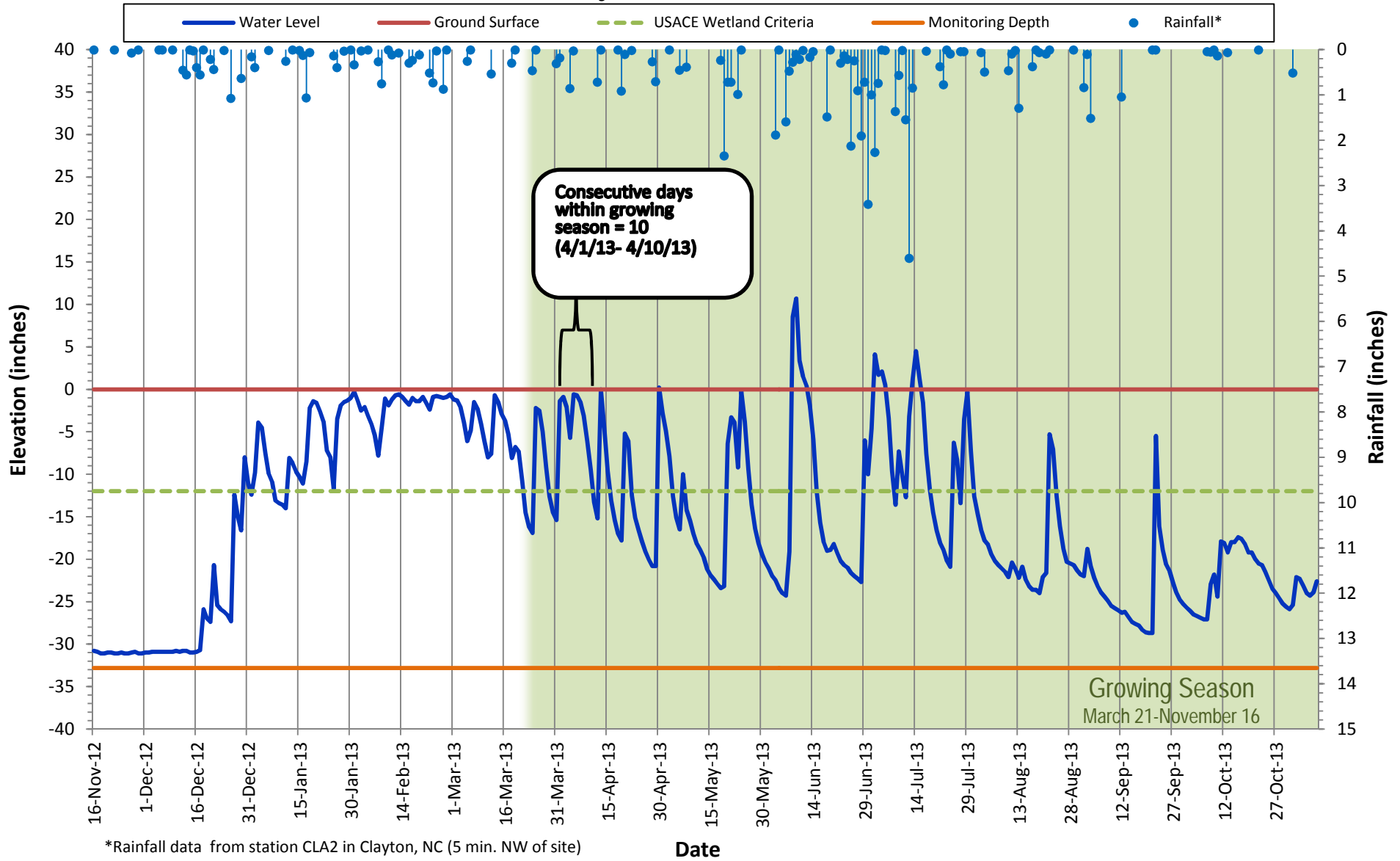


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)



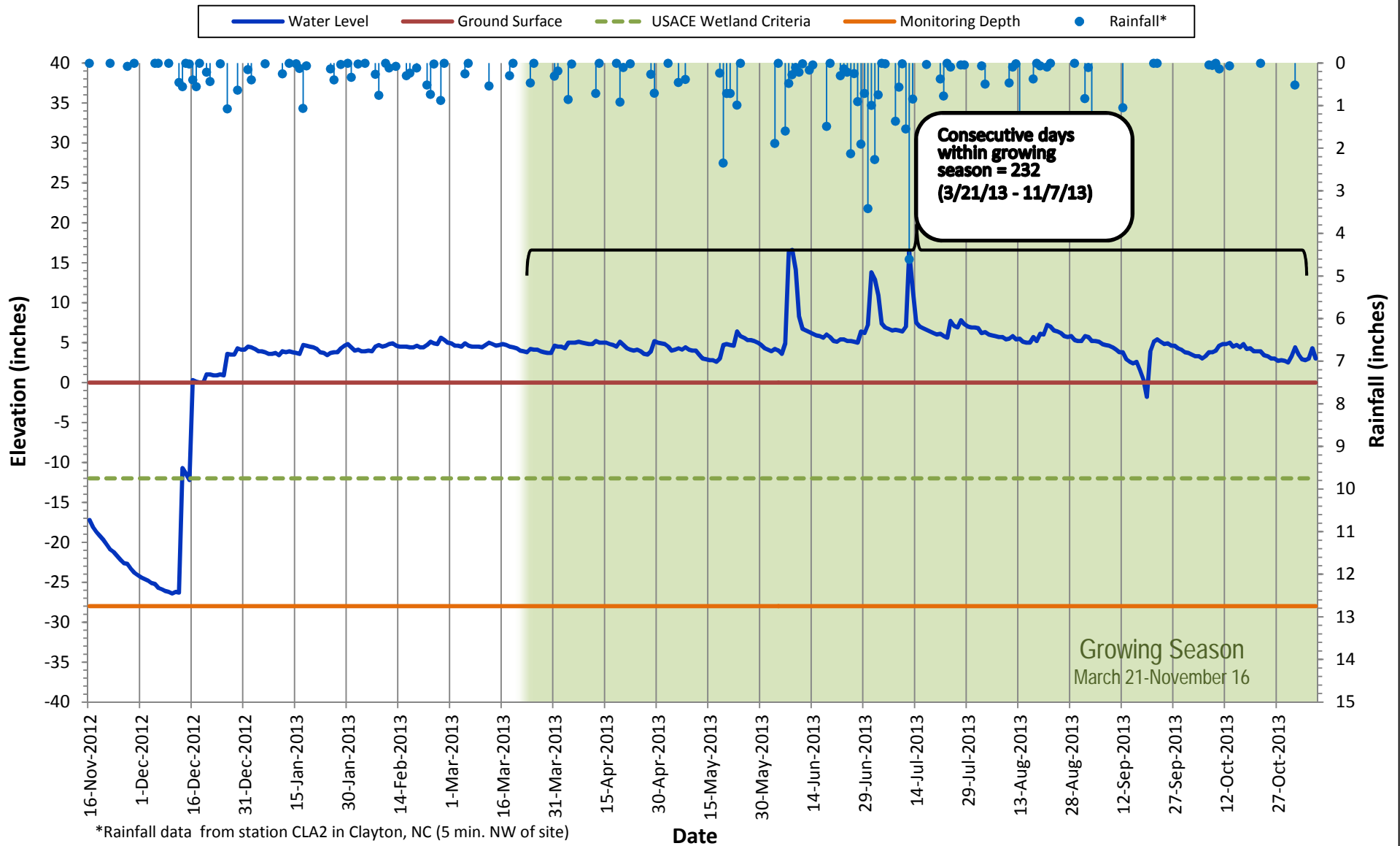
# Shallow Water Table Gauge C4

November 16, 2012 - November 8, 2013  
Growing Season: March 21 - November 16



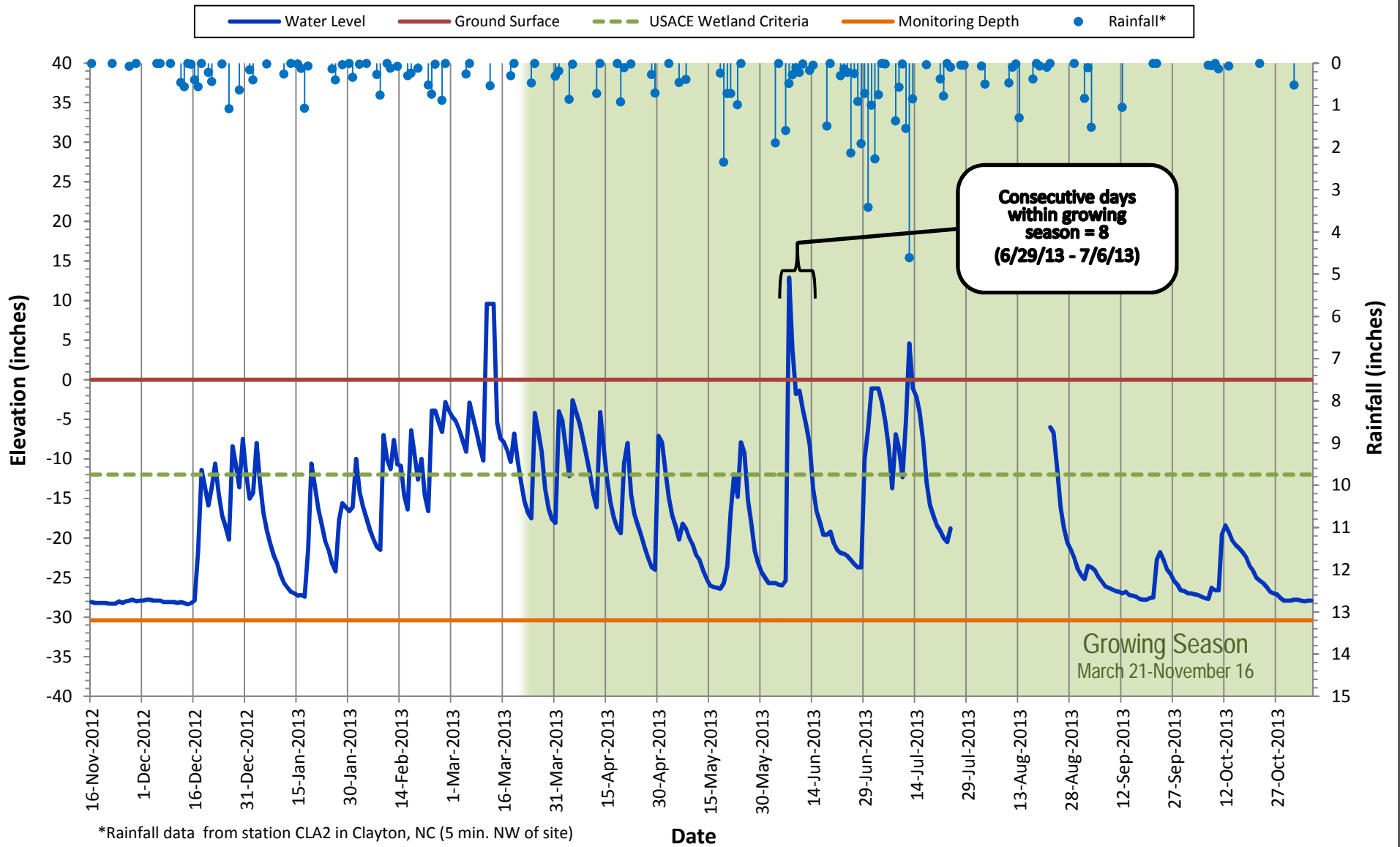
# Shallow Water Table Gauge D4

November 16, 2012 - November 7, 2013  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge E4

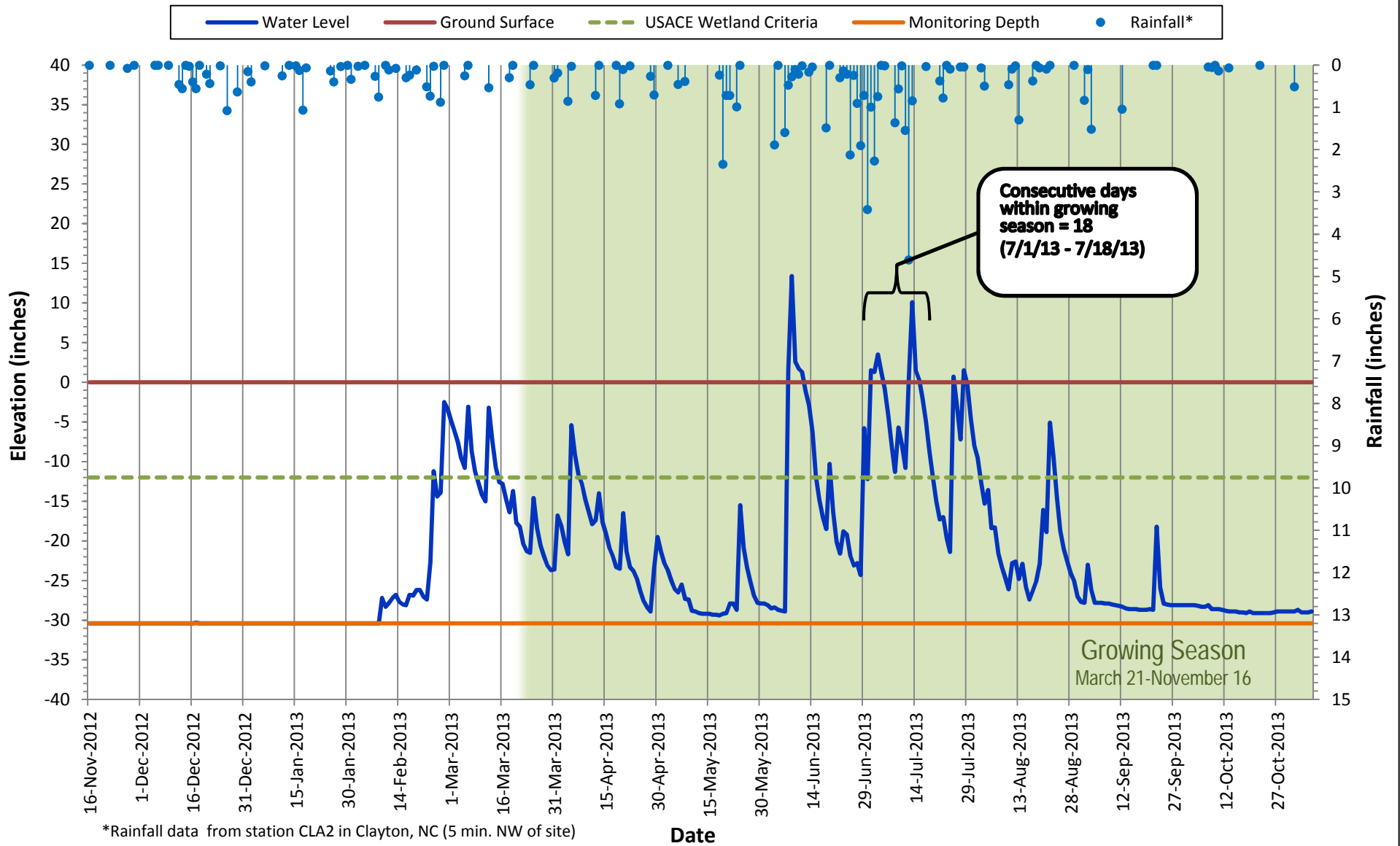
November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

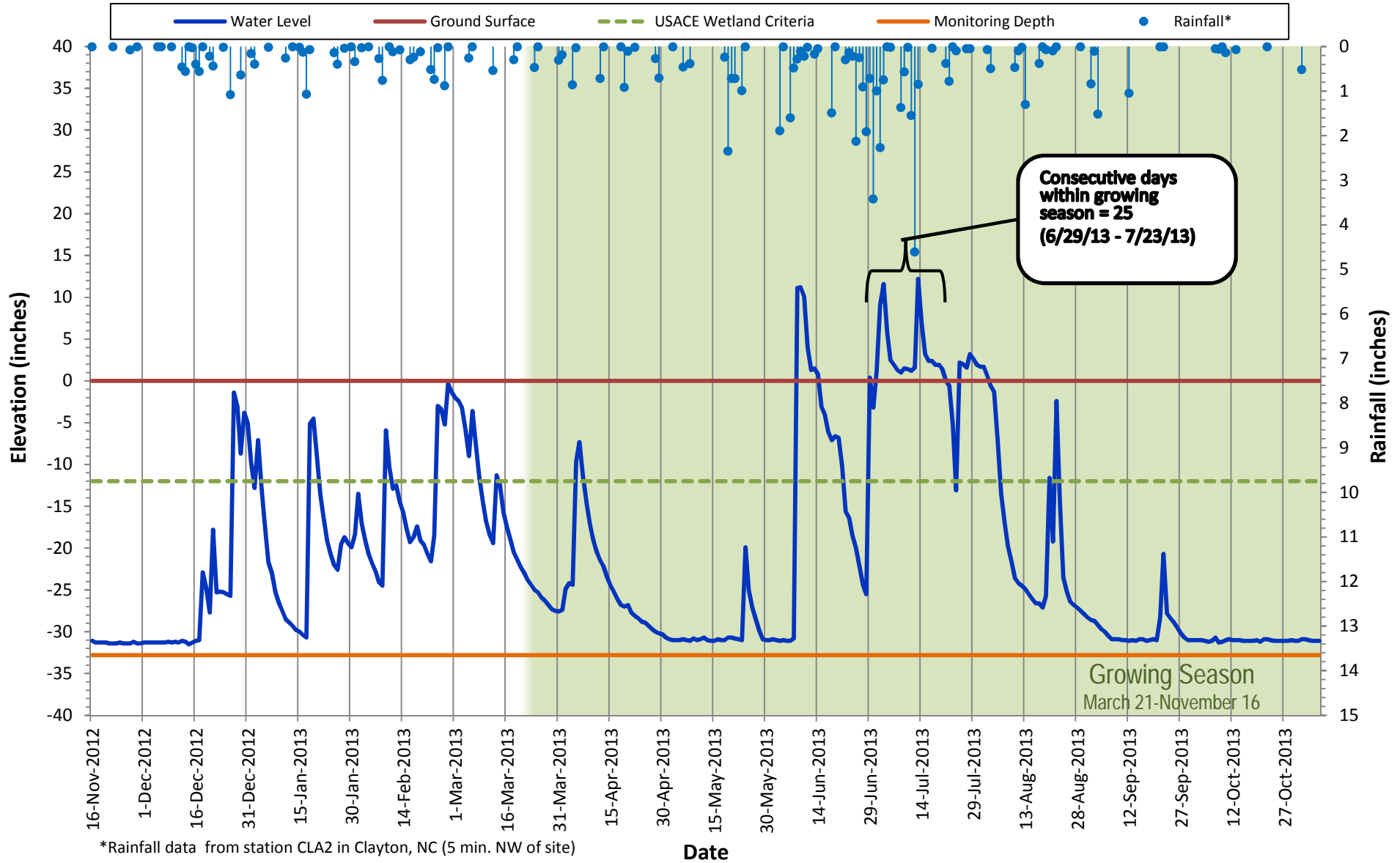
## Shallow Water Table Gauge F4

November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge G4

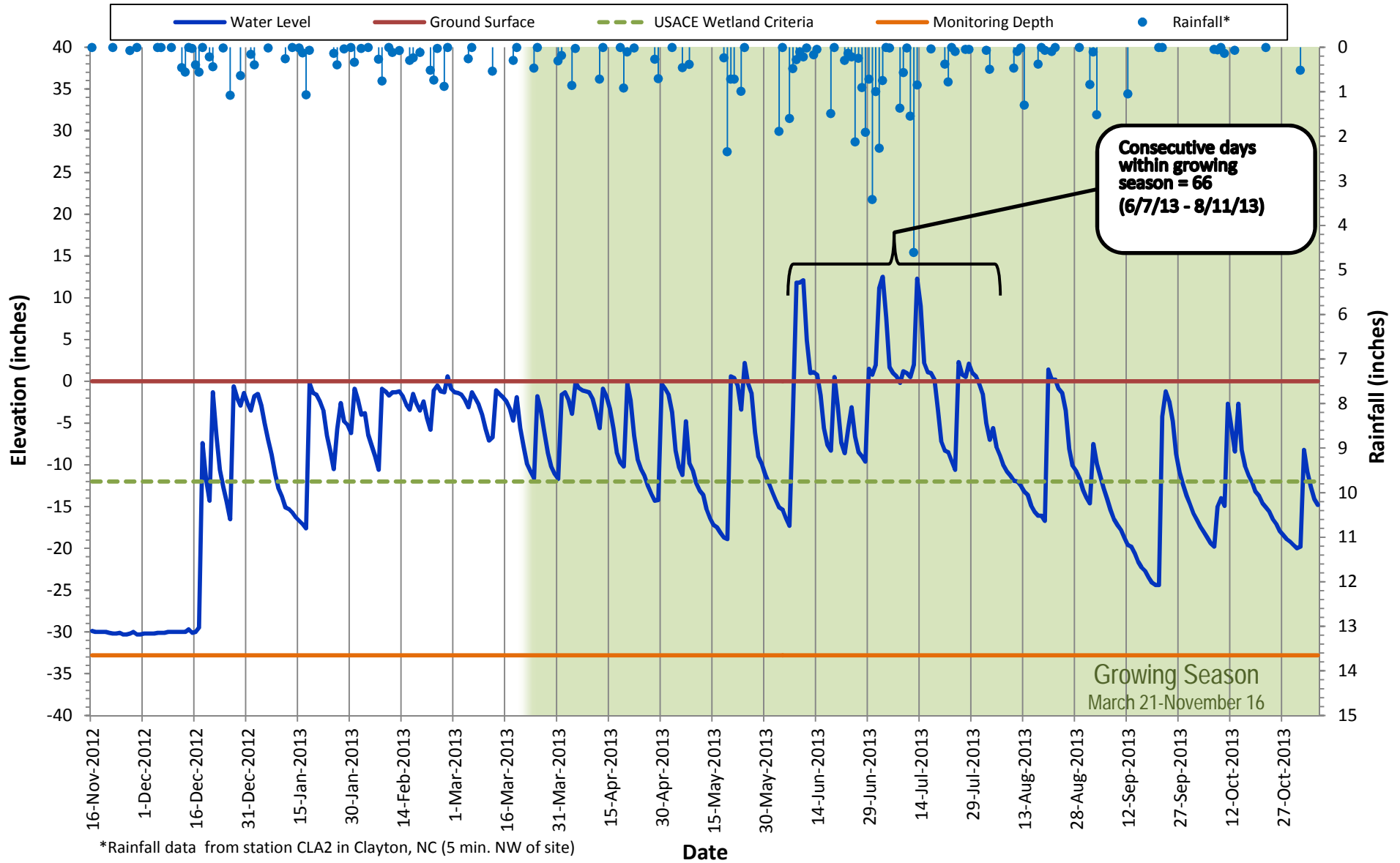
November 16, 2012 - November 6, 2013  
Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge B5

November 16, 2012 - November 6, 2013  
 Growing Season: March 21 - November 16

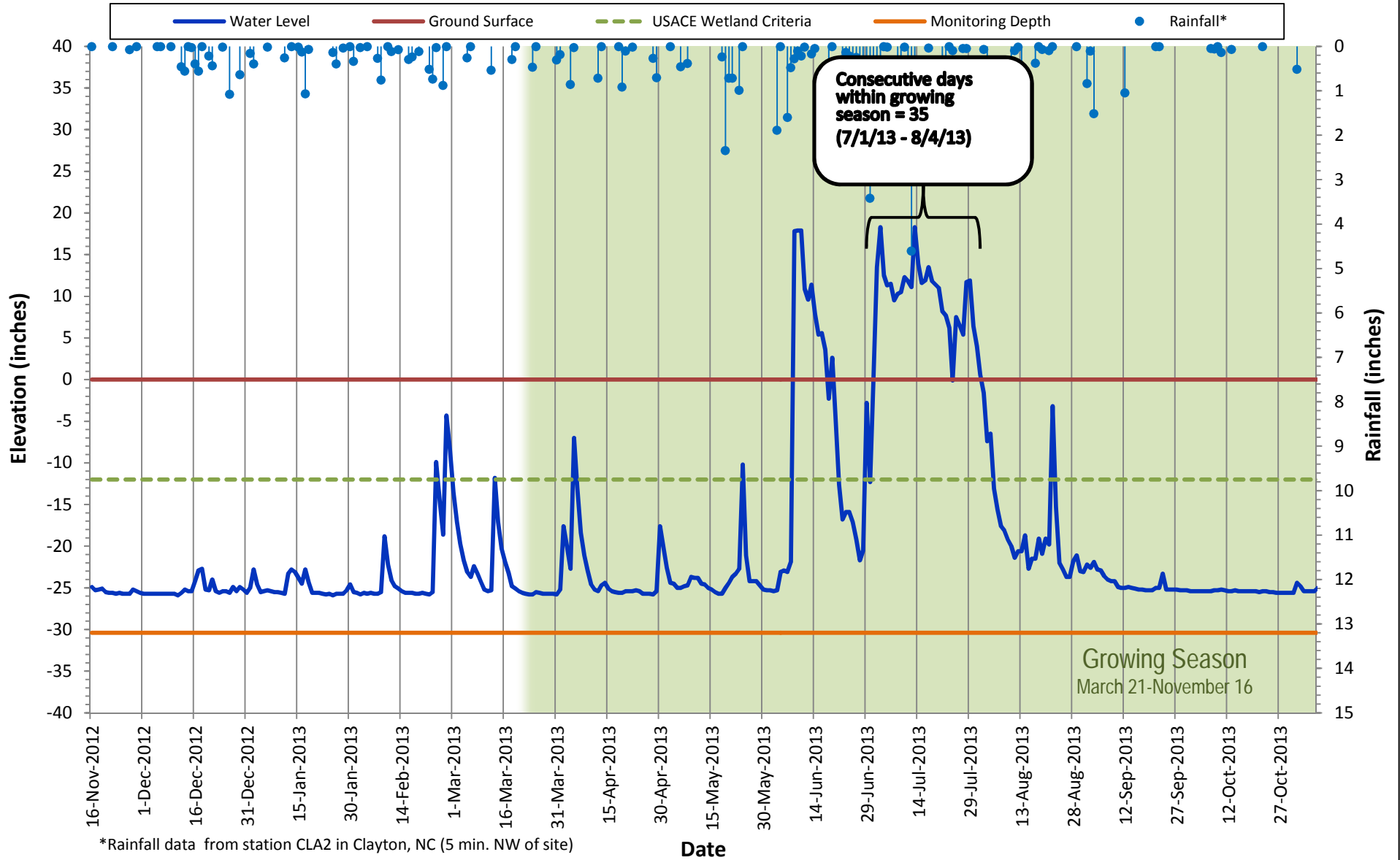


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge REF-B

November 16, 2012 - November 6, 2013

Growing Season: March 21 - November 16

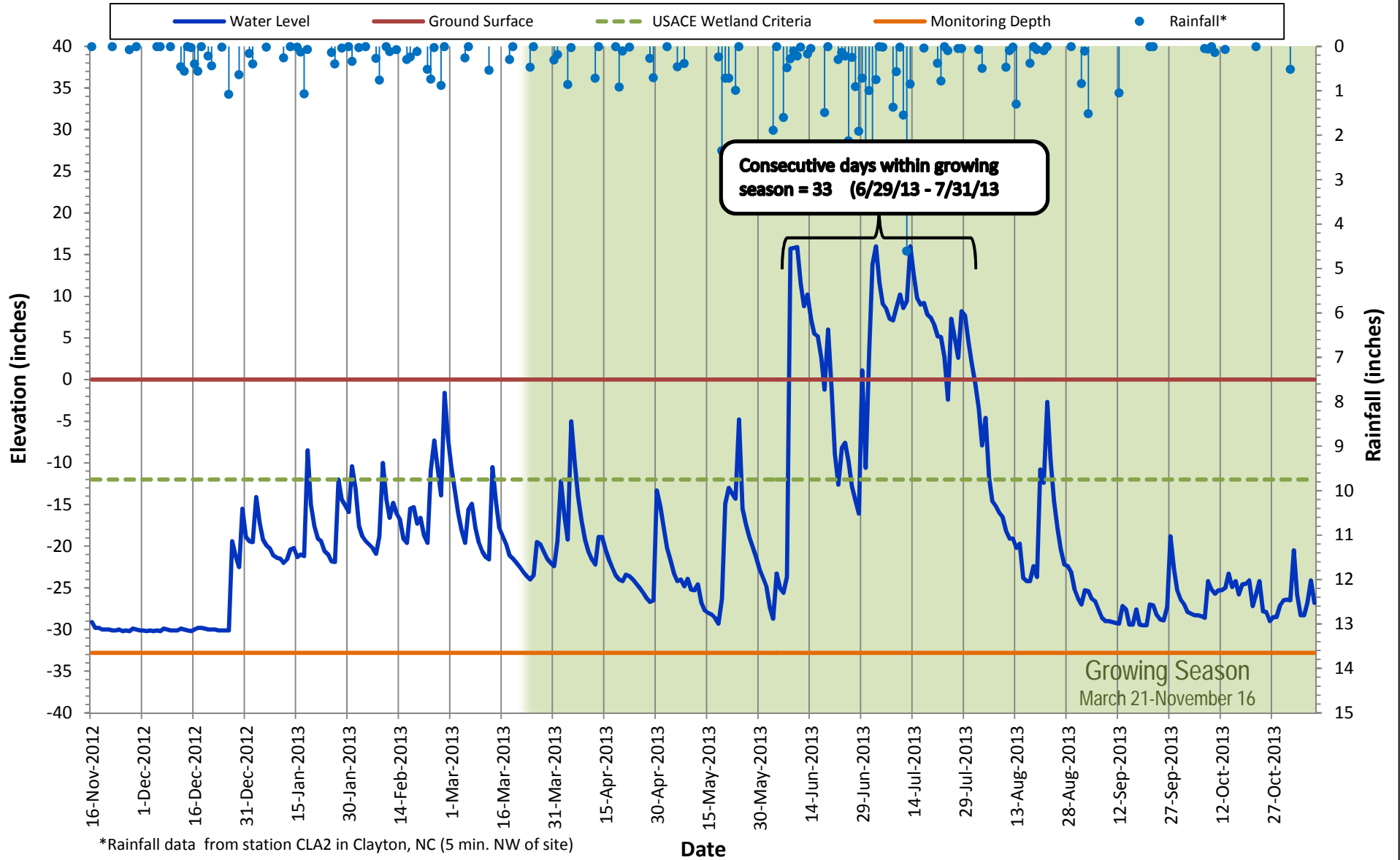


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge REF-C

November 16, 2012 - November 8, 2013

Growing Season: March 21 - November 16

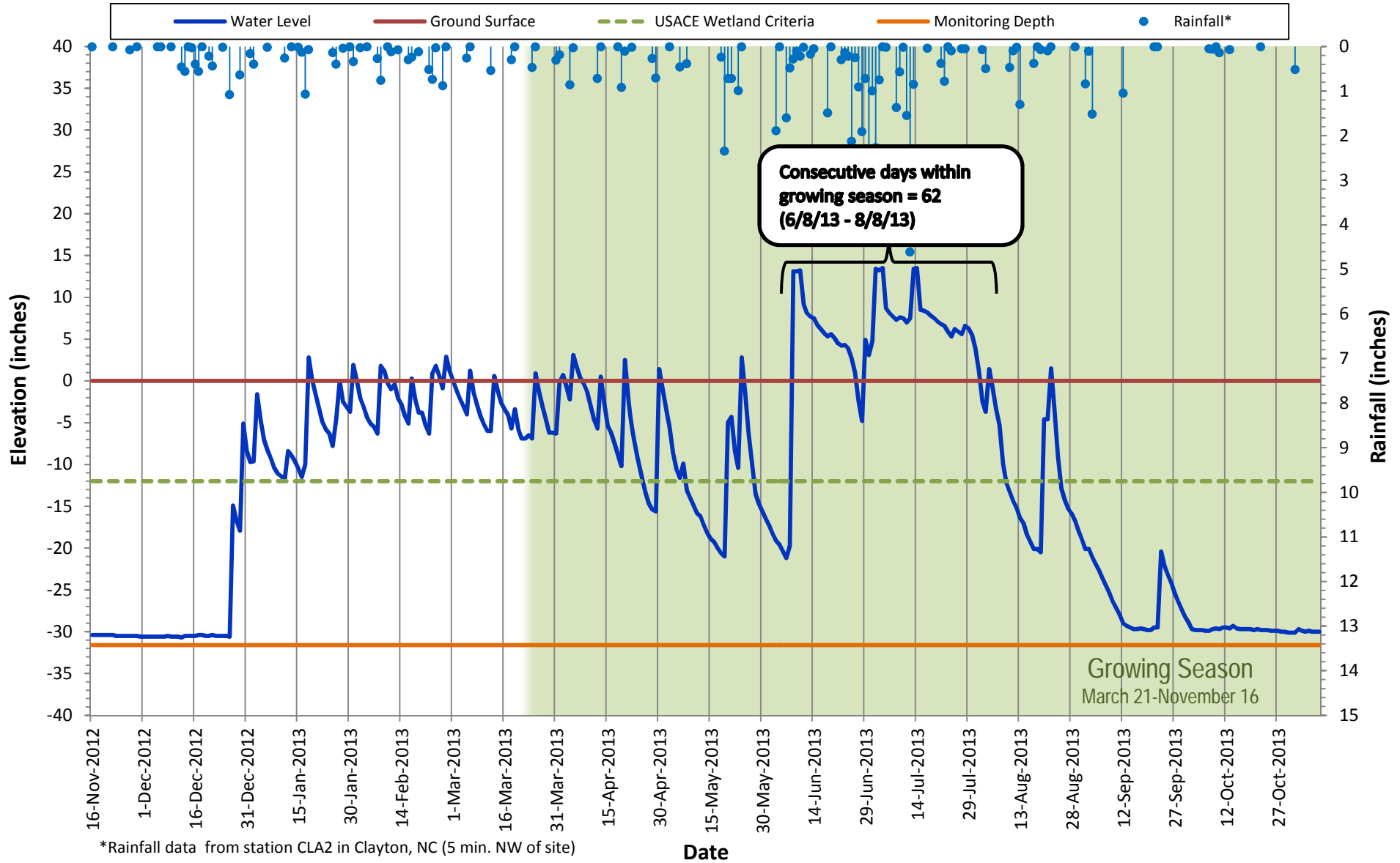


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)



# Shallow Water Table Gauge REF-D

November 16, 2012 - November 8, 2013  
 Growing Season: March 21 - November 16

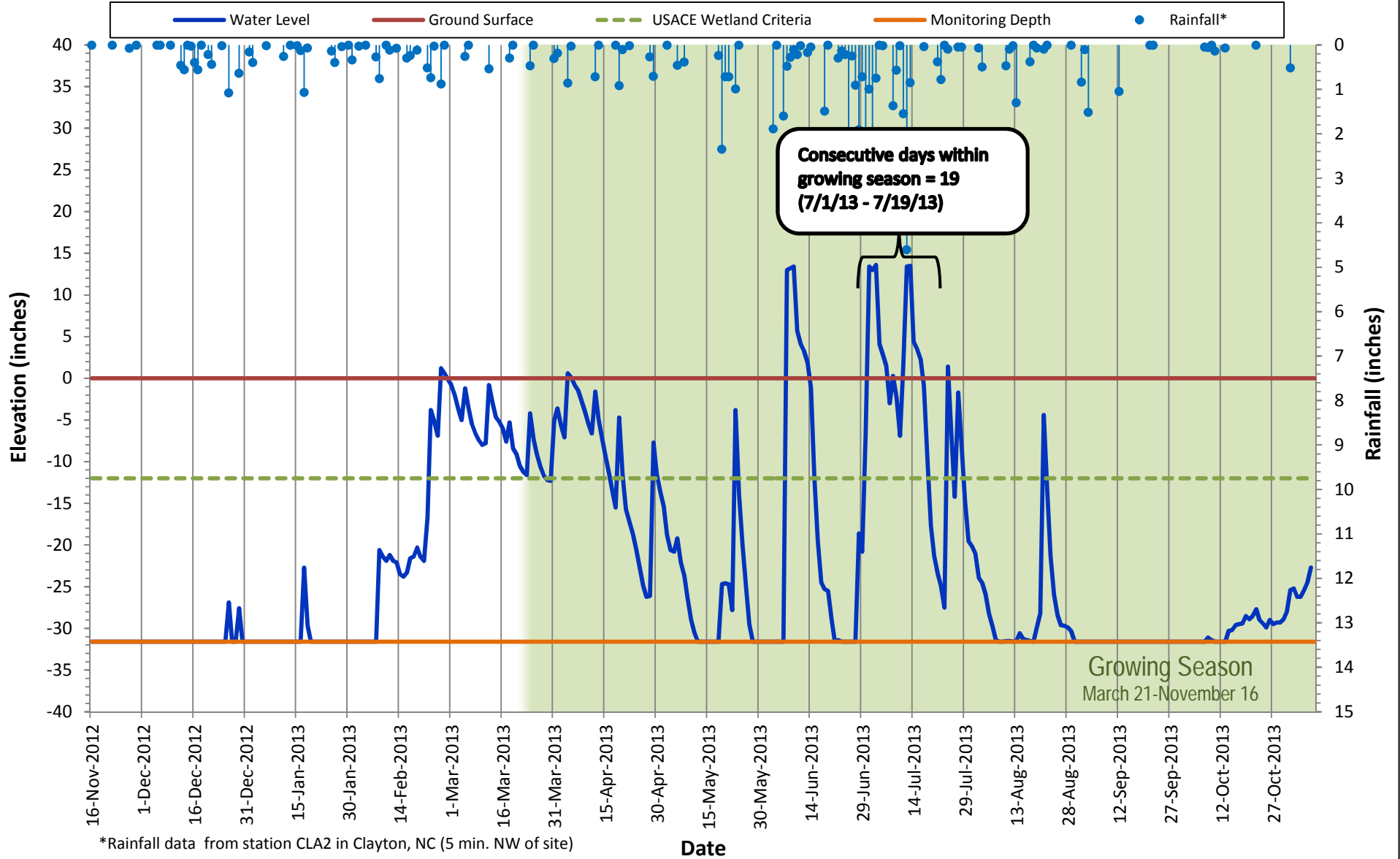


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge REF-E

November 16, 2012 - November 8, 2013

Growing Season: March 21 - November 16

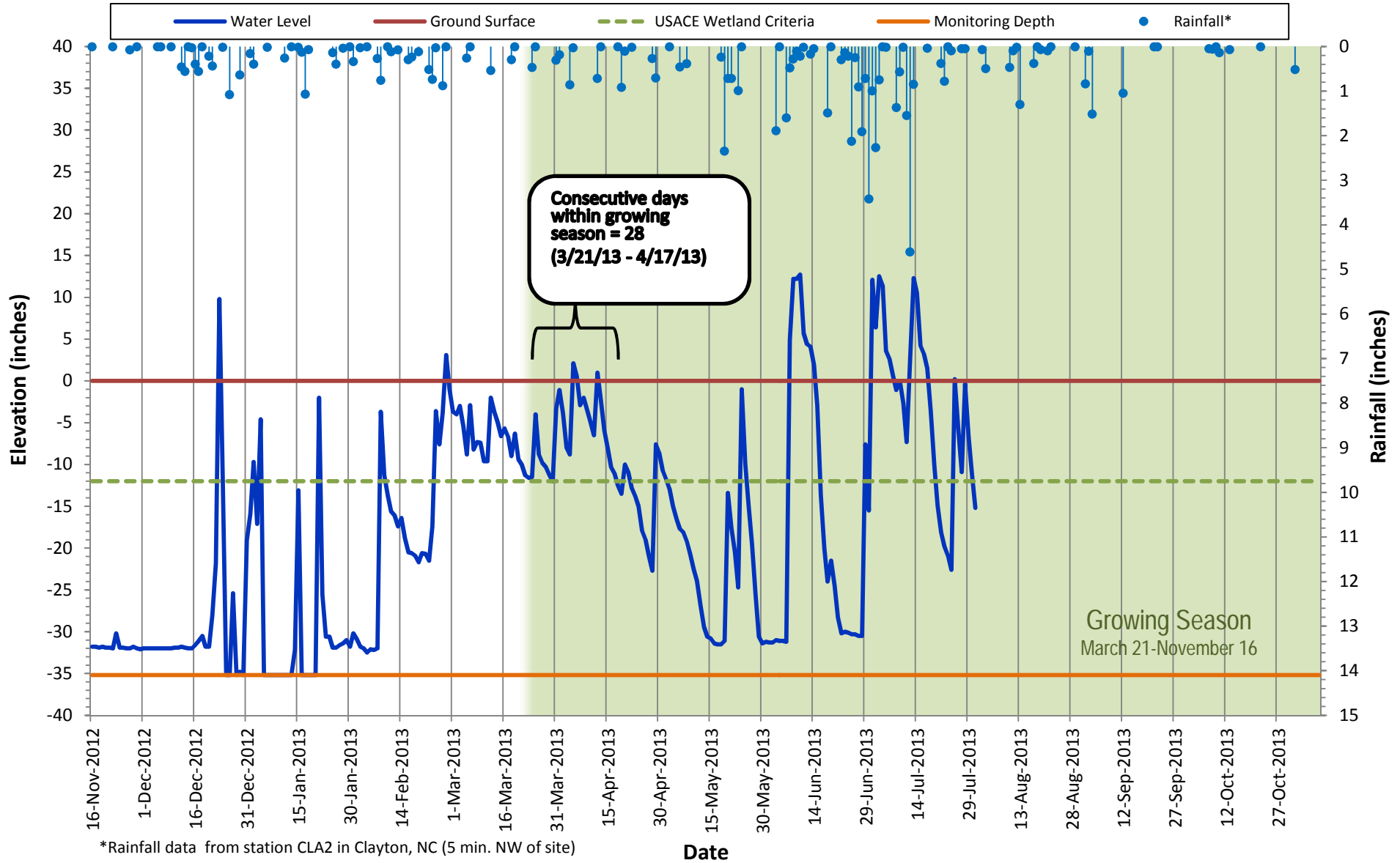


\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

# Shallow Water Table Gauge REF-F

November 16, 2012 - November 8, 2013

Growing Season: March 21 - November 16



\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)