

# Moore Property Monitoring Report FINAL Year 1 (2011)

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 2011

## **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 flooding 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 including in the Site's restoration.

<b>Project Asset Table</b>		
Project Asset	Restoration Acreage	Mitigation Ratio
RPN	5.7	
WED	10.4	1:1
TOM-A	39.8	1:1
TOM-B	1.3	1:1

KHA performed wetland monitoring in the fall of 2011 for this Year 1 Monitoring Report with the site visit occurring on November 21<sup>st</sup>, 22<sup>nd</sup>, and 30<sup>th</sup>, 2011. 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 2011 monitoring year.

<b>Rainfall by Month for 2011 Monitoring Year (Year 1)</b>							
Month	Year	Rainfall* (in)	Average Rainfall** (in)	Month	Year	Rainfall* (in)	Average Rainfall** (in)
November	2010	1.12	3.14	May	2011	11.15	3.76
December	2010	2.42	3.15	June	2011	2.71	3.74
January	2011	1.3	4.17	July	2011	11.36	5.04
February	2011	2.98	3.66	August	2011	9.19	4.56
March	2011	3.77	4.23	September	2011	3.3	4.35
April	2011	10.99	3.00	October	2011	2.93	3.14
Total for Monitoring Year = 63.22 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 assessed as part of the Year 1 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 1 Monitoring site visit:

- The areas 124.5' and lower typically had ponded water at the surface after a recent rainstorm event, and the entire wetland was covered by hydrophilic vegetation.
- With the site observation on 11/30/2011 occurring more than 24 hours after a rainfall event, it was encouraging to see the surface water storage capacity of the wetland and that minimal water (less than 1 CFS) was flowing over the emergency spillway. This indicates a longer duration of surface water storage for infiltration as the water table rises to seasonal high water mark in the dormant season.
- The wetland appears to be trending 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 two bankfull events in the monitoring year. 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 crest gauge indicating a bankfull event does not necessarily mean that the floodplain and wetland were accessed by floodwaters from Swift Creek.

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). Nine (9) of the sixteen (16) groundwater gauges indicate that the wetland is meeting the minimum success wetland hydrology for the site. Groundwater gauges C2 and B5 did not record a full growing season; however gauge C2 still met the success criteria with 47 consecutive days of the water table within 1 foot of the ground surface.

### **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. Also the minimum success criteria includes the density and growth of characteristic forest species. For wetlands, a minimum mean density of 260 characteristic trees species (planted and volunteer stems) per acre must be surviving for five (5) years after initial planting. For riparian buffers, a minimum mean density of 320 characteristic trees species (planted stems only) per acre must be surviving for five (5) 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 RBR 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 (16) vegetation quads, 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 1 Monitoring site visit on November 30<sup>th</sup>, 2011:

- Currently two (2) of the four (4) riparian vegetation plots (VQ-11, VQ-12, VQ-14, and VQ-16) are meeting the minimum success criteria of 320 stems/acre.
- Additionally, eight (8) of the twelve (12) 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 260 woody stems/acre.
- The vegetation quads exhibited an average mortality of 34.8% between the baseline monitoring assessment in January 2011 and this year's monitoring assessment. A more detailed analysis of the vegetation condition can be found in Appendix C, Table 8.
- Cattails (*Typha latifolia*) have begun to establish in the wetland swale, however the size of the invasive population was below the EEP mapping threshold (1,000 square feet) for the Current Conditions Plan View.
- There were no bare areas identified during the site visit that were equal to or greater than the EEP mapping threshold for bare areas (0.1 acres). There were small isolated areas of weak herbaceous growth (Appendix B, Photo SP2). These areas were also below the EEP mapping threshold.
- The herbaceous vegetation has vigorously propagated throughout the project site except for the previously mentioned minor areas. Upon inspection, it appeared that most of the herbaceous vegetation was planted as part of the temporary or permanent seed mix.
- At this time, DWQ hasn't set an interim year criteria for riparian buffer restoration areas. However, a plot that only has 320 stems/acre in Year 1 won't likely meet the Year 5 criteria. Those plots should be closely watched and recommended as replant areas as necessary in future years.

## 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.

## 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)

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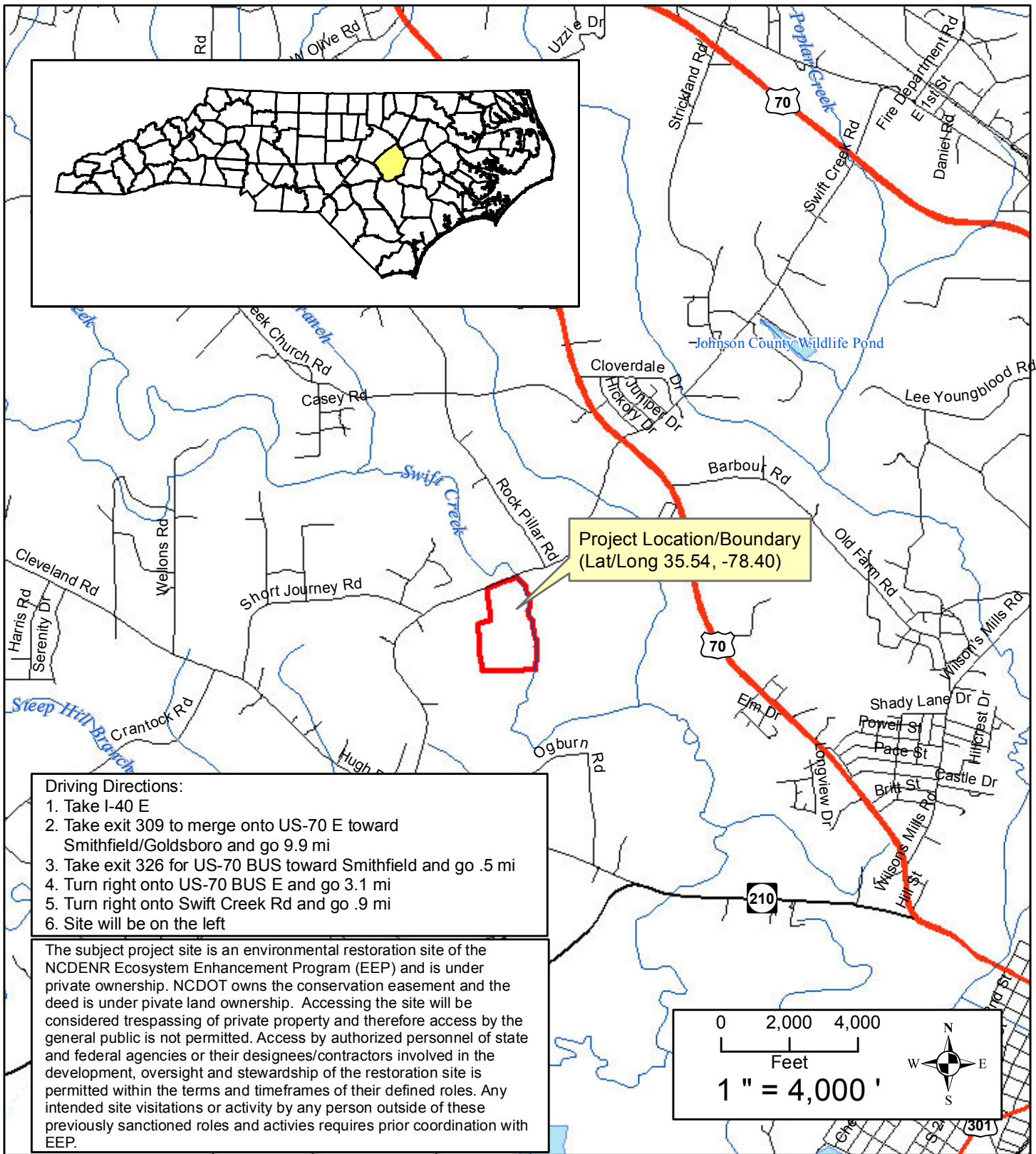
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**APPENDIX A**  
**PROJECT VICINITY MAP AND**  
**BACKGROUND TABLES**





<b>Title</b>		<b>Vicinity Map</b>		
Prepared For: 	<b>Project</b>	Moore Property Monitoring Report (725) 2011 - Year 1 Johnston County, North Carolina		
	<b>Date</b>	<b>KHA Project Number</b>	<b>Figure</b>	
	11/28/2011	011795033	1	

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

**Moore Property/725**

**Mitigation Credits**

	Stream		Riparian Wetland		Non-riparian Wetland		Neuse Riparian Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
	R	RE	R	RE	R	RE			
Type									
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	
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	27
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

- 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	Chad Evenhouse (919) 677-2121
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**



**LEGENDS AND SYMBOLS**

Monitoring Locations

- Crest Gauge
- Groundwater Gauge (Criteria Met)
- Groundwater Gauge (Criteria not Met)
- Groundwater Gauge (Criteria Undetermined)

Monitoring Vegetation Plots

- Has not met Success Criteria
- Has met Success Criteria



Photo Point

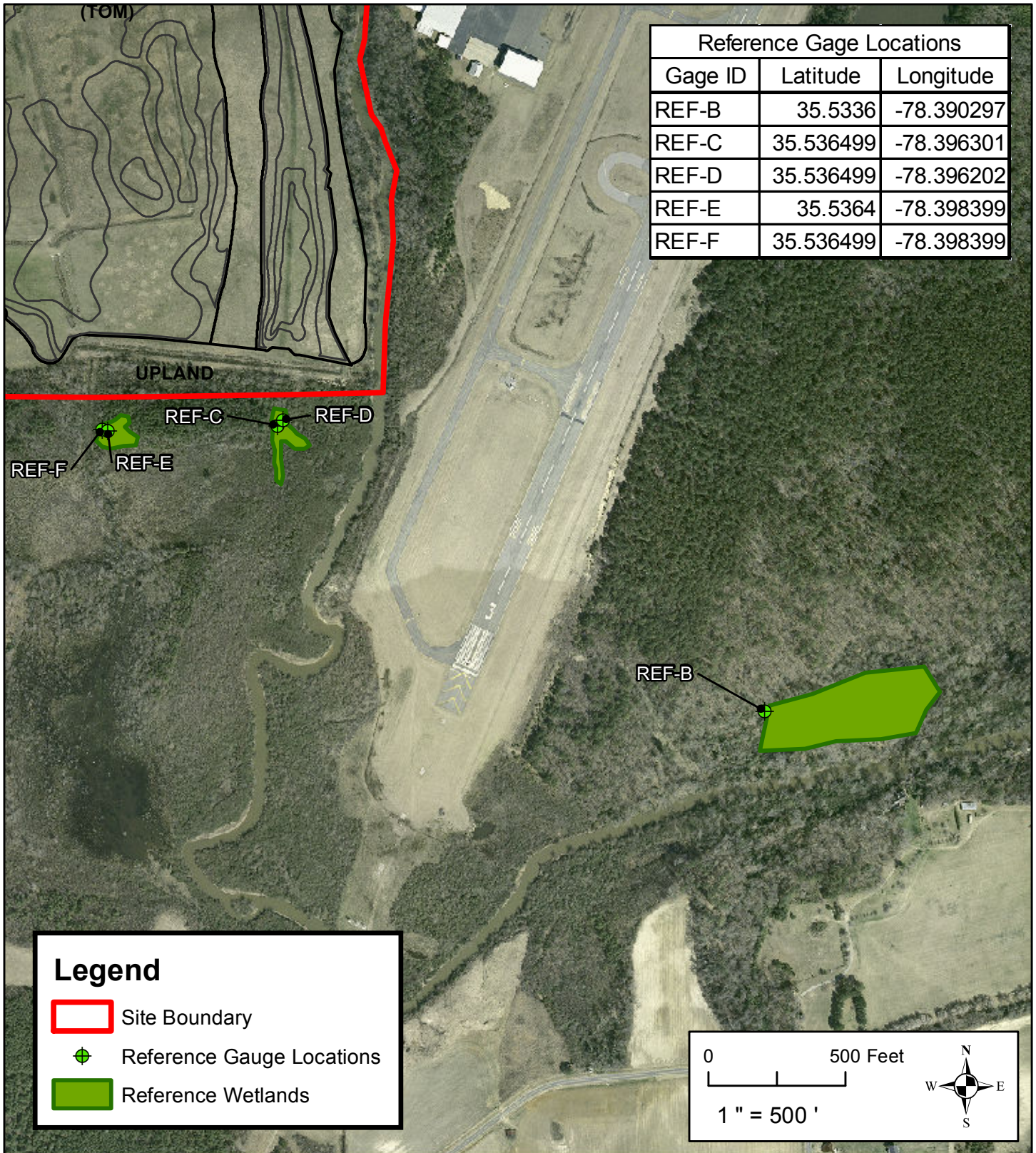
Site Boundary

Vegetation Condition

- Good Growth
- Bare Area
- Low Stem Density Area
- Area of Poor Growth Rate or Vigor
- Invasive Area of Concern
- Easement Encroachment



<b>Title</b>	<b>Current Conditions Plan View (2010 Aerial)</b>		
<b>Prepared For:</b>	<b>Project</b>	Moore Property Monitoring (725) 2011 - Year 1 Johnston County, NC	
		<b>Date</b> 01/24/2012	<b>KHA Project Number</b> 011795033



**Title** Reference Gauge Locations

Prepared For:



**Project**

Moore Property Monitoring (725) 2011 - Year 1  
Johnston County, North Carolina

Date  
1/5/2012

KHA Project Number  
011795033

Figure  
3



**Table 6** **Vegetation Condition Assessment**

**Planted Acreage<sup>1</sup>** **56.9**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
<b>Total</b>				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
<b>Cumulative Total</b>				0	0.00	0.0%

**Easement Acreage<sup>2</sup>** **97.5**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern <sup>4</sup>	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas <sup>3</sup>	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

<sup>1</sup> = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

<sup>2</sup> = The acreage within the easement boundaries.

<sup>3</sup> = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1, 2 or 3) as well as a parallel tally in item 5.

<sup>4</sup> = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likely trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where *isolated* specimens are found, particularly early in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolizing invasives polygons, particularly for situations where the condition for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.



PP1 (2011)



PP2 (2011)



PP3 (2011)



PP4 (2011)



SP1 (2011)

Bankfull events recorded by crest gauge



SP2 (2011)

Low herbaceous growth due to inundation



VQ1 (2011)



VQ2 (2011)



VQ3 (2011)



VQ4 (2011)



VQ5 (2011)



VQ6 (2011)



VQ7 (2011)



VQ8 (2011)





VQ9 (2011)



VQ10 (2011)



VQ11 (2011)



VQ12 (2011)



VQ13 (2011)



VQ14 (2011)



VQ15 (2011)



VQ16 (2011)

**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 Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean
VQ1	Coastal Plain Brownwater Bottomland	Y	63%								
VQ2		N									
VQ3		N									
VQ4		Y									
VQ7		Y									
VQ9		N									
VQ13		Y									
VQ15		Y									
VQ5	Coastal Plain Brownwater Swamp	Y	100%								
VQ6		Y									
VQ8		Y									
VQ10		Y									
VQ11	Coastal Plain Brownwater Levee (Riparian)	N	50%								
VQ12		Y									
VQ14		N									
VQ16		Y									

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

<b>Report Prepared By</b>	Josh Allen
<b>Date Prepared</b>	11/28/2011 10:36
<b>database name</b>	cvs-eeep-entrytool-v2.2.7.mdb
<b>database location</b>	K:\RAL_Environmental\011795 Moore Property Monitoring MOORE\Vegetation Data
<b>computer name</b>	DD83462
<b>file size</b>	36962304

**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
<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>	3,441,240
<b>Required Plots (calculated)</b>	61
<b>Sampled Plots</b>	16*

\* As approved by EEP





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

**Table 12. Verification of Bankfull Events\***

**Moore Property/725**

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
7/1/2011	N/A	Crest gauge indicated flow stage 1.0' over bankfull	SP1
11/1/2011	N/A	Crest gauge indicated flow stage 0.12' over bankfull	SP1

Approximate Bankfull Elevation = 120.3'

\* Bankfull Events are being monitored and recorded for the stream that receives the outlet waters from the Moore Property Wetland Restoration.

**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>									
Consecutive days within range	124'	34	29	44					
% of growing season		14.11%	12.03%	18.26%					
Criteria met?		Y	Y	Y					
<b>Groundwater Gauge REF-C</b>									
Consecutive days within range	124'	35	30	45					
% of growing season		14.52%	12.45%	18.67%					
Criteria met?		Y	Y	Y					
<b>Groundwater Gauge REF-D</b>									
Consecutive days within range	124'	43	--	--					No data from 9/2/2009 - 8/18/2011 (dead batteries). Replaced unit on 8/18/2011.
% of growing season		17.84%	--	--					
Criteria met?		Y	--	--					
<b>Groundwater Gauge REF-E</b>									
Consecutive days within range	123'	33	--	--					No data from 9/2/2009 - 8/18/2011 (dead batteries). Replaced unit on 8/18/2011.
% of growing season		13.69%	--	--					
Criteria met?		Y	--	--					
<b>Groundwater Gauge REF-F</b>									
Consecutive days within range	123'	34	27	39					
% of growing season		14.11%	11.20%	16.18%					
Criteria met?		Y	Y	Y					
<b>Average reference hydroperiod</b>	---	<b>36</b>	<b>29</b>	<b>43</b>					
<b>Consecutive number of days needed to meet the 50% deviation success criteria</b>	---	<b>18</b>	<b>15</b>	<b>22</b>					

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	---	56.25%					
<b>Groundwater Gauge B1</b>							
Consecutive days within range <sup>1</sup>	124.1'	68					
% of growing season <sup>2</sup>		28.22%					
Criteria met <sup>3</sup> ?		Y					
<b>Groundwater Gauge B2</b>							
Consecutive days within range	124.0'	50					
% of growing season		20.75%					
Criteria met?		Y					
<b>Groundwater Gauge C2</b>							
Consecutive days within range	124.5'	47					No data from 7/6/2011 - 11/30/2011 (dead batteries). Replaced unit on 11/30/2011.
% of growing season		19.50%					
Criteria met?		Y					
<b>Groundwater Gauge D2</b>							
Consecutive days within range	125.7'	0					To be replaced - data does not reflect field observations, possible gauge malfunction.
% of growing season		0.00%					
Criteria met?		N/A					
<b>Groundwater Gauge E2</b>							
Consecutive days within range	124.8'	0					To be replaced - data does not reflect field observations, possible gauge malfunction.
% of growing season		0.00%					
Criteria met?		N/A					
<b>Groundwater Gauge F2</b>							
Consecutive days within range	124.2'	4					
% of growing season		1.66%					
Criteria met?		N					
<b>Groundwater Gauge A3</b>							
Consecutive days within range	123.8'	103					
% of growing season		42.74%					
Criteria met?		Y					
<b>Groundwater Gauge B3</b>							
Consecutive days within range	123.7'	45					
% of growing season		18.67%					
Criteria met?		Y					
<b>Groundwater Gauge A4</b>							
Consecutive days within range	124.6'	20					
% of growing season		8.30%					
Criteria met?		N					
<b>Groundwater Gauge B4</b>							
Consecutive days within range	123.0'	75					
% of growing season		31.12%					
Criteria met?		Y					
<b>Groundwater Gauge C4</b>							
Consecutive days within range	124.3'	20					
% of growing season		8.30%					
Criteria met?		N					
<b>Groundwater Gauge D4</b>							
Consecutive days within range	123.3'	75					
% of growing season		31.12%					
Criteria met?		Y					
<b>Groundwater Gauge E4</b>							
Consecutive days within range	124.8'	4					
% of growing season		1.66%					
Criteria met?		N					
<b>Groundwater Gauge F4</b>							
Consecutive days within range	124.8'	4					
% of growing season		1.66%					
Criteria met?		N					
<b>Groundwater Gauge G4</b>							
Consecutive days within range	123.5'	11					
% of growing season		4.56%					
Criteria met?		N					
<b>Groundwater Gauge B5</b>							
Consecutive days within range	123.4'	6					No data from 2/8/2011 - 8/22/2011 (configuration error). Re-configured unit on 8/22/2011
% of growing season		2.49%					
Criteria met?		N/A					

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.

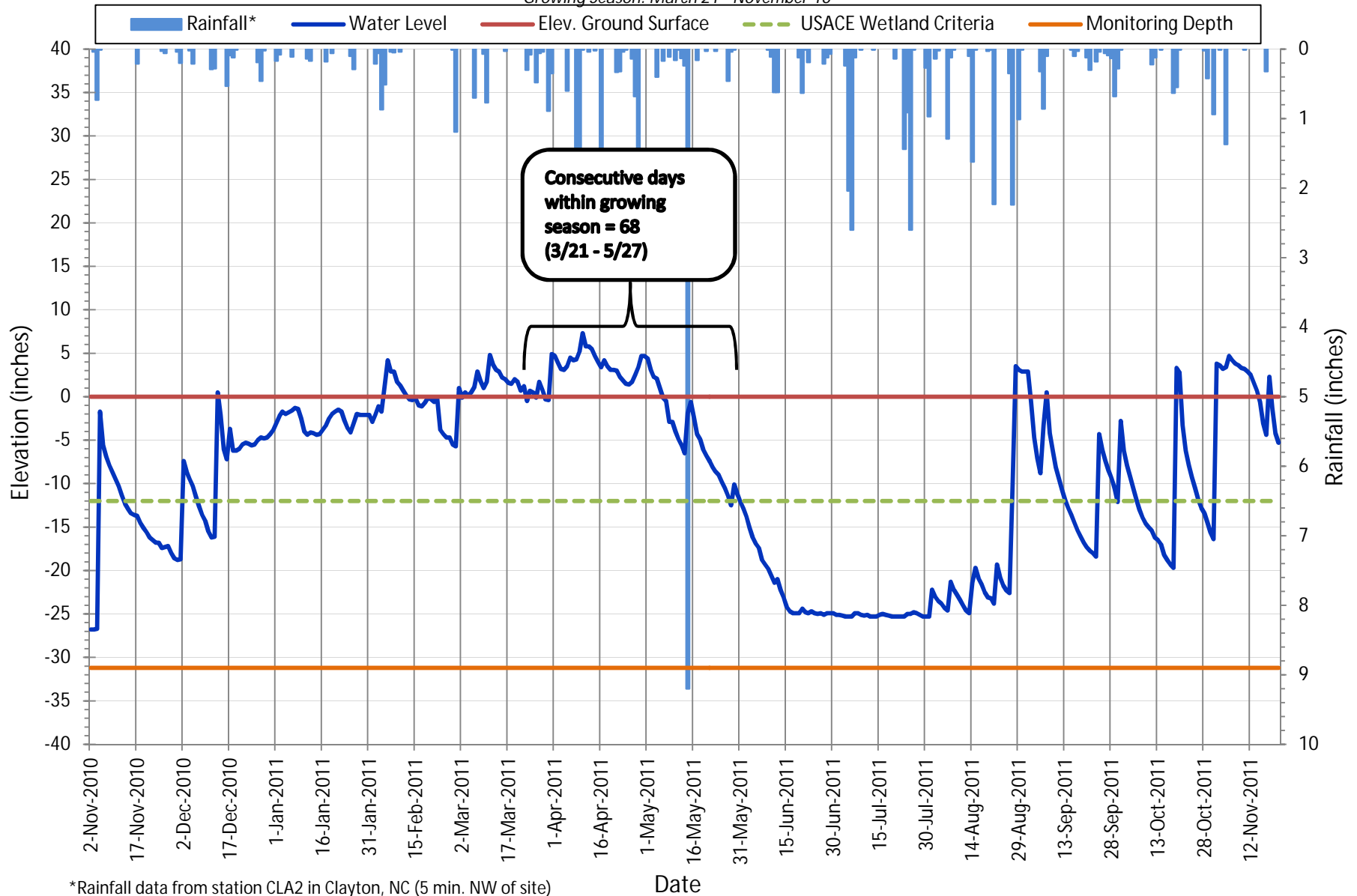
3- The minimum success criteria states that the water table must be within the USACE range for at least 5% (12 days) of the growing season consecutively.

\* Ground elevations recorded by KHA using a Trimble VRS unit. Elevations are not certified by a professional surveyor.

# Shallow Water Table Gauge B1

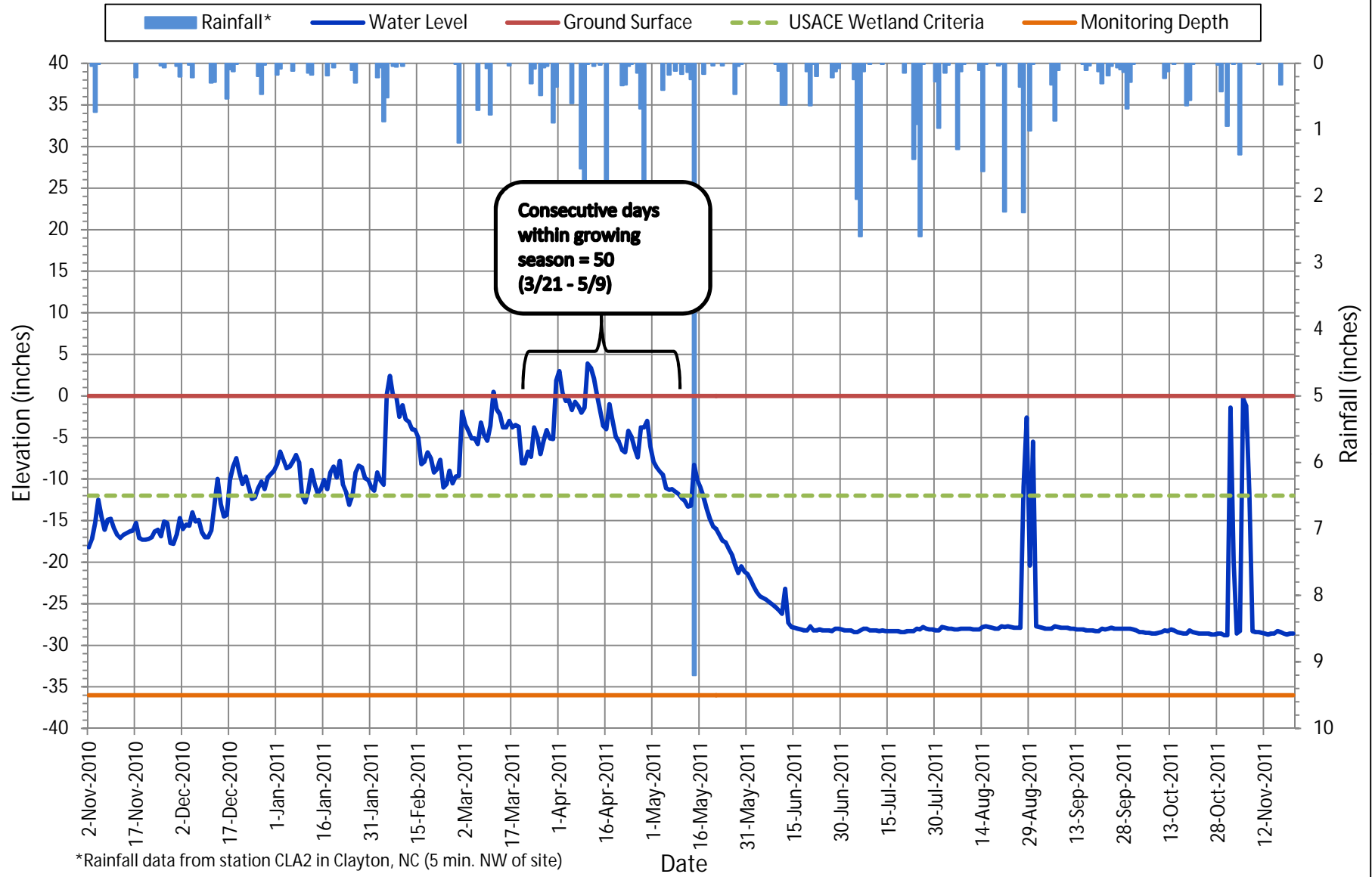
November 2, 2010 - November 21, 2011

*Growing Season: March 21 - November 16*



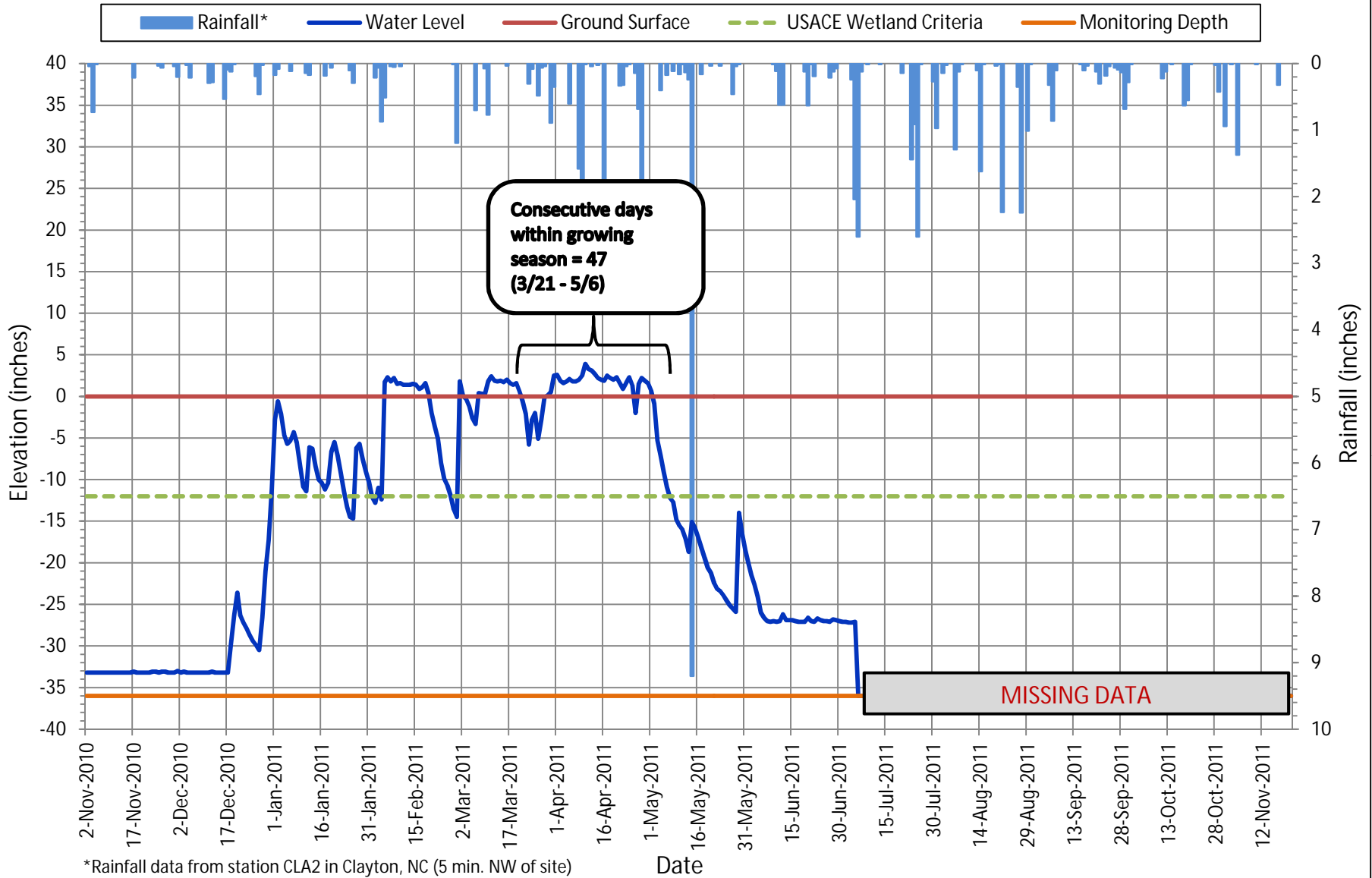
# Shallow Water Table Gauge B2

November 2, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



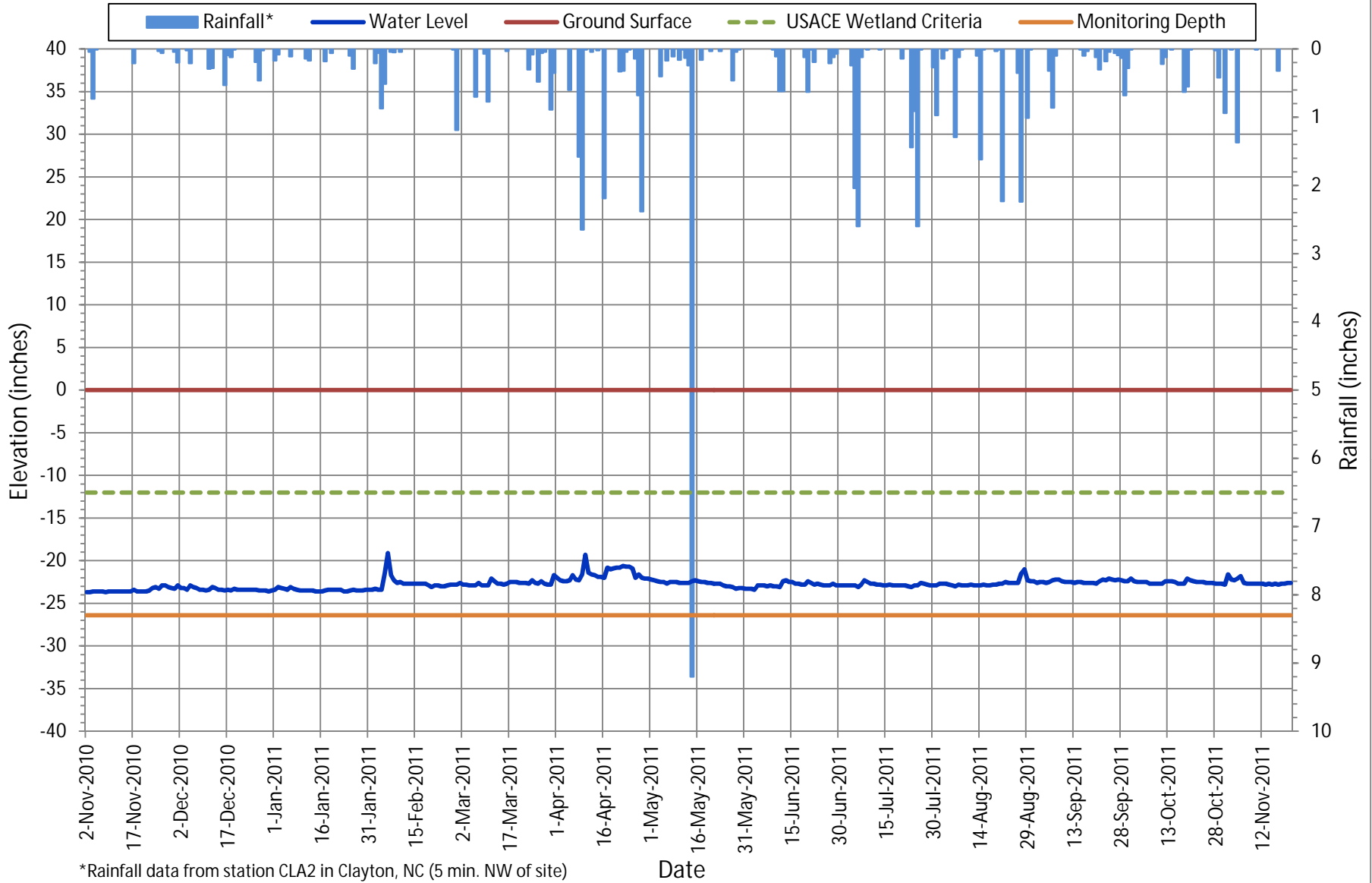
## Shallow Water Table Gauge C2

November 2, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



## Shallow Water Table Gauge D2

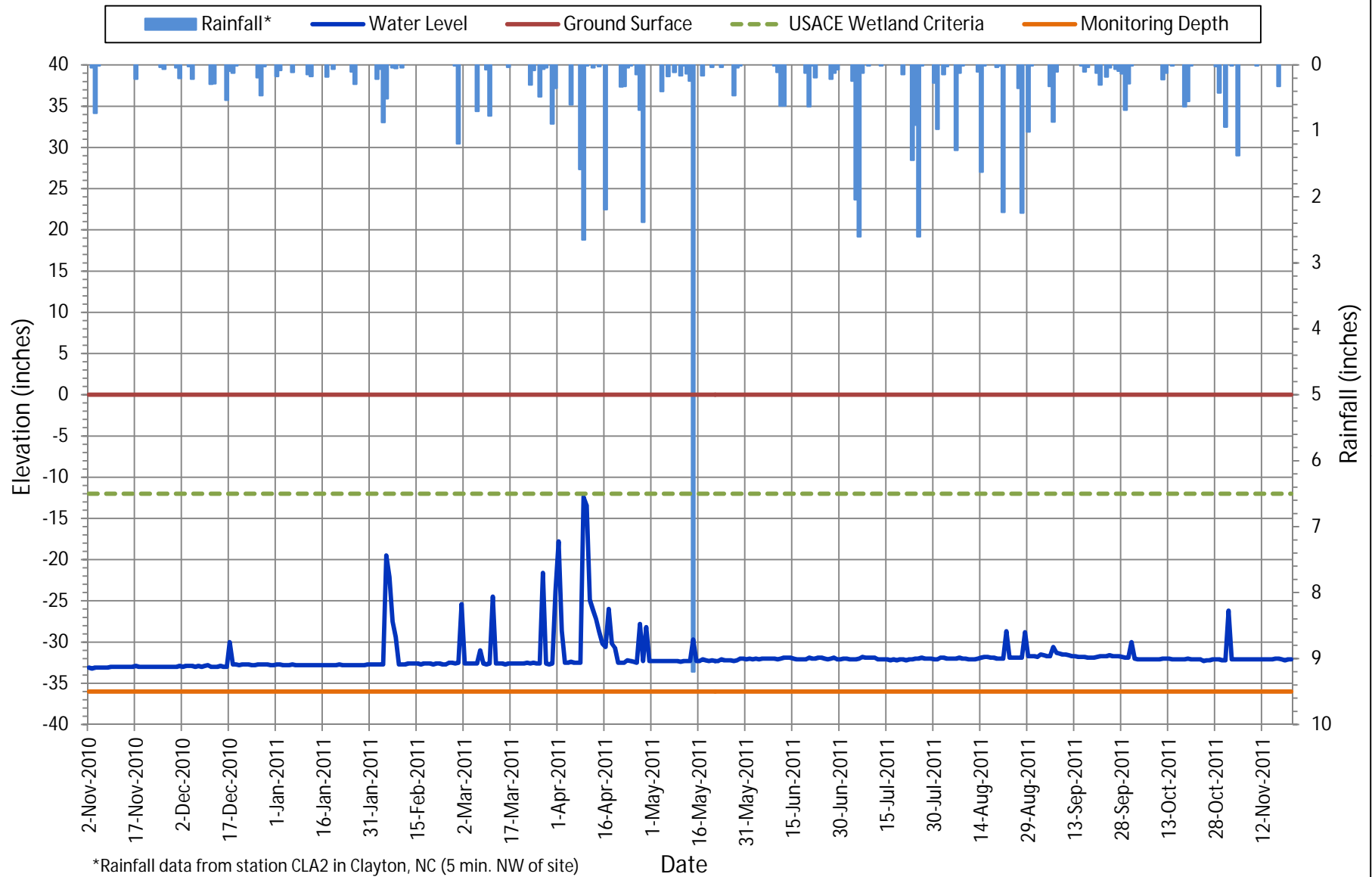
November 2, 2010 - November 21, 2011  
 Growing Season: March 21 - November 16





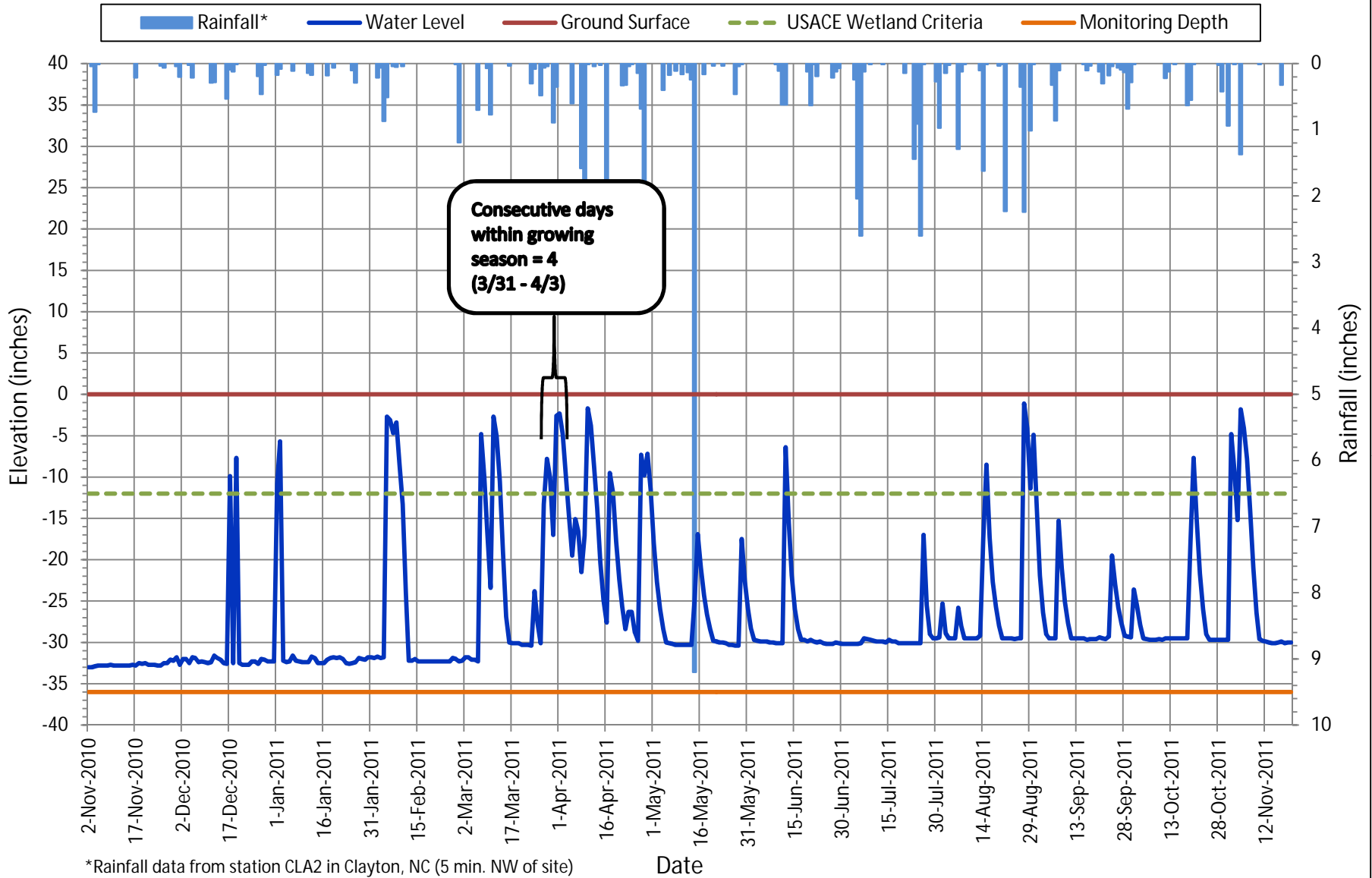
## Shallow Water Table Gauge E2

November 2, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



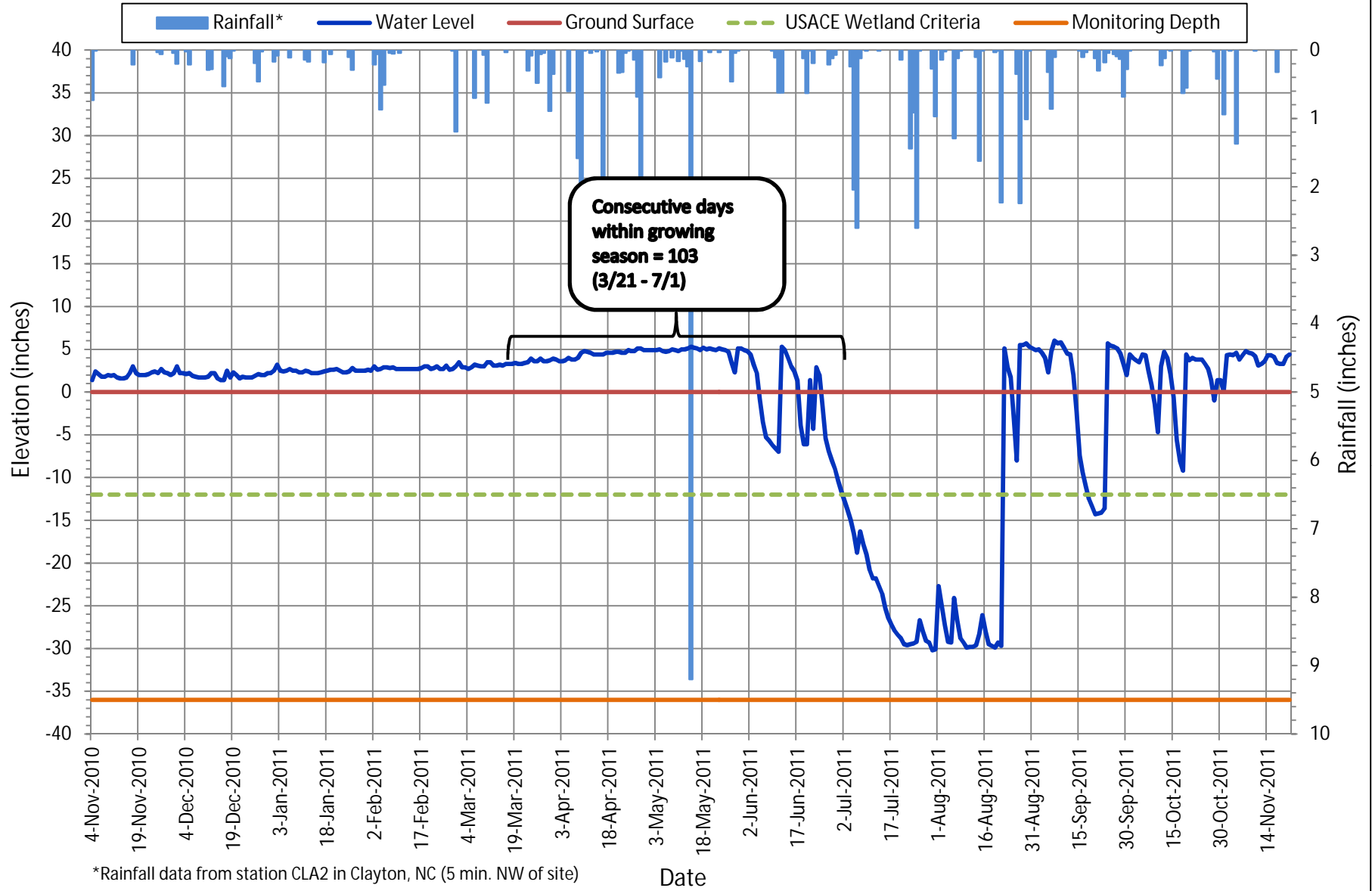
# Shallow Water Table Gauge F2

November 2, 2010 - November 20, 2011  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge A3

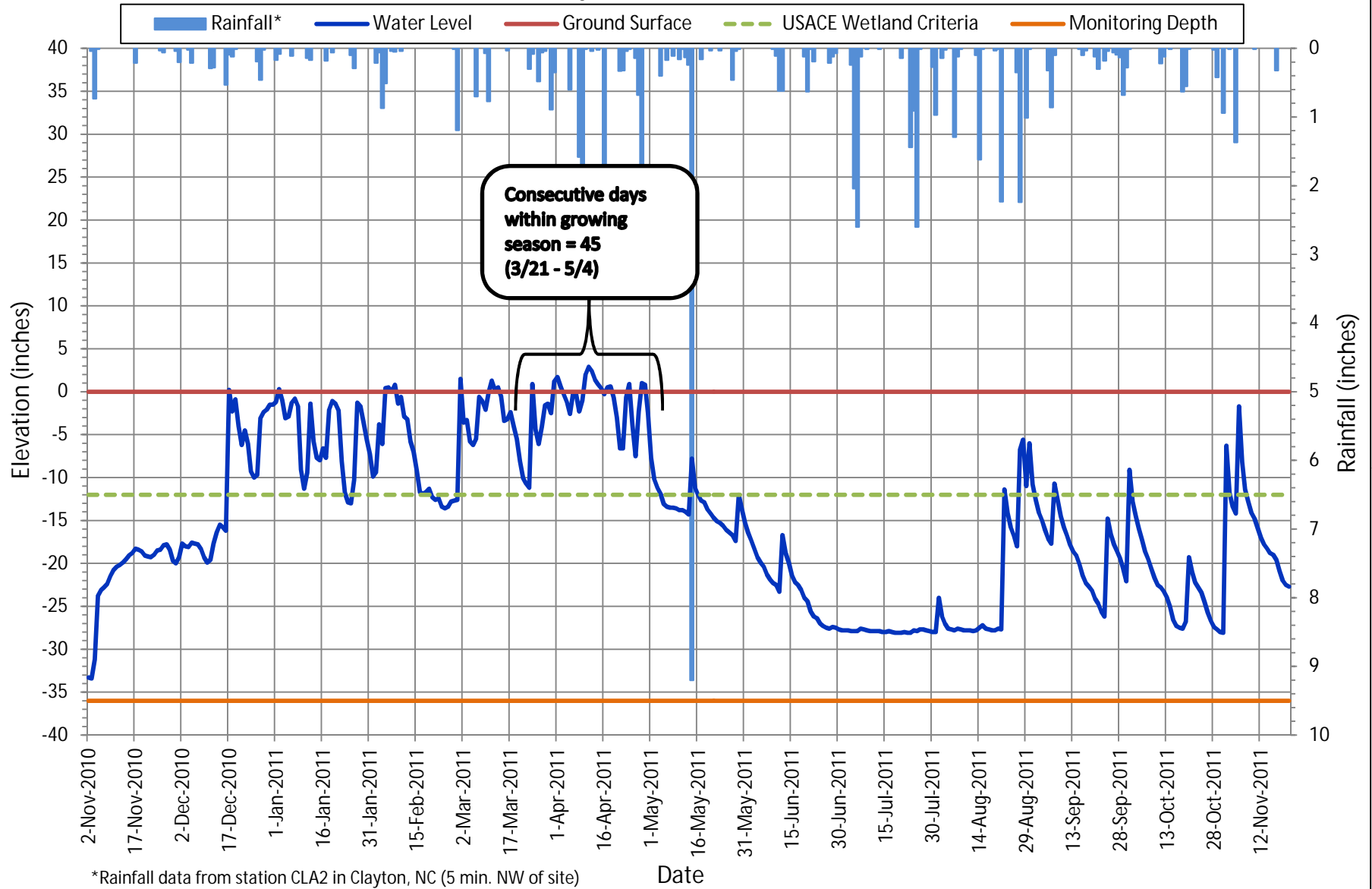
November 4, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



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

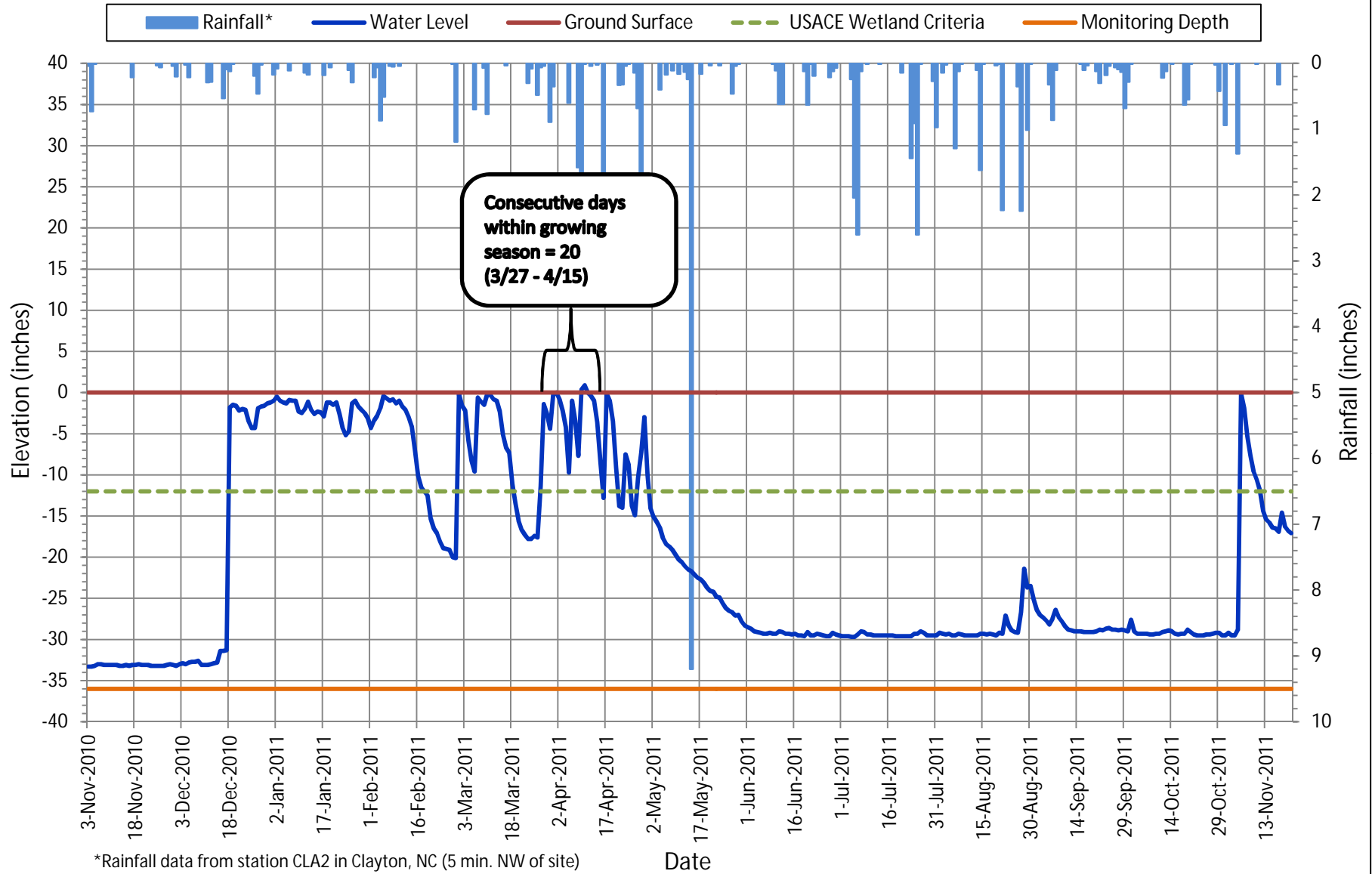
# Shallow Water Table Gauge B3

November 2, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



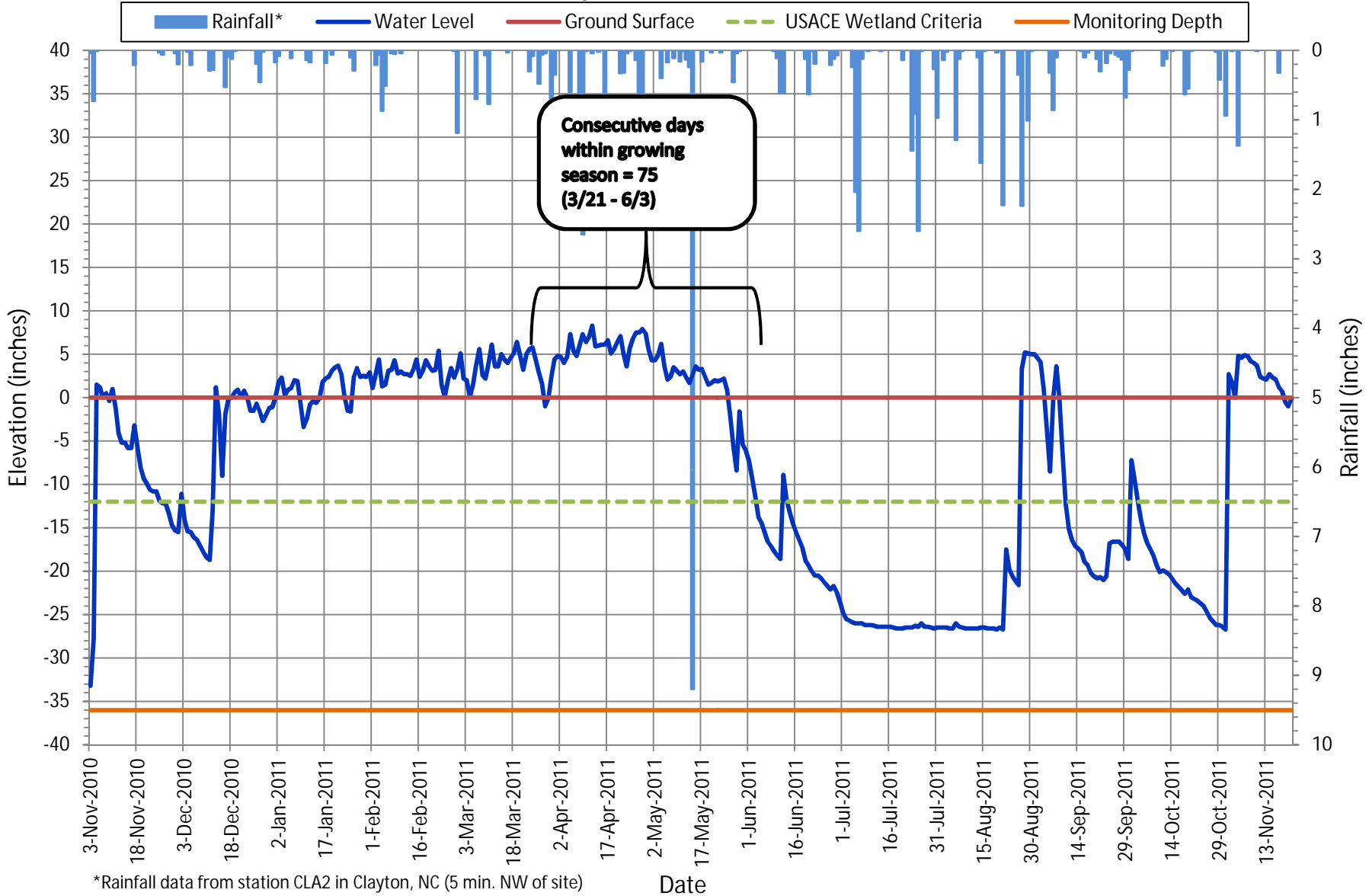
# Shallow Water Table Gauge A4

November 3, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



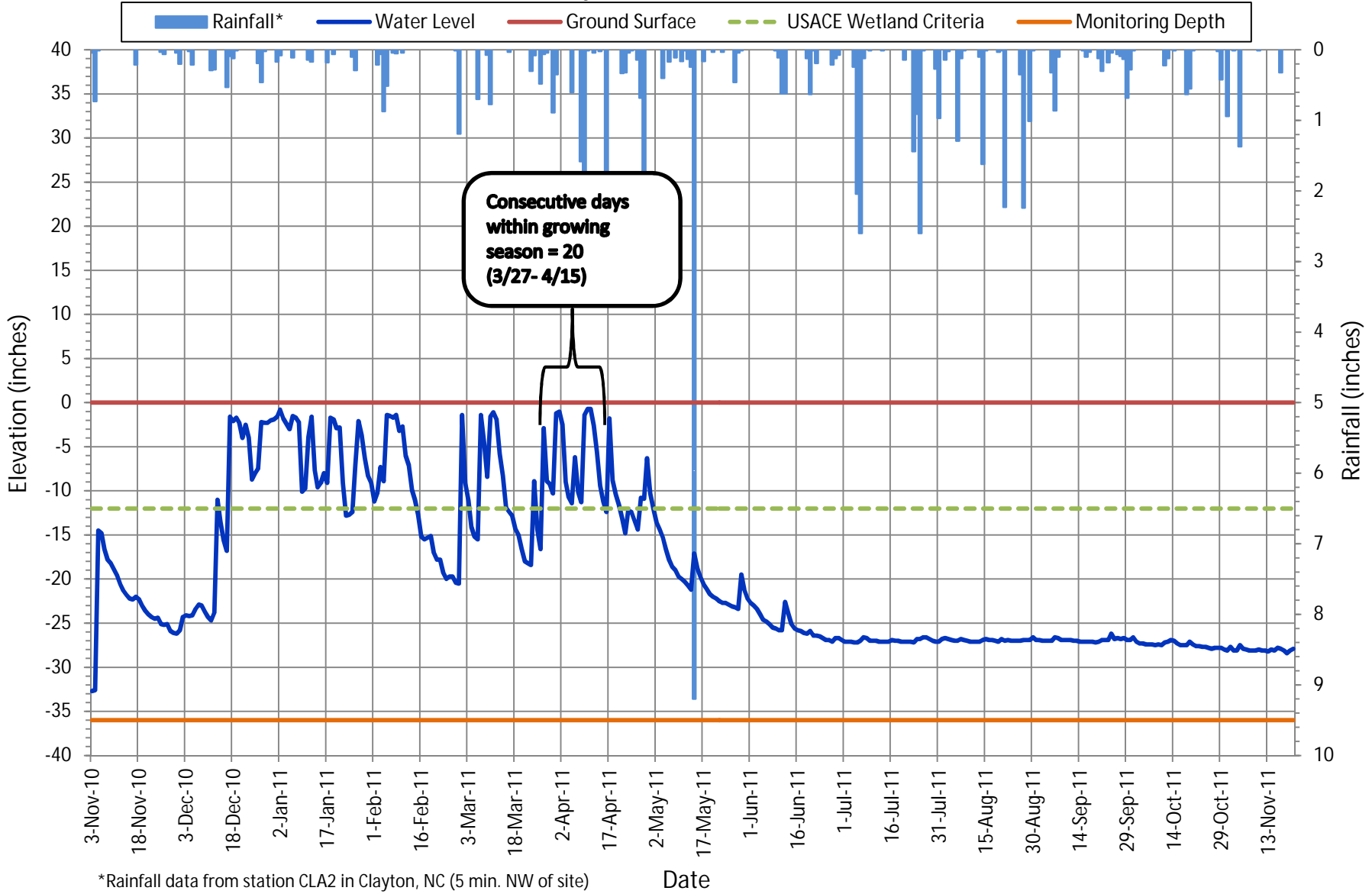
# Shallow Water Table Gauge B4

November 3, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



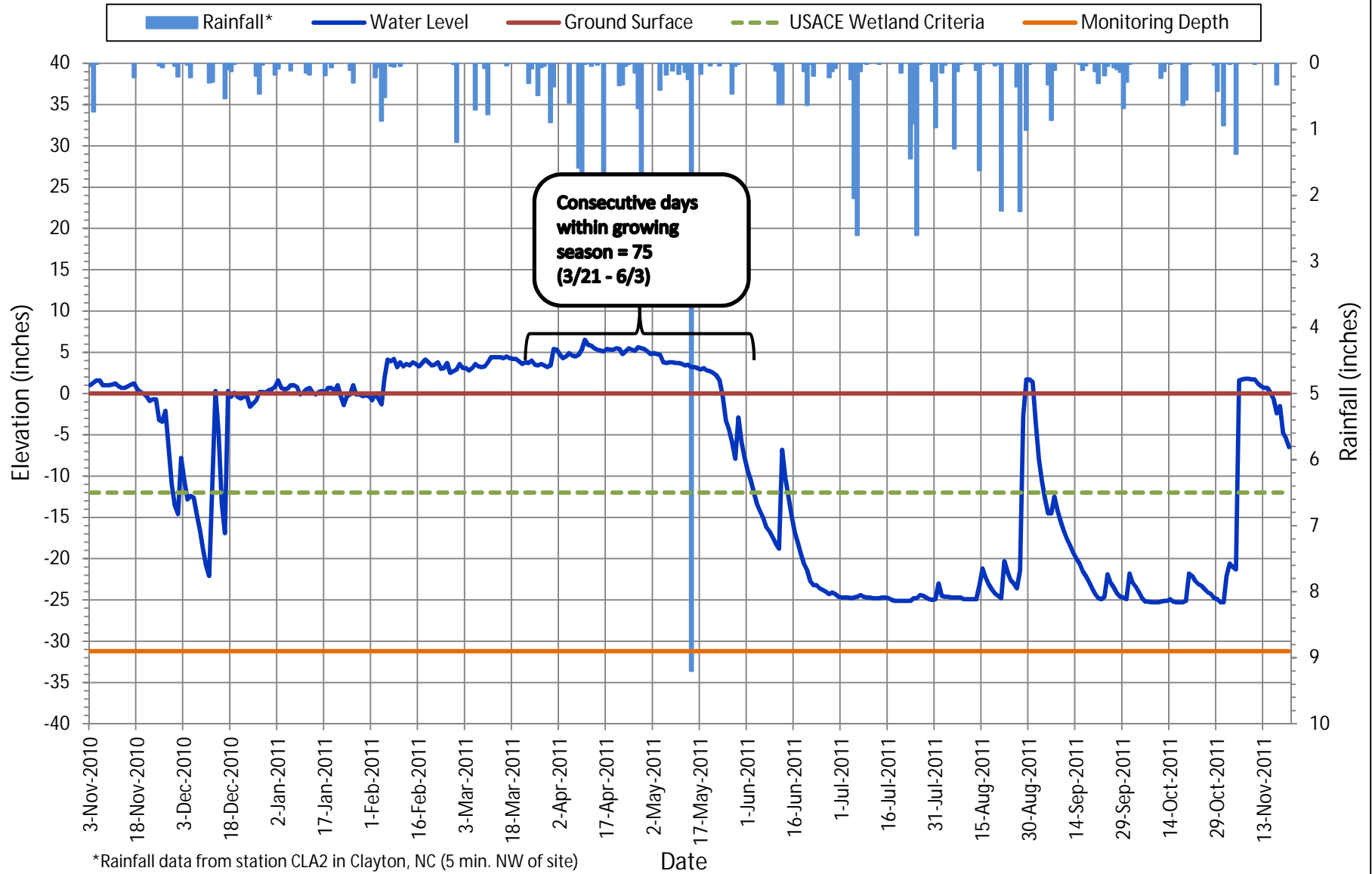
# Shallow Water Table Gauge C4

November 3, 2010 - November 21, 2011  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge D4

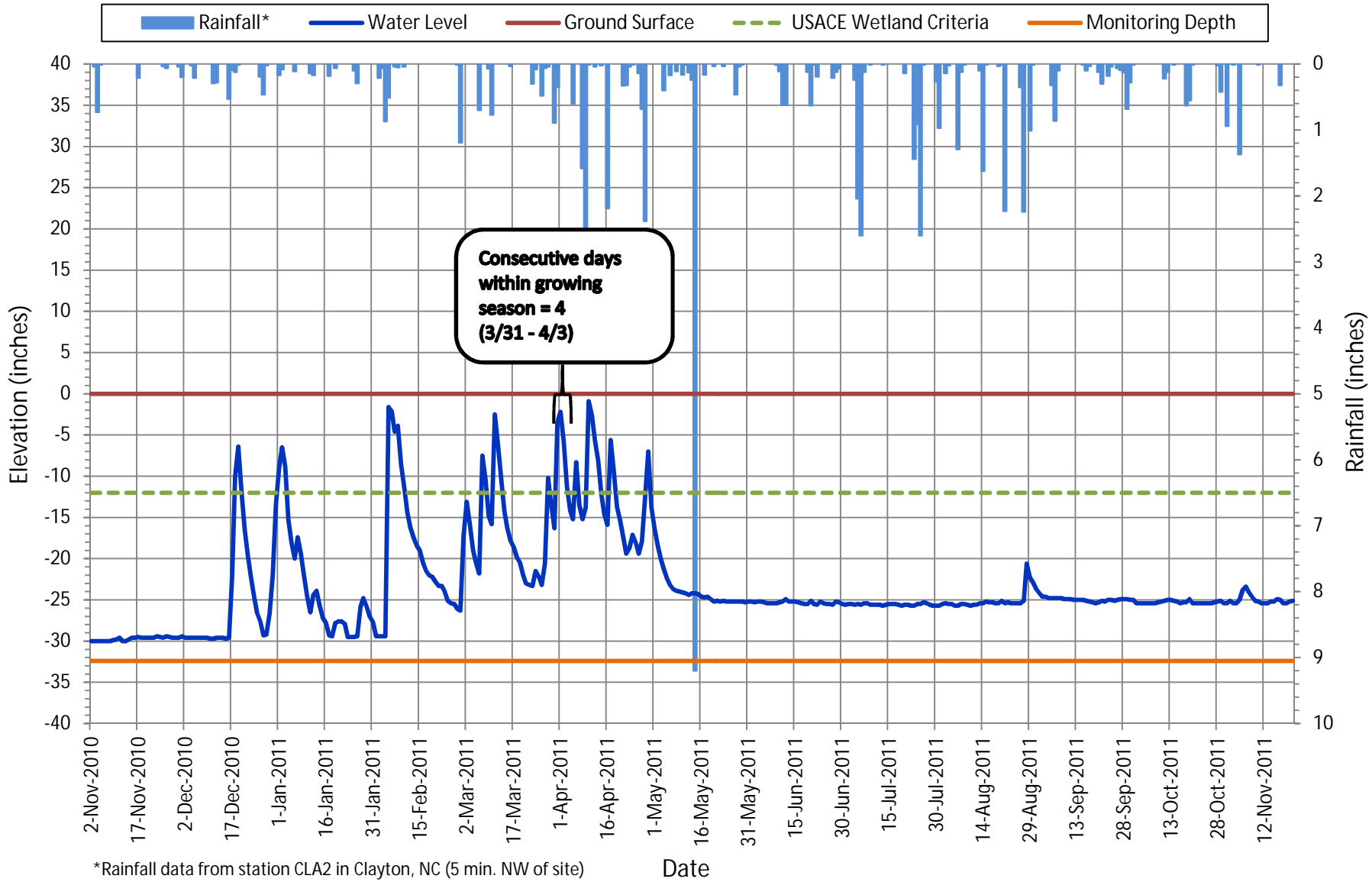
November 3, 2010 - November 21, 2011  
Growing Season: March 21 - November 16





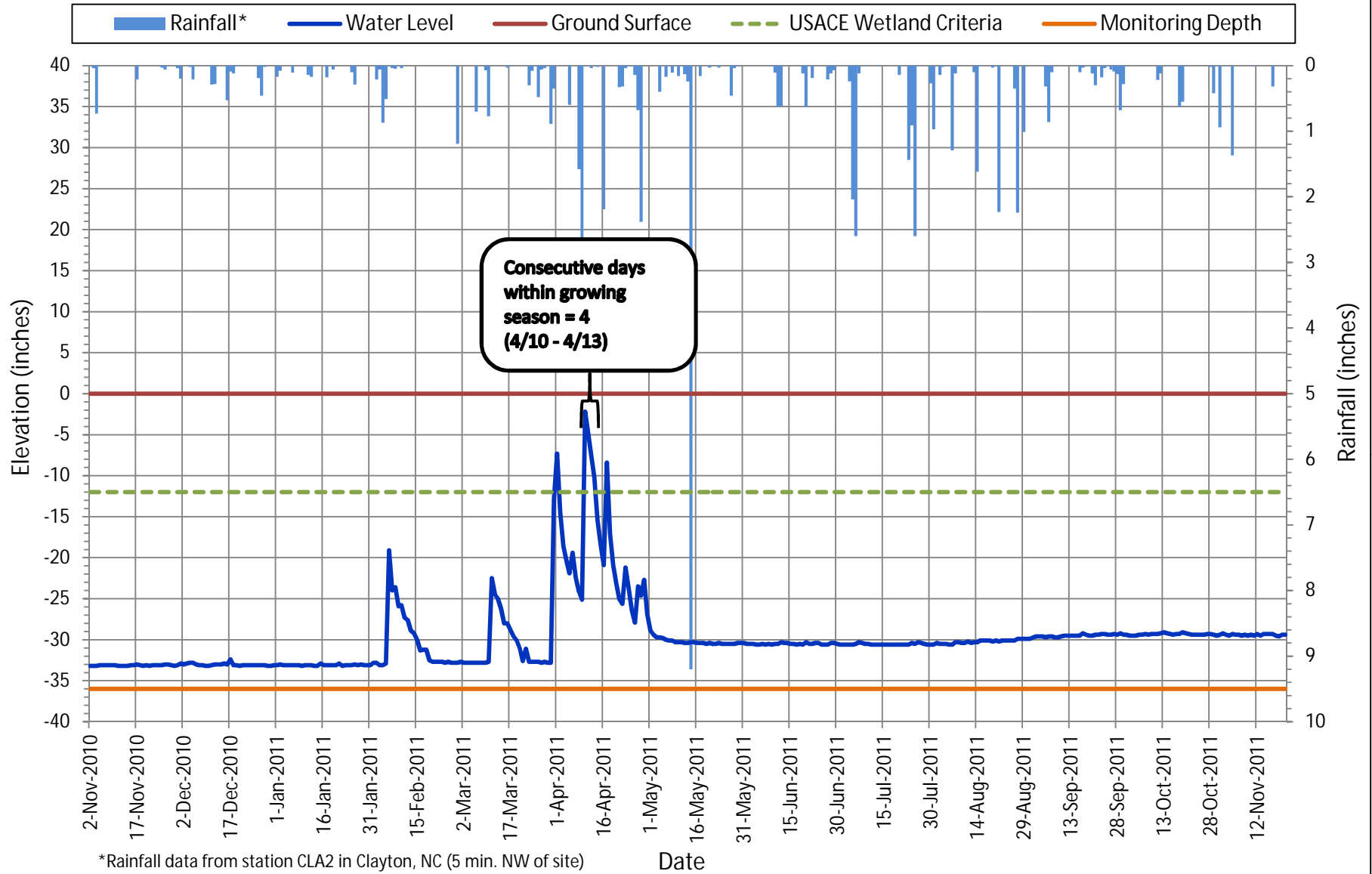
# Shallow Water Table Gauge E4

November 2, 2010 - November 21, 2011  
 Growing Season: March 21 - November 16



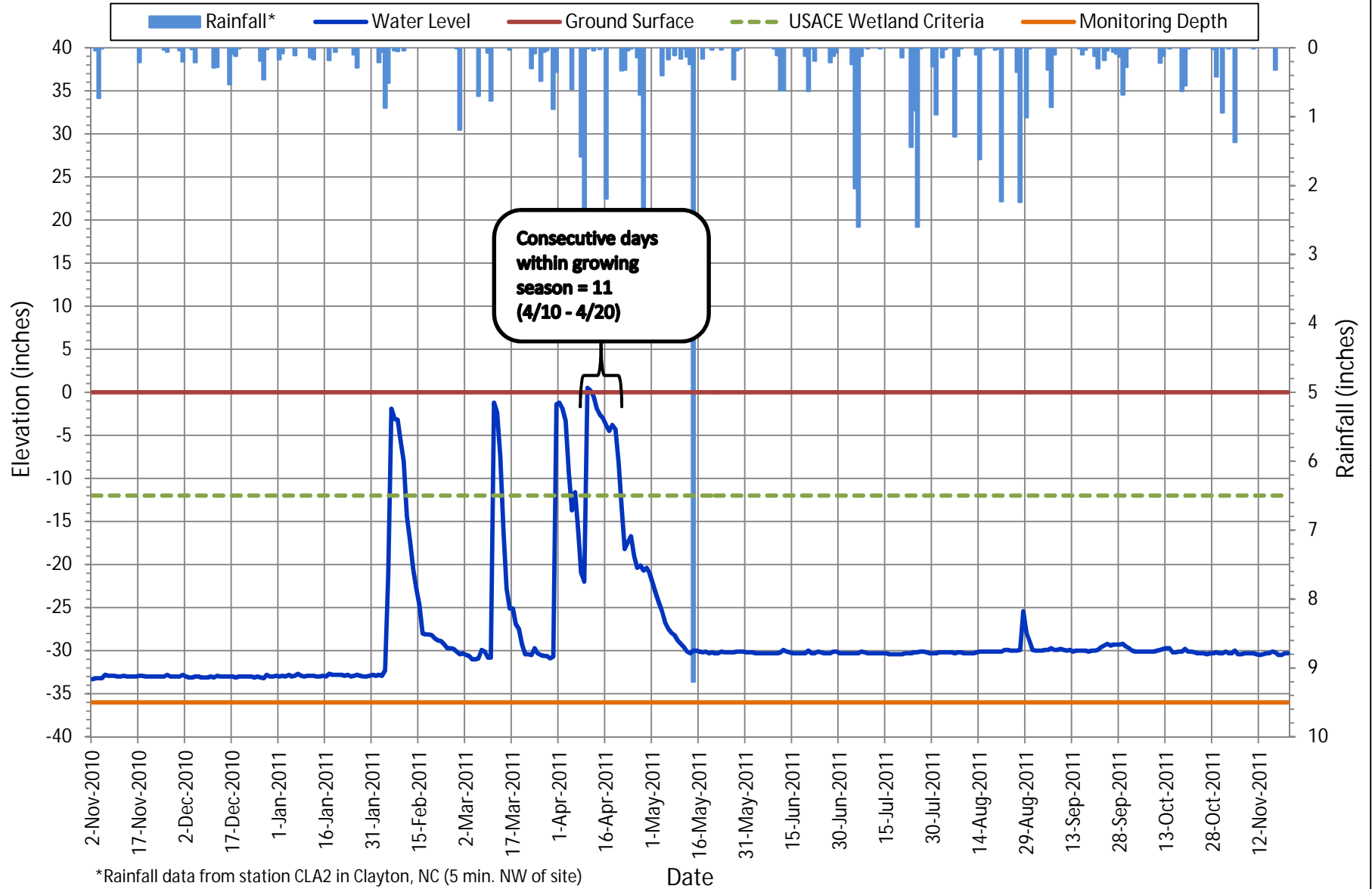
\*Rainfall data from station CLA2 in Clayton, NC (5 min. NW of site)

Shallow Water Table Gauge F4  
 November 2, 2010 - November 21, 2011  
 Growing Season: March 21 - November 16



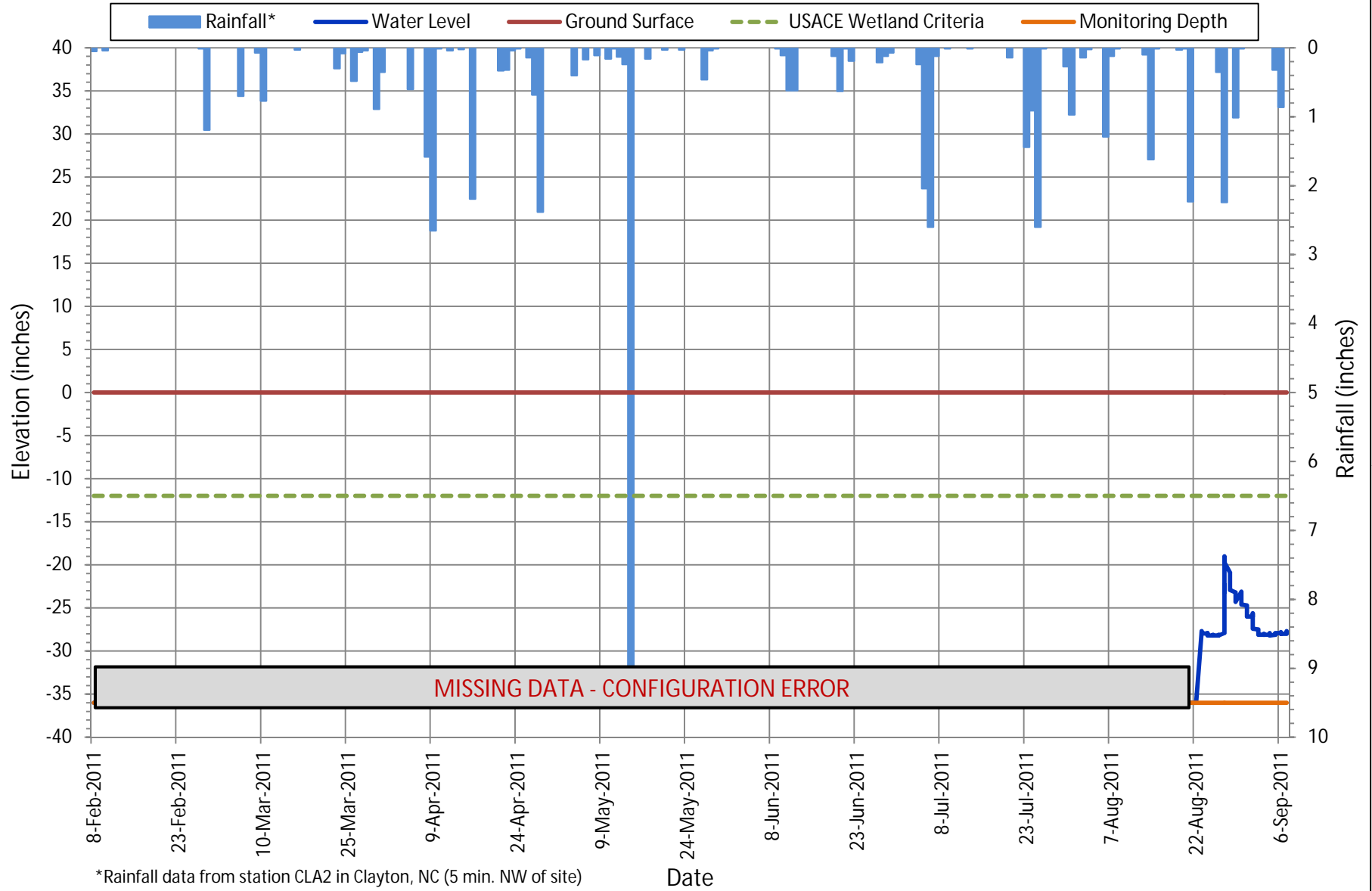
# Shallow Water Table Gauge G4

November 2, 2010 - November 21, 2011  
Growing Season: March 21 - November 16

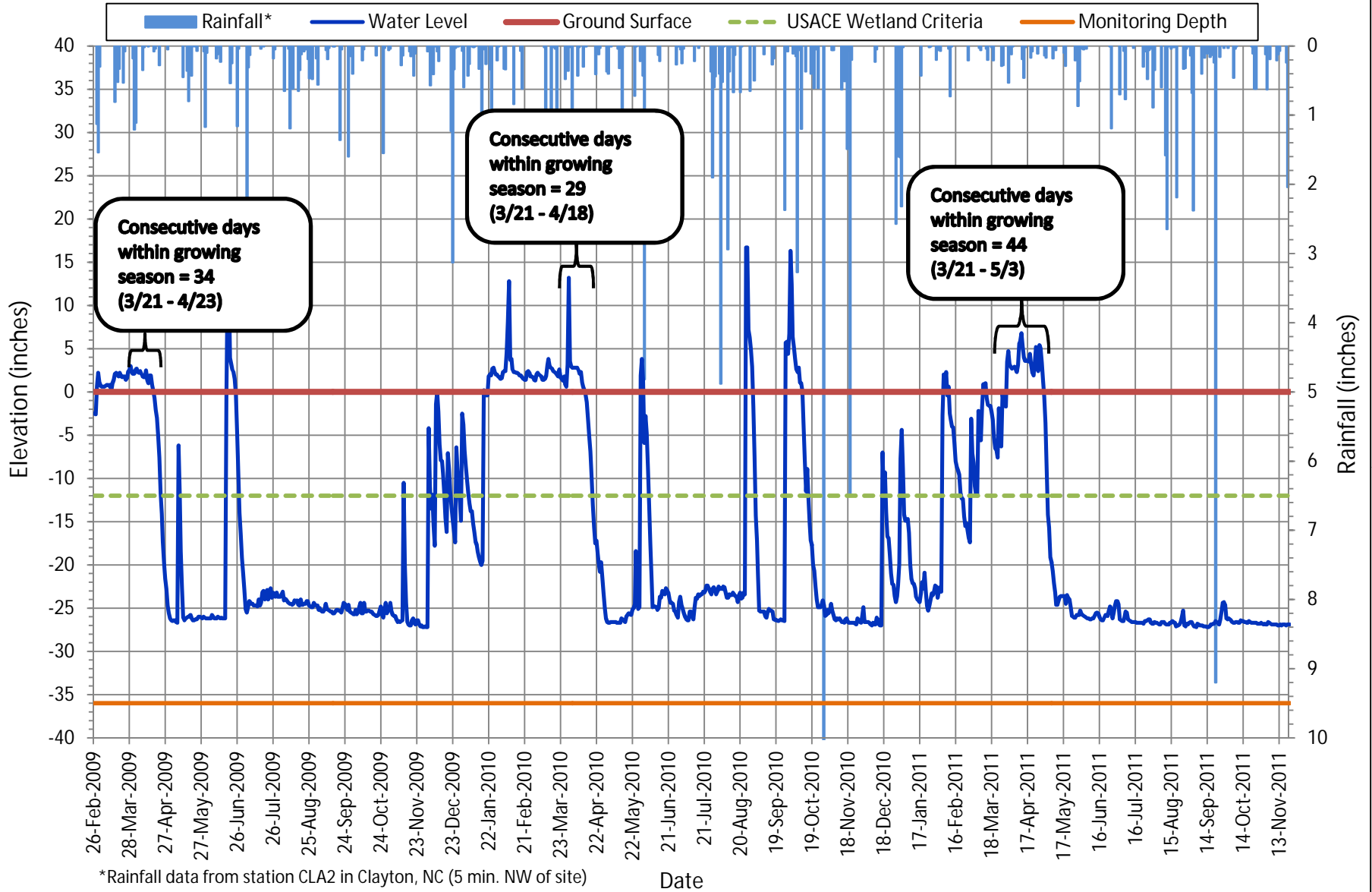


## Shallow Water Table Gauge B5

November 2, 2010 - November 21, 2011  
 Growing Season: March 21 - November 16

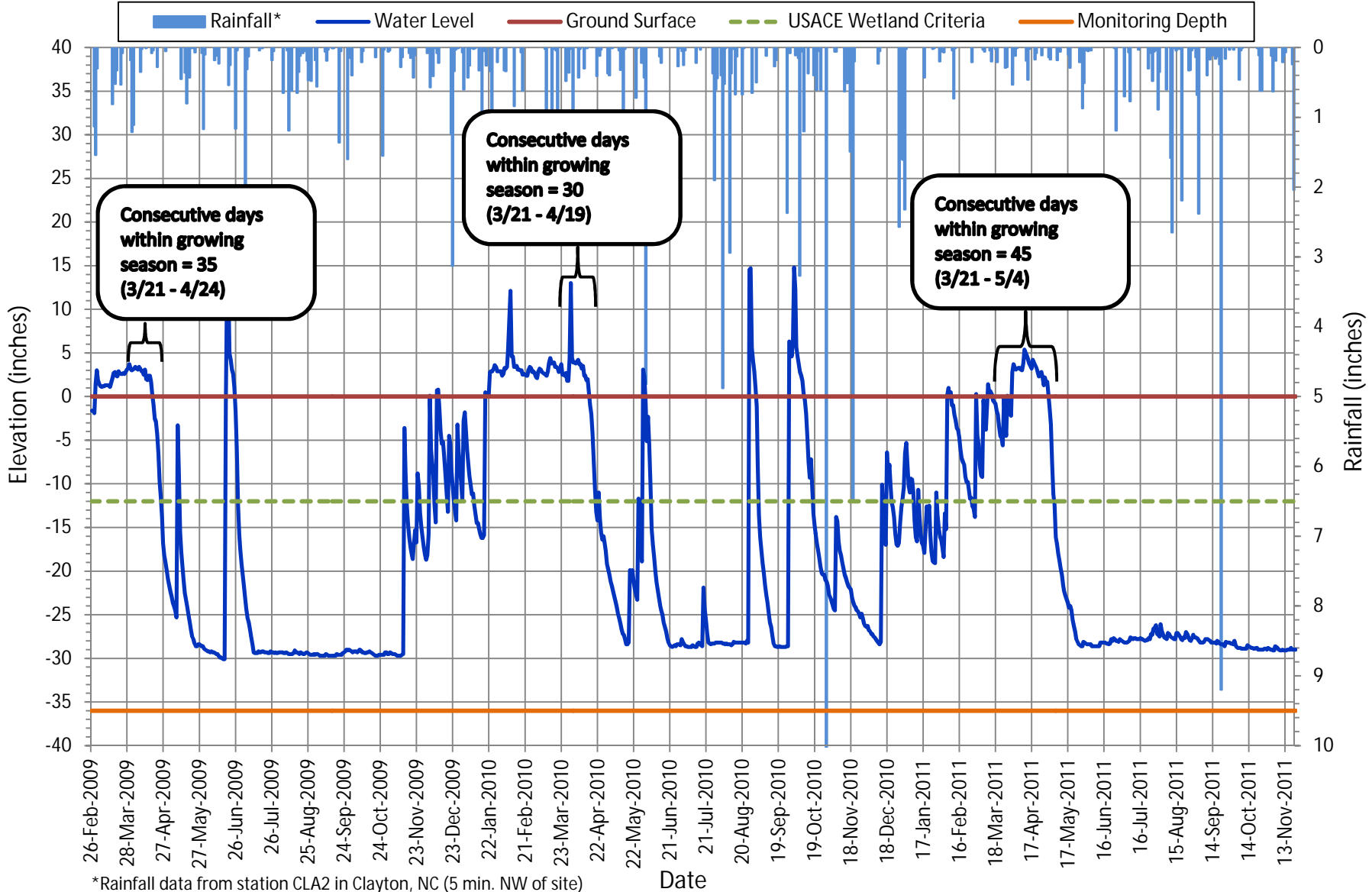


## Shallow Water Table Gauge REF-B February 26, 2009 - November 22, 2011 Growing Season: March 21 - November 16



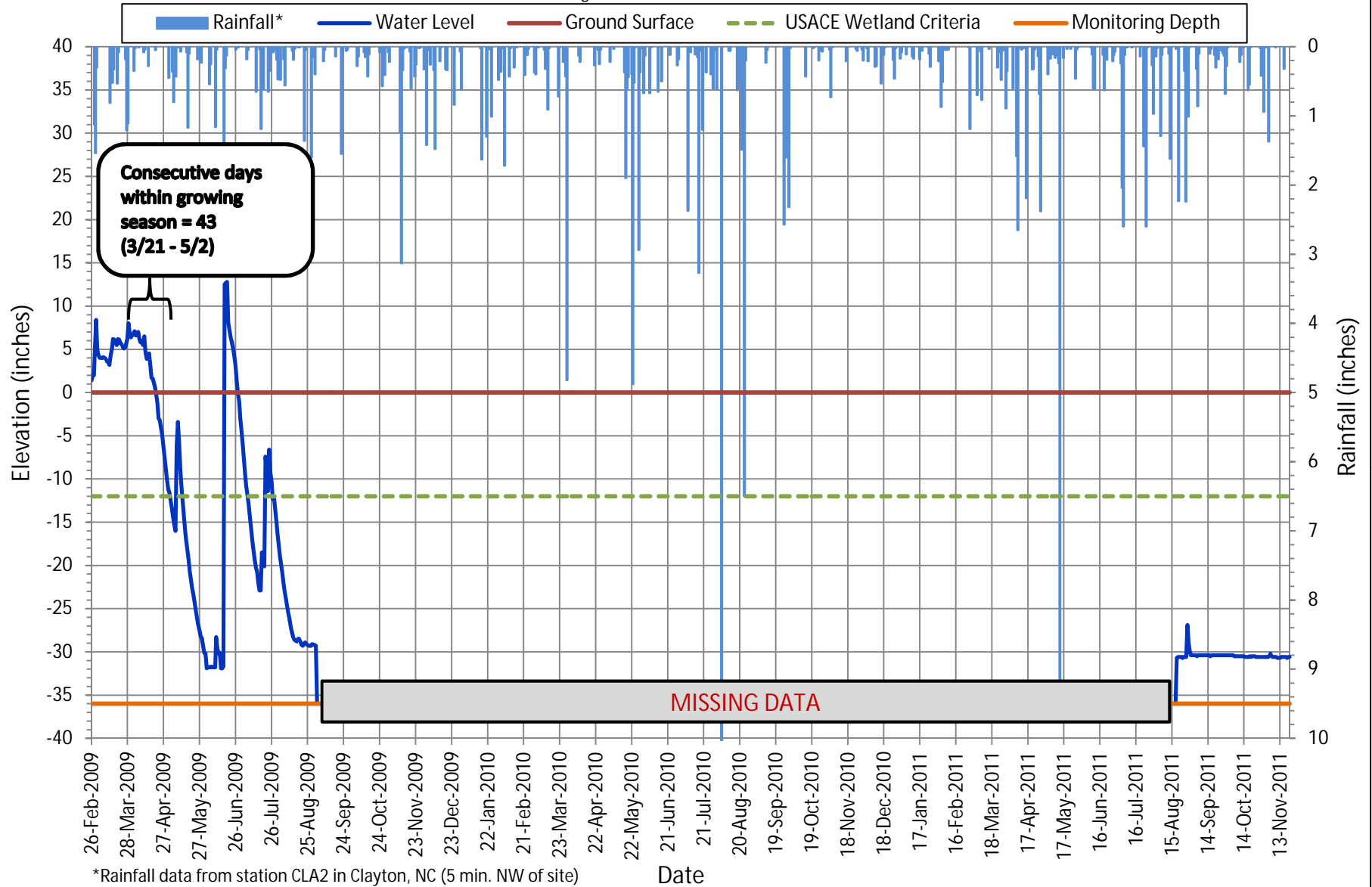
# Shallow Water Table Gauge REF-C

February 26, 2009 - November 22, 2011  
Growing Season: March 21 - November 16



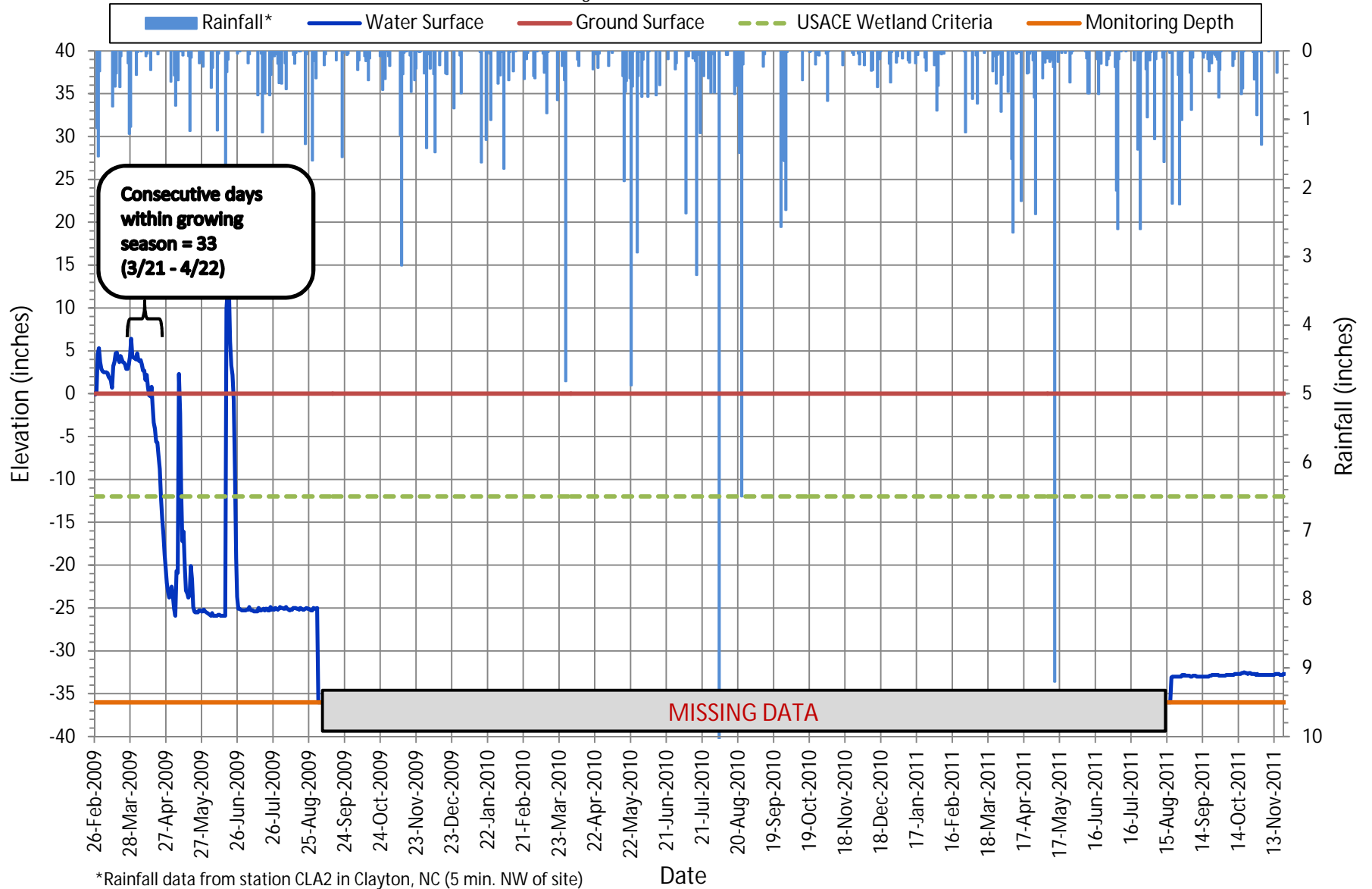
# Shallow Water Table Gauge REF-D

February 26, 2009 - November 22, 2011  
Growing Season: March 21 - November 16



# Shallow Water Table Gauge REF-E

February 26, 2009 - November 21, 2011  
 Growing Season: March 21 - November 16





# Shallow Water Table Gauge REF-F

February 26, 2009 - November 22, 2011  
Growing Season: March 21 - November 16

