UT to Lilliput Creek (Hog Branch Ponds)
Stream and Wetland Restoration Project

SCO No. 07-07155-01
DENR Contract No. D08049S
EEP Project No. 290
Brunswick County North Carolina

Year 4 of 5 Monitoring Report
Data Collection: January through December 2013
Submission Date: April 25, 2014

Prepared for:

Ecosystem Enhancement PROGRAM

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
217 West Jones St., Suite 3000A, Raleigh, N.C. 27603

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Prepared by:

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2.0 TABLE OF CONTENTS

3.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is located in Boiling Spring Lakes, Brunswick County. The restoration project is located on a 516.73 acre tract. The purchase of the site (fee simple) was funded by both the State of North Carolina Ecosystem Enhancement Program and North Carolina Department of Agriculture and Consumer Sciences Plant Conservation Program in December 2004. The UT Lilliput Stream and Wetland Restoration Site was previously owned by International Paper and used in rotation as a pine plantation. Pine plantations in southeastern North Carolina are typically characterized by major site alterations constructed to provide sufficient surface and groundwater drainage in wet conditions which allows planted pine trees to grow and cultivate. Site alterations also impair ecological function, decrease water quality and disrupts habitat for wildlife, including federally threatened and endangered species.

The goal for the UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is to restore ecological function, improve overall water quality, and enhance native wildlife habitat. This goal will be accomplished by two main objectives. The first objective is restoration of channelized tributaries to the headwater outer coastal plain stream type, as described in the "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina" guidance document (COE 2005). The stream restoration will re-establish the riparian vegetation zone, re-connect flood plain areas, and enhance wildlife habitat. These ecological functions have been non-existent for decades due to the previous ditch and drainage regime. The second objective is to restore and enhance the altered wetlands. The restoration and enhancement of wetlands onsite will generate longer soil saturation periods and the result is improved water quality. Restoring the native hydrologic characteristics will also restore the conditions that are beneficial for the long-leaf pine community type that previously dominated the site before human intervention. The long-leaf pine forest will also restore native habitat for the red-cockaded woodpecker.

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site was previously a pine plantation. Pine plantations in southeastern North Carolina are typically characterized by major site alterations that were made to eliminate much of the wet conditions. When modified, these sites provide sufficient surface and groundwater drainage that allow planted loblolly pine (*Pinus taeda*) and long-leaf pine (*P. palustris*) trees to be cultivated. Foresters typically perform two major site alterations in preparation for a pine plantation: channelization of natural stream channels and bedding. These site alterations were utilized extensively throughout the project site. Restoring this site back to its natural condition was key in both project design and implementation.

Stream restoration and stream preservation are both components of this project (Table 1). Stream restoration for UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is divided into two tributaries. The North Tributary (**1,535 linear feet**)

and South Tributary (**1,703 linear feet**) were constructed utilizing the previous referenced guidance entitled "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina" (COE 2005). The referenced document states that restoration of dimension, pattern and profile in accordance with the typical natural channel design is often not appropriate in environments similar to the project site. For zero to first order headwater stream restoration, a width of 100 feet centered along the resulting valley will determine the area that can be considered for stream restoration (COE 2005). A total of **3,238 linear feet** of stream restoration was provided in accordance with the enclosed plans. Stream preservation areas consist of **5,332 linear feet** (See Table 1 for Project Components and Figure 1a for Component Location).

The wetland component of the UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site consists of non-riparian wetland preservation, restoration, enhancement, and riparian preservation. The non-riparian wetland preservation areas total **87.74 acres** and riparian wetland preservation areas total **20.45 acres**. These areas were delineated using guidelines described in the Corps of Engineers 1987 Manual (COE 1987). Non-riparian wetland enhancement totaling **96.46 acres** makes up the bulk of the project effort. Non-riparian wetland restoration totals **7.83 acres**. Vegetative enhancement was utilized by planting with native species, and the hydrology was enhanced through the stream restoration process. (See Table 1 for Project Components and Figure 1a for Component Location)

Fifteen (15) permanent vegetation plots and one (1) total stem count for Site 6 were established and used in annual vegetation monitoring. As per the mitigation plan, the final vegetative success criterion will be the survival of 260 5-year old planted woody stems per acre at the end of the year 5 monitoring period, which is based on the US Army Corps of Engineers Stream Mitigation Guidelines (COE 2003). Based on MY4 monitoring data, the site is meeting the minimum success requirement with an observed mean stem density of 421 planted stems per acre. When counting plants that have volunteered into the plots, the observed stem density was 6,631 stems per acre. Vegetation plot locations are identified in Figure 2. Of the individual plots, only VP 13 did not meet the success criterion. Only four of the eighteen originally planted longleaf pine trees remain in this plot. This equates to 161.8 planted stems per acre. As in previous years, the health of the remaining trees in this plot is good (all rated 3 for vigor); however, other vegetation is volunteering into the site and may be contributing to increased mortality of the longleaf stems via shading.

As in MY3 (2012), plots located within the zero-order stream valleys (VP 1-8) met the vegetative success criterion, but planted stem growth is slow (average of less than 2.5 feet in height). However, the height of most stems has increased since last year. Furthermore, VP 7 experienced a noticeable decrease in survivability from MY 3 to MY4. Six planted stems died and one could not be located. Only 7 planted stems were located in this plot in MY4. However, this plot is still on track to meet the Year 5 success criterion. Supplemental planting in these areas was conducted in March of 2014.

A large number of volunteer shrubs was identified in most of the plots. Plots located within the stream channels (VP 1-8) supported mostly volunteer loblolly pine trees. Most of these pines are less than 18 inches in height. Other plots outside of the channels (VP 9-15) contained high numbers of a variety of characteristic shrubs including chokeberry (*Aronia spp.*), huckleberry (*Gaylussacia frondosa*), and gallberry (*Ilex glabra*). Densities of these shrubs have sharply increased between last year and this year. Many of these shrubs are less than two feet tall. It may be beneficial to consult with a forester to determine if a controlled burn is necessary, especially in areas where the growth of longleaf pines appears to be compromised by competition from volunteer species.

As in prior years, stream monitoring in MY4 (2013) consisted of both visual and morphological (i.e. survey) assessment of the channels. Both channels exhibited evidence of the "braided" stream type featured in the Zero to First Order outer coastal plain stream morphology. No areas of significant degradation or rill erosion were noted. Based on survey data collected from longitudinal profiles and eight fixed cross sections, the UT to Lilliput Stream Restoration Channel dimension and pattern are similar to as-built conditions (Appendix D).

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is currently being monitored for hydrology using forty-three (43) water level monitoring gauges (28 groundwater monitoring gauges, 8 surface flow monitoring gauges, and 7 reference gauges). Note that some of these gauges were installed subsequent to the original as-built. Eight groundwater monitoring gauges were installed in December of 2010. Three reference gauges were installed in June of 2011. Two additional groundwater reference gauges were installed in February of 2013.

During MY4 (2013), repairs to several gauges were necessary. The battery kits of five gauges and the guide wires of two gauges were replaced. One gauge was rendered inoperable due to equipment malfunction and was replaced. Additionally, a controlled burn of the reference area occurred sometime between March 25, 2013 and May 7, 2013. The gauges in this area were visibly affected, but are still functioning.

During Monitoring Year 4 (MY4) 2013, all 28 groundwater monitoring gauges located within the restoration site exhibited groundwater within 12 inches of the soil surface for a duration in excess of the 12% hydrologic success criterion. The hydrographs of the gauges show groundwater levels were within 12 inches of the soil surface for much of the 2013 growing season. Please see Figure 2 for gauge locations.

A comparison between pre-construction monitoring data and post-construction monitoring data demonstrated an increase in hydroperiod within the enhancement areas. Gauge 11 exhibited 97 consecutive days (36% of the growing season) of groundwater within 12 inches of the soil surface. By comparison, the pre-construction monitoring (2005) gauge located in this area exhibited 14 consecutive days (6% of the growing season). Gauge 17 exhibited 73 consecutive days (27% of the growing season) in MY4

while 2005 pre-construction monitoring data exhibited 11 consecutive days (5% of the growing season) in the same location.

As per the monitoring success criteria, surface water monitoring gauges must exhibit similar conditions to the on-site reference gauge and clearly show fluctuation in flow. For MY4 (2013), all surface water monitoring gauges exhibited fluctuations in water levels and extended periods of above-ground flow. On average, the reference stream gauge documented a lower level of water in the channel and less variable flow than the on-site stream gauges (Appendix E). The reference stream is located in a more densely vegetated area than the on-site streams. The vegetation and surface roughness appears to be reducing peak discharge events.

Verification of stream and wetland boundaries was conducted in the fall of 2013 to ensure that on-the-ground mitigation acreages match mapped boundaries as depicted in the mitigation plan. NC DWQ Stream Identification Forms (Ver. 4.11) and USACE Stream Assessment Worksheets were completed in several locations to determine the limits of streams on site. Based upon this assessment, it appears as though the stream limits are consistent with those depicted in the mitigation plan. The wetlands assessment was performed using the three parameter methodology outlined in the 1987 COE Wetland Delineation Manual and the Atlantic and Gulf Coastal Plain Regional Supplement to the COE Wetland Delineation Manual (USACE 2010). Several areas identified as wetland enhancement (6.1 acres total) and one area identified as wetland restoration (0.16 ac) in the mitigation plan did not meet hydric soil and/or wetland hydrology parameters (Figure 2).

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices are available from EEP upon request.

4.0 METHODOLOGY

Fifteen (15) permanent vegetation plots and one (1) total stem count for Site 6 are used for vegetation monitoring. All vegetation monitoring was completed in September 2013 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.2) for fifteen (15) vegetation monitoring plots. A total stem count was utilized for Site 6.

Stream morphological monitoring was conducted in MY4. Elevation data was collected at eight designated cross section stations located along the northern and southern tributaries. Longitudinal profiles were also surveyed.

For MY4 2013, hydrology was monitored through a series of forty-one (43) water level monitoring gauges (28 groundwater monitoring gauges, 8 surface flow monitoring

gauges, and 7 reference gauges). All gauges, including reference, were downloaded monthly utilizing Remote Data Systems data loggers and software.

Photo monitoring was conducted by walking the entire site. A digital camera was used to take photos at each predetermined photo point location.

5.0 REFERENCES

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US Army Corps of Engineers. 1987. U.S. Army Corps. of Engineers. Tech Report Y-87-1, 1987 Wetland Delineation Manual, Washington, DC. AD/A176.

US Army Corps of Engineers. 2005. U.S. Army Corps. of Engineers. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina, Wilmington Regulatory Field Office.

US Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0). Wetlands Regulatory Program ERDC/EL TR-10-20. 148 pp.

6.0 PROJECT CONDITION AND MONITORING DATA APPENDICES

Appendix A.
Project Vicinity Map and Background Tables

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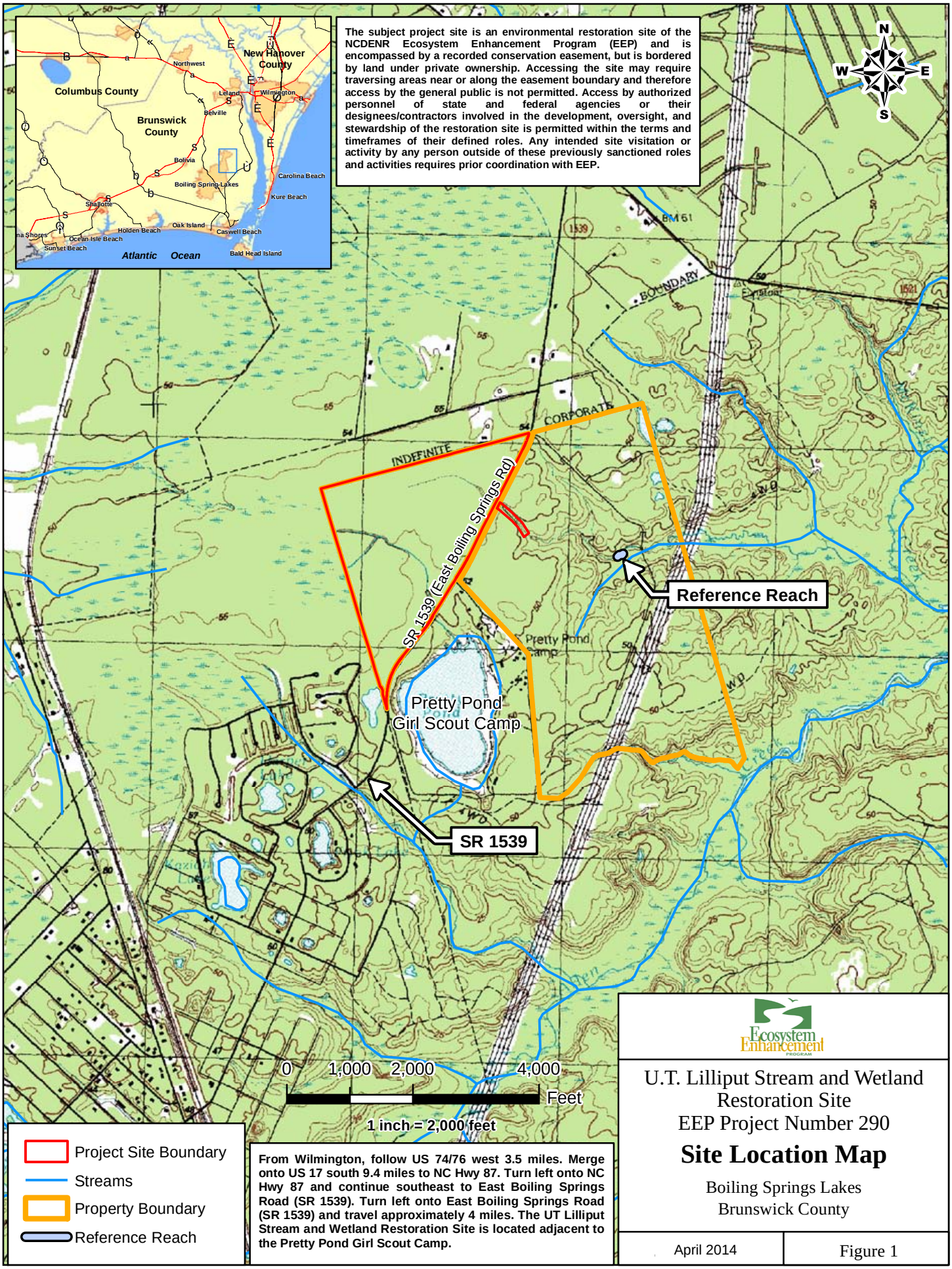

Source: USGS 7.5 Minute Quadrangle, Funston, NC

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FIGURE 1a.

Project Components

U.T. to Lilliput Creek
(Hog Branch Ponds)
Stream and Wetland Restoration Site
Project No: D05053S
EEP No. 290

Brunswick County

Legend

Restoration Plan Component

- Property Boundary
- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (20.45 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Stream Preservation (100' buffer, 8.67 Ac., 5332 LF)

N
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0 300 600 1,200
Feet

Ecosystem Enhancement Program

April 2014

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Table 1. Project Components and Mitigation Credits

UT Lilliput Stream and Wetland Restoration Project, EEP No. 290

Mitigation Credits

	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3,238	1,026		4.09	7.83 (7.67[1])	65.78 (62.73[1])			

Project Components

Project Component	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
0 to 1st Order Stream Restoration	Northern Tributary	1,535 LF	0 to 1st Order Stream Restoration	Restoration	1,535 LF	1:1
0 to 1st Order Stream Restoration	Southern Tributary	1,703 LF	0 to 1st Order Stream Restoration	Restoration	1,703 LF	1:1
Stream Preservation	See Figure 1a	4,932 LF	Preservation	Preservation (RE)	4,932 LF	5:1
Stream Preservation	See Figure 1a (area closest to road)	400 LF	Preservation	Preservation (RE)	400 LF	10:1
Non-Riparian Wetland Restoration	See Figure 1a	7.83 (7.67[1]) ac	Restoration	Restoration	7.83 (7.67[1]) ac	1:1
Non-Riparian Wetland Enhancement	See Figure 1a	96.46 (90.36[1]) ac	Enhancement	Enhancement (RE)	96.46 (90.36[1]) ac	2:1
Non-Riparian Wetland Preservation	See Figure 1a	87.74 ac	Preservation	Preservation (RE)	87.74 ac	5:1
Riparian Wetland Preservation	See Figure 1a	20.45 ac	Preservation	Preservation (RE)	20.45 ac	5:1

Component Summation

Restoration Level	Stream (lf)	Riparian Wetland (ac)	Non-Riparian Wetland (ac)	Buffer (sq ft)	Upland (ac)
Restoration	3,238 LF		7.83 (7.67[1]) ac		
Enhancement			96.46 (90.36[1]) ac		
Enhancement I					
Enhancement II					
Creation					
Preservation	5,332 LF	20.45 ac	87.74 ac		
HQ Preservation					

BMP Elements*

Element	Location	Purpose/Function	Notes
n/a	n/a	n/a	n/a

*BMP Elements are not part of the UT Lilliput Project

[1] Asset verification performed in 2013 determined that acreage of wetland restoration and enhancement decreased.

Table 2. Project Activity and Reporting History UT Lilliput Stream and Wetland Restoration Project -EEP Project No. 290		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	NA	Oct-06
Final Design – Construction Plans	NA	Apr-08
Construction	NA	Feb-10
Temporary S&E mix applied to entire project area	NA	Mar-09
Permanent seed mix applied to entire project area	NA	Mar-09
Containerized and B&B plantings	NA	Feb-10
Baseline Monitoring Document (Year 0 Monitoring -baseline)	December-10	December-10
Year 1 Monitoring	December-10	January-11
Year 2 Monitoring	December-11	December-11
Year 3 Monitoring	December-12	December-12
Year 4 Monitoring	December-13	December-13
Year 5 Monitoring		

Table 3. Project Contacts Table UT Lilliput Stream and Wetland Restoration Project	
EEP Project No. 290	
Designer Primary project design POC	Rummel, Klepper, and Kahl Engineers 900 Ridgefield Drive Suite 350; Raleigh, NC 27609 Pete Stafford (919) 878-9560
Construction Contractor Construction contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Planting Contractor Planting Contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Seeding Contractor Seeding Contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Seed Mix Sources	Contact River Works Inc.
Nursery Stock Suppliers	Contact River Works Inc.
Monitoring Performers (MY1) Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	Rummel, Klepper, and Kahl, LLP 900 Ridgefield Drive Suite 250; Raleigh, NC 27609 Pete Stafford (919) 878-9560 Pete Stafford (919) 878-9560 Pete Stafford (919) 878-9560
Monitoring Performers (MY2, MY3, & MY4) Vegetation Monitoring POC Wetland Monitoring POC	Land Management Group, Inc. 3805 Wrightsville Avenue, Suite 15; Wilmington, NC 28403 Kim Williams (910) 452-0001 Kim Williams (910) 452-0001

Table 4. Project Baseline Information and Attributes		
UT Lilliput Stream and Wetland Restoration Project		
EEP Project No. 290		
Project Information		
Project Name	UT Lilliput Stream and Wetland Restoration Project	
Project County	Brunswick	
Project Area	600 acres	
Project Coordinates (Lat and Long)	34.078043,-78.026662	
Project Watershed Summary Information		
Physiographic Region	Coastal Plain	
River Basin	Cape Fear	
USGS HUC 8 Digit 03020103	USGS HUC 14 Digit 03030005070010	
NCDWQ Subbasin	03-06-17	
Project Drainage Area	N/A	
Project Drainage impervious cover estimate (%)	< 5%	
CGIA Land Use Classification		
Reach Summary Information		
Parameters	**North Tributary**	**South Tributary**
Length of Reach	1,535 LF	1,703 LF
Valley Classification	0 to 1st order	0 to 1st order
Drainage Area	52.49 acres	66.94 acres
NCDWQ Stream Identification Score	N/A	N/A
NCDWQ Water Quality Classification	CNSW	CNSW
Morphological Description (stream type)	0 to 1st order	0 to 1st order
Evolutionary Trend	N/A	N/A
Underlying Mapped Soils	Leon	Murville
Drainage Class	Poorly Drained	Poorly Drained
Soil Hydric Status	Hydric A	Hydric A
Slope	0.001	0.001
FEMA Classification	Zone X	Zone X
Native Vegetation Community	N/A	N/A
Percent Composition Exotic Invasive Vegetation	< 1%	< 1%
Wetland Summary Information		
Parameter	**Wetland 1**	**Wetland 2**
Size (acres)	87.74	22.45
Wetland Type	Non-Riparian	Riparian
Mapped Soils Series	Murville and Leon	Muckalee
Drainage Class	Very poorly drained, poorly drained	Very poorly drained
Soil Hydric Status	A	A
Source of Hydrology	Groundwater	Groundwater
Hydrologic Impairment	N/A	N/A
Native Vegetation Community	Long Leaf Pine	Coastal Plain Blackwater Small Stream
Percent of Exotic/Invasive Veg	<1%	<1%

Table 4. Contd.			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the US – Section 404	Yes	Yes	Upon Request
Waters of the US – Section 401	Yes	Yes	Upon Request
Endangered Species Act	Yes	Yes	Upon Request
Historic Preservation Act	Yes	Yes	Upon Request
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	Yes	Yes	Upon Request
FEMA Floodplain Compliance	Yes	Yes	Upon Request
Essential Fisheries Habitat	No		

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Appendix B.
Visual Assessment Data

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FIGURE 2

Current Conditions Plan View
U.T. to Lilliput Creek
(Hog Branch Ponds)
Stream and Wetland
Restoration Site
Project No: D08049S
EEP No. 290
Brunswick County

Legend

Vegetation Monitoring Counts

- Less Than 320 Planted Stems per Acre
- More Than 320 Planted Stems per Acre
- Areas of low vegetative growth
  (meets success criterion but vegetation is slow growing and has low vigor; may need supplemental planting)

Gauge Success Criteria

- < 12%
- > 12%

Restoration Plan Component

- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Property Boundary
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (20.45 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Stream Preservation
  (100' buffer, 8.67 Ac., 5332 LF)
- Preliminary wetlands assessment conducted in 2013 found these areas to be uplands (~6.3 acres)

0 200 400 800 Feet

Ecosystem Enhancement Program

April 2014

Preliminary Uplands
Preliminary Uplands
Preliminary Uplands
SR 1539 (East Boiling Springs Rd)
Pretty Pond
Girl Scout Camp

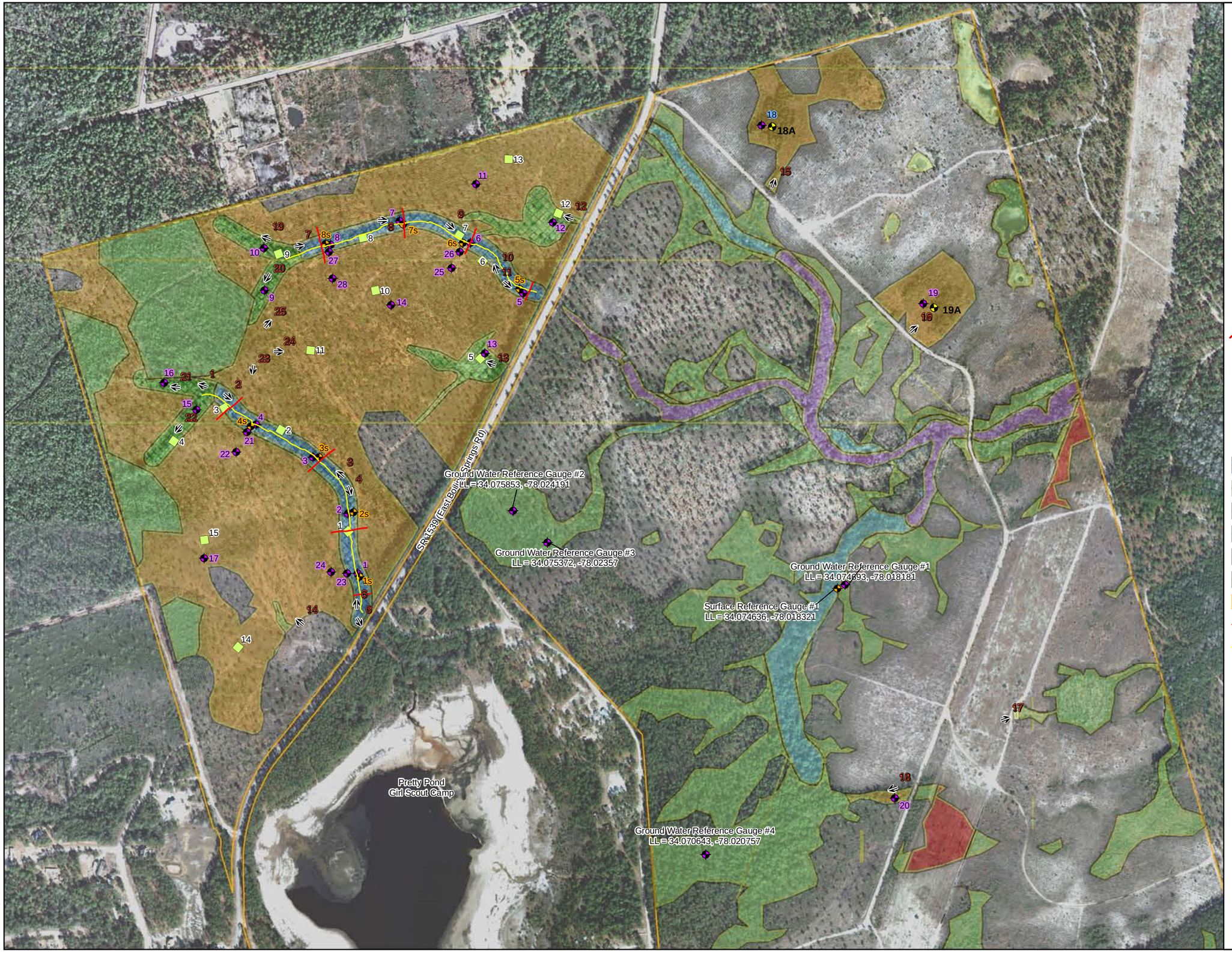

FIGURE 3

Monitoring Plan Features

U.T. Lilliput Stream and Wetland Restoration Site
Project No: D05053S
EEP No. 290

Brunswick County

Legend

- Vegetation Monitoring Plot
- Brunswick County Soils Survey

Monitoring Gauges

- Surface Gauges 2010
- Groundwater Gauges 2010/2011
- New Gauge installed in February 2013

Restoration Plan Component

- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (11.78 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Property Boundary
- Surveyed Cross Sections
- Surveyed Longitudinal Profile

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Ecosystem Enhancement Program

April 2014

Table 5a. Visual Stream Morphological Stability Assessment
Reach ID - Northern Tributary
Assessed Length - 1535 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			N/A	N/A	N/A			
		2. Degradation			N/A	N/A	N/A			
	2. Riffle Condition	1. Texture/Substrate	N/A	N/A			N/A			
	3. Meander Pool Condition	1. Depth	N/A	N/A			N/A			
		2. Length	N/A	N/A			N/A			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	N/A	N/A			N/A			
		2. Thalweg centering at downstream of meander	N/A	N/A			N/A			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	100%
	2. Undercut	Banks undercut/overhanging			N/A	N/A	N/A	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100%	N/A	N/A	100%
				TOTALS	0	0	100%	N/A	N/A	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	9	9			100%			
	2. Grade Control	Grade control exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining- Max Pool Depth: Mean Bankfull Depth Ratio >= 1.6 Rootwads/logs providng some cover at base flow	N/A	N/A			N/A			

Table 5b. Visual Stream Morphological Stability Assessment
Reach ID - Southern Tributary
Assessed Length - 1703 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			N/A	N/A	N/A			
		2. Degradation			N/A	N/A	N/A			
	2. Riffle Condition	1. Texture/Substrate	N/A	N/A			N/A			
	3. Meander Pool Condition	1. Depth	N/A	N/A			N/A			
		2. Length	N/A	N/A			N/A			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	N/A	N/A			N/A			
		2. Thalweg centering at downstream of meander	N/A	N/A			N/A			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	100%
	2. Undercut	Banks undercut/overhanging			N/A	N/A	N/A	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100%	N/A	N/A	100%
				TOTALS	0	0	100%	N/A	N/A	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	9	9			100%			
	2. Grade Control	Grade control exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining- Max Pool Depth: Mean Bankfull Depth Ratio >= 1.6 Rootwads/logs providng some cover at base flow	N/A	N/A			N/A			

Table 6. Vegetation Condition Assessment Table

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	No bare areas located onsite for MY4 2013	N/A	N/A	N/A	N/A
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	VP13 did not meet vegetative success criterion.	Red Square	1	0.02 ac	< .1%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	Many stems in plots within stream valleys exhibited slow growth	Red dotted line	2	~ 11 ac	~ 10%

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Appendix B - Stream and Cross Section Photos
(photos recorded on September 11 and September 12, 2013)

Photo Station 1. Southern Tributary Station 15+00 - SCX4 - Looking downstream

Photo Station 2. Southern Tributary Station 15+00 - SCX4 - Looking upstream

Photo Station 3. Southern Tributary Station 23+00 - SCX3 - Looking upstream

Photo Station 4. Southern Tributary Station 23+00 - SCX2 - Looking downstream

Photos recorded on September 11 and September 12, 2013

Photo Station 5. Southern Tributary Station 29+00 - SCX1 - Looking upstream

Photo Station 6. Southern Tributary Station 29+00 - SCX1 - Looking downstream

Photos recorded on September 11 and September 12, 2013

Photo Station 7. Northern Tributary Station 14+00 - NCX4 - Looking downstream

Photo Station 8. Northern Tributary Station 21+00 - NCX3 - Looking upstream

Photos recorded on September 11 and September 12, 2013

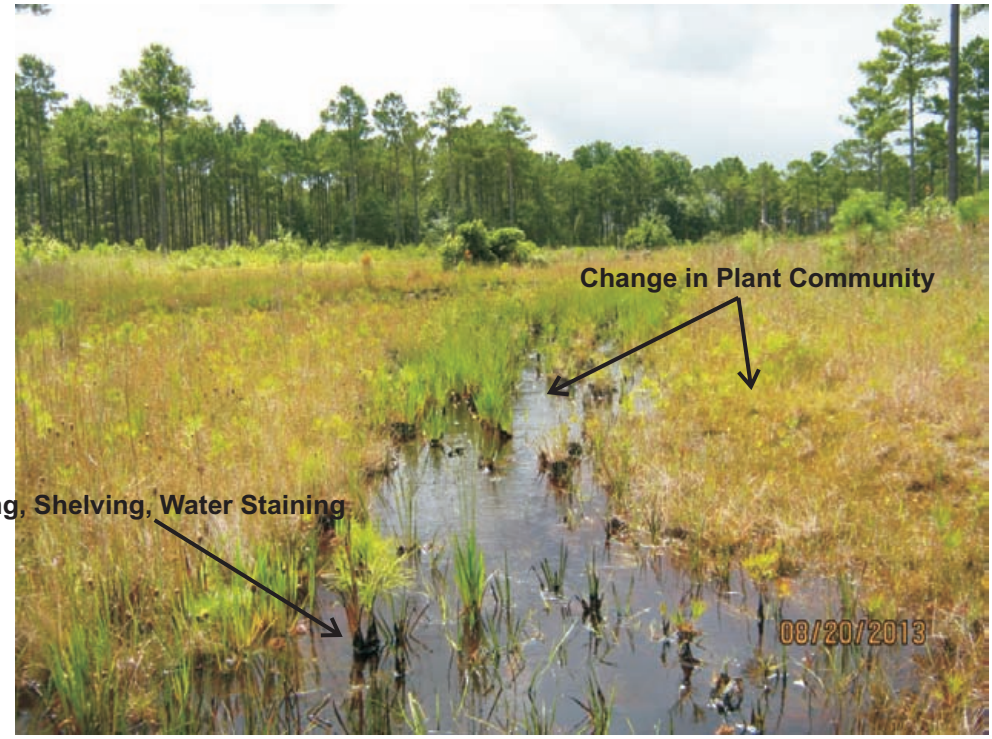
Photo Station 9. Northern Tributary Station 21+00 - NCX2 - Looking downstream

Photo Station 10. Northern Tributary Station 28+25 - NCX1 - Looking upstream

Photos recorded on September 11 and September 12, 2013

Photo Station 11. Northern Tributary Station 28+25 - NCX1 - Looking downstream

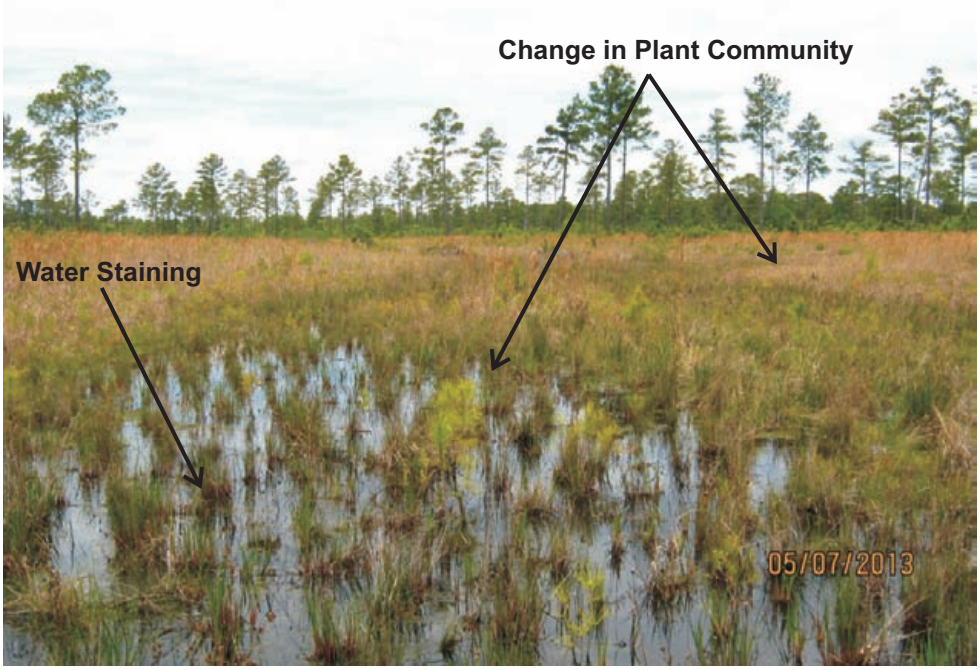
Photos recorded on September 11 and September 12, 2013



View of OHWM on South Tributary

View of OHWM on South Tributary

Photos recorded on August 20, 2013



View of OHWM on North Tributary

View of OHWM on North Tributary

Photos recorded on August 20, 2013

Appendix B - Wetland and General Site Photos (all photos recorded on September 11 & 12, 2013)

Photo Station 12. Site 1 - Looking West

Photo Station 13. Site 2 - Looking West

Photos recorded on September 11 and September 12, 2013

Photo Station 14. Site 3 - Looking West

Photo Station 15. Site 4 - Looking North

Photos recorded on September 11 and September 12, 2013

Photo Station 16. Site 5- Looking Northeast

Photo Station 17. Site 6 - Looking Northeast

Photos recorded on September 11 and September 12, 2013

Photo Station 18. Site 7 - Looking West

Photo Station 19. Northern Headwater Wetland - North Prong

Photos recorded on September 11 and September 12, 2013

Photo Station 20. Northern Headwater Wetland - South Prong

Photo Station 21. Southern Headwater Wetland - North Prong

Photos recorded on September 11 and September 12, 2013

Photo Station 22. Southern Headwater Wetland - South Prong

Photo Station 23. General Site View - Wetland Enhancement Area

Photos recorded on September 11 and September 12, 2013

Photo Station 24. General Site View - Wetland Enhancement Area

Photo Station 25. General Site View - Wetland Enhancement Area

Photos recorded on September 11 and September 12, 2013

Vegetation Plot Photos (all photos recorded on September 20 and 21, 2012)

Vegetation Plot 1

Vegetation Plot 2

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 3

Vegetation Plot 4

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 5

Vegetation Plot 6

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 7

Vegetation Plot 8

Photos recorded on September 11 and September 12, 2013

Vegetaton Plot 9

Vegetation Plot 10

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 11

Vegetation Plot 12

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 13

Vegetation Plot 14

Photos recorded on September 11 and September 12, 2013

Vegetation Plot 15

Site 6 - Total Stem Count

Photos recorded on September 11 and September 12, 2013

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Appendix C.
Vegetation Plot Data

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Table 7. Vegetation Plot Criteria Attainment			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
Southern Tributary	VP1	Y	94%
Southern Tributary	VP2	Y	
Southern Tributary	VP3	Y	
Southern Headwater Wetland	VP4	Y	
Site 2	VP5	Y	
Northern Tributary	VP6	Y	
Northern Tributary	VP7	Y	
Northern Tributary	VP8	Y	
Northern Headwater Wetland	VP9	Y	
Wetland Enhancement	VP10	Y	
Wetland Enhancement	VP11	Y	
Site 1	VP12	Y	
Wetland Enhancement	VP13	N	
Wetland Enhancement	VP14	Y	
Wetland Enhancement	VP15	Y	
Site 6	Site 6 (Total Count)	Y	

Table 8. CVS Vegetation Plot Metadata UT to Lilliput Creek EEP No. 290	
Report Prepared By	Kim Williams
Date Prepared	4/25/2014 10:00
Database Name	UTLilliput_290_MY4_2013.mdb
Database Location	L:\Wetlands\2008\UT to Lilliput\Annual Monitoring Report\Year 4
Computer Name	KWILLIAMS
Description Worksheets in This Document	
Metadata	Description of database file, the report worksheets, and a summary of project and project data.
Proj Planted	Each project is listed with its PLANTED stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Proj Total Stems	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.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc)
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
Project Summary	
Project Code	290
Project Name	UT Lilliput
Description	Stream and Wetland Restoration Project
River Basin	Cape Fear
Length (ft)	3238
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	16

Table 9. Planted and total stem counts (species by plot with annual means)

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2013)																									
			E290-LMG-0001			E290-LMG-0002			E290-LMG-0003			E290-LMG-0004			E290-LMG-0005			E290-LMG-0006			E290-LMG-0007			E290-LMG-0008			E290-LMG-0009		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																										
Aronia		Shrub																										29
Clethra alnifolia	sweetpepperbush	Shrub																										
Cyrilla racemiflora	swamp titi	Shrub						6			14			3														13
Gaylussacia dumosa	dwarf huckleberry	Shrub																										
Gaylussacia frondosa	blue huckleberry	Shrub																										33
Gordonia lasianthus	loblolly bay	tree						2						1														
Ilex cassine	dahoon	Shrub																										
Ilex coriacea	large gallberry	Shrub																										
Ilex glabra	inkberry	Shrub															15			7								40
Lyonia lucida	fetterbush lyonia	Shrub						3						12						17								
Lyonia mariana	staggerbush	Shrub																										
Magnolia virginiana	sweetbay	Tree	5	5	10	2	2	6						2							3	3	4	3	3	3	1	1	20
Morella cerifera	wax myrtle	Shrub						3									2											
Nyssa	tupelo	Tree																					4			1		
Nyssa biflora	swamp tupelo	Tree				1	1	1																1	1	1		
Nyssa sylvatica	blackgum	Tree			9																							
Persea borbonia	redbay	tree												5									3					16
Persea palustris	swamp bay	tree																										
Pinus palustris	longleaf pine	Tree													5	5	5	5	5	5								
Pinus serotina	pond pine	Tree	5	5	5	8	8	8	5	5	25	2	2	2	6	6	6	12	12	46	4	4	4	4	4	4	3	3	3
Pinus taeda	loblolly pine	Tree			97			84						32			33						23			14			30
Quercus	oak	Tree				1	1	1	1	1	1	1	1	1														
Quercus laurifolia	laurel oak	Tree										1	1	1														
Quercus lyrata	overcup oak	Tree	3	3	3	1	1	1	2	2	2	5	5	5													4	4	4
Rhus copallinum	flameleaf sumac	Shrub																										
Vaccinium	blueberry	Shrub																		4								
Vaccinium corymbosum	highbush blueberry	Shrub															3											14
Vaccinium elliottii	Elliott's blueberry	Shrub																										
Stem count			13	13	124	13	13	115	8	8	42	9	9	64	11	11	64	17	17	79	7	7	38	8	8	23	8	8	202
size (ares)			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			3	3	5	5	5	10	3	3	4	4	4	10	2	2	6	2	2	5	2	2	5	3	3	5	3	3	10
Stems per ACRE			526.09	526.09	5018.1	526.09	526.09	4653.9	323.75	323.75	1699.7	364.22	364.22	2590	445.15	445.15	2590	687.97	687.97	3197	283.28	283.28	1537.8	323.75	323.75	930.78	323.75	323.75	8174.6

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 9 contd.Planted and total stem counts (species by plot with annual means)

			Current Plot Data (MY4 2013)																			Annual Means								
			E290-LMG-0010			E290-LMG-0011			E290-LMG-0012			E290-LMG-0013			E290-LMG-0014			E290-LMG-0015			MY4 (2013)			MY3 (2012)			MY2 (2011)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			1												1						2			6			
Aronia		Shrub			50			105			1												185						
Clethra alnifolia	sweetpepperbush	Shrub												12									12			5			
Cyrilla racemiflora	swamp titi	Shrub			45									17						40			138			45			
Gaylussacia dumosa	dwarf huckleberry	Shrub												55			70						125						
Gaylussacia frondosa	blue huckleberry	Shrub			50			60												60			203						
Gordonia lasianthus	loblolly bay	tree																					3						
Ilex cassine	dahoon	Shrub																		3			3						
Ilex coriacea	large gallberry	Shrub			31									75						60			166						
Ilex glabra	inkberry	Shrub			41			54			12						49			6			224			55			
Lyonia lucida	fetterbush lyonia	Shrub									39			55									126			12			
Lyonia mariana	staggerbush	Shrub						40									40			20			100						
Magnolia virginiana	sweetbay	Tree			41			1						13							14	14	100	15	15	15	16	16	16
Morella cerifera	wax myrtle	Shrub			8						9			40			40						102			19			
Nyssa	tupelo	Tree																					5						
Nyssa biflora	swamp tupelo	Tree																			2	2	2	2	2	2	1	1	1
Nyssa sylvatica	blackgum	Tree			11																		20						
Persea borbonia	redbay	tree			43			15			8			30			31			3			154						
Persea palustris	swamp bay	tree																								26			
Pinus palustris	longleaf pine	Tree	15	15	15	9	9	9	9	9	9	4	4	5	8	8	8	8	8	8	63	63	64	59	59	59	71	71	71
Pinus serotina	pond pine	Tree							9	9	9										58	58	112	63	63	78	64	64	64
Pinus taeda	loblolly pine	Tree			10			13			51			9			11			15			422			82			
Quercus	oak	Tree																			3	3	3	7	7	7	6	6	6
Quercus laurifolia	laurel oak	Tree																			1	1	1	5	5	5	6	6	6
Quercus lyrata	overcup oak	Tree																			15	15	15	20	20	20	25	25	25
Rhus copallinum	flameleaf sumac	Shrub									6												6						
Vaccinium	blueberry	Shrub																		5			9			27			
Vaccinium corymbosum	highbush blueberry	Shrub			35			45						35									132						
Vaccinium elliottii	Elliott's blueberry	Shrub												24									24						
		Stem count	15	15	381	9	9	342	18	18	144	4	4	370	8	8	250	8	8	220	156	156	2458	171	171	463	189	189	189
		size (ares)	1			1			1			1			1			1			15			15			11		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.37			0.37			0.27		
		Species count	1	1	13	1	1	9	2	2	9	1	1	12	1	1	8	1	1	10	7	7	28	7	7	16	7	7	7
		Stems per ACRE	607.03	607.03	15419	364.22	364.22	13840	728.43	728.43	5827.5	161.87	161.87	14973	323.75	323.75	10117	323.75	323.75	8903.1	420.87	420.87	6631.4	461.34	461.34	1249.1	695.32	695.32	695.32

Site	Species	Planted	MY3 Total
Site 6	*Taxodium distichum*	40	34*

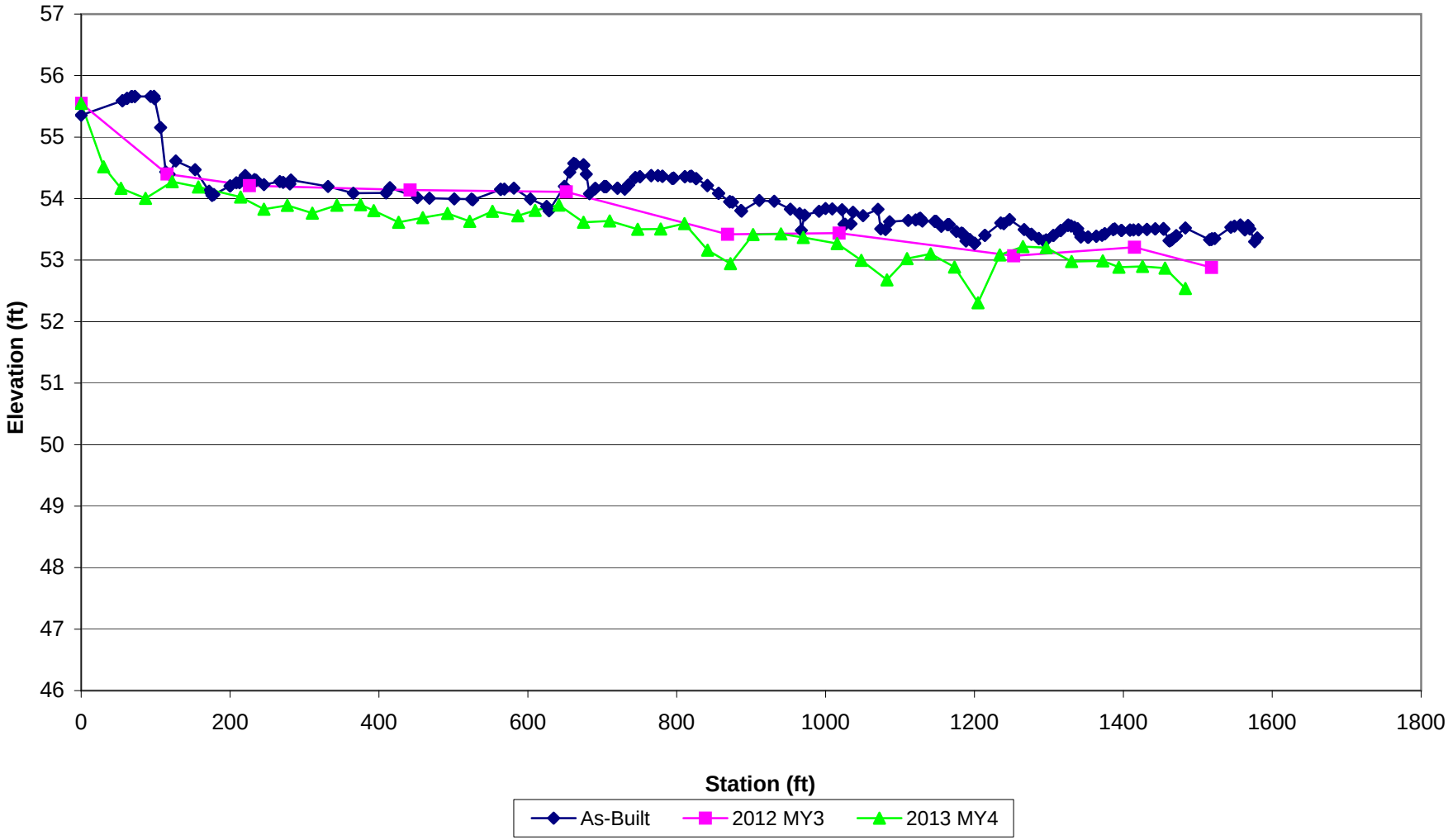
* Plot boundaries could not be located.

Color for Density

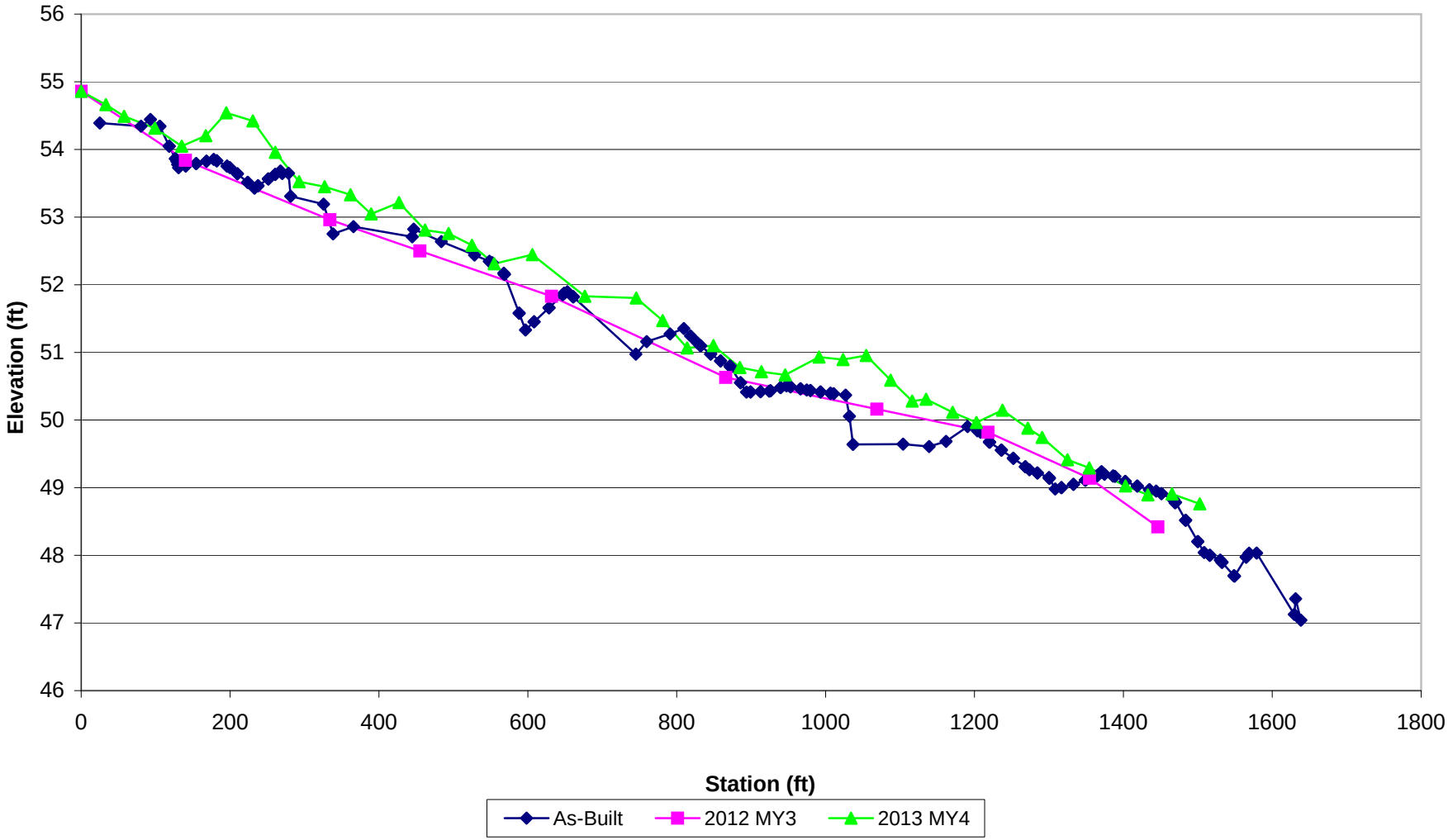
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Appendix D.
Stream Survey Data

UT to Lilliput Stream and Wetland Restoration Project
Longitudinal Profile
Northern Tributary



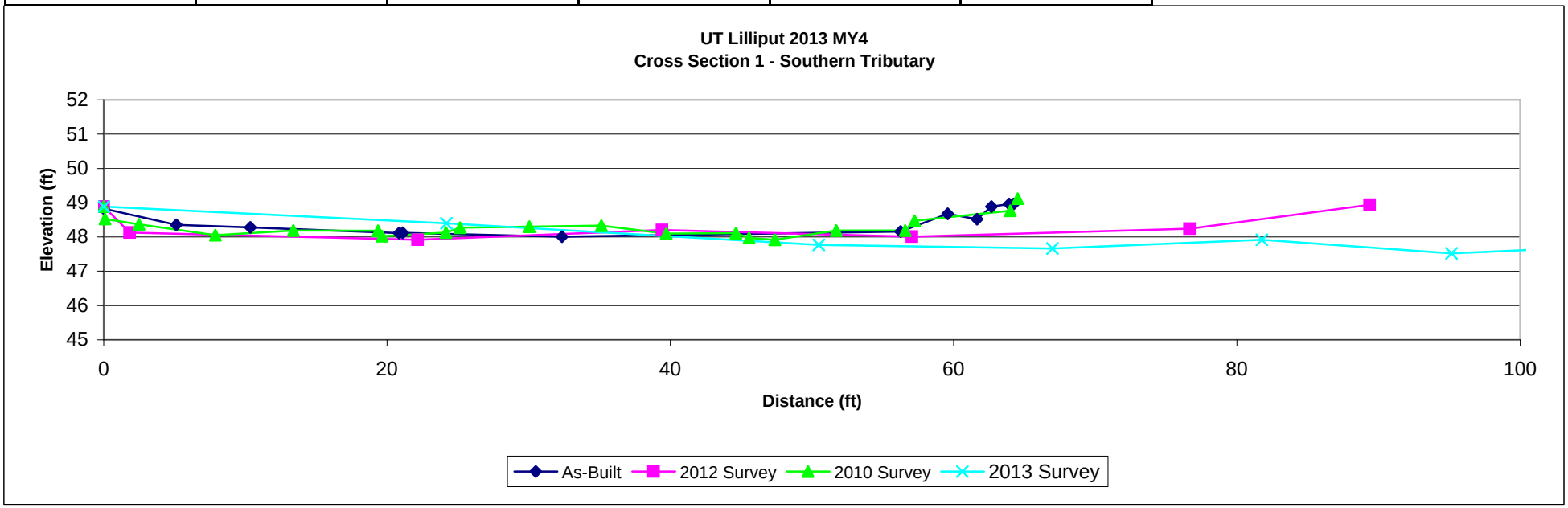
UT to Lilliput Stream and Wetland Restoration Project
Longitudinal Profile
Southern Tributary



Project Name	UT to Lilliput
Watershed	Lilliput, MY4
Cross Section	1S
Drainage Area	66.94 ac
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	48.83		0	48.89		N/A			0	48.89		0	48.89				
5.13	48.35		0.09	48.53					1.83	48.13		24.2	48.4				
10.36	48.28		2.48	48.37					22.17	47.92		50.48	47.77				
20.86	48.11		7.88	48.05					39.42	48.2		66.97	47.66				
21.1	48.12		13.38	48.19					57.06	48.01		81.76	47.92				
32.36	48.01		19.37	48.18					76.66	48.24		95.15	47.52				
56.25	48.16		19.65	48.02					89.37	48.94		114.18	47.87				
59.59	48.68		24.16	48.13								138.24	48.84				
61.65	48.52		25.16	48.27													
62.67	48.89		30.04	48.3													
63.92	48.96		35.14	48.33													
64.23	48.96		39.71	48.1													
			44.64	48.11													
			45.56	47.97													
			47.38	47.92													
			51.71	48.19													
			56.59	48.19													
			57.23	48.47													
			64	48.77													
			64.52	49.12													

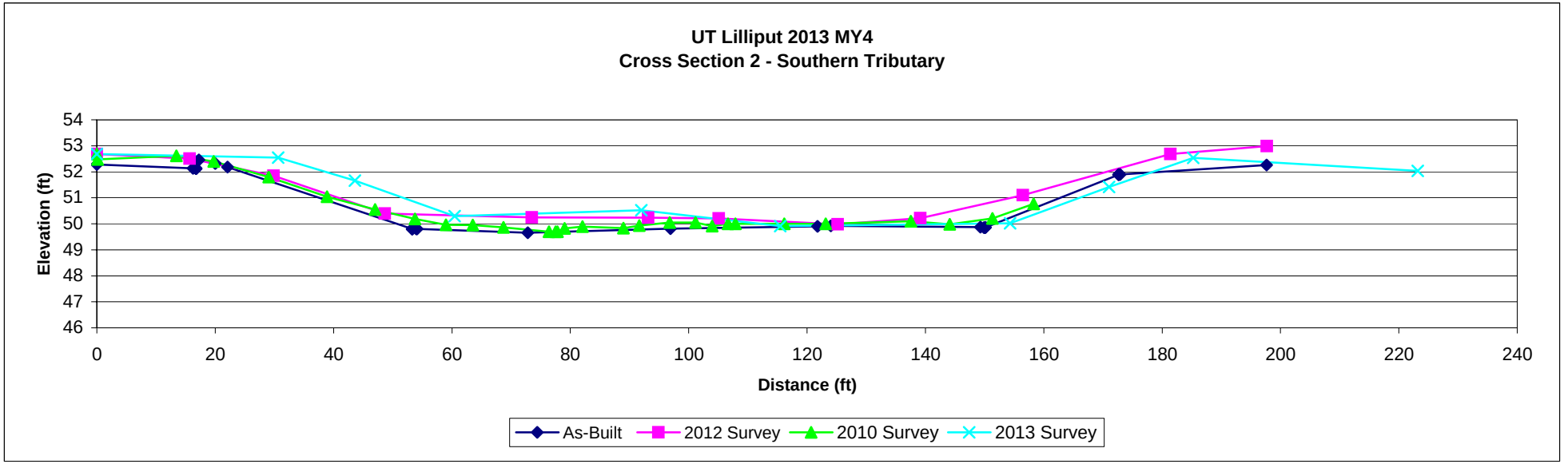
Southern Tributary Station 29+00 - SCX1
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	2S
Drainage Area	66.94 ac
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	52.28		0	52.68		N/A			0	52.68		0	52.68				
16.25	52.13		0.14	52.48					15.68	52.51		30.63	52.55				
16.73	52.13		13.46	52.61					29.88	51.85		43.6	51.66				
16.75	52.12		19.73	52.4					48.66	50.39		60.46	50.29				
16.75	52.12		29.04	51.8					73.52	50.25		92	50.52				
17.26	52.46		38.91	51.04					93.16	50.24		115.47	49.91				
20	52.32		47	50.55					105.09	50.21		154.32	50.02				
22.07	52.18		53.77	50.19					125.19	49.98		171.03	51.42				
53.26	49.8		58.97	49.96					139.15	50.22		185.26	52.54				
53.29	49.79		63.53	49.95					156.49	51.1		223.2	52.03				
53.99	49.8		68.72	49.86					181.4	52.68							
54.12	49.8		76.4	49.7					197.68	52.99							
72.82	49.66		77.52	49.7													
96.93	49.81		77.81	49.7													
121.79	49.9		79.02	49.82													
124.01	49.92		82.05	49.89													
149.28	49.87		88.99	49.83													
149.91	49.85		91.67	49.93													
150.07	49.85		96.79	50.05													
150.16	49.86		101.16	50.05													
172.65	51.89		103.95	49.91													
172.69	51.9		106.66	50													
172.91	51.9		107.92	50													
197.64	52.26		116.14	50													
			123.16	50													
			137.55	50.1													
			144.13	49.98													
			151.32	50.21													
			158.29	50.77													

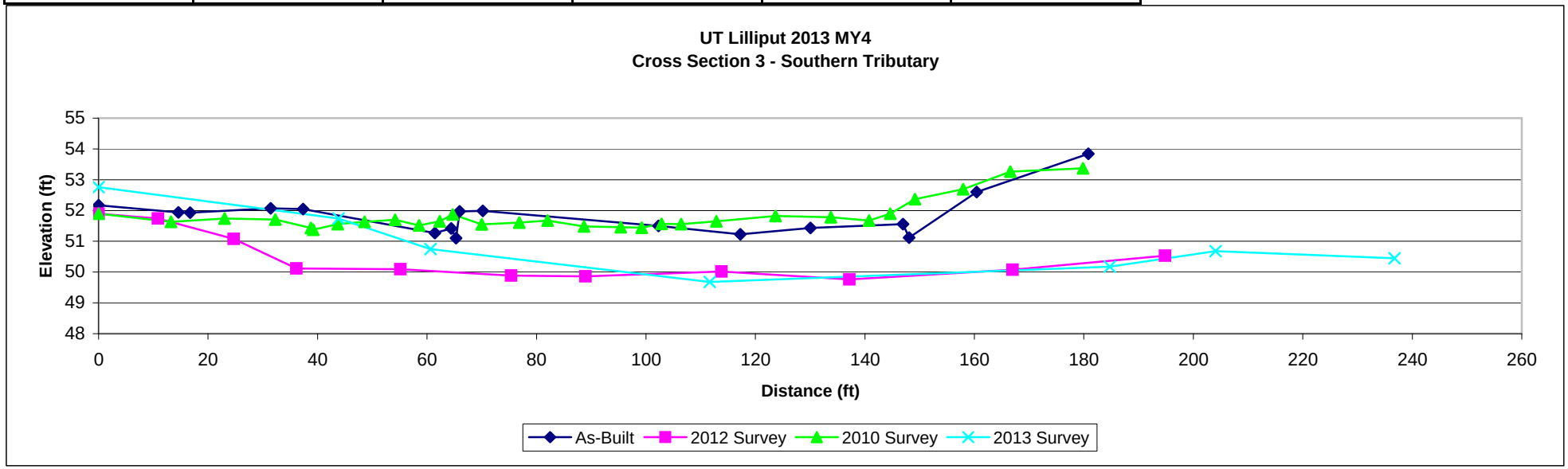
Southern Tributary Station 23+00 - SCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	3S
Drainage Area	66.94 ac
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	52.17		0	51.9		N/A			0	51.9		0	52.76				
14.6	51.94		13.24	51.63					10.83	51.74		43.85	51.74				
16.72	51.93		23.01	51.74					24.7	51.08		60.65	50.75				
31.45	52.07		32.28	51.71					36.15	50.12		111.67	49.68				
37.34	52.05		38.82	51.43					55.14	50.09		184.74	50.18				
61.46	51.27		39.2	51.38					75.38	49.89		204.04	50.68				
64.43	51.42		43.69	51.56					88.97	49.86		236.77	50.45				
65.32	51.1		48.6	51.63					113.78	50.02							
65.95	51.97		54.17	51.7					137.16	49.76							
70.21	51.99		58.55	51.52					167	50.08							
102.27	51.5		62.3	51.65					194.84	50.53							
117.25	51.23		64.72	51.87													
130.06	51.43		70.01	51.55													
146.95	51.56		76.86	51.61													
148.06	51.12		82.04	51.67													
160.4	52.6		88.7	51.48													
180.84	53.84		95.41	51.46													
			99.19	51.44													
			102.84	51.57													
			106.43	51.56													
			112.85	51.65													
			123.66	51.82													
			133.77	51.78													
			140.78	51.67													
			144.63	51.9													
			149.13	52.37													
			157.97	52.69													
			166.56	53.26													
			179.84	53.37													

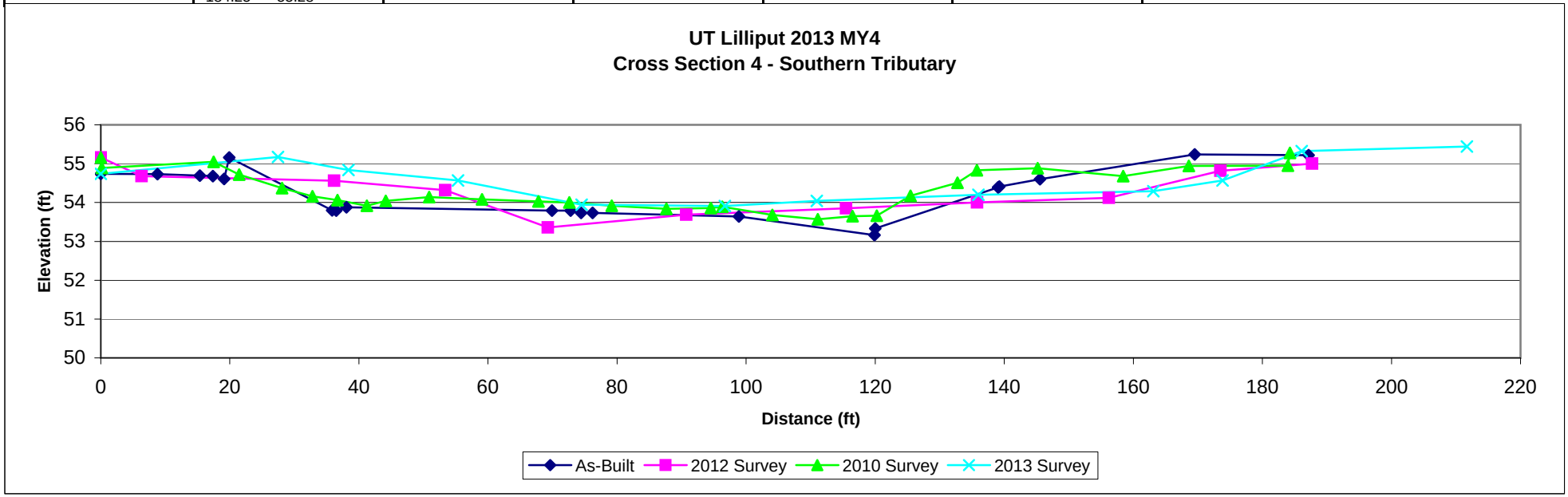
Southern Tributary Station 23+00 - SCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	4S
Drainage Area	66.94 ac
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	54.74		0	55.16		N/A			0	55.16		0	54.74				
8.78	54.73		0.15	54.89					6.33	54.68		27.46	55.17				
15.36	54.69		17.5	55.05					36.15	54.56		38.37	54.84				
17.37	54.68		21.43	54.72					53.37	54.32		55.37	54.57				
19.1	54.61		28.11	54.37					69.3	53.36		74.51	53.94				
19.91	55.16		32.8	54.16					90.73	53.69		96.71	53.91				
35.85	53.8		36.68	54.06					115.5	53.85		110.95	54.04				
36.47	53.79		41.24	53.92					135.78	54		135.98	54.2				
38.08	53.88		44.17	54.04					156.2	54.12		163.09	54.29				
69.9	53.79		50.87	54.14					173.52	54.82		173.84	54.57				
72.79	53.79		59.07	54.08					187.72	55		186.1	55.32				
74.41	53.73		67.83	54.03								211.71	55.44				
76.19	53.73		72.61	54													
98.88	53.64		79.17	53.92													
119.88	53.16		87.63	53.84													
120	53.33		94.53	53.86													
139.03	54.39		96.31	53.89													
139.26	54.41		104.06	53.68													
145.55	54.6		111.12	53.57													
169.51	55.24		116.5	53.65													
187.17	55.22		120.25	53.66													
			125.49	54.17													
			132.75	54.51													
			135.77	54.83													
			145.16	54.88													
			158.45	54.68													
			168.6	54.94													
			183.97	54.95													
			184.25	55.28													

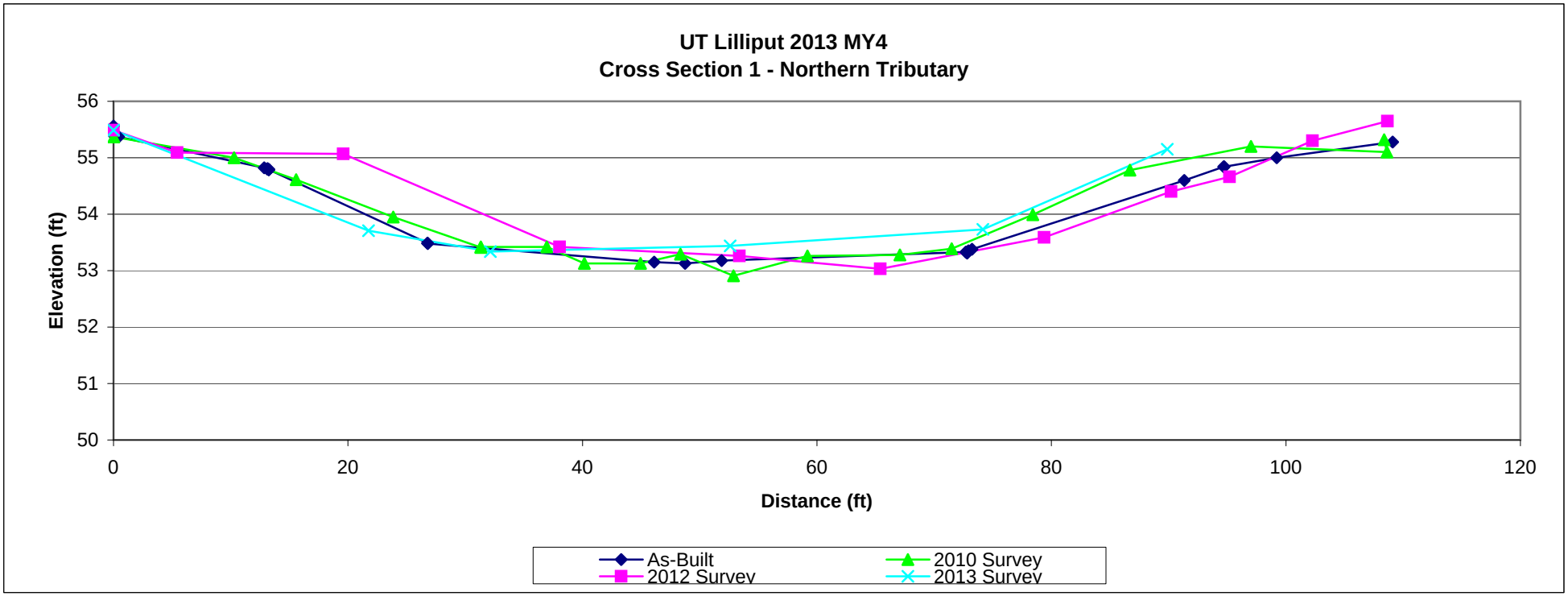
Southern Tributary Station 15+00 - SCX4
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	N1
Drainage Area	52.49
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	55.56		0	55.49		N/A			0	55.49		0	55.49				
0.07	55.39		0.02	55.37					5.42	55.09		21.74	53.71				
0.44	55.37		10.28	55					19.6	55.07		32.14	53.34				
12.86	54.82		15.58	54.61					38.05	53.42		52.59	53.44				
13.11	54.8		23.87	53.95					53.38	53.26		74.14	53.73				
13.14	54.81		31.33	53.41					65.41	53.03		89.88	55.15				
13.23	54.79		31.33	53.42					79.37	53.59							
13.25	54.79		36.95	53.42					90.2	54.4							
13.25	54.79		40.17	53.13					95.19	54.66							
26.79	53.49		44.95	53.13					102.26	55.3							
26.8	53.48		48.35	53.29					108.67	55.65							
46.12	53.15		52.89	52.91													
48.76	53.13		59.18	53.26													
51.88	53.18		67.07	53.28													
72.69	53.33		71.5	53.39													
72.8	53.31		78.4	53.99													
72.91	53.35		86.69	54.78													
73.23	53.38		97.03	55.2													
91.32	54.6		108.62	55.1													
94.69	54.84		108.38	55.32													
94.73	54.84																
99.22	55																
109.11	55.28																

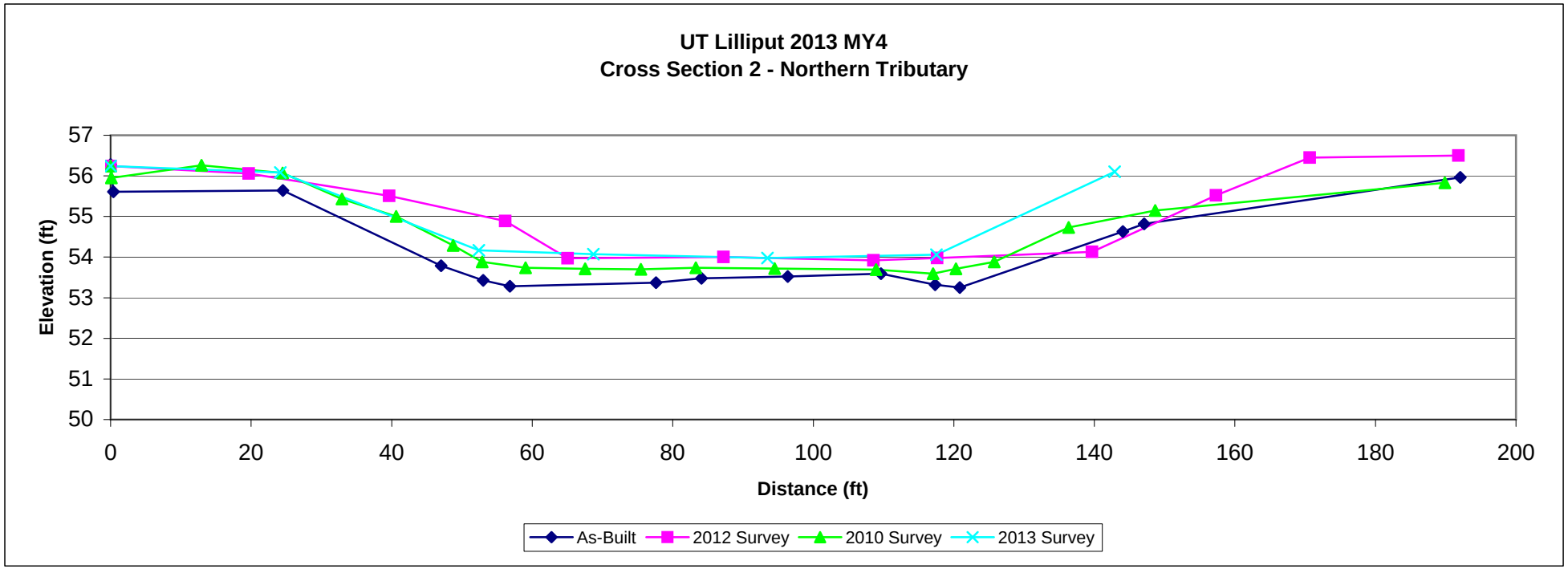
Northern Tributary Station 28+25 - NCX1
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY4
Cross Section	N2
Drainage Area	52.49
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	56.28		0	56.24		N/A			0	56.24		0	56.24				
0.4	55.61		0.1	55.95					19.65	56.06		24.17	56.08				
24.51	55.64		12.95	56.26					39.64	55.51		52.41	54.17				
47.03	53.79		24.5	56.07					56.16	54.89		68.69	54.07				
53.04	53.43		32.94	55.43					65.04	53.97		93.47	53.98				
56.82	53.28		40.64	55					87.21	54		117.51	54.06				
77.6	53.37		48.75	54.29					108.58	53.92		142.9	56.1				
84.09	53.48		52.86	53.88					117.63	53.98							
96.35	53.52		59.07	53.74					139.66	54.13							
109.63	53.59		67.53	53.71					157.3	55.52							
117.34	53.32		75.47	53.7					170.66	56.45							
120.85	53.25		83.29	53.74					191.83	56.5							
144.04	54.63		94.51	53.72													
147.08	54.82		108.93	53.69													
192.06	55.96		117.04	53.59													
			120.29	53.71													
			125.76	53.88													
			136.35	54.73													
			148.67	55.15													
			189.88	55.83													

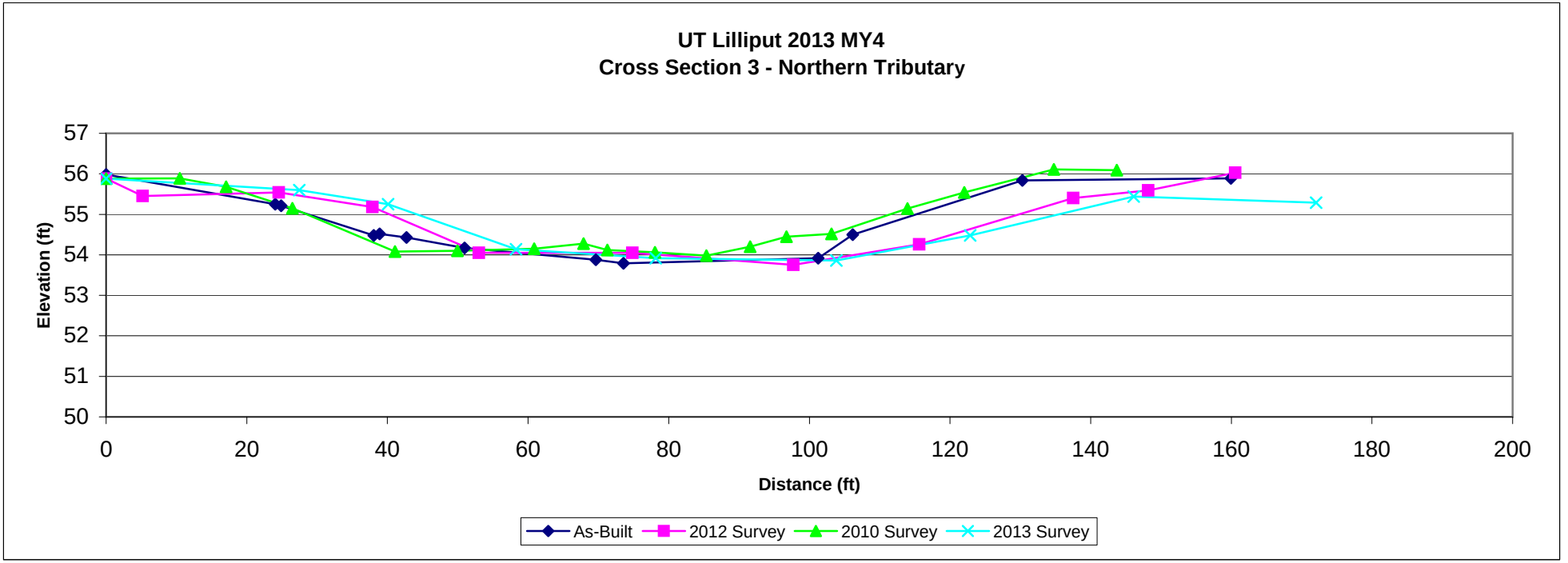
Northern Tributary Station 21+00 - NCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	N3
Drainage Area	52.49
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	55.98		0	55.88		N/A			0	55.88		0	55.88				
24.05	55.25		10.48	55.89					5.22	55.45		27.48	55.6				
24.89	55.21		17.07	55.68					24.55	55.54		40.08	55.25				
38.04	54.48		26.47	55.15					37.87	55.18		58.27	54.14				
38.91	54.52		41.07	54.08					53	54.05		78.15	53.92				
42.7	54.43		49.96	54.1					74.84	54.05		103.85	53.86				
50.97	54.17		60.88	54.15					97.72	53.75		122.88	54.48				
69.64	53.88		67.88	54.28					115.63	54.26		146.11	55.44				
73.57	53.79		71.28	54.12					137.54	55.4		172.04	55.29				
101.27	53.92		78.04	54.06					148.2	55.59							
106.16	54.5		85.34	53.98					160.55	56.03							
130.28	55.84		91.58	54.2													
159.93	55.89		96.76	54.45													
			103.14	54.52													
			113.94	55.14													
			122.02	55.54													
			134.77	56.11													
			143.73	56.09													

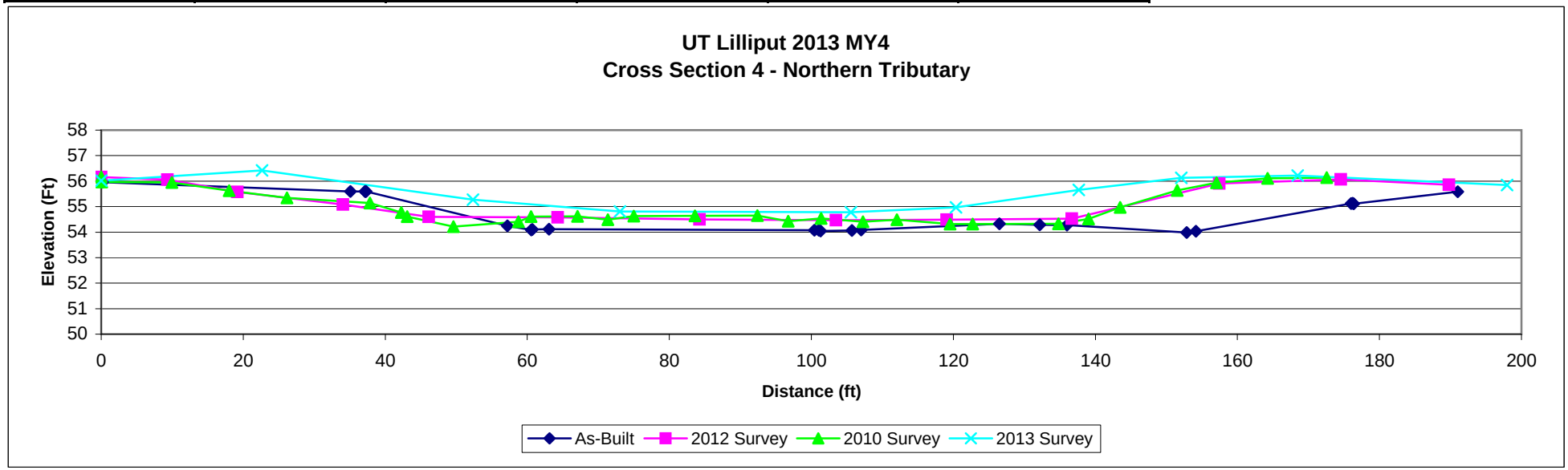
Northern Tributary Station 21+00 - NCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 4
Cross Section	N4
Drainage Area	52.49
Date	1/3/2014
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	56.02		0	56.16		N/A			0	56.16		0	56.02				
0.18	55.96		0.09	55.97					9.34	56.06		22.64	56.42				
35.09	55.59		9.96	55.95					19.18	55.57		52.36	55.27				
37.17	55.59		18.02	55.63					34.04	55.08		73.03	54.81				
37.2	55.59		26.17	55.34					46.13	54.6		105.57	54.78				
37.3	55.59		37.86	55.14					64.29	54.58		120.37	54.97				
57.19	54.25		42.25	54.77					84.27	54.5		137.68	55.66				
60.55	54.09		43.1	54.61					103.46	54.47		152.11	56.13				
60.72	54.11		49.61	54.22					119.05	54.49		168.49	56.22				
63.06	54.12		58.74	54.41					136.67	54.53		197.97	55.85				
100.42	54.08		60.54	54.61					157.47	55.91							
101.05	54.08		67.09	54.62					174.57	56.07							
101.29	54.05		71.34	54.49					189.8	55.86							
105.71	54.07		75.01	54.63					199.27	56.13							
107.01	54.09		83.61	54.64													
126.47	54.33		92.39	54.65													
132.17	54.29		96.75	54.43													
136	54.28		101.36	54.54													
152.86	53.98		107.27	54.41													
154.15	54.04		112.06	54.49													
176.01	55.12		119.55	54.32													
176.22	55.13		122.71	54.32													
176.36	55.113		134.82	54.33													
191.03	55.58		139.05	54.52													
			143.49	54.97													
			151.53	55.64													
			157.04	55.94													
			164.26	56.11													
			172.58	56.14													

Northern Tributary Station 14+00 - NCX4
Looking downstream



Appendix E.
Hydrologic Data

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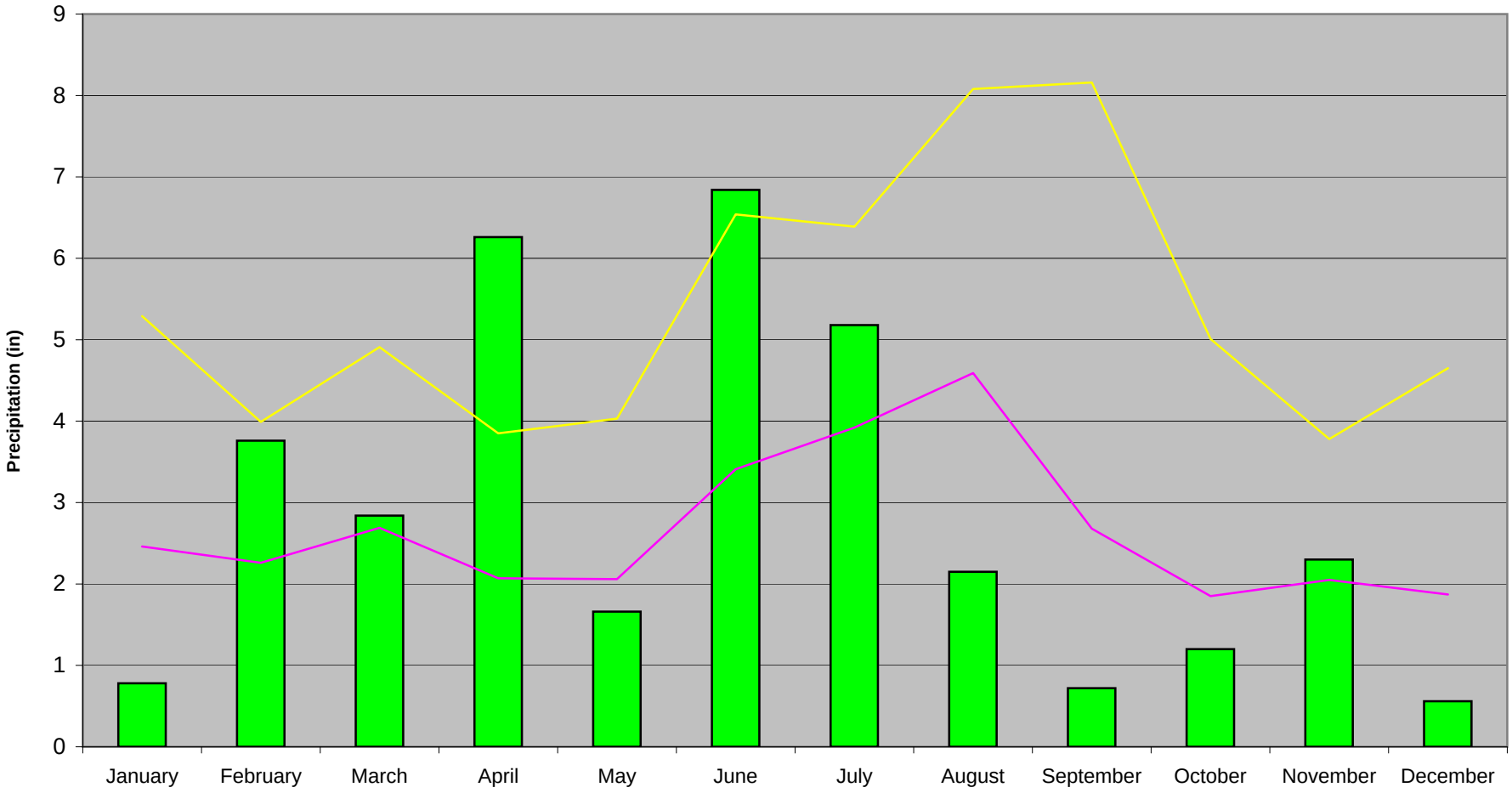
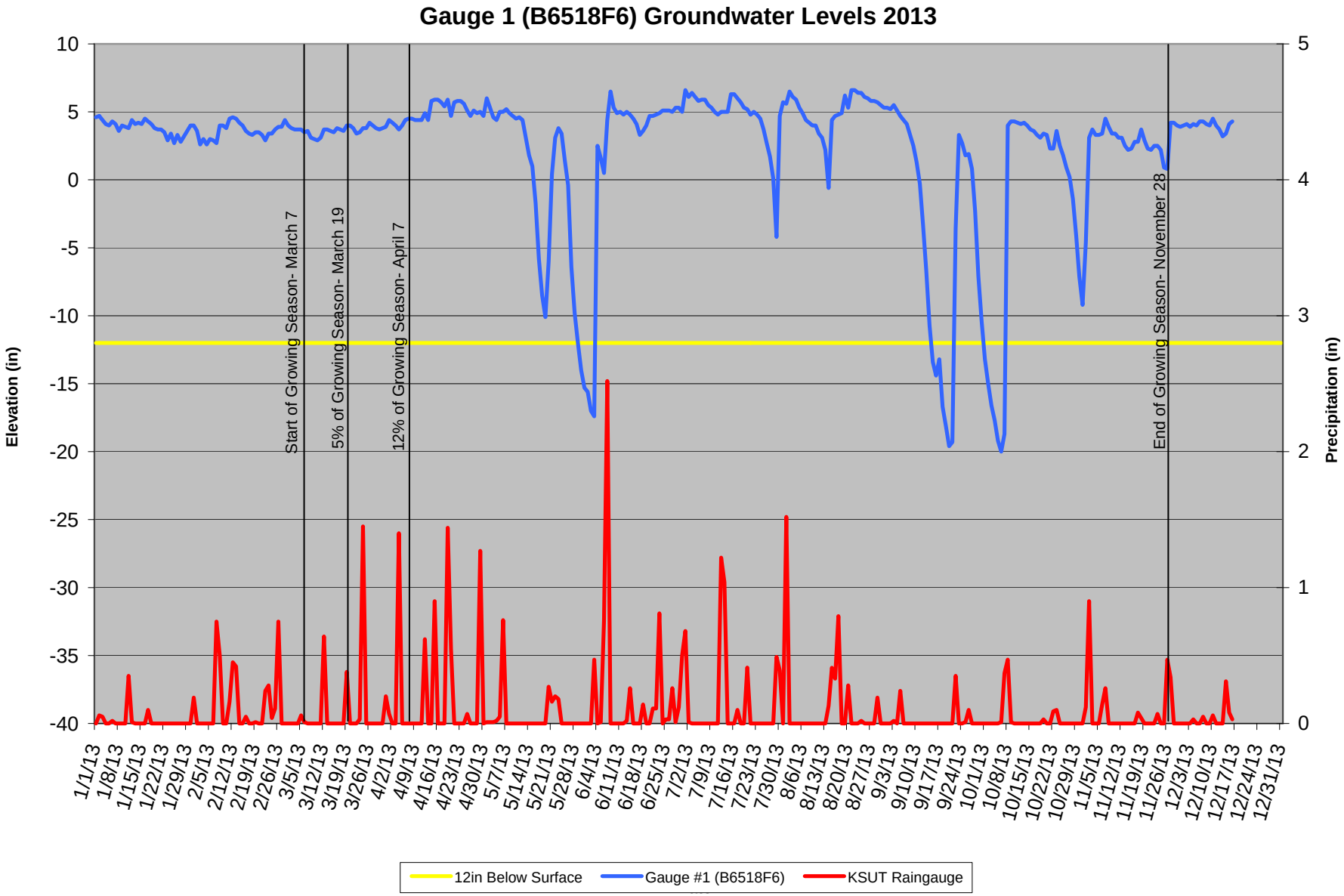
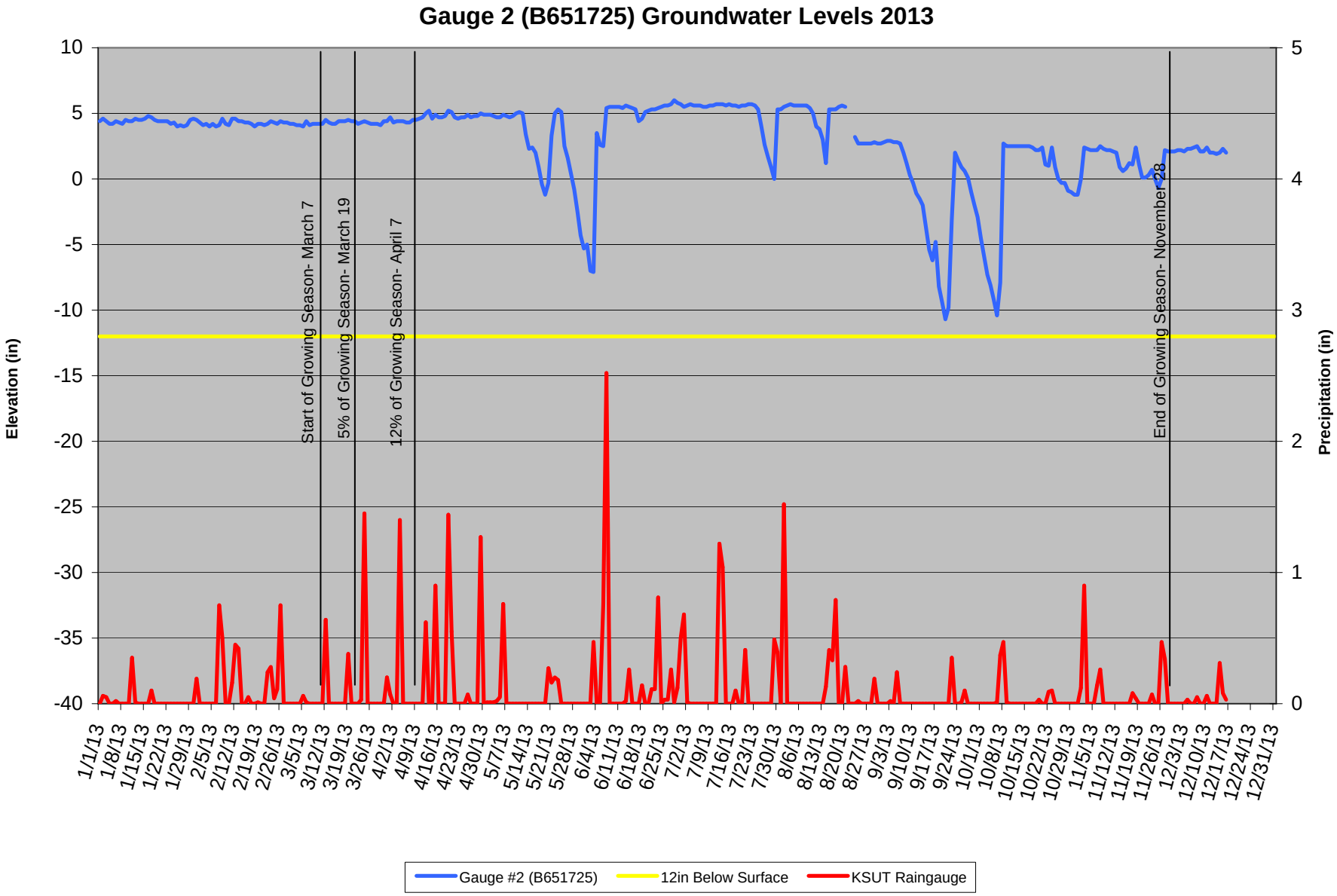
UT to Lilliput Stream and Wetland Restoration Project
30 & 70 Percentile Graph for Rainfall in 2013
Data up to December 16, 2013

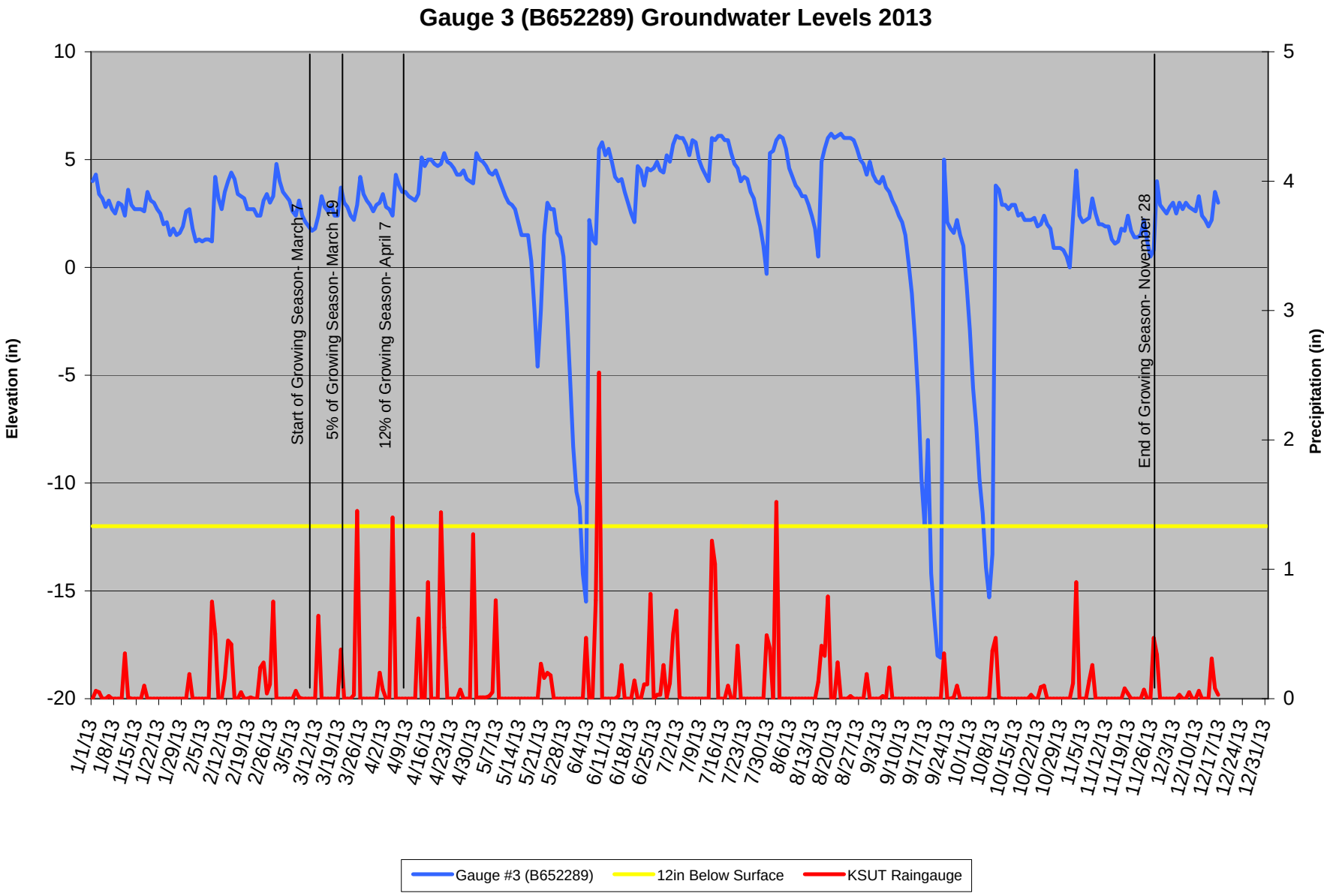


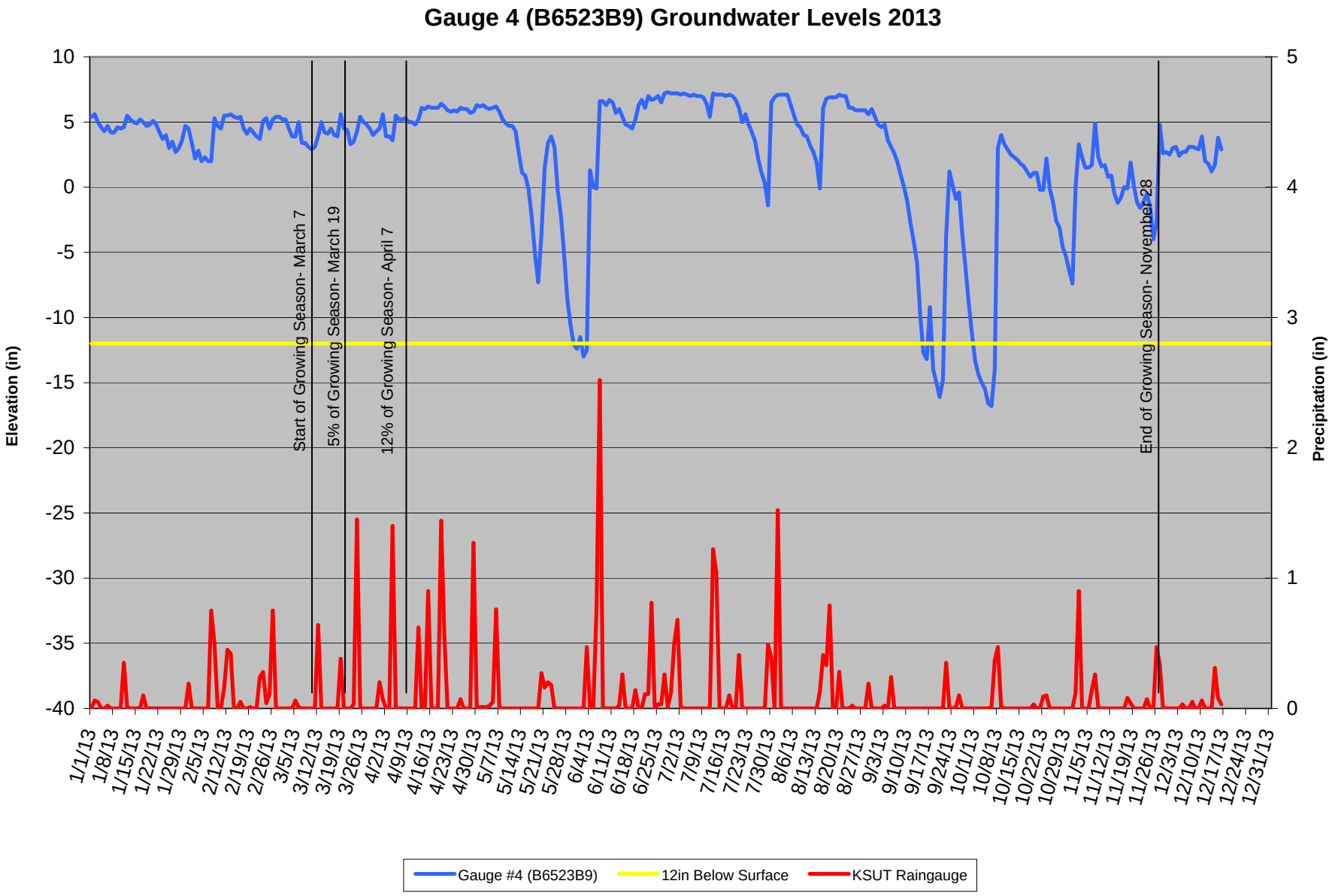
Precipitation data obtained from:
Brunswick County Airport - station KSUT
(www.nc-climate.ncsu.edu)

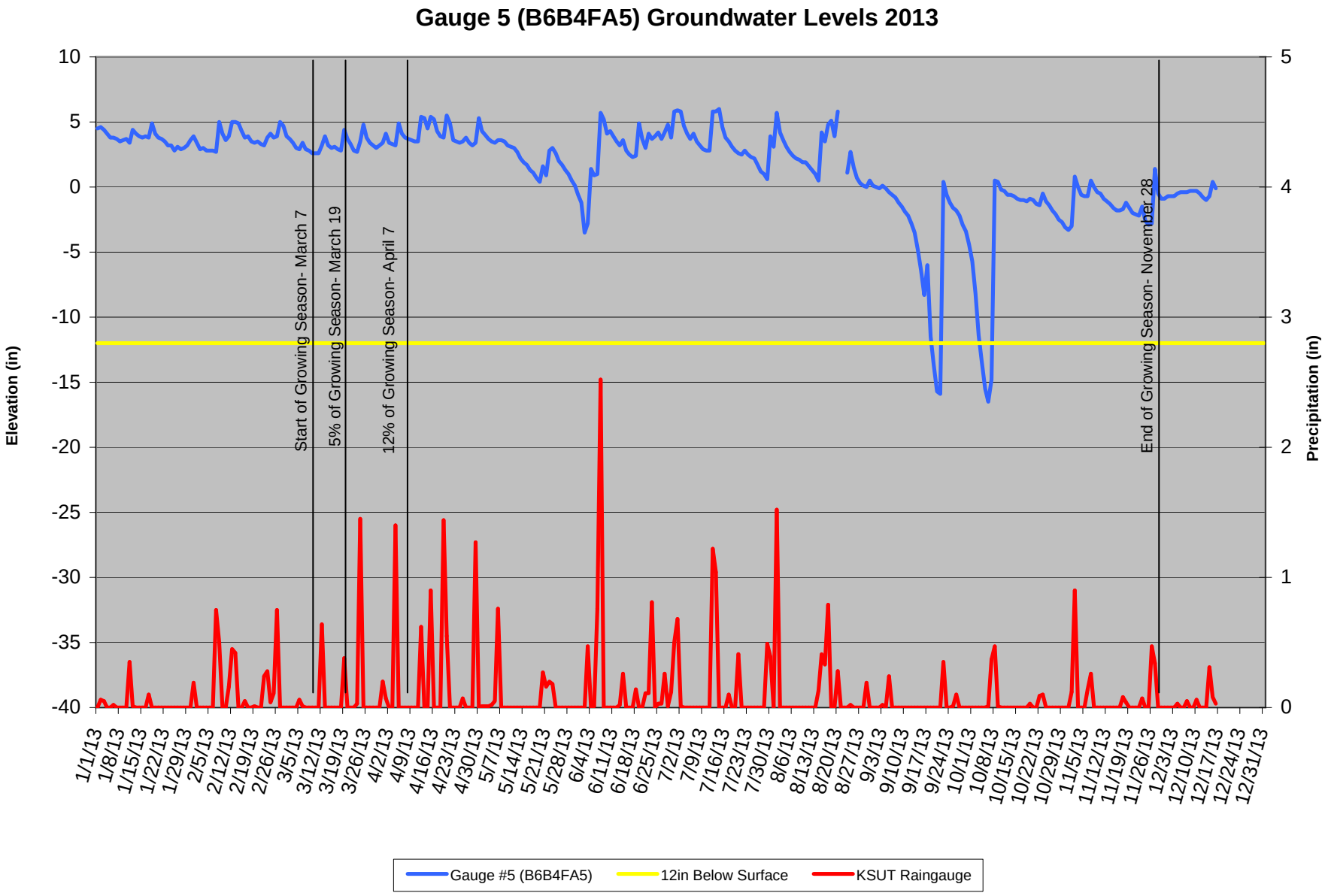
30% & 70% precipitation data obtained from
Brunswick County - Longwood WETS Station
NC5116 1978-2009 (wcc.nrcs.usda.gov)

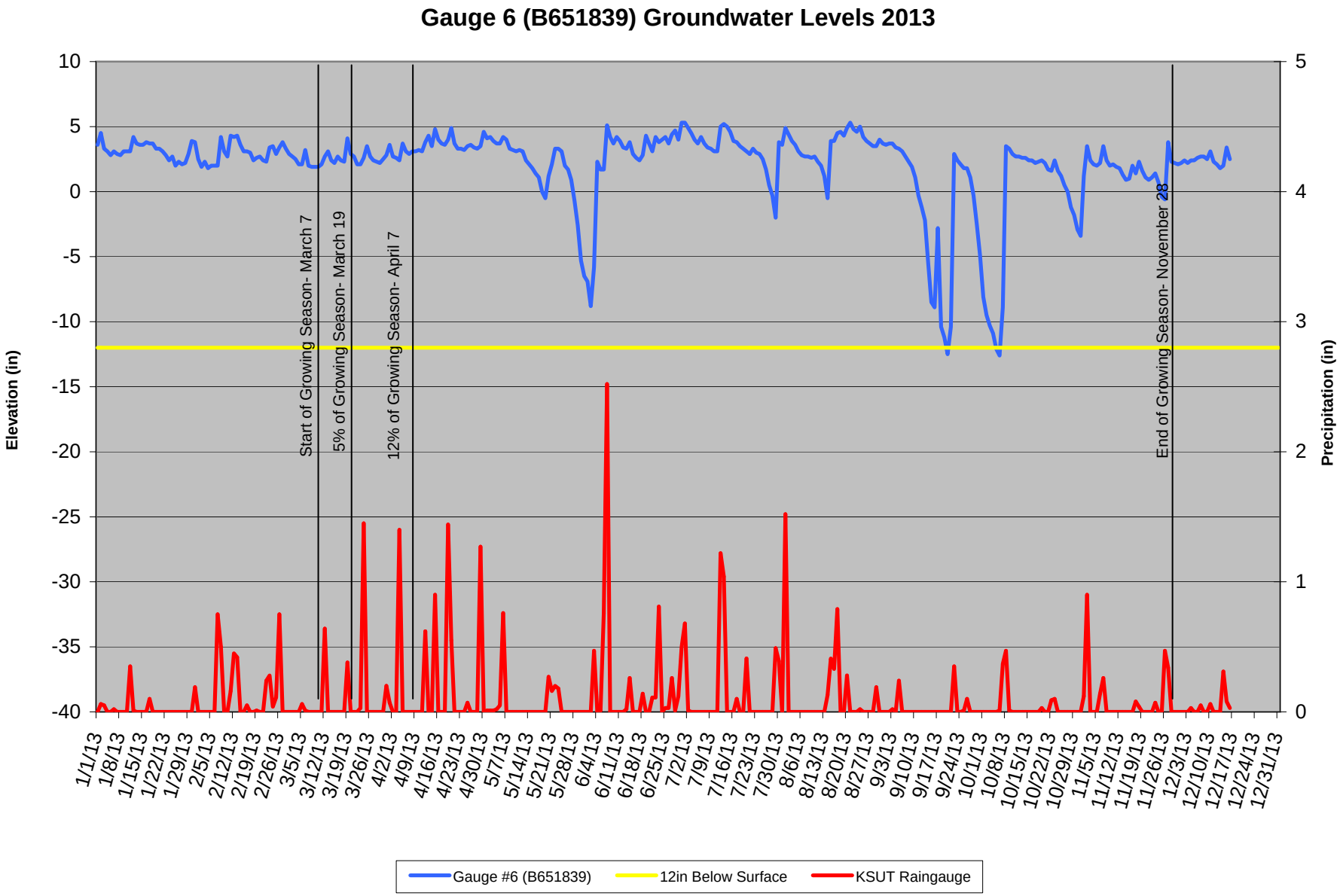

Gauge 1 (B6518F6) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
12in Below Surface
Gauge #1 (B6518F6)
KSUT Raingauge

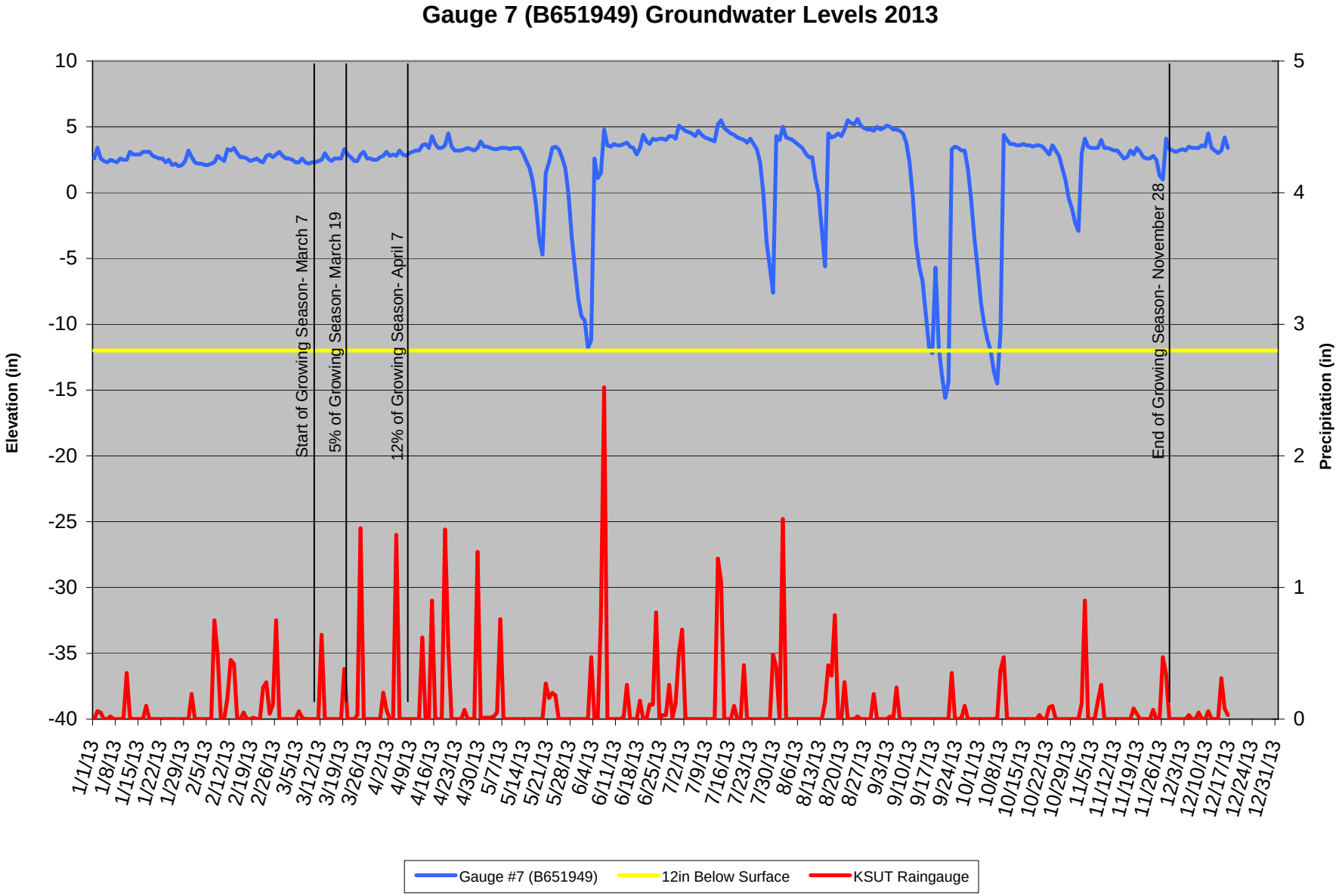

Gauge 2 (B651725) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #2 (B651725)
12in Below Surface
KSUT Raingauge

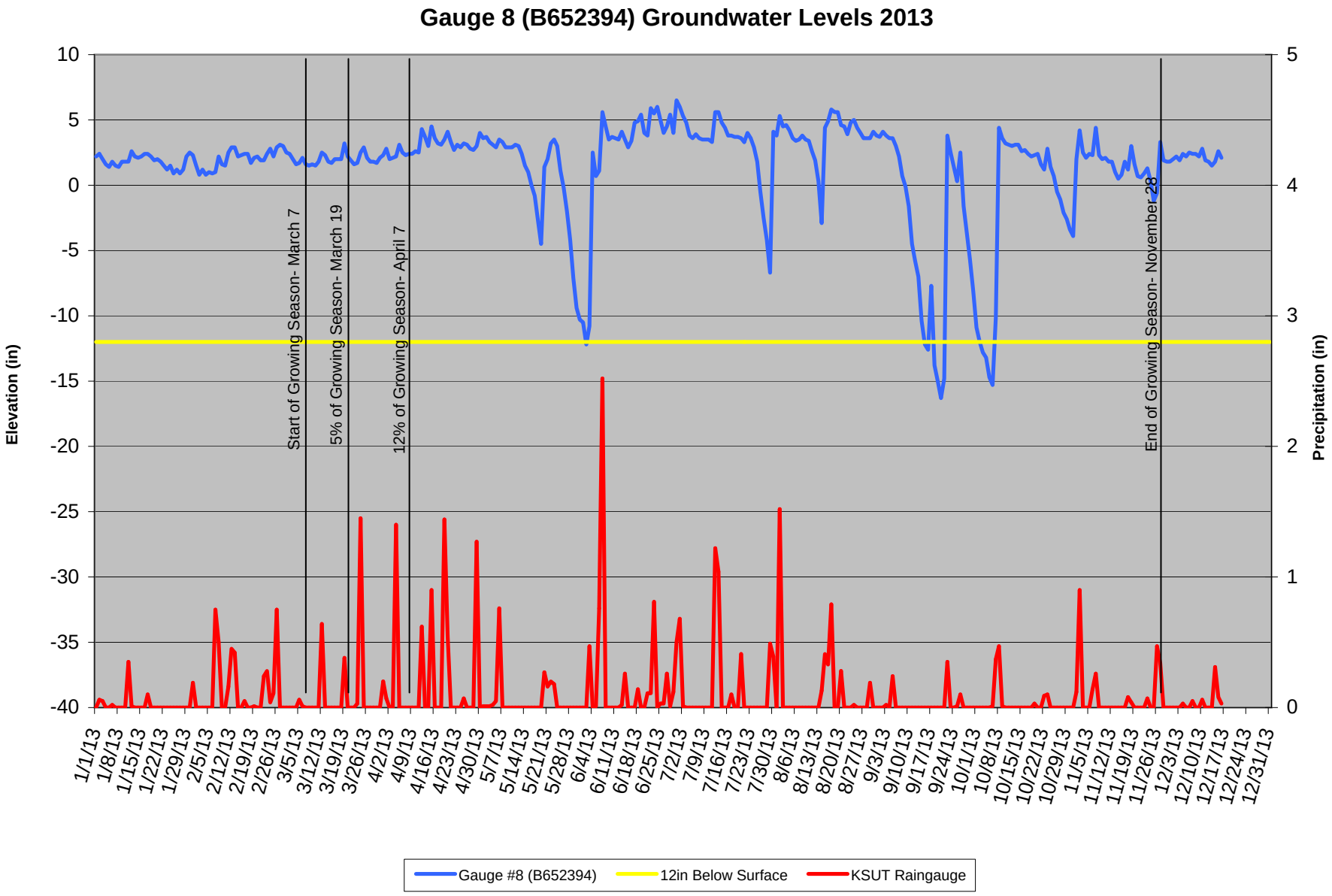

Gauge 3 (B652289) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #3 (B652289)
12in Below Surface
KSUT Raingauge

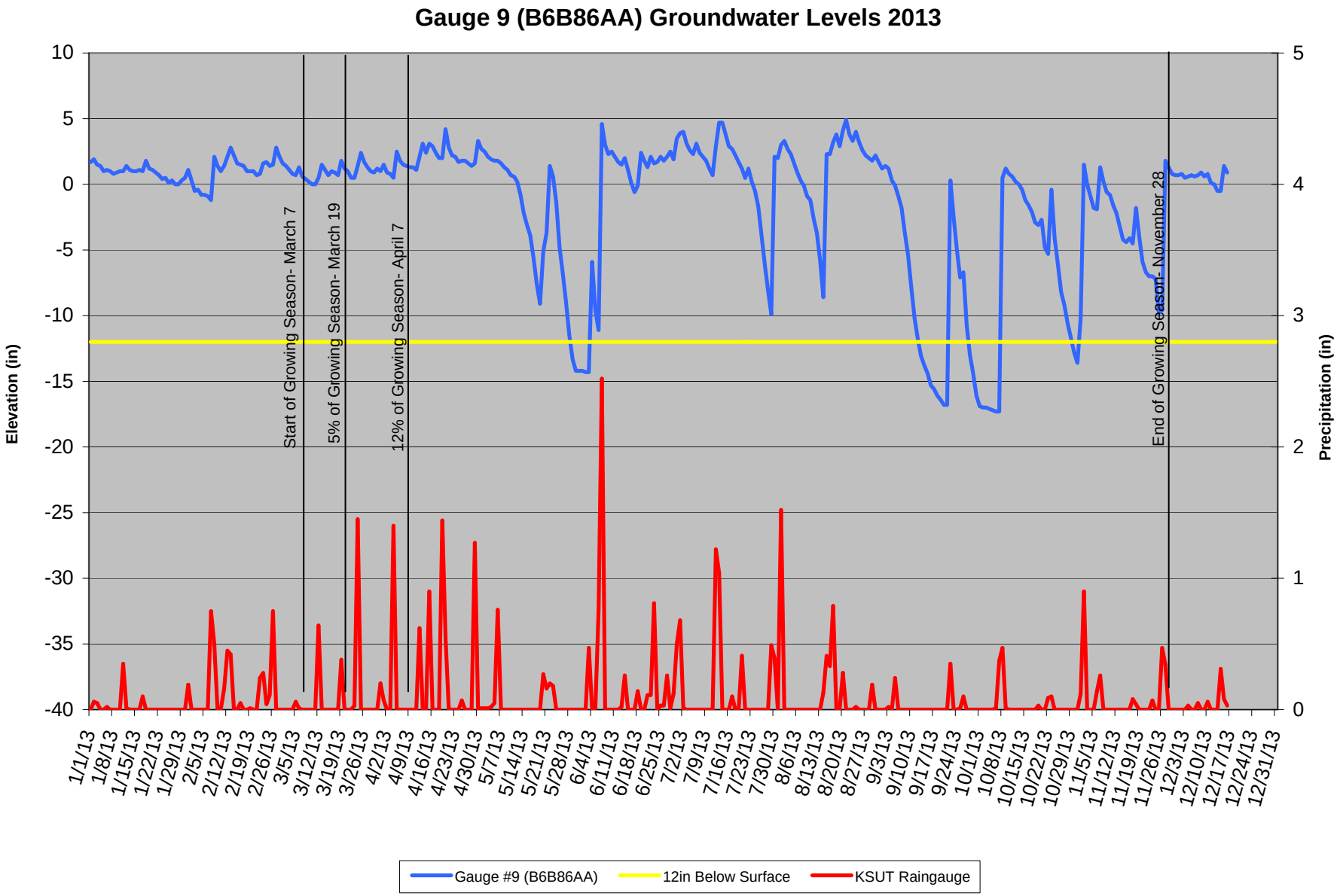

Gauge 4 (B6523B9) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #4 (B6523B9)
12in Below Surface
KSUT Raingauge


Gauge 5 (B6B4FA5) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #5 (B6B4FA5)
12in Below Surface
KSUT Raingauge


Gauge 6 (B651839) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #6 (B651839)
12in Below Surface
KSUT Raingauge


Gauge 7 (B651949) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #7 (B651949)
12in Below Surface
KSUT Raingauge


Gauge 8 (B652394) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #8 (B652394)
12in Below Surface
KSUT Raingauge


Gauge 9 (B6B86AA) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
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6/11/13
6/18/13
6/25/13
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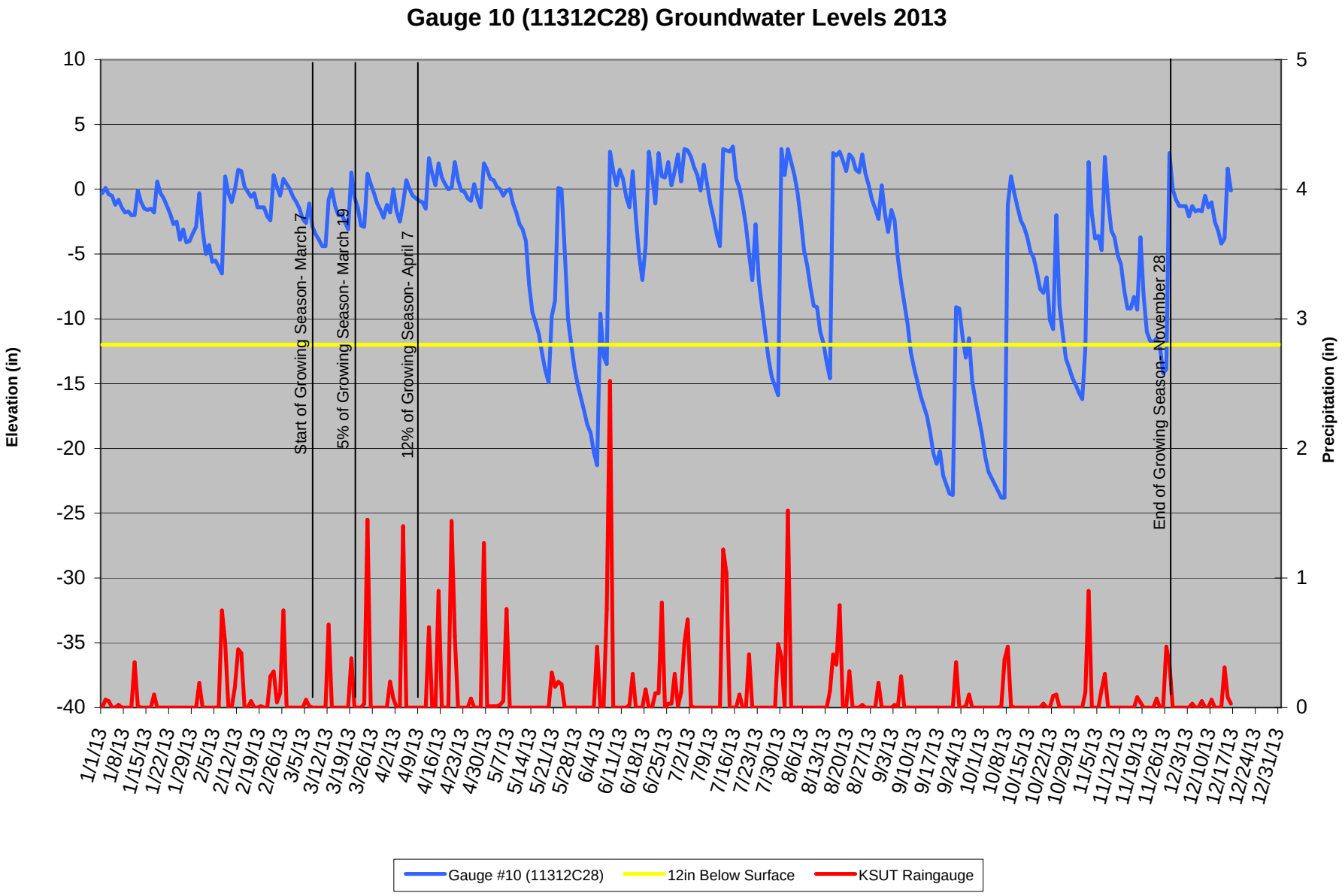
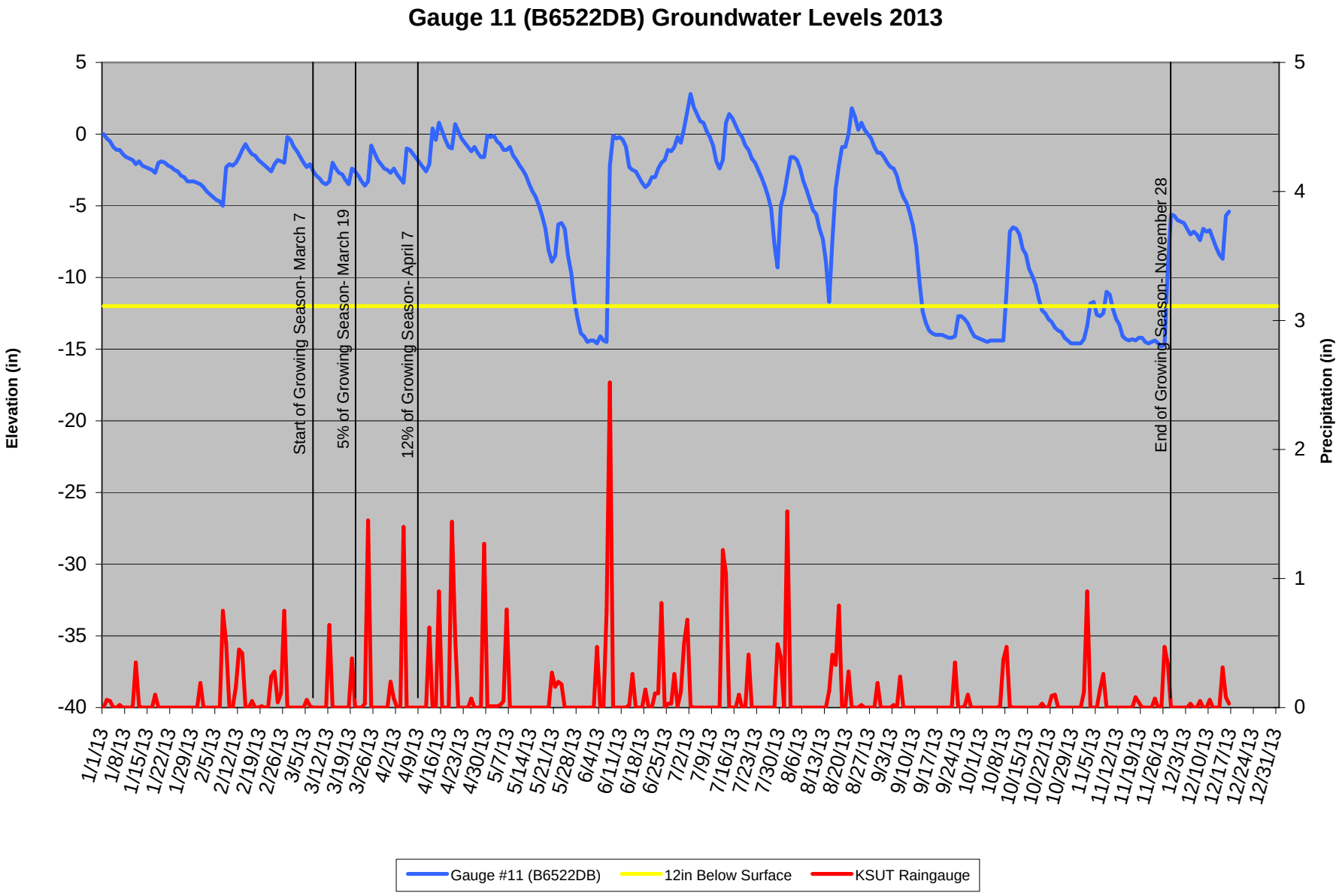
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #9 (B6B86AA)
12in Below Surface
KSUT Raingauge


Gauge 10 (11312C28) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #10 (11312C28)
12in Below Surface
KSUT Raingauge


Gauge 11 (B6522DB) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
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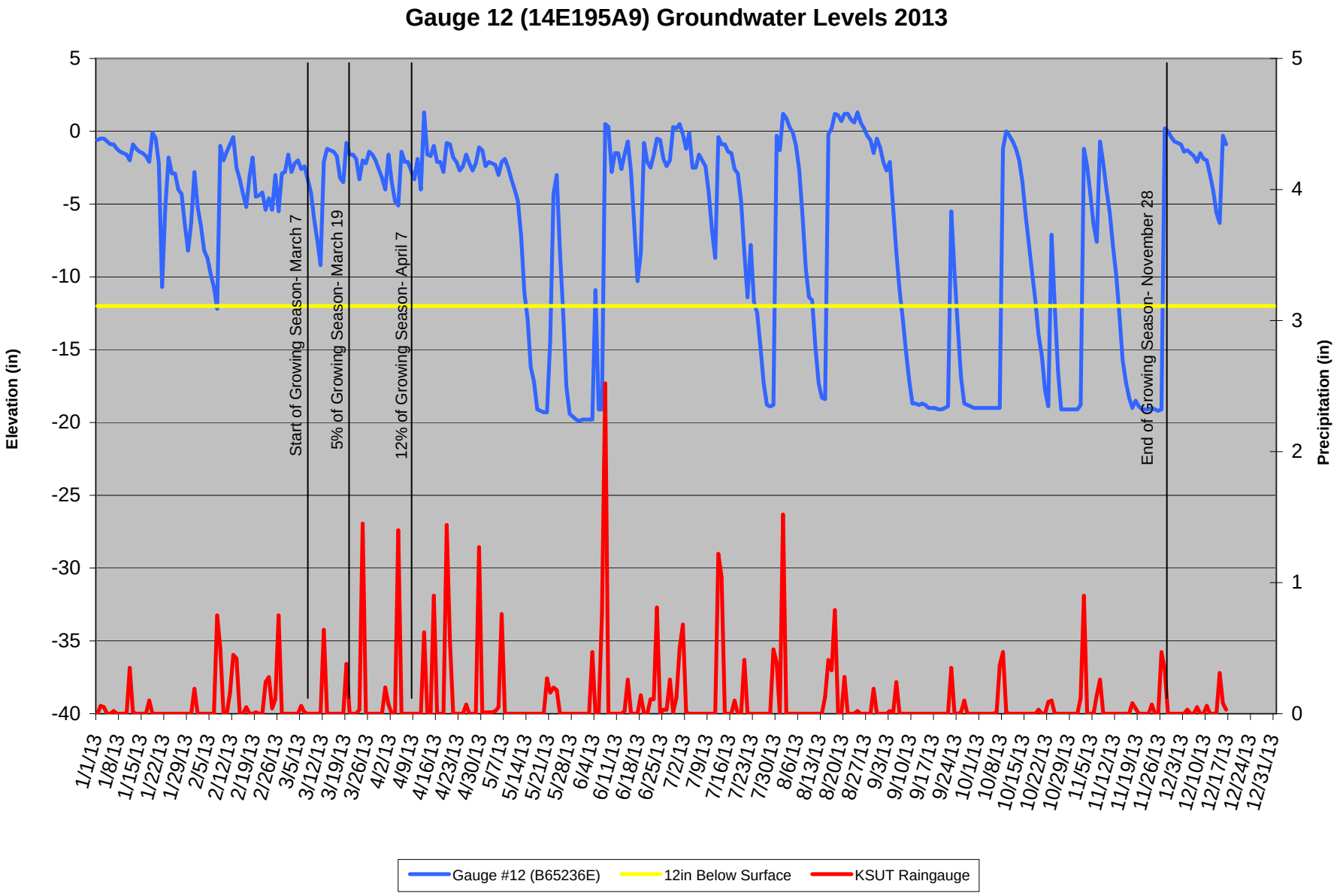
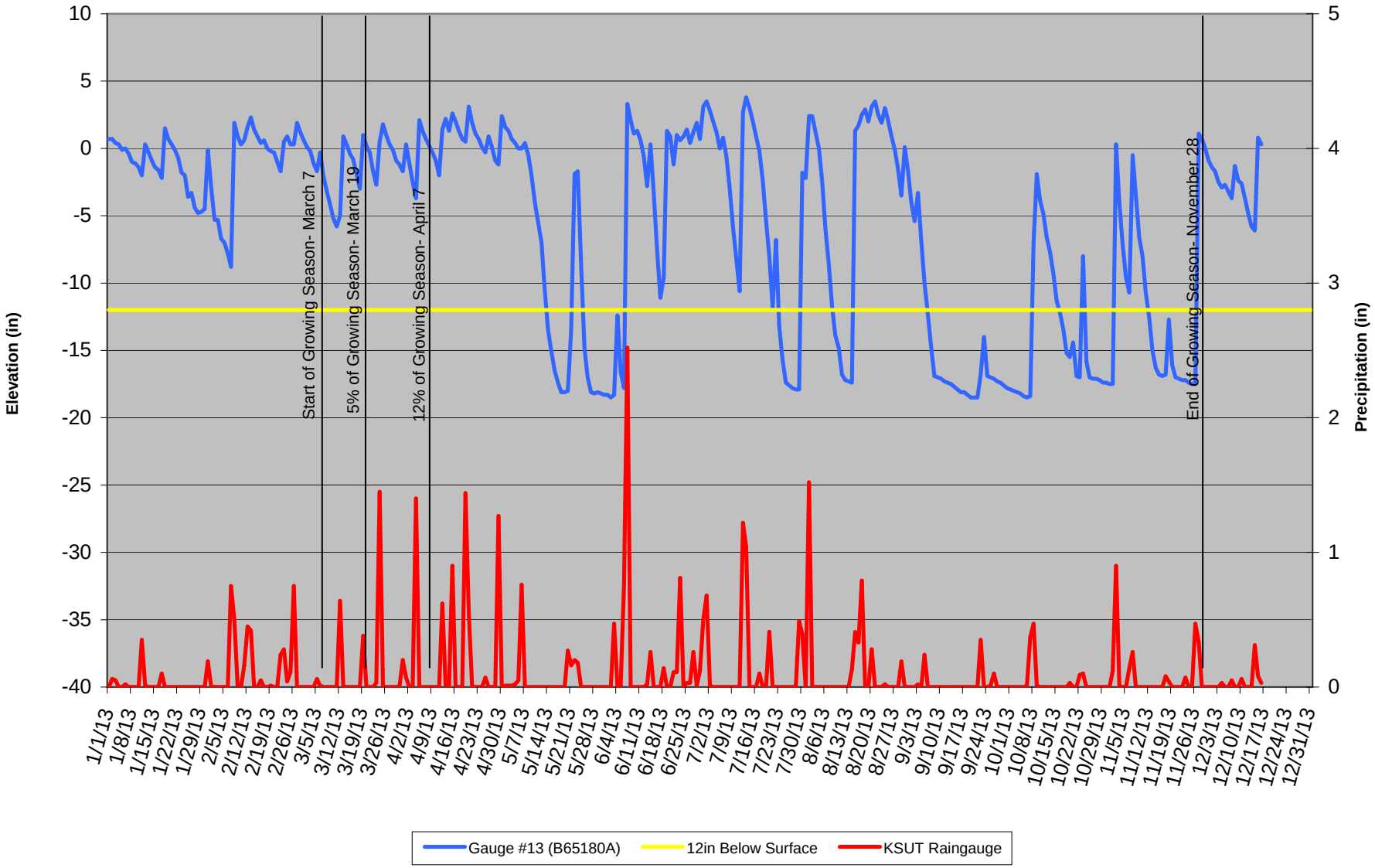
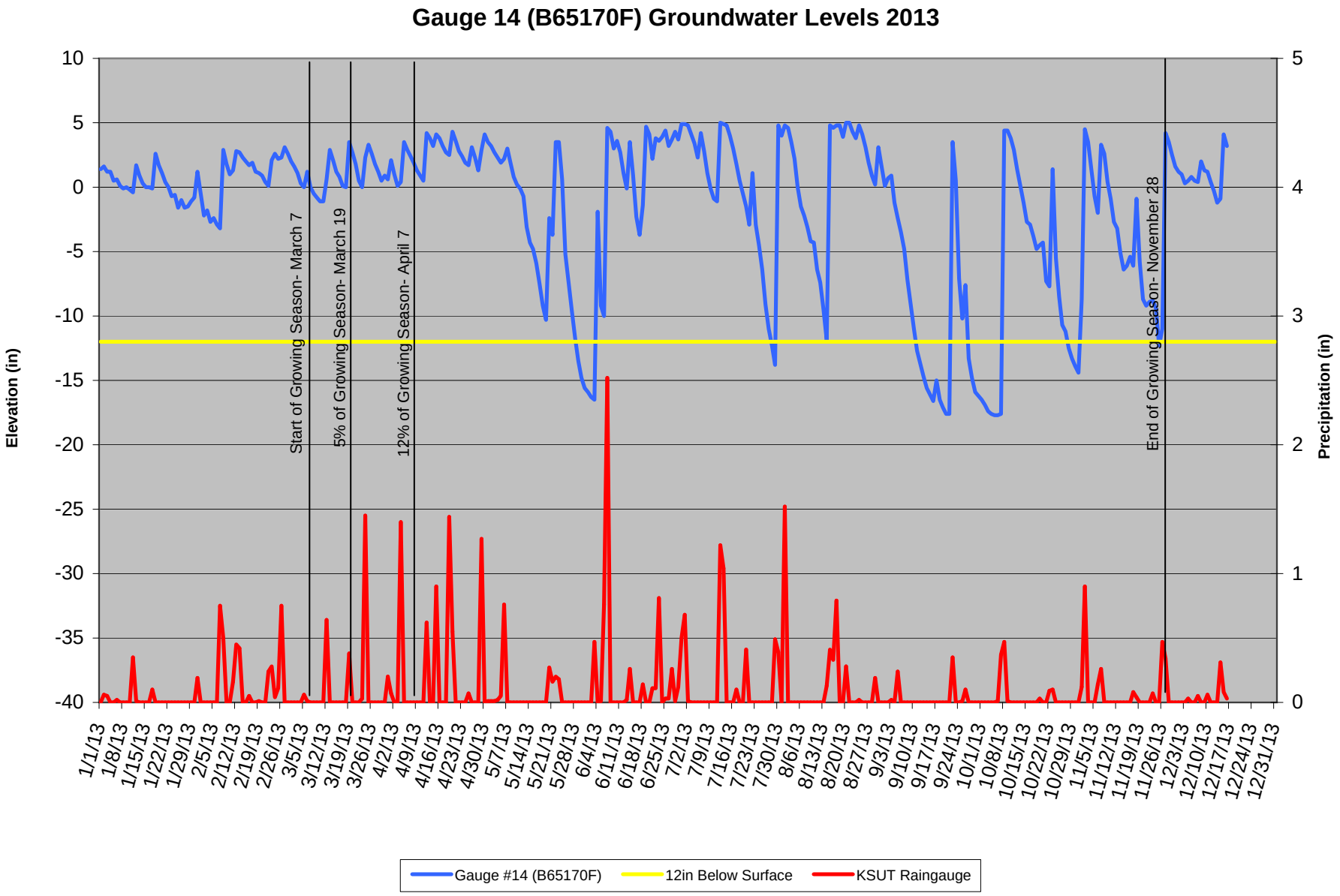
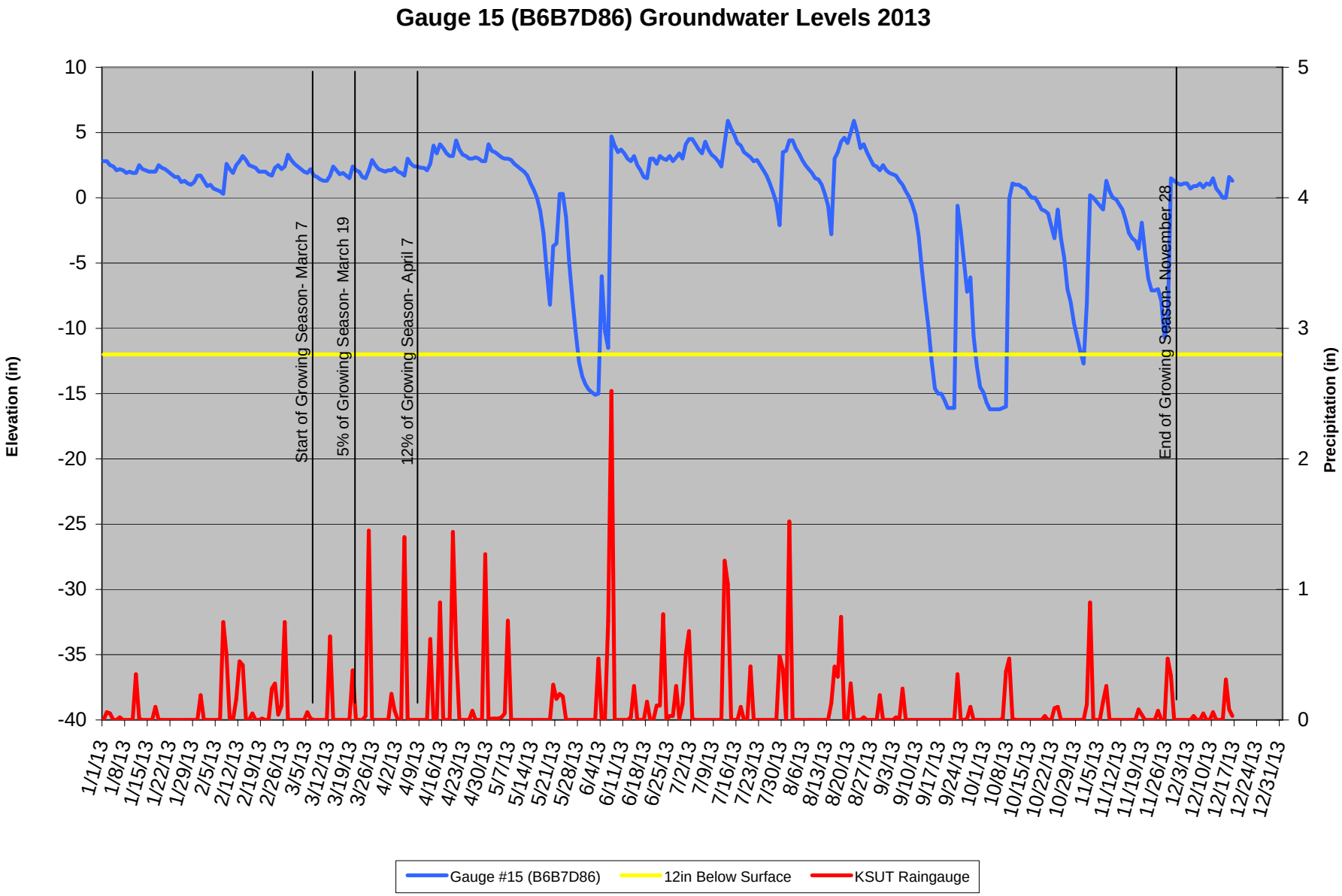
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #11 (B6522DB)
12in Below Surface
KSUT Raingauge

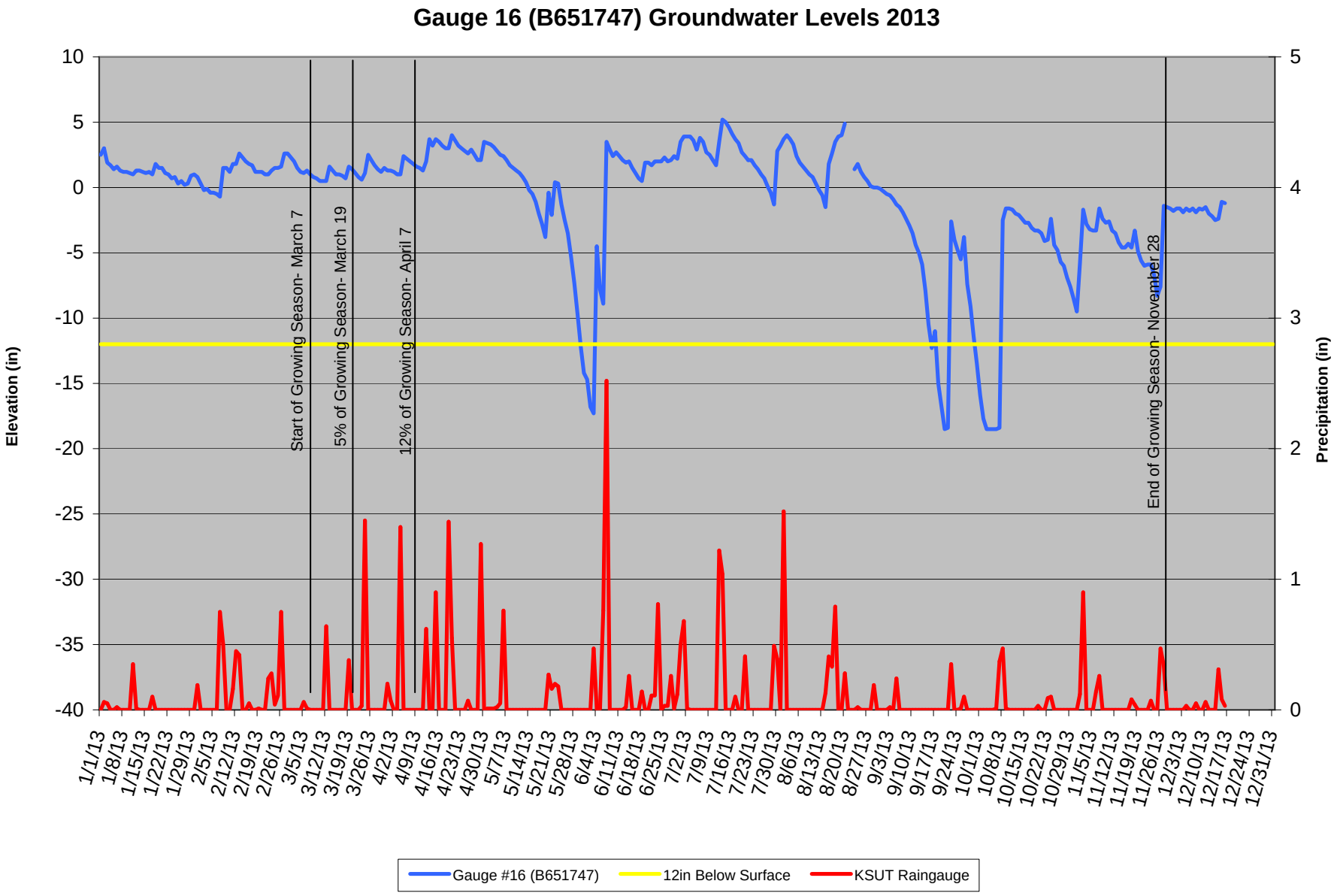

Gauge 12 (14E195A9) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #12 (B65236E)
12in Below Surface
KSUT Raingauge

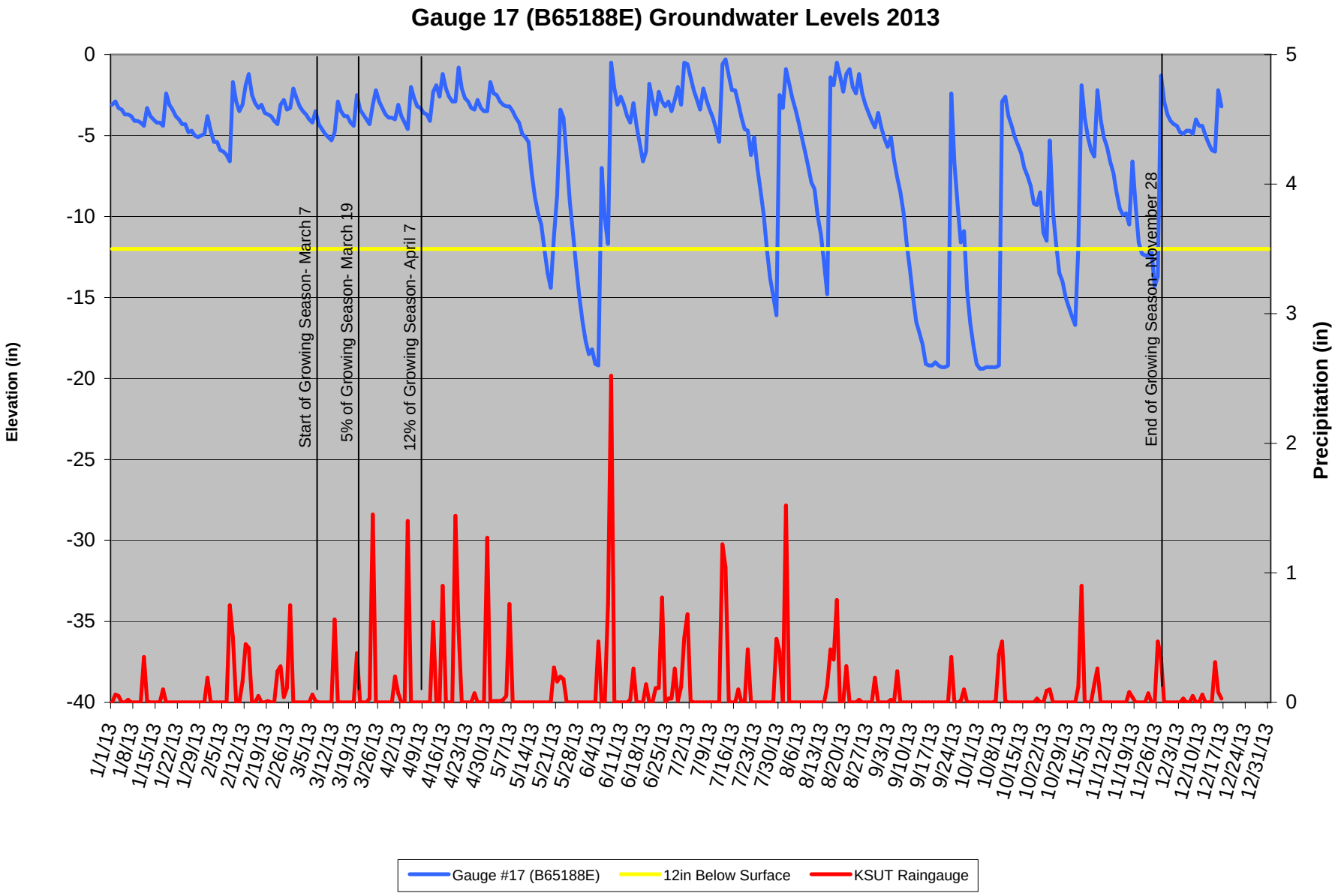
Gauge 13 (B65180A) Groundwater Levels 2013




Gauge 14 (B65170F) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #14 (B65170F)
12in Below Surface
KSUT Raingauge


Gauge 15 (B6B7D86) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #15 (B6B7D86)
12in Below Surface
KSUT Raingauge


Gauge 16 (B651747) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #16 (B651747)
12in Below Surface
KSUT Raingauge


Gauge 17 (B65188E) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
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5/28/13
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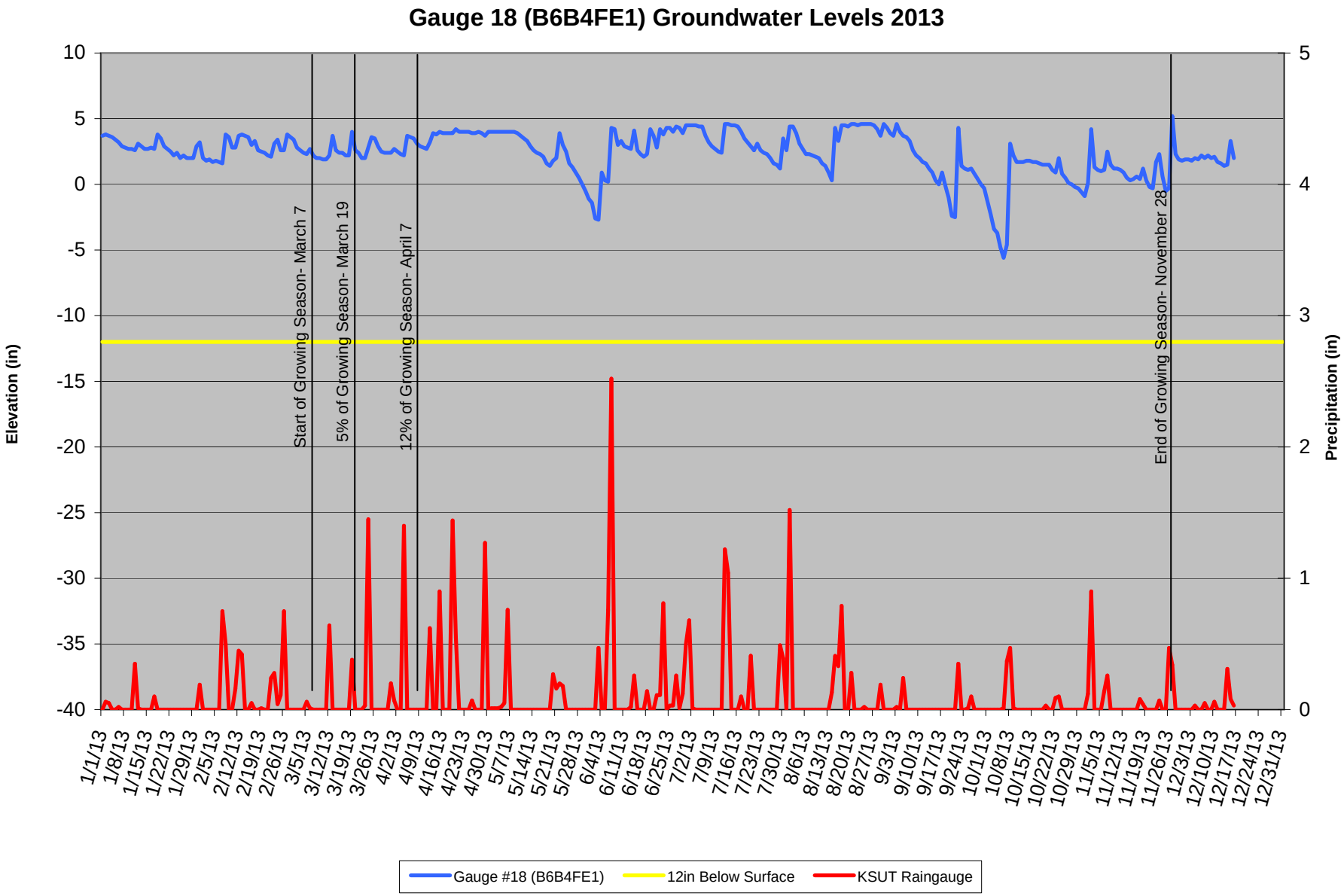
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #17 (B65188E)
12in Below Surface
KSUT Raingauge


Gauge 18 (B6B4FE1) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
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5/21/13
5/28/13
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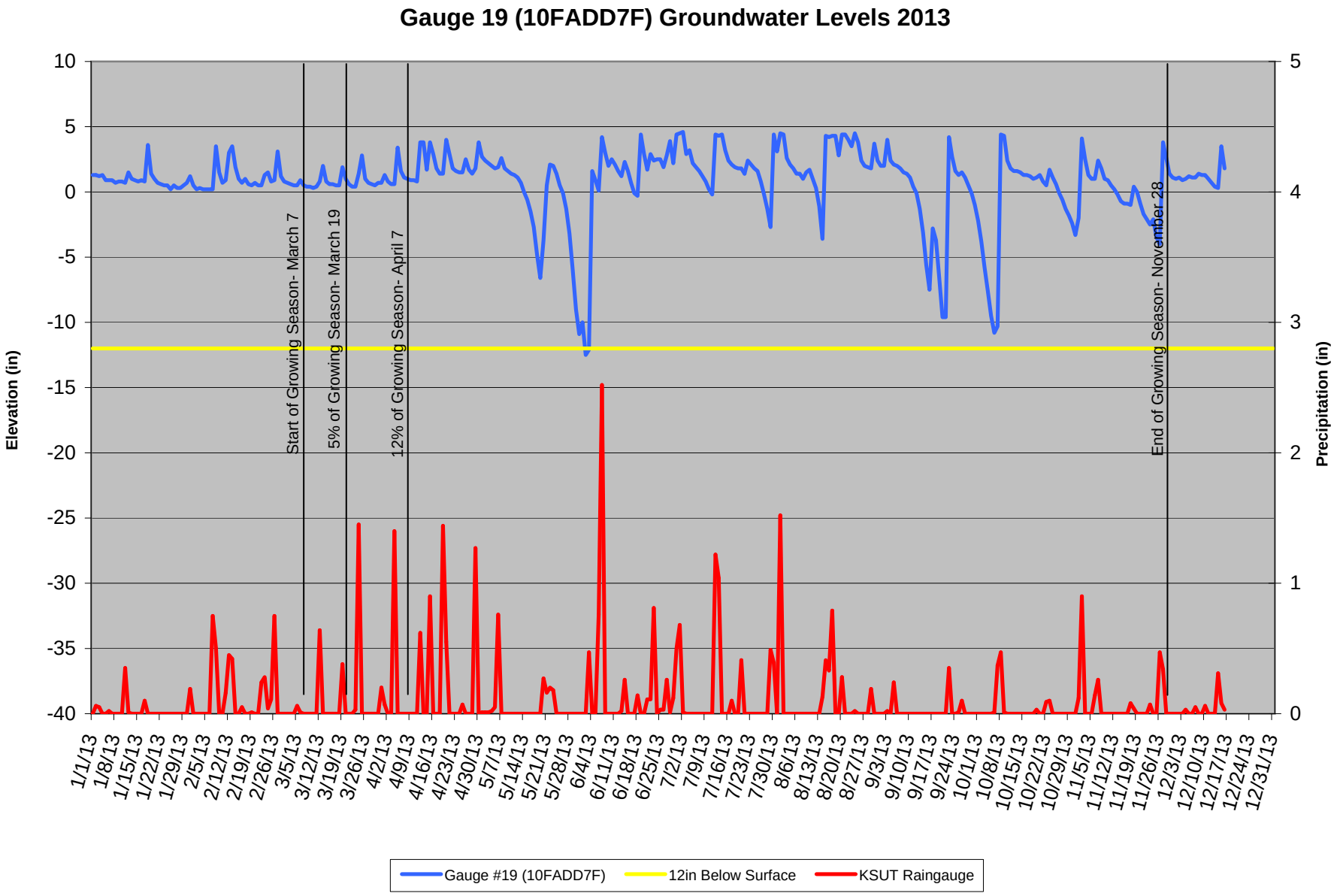
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #18 (B6B4FE1)
12in Below Surface
KSUT Raingauge


Gauge 19 (10FADD7F) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
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6/18/13
6/25/13
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7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
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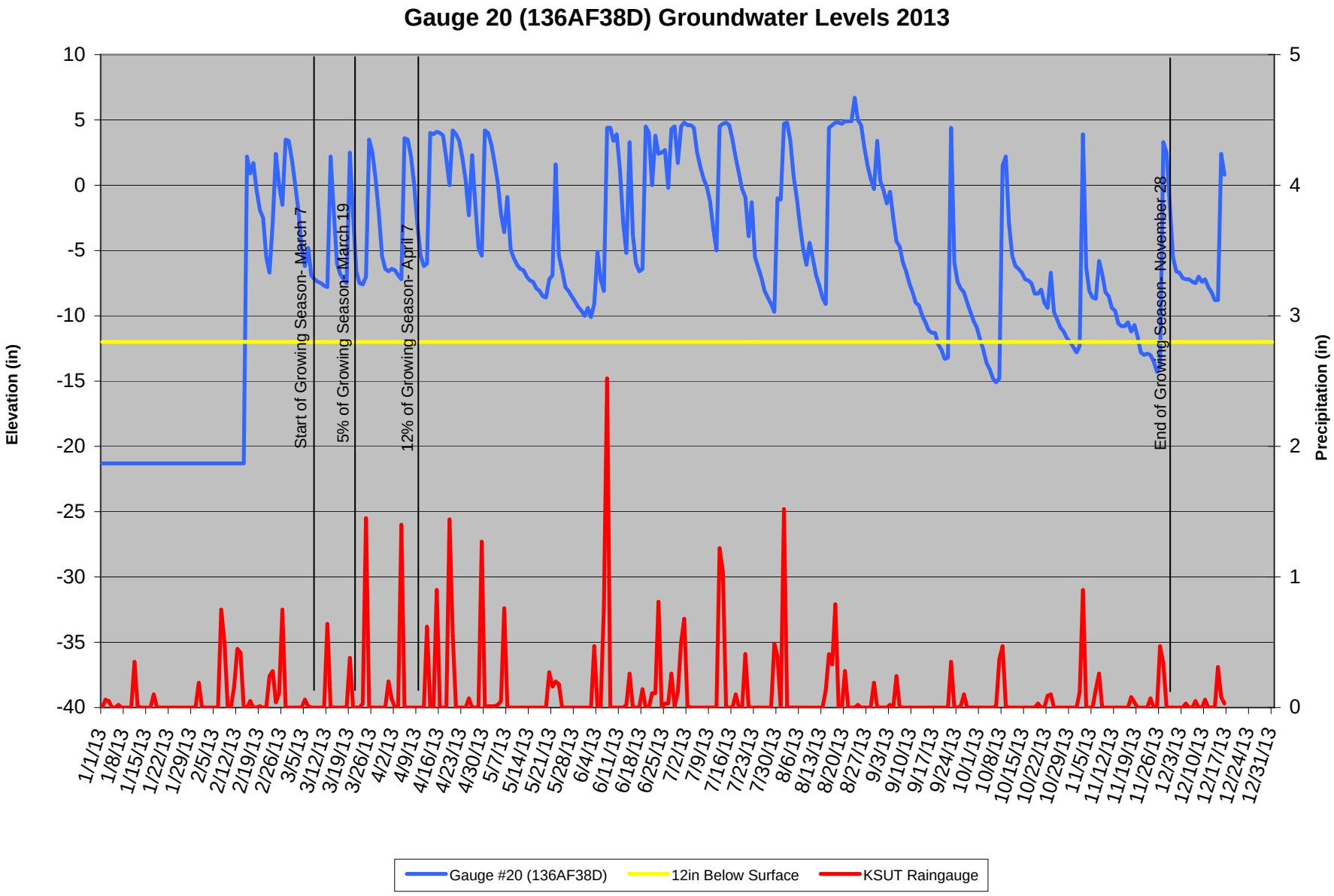
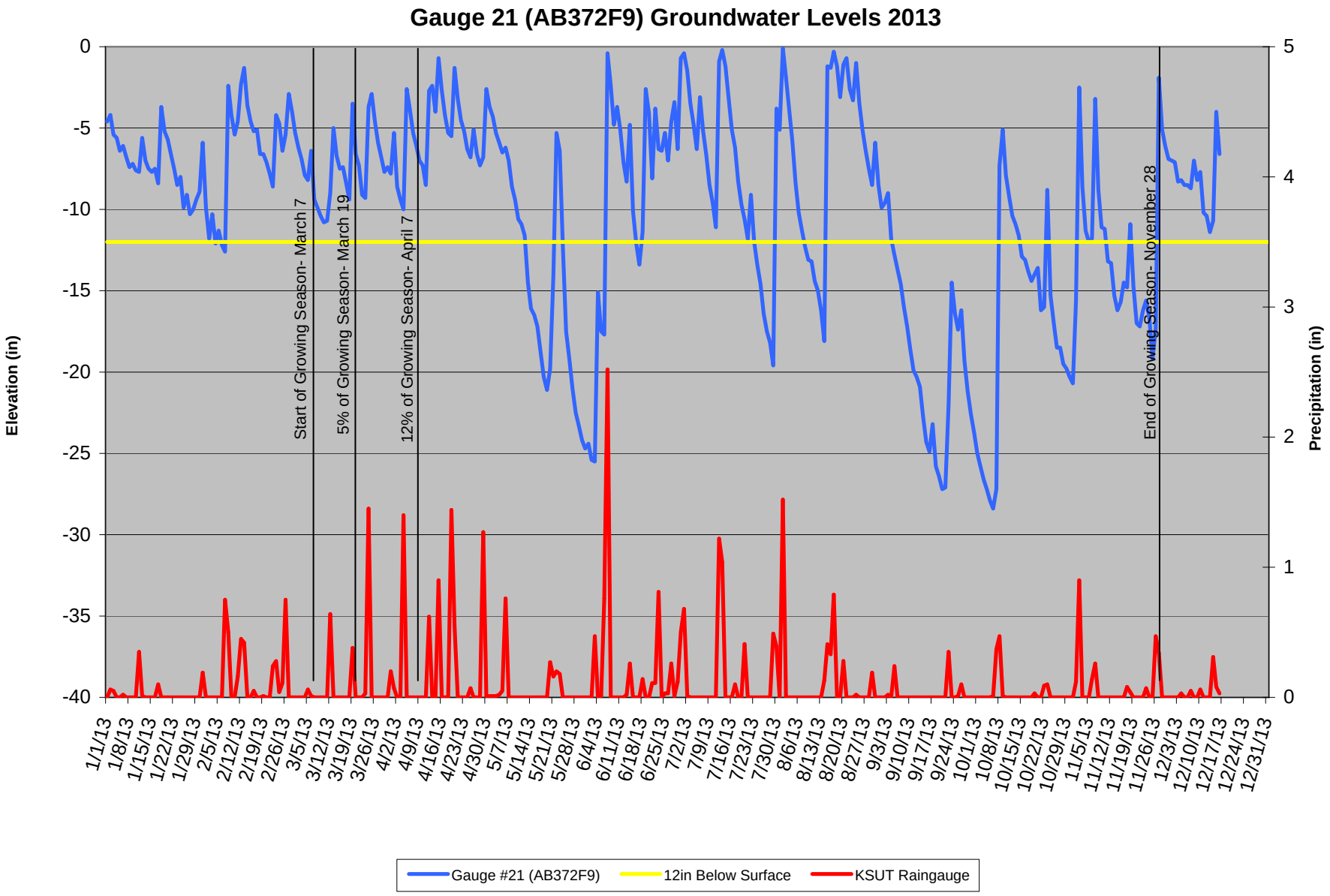
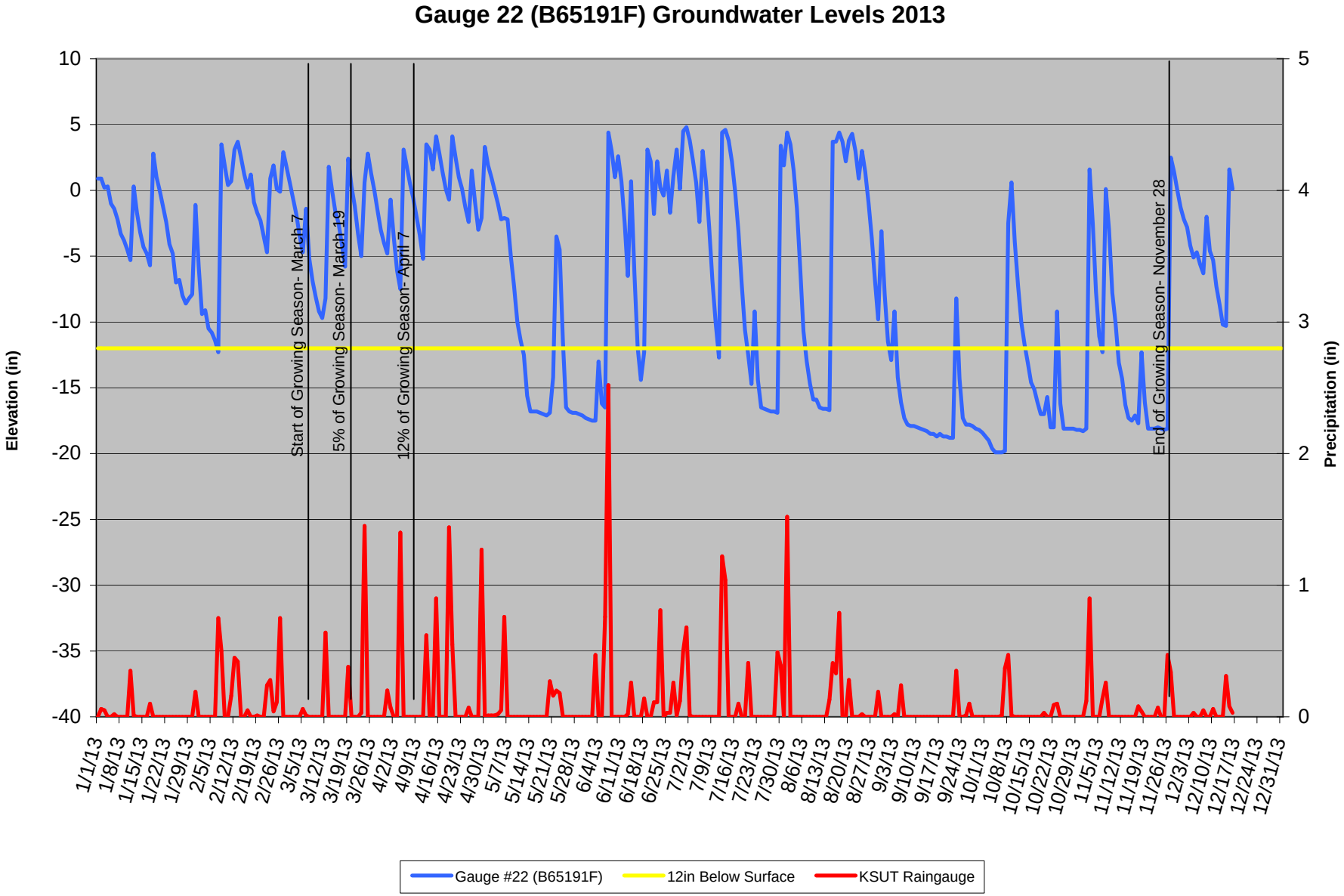
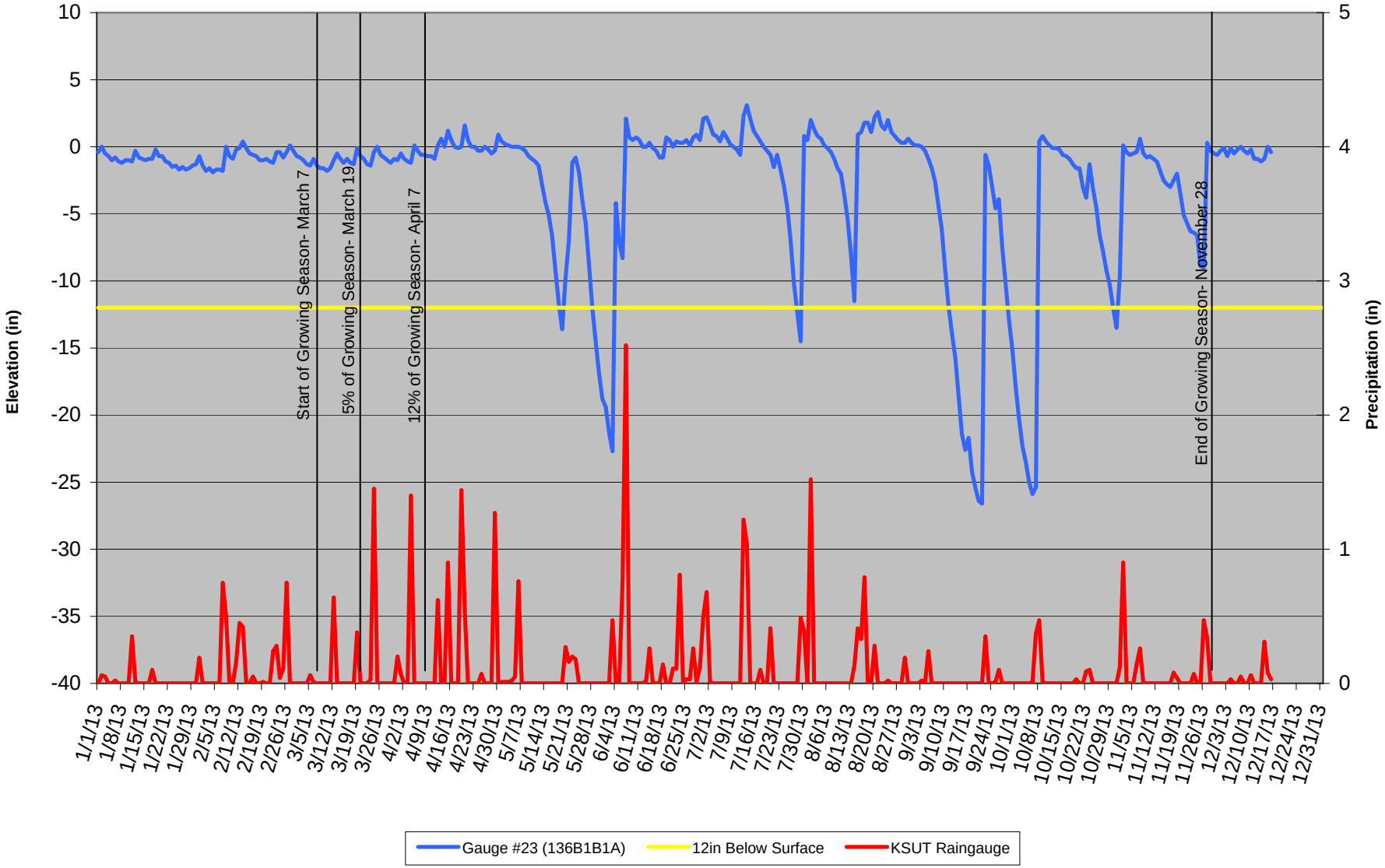
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #19 (10FADD7F)
12in Below Surface
KSUT Raingauge

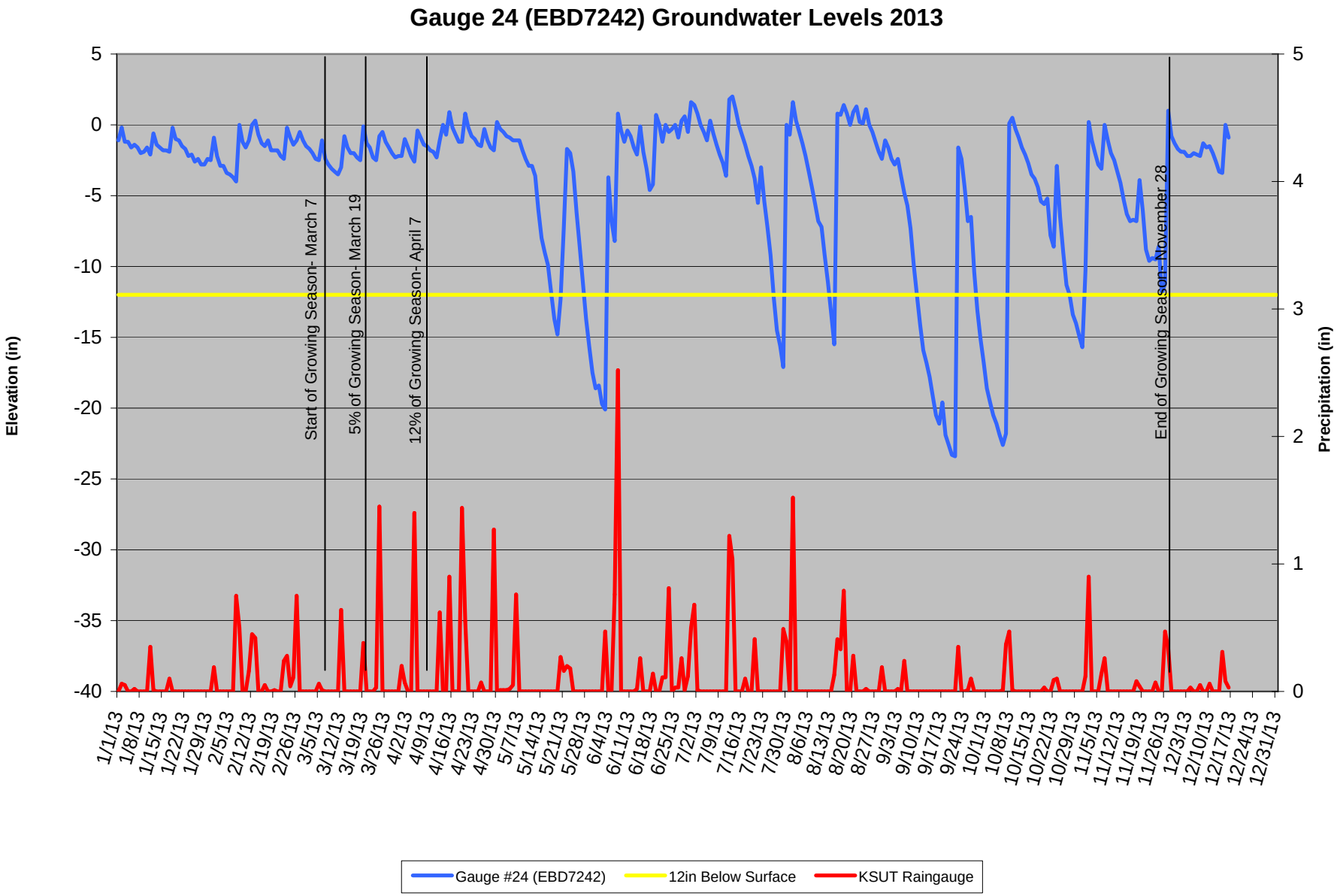

Gauge 20 (136AF38D) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #20 (136AF38D)
12in Below Surface
KSUT Raingauge

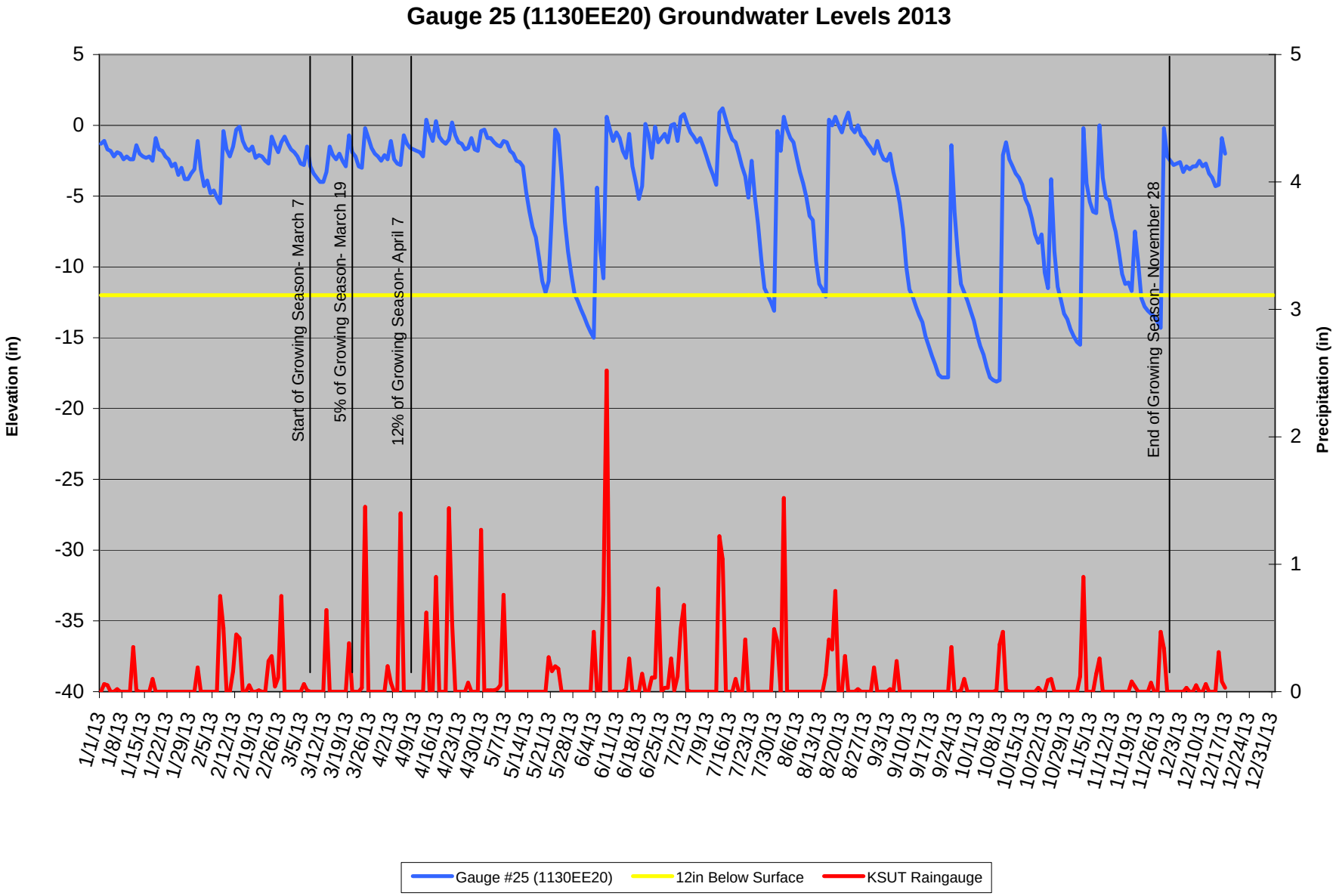

Gauge 21 (AB372F9) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #21 (AB372F9)
12in Below Surface
KSUT Raingauge


Gauge 22 (B65191F) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #22 (B65191F)
12in Below Surface
KSUT Raingauge

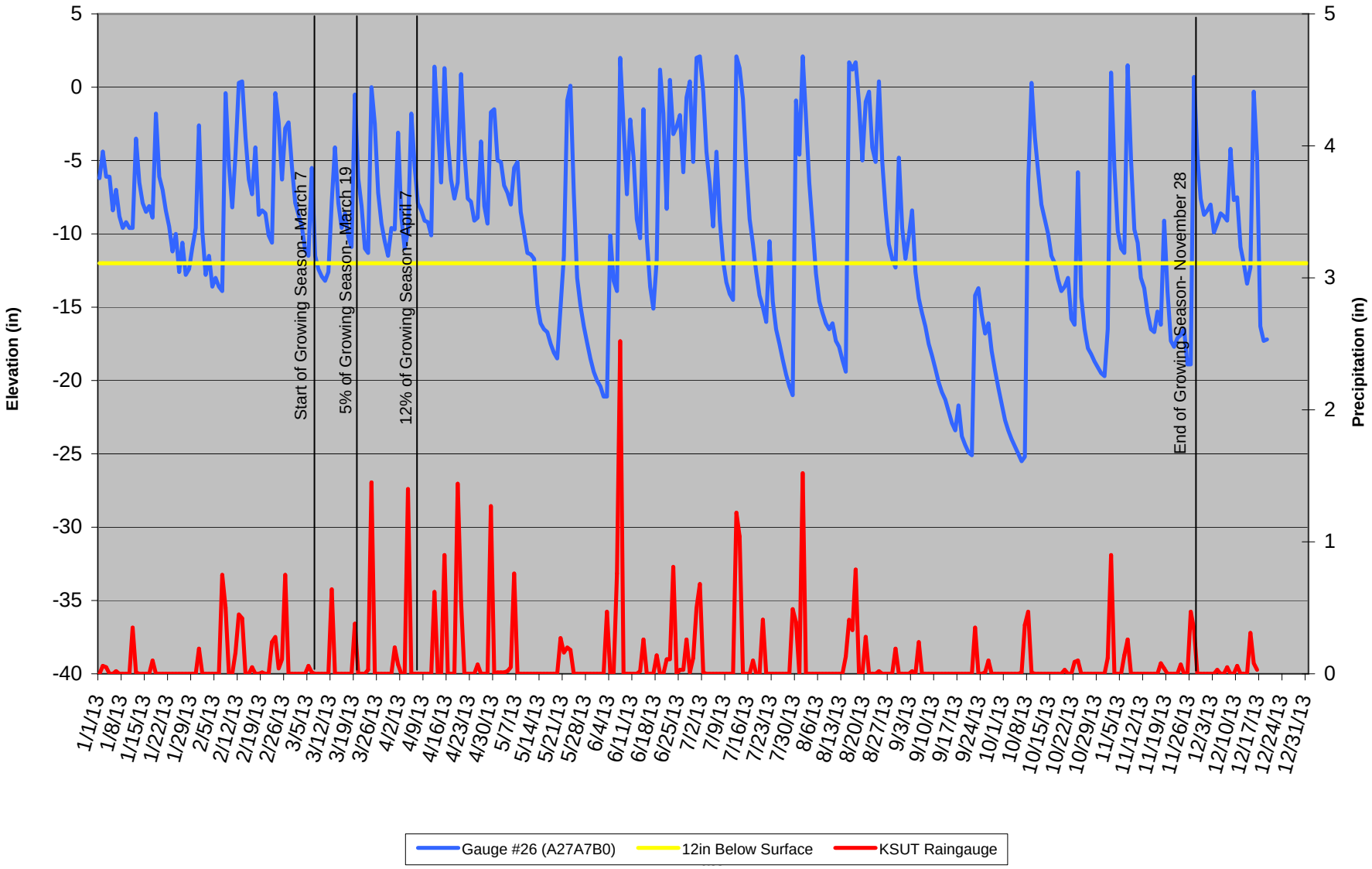
Gauge 23 (136B1B1A) Groundwater Levels 2013

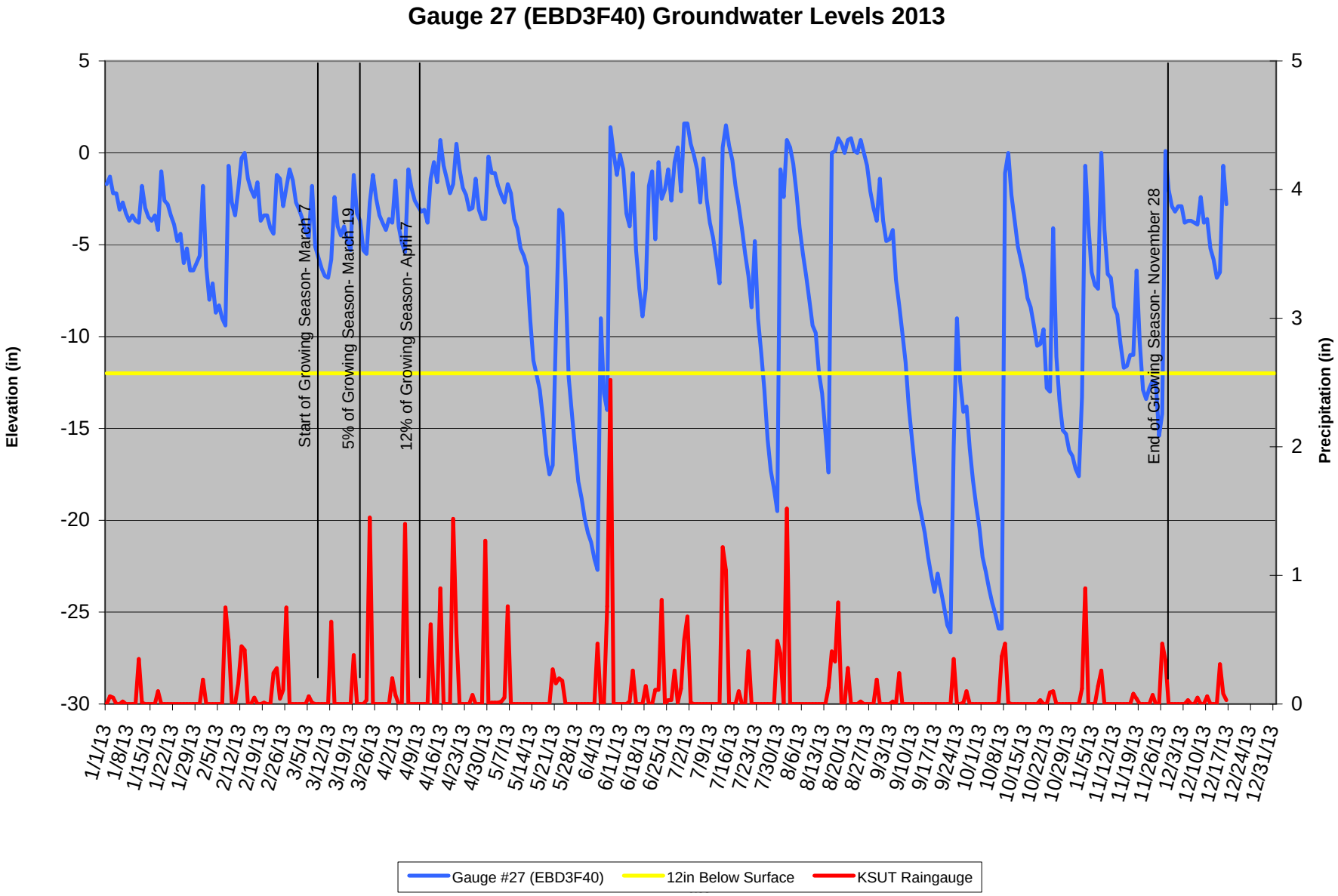


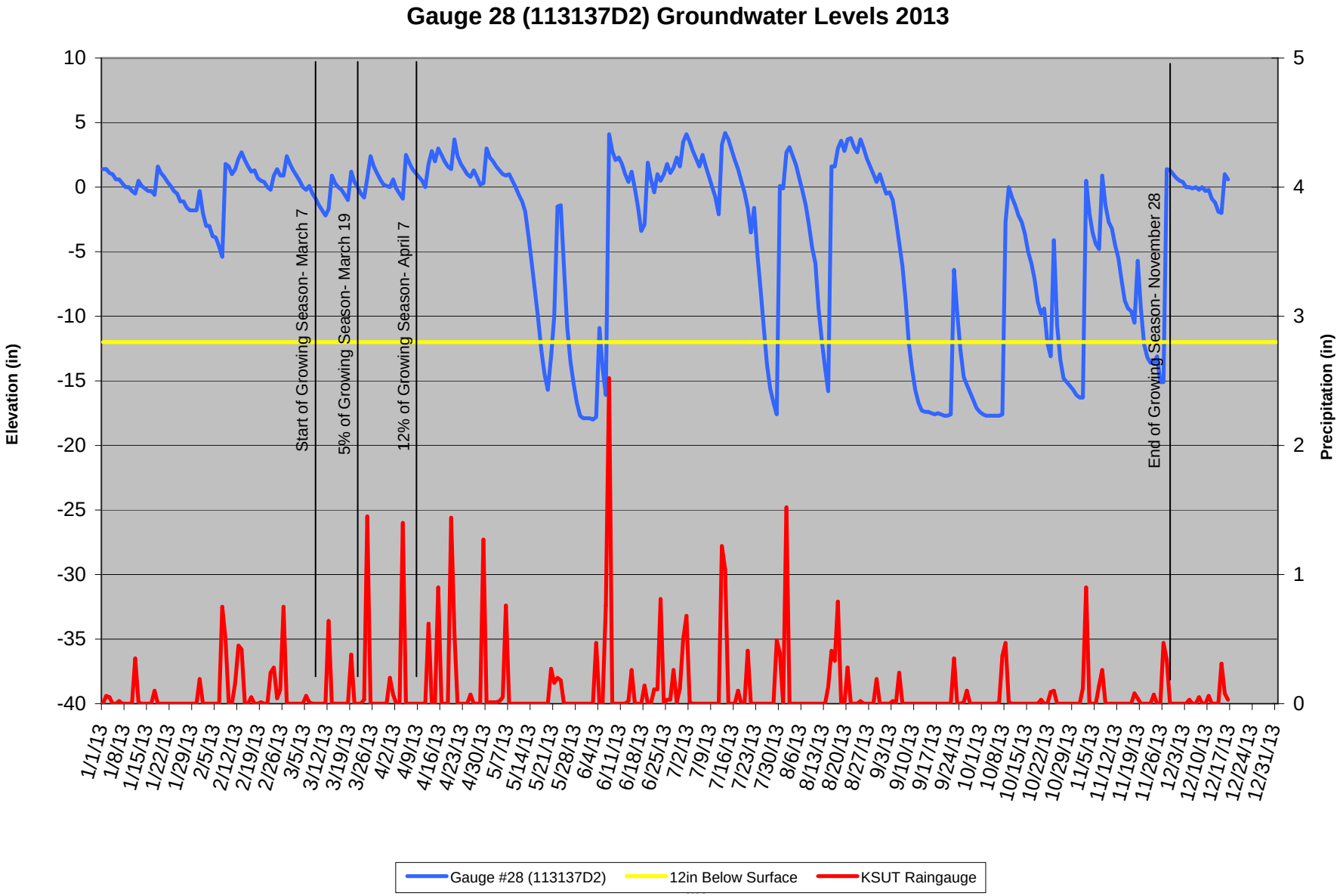

Gauge 24 (EBD7242) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #24 (EBD7242)
12in Below Surface
KSUT Raingauge


Gauge 25 (1130EE20) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #25 (1130EE20)
12in Below Surface
KSUT Raingauge

Gauge 26 (A27A7B0) Groundwater Levels 2013

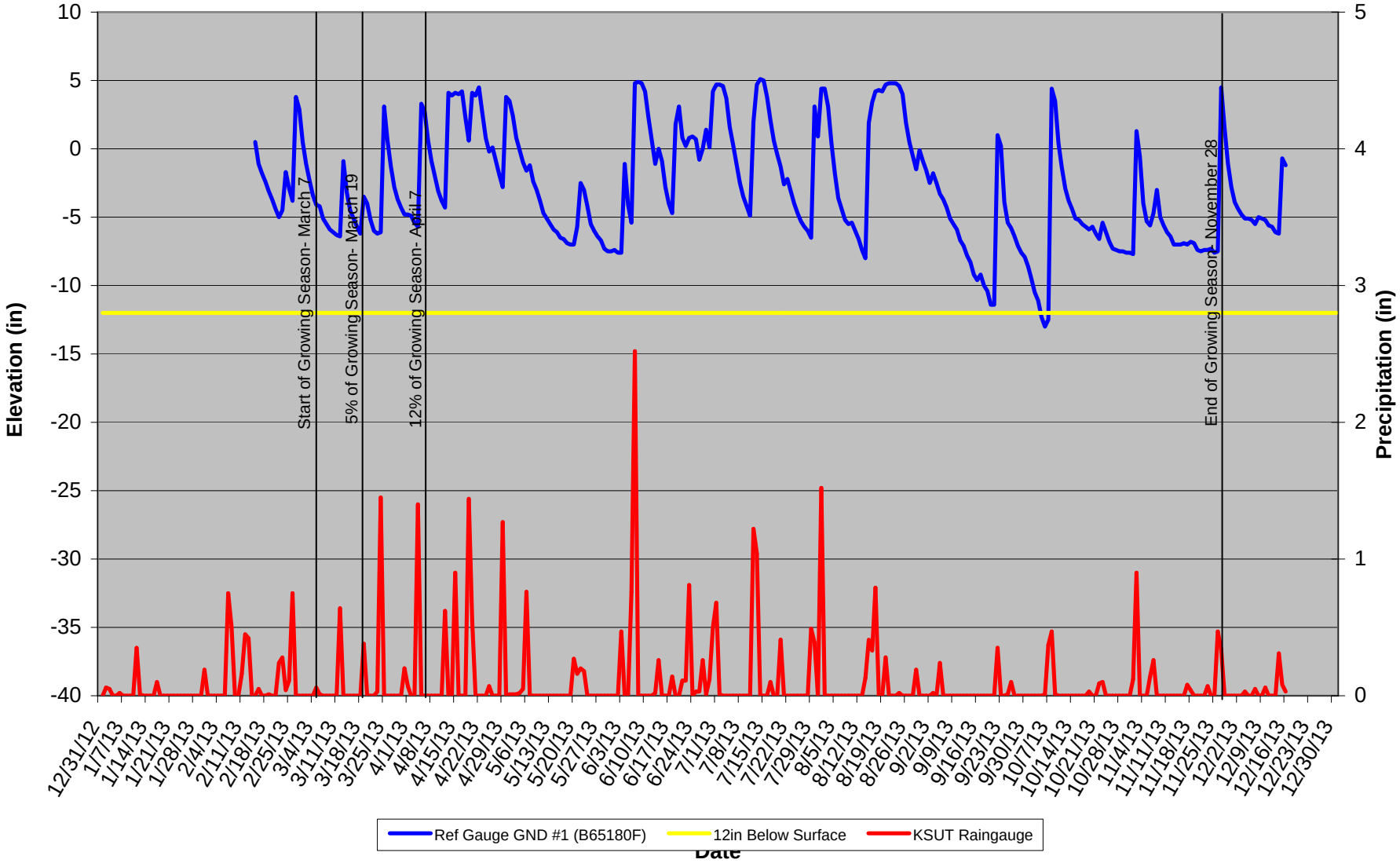



Gauge 27 (EBD3F40) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #27 (EBD3F40)
12in Below Surface
KSUT Raingauge


Gauge 28 (113137D2) Groundwater Levels 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Gauge #28 (113137D2)
12in Below Surface
KSUT Raingauge

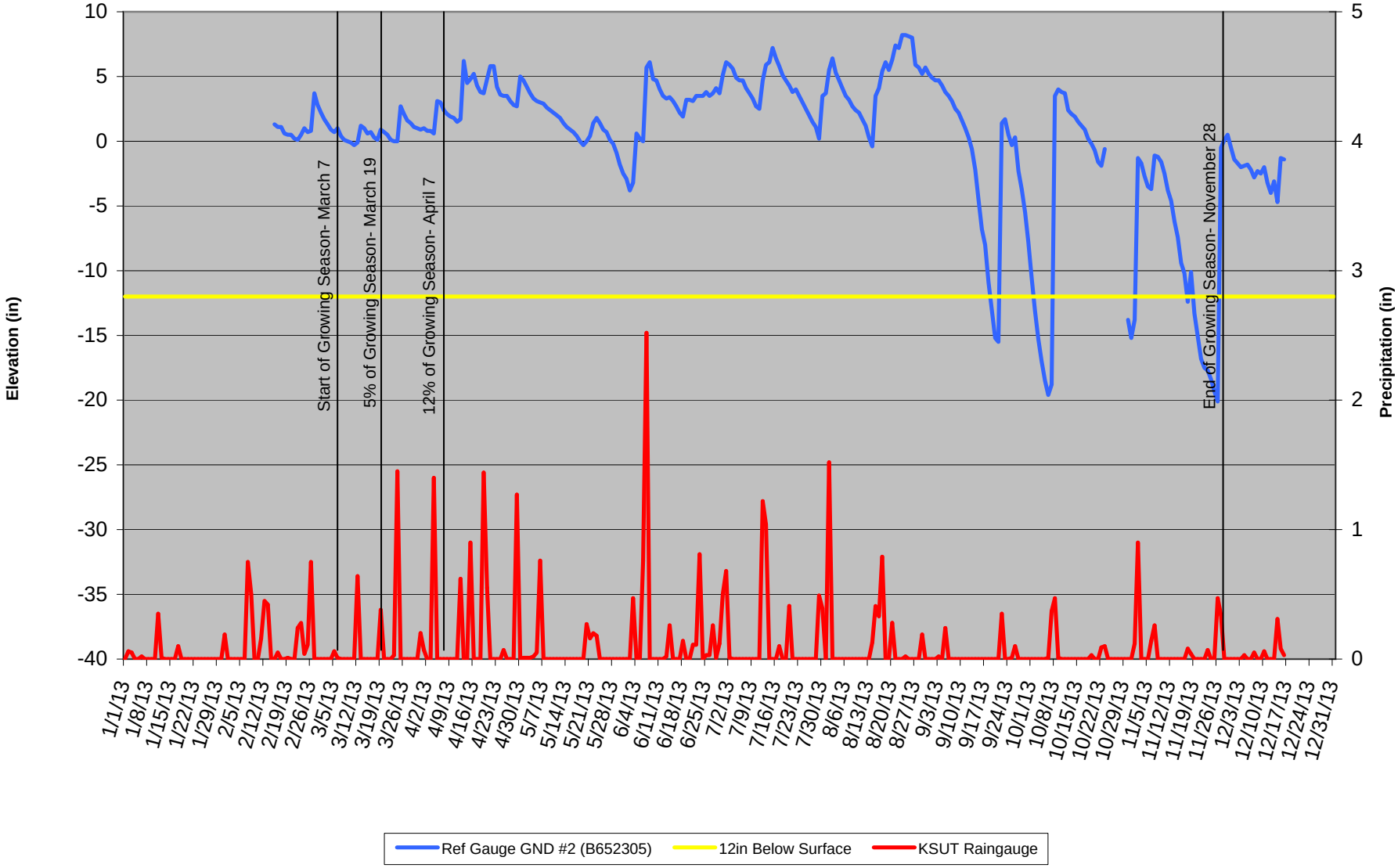
Reference Gauge G1 (B65180F) Groundwater Levels 2013

Gauge reinstalled February 15, 2013



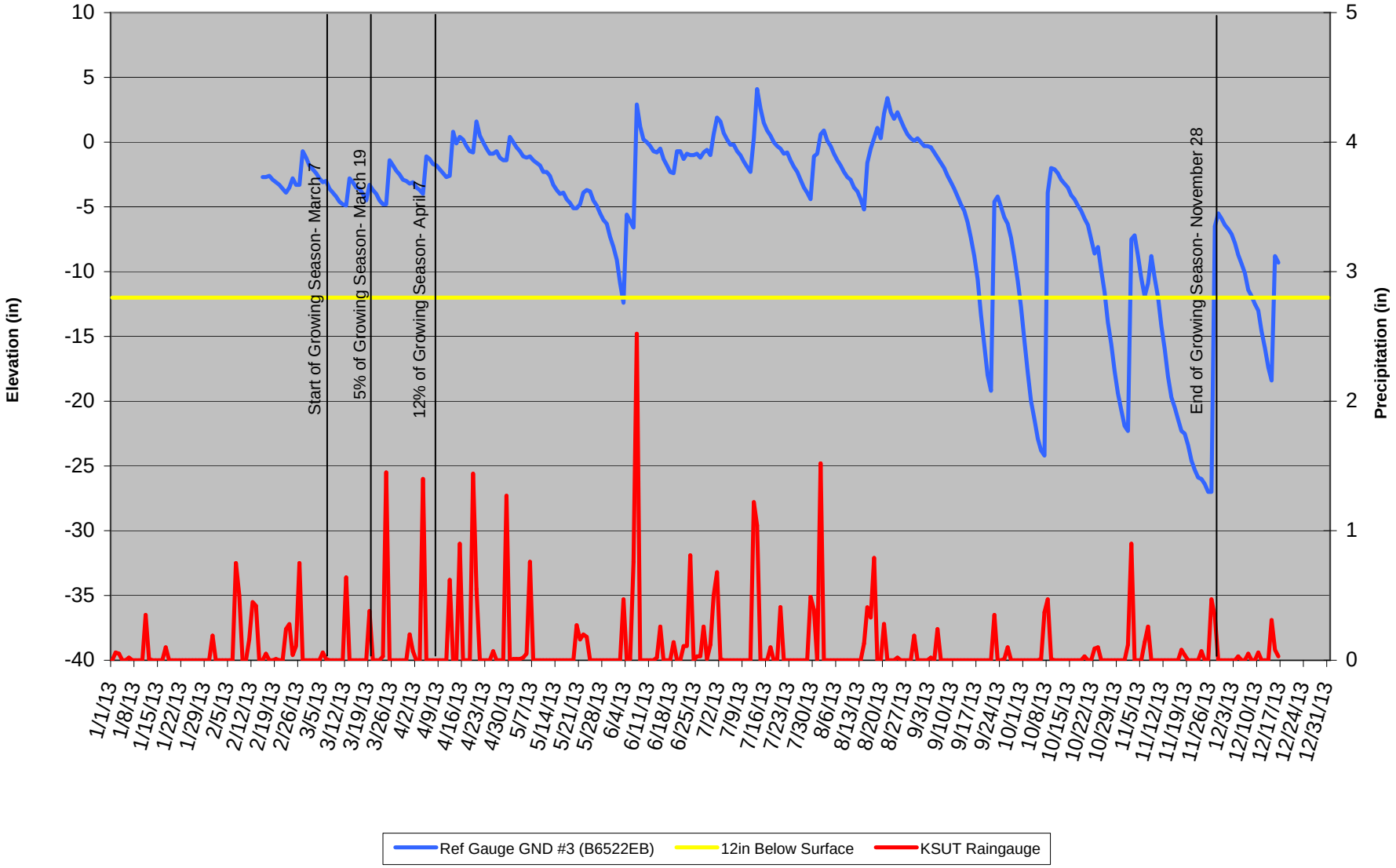
Reference Gauge G2 (B652305) Groundwater Levels 2013

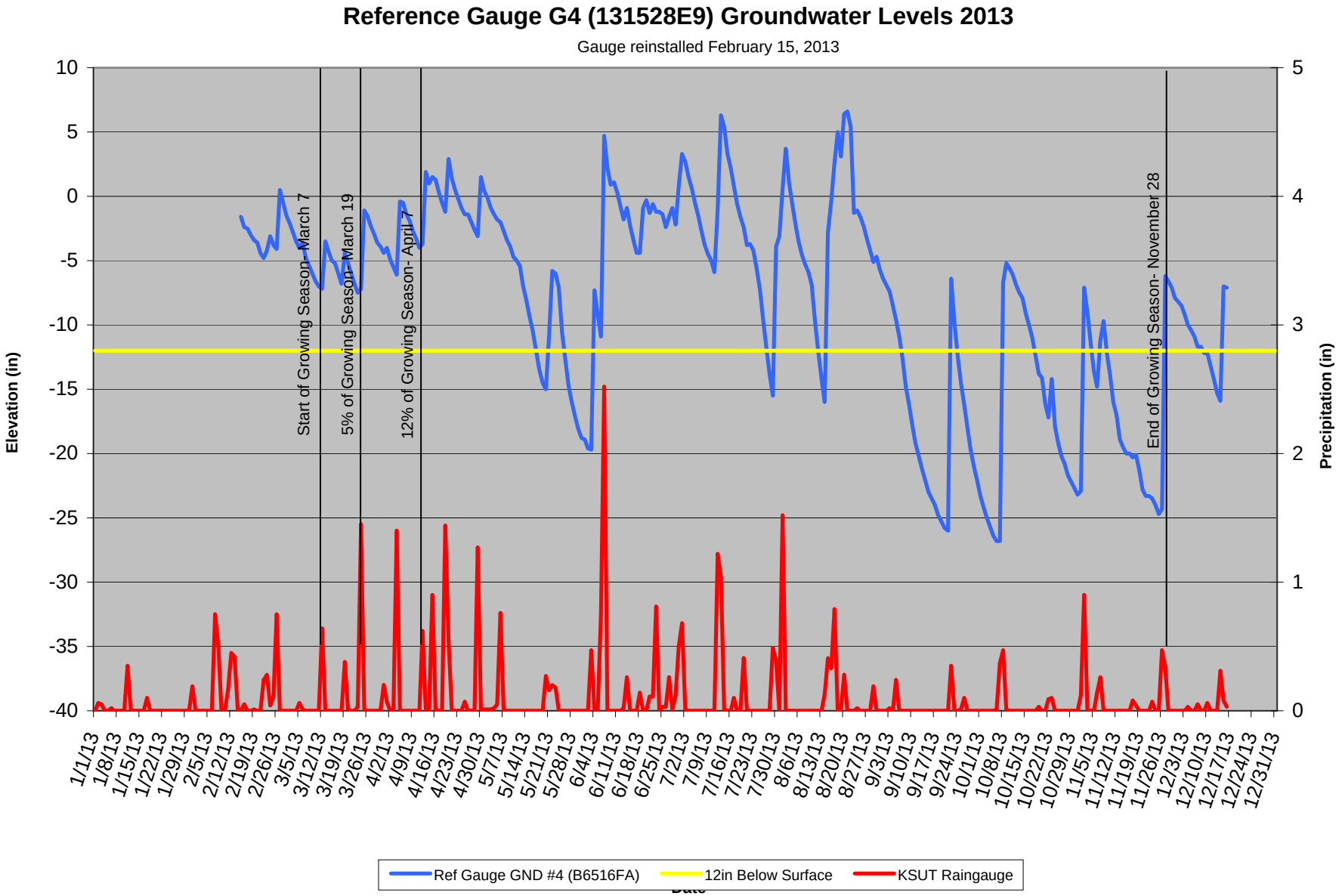
Gauge reinstalled February 15, 2013



Reference Gauge G3 (B6522EB) Groundwater Levels 2013

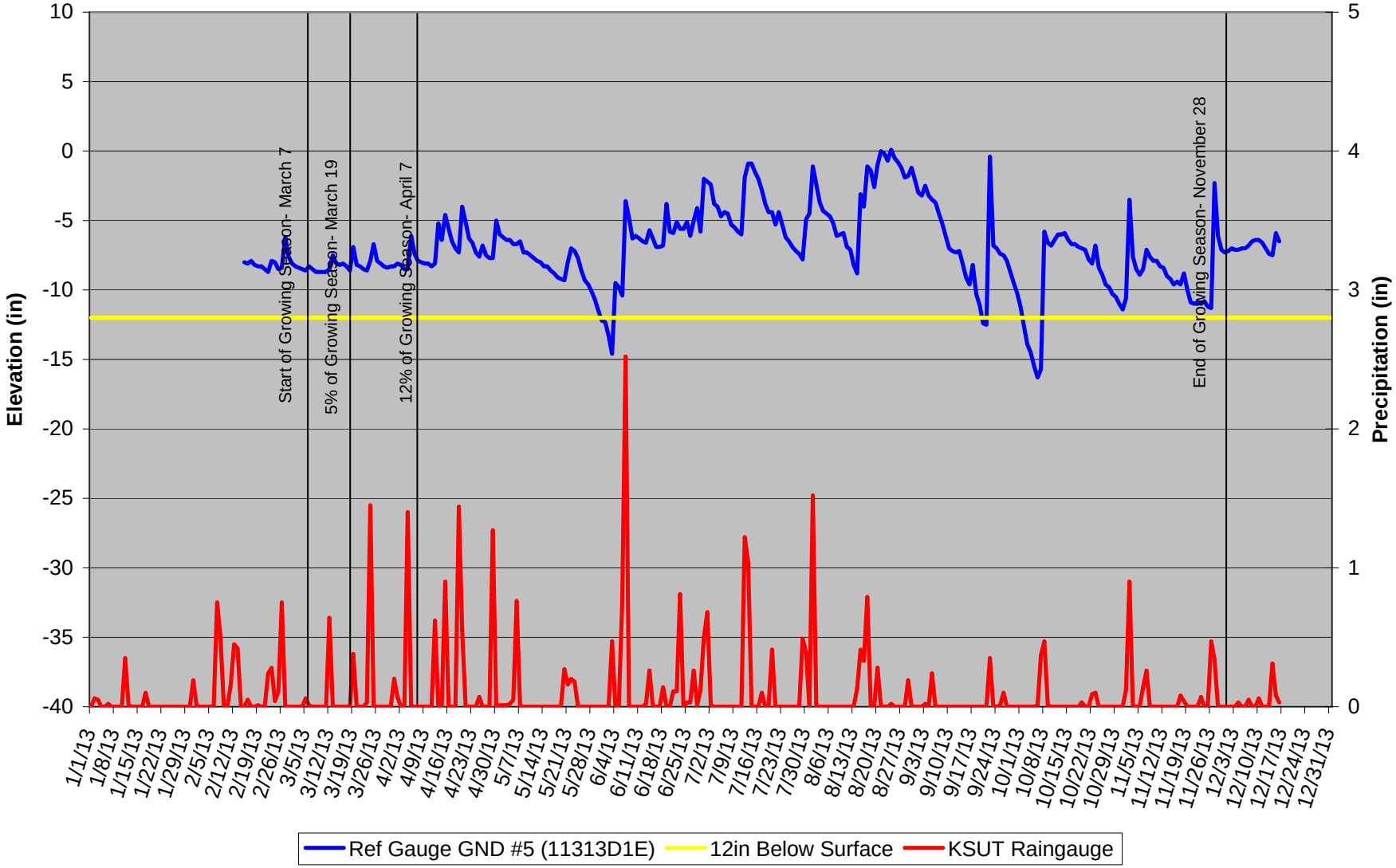
Gauge reinstalled February 15, 2013




Reference Gauge G4 (131528E9) Groundwater Levels 2013
Gauge reinstalled February 15, 2013
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Ref Gauge GND #4 (B6516FA)
12in Below Surface
KSUT Raingauge

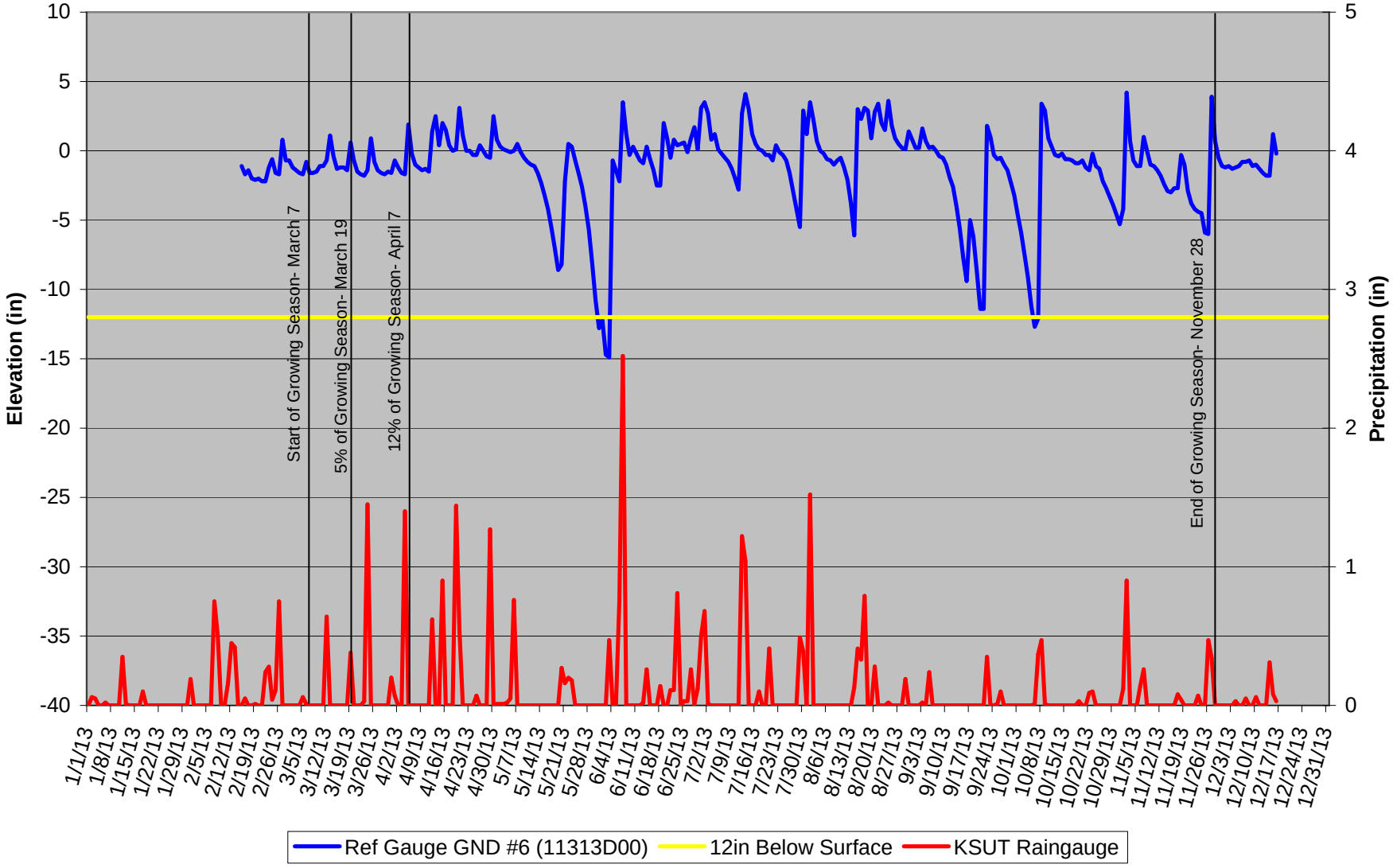
Reference Gauge G5 (11313D1E) Groundwater Levels 2013

Gauge installed February 15, 2013

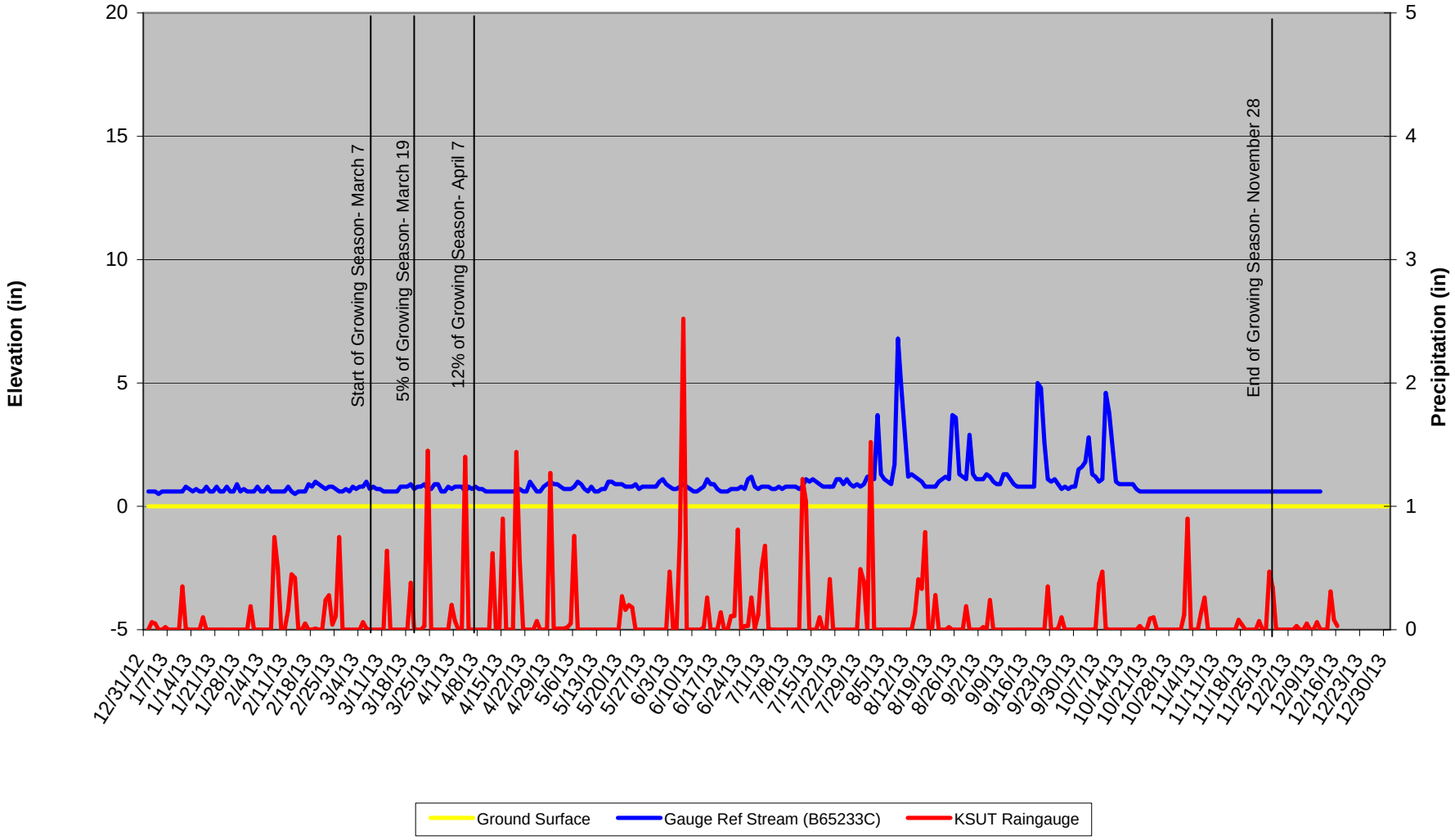


Reference Gauge G6 (11313D00) Groundwater Levels 2013

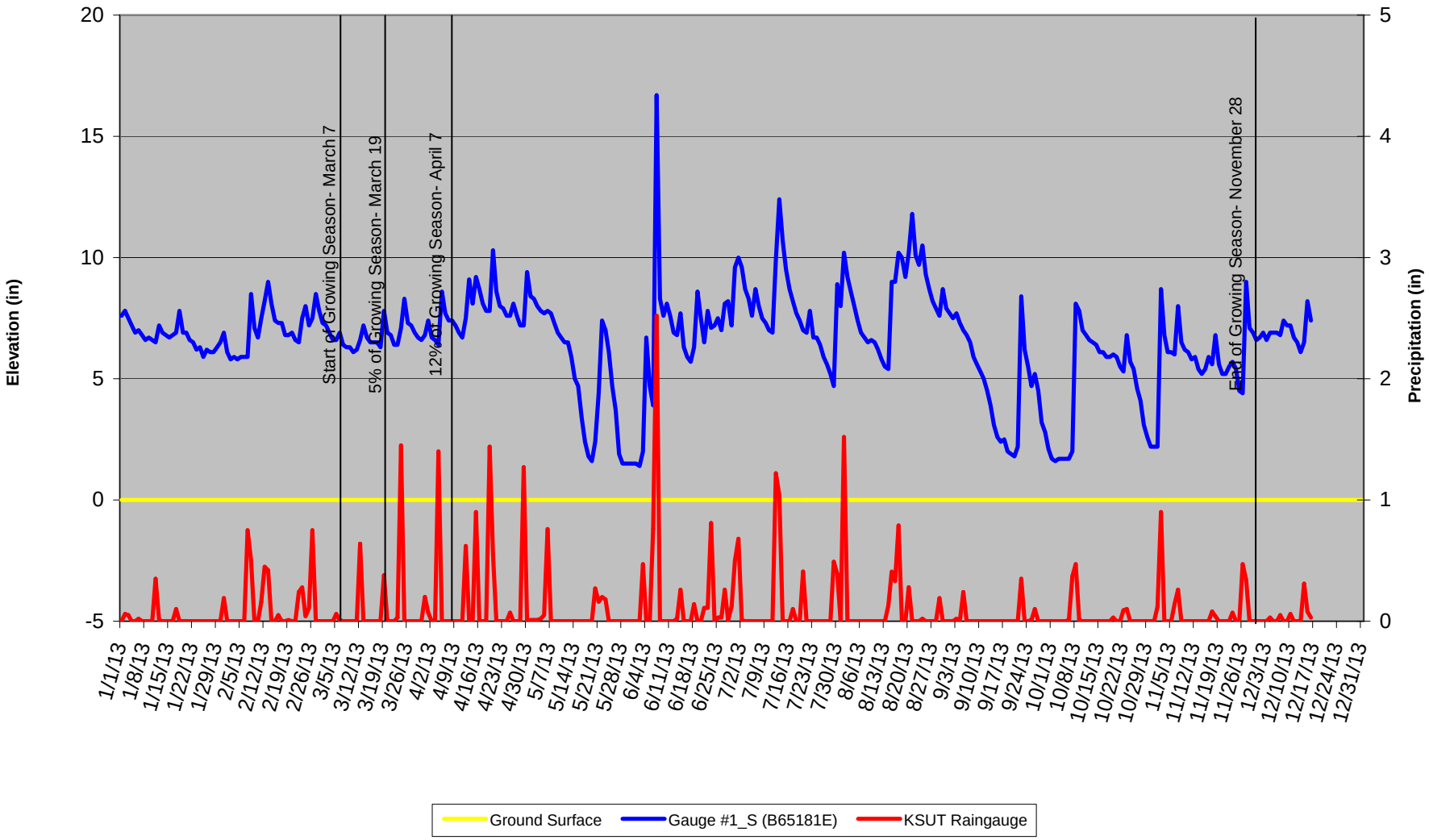
Gauge installed February 15, 2013



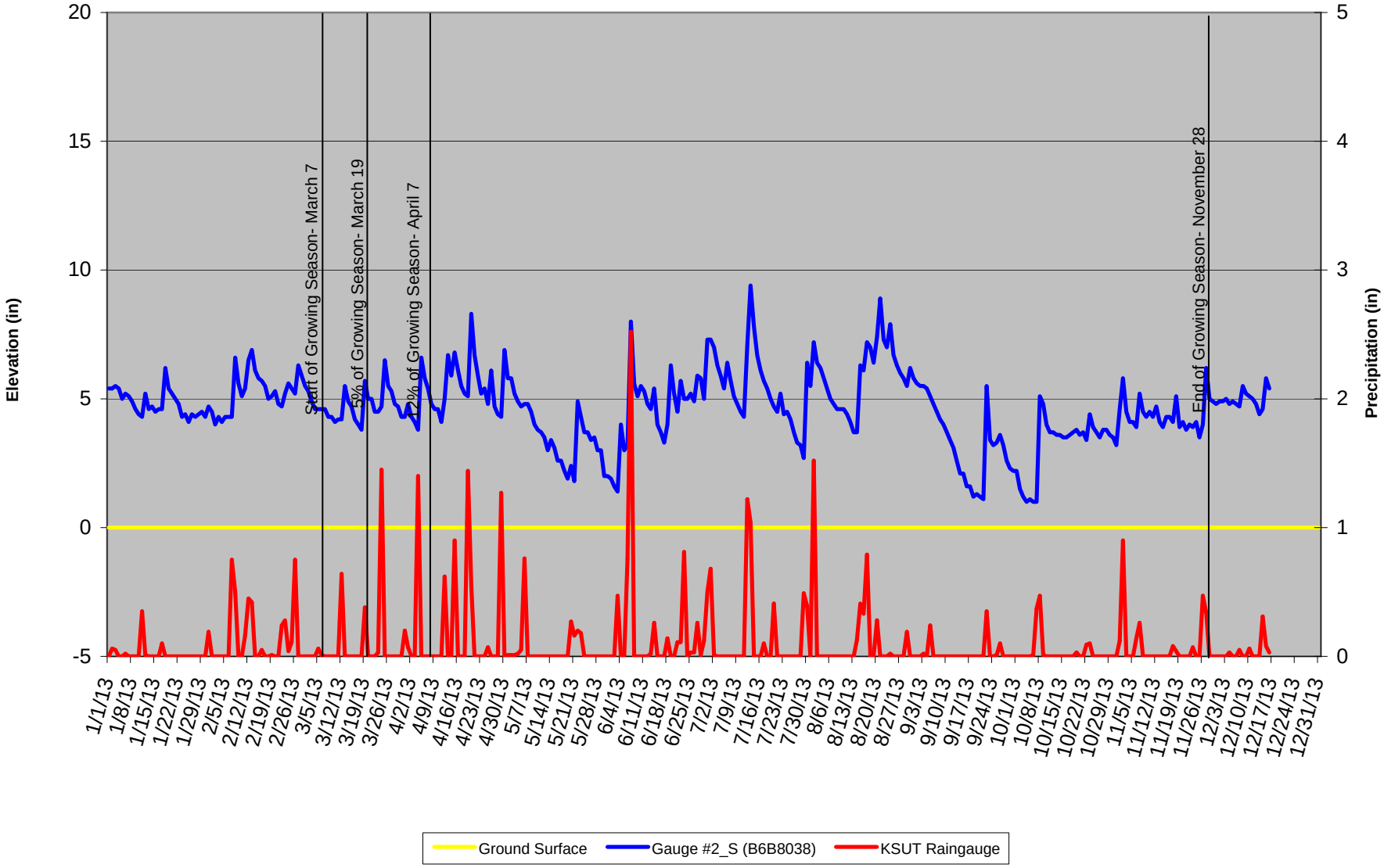
Reference Stream Gauge (B65233C) Water Levels 2013



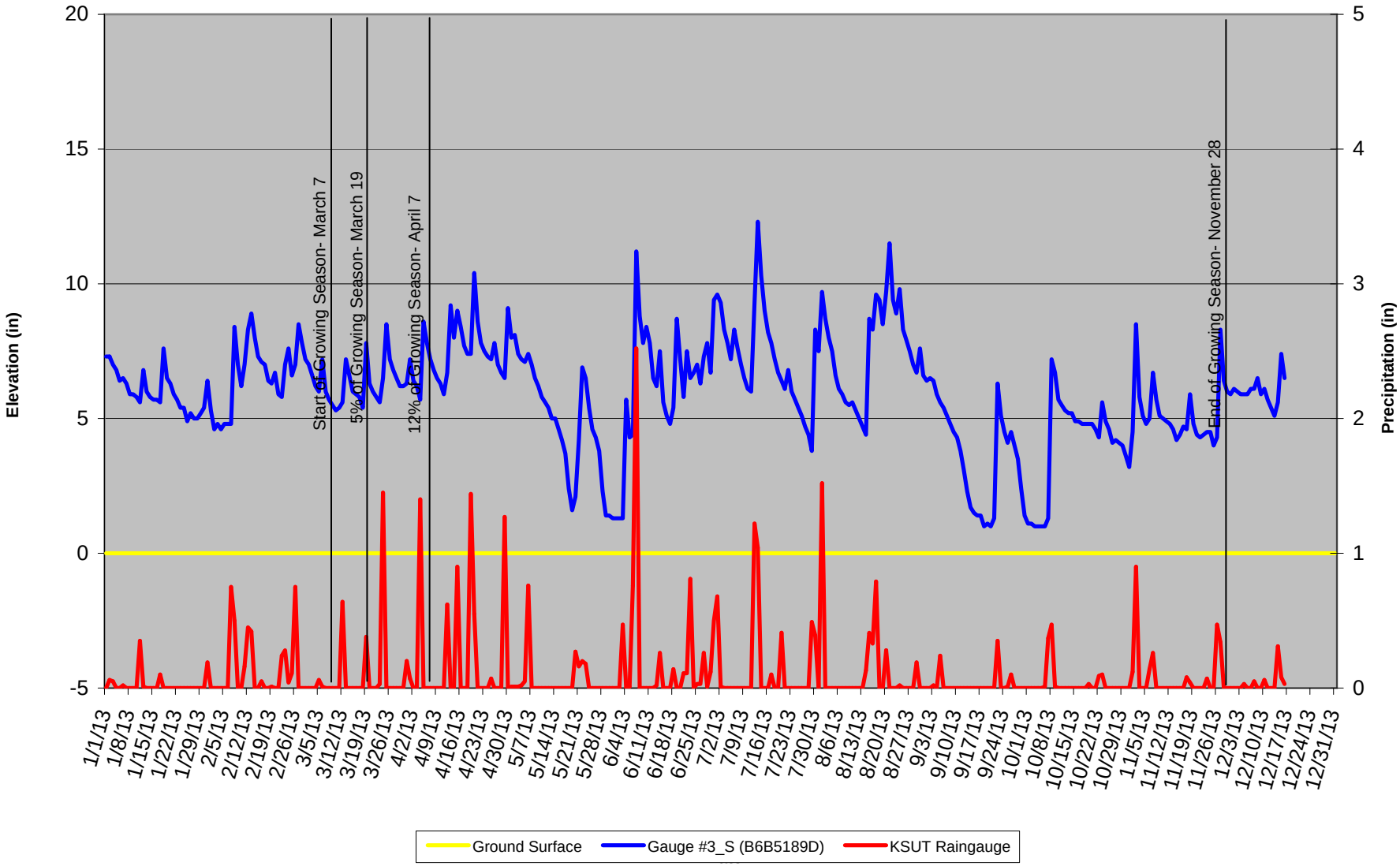
Stream Gauge 1 (B65181E) Water Levels 2013



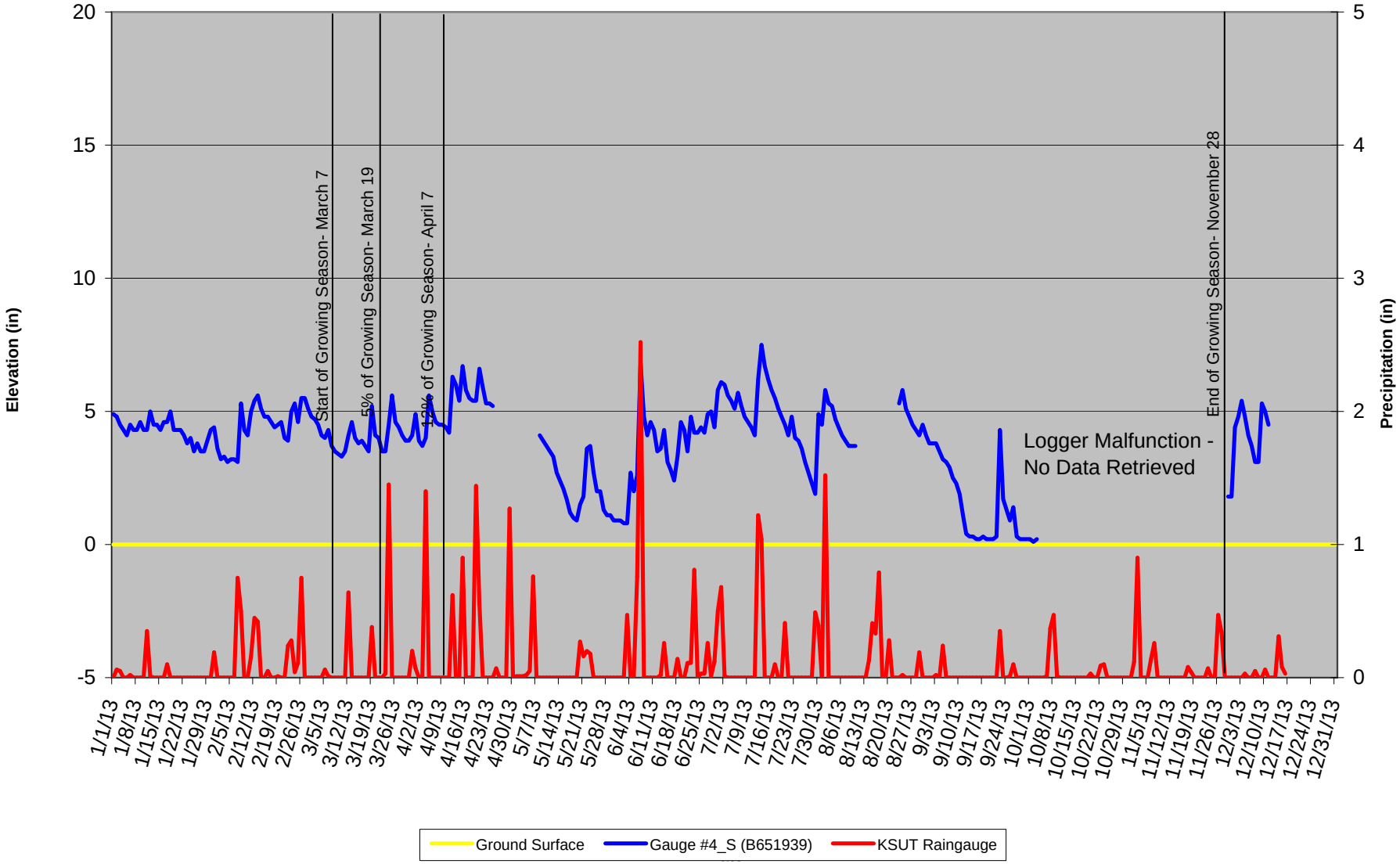
Stream Gauge 2 (B6B8038) Water Levels 2013



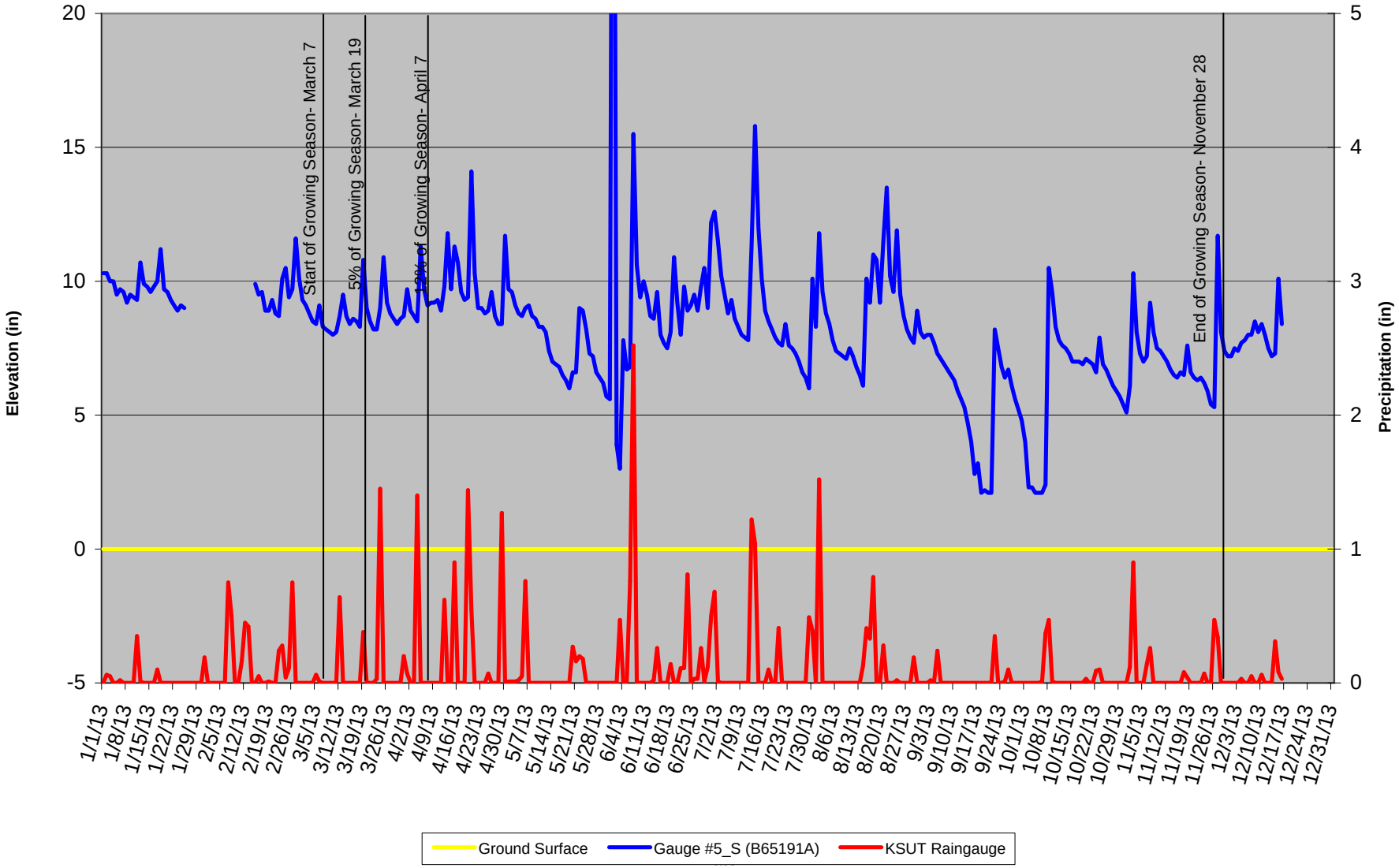
Stream Gauge 3 (B6B5189D) Water Levels 2013



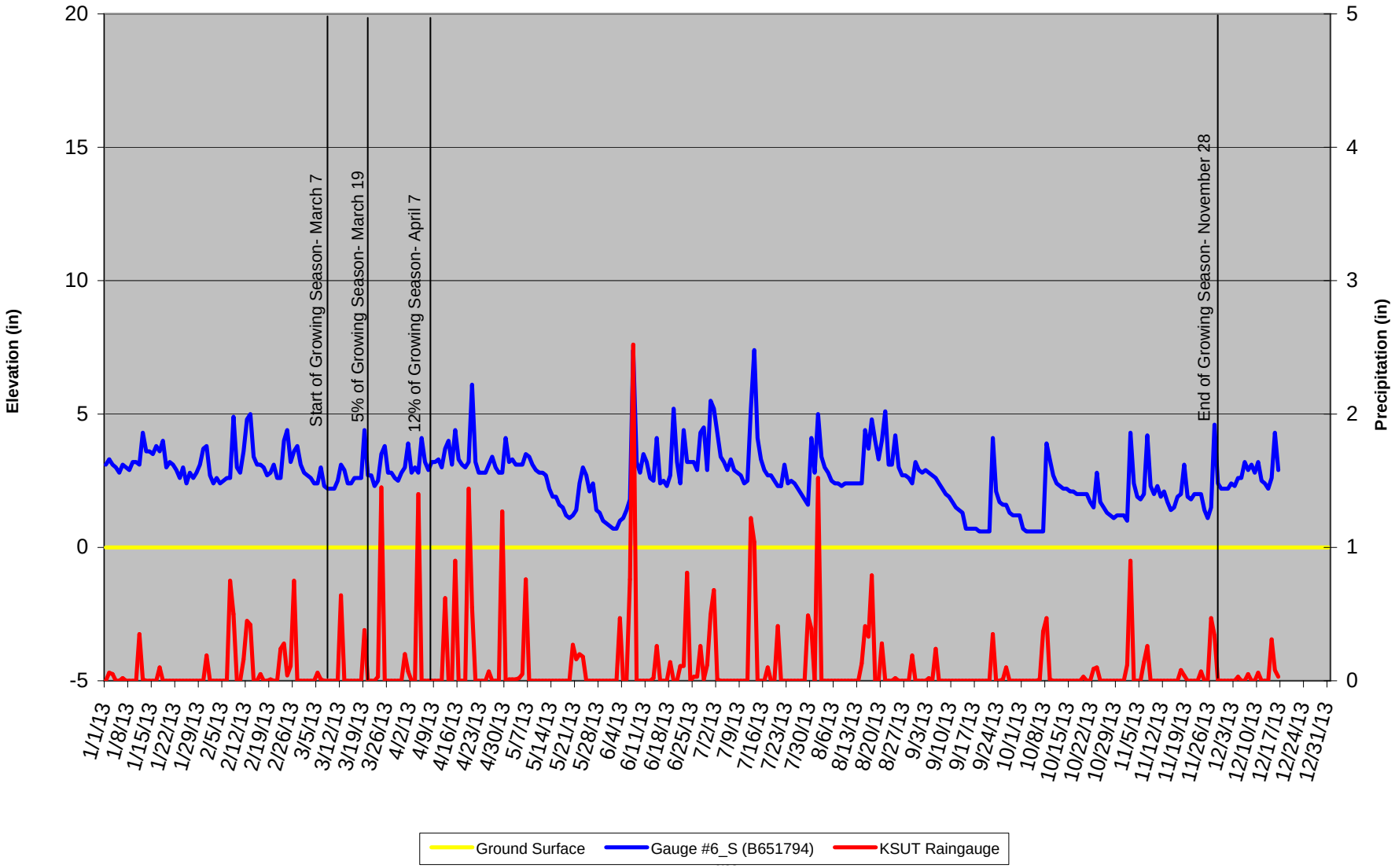
Stream Gauge 4 (B651939) Water Levels 2013

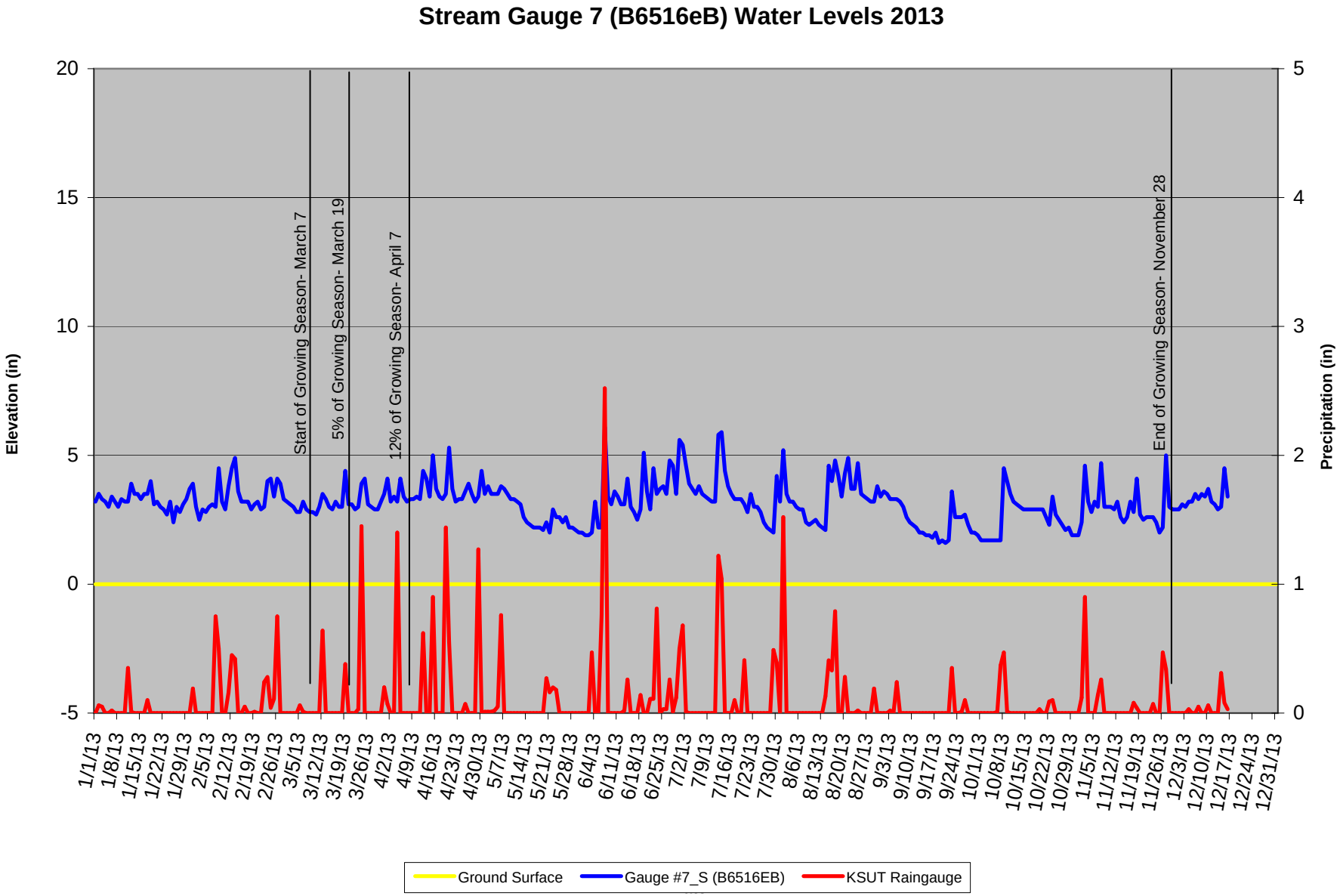


Stream Gauge 5 (1130DB70) Water Levels 2013



Stream Gauge 6 (B651794) Water Levels 2013




Stream Gauge 7 (B6516eB) Water Levels 2013
Elevation (in)
Precipitation (in)
20
15
10
5
0
-5
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Ground Surface
Gauge #7_S (B6516EB)
KSUT Raingauge

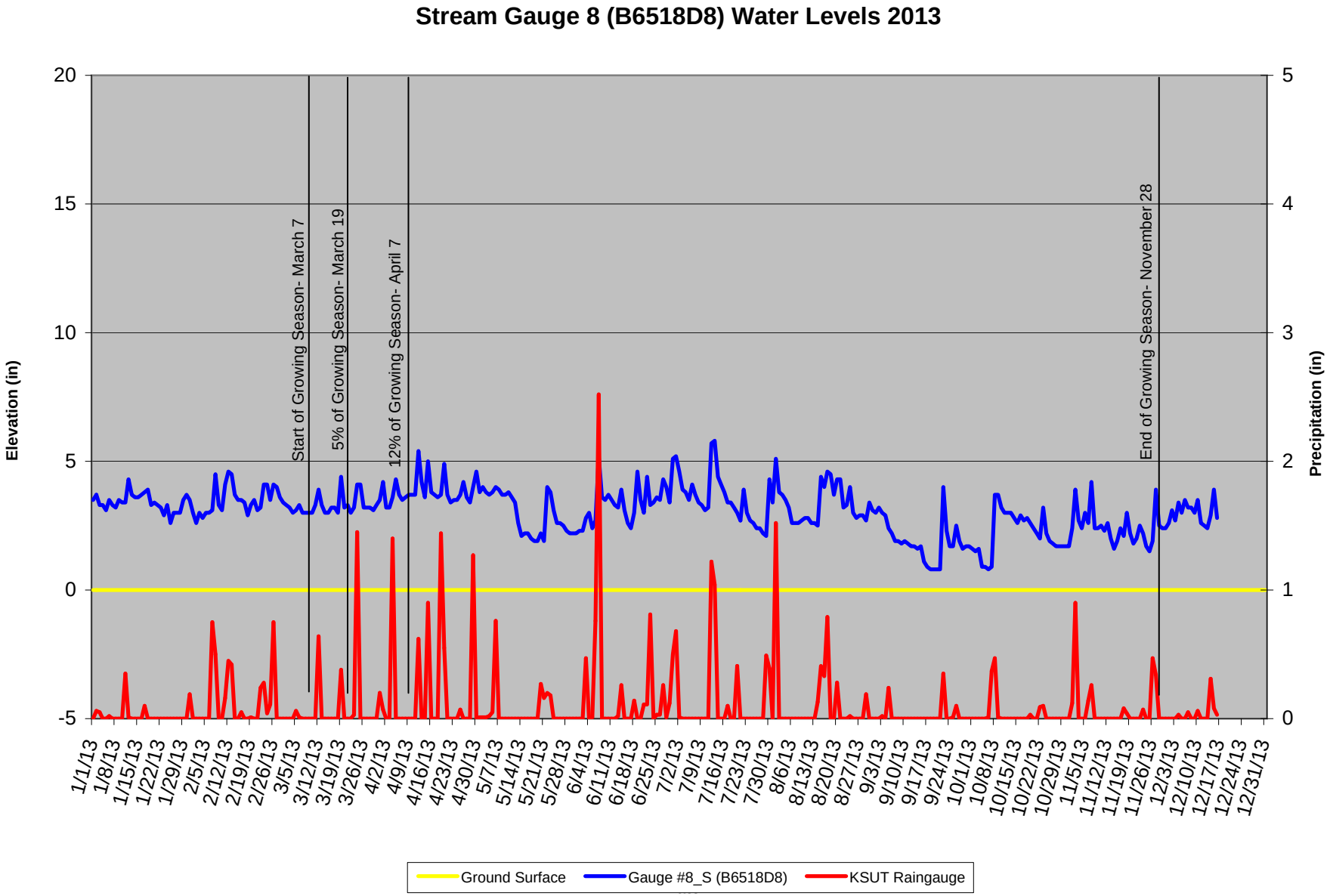

Stream Gauge 8 (B6518D8) Water Levels 2013
Elevation (in)
Precipitation (in)
20
15
10
5
0
-5
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/13
1/8/13
1/15/13
1/22/13
1/29/13
2/5/13
2/12/13
2/19/13
2/26/13
3/5/13
3/12/13
3/19/13
3/26/13
4/2/13
4/9/13
4/16/13
4/23/13
4/30/13
5/7/13
5/14/13
5/21/13
5/28/13
6/4/13
6/11/13
6/18/13
6/25/13
7/2/13
7/9/13
7/16/13
7/23/13
7/30/13
8/6/13
8/13/13
8/20/13
8/27/13
9/3/13
9/10/13
9/17/13
9/24/13
10/1/13
10/8/13
10/15/13
10/22/13
10/29/13
11/5/13
11/12/13
11/19/13
11/26/13
12/3/13
12/10/13
12/17/13
12/24/13
12/31/13
Ground Surface
Gauge #8_S (B6518D8)
KSUT Raingauge

Table 10. Wetland gauge attainment data

Summary of Groundwater Gauge Results for Years 1 through 5					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	Yes/43 days (16%)	Yes/108 days (40%)	Yes/121 days (45%)	Yes/93 days (35%)	
2	Yes/68 days (25%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/268 days 100%)	
3	Yes/44 days (16%)	Yes/127 days (47%)	Yes/121 days (45%)	Yes/107 days (40%)	
4	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/104 days (39%)	
5	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/197 days (73%)	
6	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/198 days (74%)	
7	Yes/42 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/194 days 725%)	
8	Yes/42 days (16%)	Yes/125 days (47%)	Yes/121 days (45%)	Yes/104 days (39%)	
9	Yes/58 days (22%)	Yes/125 days (47%)	Yes/121 days (45%)	Yes/101 days (37%)	
10	Yes/36 days (14%)	Yes/33 days (12%)	Yes/121 days (45%)	Yes/72 days (27%)	
11	Yes/57 days (22%)	Yes/106 days (40%)	Yes/121 days (45%)	Yes/97 days (36%)	
12	Yes/33 days (13%)	No/23 days (9%)	Yes/31 days (12%)	Yes/69 days (26%)	
13	Yes/36 days (13%)	No/23 days (9%)	Yes/31 days (12%)	Yes/69 days (26%)	
14	Yes/40 days (16%)	Yes/116 days (43%)	Yes/121 days (45%)	Yes/84 days (31%)	
15	Yes/41 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/102 days (37%)	
16	Yes/57 days (22%)	Yes/99 days (37%)	Yes/121 days (45%)	Yes/104 days (39%)	
17	Yes/43 days (16%)	Yes/99 days (37%)	Yes/121 days (45%)	Yes/73 days (27%)	
18	Yes/126 days (47%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/121 days (45%)	
19	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/178 days (66%)	
20	Yes/32 days (13%)	Yes/116 days (43%)	Yes/121 days (45%)	Yes/196 days (73%)	
21	Installed 12/10	No/19 days (7%)	Yes/31 days (12%)	Yes/68 days (25%)	
22	Installed 12/10	No/19 days (7%)	Yes/34 days (13%)	Yes/67 days (25%)	
23	Installed 12/10	Yes/116 days (43%)	Yes/121 days (45%)	Yes/74 days (28%)	
24	Installed 12/10	Yes/109 days (41%)	Yes/121 days (45%)	Yes/73 days (28%)	
25	Installed 12/10	Yes/74 days (28%)	Yes/121 days (45%)	Yes/84 days (31%)	
26	Installed 12/10	No/25 days (9%)	No/22 days (8%)	Yes/62 days (23%)	
27	Installed 12/10	No/25 days (9%)	Yes/121 days (45%)	Yes/70 days (26%)	
28	Installed 12/10	Yes/40 days (15%)	Yes/121 days (45%)	Yes/72 days (27%)	