Reeds Creek Wetland Restoration Project

Contract #:	D05016-3
County:	Iredell
Cataloging Unit:	Catawba 03050101
Monitoring Firm POC:	Mid-Atlantic Mitigation, LLC Rich Mogensen (704) 782-4133 Environmental Services, Inc. Paul Petitgout (704) 523-7225
Prepared For:	EEP Project Manager, Guy Pearce

Year 1 Monitoring Report - October 2007

Environmental Services Inc.

Mid-Atlantic Mitigation, LLC

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1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

On behalf of the North Carolina Ecosystem Enhancement Program (NCEEP), Mid-Atlantic Mitigation, LLC (MAM) with technical assistance from Environmental Services, Inc. (ESI) restored 4.2 acres of riverine wetlands, enhanced 2.2 acres (there are additional enhancement areas onsite not included in WMU calculation), and preserved approximately 3 acres of wetlands on site not included in the WMU calculation. Grading of the Reeds Creek Site was completed December 2006. Planting and seeding of the site were completed in January 2007. Overall, the project will restore, enhance, and/or preserve approximately 14.66 acres of forested and emergent wetlands and upland buffer, of which 5.3 will be provided as riverine wetland mitigation units (WMUs) to the North Carolina Ecosystem Enhancement Program (EEP).

The goals and objectives of the Reeds Creek Wetland Restoration Project (Reeds Project) are to restore the hydrologic functions, the native vegetation of the degraded and drained wetlands, flood retention and water quality functions within the Reeds Creek watershed of the Catawba River Basin (HUC 03050101).

Existing berms and spoil piles adjacent to Reeds Creek were graded down to a more natural elevation and the other existing fill areas were removed. Native woody vegetation has been established in this area. Jurisdictional wetlands were preserved in the semi-permanently impounded area associated with Lake Norman. Jurisdictional wetlands were enhanced and/or restored in the area south of Reeds Creek.

2.0 PROJECT BACKGROUND

2.1 LOCATION AND SETTING

The Reeds Project is a 14.66-acre tract located southwest of Mooresville, Iredell County, North Carolina off of U.S. Highway 21, approximately 1.3 miles northeast of the U.S. Highway 21 and Interstate 77 intersection (see Figure 1). The project site is located in the Catawba River Watershed (USGS 8-digit Hydrologic Unit 03050101, and NCDWQ River Basin 03-08-32). NCDWQ has assigned Reeds Creek within the project site the Stream Index Number (SIN) of 11-104(2). The site is immediately adjacent to Lake Norman and is characterized by a variable floodplain associated with Reeds Creek. The site is currently owned by Mid-Atlantic Mitigation, LLC with the Conservation Easement being held by the State of North Carolina.

2.2 STRUCTURE AND OBJECTIVES

The goals and objectives of the Reeds Creek Wetland Restoration Project are to restore the hydrologic functions, the native vegetation of the degraded and drained wetlands, flood retention and water quality functions within the Reeds Creek watershed of the Catawba River Basin (HUC 03050101). A Project Location Map is provided in Figure 1.

Existing berms and spoil piles adjacent to Reeds Creek were graded down to a more natural elevation and the other existing fill areas were removed. The material was graded to the surrounding landscape to provide microtopographic complexity and woody planting zones. These areas where the topography was enhanced will create diverse habitats instead of the monotypical, flat lake fringe area that previously existed. Surface hydrology will be reintroduced to the restoration areas via more frequent overbank flooding from Reeds Creek. Native woody vegetation has been established in this area.

Jurisdictional wetlands were preserved in the semi-permanently impounded area associated with Lake Norman. Jurisdictional wetlands were enhanced and/or restored in the area south of Reeds Creek. Minor grading, adjacent to the wettest areas, was done to expand the wetland hydrology and create microtopography within the contiguous floodplain and wetland area.

The riparian wetland and buffer vegetation community will transition as the system seeks its hydrologic and vegetative equilibrium. Sediments on site were initially unconsolidated and mucky with saturation due to Lake Norman water level fluctuations. While water level fluctuations are still anticipated, the areas and duration of inundation can only be determined through post-construction observation and monitoring. It is anticipated that settling and subsidence would occur throughout the initial growing season, first through evaporation and then through transpiration as the herbaceous cover (seeded and natural propagation) established. Areas that are not saturated/ponded (i.e. fringe areas and/or microtopographic mounds) were planted with bare root seedlings to establish a bottomland hardwood riparian wetland community. Additional plantings may be necessary, as the site continues to consolidate and settle and inundation patterns are determined.

In order to stabilize the newly constructed wetlands and flood plain areas, both temporary and permanent grass seed were applied to all restored areas. A silt fence will remain along the Reeds Creek channel until the site has obtained 90% herbaceous cover. The types of seeds used were: *Leersia oryzoides* (Rice Cut grass); *Panicum clandestinum* (Deertongue grass); *Panicum virgatum* (Switchgrass); *Trisacum dactyloides* (Gama grass), *Juncus effusus* (soft rush) and *Secale cereale* (Annual rye). Three hardwood planting zones were established as follows: Zone 1-Swamp Forest Zone, Zone 2-Bottomland Forest Zone, and Zone 3-Levee Forest Zone. The location of each Zone is identified on the As-built plan located in Attachment A. Approximately 400 stems per acre were planted throughout the project. Livestakes were installed in some of the wetter areas but further livestaking along Reeds Creek may be necessary as the new streambank/floodplain area stabilizes with its associated wetlands, particularly after removal of the silt fence.

Table I. Project Mitigation Structure and Objectives Table

Project Segment	Mitigation Type	Linear Footage or Acerage	WMUs	Comment
Wetland	R	4.2	4.2	Restoration areas are located along Reeds Creek and front, center of site near access road(s)
Wetland	E1	2.2	1.1	Enhancement areas are located between the restored areas and the existing wetlands (preservation area)
Wetland	P and E1	8.26	-	Not included in WMU's

Table II. Project Activity and Reporting History

Activity or Report	Calendar Year of Completion or Planned Completion	Actual Completion Date
Restoration Plan	October 2005	March 2006
Site Work Completed	February 2006	December 2006
Site Planting and installation of monitoring devices	March 2006	January 2007
Mitigation Plan	April 2006	April 2007
Year 1 Monitoring	December 2006	November 2007
Year 2 Monitoring	December 2007	December 2008
Year 3 Monitoring	December 2008	December 2009
Year 4 Monitoring	December 2009	December 2010
Year 5 Monitoring	December 2010	December 2011

Project was delayed 9 months due to issues with the Duke Power 760 Contour Lake Easement for Lake Norman. These issues had been addressed prior to proposal submittal, however Duke Power's merger with Cinergy created changes in personnel and policy which required Mid-Atlantic to re-apply for these approvals.

Table III. Project Contacts

Project Manager Mid-Atlantic Mitigation, LLC	1960 Derita Road Concord, NC 28027 Rich Mogensen (704) 782-4133
Designer Environmental Services Inc.	9401-C Southern Pine Blvd. Charlotte, NC 28273 Paul Petitgout (704) 523-7225
Construction Contractor Environmental Services Inc.	9401-C Southern Pine Blvd. Charlotte, NC 28273 Paul Petitgout (704) 523-7225
Planting & Seeding Contractor Southeastern Tree And Mid-Atlantic Mitigation, LLC	271 Windrush Trail Walhalla, SC 29691 Bill Knowles (864) 710-5970 1960 Derita Road Concord, NC 28027 Kristy Rodrigue (704) 782-6257
Monitoring Performers Mid-Atlantic Mitigation, LLC	1960 Derita Road Concord, NC 28027 Christine Cook (704) 782-4140

Table IV. Project Background

Project Background Table	
Project County	Iredell
Drainage Area	4.9 square miles
Drainage Cover Estimate (%)	10%
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont 45b
Wetland Type	Palustrine, Forested, Broad-leaved Deciduous
Cowardin Classification	PFO1Fh
Dominant soil types	Chewacla with inclusions of Wehadkee
Reference site ID	Reeds Creek
USGS HUC for Project and Reference	03050101
NCDWQ Sub-basin for Project and Reference	03-08-32; SIN 11-104(2)
% of project easement fenced	0 – Urban site surrounded by private residence

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 VEGETATION ASSESSMENT

3.1.1 Soil Data

Table V. Preliminary Soil Data

Series	Max Depth (in)	% Clay on Surface	K	T	OM %
Chewacla	60	10 - 27	.28	5	1-4
Wehadkee	62	6 - 20	.24 - .28	3	<1

3.1.2 Vegetative Problem Areas

At this time, no vegetative problem areas have been noted or invasive species problems. The site has been stabilized and vegetated with native woody and herbaceous species

3.1.3 Stem Counts

The prevalent vegetation should consist of macrophytes that typically are adapted for life in saturated soil conditions. These species should have the ability to grow, compete, reproduce, and persist in anaerobic soil conditions. A maximum of 15% nuisance vegetation in wetland areas with planted and volunteer vegetation will successfully indicate establishment of native wetland vegetation. Study plots showing that the composition and density of vegetation in the restoration areas compares closely to the reference areas will indicate restoration success for vegetation. The initial success of riparian and wetland vegetation will be evaluated based on herbaceous ground cover as the site is stabilized in the initial growing season, as well as planted woody vegetation. Stem counts of over 320 trees per acre after 3 years, and 260 trees per acre after 5 years will be considered successful. Photos taken at established photo points should indicate maturation of riparian vegetation community. Photographs will help to illustrate the health of the planted vegetation and the severity of the invasive or exotic species that are found within the site. Permanent vegetation sampling plots have been established at 2 random locations and sample each planting zone. The success of vegetation plantings will be measured through stems counts. These plots will be used to sample both the riparian buffer and restored wetlands. Each plot will cover 100 square meters for tree counts. Within each plot, a 1 meter plot will be sampled to measure herbaceous coverage. During the counts, the health of the vegetation will be noted. In addition to stem counts, the samples will inventory species diversity to allow for comparison between the reference and restoration wetlands and track the percent cover of nuisance species. The vegetation survey will occur during the growing season. On October 4th, 2007, the first year-vegetative monitoring was performed on the established vegetation sampling plots.

Exhibit Table VI: Stem Counts for Each Species Arranged by Plot					
Species	Plots		Initial Totals	Year 1 Totals	Survival %
	A	B			
Shrubs					
Cephalanthus occidentalis	7	6	13	13	100%
Cornus amomum	11	8	19	19	100%
Totals	**18**	**14**	**32**	**32**	100%
Trees					
Betula nigra:	2	3	10	5	50%
Fraxinus pennsylvanica:	2	4	11	6	55%
Liriodendron tulipifera:	1		1	1	100%
Quercus lyrata		3	4	3	75%
Quercus michauxii:	1	4	6	5	83%
Quercus pagodafolia	6	1	7	7	100%
Quercus phellos:		3	3	3	100%
Salix nigra		3	3	3	100%
Totals	**12**	**21**	**45**	**33**	73%
Woody Stems Total:	**30**	**35**	**77**	**65**	85%

3.1.4 Vegetation Assessment Summary

Vegetation success will be defined as tree survival to meet 320 stems per acre after 3 years and 260 stems per acre after 5 years inside the permanent vegetation sampling plots and herbaceous cover evaluated with photos showing 75% coverage, after 5 years.

In general, the site was over planted to allow for mortality. The site as a whole shows an average of 1315 stems per acre and demonstrates 85 percent survival. Plot A shows approximately 607 stems per acre and 81 percent survival, and Plot B shows approximately 708 stems per acre and 87.5 percent survival.The community is diverse and rich with healthy volunteers. Large numbers of *Cephalanthus occidentalis* and *Salix nigra* volunteers are present on site. It is expected that desirable species such as these will continue to colonize the site and that planted species will continue to have a low mortality rate, therefore stem counts should maintain or continue to rise slightly over the next few years as the site progresses.

In Appendix A, the vegetative survey data tables show the actual counts of each species found per plot, severely stressed but not dead plants were noted. The herbaceous cover plant community was monitored in a 1 m by 1 m square at one corner of each plot. Each herbaceous quadrant showed at least 75% cover and was actually at or close to 100%.

3.2 WETLAND ASSESSMENT

3.2.1 Wetland Criteria Attainment

There are three water level monitoring gages located on the Reeds Project. Gages 1 and 2 are located in the restoration area and Gage 3 is located in the enhancement area in the same location as the pre-construction gage. There are both mature forested and emergent areas of preservation which were not included in the WMU calculations adjacent to the small unnamed tributary entering the site from the southeast corner and flowing into the cove for the Huntington neighborhood. There is a 4th gage located in the preservation/fringe area of the site to be used as an on site reference. The data will be downloaded once a month throughout the monitoring period. A USGS rain gage located on Lake Norman (Gage #35301408052495 CRN-42 Norman Shores) will be used to monitor the amount of rainfall. This will be correlated with the ground water data. Lake Norman lake levels will also be monitored if the site becomes inundated from high lake levels. Jurisdictional Hydrology is defined as continuous saturation within the first 12 inches of the soil surface for 5 percent of the growing season in a dry year, 10 percent in a normal year, and 12 percent in a wet year. The Iredell County Soil survey uses a growing season of 195 days, therefore jurisdictional hydrology for this monitoring year 2007, a dry year, will be defined as 10 continuous days.

Gage 1 is located farthest from the lake-edge and achieved jurisdictional hydrology in March and April. Gage 2 maintained a brief period of jurisdictional hydrology in May. This gage is closest to the lake edge and has a very different pattern of drainage and inundation then the other gages on site and is most affected by lake levels which have steadily lowered due to drought. Gage 3, which is located in the enhancement area maintained jurisdictional hydrology in March and April. The reference gage performed similarly to the enhancement gage, showing jurisdictional hydrology for the first 56 days of the growing season up until it began to show symptoms of drought in early May. Graphs showing water levels and corresponding rainfall data are located in Appendix C.

Well ID	Well Hydrology Threshold Met?	Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Mean
Reeds 1	Y*	100	Plot A	Y	100
Reeds 2	Y				
Reeds 3	Y		Plot B	Y	
Reeds Ref	Y				

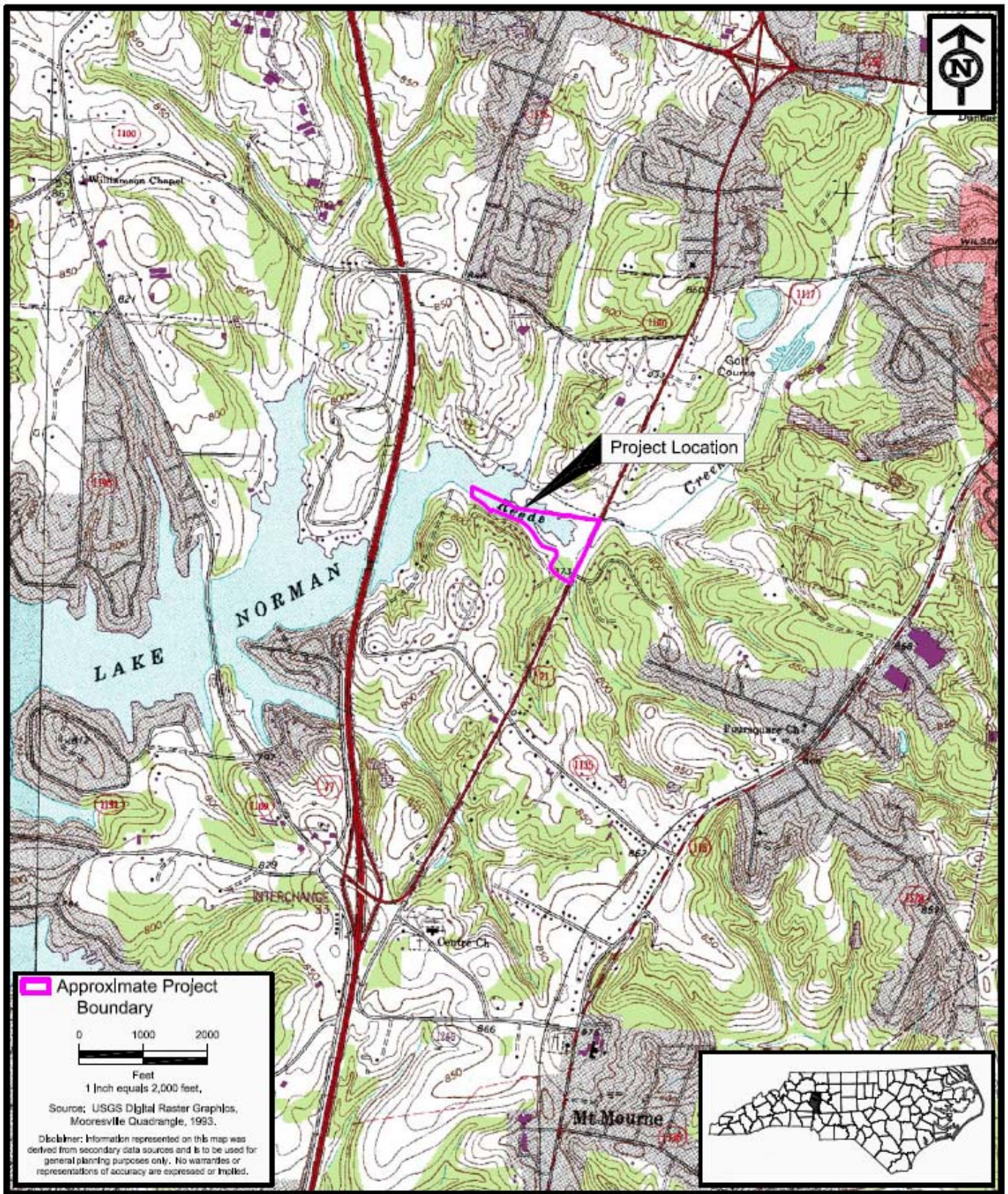
*If 2007 is considered a dry year and threshold is set at 10 days

3.2.2 Photo Reference Points

There are seven permanent photo reference points located throughout the Reeds Project and will be included in each monitoring report. Two of the photo reference points are located in the southwest corner of each vegetation plot and it will include two photographs taken from each point; one showing the health of the vegetation plot and one showing the 1 meter plot within the vegetation plot. All the Photographs will help to illustrate the health of the planted vegetation, the surface water hydrology (e.g. standing water). The Photo Log is located in Appendix B.

4.0 SITE SUCCESS ASSESSMENT SUMMARY

Overall, the stream channel has developed and stabilized well after the berm was lowered. The herbaceous vegetative cover has also developed a healthy and diverse community. The planted trees and shrubs have also done very well and are supplemented by a robust existing buffer community which provides seed source for volunteers well suited to the current site conditions. Ground water gages demonstrate favorable trends and developing jurisdictional wetland hydrology despite recent drought conditions.



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Project Location Map

Reeds Creek Wetland Restoration Site

Iredell County, North Carolina

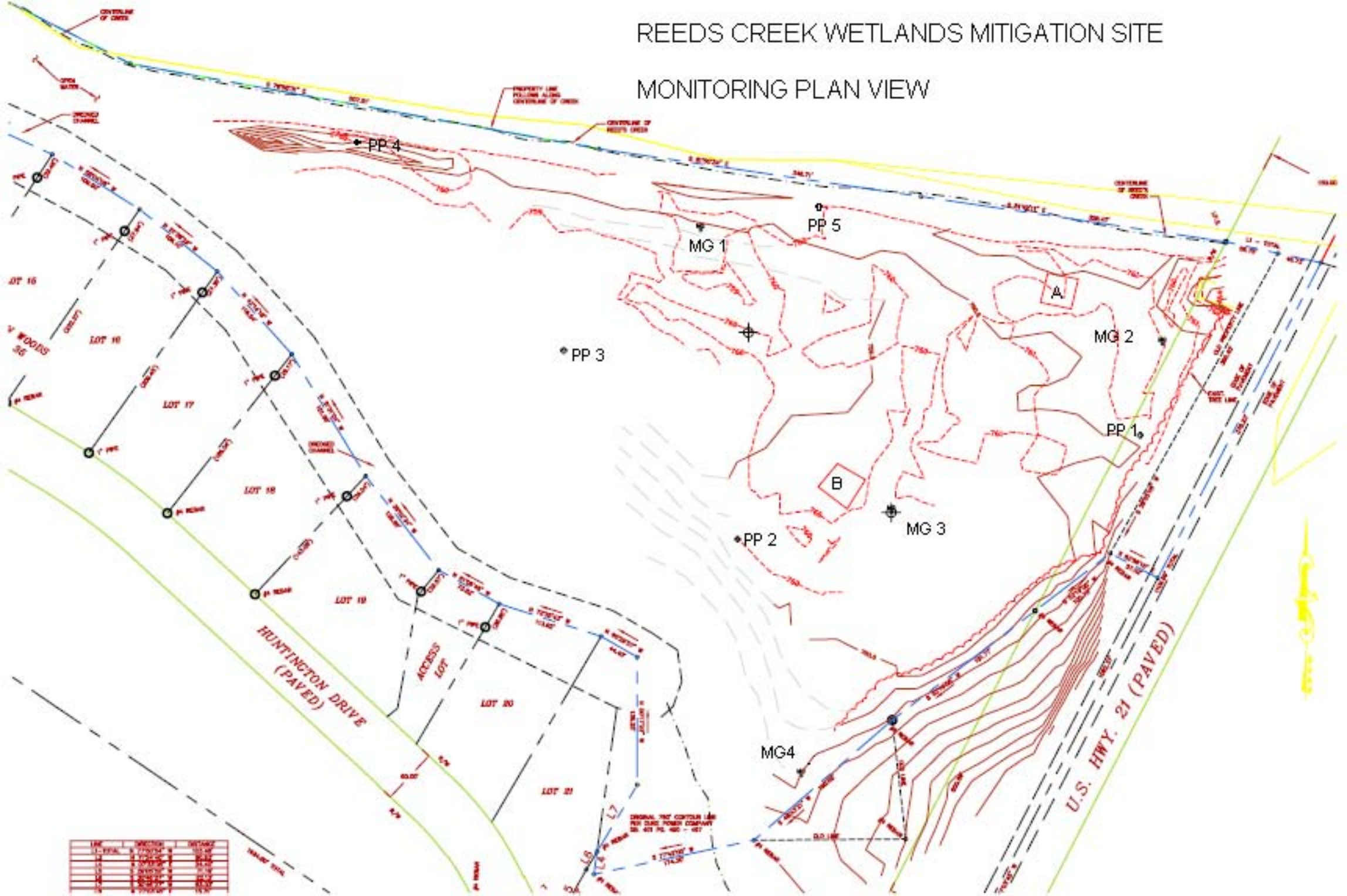
Project #: D05016-3

Drwn/Chkd: KT/CA

Figure: 1

REEDS CREEK WETLANDS MITIGATION SITE

MONITORING PLAN VIEW



APPENDIX A. Vegetation Raw Data

Vegetation Raw Data
Vegetation Monitoring Plot Photos

Exhibit Table VI: Stem Counts for Each Species Arranged by Plot					
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Totals	**12**	**21**	**45**	**33**	73%
Woody Stems Total:	**30**	**35**	**77**	**65**	85%

Plot A	100 m²	
Plot B	100 m²	
	200 m²	

Stems in plots	=	Stems per acre
200		4046.86

1315.2295 stems per acre

Species	Plot A	Plot B	Total
Shrubs			
Cephalanthus occidentalis	9	4	13
Cornus amomum	7	12	19
Totals			
Trees			
Betula nigra:	5	5	10
Fraxinus pennsylvanica:	5	6	11
Liriodendron tulipifera:	1		1
Quercus lyrata	2	2	4
Quercus michauxii:	2	4	6
Quercus pagodafolia	6	1	7
Quercus phellos:		3	3
Salix nigra		3	3
Totals			
	37	40	77

Veg Plot A

Species	
Shrubs	
Cephalanthus occidentalis	7
Cornus amomum	11
Totals	
Trees	
Betula nigra:	2
Fraxinus pennsylvanica:	2
Liriodendron tulipifera:	1
Quercus lyrata	
Quercus michauxii:	1
Quercus pagodafolia	6
Quercus phellos:	
Salix nigra	
Totals	30

$\frac{30}{100}$ =

Swamp Rose Mallow Vol

Nested Herbaceuos Plot:

dog fennel	Eupatorium capillifolium	
daisy fleabane	Erigeron strigosus	
golden rod	Solidago sp.	
deertounge grass	Panicum clandestinum	from seed mix
pennsylvania smartweed	polygonum pennsylvanicum	
water smartweed	polygonum hydropiperoides	
beggar tick	Bidens laevis	
soft rush	Juncus effusus	
blue-joint grass	Calamagrostis canadensis	

Invasives:

chinese lespedeza	Lespedeza cuneata

Veg Plot B

Species		
Shrubs		
Cephalanthus occidentalis	6	
Cornus amomum	8	1 noted as stressed
Totals		
Trees		
Betula nigra:	3	
Fraxinus pennsylvanica:	4	
Liriodendron tulipifera:		
Quercus lyrata	3	
Quercus michauxii:	4	
Quercus pagodafolia	1	
Quercus phellos:	3	
Salix nigra	3	
Totals	35	

$$\frac{35}{100} =$$

Nested Herbaceuos Plot:

dog fennel	Eupatorium capillifolium	
daisy fleabane	Erigeron strigosus	
agrimony	Eupatorium sp.	
golden rod	Solidago sp.	
deertounge grass	Panicum clandestinum	from seed mix
pennsylvania smartweed	polygonum pennsylvanicum	
water smartweed	polygonum hydropiperoides	
beggar tick	Bidens laevis	
blue-joint grass	Calamagrostis canadensis	

Veg Plot A – facing W

Nested Herbaceous plot in Veg Plot A

Veg Plot B – facing N, slightly E

Nested Herbaceous plot in Veg Plot B

APPENDIX B: Photo Log

Photo Point 1 – Facing NE

Outer edge of Reference area facing NE

Photo Point 2 – facing North, slightly E

Photo Point 3 – facing N

Photo Point 4 – facing W

Photo Point 4 – facing W

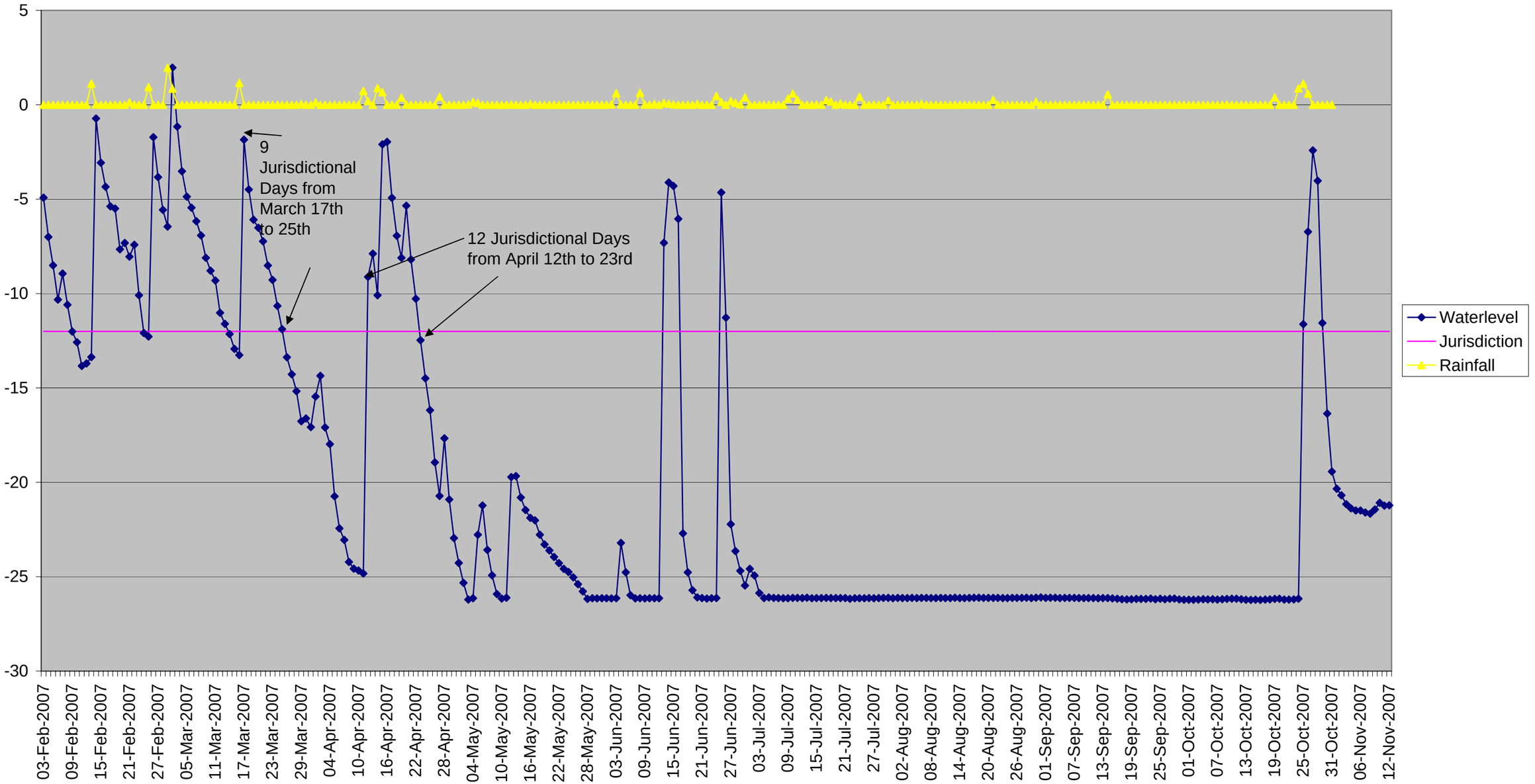
Photo Point 5 – facing S

Site Overview from bridge on Hwy 21

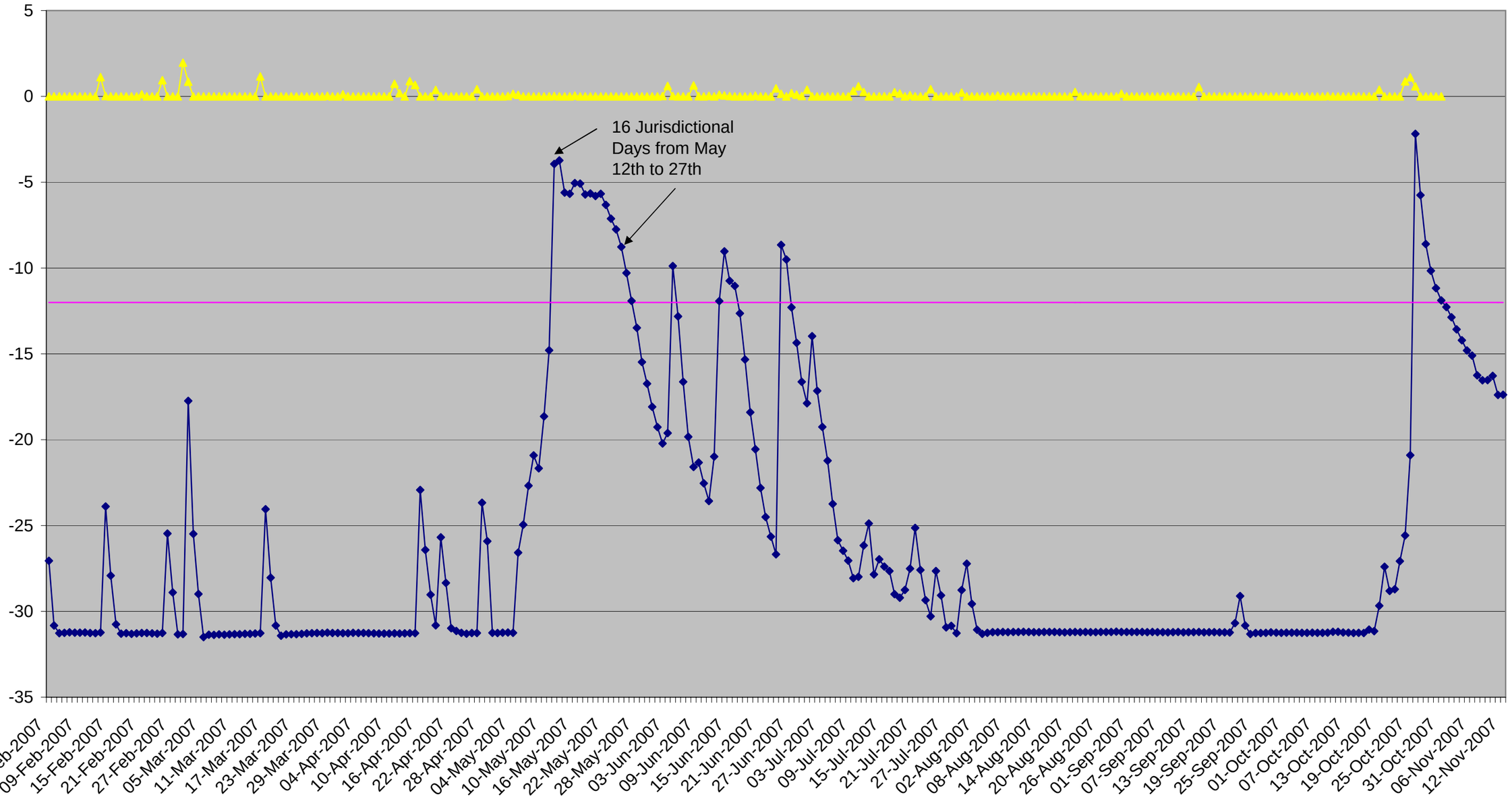
APPENDIX C: Water Level and Rainfall Data

Water Level Gage Graphs
USGS CRN 42 Rainfall Data

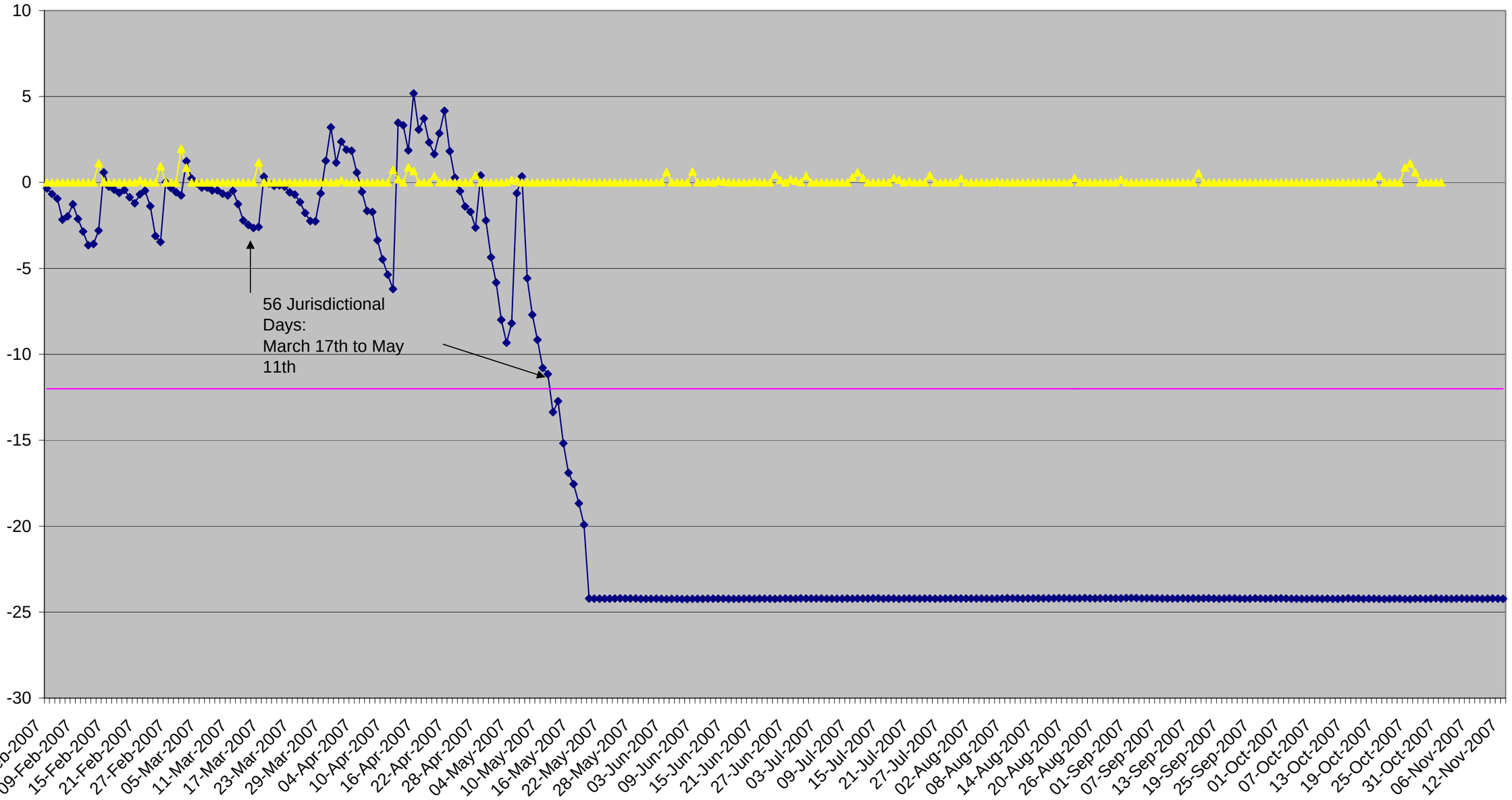
Reeds Creek Gage 1 Restoration Area



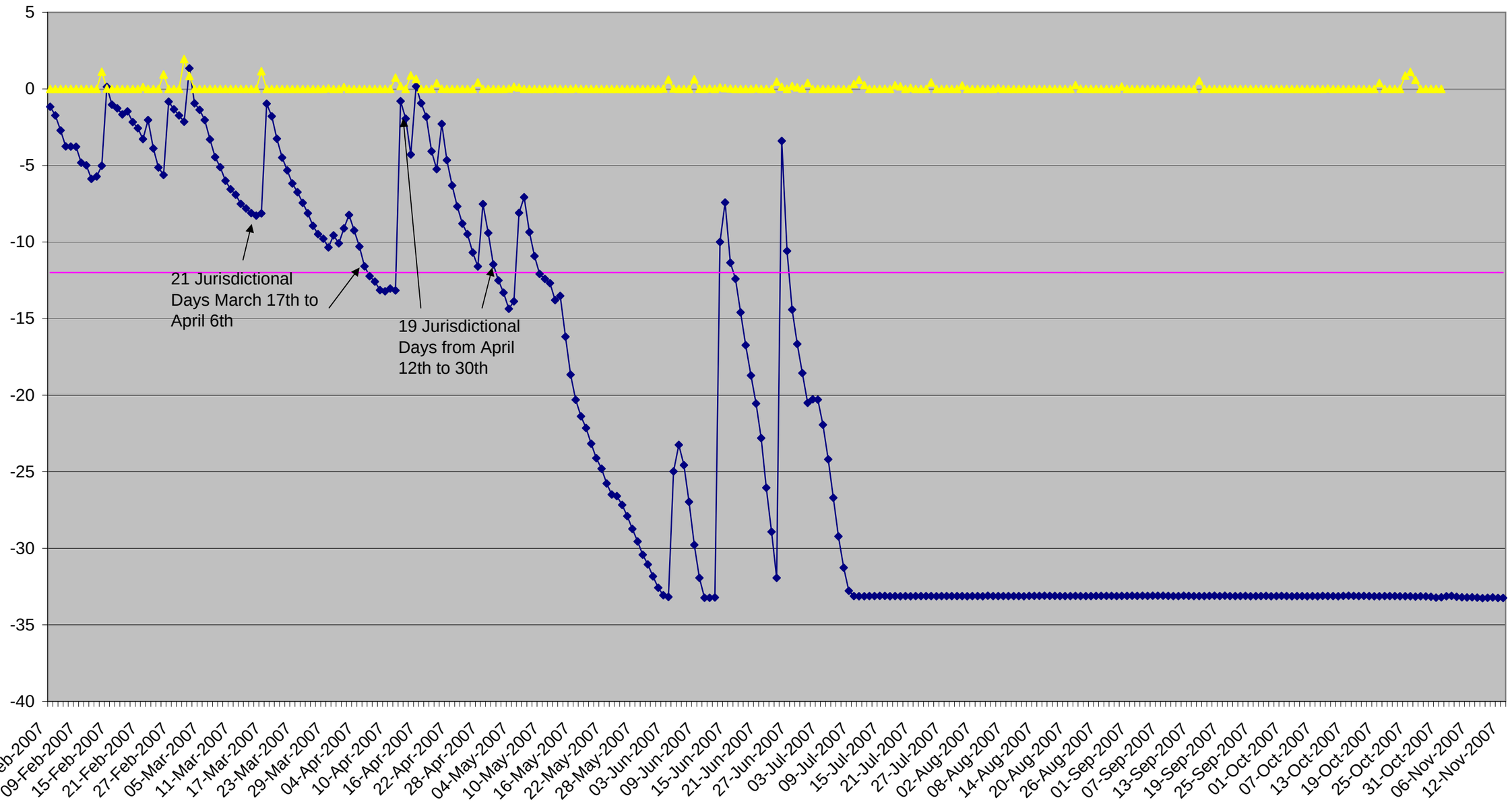
Reeds Creek Gage 2 Restoration Area



Reeds Creek Gage 3 Enhancement Area



Reeds Creek Onsite Reference Gage



CRN # 42 @ NORMAN SHORES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
1	0	0	0.01	0.44	---	1.96	0.12	0	0	0	0	0	0
2	0	0	0	0	---	0.85	0	0	0.02	0	0	0	0
3	0	0	0	0	0	0	0	0.02	0.61	0	0	0	0
4	0	0	0	0	0	0	0	0.15	0.02	0	0	0	0
5	0	0	0	0.46	0	0	0	0.09	0	0	0	0	0
6	0.07	0	0	0	0	0	0	0	0	0	0.05	0	0
7	0	0.75	0	0.95	0	0	0	0	0	0	0	0	0
8	0.14	0.25	0	0.46	0	0	0	0	0.63	0	0	0	0
9	0.07	0	0	0	0	0	0	0	0.01	0.32	0	0	0.02
10	0	0	0	0	0	0	0	0	0	0.59	0	0	0
11	0.8	0.6	0	0	0	0	0.73	0	0.03	0.26	0	0	0
12	0.01	0.01	0	0	0	0	0.19	0.02	0	0	0	0	0
13	0	0	0	0	1.12	0	0	0	0.1	0	0	0	0
14	0	0	0	0	0.02	0	0.88	0	0.05	0	0	0.55	0
15	0	0.97	0.01	0	0	0	0.66	0	0.02	0.01	0	0	0
16	0	0.84	0	0	0	1.16	0	0.04	0	0	0	0	0
17	2.02	0	0	0	0	0	0	0	0	0.25	0	0	0
18	0	0	0	0.09	0	0	0	0	0	0.17	0	0	0
19	0.12	0	0	0	0	0	0.38	0	0	0	0	0	0.39
20	0.19	0	0	0	0	0	0.01	0	0.04	0.07	0	0	0
21	0	0.89	0.04	0.61	0.12	0	0	0	0	0	0.26	0	0
22	0.06	0.79	0.7	0.01	0	0	0	0	0	0	0.01	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0.47	0.42	0	0	0.87
25	0	0	1.06	0	0.94	0	0	0	0.15	0	0	0	1.11
26	0	0	0.01	0	0	0	0	0	0	0	0	0	0.59
27	0.75	0	0	0	0	0	0.42	0	0.19	0.01	0	0	0
28	0.02	0	0	0	0	0	0	0	0.1	0	0	0	0
29	0	0	0	0	---	0.03	0	0	0.02	0	0	0	0
30	0	0.01	0	0	---	0	0	0	0.39	0.22	0.16	0	0
31	0	---	0.2	0	---	0	---	0	---	0	0	**---**	0
TOTAL	**4.25**	**5.11**	**2.03**	**3.02**	**---**	**4**	**3.39**	**0.32**	**2.85**	**2.32**	**0.48**	**0.55**	**2.98**

ALL DATA IS PROVISIONAL AND SUBJECT TO CHANGE WITHOUT NOTICE