

Appendix 5-4: Annual Permit Report for the Holey Land Wildlife Management Area¹

Permit Report (October 1, 2009 – September 30, 2010)
Permit Number: 06,500809209 and 06,501191549

Guy Germain

SUMMARY

Based on Florida Department of Environmental Protection (FDEP) permit reporting guidelines, **Table 1** lists key permit-related information associated with this report. **Table 2** lists the attachments included with this report. Table A-1 in Attachment A lists the specific attachments where the annual reporting requirements can be found. Attachments B–G contain data for surface water quality, sediment quality, flow, stage, rainfall, and evapotranspiration respectively. Attachment H is the Holey Land Wildlife Management Area 2010 Annual Cattail Monitoring Report from the Florida Fish and Wildlife Conservation Commission. No water quality results with class III standards were exceeded.

¹ On June 29, 2012, Attachment E (Tables E-2, E-3, E-5, and E-7), and Attachment F (Tables F-1 and F-3) of this report were revised and re-posted on the web (www.sfwmd.gov/SFER) to reflect only data from this reporting period (October 1, 2009–September 30, 2010) in these tables, respectively.

Table 1. Key permit-related information.

Project Name	Holey Land
Permit Numbers	06,500809209 06,501191549
Issue and Expiration Date	Issue: October 1, 1984 Expiration: October 1, 1989 <i>and</i> Issue: September 5, 1986 Expiration: September 5, 1991
Project Phase	Completed
Permit Condition Requiring Annual Monitoring Report	Specific conditions listed on permit pages 8-11
Relevant Period of Record	October 1, 2009–September 30, 2010
Report Generator	Guy Germain ggermain@sfwmd.gov 561-682-6732
Permit Coordinator	Nirmala Jeyakumar njeyaku@sfwmd.gov 561-681-2563 x3702

Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Surface Water Quality Data
C	Sediment Quality Data
D	Flow Data
E	Stage Data
F	Rainfall Data
G	Evapotranspiration Data
H	Holey Land Wildlife Management Area 2010 Annual Cattail Monitoring Report

INTRODUCTION

The Holey Land is a 35,336 acre (14,300 hectare) impoundment located in the southwest corner of Palm Beach County, Florida. In 1989, the South Florida Water Management District (SFWMD) started collecting water samples at the inflow structure (G-200A), the outflow structures (G-204, G-205, and G-206), and interior stations. In 1991, the Florida Fish and Wildlife Conservation Commission (FWCC) began conducting annual cattail surveys. In October 2005, Hurricane Wilma severely damaged the inflow pump station (G-200A) and rendered it inoperable. Due to extreme costs and the fact that the pump station was outdated, it was not repaired. To date, this pump station has not been replaced, and is dependent on other regional Everglades restoration priorities. However, since October 2005, limited surface water inflow has been available through the G-372HL box culvert. As a matter of practicality, the reporting of inflow data was switched to G-372HL, which then became the only source for surface water inflows to the Holey Land after G-200A was decommissioned.

Although G-200A has been decommissioned, water quality grab samples are collected at the site (now called G-200). No water quality samples are collected from G-372HL. The three outflow structures (G-203, G-204 and G-205) are still monitored quarterly. Since April 2008, there has been no surface water inflow to the Holey land, and no outflows have occurred since January 2006. Essentially, the Holey Land has become rainfall-driven and no longer functions as a flow-through system. The area dries out routinely, and re-wets depending on rainfall amounts.

The seepage canal on the north and northeast sides of the Holey Land were widened and deepened to become the inflow canal for STA-3/4. The only remaining seepage ditch structure for the Holey Land is G-203D, which is located on the southeast side of the Holey Land, adjacent to STA-3/4. Permit requirements state that a minimum water level of 9 ft. NVGD must be maintained in the seepage ditches of the Holey Land. These water levels were maintained. The stage results for sites G-203D and G-200A_T are included in Attachment E.

More background information and the current status of the Holey Land can be found in Attachment G (Holey Land Wildlife Management Area 2009 Annual Cattail Monitoring Report).

Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented for the Holey Land Wildlife Management Area Monitoring (Permits 06 500809209 and 06 501191549*) in this report.

Specific Condition	Description	Applicable Phase	Action & Frequency	Reported in 2012 SFER Volume 3, App. 5-4			
				Table	Narrative	Figure	Attachment
5	Maintain a normal water level in the seepage ditches no lower than +9.0 ft NVGD		Daily readings were taken	E-1 to E-12			E
6	During construction, use turbidity control devices to minimize impacts on adjacent wetland areas	Construction	N/A (No construction occurred during this reporting period)				
Page 8 of 11 in permit	Long-term water quality monitoring**		Quarterly	B-1			B
Page 9 of 11 in permit	Sediment monitoring**		Annually	C-1			C
Page 10 of 11 in permit	Vegetation monitoring***		Annually				G

* All conditions required for permit 06 500809209 apply to permit 06 501191549

** See minor modification document, dated September 20, 2005, for revised monitoring plan changes from FDEP.

*** See agreement between South Florida Water Management District and the Florida Game and Fresh Water Fish Commission dated June 28, 1990, for vegetation reporting requirements (Exhibit C).

Attachment B: Surface Water Quality Data

Note: Supporting information contained on the following pages of this attachment is available upon request.



Figure B-1. Holy Land water quality monitoring locations.

Table B-1. Surface water quality data.

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
G200	10/26/2009 11:16:00 AM	Water Temperature	26.3	°C
G200	10/26/2009 11:16:00 AM	Specific Conductance	751.1	µS/cm
G200	10/26/2009 11:16:00 AM	Water pH	7.5	S.U.
G200	10/26/2009 11:16:00 AM	Nitrate+Nitrite as N	0.081	mg/L
G200	10/26/2009 11:16:00 AM	Total Kjeldahl Nitrogen	1.86	mg/L
G200	10/26/2009 11:16:00 AM	Total Phosphorus	0.014	mg/L
G200	1/26/2010 11:52:00 AM	Water Temperature	20.3	°C
G200	1/26/2010 11:52:00 AM	Specific Conductance	868	µS/cm
G200	1/26/2010 11:52:00 AM	Water pH	7.6	S.U.
G200	1/26/2010 11:52:00 AM	Nitrate+Nitrite as N	0.212	mg/L
G200	1/26/2010 11:52:00 AM	Total Kjeldahl Nitrogen	1.79	mg/L
G200	1/26/2010 11:52:00 AM	Total Phosphorus	0.028	mg/L
G200	4/06/2010 11:35:00 AM	Water Temperature	24.2	°C
G200	4/06/2010 11:35:00 AM	Specific Conductance	576	µS/cm
G200	4/06/2010 11:35:00 AM	Water pH	7.6	S.U.
G200	4/06/2010 11:35:00 AM	Nitrate+Nitrite as N	0.009	mg/L
G200	4/06/2010 11:35:00 AM	Total Kjeldahl Nitrogen	1.94	mg/L
G200	4/06/2010 11:35:00 AM	Total Phosphorus	0.103	mg/L
G200	7/22/2010 11:55:00 AM	Water Temperature	29.7	°C
G200	7/22/2010 11:55:00 AM	Specific Conductance	436	µS/cm
G200	7/22/2010 11:55:00 AM	Water pH	7.6	S.U.
G200	7/22/2010 11:55:00 AM	Nitrate+Nitrite as N	0.09	mg/L

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
G200	7/22/2010 11:55:00 AM	Total Kjeldahl Nitrogen	1.46	mg/L
G200	7/22/2010 11:55:00 AM	Total Phosphorus	0.034	mg/L
G204	10/26/2009 10:44:00 AM	Water Temperature	24.5	°C
G204	10/26/2009 10:44:00 AM	Specific Conductance	738.6	µS/cm
G204	10/26/2009 10:44:00 AM	Water pH	7.1	S.U.
G204	10/26/2009 10:44:00 AM	Nitrate+Nitrite as N	0.026	mg/L
G204	10/26/2009 10:44:00 AM	Total Kjeldahl Nitrogen	4.63	mg/L
G204	10/26/2009 10:44:00 AM	Total Phosphorus	0.116	mg/L
G204	1/26/2010 11:27:00 AM	Water Temperature	17.7	°C
G204	1/26/2010 11:27:00 AM	Specific Conductance	826	µS/cm
G204	1/26/2010 11:27:00 AM	Water pH	7.2	S.U.
G204	1/26/2010 11:27:00 AM	Nitrate+Nitrite as N	0.005	mg/L
G204	1/26/2010 11:27:00 AM	Total Kjeldahl Nitrogen	12.24	mg/L
G204	1/26/2010 11:27:00 AM	Total Phosphorus	0.949	mg/L
G204	4/06/2010 10:43:00 AM	Water Temperature	21.7	°C
G204	4/06/2010 10:43:00 AM	Specific Conductance	762	µS/cm
G204	4/06/2010 10:43:00 AM	Water pH	7.2	S.U.
G204	4/06/2010 10:43:00 AM	Nitrate+Nitrite as N	0.142	mg/L
G204	4/06/2010 10:43:00 AM	Total Kjeldahl Nitrogen	3.1	mg/L
G204	4/06/2010 10:43:00 AM	Total Phosphorus	0.108	mg/L
G204	7/22/2010 11:25:00 AM	Water Temperature	27.7	°C
G204	7/22/2010 11:25:00 AM	Specific Conductance	633	µS/cm

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
G204	7/22/2010 11:25:00 AM	Water pH	7.2	S.U.
G204	7/22/2010 11:25:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G204	7/22/2010 11:25:00 AM	Total Kjeldahl Nitrogen	4.57	mg/L
G204	7/22/2010 11:25:00 AM	Total Phosphorus	0.026	mg/L
G205	10/26/2009 10:24:00 AM	Water Temperature	25.6	°C
G205	10/26/2009 10:24:00 AM	Specific Conductance	679.7	µS/cm
G205	10/26/2009 10:24:00 AM	Water pH	7.2	S.U.
G205	10/26/2009 10:24:00 AM	Nitrate+Nitrite as N	0.073	mg/L
G205	10/26/2009 10:24:00 AM	Total Kjeldahl Nitrogen	3.05	mg/L
G205	10/26/2009 10:24:00 AM	Total Phosphorus	0.065	mg/L
G205	1/26/2010 11:11:00 AM	Water Temperature	18.9	°C
G205	1/26/2010 11:11:00 AM	Specific Conductance	817	µS/cm
G205	1/26/2010 11:11:00 AM	Water pH	7.2	S.U.
G205	1/26/2010 11:11:00 AM	Nitrate+Nitrite as N	0.042	mg/L
G205	1/26/2010 11:11:00 AM	Total Kjeldahl Nitrogen	6.86	mg/L
G205	1/26/2010 11:11:00 AM	Total Phosphorus	0.475	mg/L
G205	4/06/2010 10:20:00 AM	Water Temperature	23.1	°C
G205	4/06/2010 10:20:00 AM	Specific Conductance	839	µS/cm
G205	4/06/2010 10:20:00 AM	Water pH	7.1	S.U.
G205	4/06/2010 10:20:00 AM	Nitrate+Nitrite as N	0.378	mg/L
G205	4/06/2010 10:20:00 AM	Total Kjeldahl Nitrogen	2.53	mg/L
G205	4/06/2010 10:20:00 AM	Total Phosphorus	0.071	mg/L
G205	7/22/2010 11:05:00 AM	Water Temperature	28.5	°C

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
G205	7/22/2010 11:05:00 AM	Specific Conductance	669	µS/cm
G205	7/22/2010 11:05:00 AM	Water pH	7.1	S.U.
G205	7/22/2010 11:05:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G205	7/22/2010 11:05:00 AM	Total Kjeldahl Nitrogen	2.77	mg/L
G205	7/22/2010 11:05:00 AM	Total Phosphorus	0.064	mg/L
G206	10/26/2009 10:00:00 AM	Water Temperature	23.6	°C
G206	10/26/2009 10:00:00 AM	Specific Conductance	281.3	µS/cm
G206	10/26/2009 10:00:00 AM	Water pH	7.1	S.U.
G206	10/26/2009 10:00:00 AM	Nitrate+Nitrite as N	0.024	mg/L
G206	10/26/2009 10:00:00 AM	Total Kjeldahl Nitrogen	1.39	mg/L
G206	1/26/2010 10:36:00 AM	Water Temperature	18.7	°C
G206	1/26/2010 10:36:00 AM	Specific Conductance	813	µS/cm
G206	1/26/2010 10:36:00 AM	Water pH	7.4	S.U.
G206	1/26/2010 10:36:00 AM	Nitrate+Nitrite as N	0.073	mg/L
G206	1/26/2010 10:36:00 AM	Total Kjeldahl Nitrogen	2.43	mg/L
G206	1/26/2010 10:36:00 AM	Total Phosphorus	0.108	mg/L
G206	4/06/2010 9:45:00 AM	Water Temperature	23.1	°C
G206	4/06/2010 9:45:00 AM	Specific Conductance	904	µS/cm
G206	4/06/2010 9:45:00 AM	Water pH	7.4	S.U.
G206	4/06/2010 9:45:00 AM	Nitrate+Nitrite as N	0.423	mg/L
G206	4/06/2010 9:45:00 AM	Total Kjeldahl Nitrogen	2.15	mg/L
G206	4/06/2010 9:45:00 AM	Total Phosphorus	0.021	mg/L

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
G206	7/22/2010 10:30:00 AM	Water Temperature	28.7	°C
G206	7/22/2010 10:30:00 AM	Specific Conductance	408	μS/cm
G206	7/22/2010 10:30:00 AM	Water pH	7.1	S.U.
G206	7/22/2010 10:30:00 AM	Nitrate+Nitrite as N	0.015	mg/L
G206	7/22/2010 10:30:00 AM	Total Kjeldahl Nitrogen	1.57	mg/L
G206	7/22/2010 10:30:00 AM	Total Phosphorus	0.024	mg/L

Attachment C: Sediment Quality Data

Note: Supporting information contained on the following pages of this attachment is available upon request.



Figure C-1. Sediment monitoring locations.

Table C-1. Sediment quality data.

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD1	5/26/2010 8:35:00 AM	Total Mercury	0.12	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Arsenic	4.98	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Cadmium	0.067	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Copper	3.53	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Lead	5.3	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Zinc	3.7	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Antimony	0.29	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Beryllium	0.15	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Chromium	3.83	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Nickel	3.02	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Selenium	2.36	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Silver	0.014	mg/Kg
HOLYSD1	5/26/2010 8:35:00 AM	Total Thallium	<0.049	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Mercury	0.13	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Arsenic	3.77	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Cadmium	0.074	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Copper	4.94	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Lead	7.6	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Zinc	5.1	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Antimony	0.27	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Beryllium	0.21	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Chromium	5.52	mg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD2	5/26/2010 8:50:00 AM	Total Nickel	3.74	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Selenium	2.23	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Silver	0.019	mg/Kg
HOLYSD2	5/26/2010 8:50:00 AM	Total Thallium	<0.044	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Mercury	0.14	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Arsenic	3.35	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Cadmium	0.091	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Copper	2.77	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Lead	5.8	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Zinc	3.6	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Antimony	0.26	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Beryllium	0.1	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Chromium	3.05	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Nickel	2.53	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Selenium	1.83	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Silver	0.013	mg/Kg
HOLYSD3	5/26/2010 9:04:00 AM	Total Thallium	<0.046	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Mercury	0.17	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Arsenic	3.77	mg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD4	5/26/2010 9:17:00 AM	Total Cadmium	0.12	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Copper	6.03	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Lead	16.8	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Zinc	5.1	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Antimony	0.26	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Beryllium	0.2	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Chromium	5.86	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Nickel	3.99	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Selenium	2.21	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Silver	0.025	mg/Kg
HOLYSD4	5/26/2010 9:17:00 AM	Total Thallium	<0.05	mg/Kg

The following hydrologic data monitoring sites are included in Attachments D – F:

Inflow Pump Station Volume (cfs-day)	Culverts Outflow Volume (cfs-day)	Stage Recorders (feet-NGVD)	Rain (inches)
G372HL_S *	G204_C	G203D	S3_R
	G205_C	HOLEY_G	G200_R
	G206_C	HOLEY1	S8_R
		HOLEY2	
		G204_H	
		G204_T	
		G205_H	
		G205_T	
		G206_H	
		G206_T	
		G373_T **	
		G200A_T	

* G372HL_S is the current inflow point. The former inflow point, G200A_P, is no longer in service.

** G373_T is used as the headwater stage for G200A. G200A pump is not operational anymore; it is replaced by the new inflow point spillway G372HL_S.

Data Tag Legend:

- E - Estimated
- P - Summary computed from partial record
- X - Included in next amount marked 'A'
- A - Accumulated
- M - Missing
- < - Less Than

Attachment D: Flow Data



Figure D-1. Holy Land flow monitoring locations.

Table D-1. Inflow into the Holey Land through G372HL_S (cfs) from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
2	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
3	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
4	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
5	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
6	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
7	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
8	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
9	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
10	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
11	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
12	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
26	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
27	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
28	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 P	0.00 E
31	0.00		0.00	0.00		0.00		0.00 E		0.00 E		0.00 E
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean												

Table D-2. Outflow from the Holey Land through G204_C (cfs) from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
2	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
3	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
4	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
5	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
6	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
7	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
8	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
9	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
10	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
11	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
12	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
26	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
27	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
28	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	0.00 E	0.00 E	0.00 P	0.00 E
31	0.00		0.00	0.00		0.00		0.00 E		0.00 E		0.00 E
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean												

Table D-3. Outflow from the Holey Land through G205_C (cfs) from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00		0.00	0.00		0.00		0.00		0.00	0.00	
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean												

Table D-4. Outflow from the Holey Land through G206_C (cfs) from October 2009 – September 2010.

Day	Oct		Nov		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	E	0.00	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
11	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
12	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
13	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
14	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
15	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
16	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	E	0.00	0.00
17	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
18	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
19	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
20	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
21	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
22	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
23	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
24	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
25	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
26	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
27	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
28	0.00	E	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
29	0.00	E	0.00		0.00	0.00		0.00	0.00	0.00	0.00		0.00	0.00
30	0.00	E	0.00		0.00	0.00		0.00	0.00	0.00	0.00		0.00	0.00
31	0.00	E			0.00	0.00		0.00		0.00			0.00	
Min	0.00		0.00		0.00	0.00		0.00		0.00			0.00	0.00
Max	0.00		0.00		0.00	0.00		0.00		0.00			0.00	0.00
Mean														

Attachment E: Stage Data

Table E-1. Tailwater stage at G373_T from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.26	10.81	10.73	10.12	10.57	10.32	10.51	10.28	10.48	10.37	10.18	10.24
2	10.29	10.77	10.74	10.14	10.57	10.38	10.35	10.33	10.79	10.32	10.14	10.19
3	10.26	10.71	10.63	9.98	10.89	10.33	10.17	10.08	10.47 E	10.59	10.12	10.13
4	10.24	10.78	10.59	9.71	10.86	10.38	10.59	10.35	9.66 E	10.95	10.21	10.07
5	10.46	10.83	10.58	10.05	10.67	10.52	10.64	10.33	9.43	10.25	10.31	10.17
6	10.80	10.78	10.59	9.98	10.57	10.63	10.63	10.30	9.44	9.73	10.40	10.75
7	10.51	10.73	10.55	10.16	10.68	10.77	10.73	10.23	9.61	9.80	10.60	10.60
8	10.37	10.80	10.48	10.15	10.47	10.83	11.01	10.45	10.04	10.13	10.65	10.22
9	10.36	10.85	10.28	10.20	10.17	10.74	10.75	10.36	9.98	10.08	10.17	10.03
10	10.49	10.85	10.33	10.32	10.34	10.71	10.78	10.30	10.05	9.92	10.44	10.09
11	10.60	10.80	10.35	10.43	10.32	10.70	10.78	10.38	10.31	10.09	10.37	10.07
12	10.65	10.77	10.29	10.42	10.37	10.66	10.81	10.41	10.24	10.62	9.94	10.08
13	10.54	10.76	10.22	10.45	10.49	10.17	10.62	10.55	10.19	10.37	10.41	10.33 P
14	10.37	10.79	10.26	10.41	10.34	10.52	10.71	10.58	10.03	10.36	10.19	9.82
15	10.10	10.87	10.23	10.52	10.36	10.48	10.63	10.80	9.90	10.24	10.28	9.98
16	10.42	10.83	10.36	10.68	10.34	9.85	10.68	10.94	9.86 E	10.29	10.31	10.45
17	10.61	10.84	10.54	10.51	10.32	10.11	10.72	11.08	9.87 E	10.75	10.29	10.26
18	10.40	10.84	10.99	10.46	10.36	9.95	10.82	11.09	9.94 E	10.84	10.57	10.28
19	10.46	10.84	10.88	10.57	10.27	10.42	10.88	10.60	10.05	10.22	10.46	10.29
20	10.74	10.88	10.93	10.73	10.32	10.89	10.77	10.45	10.34	10.16	10.44 E	10.25
21	10.86	10.86	10.85	10.74	10.35	10.74	10.49	10.40	10.18	10.24	10.21 E	10.27
22	10.83	10.87	10.38	10.62	10.35	10.75	10.54	10.56	9.78	10.13	10.32 E	10.11
23	10.79	10.87	10.31	10.64	10.34	10.67	10.58	10.33	9.88	10.24	10.65 E	10.17
24	10.81	10.86	10.39	10.79	10.35	10.55	10.42	10.31	10.14	10.41	10.54 E	10.20
25	10.85	10.88	10.81	10.62	10.37	10.42	10.21	10.51	9.99	10.60	10.51 E	10.17
26	10.88	10.85	10.28	10.42	10.30	10.57	10.42	10.64	10.01	10.35	10.39	10.09
27	10.79	10.50	10.31	10.44	10.33	10.53	10.10	10.71	10.28	10.25	10.39	10.08
28	10.79	10.61	10.14	10.45	10.30	10.45	9.96	10.83	9.99	10.25	10.29	10.14
29	10.74	10.69	10.16	10.46		10.64	9.89	11.00	9.90	10.26	10.24	10.15
30	10.74	10.76	10.24	10.48		10.32	10.11	10.93	10.00	10.17	10.22	10.11
31	10.79		10.12	10.48		10.38		10.54		10.27	10.13	
Min	10.10	10.50	10.12	9.71	10.17	9.85	9.89	10.08	9.43	9.73	9.94	9.82
Max	10.88	10.88	10.99	10.79	10.89	10.89	11.01	11.09	10.79	10.95	10.65	10.75
Mean	10.57	10.80	10.47	10.39	10.43	10.50	10.54	10.54	10.03	10.30	10.33	10.19

Table E-2. Tailwater stage at 200A_T from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.01	11.57	11.25	11.31	11.13	11.18	11.48	11.70	11.43	11.95	11.75	
2	11.99	11.55	11.25	11.32	11.21	11.14	11.47	11.69	11.64	11.95	11.74	
3	11.97	11.53	11.22	11.30	11.25	11.10	11.45	11.67	11.86	12.00	11.73	
4	11.96	11.53	11.21	11.28	11.26	11.12	11.44	11.64	11.82	12.07	11.76	
5	11.94	11.52	11.22	11.26	11.26	11.13	11.41	11.62	11.74	12.13	11.80	
6	11.93	11.51	11.23	11.26	11.20	11.12	11.39	11.60	11.71	12.16	11.85	
7	11.96	11.51	11.22	11.25	11.23	11.11	11.36	11.61	11.72	12.15	11.89	
8	11.95	11.52	11.22	11.23	11.24	11.09	11.33	11.64	11.78	12.12	11.92	
9	11.93	11.49	11.20	11.21	11.24	11.09	11.30	11.62	11.76	12.09	11.95	
10	11.90	11.44	11.18	11.19	11.18	11.09	11.31	11.63	11.72	12.06	12.01	
11	11.89	11.42	11.18	11.20	11.19	11.09	11.31	11.61	11.70	12.03	12.08	
12	11.87	11.40	11.19	11.19	11.22	11.25	11.35	11.58	11.70	12.01	12.15	
13	11.85	11.38	11.14	11.19	11.23	11.33	11.38	11.56	11.72	11.98	12.11	
14	11.82	11.38	11.13	11.19	11.25	11.38	11.37	11.54	11.70	11.97	12.07	
15	11.80	11.36	11.12	11.18	11.26	11.40	11.33	11.51	11.68	11.96	12.06	
16	11.78	11.34	11.28	11.18	11.21	11.45	11.30	11.53	11.66	11.96	12.04	
17	11.76	11.33	11.30	11.16	11.20	11.48	11.28	11.59	11.70	11.95	12.05	
18	11.73	11.31	11.34	11.15	11.20	11.46	11.33	11.58	11.76	11.93	12.08	
19	11.72	11.30	11.36	11.15	11.20	11.49	11.43	11.56	11.82	11.91	12.08	
20	11.72	11.28	11.40	11.15	11.19	11.50	11.44	11.55	11.98	11.89	12.08	
21	11.72	11.27	11.41	11.15	11.19	11.49	11.44	11.53	12.10	11.86	12.07	
22	11.70	11.26	11.42	11.11	11.18	11.46	11.45	11.51	12.08	11.84	12.08	
23	11.70	11.24	11.44	11.14	11.16	11.45	11.47	11.48	12.05	11.84	12.13	
24	11.68	11.23	11.44	11.14	11.13	11.47	11.46	11.44	12.02	11.85	12.12	
25	11.66	11.25	11.41	11.10	11.12	11.45	11.44	11.41	11.98	11.83	12.12	
26	11.66	11.30	11.40	11.11	11.15	11.43	11.58	11.38	11.96	11.83	12.12	
27	11.66	11.29	11.39	11.10	11.16	11.45	11.68	11.35	11.95	11.80	12.12	
28	11.64	11.28	11.36	11.10	11.16	11.43	11.70	11.35	11.93	11.79	12.10	
29	11.63	11.27	11.35	11.08		11.45	11.71	11.36	11.91	11.76	12.09	
30	11.61	11.26	11.35	11.06		11.47	11.71	11.34	11.91	11.75	12.09	
31	11.58		11.33	11.04		11.48		11.34		11.75		
Min	11.58	11.23	11.12	11.04	11.12	11.09	11.28	11.34	11.43	11.75	11.73	0.00
Max	12.01	11.57	11.44	11.32	11.26	11.50	11.71	11.70	12.10	12.16	12.15	0.00
Mean	11.80	11.38	11.29	11.18	11.20	11.32	11.44	11.53	11.82	11.94	12.01	

Table E-3. Headwater stage at G206_H from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.04	10.82	10.73	10.14	10.63	10.30	10.55	10.36	10.47	10.39	10.19	10.59
2	10.76	10.78	10.73	10.21	10.64	10.38	10.37	10.31	10.79	10.34	10.13	10.46
3	10.63	10.73	10.65	10.02	10.90	10.37	10.19	10.04	11.00	10.56	10.11	10.34
4	10.51	10.80	10.63	9.73	10.84	10.40	10.56	10.38	10.85	10.97	10.21	10.24
5	10.53	10.87	10.63	10.06	10.65	10.52	10.62	10.46	10.80	11.13	10.32	10.68
6	10.92	10.80	10.64	9.99	10.60	10.62	10.61	10.36	10.79	10.87	10.40	11.76
7	10.68	10.74	10.68	10.16	10.71	10.75	10.69	10.34	10.69	11.01	10.60	11.69
8	10.50	10.79	10.62	10.14	10.55	10.80	10.98	10.49	10.62	11.13	10.65	11.51
9	10.45	10.83	10.43	10.23	10.19	10.72	10.74	10.41	10.43	11.01	10.24	11.51
10	10.53	10.86	10.40	10.36	10.44	10.67	10.74	10.35	10.26	E	10.60	11.92
11	10.62	10.83	10.40	10.44	10.40	10.64	10.76	10.37	10.38	E	10.35	11.88
12	10.64	10.83	10.30	10.42	10.38	10.73	10.77	10.39	10.26	E	10.83	11.85
13	10.55	10.81	10.25	10.45	10.53	10.69	10.60	10.53	10.22	E	10.50	11.83
14	10.42	10.82	10.30	10.39	10.36	11.11	10.68	10.55	10.03	E	10.39	11.41
15	10.18	10.88	10.25	10.49	10.34	11.33	10.60	10.78	9.90	E	10.26	11.18
16	10.60	10.86	10.41	10.62	10.34	11.13	10.65	10.94	9.85	E	10.29	11.30
17	10.66	10.85	10.60	10.49	10.33	11.07	10.69	11.08	9.89		10.70	10.94
18	10.51	10.85	11.22	10.46	10.36	10.84	10.80	11.06	9.96		10.78	10.91
19	10.59	10.86	11.29	10.56	10.25	10.77	10.87	10.57	10.09		10.22	11.14
20	10.81	10.87	11.32	10.70	10.31	10.98	10.78	10.43	10.45		10.11	11.64
21	10.87	10.85	11.26	10.69	10.33	10.84	10.96	10.41	10.49		10.19	11.21
22	10.82	10.85	10.81	10.62	10.31	10.86	10.92	10.52	10.08		10.17	11.41
23	10.79	10.86	10.45	10.61	10.34	10.78	10.86	10.31	10.12		10.20	11.62
24	10.82	10.86	10.43	10.73	10.36	10.61	10.55	10.31	10.26		10.37	11.45
25	10.88	10.88	10.77	10.62	10.43	10.45	10.27	10.51	10.04		10.57	11.27
26	10.89	10.85	10.39	10.48	10.35	10.59	10.65	10.64	10.01		10.31	11.20
27	10.79	10.52	10.31	10.48	10.34	10.54	10.49	10.71	10.30		10.22	11.29
28	10.79	10.60	10.15	10.47	10.33	10.46	10.72	10.81	9.98		10.23	11.07
29	10.74	10.67	10.15	10.45		10.59	10.51	11.00	9.88		10.26	10.87
30	10.74	10.75	10.21	10.45		10.45	10.34	10.89	10.00		10.18	10.80
31	10.79		10.09	10.52		10.51		10.52			10.30	10.57
Min	10.18	10.52	10.09	9.73	10.19	10.30	10.19	10.04	9.85	10.11	10.11	10.08
Max	11.04	10.88	11.32	10.73	10.90	11.33	10.98	11.08	11.00	11.13	11.64	11.92
Mean	10.68	10.81	10.56	10.39	10.45	10.69	10.65	10.54	10.30	10.50	10.76	10.82

Table E-4. Tailwater stage at G206_T from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.64 E	10.81 E	10.73	10.12	10.62	10.28	10.54	10.34	10.45	10.38	10.20	10.46
2	10.44 E	10.78 E	10.72	10.19	10.63	10.35	10.35	10.29	10.79	10.32	10.15	10.39
3	10.40 E	10.73 E	10.64	10.01	10.89	10.34	10.17	10.03	10.99	10.55	10.12	10.28
4	10.35 E	10.80 E	10.62	9.72	10.84	10.37	10.55	10.36	10.84	10.96 E	10.22	10.16
5	10.44 E	10.87 E	10.62	10.05	10.64	10.50	10.61	10.45	10.80	11.12 E	10.32	10.23
6	10.86 E	10.80 E	10.63	9.98	10.59	10.61	10.60	10.35	10.79	10.86 E	10.40	10.75
7	10.63 E	10.74 E	10.67	10.14	10.70	10.75	10.68	10.33	10.68	11.00 E	10.61	10.77
8	10.45 E	10.79 E	10.61	10.12	10.54	10.80	10.97	10.48	10.62	11.12 E	10.66	10.61
9	10.40 E	10.83 E	10.41	10.21	10.18	10.71	10.73	10.39	10.41	11.00 E	10.23	10.57
10	10.49 E	10.85 E	10.38	10.34	10.41	10.65	10.74	10.33	10.24 E	10.58 E	10.45	10.66
11	10.59 E	10.82	10.38	10.42	10.37	10.63	10.75	10.35	10.36 E	10.34 E	10.70	10.56
12	10.62 E	10.82	10.28	10.40	10.36	10.72	10.77	10.37	10.26 E	10.81 E	10.18	10.37
13	10.53 E	10.81	10.23	10.43	10.52	10.67	10.59	10.52	10.21 E	10.48 E	10.72	10.78
14	10.40 E	10.81	10.28	10.37	10.34	11.09	10.67	10.55	10.04 E	10.38 E	10.52	10.22
15	10.16 E	10.88	10.23	10.47	10.32	11.34	10.59	10.78	9.90 E	10.24 E	10.45	10.35
16	10.59 E	10.86	10.38	10.61	10.31	11.11	10.64	10.93	9.86 E	10.28 E	10.46	10.73
17	10.66 E	10.85	10.59	10.48	10.31	11.06	10.68	11.07	9.90	10.69 E	10.44	10.50
18	10.51 E	10.85	11.21	10.44	10.34	10.83	10.79	11.05	9.97	10.77 E	10.80	10.41
19	10.59 E	10.85	11.30	10.54	10.23	10.76	10.87	10.56	10.10	10.21 E	10.82	10.35
20	10.82 E	10.87	11.34	10.70	10.28	10.96	10.75	10.42	10.47	10.11 E	10.79	10.28
21	10.88 E	10.85	11.27	10.68	10.30	10.82	10.89	10.39	10.50	10.19	10.50	10.27
22	10.83 E	10.85	10.79	10.60	10.29	10.84	10.89	10.51	10.09	10.18	10.57	10.11
23	10.79 E	10.86	10.44	10.60	10.31	10.76	10.84	10.28	10.13	10.21	10.75	10.18
24	10.82 E	10.85	10.42	10.72	10.33	10.60	10.53	10.29	10.27	10.38	10.74	10.19
25	10.88 E	10.87	10.76	10.61	10.41	10.44	10.26	10.50	10.05	10.58	10.68	10.18
26	10.89 E	10.84	10.38	10.46	10.33	10.58	10.55	10.64	10.02	10.32	10.64	10.09
27	10.79 E	10.51	10.29	10.46	10.31	10.53	10.42	10.71	10.30	10.22	10.67	10.06
28	10.79 E	10.59	10.13	10.45	10.31	10.44	10.69	10.81	9.99	10.24	10.57	10.13
29	10.73 E	10.66	10.13	10.43		10.57	10.49	10.99	9.89	10.27	10.49	10.16
30	10.74 E	10.75	10.19	10.43		10.43	10.32	10.88	10.01	10.19	10.47	10.26
31	10.79 E		10.08	10.50		10.50		10.51		10.30	10.36	
Min	10.16	10.51	10.08	9.72	10.18	10.28	10.17	10.03	9.86	10.11	10.12	10.06
Max	10.89	10.88	11.34	10.72	10.89	11.34	10.97	11.07	10.99	11.12	10.82	10.78
Mean	10.63	10.80	10.55	10.38	10.43	10.68	10.63	10.53	10.30	10.49	10.50	10.37

Table E-5. Headwater stage at G205_H from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1	11.30	10.81	10.73	10.11	10.59	10.29	10.50	10.28	10.47	10.38	10.19	11.55	
2	10.95	E	10.78	10.71	10.16	10.59	10.35	10.34	10.28	10.80	10.34	10.15	11.18
3		M	10.72	10.63	9.99	10.89	10.34	10.16	10.05	10.66	10.58	10.14	11.01
4		M	10.79	10.60	9.70	10.85	10.38	10.57	10.35	10.11	10.99	10.22	10.86
5		M	10.86	10.60	10.04	10.64	10.52	10.63	10.38	9.99	10.67	10.35	10.84
6		M	10.80	10.62	9.97	10.57	10.62	10.62	10.32	9.99	10.39	10.43	12.00
7		M	10.74	10.59	10.14	10.69	10.76	10.70	10.27	10.04	10.71	10.62	12.12
8		M	10.79	10.53	10.12	10.49	10.81	10.99	10.47	10.26	10.99	10.96	12.09
9		M	10.83	10.32	10.20	10.16	10.72	10.74	10.39	10.15	10.94	10.93	12.11
10		M	10.84	10.34	10.33	10.37	10.68	10.77	10.31	10.13	10.60	11.30	12.20
11		M	10.81	10.37	10.42	10.34	10.65	10.78	10.37	10.37	10.47	11.57	12.20
12		M	10.80	10.28	10.40	10.33	10.65	10.80	10.39	10.26	10.90	11.08	12.19
13		M	10.79	10.22	10.43	10.51	10.35	10.61	10.54	10.22	10.54	11.47	12.17
14		M	10.80	10.27	10.38	10.34	10.73	10.70	10.57	10.04	10.43	11.18	12.14
15		M	10.87	10.23	10.49	10.34	10.77	10.62	10.80	9.91	10.28	11.10	12.12
16	10.56	E	10.84	10.37	10.63	10.33	10.35	10.67	10.95	9.88	10.29	11.30	12.11
17	10.64		10.84	10.55	10.48	10.31	10.45	10.71	11.08	9.90	10.74	11.50	12.07
18	10.46		10.84	11.06	10.45	10.35	10.27	10.82	11.06	9.97	10.83	11.96	12.03
19	10.53		10.85	11.05	10.55	10.25	10.54	10.88	10.58	10.07	10.22	11.96	11.99
20	10.78		10.87	11.09	10.71	10.29	10.89	10.76	10.43	10.39	10.14	12.04	11.94
21	10.87		10.85	11.01	10.69	10.32	10.74	10.65	10.40	10.30	10.23	11.97	11.77
22	10.82		10.85	10.53	10.60	10.30	10.76	10.68	10.53	9.90	10.15	11.99	11.42
23	10.79		10.86	10.35	10.62	10.32	10.70	10.68	10.30	9.99	10.22	12.07	11.74
24	10.81		10.85	10.38	10.74	10.34	10.56	10.45	10.30	10.20	10.40	12.05	12.02
25	10.86		10.87	10.78	10.61	10.40	10.41	10.22	10.51	10.02	10.60	12.03	12.00
26	10.88		10.85	10.31	10.44	10.31	10.57	10.49	10.64	10.02	10.34	12.04	11.94
27	10.79		10.51	10.30	10.45	10.32	10.54	10.24	10.72	10.30	10.24	12.12	11.80
28	10.79		10.59	10.13	10.44	10.30	10.44	10.24	10.83	9.99	10.25	12.06	11.59
29	10.73		10.66	10.14	10.44		10.59	10.09	11.00	9.90	10.26	12.01	11.91
30	10.74		10.75	10.21	10.44		10.36	10.16	10.90	10.00	10.18	11.97	11.91
31	10.79			10.09	10.49		10.42		10.53		10.30	11.84	
Min	10.46	10.51	10.09	9.70	10.16	10.27	10.09	10.05	9.88	10.14	10.14	10.84	
Max	11.30	10.87	11.09	10.74	10.89	10.89	10.99	11.08	10.80	10.99	12.12	12.20	
Mean	10.78	10.80	10.50	10.38	10.42	10.56	10.58	10.53	10.14	10.47	11.37	11.83	

Table E-6. Tailwater stage at G205_T from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.44	10.86	10.77	10.16	10.63	10.34	10.54	10.32	10.49	10.40	10.22	10.35
2	10.38	10.82	10.76	10.21	10.63	10.39	10.38	10.32	10.82	10.35	10.18	10.29
3	10.36	10.76	10.67	10.05	10.93	10.39	10.20	10.08	10.68	10.58	10.16	10.21
4	10.32	10.84	10.65	9.75	10.89	10.42	E 10.60	10.37	10.14	10.94	10.25	10.12
5	10.49	10.90	10.64	10.09	10.67	10.55	E 10.66	10.39	10.02	10.48	10.35	10.22
6	10.86	10.85	10.66	10.02	10.61	10.66	E 10.65	10.34	10.02	10.03	10.43	10.76
7	10.60	10.78	10.63	10.20	10.72	10.80	E 10.73	10.29	10.07	10.15	10.63	10.68
8	10.44	10.84	10.57	10.18	10.53	10.85	E 11.01	10.49	10.29	10.38	10.68	10.39
9	10.41	10.88	10.38	10.26	10.20	10.76	10.77	10.41	10.17	10.33	10.22	10.26
10	10.54	10.89	10.39	10.38	10.41	10.71	10.79	10.33	10.16	10.09	10.46	10.34
11	10.64	10.85	10.42	10.46	10.39	10.69	10.80	10.40	10.39	10.14	10.51	10.28
12	10.67	10.84	10.34	10.44	10.37	10.69	10.82	10.42	10.28	10.67	10.07	10.22
13	10.58	10.83	10.28	10.47	10.55	10.39	10.64	10.56	10.24	10.42	10.56	10.52
14	10.43	10.85	10.32	10.43	10.38	10.76	10.73	10.59	10.07	10.38	10.35	10.00
15	10.19	10.92	10.29	10.53	10.38	10.81	10.65	10.82	9.94	10.26	10.38	10.15
16	10.55	10.89	10.42	10.67	10.37	10.40	10.70	10.97	9.91	10.30	10.40	10.59
17	10.68	10.89	10.60	10.52	10.36	10.49	10.74	11.10	9.92	10.75	10.38	10.38
18	10.51	10.89	11.10	10.48	10.39	10.31	10.85	11.08	9.99	10.84	10.70	10.36
19	10.57	10.89	11.08	10.58	10.30	10.58	10.92	10.60	10.10	10.23	10.64	10.35
20	10.82	10.92	11.13	10.74	10.35	10.93	10.80	10.46	10.41	10.17	10.63	10.28
21	10.91	10.90	11.05	10.73	10.37	10.78	10.69	10.43	10.33	10.25	10.37	10.29
22	10.87	10.90	10.58	10.64	10.35	10.80	10.71	10.55	9.94	10.18	10.46	10.13
23	10.83	10.90	10.39	10.66	10.37	10.74	10.71	10.34	10.02	10.25	10.71	10.19
24	10.85	10.90	10.42	10.78	10.38	10.60	10.49	10.34	10.22	10.42	10.63	10.22
25	10.91	10.92	10.81	10.65	10.43	10.45	10.26	10.53	10.05	10.61	10.58	10.19
26	10.93	10.89	10.36	10.48	10.36	10.61	10.49	10.66	10.04	10.36	10.50	10.11
27	10.83	10.55	10.35	10.49	10.37	10.58	10.25	10.74	10.33	10.27	10.51	10.08
28	10.83	10.63	10.19	10.49	10.35	10.48	10.28	10.85	10.02	10.28	10.42	10.15
29	10.77	10.70	10.20	10.48		10.63	10.13	11.02	9.93	10.30	10.35	10.17
30	10.78	10.79	10.26	10.48		10.40	10.20	10.92	10.03	10.21	10.34	10.18
31	10.83		10.14	10.53		10.46		10.55		10.32	10.24	
Min	10.19	10.55	10.14	9.75	10.20	10.31	10.13	10.08	9.91	10.03	10.07	10.00
Max	10.93	10.92	11.13	10.78	10.93	10.93	11.01	11.10	10.82	10.94	10.71	10.76
Mean	10.64	10.84	10.54	10.42	10.47	10.59	10.61	10.56	10.17	10.37	10.43	10.28

Table E-7. Headwater stage at G204_H from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.77	10.90	10.65	10.02	10.52	10.24 E	10.56	11.22	10.72	11.92	11.58	11.94
2	11.68	10.81	10.63	10.06	10.52	10.29 E	10.40	11.14	10.89	11.90	11.45	11.91
3	11.56	10.69	10.55	9.90	10.80	10.28 E	10.17	10.89	10.91	11.93	11.42	11.87
4	11.39	10.71	10.52	9.62	10.79	10.31 E	10.50	10.75	10.28	12.01	11.72	11.85
5	11.24	10.77	10.52	9.95	10.59	10.44	10.56	10.68	10.00	11.99	11.84	11.84
6	11.25	10.72	10.53	9.88	10.51	10.54	10.55	10.48	9.91	11.98	11.80	11.98
7	11.43	10.66	10.48	10.06	10.60	10.68	10.63	10.74	9.91	11.99	11.78	12.10
8	11.13	10.72	10.41	10.04	10.45	10.73	10.91	11.11	10.06	11.98	11.82	12.08
9	10.86	10.76	10.22	10.12	10.12	10.64	10.67	10.96	9.99	11.95	11.92	12.12
10	10.88	10.76	10.25	10.24	10.29	10.60	10.70	10.75	9.96	11.91	11.98	12.17
11	10.93	10.72	10.29	10.33	10.27	10.58	10.71	10.57	10.28	11.85	12.00	12.16
12	10.93	10.71	10.21	10.32	10.29	11.16	10.74	10.44	10.17	11.84	11.98	12.14
13	10.85	10.69	10.14	10.35	10.47	11.39	10.54	10.48	10.14	11.79	11.95	12.12
14	10.67	10.71	10.18	10.30	10.30	11.48	10.64	10.51	9.97	11.75	11.92	12.11
15	10.46	10.79	10.14	10.41	10.31	11.32	10.55	10.74	9.84	11.72	11.92	12.09
16	10.41	10.75	10.29	10.56	10.28	10.78	10.60	10.88	9.81	11.74	11.95	12.07
17	10.56	10.76	10.45	10.40	10.27	10.84	10.64	11.01	9.83	11.77	11.98	12.05
18	10.37	10.75	10.95	10.36	10.28	10.83	10.80	11.00	9.89	11.76	12.05	12.03
19	10.42	10.76	10.90	10.46	10.24	10.76	11.07	10.53	10.08	11.70	12.06	12.01
20	10.69	10.78	10.94	10.62	10.23	11.06	11.08	10.38	10.90	11.58	12.09	11.98
21	10.78	10.77	10.85	10.62	10.26	10.91	11.11	10.34	11.84	11.46	12.08	11.96
22	10.74	10.77	10.36	10.51	10.25	10.85	10.95	10.47	11.73	11.22	12.10	11.92
23	10.70	10.78	10.23	10.54	10.25	10.78 E	10.83	10.25	11.65	11.31	12.10	11.97
24	10.72	10.77	10.29	10.67	10.28 E	10.64	10.57	10.23	11.66	11.60	12.09	12.06
25	10.77	10.79	10.69	10.53	10.32 E	10.46	10.27	10.44	11.61	11.59	12.06	12.05
26	10.80	10.79	10.22	10.35	10.25 E	10.50	11.45	10.57	11.58	11.68	12.07	12.02
27	10.71	10.44	10.22	10.37	10.27 E	10.47	11.80	10.64	11.66	11.62	12.07	12.01
28	10.81	10.52	10.06	10.37	10.24 E	10.38	11.55	10.78	11.66	11.55	12.04	12.01
29	10.97	10.59	10.07	10.37		10.80	11.28	10.97	11.59	11.44	12.02	12.07
30	10.87	10.67	10.13	10.37		10.79	11.23	10.87	11.66	11.30	12.00	12.05
31	10.91		10.02	10.40		10.55		10.52		11.58	11.98	
Min	10.37	10.44	10.02	9.62	10.12	10.24	10.17	10.23	9.81	11.22	11.42	11.84
Max	11.77	10.90	10.95	10.67	10.80	11.48	11.80	11.22	11.84	12.01	12.10	12.17
Mean	10.91	10.73	10.40	10.29	10.37	10.71	10.80	10.69	10.67	11.72	11.93	12.02

Table E-8. Tailwater stage at G204_T from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.22	10.78	10.69	10.06	10.53	10.27 E	10.47	10.23	10.47	10.37	10.19	10.26
2	10.23	10.73	10.67	10.10	10.52 E	10.32 E	10.32	10.26	10.81	10.32	10.15	10.19
3	10.22	10.68	10.59	9.93	10.85 E	10.31 E	10.14	10.04	10.48	10.57	10.12	10.13
4	10.19	10.76	10.56	9.65	10.81 E	10.35 E	10.58	10.34	9.72	10.93	10.21	10.06
5	10.41	10.81	10.55	9.99	10.59 E	10.50 E	10.64	10.33	9.54	10.25	10.32	10.17
6	10.77	10.76	10.57	9.93	10.52 E	10.60 E	10.63	10.30	9.55	9.72	10.41	10.75
7	10.47	10.70	10.51	10.11	10.64 E	10.75 E	10.71	10.23	9.69	9.81	10.61	10.61
8	10.33	10.76	10.45	10.08	10.42 E	10.80 E	10.99	10.46	10.09	10.10	10.66	10.23
9	10.30	10.81	10.24	10.16	10.10 E	10.71 E	10.74	10.37	10.00	10.05	10.16	10.06
10	10.45	10.80	10.29	10.28	10.31 E	10.67 E	10.78	10.29	10.08	9.86	10.43	10.13
11	10.56	10.76	10.33	10.37	10.29 E	10.64 E	10.78	10.37	10.32	10.06	10.36	10.09
12	10.60	10.75	10.24	10.36	10.27 E	10.58 E	10.81	10.40	10.25	10.58	9.96	10.09
13	10.51	10.73	10.18	10.39	10.46 E	10.17 E	10.61	10.54	10.20	10.34	10.43	10.34
14	10.34	10.76	10.22	10.34	10.30 E	10.51 E	10.71	10.59	10.03	10.32	10.22	9.83
15	10.08	10.84	10.19	10.45	10.30 E	10.43 E	10.63	10.82	9.91	10.21	10.29	10.00
16	10.43	10.80	10.32	10.60	10.30 E	9.93	10.68	10.97	9.88	10.26	10.32	10.47
17	10.59	10.81	10.50	10.44	10.28 E	10.12	10.72	11.09	9.90	10.74	10.31	10.27
18	10.41	10.80	10.95	10.40	10.32 E	9.95	10.82	11.07	9.96	10.83	10.61	10.29
19	10.47	10.81	10.87	10.51	10.23 E	10.43	10.88	10.58	10.05	10.19	10.51	10.30
20	10.73	10.84	10.92	10.67	10.27 E	10.84	10.76	10.43	10.34	10.14	10.49	10.24
21	10.83	10.82	10.84	10.66	10.30 E	10.68	10.52	10.41	10.18	10.23	10.26	10.26
22	10.79	10.82	10.35	10.55	10.28 E	10.71	10.56	10.54	9.80	10.13	10.35	10.09
23	10.75	10.83	10.26	10.59	10.30 E	10.65	10.58	10.31	9.91	10.23	10.65	10.15
24	10.77	10.82	10.32	10.71	10.31 E	10.53	10.39	10.31	10.14	10.39	10.53	10.18
25	10.82	10.83	10.74	10.56	10.35 E	10.38	10.17	10.52	9.99	10.60	10.48	10.15
26	10.85	10.81	10.23	10.38	10.28 E	10.56	10.38	10.65	10.00	10.33	10.37	10.07
27	10.75	10.46	10.26	10.40	10.29 E	10.53	10.09	10.72	10.29	10.24	10.39	10.04
28	10.75	10.56	10.09	10.40	10.27 E	10.43	9.99	10.83	9.98	10.25	10.29	10.12
29	10.70	10.63	10.11	10.40		10.59	9.87	11.01	9.90	10.26	10.24	10.13
30	10.70	10.71	10.18	10.40		10.30	10.06	10.92	9.99	10.17	10.22	10.09
31	10.75		10.05	10.44		10.36		10.53		10.28	10.14	
Min	10.08	10.46	10.05	9.65	10.10	9.93	9.87	10.04	9.54	9.72	9.96	9.83
Max	10.85	10.84	10.95	10.71	10.85	10.84	10.99	11.09	10.81	10.93	10.66	10.75
Mean	10.54	10.76	10.43	10.33	10.38	10.47	10.53	10.53	10.05	10.28	10.34	10.19

Table E-9. Marsh Stage at HOLEY2 from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.91 E	11.50	11.23	11.25	11.14	11.23	11.38	11.57	11.30	11.66	11.62	11.83
2	11.90	11.49	11.22	11.26	11.23	11.23	11.36	11.55	11.28	11.66	11.58	11.80
3	11.88	11.47	11.21	11.25	11.22	11.23	11.34	11.53	11.27	11.68	11.55	11.78
4	11.86	11.46	11.20	11.23	11.21	11.22	11.32	11.50	11.27	11.73	11.55	11.79
5	11.83	11.46	11.22	11.22	11.20	11.20	11.31	11.48	11.27	11.80	11.57	11.83
6	11.82	11.44	11.21	11.20	11.20	11.19	11.29	11.47	11.30	11.82	11.61	11.97
7	11.85	11.43	11.21	11.19	11.18	11.18	11.27	11.50	11.36	11.82	11.65	11.97
8	11.84	11.41	11.19	11.18	11.17	11.17	11.25	11.50	11.46	11.82	11.68	11.97
9	11.82	11.39	11.18	11.19	11.17	11.15	11.24	11.48	11.45	11.81	11.72	12.01
10	11.80	11.37	11.18	11.19	11.17	11.15	11.23	11.46	11.43	11.79	11.76	12.09
11	11.79	11.37	11.16	11.18	11.15	11.14	11.24	11.44	11.40	11.77	11.81	12.10
12	11.77	11.37	11.15	11.17	11.17	11.30	11.27	11.41	11.39	11.75	11.79	12.09
13	11.75	11.36	11.14	11.16	11.25	11.40	11.26	11.39	11.45	11.73	11.77	12.06
14	11.73	11.34	11.13	11.15	11.24	11.38	11.24	11.36	11.49	11.72	11.76	12.02
15	11.71	11.32	11.12	11.15	11.22	11.38	11.22	11.34	11.46	11.71	11.75	11.99
16	11.69	11.31	11.24	11.14	11.21	11.40	11.21	11.33	11.43	11.71	11.76	11.96
17	11.68	11.29	11.22	11.18	11.20	11.42	11.21	11.34	11.43	11.69	11.79	11.93
18	11.66	11.28	11.27	11.20	11.19	11.42	11.27	11.35	11.52	11.67	11.82	11.91
19	11.64	11.26	11.33	11.18	11.18	11.41	11.38	11.34	11.59	11.65	11.85	11.88
20	11.63	11.25	11.33	11.17	11.17	11.40	11.39	11.34	11.67	11.63	11.95	11.85
21	11.62	11.24	11.34	11.16	11.15	11.39	11.43	11.32	11.67	11.60	11.91	11.83
22	11.61	11.22	11.34	11.15	11.16	11.40	11.44	11.29	11.66	11.57	11.93	11.81
23	11.61	11.21	11.34	11.16	11.15	11.39	11.43	11.27	11.65	11.58	11.96	11.81
24	11.60	11.20	11.32	11.15	11.18	11.38	11.41	11.24	11.64	11.58	11.93	11.84
25	11.60	11.24	11.31	11.14	11.25	11.36	11.39	11.22	11.62	11.57	11.91	11.84
26	11.58	11.30	11.31	11.12	11.23	11.36	11.57	11.20	11.61	11.58	11.92	11.82
27	11.58	11.28	11.30	11.10	11.23	11.35	11.64	11.17	11.59	11.56	11.95	11.79
28	11.56	11.27	11.29	11.09	11.25	11.34	11.62	11.21	11.58	11.53	11.92	11.78
29	11.55	11.25	11.27	11.07		11.39	11.61	11.29	11.56	11.50	11.89	11.82
30	11.53	11.24	11.26	11.05		11.41	11.59	11.31	11.58	11.54	11.89	11.82
31	11.52		11.25	11.04		11.39		11.29		11.66	11.86	
Min	11.52	11.20	11.12	11.04	11.14	11.14	11.21	11.17	11.27	11.50	11.55	11.78
Max	11.91	11.50	11.34	11.26	11.25	11.42	11.64	11.57	11.67	11.82	11.96	12.10
Mean	11.71	11.33	11.24	11.16	11.19	11.31	11.36	11.37	11.48	11.67	11.79	11.90

Table E-10. Marsh Stage at HOLEY1 from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.85 E	11.43	11.17	11.30	11.14	11.20	11.33	11.52	11.26	11.79	11.57	11.86
2	11.83 E	11.41	11.15	11.32	11.27	11.20	11.31	11.51	11.40	11.78	11.57	11.84
3	11.81 E	11.40	11.14	11.31	11.31	11.20	11.29	11.50	11.64	11.82	11.58	11.83
4	11.79 E	11.39	11.12	11.29	11.31	11.18	11.27	11.48	11.64	11.88	11.59	11.84
5	11.77 E	11.39	11.19	11.28	11.30	11.16	11.25	11.46	11.58	11.94	11.64	11.84
6	11.76	11.37	11.20	11.26	11.32	11.14	11.23	11.43	11.56	11.96	11.66	11.89
7	11.78	11.35	11.19	11.25	11.31	11.12	11.20	11.42	11.57	11.95	11.68	11.92
8	11.78	11.33	11.17	11.24	11.29	11.09	11.18	11.41	11.61	11.93	11.74	11.93
9	11.76	11.31	11.16	11.24	11.28	11.07	11.15	11.40	11.59	11.91	11.77	11.93
10	11.74	11.29	11.14	11.25	11.27	11.05	11.13	11.39	11.56	11.88	11.83	11.99
11	11.72	11.31	11.12	11.24	11.26	11.03	11.18	11.37	11.53	11.86	11.92	12.09
12	11.70	11.33	11.10	11.22	11.27	11.23	11.28	11.35	11.53	11.84	11.99	12.08
13	11.68	11.31	11.09	11.21	11.34	11.40	11.30	11.32	11.55	11.81	11.93	12.06
14	11.66	11.29	11.06	11.20	11.33	11.40	11.28	11.30	11.54	11.79	11.90	12.04
15	11.64	11.27	11.07	11.19	11.31	11.39	11.26	11.28	11.52	11.78	11.88	12.02
16	11.63	11.25	11.37	11.18	11.30	11.37	11.23	11.33	11.50	11.78	11.87	12.00
17	11.61	11.23	11.38	11.20	11.29	11.37	11.22	11.49	11.53	11.77	11.87	11.97
18	11.59	11.22	11.42	11.21	11.27	11.36	11.27	11.50	11.59	11.74	11.90	11.95
19	11.56	11.20	11.45	11.19	11.26	11.35	11.40	11.47	11.64	11.72	11.90	11.93
20	11.55	11.18	11.43	11.18	11.24	11.34	11.40	11.44	11.81	11.70	11.91	11.91
21	11.54	11.16	11.41	11.16	11.23	11.32	11.40	11.42	11.91	11.68	11.90	11.89
22	11.52	11.15	11.40	11.15	11.22	11.32	11.38	11.39	11.88	11.65	11.91	11.87
23	11.53	11.13	11.39	11.14	11.22	11.31	11.36	11.36	11.86	11.67	11.94	11.87
24	11.52	11.11	11.38	11.13	11.21	11.30	11.33	11.33	11.83	11.67	11.94	11.89
25	11.52	11.16	11.37	11.13	11.21	11.28	11.31	11.31	11.80	11.67	11.94	11.91
26	11.51	11.24	11.36	11.14	11.19	11.28	11.45	11.28	11.78	11.66	11.93	11.90
27	11.50	11.23	11.34	11.12	11.19	11.27	11.53	11.25	11.78	11.64	11.93	11.88
28	11.49	11.21	11.33	11.10	11.22	11.26	11.53	11.24	11.76	11.62	11.92	11.88
29	11.48	11.20	11.32	11.08		11.34	11.53	11.21	11.74	11.60	11.90	11.92
30	11.46	11.18	11.30	11.06		11.36	11.53	11.18	11.75	11.59	11.90	11.92
31	11.44		11.29	11.05		11.35		11.15		11.58	11.88	
Min	11.44	11.11	11.06	11.05	11.14	11.03	11.13	11.15	11.26	11.58	11.57	11.83
Max	11.85	11.43	11.45	11.32	11.34	11.40	11.53	11.52	11.91	11.96	11.99	12.09
Mean	11.64	11.27	11.26	11.19	11.26	11.26	11.32	11.37	11.64	11.76	11.83	11.93

Table E-11. Marsh Stage at HOLEY_G from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.99	11.64	11.53	11.60	11.58	11.63	11.66	11.78	11.60	11.95	11.79	12.02
2	11.97	11.63	11.52	11.62	11.64	11.63	11.64	11.76	11.62	11.94	11.78	12.00
3	11.95	11.61	11.52	11.61	11.63	11.63	11.63	11.74	11.66	11.98	11.77	11.99
4	11.94	11.61	11.51	11.60	11.62	11.61	11.61	11.72	11.69	12.04	11.85	11.99
5	11.92	11.60	11.54	11.58	11.62	11.60	11.59	11.70	11.68	12.04	11.91	11.99
6	11.92	11.59	11.54	11.57	11.62	11.59	11.58	11.69	11.69	12.06	11.88	12.07
7	11.96	11.58	11.53	11.57	11.61	11.58	11.56	11.74	11.74	12.07	11.87	12.12
8	11.94	11.56	11.52	11.56	11.60	11.57	11.54	11.78	11.75	12.07	11.95	12.11
9	11.92	11.55	11.51	11.57	11.59	11.56	11.52	11.76	11.74	12.05	12.00	12.13
10	11.90	11.54	11.50	11.58	11.58	11.55	11.50	11.73	11.72	12.03	12.01	12.17
11	11.89	11.55	11.48	11.57	11.57	11.55	11.54	11.71	11.70	12.01	12.04	12.22
12	11.87	11.55	11.46	11.56	11.59	11.69	11.61	11.69	11.69	11.99	12.06	12.21
13	11.85	11.54	11.44	11.55	11.65	11.79	11.61	11.67	11.75	11.96	12.04	12.19
14	11.83	11.52	11.42	11.54	11.63	11.76	11.59	11.65	11.78	11.95	12.02	12.18
15	11.82	11.50	11.43	11.54	11.62	11.74	11.57	11.63	11.75	11.94	12.02	12.16
16	11.80	11.49	11.64	11.54	11.61	11.73	11.56	11.64	11.73	11.94	12.02	12.14
17	11.78	11.47	11.63	11.55	11.60	11.72	11.57	11.67	11.75	11.93	12.06	12.12
18	11.77	11.45	11.68	11.55	11.59	11.71	11.63	11.66	11.81	11.91	12.10	12.10
19	11.75	11.42	11.71	11.54	11.58	11.69	11.73	11.65	11.82	11.89	12.12	12.08
20	11.74	11.40	11.69	11.54	11.58	11.68	11.73	11.64	11.93	11.87	12.12	12.06
21	11.73	11.37	11.68	11.53	11.57	11.67	11.74	11.62	12.05	11.85	12.09	12.04
22	11.72	11.35	11.67	11.53	11.57	11.66	11.72	11.60	12.02	11.83	12.09	12.03
23	11.72	11.32	11.66	11.54	11.57	11.66	11.70	11.58	12.00	11.86	12.11	12.06
24	11.71	11.30	11.65	11.54	11.59	11.64	11.68	11.56	11.97	11.87	12.11	12.09
25	11.70	11.44	11.64	11.54	11.63	11.63	11.67	11.53	11.95	11.86	12.10	12.09
26	11.69	11.58	11.64	11.54	11.62	11.63	11.82	11.51	11.93	11.87	12.09	12.07
27	11.69	11.57	11.63	11.53	11.63	11.63	11.87	11.48	11.94	11.85	12.09	12.05
28	11.68	11.56	11.62	11.52	11.64	11.62	11.85	11.48	11.92	11.83	12.08	12.05
29	11.68	11.55	11.61	11.50		11.68	11.82	11.50	11.90	11.80	12.07	12.08
30	11.66	11.54	11.60	11.49		11.68	11.81	11.47	11.90	11.79	12.06	12.09
31	11.65		11.59	11.48		11.67		11.47		11.81	12.04	
Min	11.65	11.30	11.42	11.48	11.57	11.55	11.50	11.47	11.60	11.79	11.77	11.99
Max	11.99	11.64	11.71	11.62	11.65	11.79	11.87	11.78	12.05	12.07	12.12	12.22
Mean	11.81	11.51	11.57	11.55	11.60	11.65	11.65	11.64	11.81	11.93	12.01	12.09

Table E-12. Stage at G203D from October 2009 – September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.03	11.58	11.25	11.32	11.11	11.15 E	11.43 E	11.64 E	11.35 E	11.89 E	11.70 E	11.98
2	12.00	11.56	11.23	11.33	11.20	11.12 E	11.42 E	11.63 E	11.56 E	11.89 E	11.69 E	11.96
3	11.98	11.54	11.22	11.31	11.24	11.07 E	11.41 E	11.60 E	11.77 E	11.90	11.69 E	11.95
4	11.96	11.53	11.22	11.29	11.24 E	11.10 E	11.39 E	11.58 E	11.73 E	11.97	11.72 E	11.96
5	11.94	11.53	11.23	11.28	11.23 E	11.10 E	11.36 E	11.55 E	11.65 E	12.01	11.76 E	11.96
6	11.94	11.51	11.23	11.26	11.25 E	11.09 E	11.34 E	11.53 E	11.62 E	12.04 E	11.81 E	12.01
7	11.98	11.49	11.22	11.24	11.25 E	11.08 E	11.31 E	11.54 E	11.63 E	12.04 E	11.84 E	12.04
8	11.96	11.47	11.21	11.23	11.25 E	11.07 E	11.28 E	11.57 E	11.69 E	12.02 E	11.87 E	12.05
9	11.93	11.45	11.19	11.23	11.23 E	11.06 E	11.25 E	11.55 E	11.67 E	12.02	11.89 E	12.05
10	11.91	11.43	11.18	11.23	11.22 E	11.06 E	11.26 E	11.56 E	11.63 E	12.00	11.93	12.11
11	11.89	11.43	11.17	11.20	11.20 E	11.06 E	11.26 E	11.54 E	11.61 E	11.97	11.99	12.21
12	11.87	11.43	11.15	11.19	11.21 E	11.22 E	11.30 E	11.51 E	11.60 E	11.95	12.06	12.20
13	11.85	11.41	11.13	11.18	11.22 E	11.30 E	11.32 E	11.48 E	11.62 E	11.93	12.03	12.17
14	11.83	11.39	11.12	11.16	11.24 E	11.35 E	11.31 E	11.46 E	11.61 E	11.91	12.01	12.15
15	11.82	11.37	11.11	11.15	11.25 E	11.37 E	11.28 E	11.43 E	11.59 E	11.89	11.99	12.13
16	11.79	11.35	11.25	11.13	11.20 E	11.42 E	11.24 E	11.46 E	11.57 E	11.89	11.98	12.10
17	11.78	11.34	11.27	11.15	11.19 E	11.44 E	11.22 E	11.51 E	11.61 E	11.88	11.99	12.08
18	11.76	11.32	11.33	11.15	11.19 E	11.43 E	11.27 E	11.51 E	11.66 E	11.85	12.01	12.06
19	11.73	11.30	11.39	11.15	11.19 E	11.46 E	11.37 E	11.49 E	11.72 E	11.83	12.01	12.04
20	11.72	11.29	11.42	11.14	11.18 E	11.47 E	11.38 E	11.47 E	11.86	11.81	12.02	12.02
21	11.70	11.27	11.43	11.12	11.18 E	11.45 E	11.38 E	11.45 E	11.96	11.78	12.01	12.00
22	11.69	11.26	11.43	11.12	11.17 E	11.42 E	11.40 E	11.43 E	11.96	11.77 E	12.03	11.98
23	11.69	11.24	11.42	11.11	11.14 E	11.42 E	11.41 E	11.40 E	11.95 E	11.78 E	12.05	11.98
24	11.68	11.23	11.41	11.10	11.11 E	11.43 E	11.40 E	11.36 E	11.94 E	11.78 E	12.05	12.00
25	11.67	11.25	11.40	11.10	11.10 E	11.41 E	11.38 E	11.33 E	11.89	11.77 E	12.05	12.02
26	11.66	11.32	11.40	11.11	11.13 E	11.39 E	11.52 E	11.29 E	11.87	11.77	12.05	12.00
27	11.65	11.30	11.38	11.10	11.14 E	11.41 E	11.62 E	11.27 E	11.87	11.75	12.05	11.98
28	11.64	11.29	11.37	11.08	11.14 E	11.39 E	11.64 E	11.27 E	11.85	11.74	12.03	11.98
29	11.63	11.27	11.35	11.06		11.41 E	11.64 E	11.27 E	11.84	11.72	12.02	12.02
30	11.61	11.26	11.34	11.04		11.43 E	11.65 E	11.26 E	11.85 E	11.70	12.01	12.04
31	11.59		11.32	11.05		11.44 E		11.25 E		11.72	12.00	
Min	11.59	11.23	11.11	11.04	11.10	11.06	11.22	11.25	11.35	11.70	11.69	11.95
Max	12.03	11.58	11.43	11.33	11.25	11.47	11.65	11.64	11.96	12.04	12.06	12.21
Mean	11.80	11.38	11.28	11.17	11.19	11.29	11.38	11.46	11.72	11.87	11.95	12.04

Attachment F: Rainfall Data

Table F-1. Rainfall at S3_R from October 1, 2009 – September 30, 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.24	0.54	0.00	0.00	0.00	1.21	0.53	0.01	0.05
2	0.00	0.00	0.03	0.00	0.20	0.75	0.00	0.00	0.54	1.17	0.00	0.00
3	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.18	0.38	0.00	0.35
4	0.00	0.05	0.25	0.00	0.01	0.00	0.00	0.00	0.01	1.65	1.20	0.01
5	0.07	0.00	1.54	0.00	0.46	0.00	0.00	0.00	0.00	0.32	0.71	0.29
6	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.01	1.27	3.59	2.60
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.76	0.02	1.05
8	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.62	0.01
9	0.00	0.01	0.01	0.28	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.75
10	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00
11	0.00	0.22	0.00	0.00	0.00	3.54	0.43	0.00	0.00	0.00	0.82	0.00
12	0.00	0.00	0.11	0.00	0.44	3.05	0.34	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.01	0.00
14	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.01	0.00
15	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.19	0.00	0.01	0.01	0.00	0.00	0.08	0.13	0.59	0.10	6.42	0.00
17	0.00	0.00	0.00	0.56	0.00	0.08	0.03	0.04	2.02	0.00	0.01	0.11
18	0.00	0.00	1.01	0.00	0.00	0.01	0.89	0.01 P	0.39	0.00	0.01	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.14 P	0.00	0.00	0.05	0.01
20	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.01	0.63	0.00	0.08	0.00
21	0.00	0.01	0.00	0.00	0.00	0.12	0.01	0.00	0.00	0.00	0.00	0.00
22	0.01	0.00	0.00	0.19	0.02	0.16	0.00	0.00	0.00	0.00	0.23	0.13
23	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.53	0.80	0.04
24	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.01	0.00
25	0.00	0.74	0.01	0.40	0.00	0.00	0.08	0.00	0.00	0.08	0.56	0.00
26	0.00	0.01	0.00	0.00	0.00	0.05	1.97	0.00	0.19	0.01	0.27	0.00
27	0.00	0.00	0.00	0.00	0.18	0.00	0.00	1.03	0.00	0.00	0.53	0.19
28	0.02	0.00	0.00	0.00	0.01	0.18	0.00	0.23	0.00	0.00	0.26	0.84
29	0.01	0.00	0.00	0.00		1.31	0.00	0.00	0.00	0.00	0.11	0.33
30	0.00	0.00	0.00	0.00		0.00	0.00	0.55	0.24	0.00	0.02	0.00
31	0.00		0.00	0.00		0.00		1.69		0.03	0.00	
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.19	0.74	1.54	0.56	0.59	3.54	1.97	1.69	2.02	1.65	6.42	2.60
Mean	0.01	0.04	0.12	0.06	0.09	0.30	0.15	0.13	0.23	0.23	0.55	0.23

Table F-2. Rainfall at G200_R from October 1, 2009 – September 30, 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.43	0.60	0.00	0.00	0.00	0.12	0.80	0.00	0.00
2	0.00	0.00	0.00	0.00	0.53	0.26	0.00	0.00	3.80	0.25	0.03	0.00
3	0.00	0.00	0.06	0.00	0.00	0.00	0.01	0.00	1.15	1.58	0.01	0.63
4	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.90	1.55	0.00
5	0.39	0.00	0.48	0.00	0.61	0.00	0.00	0.00	0.08	0.46	0.04	0.49
6	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	1.16	0.01	0.44
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.00	0.04
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.71	0.07
9	0.00	0.00	0.01	0.29	0.06	0.01	0.00	0.00	0.00	0.00	0.10	0.03
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	1.63
11	0.00	0.28	0.00	0.00	0.00	0.12	2.07	0.00	0.00	0.00	0.38	0.00
12	0.00	0.00	0.01	0.00	0.86	2.25	0.50	0.00	0.40	0.00	0.01	0.11
13	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.68	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	3.11	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.11	0.00
16	0.01	0.00	0.02	0.00	0.01	0.00	0.06	1.87	0.01	0.07	0.09	0.00
17	0.00	0.00	0.00	0.32	0.00	0.06	0.04	0.22	0.80	0.00	0.94	0.00
18	0.00	0.00	0.70	0.01	0.00	0.00	1.32	0.10	0.04	0.00	0.21	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	1.84	0.00	0.28	0.04
20	0.00	0.00	0.00	0.01	0.00	0.00	0.18	0.00	0.99	0.00	0.01	0.00
21	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.01	0.00	0.14	0.04
22	0.26	0.00	0.00	0.00	0.11	0.11	0.00	0.00	0.00	0.00	0.24	0.00
23	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.63	0.25	0.62
24	0.00	0.00	0.00	0.03	0.24	0.00	0.00	0.00	0.00	0.01	0.00	0.17
25	0.00	0.60	0.00	0.06	0.00	0.00	0.01	0.00	0.00	0.41	0.01	0.21
26	0.00	0.00	0.00	0.00	0.00	0.24	2.05	0.00	0.53	0.01	0.04	0.01
27	0.06	0.00	0.01	0.00	0.24	0.00	0.00	1.00	0.02	0.00	0.01	0.03
28	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.10	0.00	0.00	0.00	0.32
29	0.00	0.00	0.00	0.00		1.11	0.00	0.01	0.00	0.00	0.03	0.62
30	0.00	0.00	0.00	0.00		0.00	0.01	0.00	0.73	0.00	0.07	0.06
31	0.00		0.00	0.00		0.00		0.89		0.04	0.00	
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.39	0.60	3.11	0.43	0.86	2.25	2.07	1.87	3.80	1.58	1.55	1.63
Mean	0.02	0.03	0.14	0.04	0.12	0.14	0.21	0.14	0.38	0.21	0.19	0.19

Table F-3. Rainfall at S8_R from October 1, 2009 – September 30, 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.45	1.00	0.01	0.00	0.00	0.12	0.17	0.01	0.00
2	0.00	0.00	0.00	0.00	0.03	0.17	0.01	0.00	0.46	0.08	0.04	0.00
3	0.00	0.00	0.03	0.00	0.01	0.01	0.00	0.00	0.16	1.31	0.84	0.25
4	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.92	0.01
5	0.00	0.00	0.28	0.00	0.11	0.00	0.00	0.00	0.02	0.08	0.03	0.55
6	0.47	0.00	0.00	0.00	0.02	0.00	0.00	0.32	0.00	0.66	0.00	1.63
7	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.05	0.34	0.08	0.14
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.86	0.11
9	0.00	0.00	0.01	0.25	0.05	0.00	0.00	0.00	0.00	0.00	0.45	1.02
10	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.65	1.44
11	0.00	0.23	0.00	0.00	0.00	0.10	0.68	0.00	0.00	0.00	0.16	0.01
12	0.00	0.00	0.05	0.00	1.00	2.56	0.08	0.00	0.00	0.00	0.01	0.03
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.04	0.00
14	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0.00
15	0.00	0.00	0.71	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.54	0.00
16	0.01	0.00	0.00	0.01	0.01	0.00	0.07	0.32	0.01	0.41	0.19	0.00
17	0.01	0.00	0.62	0.19	0.00	0.04	0.09	0.72	0.71	0.00	1.13	0.00
18	0.00	0.00	0.89	0.01	0.00	0.01	1.64	0.00	0.39	0.01	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.06	1.50	0.08	1.44	0.00
20	0.05	0.00	0.00	0.00	0.00	0.00	0.76	0.01	1.88	E 0.02	0.01	0.00
21	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.05	E 0.00	0.96	0.00
22	0.12	0.00	0.00	0.16	0.13	0.10	0.00	0.00	0.00	0.00	0.29	0.00
23	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.75	0.37	1.29
24	0.12	0.00	0.00	0.09	1.14	0.00	0.00	0.00	0.00	0.02	0.10	0.08
25	0.00	1.04	0.01	0.16	0.00	0.00	0.01	0.09	0.00	0.41	0.03	0.01
26	0.00	0.00	0.00	0.01	0.00	0.20	2.68	0.00	0.19	0.01	0.77	0.00
27	0.20	0.00	0.00	0.00	0.39	0.01	0.00	0.29	0.00	0.00	0.01	0.39
28	1.42	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00	0.00	0.00	0.61
29	0.01	0.00	0.00	0.00		0.99	0.00	0.01	0.00	0.00	0.07	0.44
30	0.00	0.00	0.00	0.00		0.00	0.04	0.00	1.73	0.38	0.01	0.08
31	0.01		0.00	0.00		0.00		1.11		0.12	0.01	
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	1.42	1.04	0.89	0.45	1.14	2.56	2.68	1.83	1.88	1.31	1.44	1.63
Mean	0.08	0.04	0.08	0.04	0.14	0.14	0.21	0.17	0.24	0.16	0.32	0.27

Attachment G: Evapotranspiration Data

Table G-1. Evapotranspiration at S7_E from October 2009–September 2010.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.09	X	0.10 A	X	0.34 A	0.45 A	0.19	0.24	0.96	0.25	0.00	0.27
2	0.16	0.48 A	0.09	X	0.05	0.10	0.21	0.19	M	0.27	0.97	0.26
3	0.27	0.18	0.08	X	0.09	0.24	0.23	0.32	0.42	X	0.24	0.23
4	0.19	0.10	0.13	0.50 A	0.13	0.16	X	0.25	0.28	X	0.14	0.19
5	0.23	0.15	X	0.13	0.15	0.20	0.46 A	0.29	0.30	X	0.23	0.23
6	0.23	0.15	X	0.13	0.09	X	0.24	0.33	0.33	X	0.19	0.24
7	0.19	X	0.17 A	0.08	X	X	0.23	0.22	0.24	0.15 A	X	0.03
8	0.20	X	0.11	0.08	0.37 A	0.47 A	0.22	X	0.29	0.26	X	0.19
9	0.21	0.54 A	0.03	X	0.06	0.21	0.20	X	0.46	0.29	0.64 A	0.40
10	0.24	0.19	0.14	X	0.16	0.03	X	X	0.22	0.34	M	0.19
11	0.10	X	0.19	0.16 A	0.21	0.18	X	1.11 A	0.23	0.33	M	0.19
12	0.31	0.26 A	X	0.18	0.13	0.12	0.79 A	0.26	0.31	0.33	0.29	0.23
13	0.20	X	X	0.10	0.16	X	0.16	0.26	0.20	0.28	0.19	0.18
14	0.19	X	0.33 A	0.09	0.16	0.68 A	0.25	0.28	0.10	0.22	0.32	0.26
15	0.23	X	0.08	0.06	0.10	0.23	0.28	X	0.19	0.14	0.20	0.11
16	0.17	0.56 A	0.03	X	0.18	0.30	0.22	X	0.25	0.34	0.22	0.24
17	X	0.08	0.08	X	0.19	0.14	X	0.68 A	M	X	0.31	0.27
18	X	0.11	0.12	X	0.14	0.06	X	0.18	M	X	0.20	0.23
19	0.57 A	0.12	0.24	0.51 A	0.18	0.19	0.34 A	0.27	0.26	0.62 A	0.21	0.34
20	0.18	0.06	0.20	0.07	X	0.20	0.11	0.17	0.23	0.31	0.25	0.17
21	0.23	X	0.11	0.09	X	0.14	0.19	0.29	0.16	0.30	0.22	0.26
22	0.21	X	0.10	0.11	0.34 A	0.23	0.24	X	0.33	0.36	0.25	0.26
23	0.16	0.34 A	0.05	X	0.09	0.16	0.22	X	0.31	0.29	0.16	0.18
24	X	0.01	0.12	X	0.11	0.23	0.24	0.88 A	0.30	X	0.21	0.13
25	X	0.22	X	0.37 A	0.30	0.17	0.29	0.25	0.23	X	0.14	0.20
26	0.49 A	X	0.22 A	0.14	0.19	0.18	0.25	0.18	0.30	0.67 A	0.07	0.14
27	0.17	X	0.08	0.14	X	X	X	0.29	X	0.28	0.15	0.18
28	0.18	X	0.06	0.11	X	X	0.32 A	M	0.55 A	0.26	0.16	0.22
29	0.12	X	0.17	0.15		0.50 A	0.26	N	0.34	0.33	0.22	0.28
30	0.19	0.54 A	0.09	X		0.30	0.11	N	0.25	0.00	0.15	0.10
31	X		0.07	X		0.25		0.00		0.00	0.21	
Min	0.09	0.01	0.03	0.06	0.05	0.03	0.11	0.00	0.10	0.00	0.00	0.03
Max	0.57	0.56	0.33	0.51	0.37	0.68	0.79	1.11	0.96	0.67	0.97	0.40
Mean	0.22	0.24	0.12	0.17	0.17	0.23	0.26	0.33	0.31	0.29	0.24	0.21

Data Tag Legend

- E - Estimated
- P - Summary computed from partial record
- X - Included in next amount marked 'A'
- A - Accumulated
- M - Missing
- < - Less Than

Attachment H: Holey Land Wildlife Management Area 2010 Annual Cattail Monitoring Report

Note: This document, dated May 5, 2011, was provided to the South Florida Water Management District by the Florida Fish and Wildlife Conservation Commission.

HOLEY LAND WILDLIFE MANAGEMENT AREA 2010 ANNUAL CATTAIL MONITORING REPORT

Daniel Mitchell
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Florida Fish and Wildlife Conservation Commission
Sunrise, Florida
May 5, 2011

INTRODUCTION

Holey Land Wildlife Management Area (WMA) is a 35,350 acre wetland in the southwest corner of Palm Beach County, Florida. The area was originally a marsh of dense sawgrass with scattered shrubs and sloughs (Davis 1943); however, unnatural alteration of the area's hydropattern began when the Miami Canal was excavated (1907-1917) along the western border of the area. After the authorization of the Central and Southern Florida Project for Flood Control and Other Purposes in 1948, the canal was deepened and the L-5 levee was constructed creating the southern border of Holey Land and blocking sheetflow to the south (Light and Dineen 1994). By the late 1960s, these changes, in combination with the conversion of marsh to farmland in the north and east, had altered the area's hydropattern and caused significant changes in the plant communities (Cornwell and Hutchinson 1974).

In 1968 the area was leased to the Florida Fish and Wildlife Conservation Commission (FWC) for fish and wildlife management purposes. Pursuant to that objective, from 1974 to 1975, 54 artificial islands 0.3 to 0.5 has in size were created by dredging muck from the marsh, leaving behind a small pond adjacent to each island. This was part of an Everglades-wide program, initiated by sportsman Francis "Franny"

Taylor to mitigate for the loss of tree island habitat caused by muck fires (Shortemeyer 1980).

A 1983 interagency agreement between FWC, the South Florida Water Management District (SFWMD), and the Florida Department of Environmental Regulation identified hydropattern improvement as a goal for restoration in Holey Land. Subsequently, in the late 1980's a system of levees, canals, and pumps was built that allowed managers to pump water from the Miami Canal into the area to achieve desired water levels. This system was fully functional by 1990 and the initial water schedule, which called for water levels varying from 11.5-13.5 feet above mean sea level (MSL), was achieved in June 1991. A topographic survey performed in 1992 revealed that the average elevation was 11.1 ft MSL, 0.4 ft lower than the previous estimate of 11.5 ft MSL prompting managers to lower the water regulation schedule to 11.0-13.0 ft MSL in July 1993. The elevation in Holey Land also ranges as much as four feet, a result of muck fires burning away organic soil during extreme dry periods. Extended high water levels in Holey Land can drown out typical marsh species in these deep pockets, creating an opening in the landscape susceptible to invasion by cattail (Newman et al. 1998). In early 1995, the schedule was dropped to 10.5-12.0 ft. MSL in an attempt to slow the proliferation of cattail.

Both of the major changes in the schedule were done informally and a revised schedule similar to that adopted in 1995 is under review by the FWC and SFWMD, as is a formal Memorandum of Understanding. Conforming to a revised schedule has been hindered by the fact that the G200A pump station is no longer functioning, restricting the ability to deliver clean water to Holey Land.

METHODS

The cattail survey method used from 1992-2003 was initiated after an attempt to use color infrared photography failed due to a combination of low cattail density and poor survey timing (Gilbert 1991). Two separate surveys conducted via helicopter were used to determine cattail coverage by first delineating boundaries of cattail monocultures and then sampling these areas to determine aerial percent cattail coverage. Cattail stands were first located by systematically traversing the entire area. Global Positioning System (GPS) readings were taken at all extensive areas of cattail growth. After completing this initial survey, each of the areas of extensive cattail growth previously located were revisited and mapped by taking GPS readings along their perimeters.

The second phase employed an aerial point-sampling scheme that utilized a 4 x 5 grid of crosshairs to systematically select 20 sample points. This grid was copied onto an 8.5" x 11" sheet of clear plastic and provided to two biologists observing out of either side of the helicopter. Sampling was conducted at different altitudes, depending on the size of the area sampled (e.g., observations were made at lower altitudes in areas with smaller cattail stands to ensure that samples were taken within the boundaries of the area surveyed), by holding the grid at arm's-length (as nearly parallel to the ground as possible given the configuration of the helicopter) and recording the number of points where the cross-hairs landed on the various vegetation types surveyed. The vegetation types were classified as cattail, sawgrass, brush, open water, or other. Each biologist took 10 sets of 20 sample points totaling 400 sample points in each area (200 sample points per biologist). The number of points landing on cattail, divided by the total number of sample points, provided the percent aerial cattail coverage in each sampling

area. The field map produced using the GPS coordinates recorded along the boundary of each sampling area was transformed into an area layer that provided measurements of total acreage within each area. The total cattail coverage in Holey Land WMA was the sum of the resulting estimates of cattail coverage in the individual sampling areas. Estimates of cattail coverage were computed using the 35,350 acre base map.

In 2004 the point intercept method was adopted in an effort to obtain more accurate and less subjective data (Owensby 1973). The survey involves two biologists, one on each side of the helicopter, selecting a specific point on the helicopter skid and looking directly down past that point at the vegetation below at 369 evenly spaced points. The surveys are performed in May and involve flying 12 transects, collecting data at all 369 points for a total of 738 data entries. At each point the observer records one of five different categories: cattail, sawgrass, brush, open water, and other. These categories were changed in 2005 to cattail, wax myrtle, Brazilian pepper, red maple, sawgrass, willow, and other. In 2007 a “burned” category was added to account for a 13,395 acre wildfire that occurred on April 1, 2007, one month before the survey. The helicopter is flown at an altitude of 200 feet and at a speed of approximately 80 miles/hour. The number of points where cattail is observed is divided by the total number of points and multiplied by 100 to provide a percent coverage of cattail. The percentage is multiplied by the total acres surveyed to calculate total acres of cattail.

In 2005, the FWC contracted Florida Natural Areas Inventory (FNAI) to conduct a vegetation survey of Holey Land WMA (Figure 1) via remote sensing of aerial photographs. They digitized as many community types as possible and ground-truthed each polygon identified during their remote sensing. They found 25.5% (9,025.22 acres)

of the area to be cattail monoculture, which is consistent with the results of our sampling from 2004-2006.

RESULTS

The results of the 2010 survey estimate that 10.5% of the area is covered by cattail (Table 1; see Figure 1 for sample locations and results). The acreage covered by cattail was calculated to be 3,706 acres. This indicates a significant decrease in estimated cattail coverage from 2009 (17.3%) and is less than half of what was estimated in 2004.

DISCUSSION

Cattail coverage increased rapidly over the course of the initial hydrological restoration of Holey Land, aided by the higher water regime schedules. During this time, cattail invaded sloughs and open-water areas that were created when muck fires burned the peat and sawgrass rootstock. These muck fires also released large amounts of nutrients. Sawgrass can survive total submergence for up to six weeks, but is adversely affected by high water and a combination of increased water depth, extended hydropatterns, and increased nutrients will promote the growth of cattail over sawgrass (Newman et al. 1998).

Determining the cattail coverage from the air continues to be subjective due to different biologists participating in the surveying each year and the varying appearance of cattail throughout the area and years, e.g., the area's soil moisture at any given time and location can affect the "greenness" and detectability of cattail. The survey does show a clear trend of decreasing cattail coverage in Holey Land WMA (Figure 2). This could be

attributed to the lowered water schedule, the overall reduction in water deliveries after the G200A pump station was decommissioned, and the drought conditions that occurred during the first half of 2009 (Figure 3).

Cattail would be expected to spread again and possibly encroach into the dominant sawgrass expanse in Holey Land WMA if extreme high water levels or extremely long hydroperiods are adopted (Newman et al. 1998). Because regular water deliveries have not been made, Holey Land has generally had lower than normal water levels. This has allowed shrub encroachment over much of the area and one reason for the decrease in cattail may be replacement by Carolina willow. These dry conditions also increase the probability of muck fires which could create more suitable conditions for cattail expansion. The FWC is working with the South Florida Water Management District to ensure that the primary focus in Holey Land is to restore water levels and hydroperiods that are closer to historic levels in order to achieve a healthier natural community.

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Table 1. Cattail surveys in the Holey Land WMA, 1991-2010

Year	Actual Acres Surveyed	Cattail Acres (95% C.I.)	Estimated % of Cattail Coverage in WMA
1991 ¹	N/A	538	N/A
1992	4,640	1,456 (990-1920)	4.1
1993	12,814	3,838 (2,890-4,823)	10.9
1994	19,460	5,434 (3,928-6,961)	15.4
1995	19,253	6,534 (5,321-7,731)	18.5
1996	19,657	6,706 (5,064-8,346)	19.0
1997 ²	21,987	9,092 (7,398-10,772)	25.7
1998 ²	20,937	9,987 (7,935-11,208)	28.3
1999 ²	21,850	10,392 (7,377-13,401)	29.4
2000	22,442	11,195 (10,750-13,804)	31.7
2004	35,350	9,545 (8,484-10,605)	27.0
2005	35,350	7,848 (6,514-9,182)	22.2
2006	35,350	8,060 (6,999-9,120)	22.8
2007	35,350	6,850 (5,819-7,897)	19.4
2008	35,350	5,508 (4,596-6,434)	15.6
2009	35,350	6,108 (5,142-7,074)	17.3
2010	35,350	3,706 (2,928-4,484)	10.5

¹ Visual estimates of cattail given in Gilbert (1991).

² Cattail surveys performed in the fall rather than in the spring as was done from 1991-1996 and 2004-2009.

Figure 1. Results of the 2010 cattail survey overlaid on top of the 2005 FNAI survey.

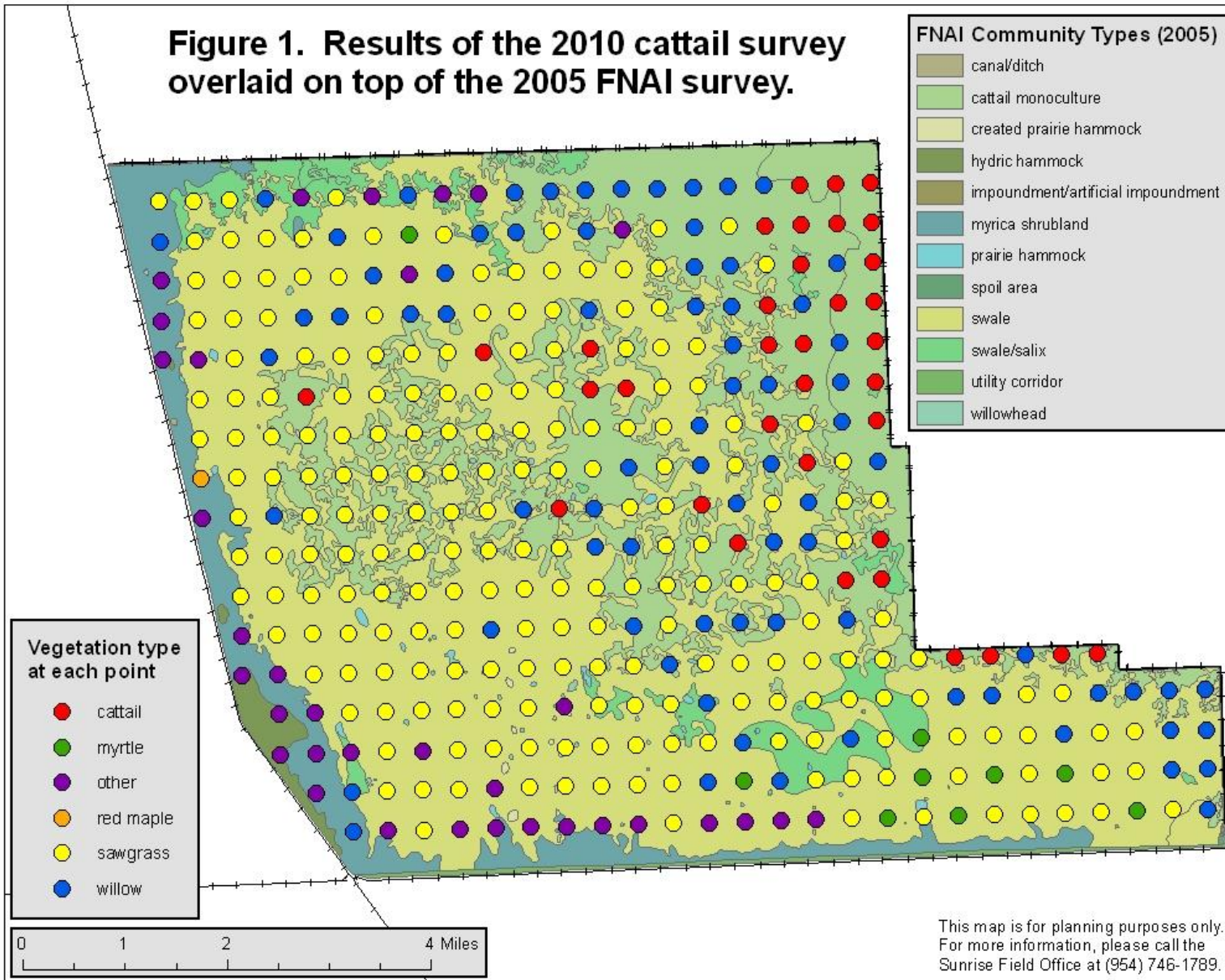


Figure 2. Cattail Coverage in Holey Land WMA

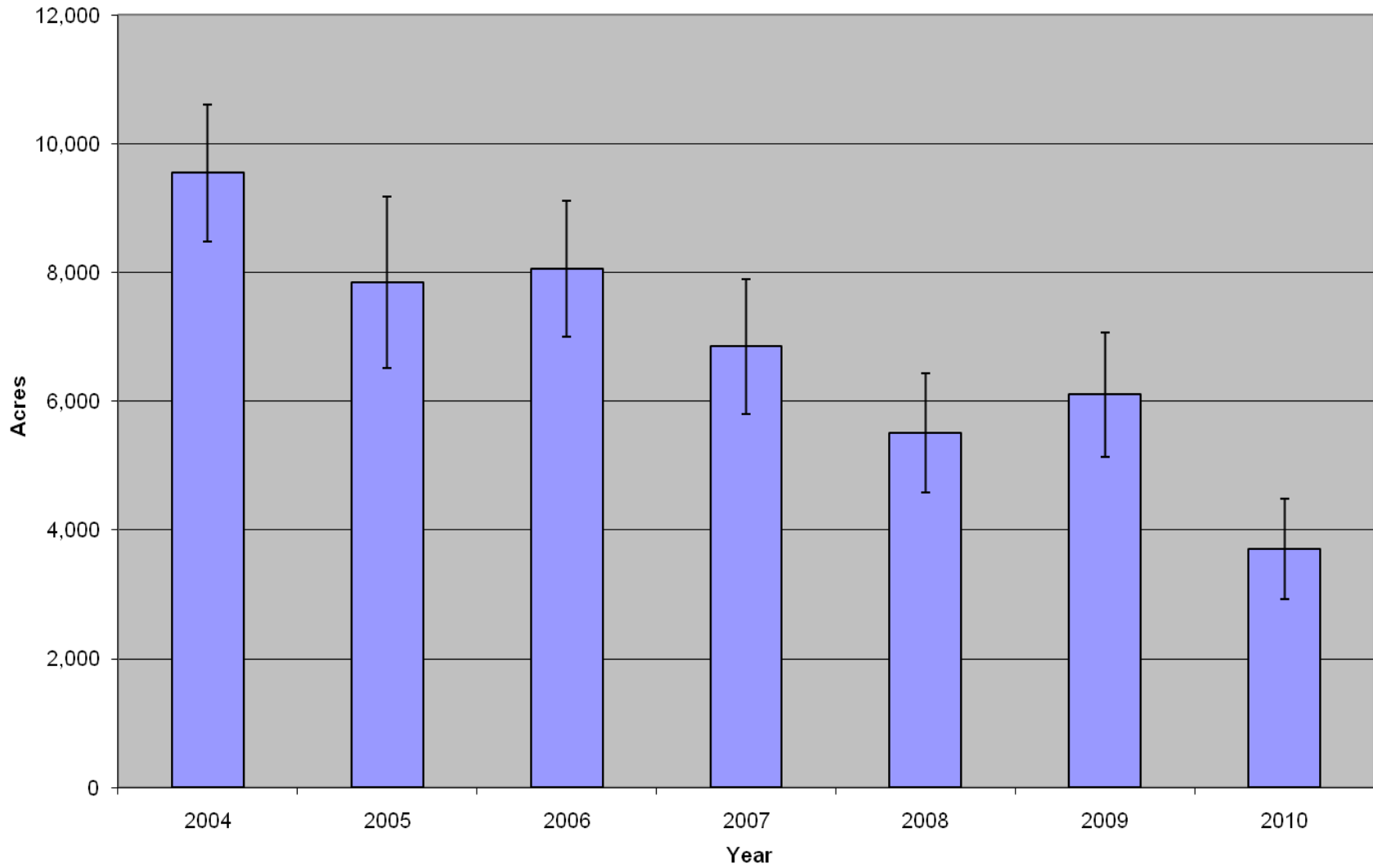


Figure 3. Holey Land WMA stage level (G203) water levels from 2010 and 2009, average weekly water levels for 1990-2008, average ground elevation, closure criteria and the schedule.

