Appendix 5-3: Annual Permit Report for the Holey Land Wildlife Management Area

Permit Report (October 1, 2008–September 30, 2009)

Permit Number: 06,500809209 and 06,501191549

Guy Germain

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SUMMARY

This report covers the reporting period from October 1, 2008–September 30, 2009 and includes water quality, sediment quality, flow, stage, rainfall, and evaporation as well as the annual cattail monitoring report for the Holey Land Wildlife Management Area. **Table 1** shows cross-references for permit-specific conditions in the permit and the specific reference pages. **Table 2** lists key permit-related information. **Attachment A**, Table A-1, shows specific pages, tables, and graphs where project status and annual reporting requirements are addressed. **Attachments B–G** provide surface water quality data for inflows and outflows, sediment data, daily flow data, daily stage data, daily rainfall data, and daily evaporation data, respectively. **Attachment H** is the Holey Land Wildlife Management Area 2009 Annual Cattail Monitoring Report from the Florida Fish and Wildlife Conservation Commission.

Table 1. Permit-specific conditions referenced in the permit.

Permit Conditions	Permit Reference (06,500809209)
Long-term Monitoring	Specific Condition pages 8-11

Table 2. Key permit-related information.

Project Name	**Holey Land Wildlife Management Area**
Permit Number	06,500809209 and 06,501191549
Issue and Expiration Date	Issue: October 1, 1984 Expiration: October 1, 1989 and Issue: September 5, 1986 Expiration: September 5, 1991
Project Phase	Completed
Relevant Period of Record	October 1, 2008– September 30, 2009
Report Generator	Guy Germain ggermain@sfwmd.gov 561-682-6732
Permit Coordinator	Ronald Bearzotti rbearzot@sfwmd.gov 561-681-2563 (ext. 3703)
Date	June 1, 2010

INTRODUCTION

The Holey Land Wildlife Management Area (Holey Land) is a 35,336 acre (14,300 ha) impoundment located in the southwest corner of Palm Beach County, Florida. In 1989, the South Florida Water Management District (District or SFWMD) started collecting water samples at the inflow structure (G-200A), the outflow structures (G-204, G-205 and G-206), and interior stations and, in 1991, the Florida Fish and Wildlife Conservation Commission began conducting annual cattail surveys. In October 2005, Hurricane Wilma severely damaged the inflow pump station (G200A) and rendered it inoperable. Due to relatively high costs to fix the outdated pump station, it was not repaired and ultimately it was demolished. To date, this pump station has not been replaced. However, since October 2005 limited surface water inflow has been available through the G-372HL box culvert. 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.

Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions and cross-references presented in this report.

Condition	Table	Narrative (pages)	Figure	Attachment
Specific Condition: Water Quality	B-1	---	B-1	B
Specific Condition: Sediment Quality	C-1	---	C-1	C
Specific Condition: Flows	D-1—D-5	---	---	D
Specific Condition: Stage	E-1—E-8	---	---	E
Specific Condition: Rainfall	F-1—F-3	---	---	F
Specific Condition: Evaporation	G-1	---	---	G
Annual Cattail Monitoring Report	Att. H, Tab. 1	App. 5-3-48 — 5-3-59	Att. H, Fig. 1—3	H

Attachment B: Surface Water Quality Data for Inflows and Outflows

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

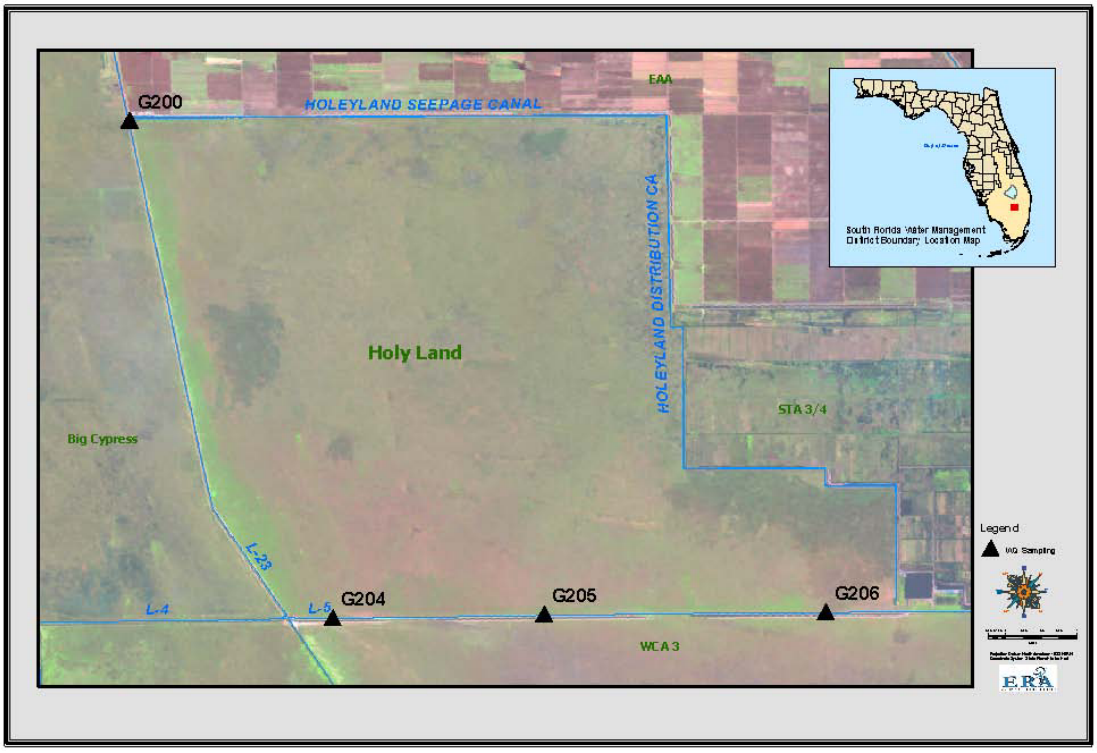

Figure B-1. Holey Land water quality monitoring locations.

Table B-1. Surface water quality data.

Sampling Station	Date and TimeCollected	Parameter Name	Value	Units
G200	10/14/2008 10:35:00 AM	Water Temperature	26.4	°C
G200	10/14/2008 10:35:00 AM	Specific Conductance	489	µS/cm
G200	10/14/2008 10:35:00 AM	Water pH	7.2	S.U.
G200	10/14/2008 10:35:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G200	10/14/2008 10:35:00 AM	Total Kjeldahl Nitrogen	1.68	mg/L
G200	10/14/2008 10:35:00 AM	Total Phosphorus	0.042	mg/L
G200	1/15/2009 11:29:00 AM	Water Temperature	19.4	°C
G200	1/15/2009 11:29:00 AM	Specific Conductance	554	µS/cm
G200	1/15/2009 11:29:00 AM	Water pH	7.7	S.U.
G200	1/15/2009 11:29:00 AM	Nitrate+Nitrite as N	0.146	mg/L
G200	1/15/2009 11:29:00 AM	Total Kjeldahl Nitrogen	1.25	mg/L
G200	1/15/2009 11:29:00 AM	Total Phosphorus	0.055	mg/L
G200	4/14/2009 11:03:00 AM	Water Temperature	23.7	°C
G200	4/14/2009 11:03:00 AM	Specific Conductance	544	µS/cm
G200	4/14/2009 11:03:00 AM	Water pH	7.9	S.U.
G200	4/14/2009 11:03:00 AM	Nitrate+Nitrite as N	0.194	mg/L
G200	4/14/2009 11:03:00 AM	Total Kjeldahl Nitrogen	1.14	mg/L
G200	4/14/2009 11:03:00 AM	Total Phosphorus	0.078	mg/L
G200	7/13/2009 11:45:00 AM	Water Temperature	29	°C

Sampling Station	Date and TimeCollected	Parameter Name	Value	Units
G200	7/13/2009 11:45:00 AM	Specific Conductance	389	µS/cm
G200	7/13/2009 11:45:00 AM	Water pH	7.3	S.U.
G200	7/13/2009 11:45:00 AM	Nitrate+Nitrite as N	0.026	mg/L
G200	7/13/2009 11:45:00 AM	Total Kjeldahl Nitrogen	1.46	mg/L
G200	7/13/2009 11:45:00 AM	Total Phosphorus	0.025	mg/L
G204	10/14/2008 10:00:00 AM	Water Temperature	25.1	°C
G204	10/14/2008 10:00:00 AM	Specific Conductance	261	µS/cm
G204	10/14/2008 10:00:00 AM	Water pH	6.8	S.U.
G204	10/14/2008 10:00:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G204	10/14/2008 10:00:00 AM	Total Kjeldahl Nitrogen	1.75	mg/L
G204	10/14/2008 10:00:00 AM	Total Phosphorus	0.028	mg/L
G204	1/15/2009 10:57:00 AM	Water Temperature	16.6	°C
G204	1/15/2009 10:57:00 AM	Specific Conductance	677	µS/cm
G204	1/15/2009 10:57:00 AM	Water pH	6.9	S.U.
G204	1/15/2009 10:57:00 AM	Nitrate+Nitrite as N	0.043	mg/L
G204	1/15/2009 10:57:00 AM	Total Kjeldahl Nitrogen	2.67	mg/L
G204	1/15/2009 10:57:00 AM	Total Phosphorus	0.149	mg/L
G204	4/14/2009 10:33:00 AM	Water Temperature	24.3	°C
G204	4/14/2009 10:33:00 AM	Specific Conductance	595	µS/cm
G204	4/14/2009 10:33:00 AM	Water pH	7.3	S.U.

Sampling Station	Date and TimeCollected	Parameter Name	Value	Units
G204	4/14/2009 10:33:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G204	4/14/2009 10:33:00 AM	Total Kjeldahl Nitrogen	2.35	mg/L
G204	4/14/2009 10:33:00 AM	Total Phosphorus	0.163	mg/L
G204	7/13/2009 11:01:00 AM	Water Temperature	26.4	°C
G204	7/13/2009 11:01:00 AM	Specific Conductance	449	µS/cm
G204	7/13/2009 11:01:00 AM	Water pH	6.9	S.U.
G204	7/13/2009 11:01:00 AM	Nitrate+Nitrite as N	0.012	mg/L
G204	7/13/2009 11:01:00 AM	Total Kjeldahl Nitrogen	4	mg/L
G204	7/13/2009 11:01:00 AM	Total Phosphorus	0.033	mg/L
G205	10/14/2008 9:45:00 AM	Water Temperature	25.6	°C
G205	10/14/2008 9:45:00 AM	Water pH	6.7	S.U.
G205	10/14/2008 9:45:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G205	10/14/2008 9:45:00 AM	Total Kjeldahl Nitrogen	1.47	mg/L
G205	10/14/2008 9:45:00 AM	Total Phosphorus	0.022	mg/L
G205	1/15/2009 10:41:00 AM	Water Temperature	18.8	°C
G205	1/15/2009 10:41:00 AM	Specific Conductance	643.7	µS/cm
G205	1/15/2009 10:41:00 AM	Water pH	7.5	S.U.
G205	1/15/2009 10:41:00 AM	Nitrate+Nitrite as N	0.146	mg/L
G205	1/15/2009 10:41:00 AM	Total Kjeldahl Nitrogen	2.02	mg/L
G205	1/15/2009 10:41:00 AM	Total Phosphorus	0.058	mg/L

Sampling Station	Date and TimeCollected	Parameter Name	Value	Units
G205	4/14/2009 10:07:00 AM	Water Temperature	24.7	°C
G205	4/14/2009 10:07:00 AM	Specific Conductance	584	µS/cm
G205	4/14/2009 10:07:00 AM	Water pH	8.1	S.U.
G205	4/14/2009 10:07:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G205	4/14/2009 10:07:00 AM	Total Kjeldahl Nitrogen	1.87	mg/L
G205	4/14/2009 10:07:00 AM	Total Phosphorus	0.095	mg/L
G205	7/13/2009 10:33:00 AM	Water Temperature	27.1	°C
G205	7/13/2009 10:33:00 AM	Specific Conductance	235	µS/cm
G205	7/13/2009 10:33:00 AM	Water pH	6.4	S.U.
G205	7/13/2009 10:33:00 AM	Nitrate+Nitrite as N	0.005	mg/L
G205	7/13/2009 10:33:00 AM	Total Kjeldahl Nitrogen	1.91	mg/L
G205	7/13/2009 10:33:00 AM	Total Phosphorus	0.026	mg/L
G206	10/14/2008 9:20:00 AM	Water Temperature	25.5	°C
G206	10/14/2008 9:20:00 AM	Water pH	6.1	S.U.
G206	10/14/2008 9:20:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G206	10/14/2008 9:20:00 AM	Total Kjeldahl Nitrogen	0.82	mg/L
G206	10/14/2008 9:20:00 AM	Total Phosphorus	0.009	mg/L
G206	1/15/2009 10:06:00 AM	Water Temperature	18.3	°C
G206	1/15/2009 10:06:00 AM	Specific Conductance	649.1	µS/cm
G206	1/15/2009 10:06:00 AM	Water pH	7.4	S.U.

Sampling Station	Date and TimeCollected	Parameter Name	Value	Units
G206	1/15/2009 10:06:00 AM	Nitrate+Nitrite as N	0.102	mg/L
G206	1/15/2009 10:06:00 AM	Total Kjeldahl Nitrogen	1.65	mg/L
G206	4/14/2009 9:26:00 AM	Water Temperature	24.7	°C
G206	4/14/2009 9:26:00 AM	Specific Conductance	654	µS/cm
G206	4/14/2009 9:26:00 AM	Water pH	7.9	S.U.
G206	4/14/2009 9:26:00 AM	Nitrate+Nitrite as N	0.062	mg/L
G206	4/14/2009 9:26:00 AM	Total Kjeldahl Nitrogen	1.44	mg/L
G206	4/14/2009 9:26:00 AM	Total Phosphorus	0.023	mg/L
G206	7/13/2009 9:46:00 AM	Water Temperature	27	°C
G206	7/13/2009 9:46:00 AM	Specific Conductance	117	µS/cm
G206	7/13/2009 9:46:00 AM	Water pH	6.6	S.U.
G206	7/13/2009 9:46:00 AM	Nitrate+Nitrite as N	<0.005	mg/L
G206	7/13/2009 9:46:00 AM	Total Kjeldahl Nitrogen	1.18	mg/L
G206	7/13/2009 9:46:00 AM	Total Phosphorus	0.017	mg/L

Attachment C: Sediment Data

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

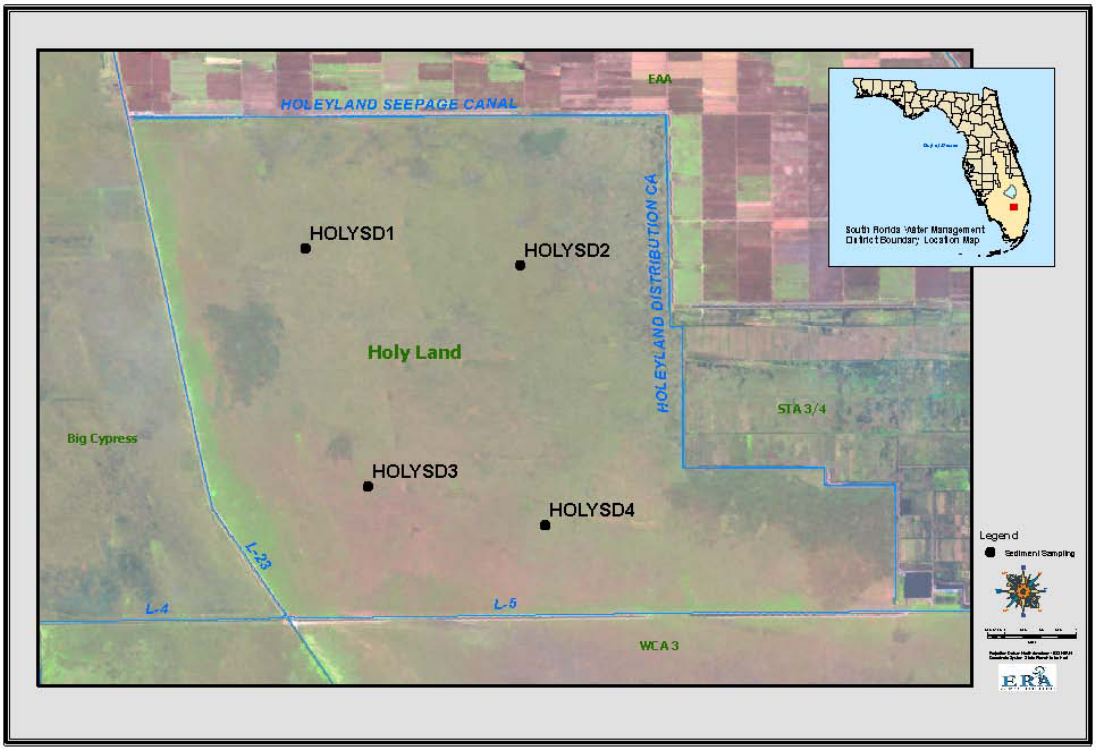

Figure C-1. Land sediment monitoring locations.

Table C-1. Sediment quality data**.**

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD1	5/20/2009 11:35:00 AM	Ametryn	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Atrazine	29	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Azinphos Methyl	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Alpha	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Beta	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Delta	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Gamma	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Bromacil	<25	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Carbophenothion	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlordane	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorothalonil	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorpyrifos Ethyl	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorpyrifos Methyl	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDD P,P'	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDE P,P'	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDT P,P'	<3.8	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Demeton	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Diazinon	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Dicofol	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Dieldrin	<1.3	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD1	5/20/2009 11:35:00 AM	Ametryn	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Atrazine	29	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Azinphos Methyl	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Alpha	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Beta	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Delta	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	BHC Gamma	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Bromacil	<25	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Carbophenothion	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlordane	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorothalonil	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorpyrifos Ethyl	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Chlorpyrifos Methyl	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDD P,P'	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDE P,P'	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	DDT P,P'	<3.8	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Demeton	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Diazinon	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Dicofol	<19	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Dieldrin	<1.3	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD1	5/20/2009 11:35:00 AM	Disulfoton	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Diuron	<23	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Endosulfan Alpha	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Endosulfan Beta	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Endosulfan Sulfate	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Endrin	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Endrin Aldehyde	<2.5	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Ethion	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Ethoprop	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Fenamiphos	<25	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Fonofos	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Heptachlor	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Heptachlor Epoxide	<1.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Hexazinone	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Linuron	<23	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Malathion	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Methoxychlor	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Metolachlor	<38	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Metribuzin	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Mevinphos	<25	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD1	5/20/2009 11:35:00 AM	Mirex	<5.1	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Monocrotophos	<63	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Naled	<51	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Norflurazon	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Parathion	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Parathion Methyl	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Phorate	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Prometryn	<13	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Simazine	<6.3	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Toxaphene	<95	µg/Kg
HOLYSD1	5/20/2009 11:35:00 AM	Trifluralin	<5.1	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Mercury	0.12	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Arsenic	5.24	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Cadmium	0.14	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Copper	7.53	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Lead	12.1	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Zinc	7.2	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Antimony	0.27	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Beryllium	0.17	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Chromium	5.99	mg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD2	5/20/2009 11:20:00 AM	Total Nickel	4.58	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Selenium	2.49	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Silver	0.026	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Total Thallium	0.054	mg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Acifluorfen	<27	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	2,4,5 T	<27	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	2,4,5 TP	<27	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	2,4 D	<27	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Alachlor	<42	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Aldrin	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Ametryn	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Atrazine	11	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Azinphos Methyl	<21	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	BHC Alpha	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	BHC Beta	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	BHC Delta	<2.8	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	BHC Gamma	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Bromacil	<28	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Carbophenothion	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Chlordane	<21	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD2	5/20/2009 11:20:00 AM	Chlorothalonil	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Chlorpyrifos Ethyl	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Chlorpyrifos Methyl	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	DDD P,P'	<2.8	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	DDE P,P'	<2.8	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	DDT P,P'	<4.2	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Demeton	<21	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Diazinon	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Dicofol	<21	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Dieldrin	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Disulfoton	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Diuron	<25	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Endosulfan Alpha	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Endosulfan Beta	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Endosulfan Sulfate	<2.8	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Endrin	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Endrin Aldehyde	<2.8	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Ethion	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Ethoprop	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Fenamiphos	<28	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD2	5/20/2009 11:20:00 AM	Fonofos	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Heptachlor	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Heptachlor Epoxide	<1.4	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Hexazinone	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Linuron	<25	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Malathion	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Methoxychlor	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Metolachlor	<42	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Metribuzin	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Mevinphos	<28	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Mirex	<5.6	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Monocrotophos	<70	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Naled	<56	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Norflurazon	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Parathion	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Parathion Methyl	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Phorate	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Prometryn	<14	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Simazine	<7	µg/Kg
HOLYSD2	5/20/2009 11:20:00 AM	Toxaphene	<110	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD2	5/20/2009 11:20:00 AM	Trifluralin	<5.6	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Mercury	0.18	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Arsenic	8.12	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Cadmium	0.22	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Copper	7.37	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Lead	19.6	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Zinc	11.1	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Antimony	0.3	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Beryllium	0.14	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Chromium	4.01	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Nickel	4.57	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Selenium	1.77	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Silver	0.027	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Total Thallium	<0.049	mg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Acifluorfen	<23	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	2,4,5 T	<23	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	2,4,5 TP	<23	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	2,4 D	<23	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Alachlor	<35	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Aldrin	<1.2	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD3	5/20/2009 11:45:00 AM	Ametryn	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Atrazine	13	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Azinphos Methyl	<18	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	BHC Alpha	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	BHC Beta	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	BHC Delta	<2.4	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	BHC Gamma	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Bromacil	<24	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Carbophenothion	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Chlordane	<18	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Chlorothalonil	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Chlorpyrifos Ethyl	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Chlorpyrifos Methyl	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	DDD P,P'	<2.4	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	DDE P,P'	<2.4	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	DDT P,P'	<3.5	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Demeton	<18	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Diazinon	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Dicofol	<18	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Dieldrin	<1.2	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD3	5/20/2009 11:45:00 AM	Disulfoton	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Diuron	<21	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Endosulfan Alpha	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Endosulfan Beta	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Endosulfan Sulfate	<2.4	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Endrin	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Endrin Aldehyde	<2.4	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Ethion	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Ethoprop	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Fenamiphos	<24	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Fonofos	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Heptachlor	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Heptachlor Epoxide	<1.2	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Hexazinone	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Linuron	<21	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Malathion	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Methoxychlor	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Metolachlor	<35	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Metribuzin	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Mevinphos	<24	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD3	5/20/2009 11:45:00 AM	Mirex	<4.7	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Monocrotophos	<59	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Naled	<47	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Norflurazon	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Parathion	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Parathion Methyl	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Phorate	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Prometryn	<12	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Simazine	<5.9	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Toxaphene	<88	µg/Kg
HOLYSD3	5/20/2009 11:45:00 AM	Trifluralin	<4.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Mercury	0.16	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Arsenic	3.71	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Cadmium	0.18	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Copper	6.68	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Lead	10	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Zinc	10.7	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Antimony	0.3	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Beryllium	0.12	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Chromium	3.51	mg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD4	5/20/2009 11:50:00 AM	Total Nickel	3.58	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Selenium	1.4	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Silver	0.022	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Total Thallium	<0.049	mg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Acifluorfen	<32	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	2,4,5 T	<32	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	2,4,5 TP	<32	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	2,4 D	<32	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Alachlor	<50	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Aldrin	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Ametryn	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Atrazine	8.8	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Azinphos Methyl	<25	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	BHC Alpha	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	BHC Beta	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	BHC Delta	<3.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	BHC Gamma	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Bromacil	<33	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Carbophenothion	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Chlordane	<25	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD4	5/20/2009 11:50:00 AM	Chlorothalonil	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Chlorpyrifos Ethyl	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Chlorpyrifos Methyl	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	DDD P,P'	<3.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	DDE P,P'	<3.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	DDT P,P'	<5	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Demeton	<25	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Diazinon	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Dicofol	<25	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Dieldrin	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Disulfoton	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Diuron	<30	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Endosulfan Alpha	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Endosulfan Beta	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Endosulfan Sulfate	<3.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Endrin	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Endrin Aldehyde	<3.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Ethion	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Ethoprop	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Fenamiphos	<33	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD4	5/20/2009 11:50:00 AM	Fonofos	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Heptachlor	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Heptachlor Epoxide	<1.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Hexazinone	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Linuron	<30	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Malathion	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Methoxychlor	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Metolachlor	<50	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Metribuzin	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Mevinphos	<33	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Mirex	<6.7	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Monocrotophos	<83	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Naled	<67	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Norflurazon	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Parathion	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Parathion Methyl	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Phorate	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Prometryn	<17	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Simazine	<8.3	µg/Kg
HOLYSD4	5/20/2009 11:50:00 AM	Toxaphene	<120	µg/Kg

Sampling Station	Date and Time Collected	Parameter Name	Value	Units
HOLYSD4	5/20/2009 11:50:00 AM	Trifluralin	<6.7	µg/Kg

Attachment D: Daily Flow Data

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

Table D-1. Holey Land hydrologic data monitoring sites.

Inflow Pump Station Volume (cfs-day)	Culverts Outflow Volume (cfs-day)	Stage Recorders (feet-NGVD)	Rain (inches)	Evaporation (inches)
G372HL_S*	G204_C G205_C G206_C	G203D HOLEY_G HOLEY1 HOLEY2 G204_H G204_T G205_H G205_T G206_H G206_T G373_T** G200A_T	S3_R S7_R S8_R	S7_E

* 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.

Data Tag Legend:

E - Estimated

P - Summary computed from partial record

X - Included in next amount marked 'A'

A - Accumulated

M - Missing

< - Less Than

Table D-2. Inflow into the Holey Land through G372HL_S (cfs) from October 2008–September 2009.

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 E	N	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00 E	N	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	N	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	N	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N	0.00
18	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00	0.00	N	0.00
19	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00	0.00	N	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	N	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	N	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	N E	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	N	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	N	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	N	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	N	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	N	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00 E	N	0.00	0.00	0.00
31	0.00		0.00	0.00		0.00		0.00 E		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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D-3. Outflow from the Holey Land through G204_C (cfs) from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00
2	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00
3	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00
4	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00
5	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E	0.00
6	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
7	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
8	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
9	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
10	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
11	0.00	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	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	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	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	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	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	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
18	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
19	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
20	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
21	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
22	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
23	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
24	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00	0.00 E	0.00	0.00
25	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
26	0.00	0.00 E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	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 E	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 E	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
30	0.00 E	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00 E	0.00	0.00
31	0.00 E		0.00	0.00		0.00		0.00		0.00 E	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table D-4. Outflow from the Holey Land through G205_C (cfs) from October 2008–September 2009.

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	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	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	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	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	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	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	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	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	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 E	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 E	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 E	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 E	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 E	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 E	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 E	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00 E	0.00
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00 E	0.00
31	0.00		0.00	0.00		0.00		0.00		0.00	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table D-5. Outflow from the Holey Land through G206_C (cfs) from October 2008–September 2009.

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 E
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00 E	0.00 E
31	0.00		0.00	0.00		0.00		0.00		0.00	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
Mea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Attachment E: Daily Stage Data

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

Table E-1. Tail water stage at G373_T from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.30	10.33	10.94	11.35	10.91	11.17	10.56	10.59	9.81	10.19	10.25	10.38
2	10.74	10.62	10.37	11.34	10.95	11.05	10.61	10.63	9.70	10.21	10.38	10.53
3	11.20	10.78	10.74	11.35	10.84	10.94	10.64	10.62	9.65	9.99	10.40	10.54
4	11.28	10.41	10.65	11.35	10.81	11.08	10.75	10.44	10.29	9.99	10.28	10.69
5	10.50	10.18	10.60	11.34	10.86	11.05	10.62	10.35	10.03	9.75	10.45	10.58
6	9.77	10.26	10.87	11.35	10.95	11.13	10.48	10.21	9.97	10.40	10.93	10.59
7	9.88	11.61	11.07	11.34	11.31	11.08	10.64	10.12	9.94	10.07	10.48	10.49
8	9.93	11.54	11.09	11.35	11.20	11.19	10.67	10.04	9.85	10.23	10.25	9.95
9	9.78	11.60	10.83	11.26	11.03	11.13	10.71	10.08	10.04	10.55	10.47	10.15
10	10.00	11.54	10.63	11.24	10.91	11.04	10.61	10.11	9.83	10.49	10.60	9.92
11	9.99	11.41	10.51	11.26	10.88	10.88	10.73	9.99	9.63	10.34	10.45	10.23
12	10.19	11.36	10.44	11.26	10.90	10.82	10.71	10.04	9.91	10.74	10.27	10.31
13	10.22	11.46	10.37	10.99	10.91	11.06	10.57	10.29	10.55	10.49	10.12	10.76
14	10.16	11.45	10.39	10.77	10.91	11.04	10.68	10.28	10.10	10.44	10.06	10.41
15	9.91	11.30	10.44	10.71	10.96	11.00	10.65	10.33	10.16	10.25	10.42	10.33
16	9.81	11.27	10.46	10.89	11.01	10.90	10.66	10.53	10.09	10.24	10.48	10.48
17	9.70	11.22	10.50	10.91	10.99	10.70	10.67	10.55	10.27	10.37	10.45	10.39
18	10.45	11.16	10.50	10.88	10.90	10.83	10.75	10.57	10.56	10.34	10.27	10.34
19	10.48	11.10	10.47	11.02	11.02	10.67	10.57	11.17	10.66	10.21	10.38	10.59
20	10.51	11.07	10.44	10.99	11.11	10.49	10.57	11.21	10.43	10.13	10.48	10.44
21	10.35	11.05	10.40	10.83	11.13	10.43	10.67	10.59	10.48	10.05	10.38	10.39
22	10.09	11.11	10.32	10.89	11.03	10.50	10.61	10.02	10.38	10.19	10.32	10.36
23	10.51	11.10	10.60	10.97	11.04	10.49	10.69	9.84	10.49	10.17	10.26	10.70
24	10.57	11.00	10.87	10.99	11.04	10.35	10.64	10.15	10.15	10.32	10.29	10.84
25	10.30	10.82	11.04	11.06	11.16	10.68	10.71	10.27	10.43	10.43	10.37	10.48
26	10.99 E	10.97	11.14	11.00	11.19	10.55	10.56	10.54	11.36	11.18	10.17	10.22
27	10.89	11.03	11.21	10.81	11.09	10.75	10.63	10.11	10.69	10.67	10.13	10.44
28	10.41	11.10	11.25	10.93	10.98	10.63	10.60	10.06	10.43	10.24	10.32	10.30
29	10.15	11.05	11.27	10.81		10.52	10.64	9.93	10.55	10.47	10.19	10.38
30	9.98	11.12	11.29	10.74		10.64	10.63	9.85	10.49	10.43	10.24	10.47
31	9.99		11.31	10.76		10.70		9.74		10.40	10.34	
Min	9.70	10.18	10.32	10.71	10.81	10.35	10.48	9.74	9.63	9.75	10.06	9.92
Max	11.28	11.61	11.31	11.35	11.31	11.19	10.75	11.21	11.36	11.18	10.93	10.84
Mean	10.29	11.07	10.74	11.06	11.00	10.82	10.64	10.30	10.23	10.32	10.35	10.42

Table E-2. Tail water stage at 200A_T from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.39	12.17	11.75	11.43	11.01	10.64	10.42	9.31	11.58	11.79	11.86	11.95
2	12.37	12.15	11.74	11.40	11.01	10.62	10.40	9.26	11.63	11.91	11.83	12.06
3	12.35	12.13	11.73	11.39	10.96	10.64	10.37	9.21	11.63	11.94	11.81	12.04
4	12.49	12.11	11.72	11.38	10.93	10.65	10.37	9.16	11.62	11.94	11.79	12.08
5	12.94	12.09	11.70	11.36	10.95	10.66	10.35	9.10	11.61	11.94	11.79	12.14
6	13.01	12.08	11.69	11.35	10.97	10.65	10.29	9.05	11.61	11.92	11.77	12.15
7	12.77	12.06	11.67	11.33	10.98	10.63	10.20	9.00	11.60	11.90	11.76	12.16
8	12.41	12.04	11.67	11.33	10.97	10.61	10.20	8.96	11.61	11.88	11.76	12.13
9	12.39	12.02	11.67	11.32	10.97	10.59	10.19	8.90	11.62	11.87	11.77	12.11
10	12.37	12.01	11.65	11.33	10.95	10.58	10.16	8.85	11.60	11.88	11.77	12.10
11	12.35	12.00	11.64	11.30	10.93	10.56	10.11	8.88	11.58	11.87	11.77	12.09
12	12.34	11.99	11.64	11.29	10.89	10.55	10.07	9.18	11.55	11.94	11.77	12.08
13	12.35	11.97	11.64	11.27	10.88	10.55	10.03	9.31	11.53	11.93	11.78	12.08
14	12.37	11.96	11.64	11.27	10.87	10.55	9.95	9.33	11.52	11.95	11.77	12.08
15	12.35	11.93	11.63	11.25	10.85	10.53	9.88	9.31	11.49	11.94	11.81	12.06
16	12.32	11.91	11.61	11.23	10.83	10.51	9.84	9.28	11.47	11.94	11.85	12.04
17	12.29	11.90	11.60	11.22	10.85	10.48	9.80	9.22	11.45	11.93	11.83	12.02
18	12.26	11.88	11.59	11.22	10.83	10.48	9.75	9.28	11.44	11.95	11.80	12.01
19	12.24	11.86	11.57	11.19	10.79	10.53	9.69	9.85	11.45	11.99	11.78	12.01
20	12.23	11.85	11.55	11.14	10.78	10.53	9.63	10.49	11.43	11.99	11.75	12.00
21	12.21	11.84	11.53	11.16	10.80	10.54	9.61	10.66	11.39	11.98	11.80	12.00
22	12.18	11.84	11.52	11.15	10.77	10.58	9.59	10.75	11.35	11.97	11.93 E	11.99
23	12.25	11.82	11.54	11.15	10.75	10.59	9.60	10.82	11.42	11.97	11.88	11.97
24	12.27	11.81	11.52	11.13	10.76	10.56	9.62	10.90	11.45	11.96	11.86	11.97
25	12.25	11.78	11.50	11.12	10.76	10.54	9.61	10.97	11.45	11.97	11.87	11.95
26	12.27	11.77	11.50	11.12	10.75	10.53	9.58	11.06	11.46	11.99	11.85	11.93
27	12.26	11.76	11.49	11.10	10.73	10.51	9.54	11.13	11.48	11.96	11.83	12.08
28	12.23	11.75	11.46	11.08	10.71	10.51	9.49	11.25	11.48	11.94	11.84	12.08
29	12.21	11.74	11.44	11.05		10.46	9.43	11.34	11.51	11.92	11.82	12.05
30	12.20	11.74	11.42	11.02		10.44	9.37	11.41	11.64	11.91	11.83	12.03
31	12.19		11.40	11.00		10.43		11.47		11.89	11.86	
Min	12.18	11.74	11.40	11.00	10.71	10.43	9.37	8.85	11.35	11.79	11.75	11.93
Max	13.01	12.17	11.75	11.43	11.01	10.66	10.42	11.47	11.64	11.99	11.93	12.16
Mean	12.36	11.93	11.59	11.23	10.87	10.56	9.90	9.89	11.52	11.93	11.81	12.05

Table E-3. Tail water stage at G206_H from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	11.95	11.22	10.96	11.32	10.88	11.15	10.56	10.55	11.08	10.75	10.29	10.36
2	12.05	11.34	10.44	11.33	10.91	11.06	10.60	10.58	10.92	11.06	10.37	10.66
3	12.12	11.41	10.73	11.33	10.86	10.94	10.63	10.56	10.75	11.25	10.41	10.69
4	12.24	11.02	10.65	11.34	10.82	11.07	10.75	10.41	10.75	11.47	10.28	11.20
5	12.39	10.69	10.60	11.34	10.85	11.01	10.63	10.34	10.48	11.48	10.43	11.27
6	12.30	10.66	10.84	11.33	10.93	11.10	10.52	10.19	10.41	11.53	10.91	11.10
7	12.17	11.78	11.06	11.35	11.24	11.06	10.66	10.10	10.33	11.16	10.53	11.39
8	12.09	11.77	11.09	11.36	11.18	11.17	10.65	10.01	10.29	10.80	10.24	11.07
9	11.99	11.80	10.80	11.26	11.01	11.10	10.69	10.07	10.49	10.91	10.44	11.13
10	11.94	11.77	10.61	11.22	10.88	11.03	10.57	10.10	10.22	10.92	10.69	10.84
11	11.88	11.68	10.50	11.26	10.83	10.87	10.72	9.98	10.03	10.70	10.65	10.98
12	11.94	11.61	10.48	11.25	10.89	10.79	10.70	10.01	10.14	11.22	10.58	10.95
13	11.86	11.66	10.40	11.00	10.90	11.02	10.53	10.27	10.53	11.02	10.30	11.34
14	11.79	11.64	10.39	10.78	10.90	11.01	10.67	10.24	10.09	10.74	10.11	11.19
15	11.64	11.51	10.44	10.71	10.96	10.96	10.66	10.29	10.14	10.52	10.48	10.92
16	11.40	11.48	10.46	10.89	11.01	10.89	10.65	10.48	9.80	10.42	10.55	10.92
17	11.10	11.39	10.49	10.91	10.96	10.70	10.64	10.51	9.97	10.55	10.43	10.75
18	11.58	11.32	10.50	10.86	10.85	10.81	10.71	10.54	10.56	10.50	10.24	10.54
19	11.54	11.26	10.47	11.01	11.00	10.67	10.55	11.18	10.65	10.41	10.42	10.88
20	11.48	11.19	10.44	11.02	11.10	10.50	10.55	11.17	10.42	10.35	10.59	10.81
21	11.27	11.15	10.42	10.82	11.11	10.44	10.67	10.66	10.48	10.23	10.46	10.70
22	10.93	11.18	10.36	10.87	11.03	10.49	10.60	10.72	10.44	10.36	10.37	10.67
23	11.69	11.16	10.57	10.95	11.03	10.47	10.66	11.00	10.50	10.38	10.45	10.90
24	11.84	11.06	10.83	10.98	11.00	10.32	10.59	11.00	10.15	10.49	10.42	11.09
25	11.73	10.91	11.00	11.04	11.12	10.62	10.66	10.36	10.47	10.57	10.69	10.78
26	12.13	11.03	11.11	10.98	11.14	10.50	10.50	11.09	11.28	11.22	10.51	10.44
27	12.06	11.06	11.18	10.76	11.06	10.71	10.58	10.81	10.81	10.91	10.46	10.98
28	11.91	11.11	11.23	10.89	10.96	10.59	10.55	10.89	10.55	10.41	10.46	11.13
29	11.61	11.04	11.27	10.79		10.53	10.60	10.96	10.68	10.54	10.29	11.25
30	11.25	11.10	11.30	10.75		10.62	10.59	11.04	10.77	10.51	10.25	11.30
31	11.01		11.31	10.76		10.68		11.08		10.46	10.30	
Min	10.93	10.66	10.36	10.71	10.82	10.32	10.50	9.98	9.80	10.23	10.11	10.36
Max	12.39	11.80	11.31	11.36	11.24	11.17	10.75	11.18	11.28	11.53	10.91	11.39
Mean	11.77	11.30	10.74	11.05	10.98	10.80	10.62	10.55	10.47	10.77	10.44	10.94

Table E-4. Tail water stage at G206_T from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.55	10.39	10.97	11.34	10.92	11.17	10.58	10.59	11.10	10.76	10.29	10.36 E
2	11.19	10.64	10.46	11.35	10.94	11.09	10.62	10.62	10.95	10.99	10.38	10.63 E
3	11.56	10.79	10.76	11.36	10.90	10.97	10.66	10.60	10.76	11.11	10.43	10.65 E
4	11.67	10.45	10.68	11.36	10.86	11.09	10.78	10.44	10.76	11.28	10.31	10.93 E
5	11.44	10.21	10.63	11.36	10.89	11.04	10.66	10.37	10.50	11.23	10.45 E	10.80 E
6	10.76	10.31	10.88	11.35	10.96	11.12	10.54	10.23	10.43	11.26	10.93 E	10.63 E
7	10.12	11.63	11.08	11.37	11.26	11.08	10.68	10.14	10.36	10.87	10.55 E	10.84 E
8	10.18	11.57	11.11	11.38	11.20	11.19	10.68	10.05	10.33	10.60	10.26 E	10.50 E
9	10.00	11.64	10.84	11.29	11.03	11.13	10.72	10.11	10.53	10.62	10.46 E	10.52 E
10	10.17	11.59	10.63	11.24	10.91	11.05	10.60	10.14	10.26	10.55	10.69 E	10.25 E
11	10.03	11.44	10.52	11.29	10.86	10.90	10.76	10.02	10.07	10.47	10.63 E	10.44 E
12	10.16	11.37	10.50	11.28	10.92	10.83	10.74	10.05	10.18	10.84	10.54 E	10.45 E
13	10.18	11.50	10.42	11.02	10.93	11.04	10.56	10.30	10.57	10.77	10.26 E	10.80 E
14	10.13	11.48	10.40	10.82	10.93	11.04	10.71	10.28	10.13	10.56	10.11 E	10.55 E
15	9.96	11.35	10.45	10.74	10.99	10.99	10.70	10.32	10.18	10.40	10.48 E	10.42 E
16	9.86	11.35	10.48	10.92	11.04	10.92	10.69	10.52	9.85	10.34	10.54 E	10.52 E
17	9.79	11.29	10.52	10.94	10.99	10.73	10.67	10.55	10.01	10.49	10.42 E	10.41 E
18	10.50	11.24	10.52	10.90	10.89	10.84	10.75	10.58	10.60	10.43	10.25 E	10.30 E
19	10.53	11.20	10.49	11.03	11.03	10.70	10.58	11.23	10.69	10.30	10.43 E	10.68 E
20	10.53	11.14	10.46	11.04	11.12	10.52	10.58	11.22	10.46	10.22	10.60 E	10.58 E
21	10.39	11.12	10.44	10.86	11.13	10.45	10.71	10.71	10.52	10.11	10.48 E	10.49 E
22	10.14	11.16	10.37	10.90	11.05	10.51	10.64	10.76	10.48	10.26	10.39 E	10.50 E
23	10.50	11.15	10.59	10.98	11.06	10.49	10.70	11.05	10.54	10.30	10.46 E	10.76 E
24	10.59	11.06	10.87	11.01	11.03	10.33	10.62	11.05	10.19	10.43	10.42 E	10.95 E
25	10.36	10.92	11.03	11.06	11.14	10.65	10.70	10.40	10.51	10.51	10.69 E	10.65 E
26	11.06	11.04	11.14	11.01	11.16	10.53	10.53	11.14	11.33	11.17	10.51 E	10.35 E
27	11.03	11.07	11.20	10.80	11.08	10.74	10.62	10.86	10.86	10.84	10.45 E	10.55 E
28	10.63	11.12	11.25	10.93	10.99	10.61	10.58	10.93	10.59	10.36	10.45 E	10.56 E
29	10.24	11.06	11.29	10.82		10.55	10.63	10.99	10.72	10.50	10.29 E	10.71 E
30	10.04	11.11	11.32	10.78		10.64	10.62	11.07	10.81	10.48	10.25 E	10.85 E
31	10.02		11.33	10.80		10.71		11.11		10.44	10.31 E	
Min	9.79	10.21	10.37	10.74	10.86	10.33	10.53	10.02	9.85	10.11	10.11	10.25
Max	11.67	11.64	11.33	11.38	11.26	11.19	10.78	11.23	11.33	11.28	10.93	10.95
Mean	10.46	11.11	10.76	11.07	11.01	10.83	10.65	10.59	10.51	10.63	10.44	10.59

Table E-5. Tail water stage at G205_H from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.33	12.09	10.95	11.33	10.90	11.15	10.56	10.58	10.37	10.48	10.25	10.36
2	12.32	12.08	10.42	11.33	10.92	11.06	10.60	10.62	10.24	10.89	10.36	10.55
3	12.30	12.06	10.74	11.34	10.86	10.95	10.63	10.60	10.12	11.04	10.40	10.61
4	12.36	12.03	10.65	11.34	10.82	11.08	10.77	10.43	10.47	10.88	10.29	11.33
5	12.44	11.99	10.60	11.33	10.86	11.03	10.64	10.35	10.23	10.55	10.45	11.51
6	12.42	11.94	10.85	11.33	10.94	11.11	10.50	10.21	10.16	10.89	10.93	11.50
7	12.39	11.99	11.06	11.34	11.26	11.07	10.66	10.12	10.11	10.47	10.50	11.92
8	12.36	12.00	11.09	11.35	11.18	11.17	10.67	10.03	10.04	10.37	10.24	11.85
9	12.34	11.99	10.82	11.27	11.02	11.11	10.70	10.09	10.25	10.57	10.44	11.81
10	12.32	11.97	10.61	11.23	10.89	11.04	10.59	10.12	10.02	10.62	10.61	11.56
11	12.30	11.95	10.50	11.26	10.85	10.88	10.74	10.00	9.83	10.42	10.51	11.56
12	12.30	11.93	10.46	11.25	10.89	10.81	10.72	10.03	10.02	10.87	10.37	11.51
13	12.28	11.92	10.39	10.99	10.91	11.04	10.55	10.29	10.56	10.68	10.16	11.88
14	12.27	11.90	10.38	10.79	10.91	11.02	10.68	10.27	10.12	10.51	10.07	11.82
15	12.26	11.86	10.43	10.71	10.96	10.98	10.66	10.31	10.17	10.31	10.42	11.67
16	12.24	11.81	10.45	10.90	11.01	10.90	10.67	10.52	9.84	10.26	10.48	11.63
17	12.21	11.68	10.49	10.92	10.97	10.71	10.67	10.55	9.99	10.40	10.42	11.42
18	12.19	11.42	10.50	10.87	10.87	10.83	10.75	10.57	10.58	10.36	10.24	11.10
19	12.17	11.27	10.46	11.00	11.00	10.68	10.57	11.20	10.68	10.25	10.38	11.21
20	12.15	11.17	10.43	11.00	11.10	10.51	10.56	11.21	10.44	10.26	10.50	11.02
21	12.13	11.11	10.40	10.83	11.12	10.44	10.68	10.73	10.49	10.12	10.40	11.25
22	12.10	11.14	10.34	10.88	11.03	10.50	10.62	10.34	10.42	10.22	10.32 E	11.19
23	12.16	11.12	10.58	10.96	11.04	10.48	10.69	10.38	10.51	10.22	10.21 E	11.15
24	12.21	11.04	10.85	10.98	11.02	10.33	10.62	10.52	10.18	10.36	10.25 E	11.39
25	12.21	10.87	11.02	11.05	11.14	10.65	10.70	10.32	10.46	10.45	10.34 E	11.15
26	12.28	11.01	11.13	10.99	11.16	10.52	10.54	10.78	11.33	11.16	10.14 E	10.53
27	12.25	11.04	11.19	10.78	11.07	10.73	10.62	10.40	10.73	10.73	10.08 E	11.52
28	12.21	11.10	11.23	10.91	10.97	10.60	10.59	10.41	10.48	10.27	10.29 E	11.58
29	12.17	11.04	11.26	10.80		10.52	10.63	10.37	10.57	10.45	10.16 E	11.73
30	12.14	11.10	11.29	10.75		10.63	10.62	10.36	10.56	10.42	10.21 E	11.59
31	12.11		11.30	10.78		10.69		10.33		10.40	10.31 E	
Min	12.10	10.87	10.34	10.71	10.82	10.33	10.50	10.00	9.83	10.12	10.07	10.36
Max	12.44	12.09	11.30	11.35	11.26	11.17	10.77	11.21	11.33	11.16	10.93	11.92
Mean	12.26	11.59	10.74	11.05	10.99	10.81	10.64	10.42	10.33	10.51	10.35	11.36

Table E-6. Tail water stage at G205_T from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.42	10.38	10.97	11.35	10.93	11.18	10.59	10.61	10.38	10.37	10.26	10.39
2	10.93	10.65	10.44	11.35	10.95	11.08	10.63	10.65	10.25	10.49	10.38	10.58
3	11.35	10.80	10.77	11.36	10.89	10.98	10.66	10.63	10.13	10.42	10.42	10.58
4	11.44	10.45	10.69	11.36	10.85	11.10	10.79	10.46	10.49	10.51	10.30	10.79
5	10.90	10.21	10.63	11.36	10.89	11.05	10.67	10.38	10.24	10.36	10.47	10.66
6	10.21	10.31	10.88	11.36	10.97	11.13	10.53	10.24	10.17	10.74	10.95	10.58
7	9.99	11.64	11.08	11.36	11.29	11.09	10.69	10.15	10.13	10.38	10.52	10.62
8	10.05	11.56	11.11	11.37	11.20	11.20	10.70	10.06	10.06	10.38	10.26	10.18
9	9.89	11.63	10.85	11.29	11.04	11.13	10.73	10.12	10.26	10.58	10.47	10.28
10	10.09	11.58	10.64	11.25	10.92	11.06	10.62	10.15	10.03	10.51	10.64	10.05
11	10.03	11.45	10.53	11.28	10.88	10.91	10.77	10.03	9.84	10.40	10.53	10.31
12	10.19	11.38	10.49	11.27	10.93	10.84	10.75	10.06	10.05	10.78	10.38	10.34
13	10.20	11.49	10.42	11.01	10.94	11.06	10.58	10.32	10.59	10.61	10.18	10.76
14	10.15	11.48	10.41	10.82	10.94	11.05	10.71	10.30	10.14	10.49	10.10	10.46
15	9.95	11.34	10.46	10.75	10.99	11.00	10.69	10.34	10.19	10.32	10.44	10.37
16	9.86	11.35	10.48	10.93	11.04	10.93	10.70	10.54	9.86	10.28	10.51	10.49
17	9.75	11.29	10.53	10.95	11.00	10.73	10.70	10.57	10.02	10.42	10.44	10.41
18	10.49	11.23	10.52	10.90	10.90	10.86	10.77	10.59	10.61	10.38	10.27	10.35
19	10.53	11.19	10.49	11.03	11.03	10.71	10.60	11.22	10.70	10.25	10.41	10.63
20	10.54	11.13	10.47	11.03	11.13	10.54	10.59	11.23	10.47	10.18	10.53	10.51
21	10.39	11.11	10.44	10.86	11.14	10.47	10.71	10.65	10.53	10.08	10.43	10.45
22	10.14	11.16	10.37	10.91	11.05	10.53	10.65	10.33	10.46	10.23	10.34 E	10.45
23	10.52	11.14	10.62	10.99	11.06	10.51	10.72	10.35	10.54	10.23	10.22 E	10.74
24	10.58	11.05	10.88	11.01	11.04	10.36	10.65	10.53	10.20	10.38	10.27 E	10.89
25	10.35	10.90	11.04	11.07	11.16	10.68	10.73	10.34	10.49	10.47	10.36 E	10.58
26	11.04	11.03	11.15	11.02	11.19	10.55	10.57	10.80	11.35	11.19	10.16 E	10.32
27	10.96	11.06	11.21	10.81	11.09	10.75	10.65	10.43	10.75	10.73	10.10 E	10.50
28	10.53	11.12	11.26	10.93	10.99	10.63	10.62	10.43	10.50	10.29	10.31 E	10.43
29	10.21	11.06	11.29	10.83		10.55	10.66	10.39	10.59	10.46	10.18 E	10.54
30	10.02	11.11	11.32	10.78		10.66	10.65	10.38	10.57	10.43	10.23 E	10.65
31	10.01		11.33	10.81		10.72		10.34		10.41	10.34 E	
Min	9.75	10.21	10.37	10.75	10.85	10.36	10.53	10.03	9.84	10.08	10.10	10.05
Max	11.44	11.64	11.33	11.37	11.29	11.20	10.79	11.23	11.35	11.19	10.95	10.89
Mean	10.38	11.11	10.77	11.08	11.02	10.84	10.67	10.44	10.35	10.44	10.37	10.50

Table E-7. Tail water stage at G204_H from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.32	12.06 E	11.53	11.14	10.69	10.94	10.35	10.39	11.59	11.99 E	10.90 E	10.33
2	12.30	12.05 E	11.44	11.14	10.72	10.86	10.39	10.42	11.34	12.01 E	10.69 E	10.60
3	12.27	12.04 E	11.29	11.15	10.65	10.73	10.42	10.40	10.88	11.98 E	10.62 E	10.78
4	12.31	12.01 E	11.22	11.15	10.61	10.87	10.56	10.23	10.86	11.93 E	10.47 E	11.50
5	12.38	11.97 E	11.07	11.14	10.66	10.83	10.43	10.16	10.75	11.86 E	10.44 E	11.99
6	12.36	11.91 E	10.97	11.14	10.75	10.91	10.28	10.01	10.67	11.79 E	10.87	12.03
7	12.34	11.97 E	10.95	11.14	11.08	10.86	10.44	9.92	10.63	11.55 E	10.65	12.04
8	12.31	11.97 E	10.99	11.15	10.98	10.97	10.46	9.82	10.88	11.16 E	10.37	12.00
9	12.29	11.96 E	10.86	11.07	10.83	10.91	10.50	9.88	11.55	11.29 E	10.55	11.97
10	12.27	11.95 E	10.72	11.03	10.69	10.84	10.39	9.91	11.26	11.88 E	10.70	11.92
11	12.26	11.92 E	10.67	11.06	10.67	10.68	10.52	9.80	10.79	11.83 E	10.56	11.90
12	12.24	11.90 E	10.74	11.06	10.69	10.61	10.52	9.88	10.46	11.92 E	10.47	11.91
13	12.23	11.89 E	10.66	10.79	10.70	10.82	10.35	10.10	11.03	11.90 E	10.07	12.00
14	12.23	11.88 E	10.61	10.59	10.70	10.82	10.46	10.09	11.61	11.85 E	10.03	11.98
15	12.22	11.84 E	10.60	10.51	10.75	10.76	10.45	10.13	11.25	11.79 E	10.40	11.94
16	12.21	11.78 E	10.59	10.69	10.81	10.71	10.46	10.33	10.83	11.88 E	10.45	11.91
17	12.18	11.69 E	10.58	10.71	10.78	10.50	10.47	10.35	10.69	11.91 E	10.39	11.85
18	12.17	11.61 E	10.58	10.66	10.66	10.62	10.55	10.37	10.79	11.98 E	10.20	11.76
19	12.15	11.57 E	10.56	10.79	10.79	10.49	10.37	11.01	10.97	11.96 E	10.31	11.70
20	12.13	11.53 E	10.52	10.79	10.90	10.31	10.35	11.03	10.70	11.94 E	10.42	11.62
21	12.11	11.51 E	10.48	10.63	10.92	10.24	10.46	10.83	10.58	11.88 E	10.31	11.72
22	12.09	11.50 E	10.44	10.67	10.82	10.31	10.41	10.40	10.56	11.85 E	10.25	11.81
23	12.12	11.49 E	10.44	10.76	10.83	10.30	10.49	10.57	10.76	11.92 E	10.18	11.81
24	12.14	11.48 E	10.65	10.78	10.83	10.15	10.43 E	10.68	11.03	11.89 E	10.21	11.89
25	12.15	11.43 E	10.82	10.84	10.94	10.45	10.50	10.63	10.65	11.85 E	10.37	11.84
26	12.20	11.41 E	10.93	10.80	10.97	10.32	10.35	11.04	11.16	11.84 E	10.14	11.70
27	12.18	11.38	11.00	10.59	10.88	10.52	10.43	10.80	10.87	11.83 E	10.09	11.85
28	12.16	11.35	11.04	10.70	10.76	10.40	10.39	11.41	10.73	11.65 E	10.26	11.90
29	12.13	11.30	11.07	10.59		10.31	10.43	11.61	11.35	11.47 E	10.19	11.87
30	12.11 E	11.31	11.10	10.56		10.42	10.42	11.67	11.85	11.32 E	10.19	11.84
31	12.08 E		11.11	10.57		10.49		11.60		11.16 E	10.27	
Min	12.08	11.30	10.44	10.51	10.61	10.15	10.28	9.80	10.46	11.16	10.03	10.33
Max	12.38	12.06	11.53	11.15	11.08	10.97	10.56	11.67	11.85	12.01	10.90	12.04
Mean	12.21	11.72	10.85	10.85	10.79	10.61	10.43	10.50	10.97	11.78	10.39	11.73

Table E-8. Tail water stage at G204_T from October 2008–September 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.32	10.32	10.89	11.30	10.86	11.12	10.51	10.55	9.88	10.09	10.17	10.31
2	10.78	10.57	10.34	11.29	10.88	11.01	10.55	10.58	9.76	10.14	10.30	10.44
3	11.21	10.72	10.69	11.30	10.81	10.91	10.58	10.56	9.70	9.96	10.33	10.45
4	11.30	10.39	10.61	11.30	10.77	11.04	10.72	10.38	10.27	9.99	10.22	10.62
5	10.54	10.18	10.55	11.30	10.82	11.00	10.59	10.31	10.02	9.79	10.40	10.48
6	9.85	10.28	10.81	11.29	10.90	11.08	10.43	10.17	9.95	10.37	10.89	10.46
7	9.89	13.28 E	11.02	11.29	11.25	11.03	10.60	10.08	9.92	10.04	10.42	10.40
8	9.94	11.55 E	11.04	11.31	11.15	11.14	10.62	9.99	9.84	10.18	10.17	9.91
9	9.79	11.62 E	10.78	11.23	10.99	11.08	10.66	10.05	10.04	10.48	10.38	10.06
10	10.01	11.56 E	10.57	11.19	10.86	11.00	10.54	10.07	9.82	10.40	10.53	9.84
11	10.00	11.43 E	10.44	11.22	10.81	10.84	10.68	9.95	9.62	10.27	10.40	10.14
12	10.17	11.37 E	10.40	11.21	10.85	10.78	10.67	9.99	9.90	10.67	10.21	10.18
13	10.18	11.46 E	10.34	10.94	10.87	11.01	10.51	10.25	10.51	10.44	10.06	10.64
14	10.13	11.45 E	10.34	10.74	10.87	10.99	10.62	10.23	10.06	10.36	10.00	10.31
15	9.91	11.30 E	10.39	10.66	10.92	10.94	10.61	10.28	10.11	10.19	10.34	10.23
16	9.82	11.31 E	10.40	10.86	10.98	10.86	10.63	10.48	9.78	10.16	10.41	10.38
17	9.70	11.24 E	10.45	10.88	10.94	10.66	10.63	10.51	9.94	10.29	10.36	10.31
18	10.46	11.18 E	10.45	10.83	10.83	10.79	10.71	10.52	10.53	10.26	10.19	10.27
19	10.49	11.14 E	10.42	10.96	10.96	10.63	10.52	11.15	10.63	10.13	10.31	10.50
20	10.51	11.08 E	10.39	10.95	11.07	10.46	10.51	11.17	10.39	10.06	10.40	10.36
21	10.36	11.05 E	10.35	10.78	11.09	10.39	10.63	10.54	10.45	9.98	10.31	10.33
22	10.10	11.11 E	10.29	10.84	10.99	10.46	10.57	10.03	10.36	10.12	10.24	10.31
23	10.51	11.08 E	10.55	10.92	11.00	10.45	10.64	9.90	10.45	10.11	10.18	10.64
24	10.54	10.98 E	10.81	10.95	10.98	10.30	10.59 E	10.17	10.11	10.27	10.23	10.76
25	10.29	10.81 E	10.98	11.01	11.11	10.62	10.66	10.24	10.40	10.37	10.33	10.43
26	10.96	10.96 E	11.10	10.95	11.14	10.48	10.51	10.54	11.29	11.13	10.13	10.18
27	10.85	11.00	11.16	10.74	11.04	10.68	10.58	10.12	10.61	10.59	10.07	10.37
28	10.42	11.06	11.20	10.87	10.93	10.55	10.56	10.07	10.37	10.17	10.27	10.24
29	10.15	11.00	11.23	10.75		10.47	10.60	9.98	10.45	10.37	10.13	10.34
30	9.99	11.05	11.25	10.70		10.59	10.58	9.90	10.36	10.33	10.18	10.43
31	9.99		11.26	10.73		10.64		9.82		10.32	10.26	
Min	9.70	10.18	10.29	10.66	10.77	10.30	10.43	9.82	9.62	9.79	10.00	9.84
Max	11.30	13.28	11.26	11.31	11.25	11.14	10.72	11.17	11.29	11.13	10.89	10.76
Mean	10.30	11.12	10.69	11.01	10.95	10.77	10.59	10.28	10.18	10.26	10.28	10.34

Attachment F: Daily Rainfall Data

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

Table F-1. Rainfall at S3_R from October 1, 2008–September 30, 2009.

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	0.01	0.48	0.08	0.11
2	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.76	0.00	0.06
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.01
4	0.12	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.31	0.01	0.00	0.10
5	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.17
6	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.07	1.07	0.01
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
10	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.08
11	0.01	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.01	0.00
12	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.38
13	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.01	0.34
14	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.00	0.00	0.03	0.00	0.01
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.16	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	0.30	0.00	4.24	0.20	0.00	0.02	0.02
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.45	0.05	0.04
20	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.01	0.26
21	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.86	0.00	0.00	4.03	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.01	1.41
23	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.06	2.38	0.00	0.01	0.00
24	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.01	0.05	0.01
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.05	0.02	0.00
26	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.33	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.01	0.00	0.64	0.42
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.01	0.15	0.05	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.14	0.99	0.22	0.11	0.00
30	0.00	0.10	0.00	0.10		0.00	0.00	0.59	0.38	0.00	0.02	0.00
31	0.00		0.00	0.00		0.10		0.02		0.00	0.06	
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	1.88	0.10	0.30	0.10	0.00	0.30	1.29	4.24	2.38	0.76	4.03	1.41
Mea	0.09	0.00	0.01	0.01		0.01	0.05	0.31	0.21	0.11	0.23	0.11

Table F-2. Rainfall at S7_R from October 1, 2008–September 30, 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.50	0.46	0.00	0.40
2	0.00	0.00	0.02	0.00	0.20	0.00	0.00	0.00	0.00	0.56	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.02	0.01	2.61
4	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.31
5	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.01
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.08	0.00	0.17
7	0.00	0.00	0.02	0.10	0.00	0.00	0.00	0.00	0.07	0.00	0.15	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.20	0.00	0.03
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.86	0.00	0.59
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	1.39
11	0.00	0.02	0.34	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.47	0.22
12	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.10	1.73	0.01	0.12	0.05
13	0.20	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.03	0.66
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
15	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	1.66	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
18	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.60	0.13	0.20	0.00	0.00
19	0.00	0.00	0.01	0.00	0.00	0.00	0.00	1.42	0.01	1.06	0.15	0.41
20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.01	0.00	0.16
21	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.13	0.00	0.12	0.03	0.06
22	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.23	0.05	0.00
23	1.06	0.00	0.00	0.00	0.00	0.20	0.00	0.06	1.57	0.37	0.47	0.11
24	0.03	0.00	0.12	0.00	0.00	0.00	0.00	0.40	0.00	0.11	0.09	0.83
25	0.71	0.00	0.00	0.00 E	0.00	0.00	0.00	0.10	0.00	0.02	0.35	0.01
26	0.01	0.00	0.00	0.00 E	0.00	0.00	0.00	0.10	0.19	0.01	0.00	0.03
27	0.57	0.00	0.00	0.00 E	0.00	0.00	0.00	0.30	0.00	0.04	0.00	0.39
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.23	0.01	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.90	1.16	0.01	0.08	0.01
30	0.00	0.30	0.00	0.10		0.00	0.00	0.00	2.76	0.01	0.10	0.00
31	0.00		0.00	0.00		0.00		0.70		0.00	0.43	
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	1.14	0.30	0.34	0.10	0.20	0.70	0.20	1.42	2.76	1.86	1.66	2.61
Mean	0.14	0.01	0.02	0.01	0.01	0.04	0.01	0.20	0.41	0.21	0.14	0.28

Table F-3. Rainfall at S8_R from October 1, 2008–September 30, 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.10	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.19	0.66	0.01	0.76
2	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.03	0.23	0.00	0.06
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	1.10
4	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.75
5	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.06	0.01	0.23
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.04	0.02	0.62
7	0.00	0.00	0.04	0.10	0.00	0.00	0.00	0.00	0.07	0.01	0.00	0.01
8	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.59	0.00	0.33	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53	0.02	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.05	0.43
11	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.80	0.00	0.91	0.11	0.00
12	0.00	0.01	0.00	0.00	0.00	0.00	0.00	3.32	0.28	0.00	0.14	0.58
13	0.12	0.00	0.00	0.10	0.00	0.00	0.00	0.00	1.89	0.00	0.00	0.20
14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.01	0.00	0.00	0.00
15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.84	0.65	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.01	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.10	1.15	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.10	0.00	1.22	0.18	0.31	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.20	0.00	1.87	0.01	0.28	0.10	0.49
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.07
21	0.00	0.00	0.00	0.00	0.00	0.30	0.10	1.05	0.19	0.01	1.17	0.13
22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.01	0.68	0.06	0.00
23	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.81	1.23	0.34	0.11	0.18
24	0.07	0.00	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.11	1.40	0.02
25	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.05	0.00	0.00
26	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.35	0.04	0.06	0.18
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.01	0.01	0.19	0.62
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.90	0.00	0.28	0.25
29	0.00	0.00	0.00	0.00		0.00	0.00	0.53	1.93	0.02	0.01	0.00
30	0.00	0.45	0.00	0.10		0.00	0.00	0.41	1.35	0.00	0.25	0.00
31	0.00		0.00	0.00		0.00		0.64		0.01	0.75	
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	1.75	0.45	0.40	0.10	0.20	0.30	0.10	3.32	1.93	1.53	1.40	1.10
Mean	0.12	0.02	0.02	0.01	0.01	0.02	0.00	0.45	0.37	0.24	0.19	0.22

Attachment G: Evaporation Data

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

Table G-1. Evaporation S7_E from October 1, 2008–September 30, 2009.

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.07	X	0.64 A	N	N	X	0.23	0.27	0.21	M	0.28	0.28
2	0.20	X	1.75	N	0.43 A	0.61 A	0.29	X	0.23	0.30	0.22	0.23
3	0.20	0.50 A	0.14	N	0.14	0.24	0.25	X	0.17	0.19	0.30	0.14
4	0.23	0.02	0.08	N	0.25	0.19	X	0.84 A	0.28	0.20	0.29	M
5	0.19	0.09	0.11	0.59	0.24	X	X	0.30	0.17	0.23	0.24	0.11
6	0.13	0.22	X	0.09	0.16	0.33 A	0.69 A	0.27	0.35	0.26	0.20	0.03
7	0.18	0.09	X	0.12	X	X	0.43	0.28	0.39	0.30	0.23	0.32
8	0.22	X	0.34 A	0.16	X	X	0.33	0.27	0.14	0.36	0.13	0.24
9	0.18	X	0.10	0.14	0.44 A	0.50 A	0.22	X	0.30	0.27	0.23	0.17
10	0.16	0.45 A	0.12	X	0.16	0.21	0.24	X	0.20	M	0.23	0.28
11	0.26	X	0.14	X	0.14	0.22	X	0.96 A	0.20	0.19	0.19	0.40
12	0.14	0.27 A	0.05	0.36 A	0.19	0.22	X	0.15	0.29	M	0.23	0.20
13	0.15	0.12	X	0.12	0.16	0.18	0.68 A	0.37	0.65	0.30	0.16	0.17
14	0.11	X	X	0.11	X	X	0.26	0.15	0.29	0.29	0.18	0.37
15	0.22	X	0.23 A	0.14	X	X	0.36	0.23	0.23	0.31	0.28	0.21
16	0.23	X	0.11	0.14	X	0.60 A	0.26	X	0.29	0.23	0.25	0.21
17	0.23	0.69 A	0.05	X	0.70 A	0.15	0.32	X	0.31	0.26	0.28	0.23
18	0.15	0.14	0.12	X	0.18	0.19	X	0.67 A	0.33	0.20	0.27	0.22
19	0.26	0.18	0.20	X	0.18	0.09	X	0.28	0.17	0.27	0.29	0.29
20	0.17	0.13	X	0.51 A	0.27	0.11	0.81 A	M	0.29	0.41	0.23	0.04
21	0.15	0.13	X	0.16	X	X	0.19	0.14	0.22	0.16	0.27	0.18
22	0.18	X	0.33 A	0.13	X	X	0.25	0.10	0.33	0.25	0.24	0.15
23	0.19	X	0.17	0.11	0.56 A	0.64 A	0.26	0.20	0.34	0.16	0.12	0.24
24	0.15	X	0.11	X	X	0.26	0.29	0.07	0.52	0.29	0.38	0.15
25	0.02	0.49 A	X	X	0.31 A	0.24	X	0.13	0.24	0.23	0.20	0.23
26	X	0.13	X	0.33 A	0.20	0.22	X	0.20	0.33	X	0.24	0.16
27	0.37 A	1.96	X	0.15	0.19	0.23	0.92 A	0.16	0.14	0.36 A	0.16	0.21
28	0.19	X	X	0.11	X	X	0.27	0.22	0.22	0.22	0.22	0.20
29	0.22	X	0.29 A	0.14		X	0.31	0.05	0.17	0.20	0.29	0.14
30	0.21	X	0.34	N		0.57 A	0.28	M	0.33	0.14	0.22	0.25
31	0.06		N	N		0.15		0.21		0.08	0.16	
Min	0.02	0.02	0.05	0.09	0.14	0.09	0.19	0.05	0.14	0.08	0.12	0.03
Max	0.37	1.96	1.75	0.59	0.70	0.64	0.92	0.96	0.65	0.41	0.38	0.40
Mean	0.18	0.35	0.27	0.20	0.27	0.29	0.37	0.28	0.28	0.25	0.23	0.21

Attachment H: Holey Land Wildlife Management Area 2009 Annual Cattail Monitoring Report

Note: This document, dated June 2010, was provided to the South Florida Water Management District by the Florida Fish and Wildlife Conservation Commission.

HOLEY LAND WILDLIFE MANAGEMENT AREA
2009 ANNUAL CATTAIL MONITORING REPORT

Jennifer Ketterlin
Biological Scientist III

Florida Fish and Wildlife Commission
Sunrise, Florida
June 1, 2010

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). 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 a significant change 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 2009 survey estimate that 17.3% 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 6,108 acres. This indicates a higher percentage of coverage than in 2008 but is significantly less than estimated cattail coverage in 2004 and is almost half of what was estimated in 2000.

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 2007 and the early part of 2008. The latter part of 2008 did experience higher than average water levels which may have resulted in the increased health and detectability of the species in the 2009 survey (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, 1991-2009

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
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
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 (5,104-7,074)	17.3

[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.

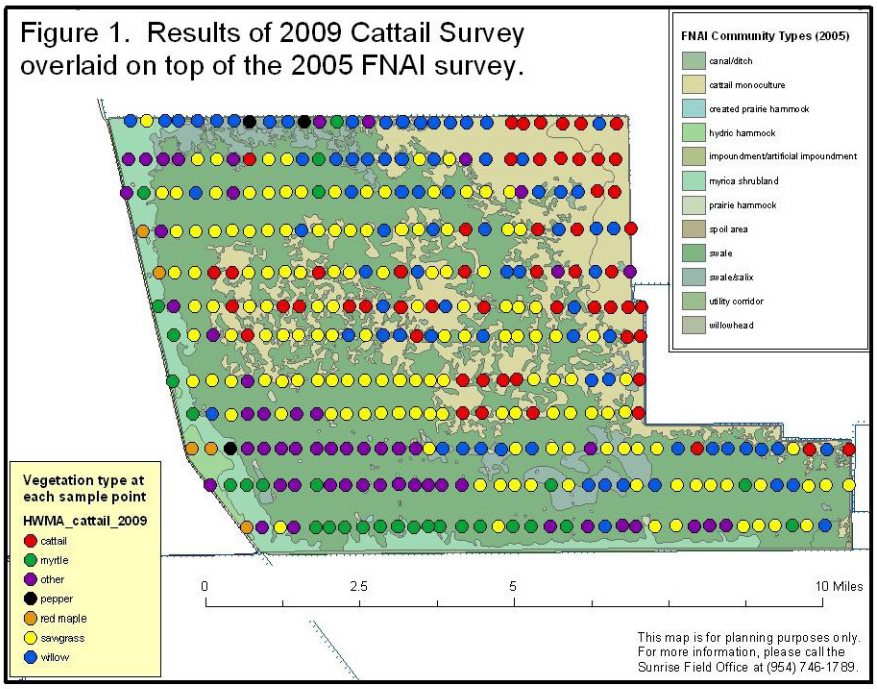
Figure 1. Results of 2009 Cattail Survey overlaid on top of the 2005 FNAI survey.
FNAI Community Types (2005)
canal/ditch
cattail monoculture
created prairie hammock
hydric hammock
impoundment/artificial impoundment
myrica shrubland
prairie hammock
spoil area
swale
swale/salix
utility corridor
willowhead
Vegetation type at each sample point
HWMA_cattail_2009
cattail
myrtle
other
pepper
red maple
sawgrass
willow
0
2.5
5
10 Miles
This map is for planning purposes only.
For more information, please call the
Sunrise Field Office at (954) 746-1789.

Figure 2. Cattail Coverage in Holey Land WMA

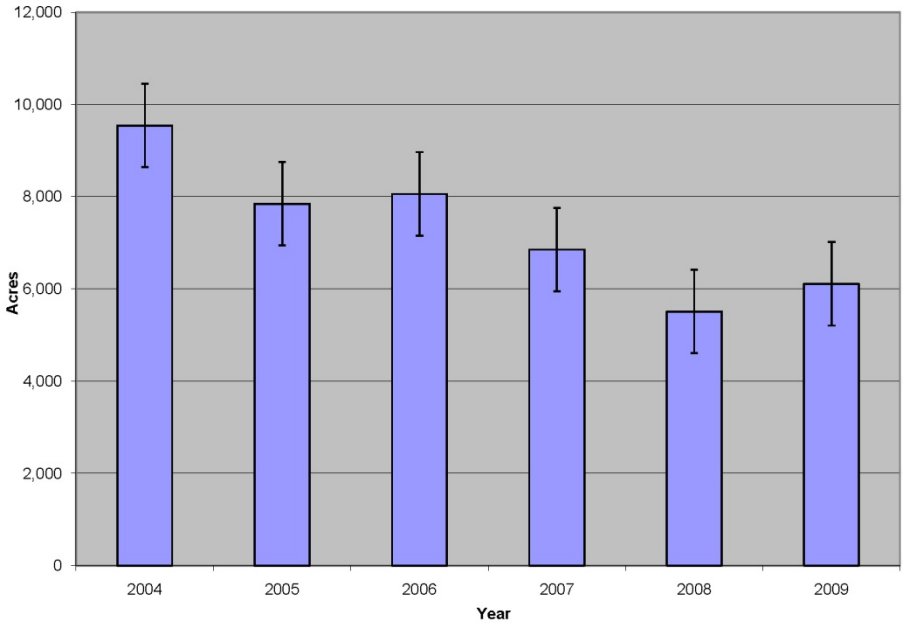
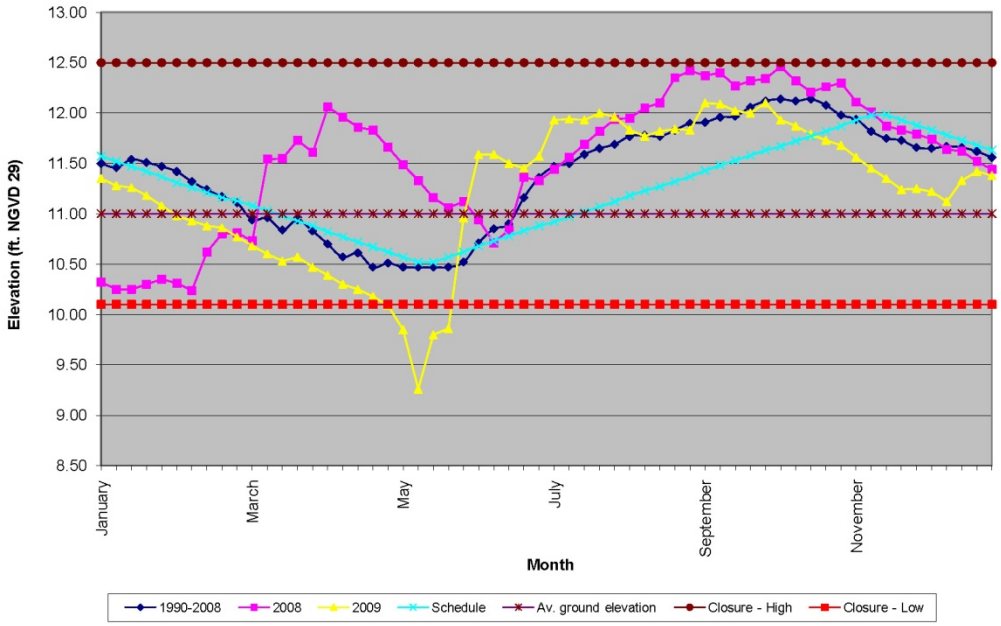
Figure 3. Holey Land WMA stage level (G203) water levels from 2009 and 2008, average weekly water levels for 1990-2008, average ground elevation, closure criteria and the schedule.