

# AFIRST

## ALTAMONTE – FDOT INTEGRATED REUSE & STORMWATER TREATMENT

*PRESENTED BY*

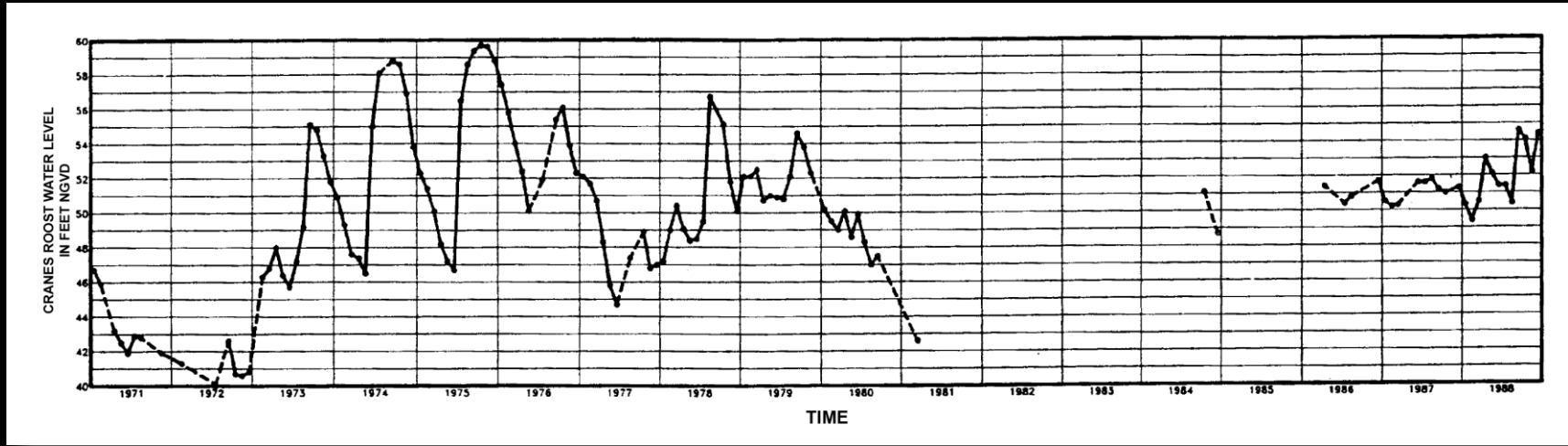
ED TORRES, M.S., P.E., LEED AP  
DEVO SEEREERAM, PH.D., P.E.





# HISTORIC AERIALS

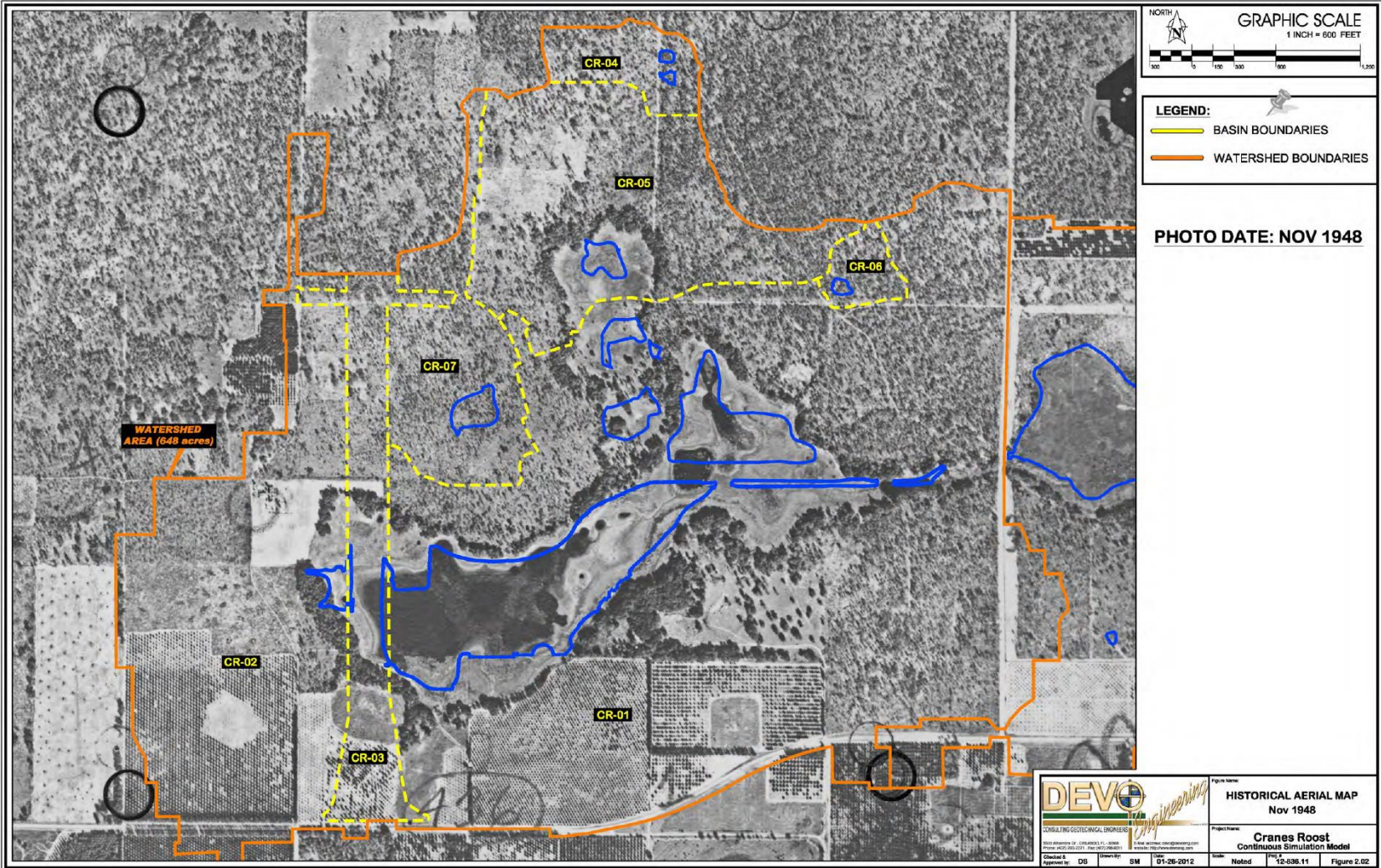
# WATER LEVEL IN CRANES ROOST (1971 - 1988)



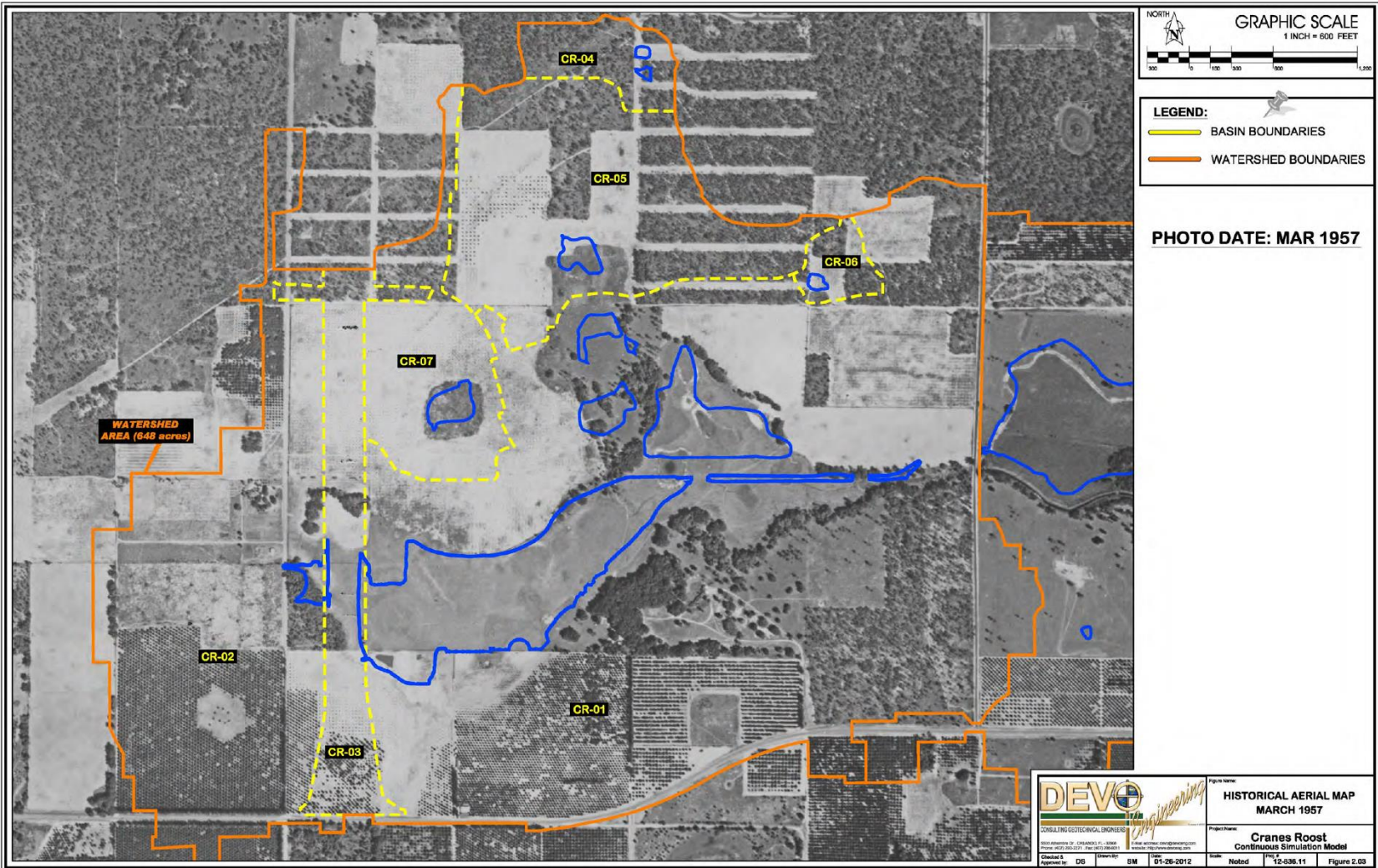
# HISTORIC AERIAL - CRANES ROOST, 1940



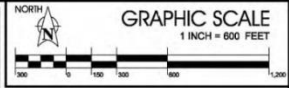
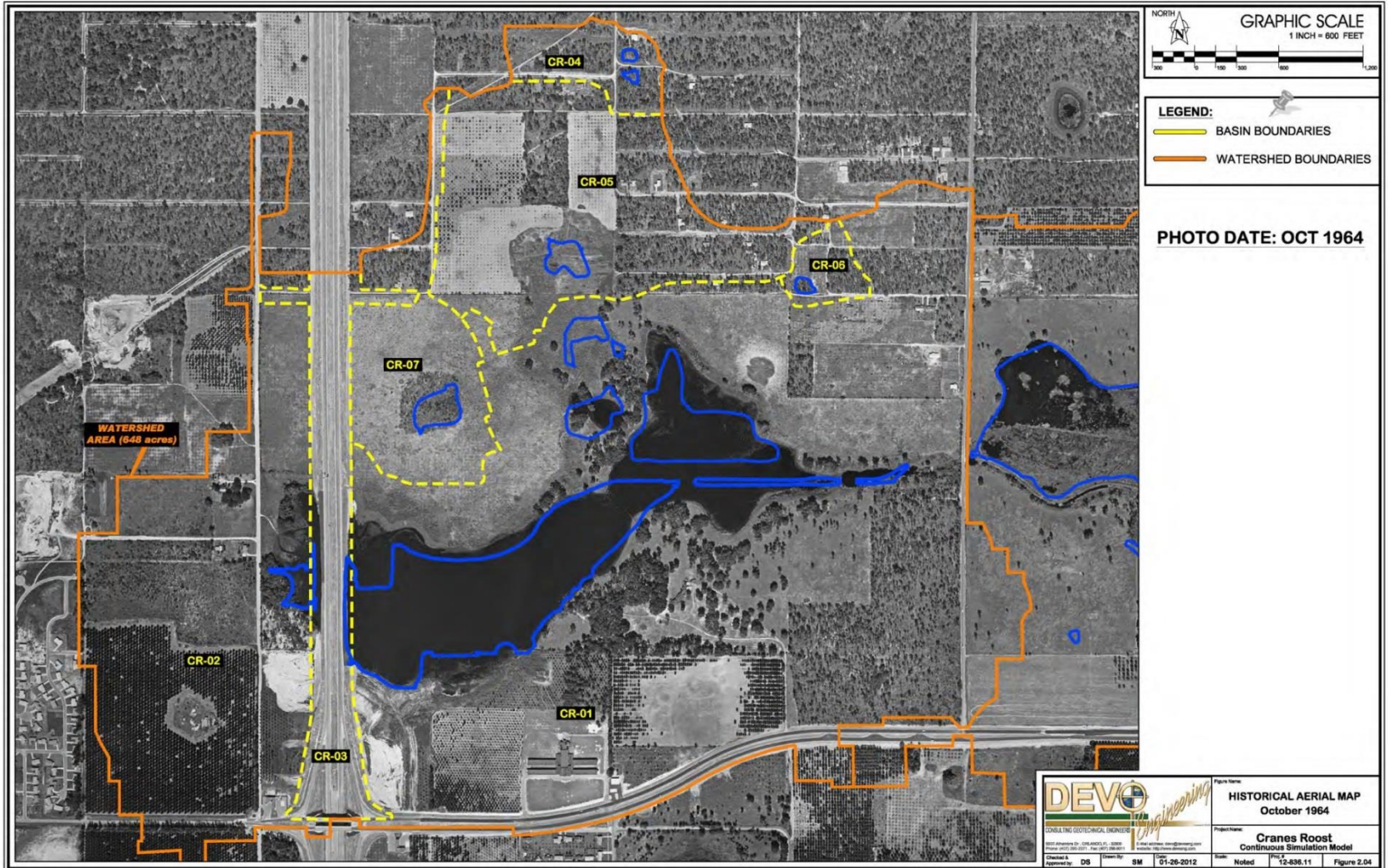
# HISTORIC AERIAL - CRANES ROOST, 1948



# HISTORIC AERIAL - CRANES ROOST, 1957



# HISTORICAL AERIAL - CRANES ROOST, 1964



**LEGEND:**

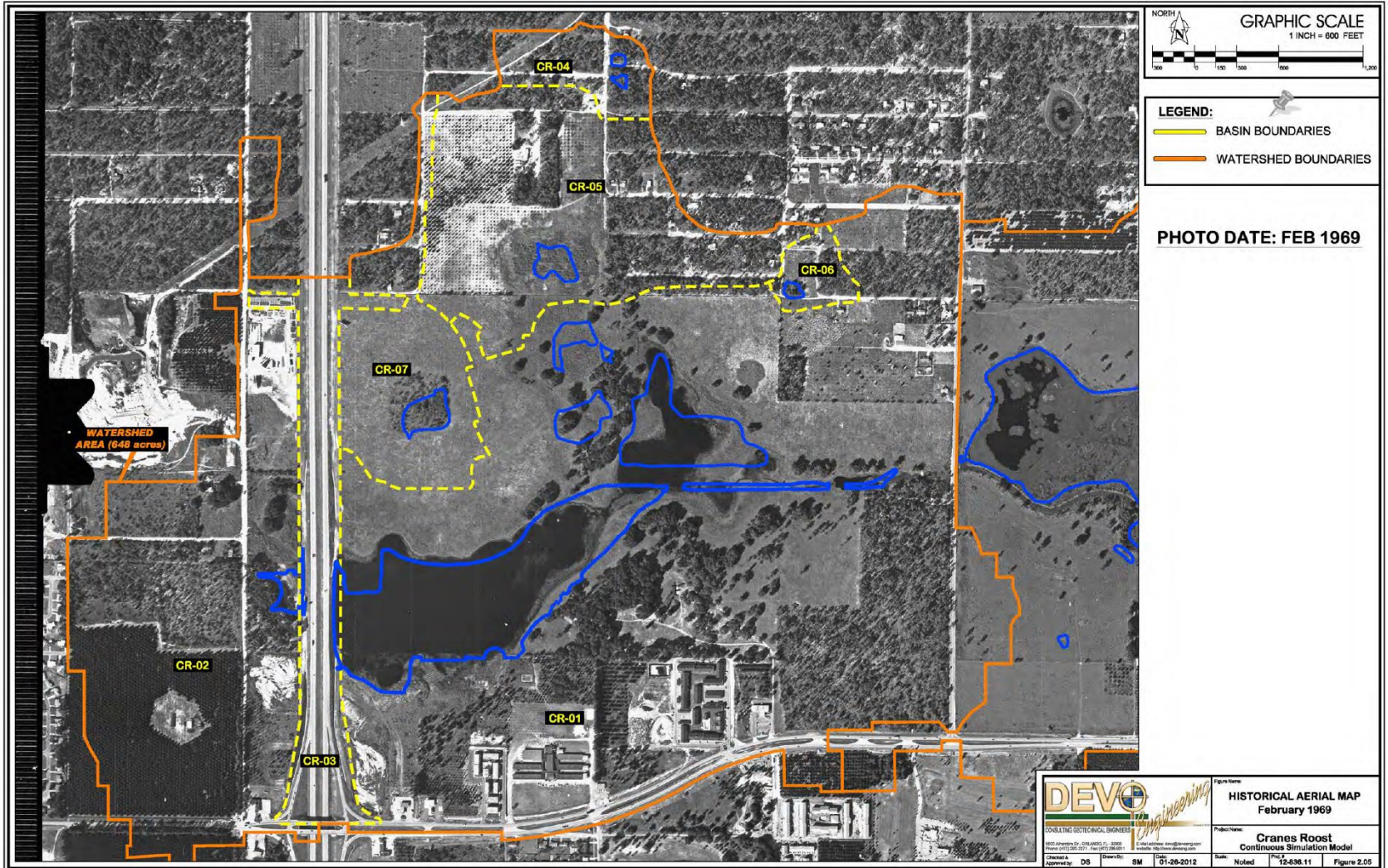
BASIN BOUNDARIES

WATERSHED BOUNDARIES

**PHOTO DATE: OCT 1964**

<p>DEVO Engineering CONSULTING ENGINEERS</p>	Figure Name	HISTORICAL AERIAL MAP October 1964
	Project Name	Cranes Roost Continuous Simulation Model
Prepared by: DS Approved by: DS	Date: 01-26-2012 Scale: Noted	Figure 2.04 12-836.11

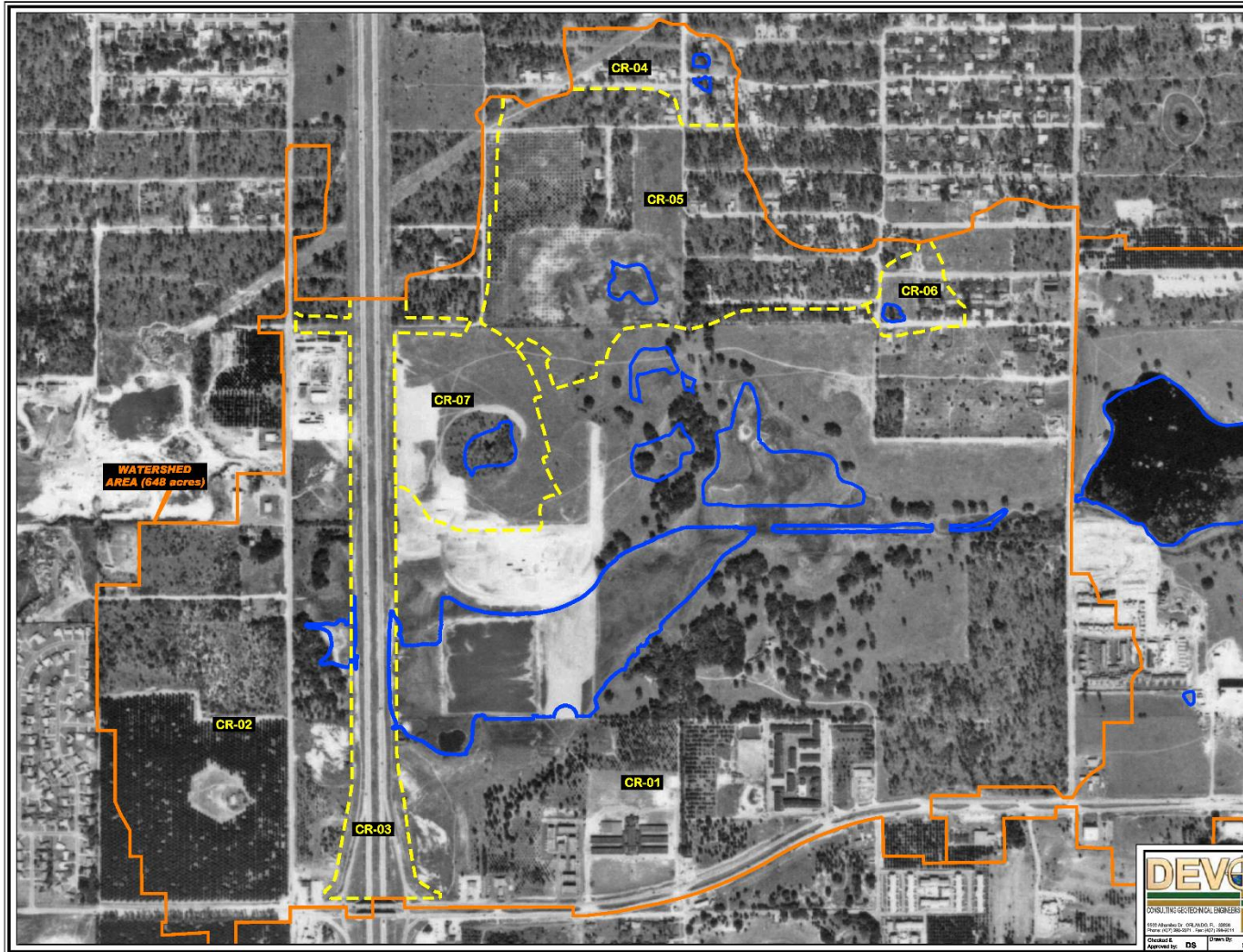
# HISTORICAL AERIAL - CRANES ROOST, 1969



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# HISTORICAL AERIAL - CRANES ROOST, 1972



NORTH

GRAPHIC SCALE  
1 INCH = 600 FEET

0 100 200 300 400 500

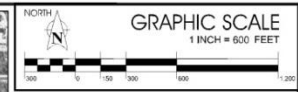
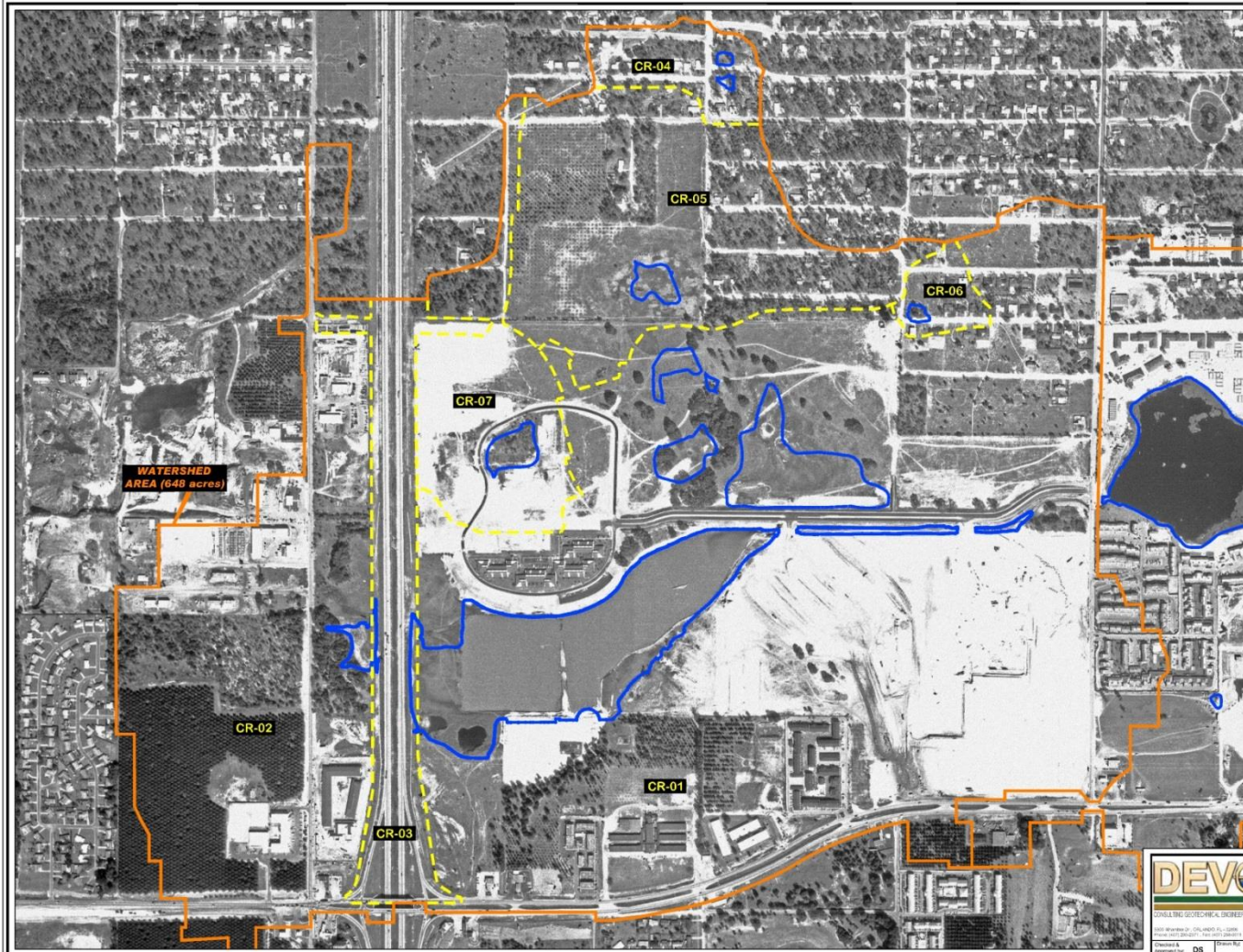
LEGEND:

- BASIN BOUNDARIES
- WATERSHED BOUNDARIES

PHOTO DATE: FEB 1972

<p>CONSULTING ENGINEERS</p> <p>1110 Marlette Dr. OREGON, IL 60051 PH: 708.235.2077 FAX: 708.235.2078 E-MAIL: info@devoeng.com WWW: www.devoeng.com</p> <p>Checked by: DS Date: 01-26-2012 Approved by: SM Date: 01-26-2012</p>	<p>Figure Name:</p> <p><b>HISTORICAL AERIAL MAP</b> February 1972</p>
	<p>Project Name:</p> <p><b>Cranes Roost</b> Continuous Simulation Model</p>
<p>Scale:</p> <p>Noted 1" = 600'</p>	<p>Figure 2.06</p>

# HISTORICAL AERIAL - CRANES ROOST, 1973



**LEGEND:**

	BASIN BOUNDARIES
	WATERSHED BOUNDARIES

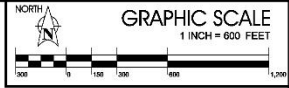
**PHOTO DATE: FEB 1973**

 CONSULTING GEOTECHNICAL ENGINEERS 2125 W. Highway 101, CHANDLER, AZ 85224 (480) 948-2277 • FAX (480) 948-2278 www.devoeng.com	Figure Name	HISTORICAL AERIAL MAP February 1973
	Project Name	Cranes Roost Continuous Simulation Model
Prepared by	DS	SM
Reviewed by		
Date	01-26-2012	Scale
Noted	12-836.11	Figure 2.07

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# HISTORICAL AERIAL - CRANES ROOST, 1974



**LEGEND:**

- BASIN BOUNDARIES
- WATERSHED BOUNDARIES

PHOTO DATE: NOV 1974

<p>CONSULTING ENGINEERS</p> <p>2802 Markon Dr., ORLANDO, FL 32825 PH: 407.255.2277 FAX: 407.255.2278</p> <p>Client: <i>DEVO Engineering</i></p> <p>Checked by: DS    Drawn by: SM    Date: 01-26-2012    Scale: Noted    12-636.11    Figure 2.08</p>	<p>Figure Name:</p> <p><b>HISTORICAL AERIAL MAP</b> November 1974</p>
	<p>Project Name:</p> <p><b>Cranes Roost</b> Continuous Simulation Model</p>

# HISTORICAL AERIAL - CRANES ROOST, 1978

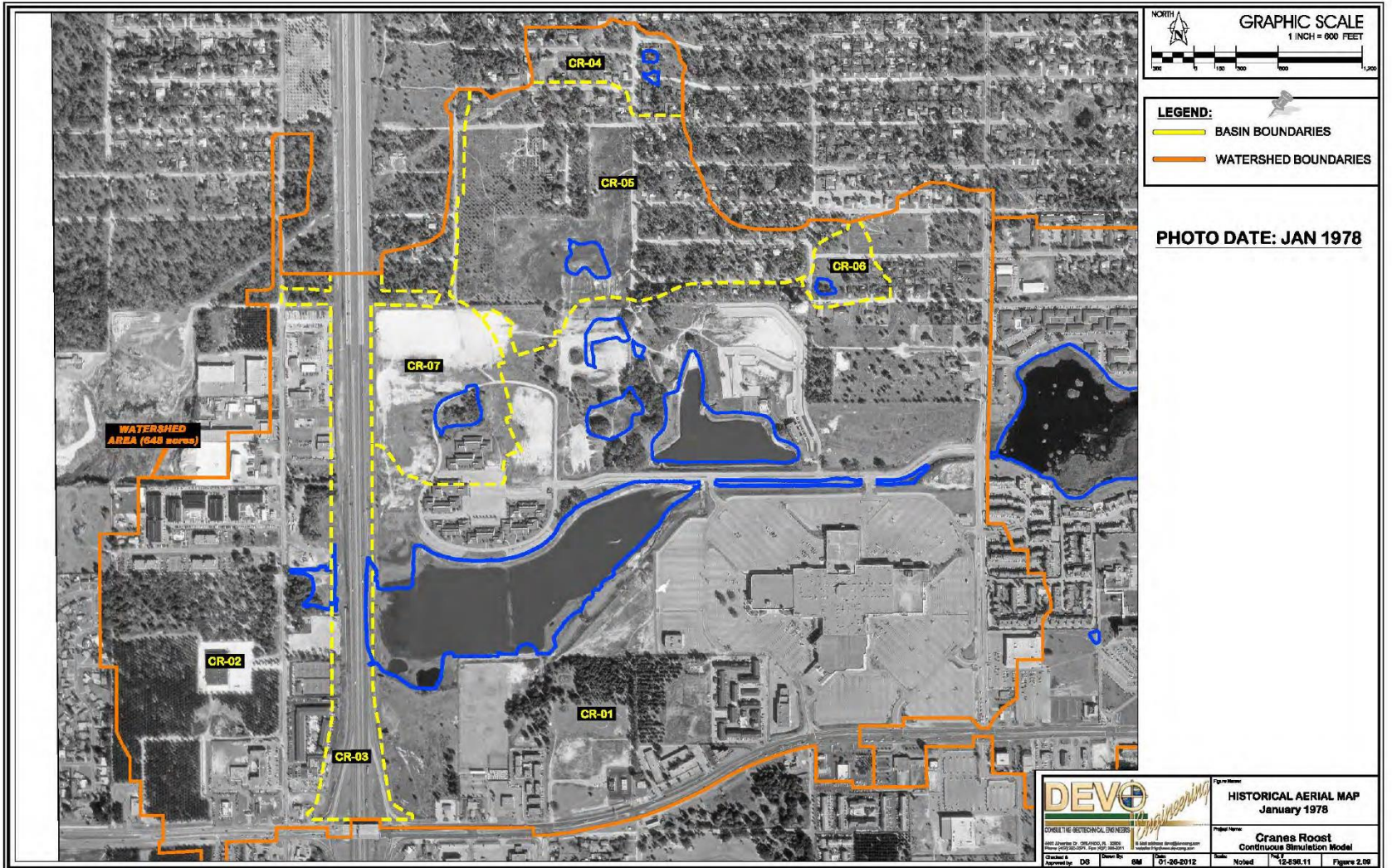
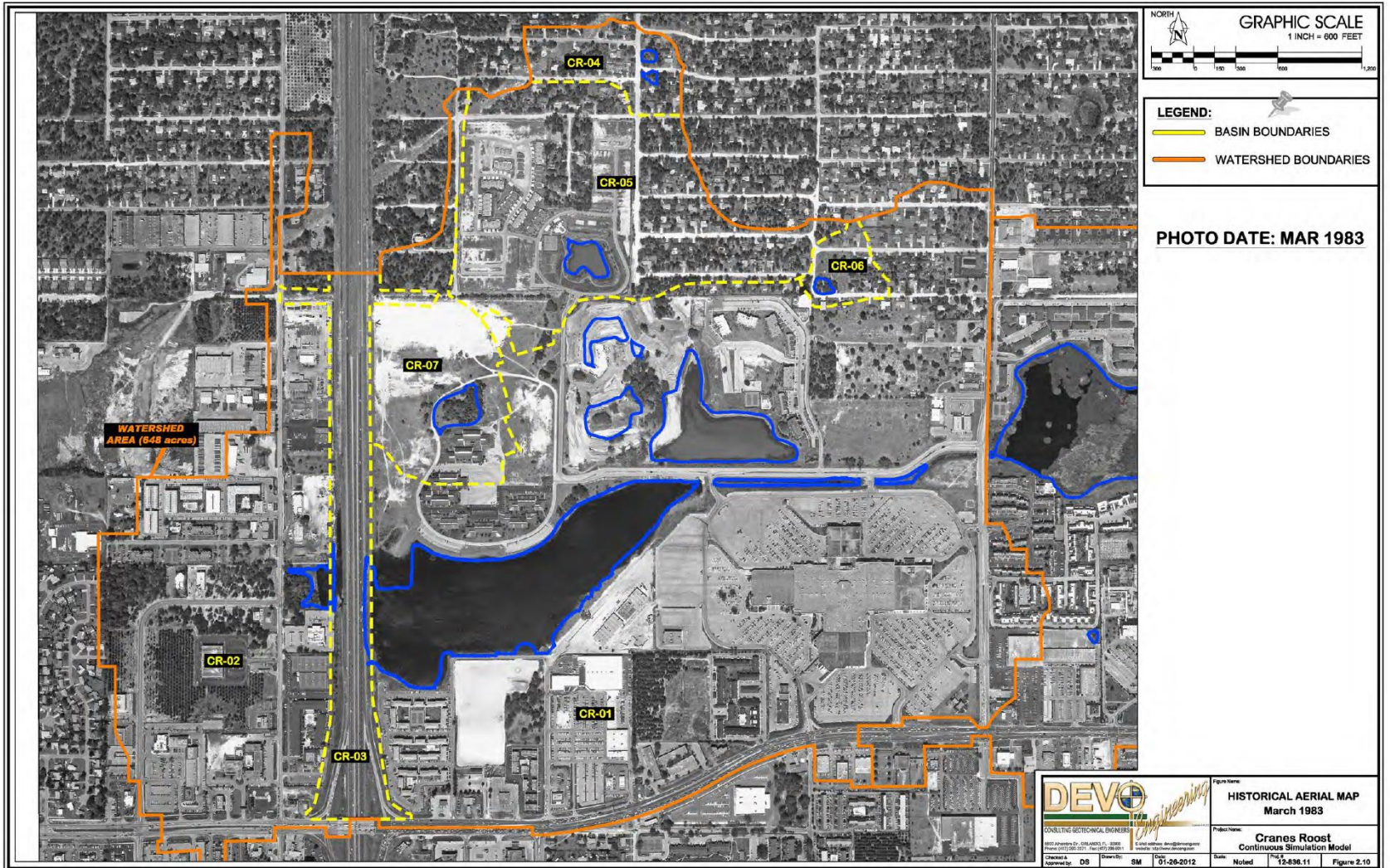
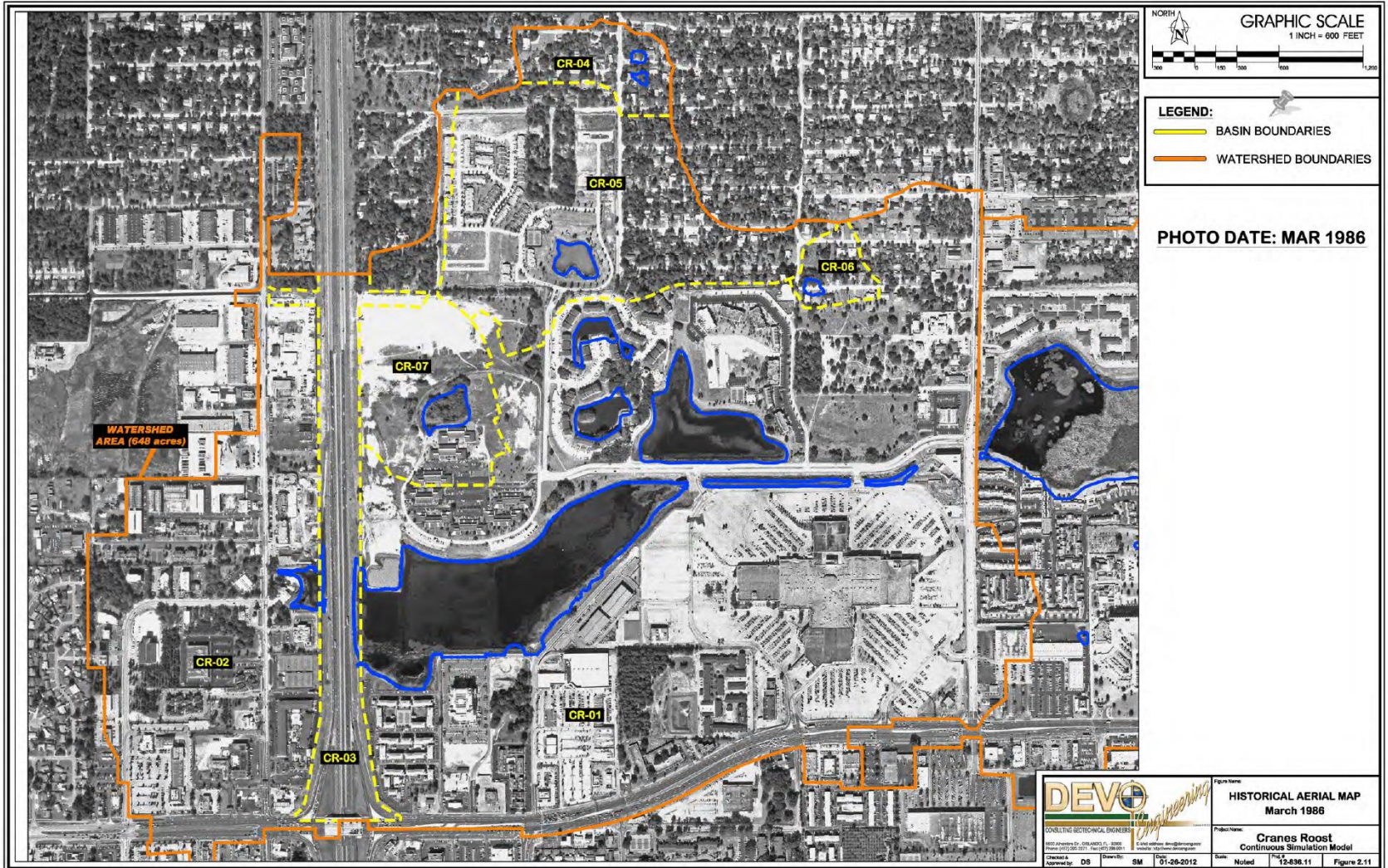


	Figure Name <b>HISTORICAL AERIAL MAP</b> January 1978
	Project Name <b>Cranes Roost</b> Continuous Simulation Model
Checked by: DG Approved by: DG	Date: 01-26-2012 Scale: Noted Figure: 2.00

# HISTORICAL AERIAL - CRANES ROOST, 1983



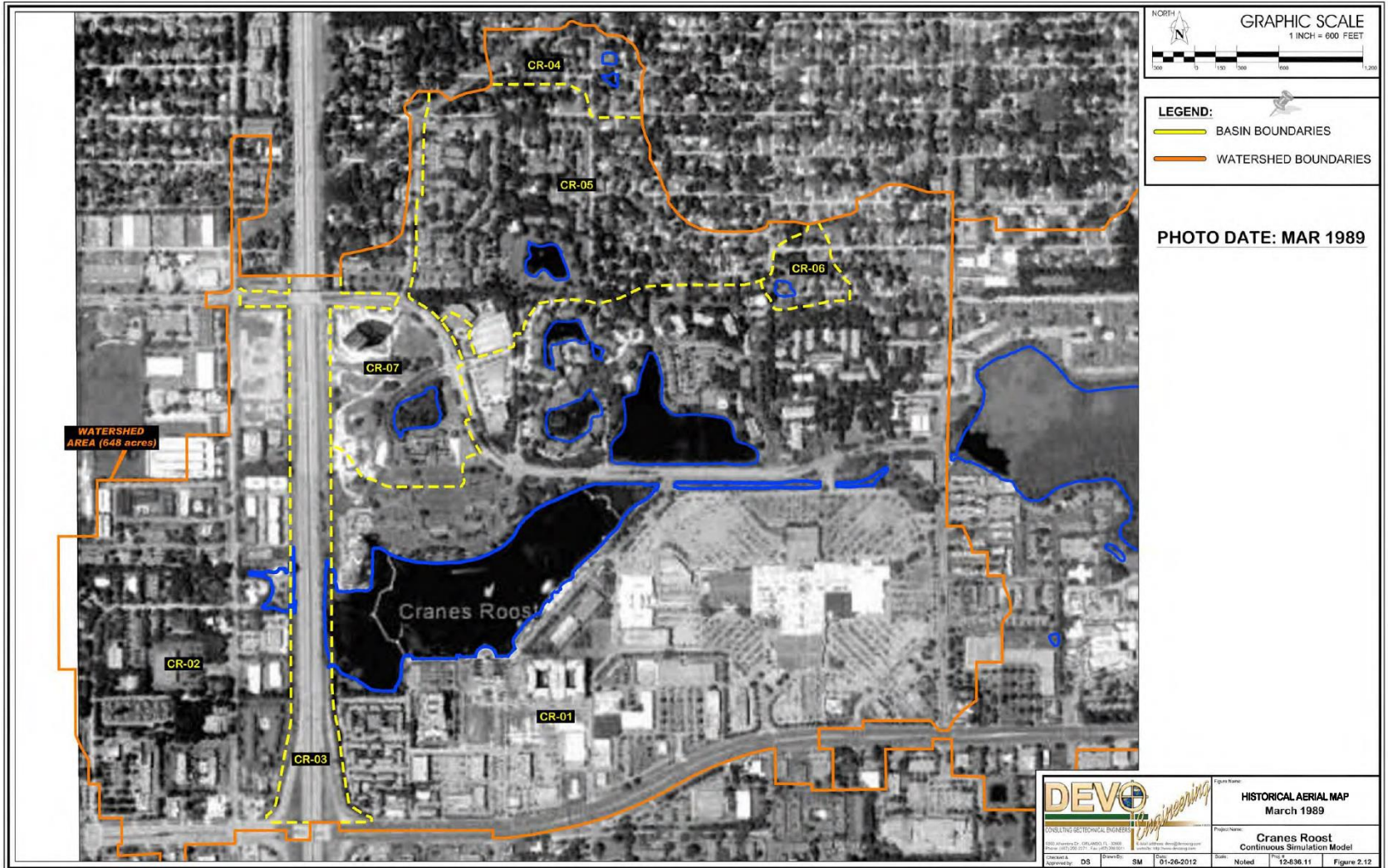
# HISTORICAL AERIAL - CRANES ROOST, 1986



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# HISTORICAL AERIAL - CRANES ROOST, 1989



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# HISTORICAL AERIAL - CRANES ROOST, 1993

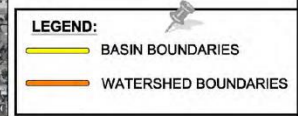
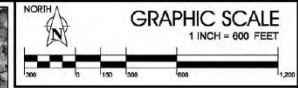
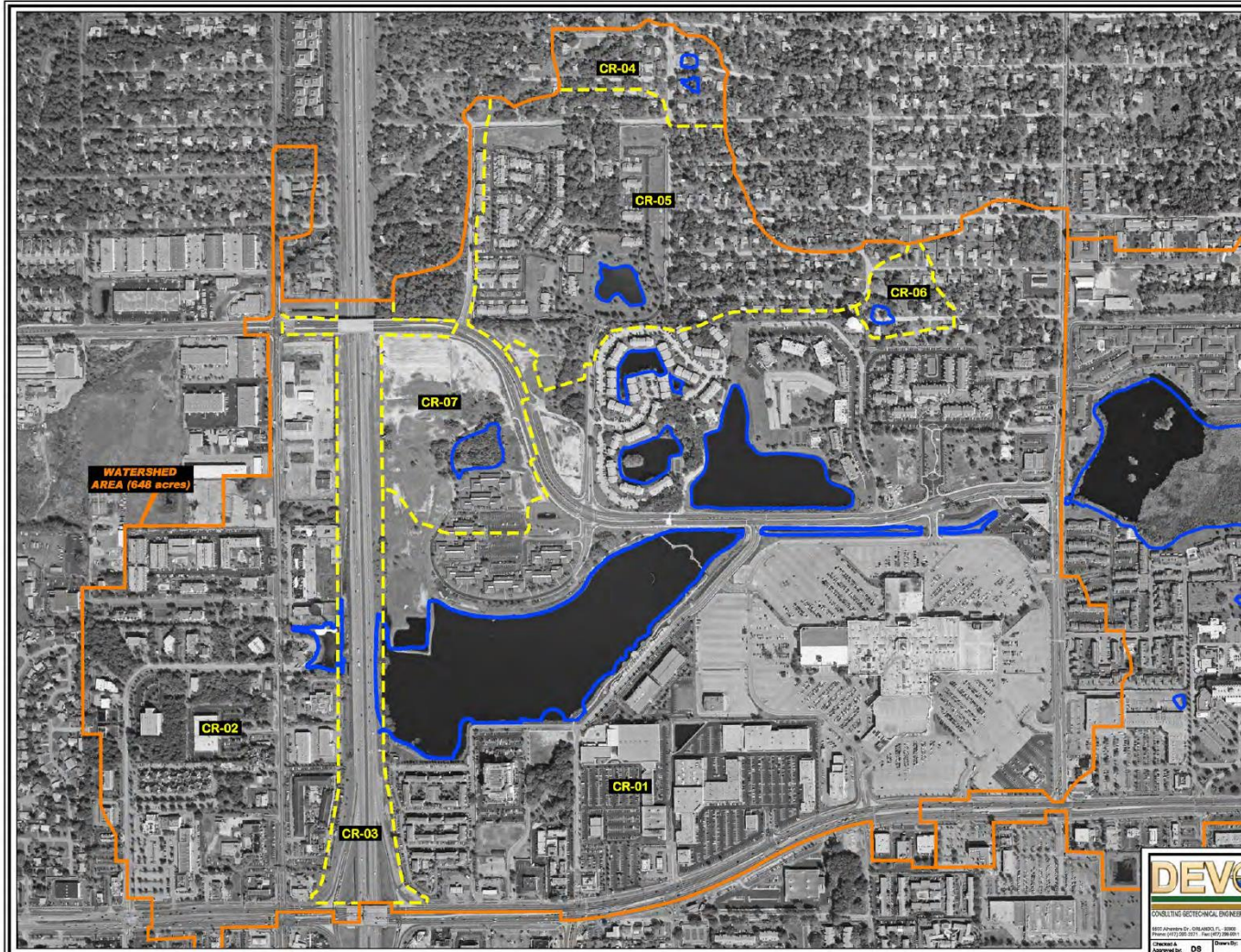


PHOTO DATE: APR 1993

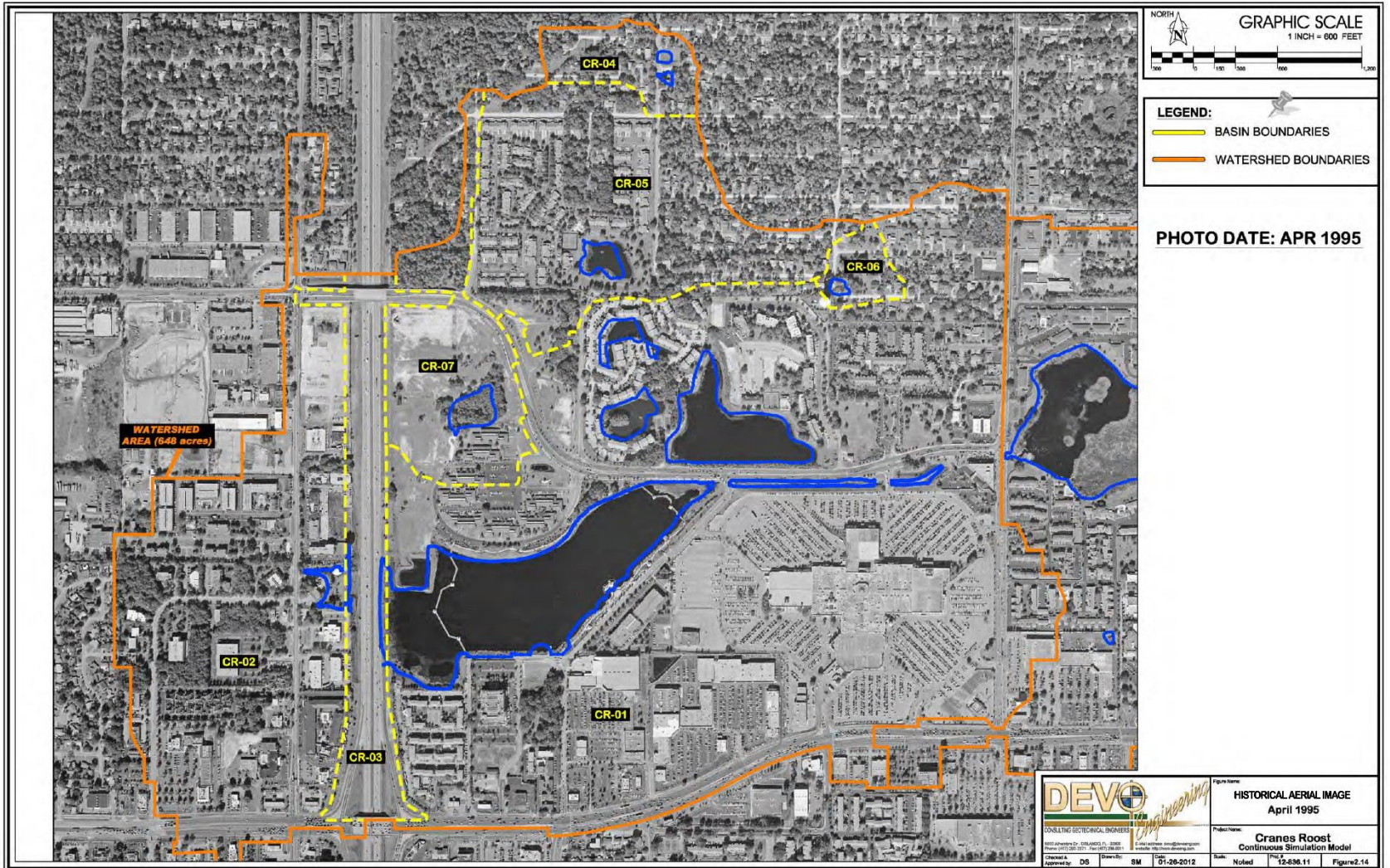
<p>CONSULTING ELECTRICAL ENGINEERS</p> <p>1850 Andrews Dr., Clearwater, FL 34615 Phone: (813) 285-0377 Fax: (813) 285-0371</p> <p>Clearwater, FL www.devoeng.com</p>	Figure Name	HISTORICAL AERIAL MAP APR. 1993
	Project Name	Cranes Roost Continuous Simulation Model
Drawn by	DS	Scale
Checked by	EM	Noted
Date	01-26-2012	Figure 2.13

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# HISTORICAL AERIAL - CRANES ROOST, 1995



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# HISTORICAL AERIAL - CRANES ROOST, 2002

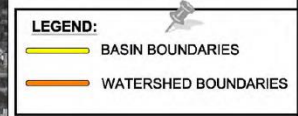
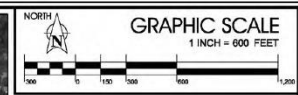
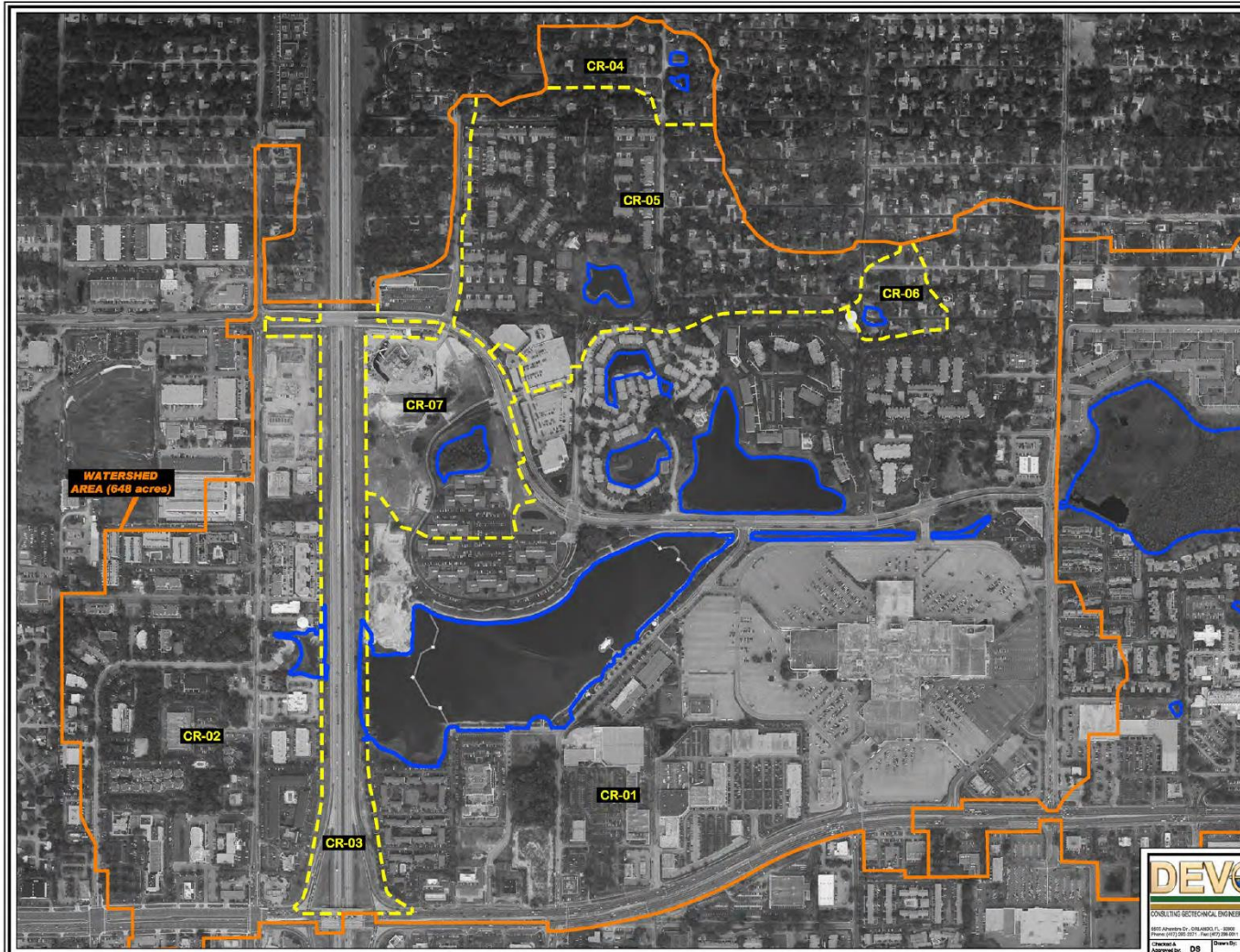


PHOTO DATE: FEB 2002

<p>CONSULTING MECHANICAL ENGINEERS</p> <p>1850 Alameda Dr., COLUMBIA, FL 32909 Phone: (813) 285-8377 Fax: (813) 285-8371</p> <p>Created by: DS Reviewed by: RM Date: 01-26-2012</p>	<p>Figure Name: HISTORICAL AERIAL MAP FEB. 2002</p>
	<p>Project Name: Cranes Roost Continuous Simulation Model</p> <p>Scale: Noted Plot: 12-836.11 Figure 2.15</p>

# HISTORICAL AERIAL - CRANES ROOST, 2006

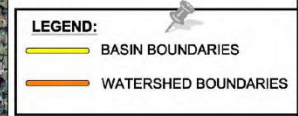
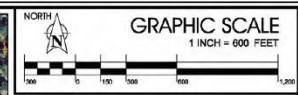
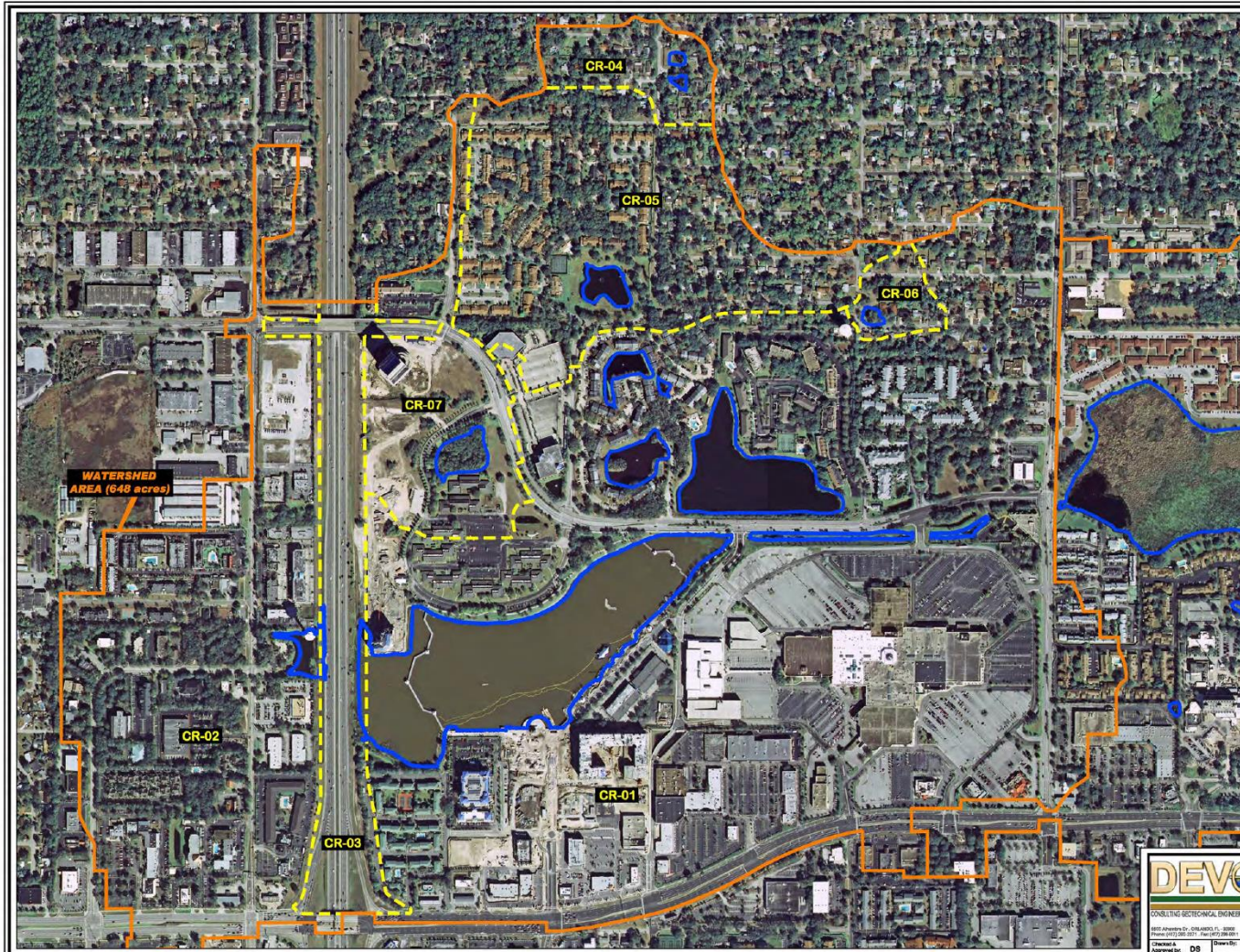


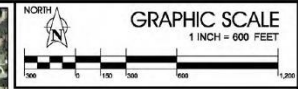
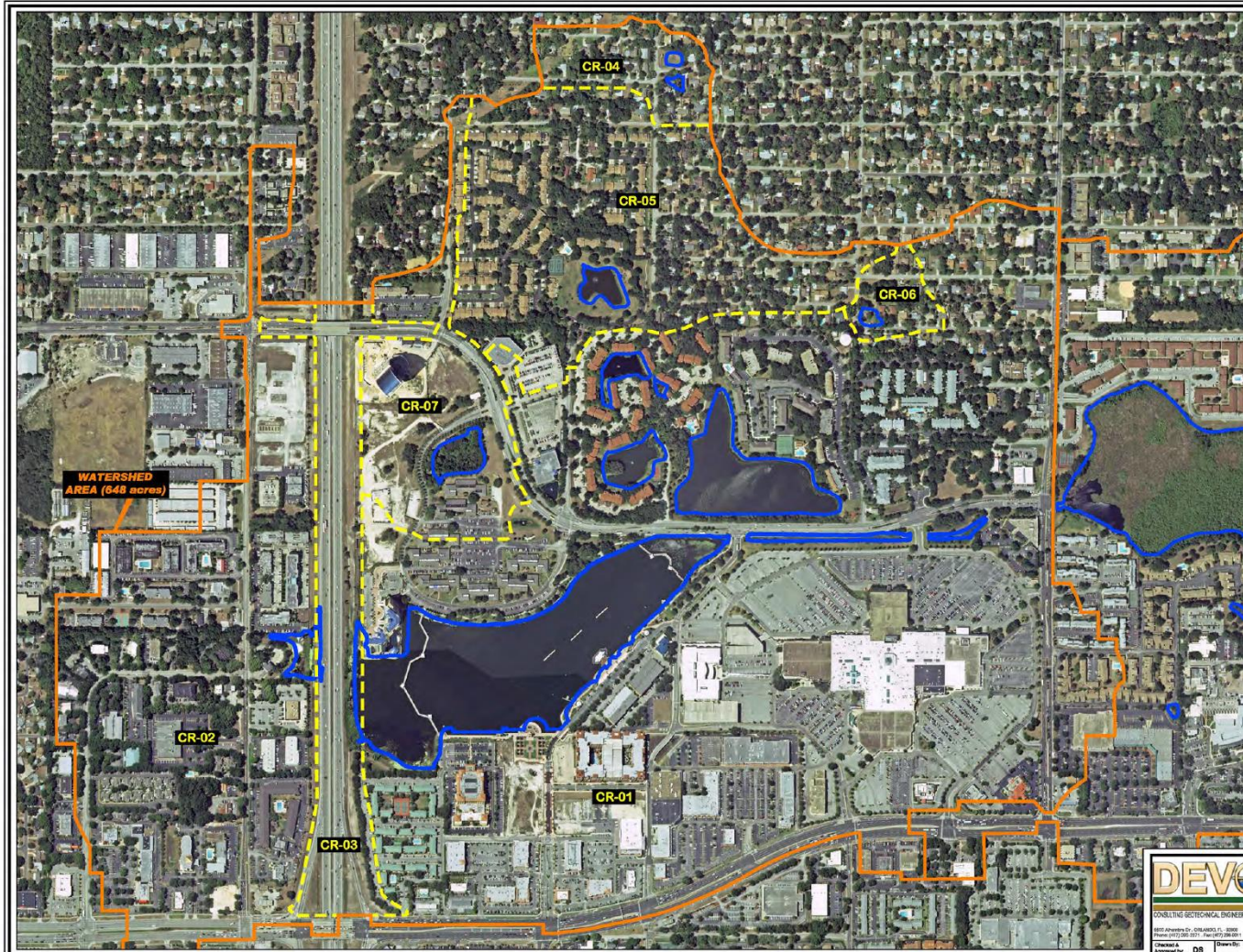
PHOTO DATE: FEB 2006

<p>CONSULTING ENGINEERS</p> <p>1850 Alameda Dr., ORLANDO, FL 32806 Phone: (407) 261-0377 Fax: (407) 261-0371</p> <p>Created by: DS Drawn by: RM Date: '01-26-2012 Scale: Noted Plot: 12-436.11 Figure: 2.16</p>	<p>Figure Name: HISTORICAL AERIAL MAP FEB. 2006</p> <p>Project Name: Cranes Roost Continuous Simulation Model</p>
	<p>Scale: Noted Plot: 12-436.11 Figure: 2.16</p>

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# HISTORICAL AERIAL - CRANES ROOST, 2008



**LEGEND:**

	BASIN BOUNDARIES
	WATERSHED BOUNDARIES

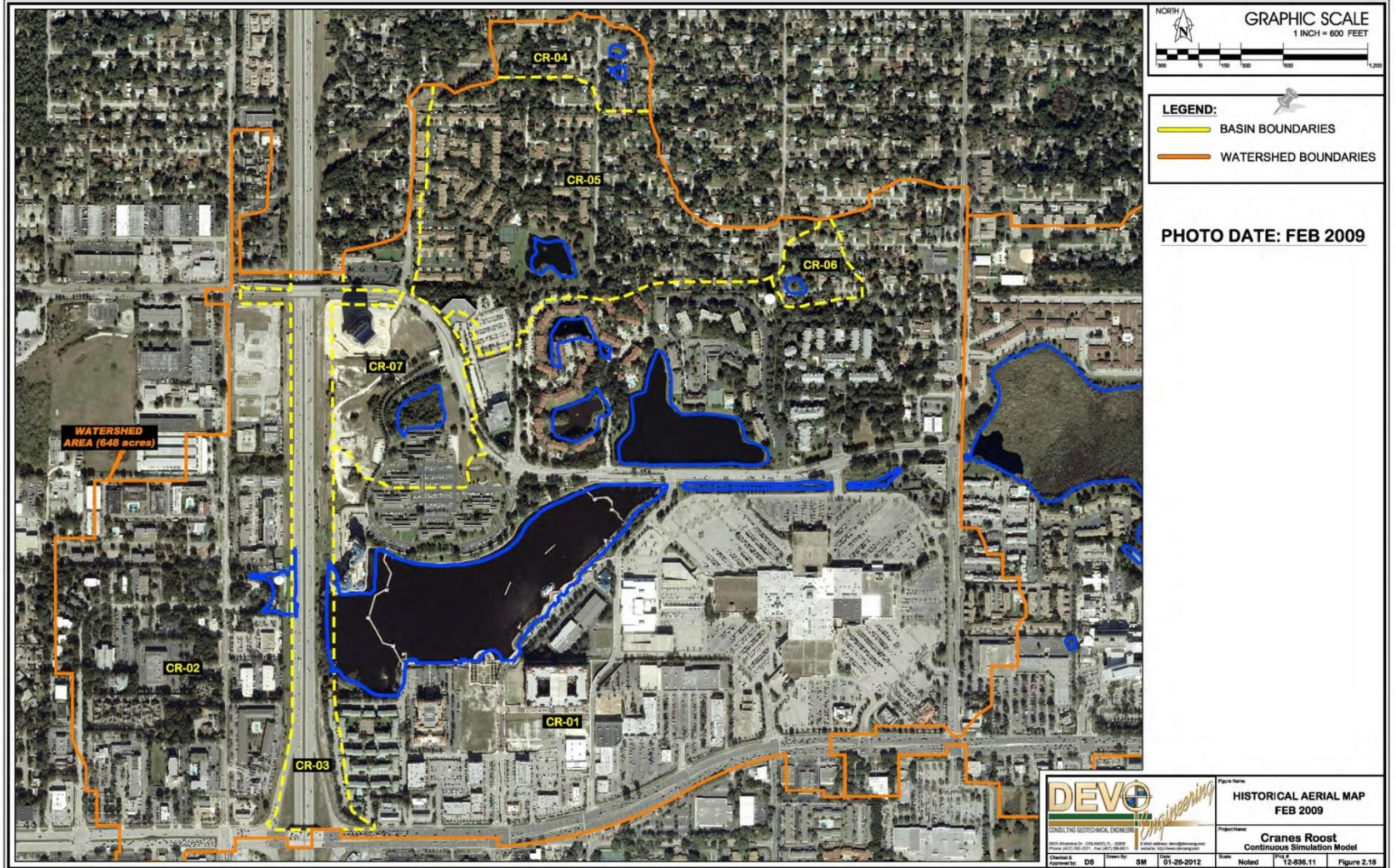
**PHOTO DATE: MAY 2008**

 CONSULTING ELECTRICAL ENGINEERS 8850 Alvarado Dr., ORLANDO, FL 32818 Phone: (407) 261-0377 Fax: (407) 261-0371 E-mail: info@devoeng.com Website: www.devoeng.com	Figure Name: HISTORICAL AERIAL MAP MAY 2008
	Project Name: Cranes Roost Continuous Simulation Model
Drawn by: DS Checked by: RM Date: '01-26-2012 Scale: Noted Plot: 12-436.11 Figure 2.17	

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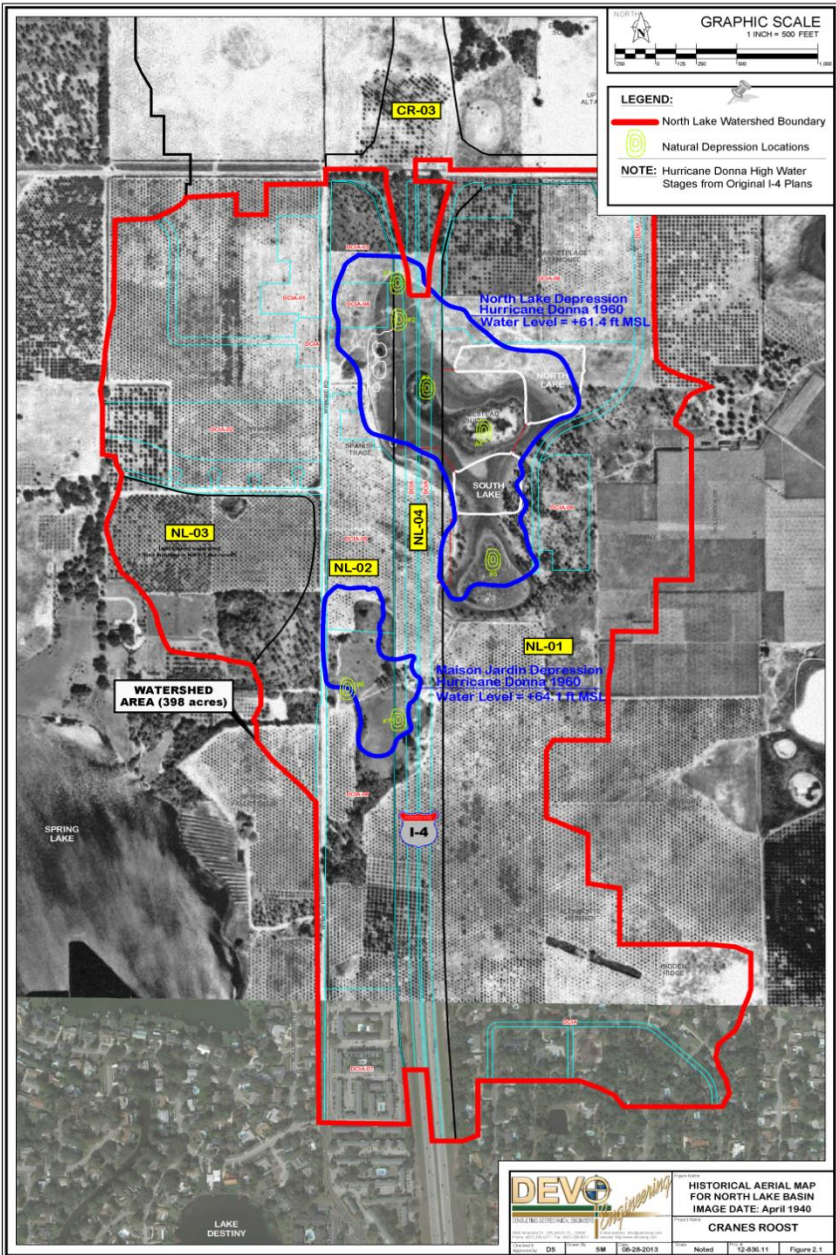
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# HISTORICAL AERIAL - CRANES ROOST, 2009

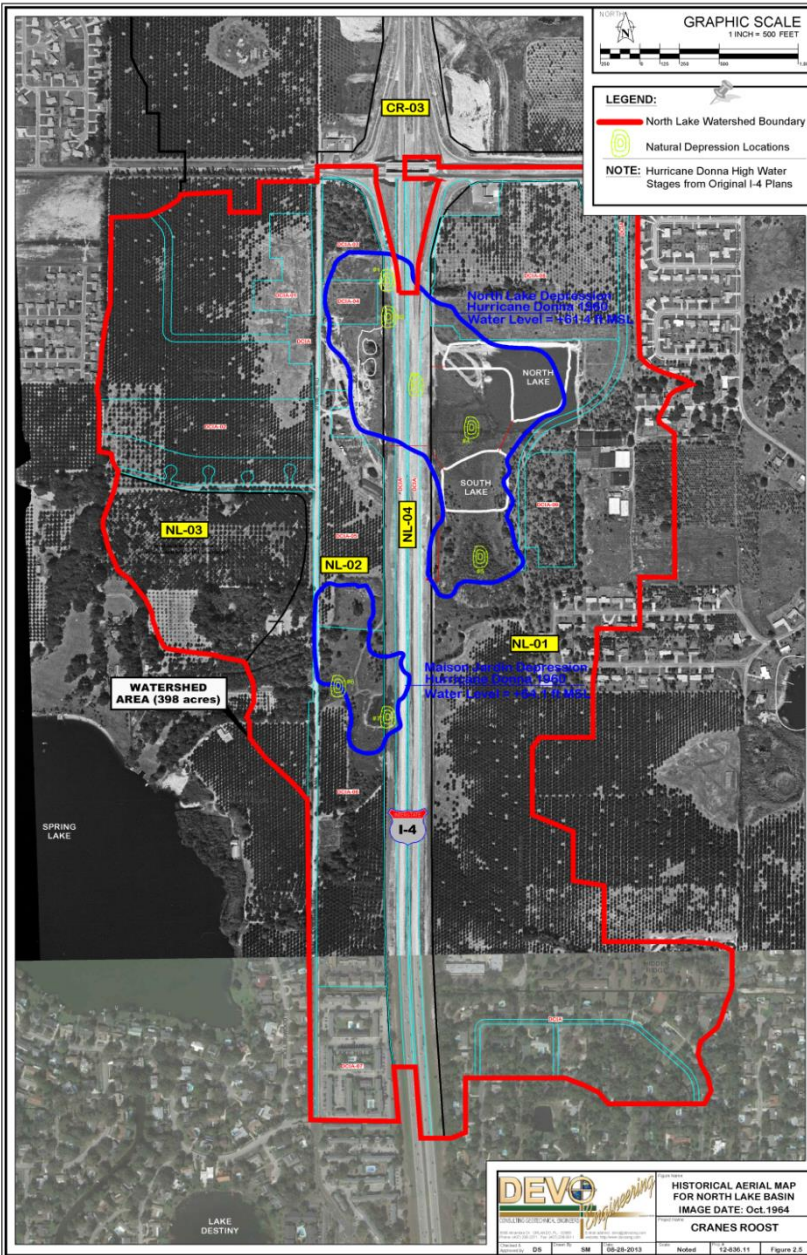


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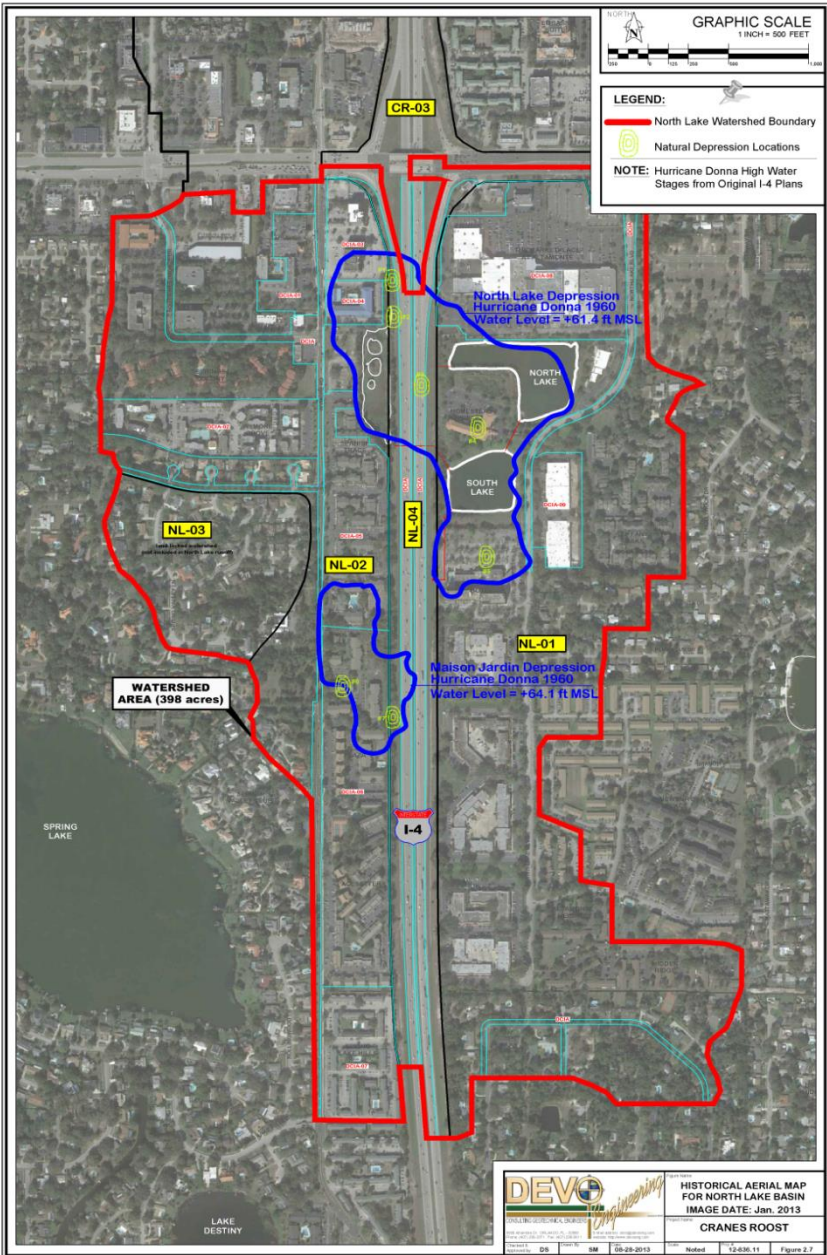
www.devoeng.com



# HISTORICAL AERIAL NORTH LAKE, 1940



# HISTORICAL AERIAL NORTH LAKE, 1964



# HISTORICAL AERIAL NORTH LAKE, 2013



# CHRONIC FLOODING OF I-4 RIGHT-OF-WAY ADJACENT TO NORTH LAKE





# THE CONCEPT

08

08

# THE CONCEPT

- Lower the normal water level in Cranes Roost, by re-permitting pumping elevation thresholds, while retaining existing functions of water body.
  - Stormwater retention
  - Storage for reclaimed water
  - Aesthetic features
- Provide additional stormwater retention for I-4 expansion
- Enhance environmental benefits
  - Reduced discharge to Little Wekiva River
  - Less reliance on supplemental groundwater withdrawals
  - Reduced nutrient discharge
- Allows the City of Altamonte Springs to provide irrigation water to the City of Apopka

# THE CONCEPT

- Cranes Roost was previously permitted as an integrated surface water and reclaimed water storage facility for the City of Altamonte Springs (SJRWMD permit issued on May 4, 2012).
- Planned widening of I-4 through Altamonte Springs required that additional stormwater treatment be provided. FDOT originally planned to build a separate, above ground retention pond in an adjacent basin.
- Cooperation between the City, Apopka, FDOT and SJRWMD, enabled re-permitting of Cranes Roost to accommodate the additional runoff from I-4, as well as considering the City's infrastructure needs.
- Thus leading to the creation of the A-FIRST Project: Altamonte Springs – FDOT Integrated Reuse & Stormwater Treatment

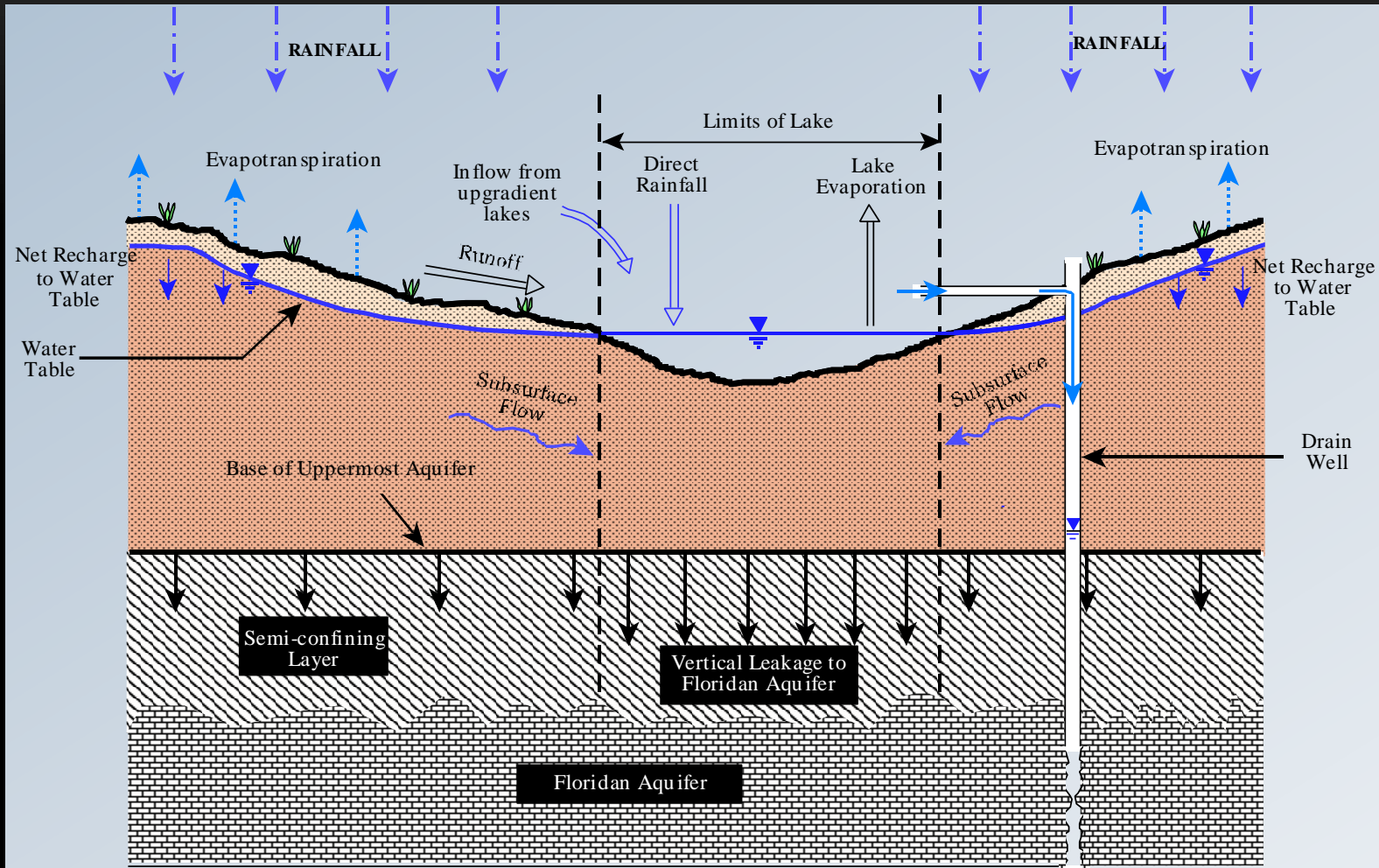


# NORTH LAKE WATERSHED & I-4 CORRIDOR

# CONTINUOUS SIMULATION MODELING

- Continuous simulation modeling based on 21 years of rainfall data and lake level/Floridan aquifer observations for Cranes Roost (1991 to 2011 at 15 minute increments)
- Modeled using the PONDS 3.3 Refined Method software, with features added specifically for this project
- Multi-basin, interconnected lake water bodies connected to Floridan aquifer

# CONCEPTUAL MODEL

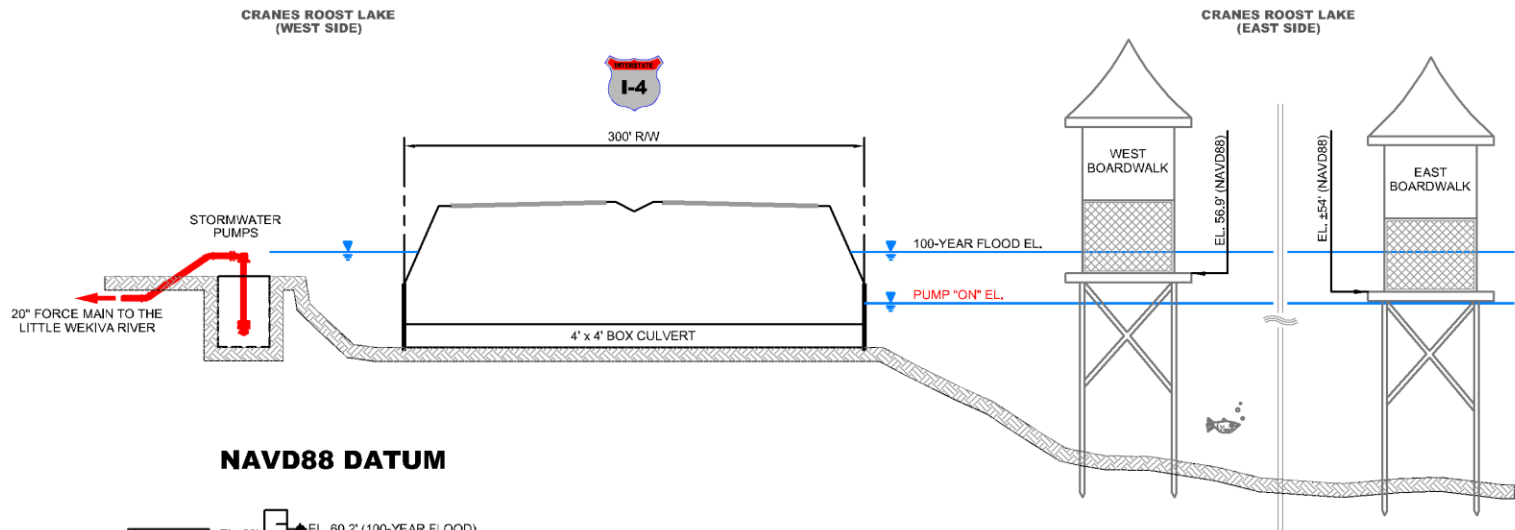




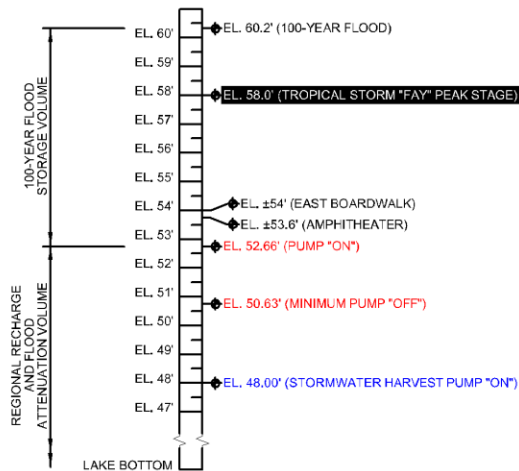
# THE TECHNOLOGY



# CRANE'S ROOST KEY ELEVATIONS



## NAVD88 DATUM



# MODELED PUMPING CONFIGURATION

## Pumping Schematic For Proposed Conditions

### PUMP 1 - RECLAIMED WATER INFLOW INTO CRANES ROOST

1. Pump 1 can be activated when water level in Cranes Roost is below +48 ft NAVD, and
2. Pump 1 can be activated if Antecedent Moisture Condition (AMC) is AMC II or AMC III.
3. Reuse water is pumped in at a rate of 4 MGD (only if reclaimed water is available from City plant).

### PUMP 2 - STORMWATER HARVESTING

1. Stormwater harvesting occurs if the water level in Cranes Roost is greater than +48.0 ft NAVD.
2. Pumping occurs at a rate of 3 MGD (2,083 gpm).
3. Pumping is independent of Antecedent Moisture Condition.

### PUMP 3 - STORMWATER PUMP OUTFALL TO LITTLE WEKIVA RIVER

1. Stormwater pumping to Little Wekiva River operates when water level exceeds +52.66 ft NAVD (by permit)
2. Stormwater pumping to Little Wekiva River stops when water level drops below +50.63 ft NAVD (by permit).
3. Water is pumped to Little Wekiva River at a rate of 10.8 MGD (7,500 gpm).
4. Maximum pumping threshold (by permit) is 11.5 MGD.

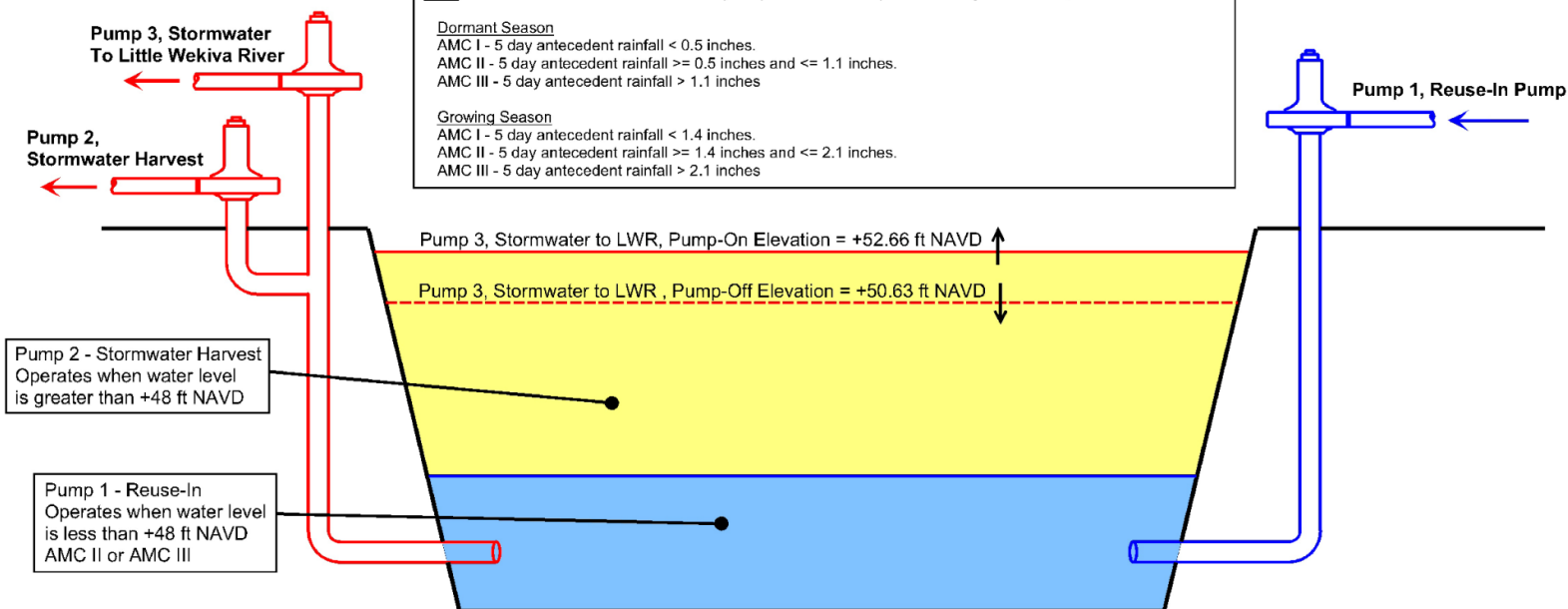
**Note:** The Antecedent Moisture Condition (AMC) is based on the previous 5-day rainfall total, as follows:

#### Dormant Season

- AMC I - 5 day antecedent rainfall < 0.5 inches.
- AMC II - 5 day antecedent rainfall  $\geq$  0.5 inches and  $\leq$  1.1 inches.
- AMC III - 5 day antecedent rainfall > 1.1 inches

#### Growing Season

- AMC I - 5 day antecedent rainfall < 1.4 inches.
- AMC II - 5 day antecedent rainfall  $\geq$  1.4 inches and  $\leq$  2.1 inches.
- AMC III - 5 day antecedent rainfall > 2.1 inches



Refined Method - Cranes Roost - Proposed (Trial G-02, with Reuse-In).prm

File Edit Hydrographs Route Units Options Help

1 Project Data 2 Aquifer Data 3 Geometry 4 Ditches and Trenches  
5 Discharge Structures 6 Hydrographs 7 Tabular Results 8 Graphical Results

Discharge Structure 1 Structure Type Constant rate pumping station

### Constant Rate Pumping Station Properties

Structure Data

Tailwater

Description High Level Stormwater Pump @ 7500 gpm

Units English

Flow Direction Out of pond

Pump on elevation, (ft datum) 52.66

Pump off elevation, (ft datum) 50.63

Pumping rate, (ft<sup>3</sup>/s) 16.710

Start of Pumping Active from beginning of simulation

Ready DATA IS UNLOCKED

# HIGH LEVEL STORMWATER PUMP

Refined Method - Cranes Roost - Proposed (Trial G-02, with Reuse-In).prm

File Edit Hydrographs Route Units Options Help

1 Project Data 2 Aquifer Data 3 Geometry 4 Ditches and Trenches

5 Discharge Structures 6 Hydrographs 7 Tabular Results 8 Graphical Results

Discharge Structure 2 Structure Type Rating curve

**Rating Curve Properties**

Structure Data

Tailwater

Description 3 MGD Stormwater Harvesting Pump

Polynomial Interpolation Order 1 Calibrate

Pumping Into Pond Can Not Occur If The Following Discharge Structures Are Simultaneously Pumping:

Discharge Structure 1  
 Discharge Structure 2  
 Discharge Structure 3

Units English

**Discharge Rating Curve**

	Stage (ft datum)	Discharge (ft <sup>3</sup> /s)
1	48	0
2	48.01	4.642
3	70	4.642
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

Ready DATA IS UNLOCKED

# STORMWATER HARVESTING PUMP, (RATING CURVE)

Refined Method - Cranes Roost - Proposed (Trial G-02, with Reuse-In).prm

File Edit Hydrographs Route Units Options Help

1 Project Data 2 Aquifer Data 3 Geometry 4 Ditches and Trenches

5 Discharge Structures 6 Hydrographs 7 Tabular Results 8 Graphical Results

Discharge Structure 3 Structure Type Conditional pump

**Conditional Pump**

**Structure Data**

Tailwater

Description 4 MGD Reuse-In Pumping, Below Elevation +48 ft NAVD

**Pumping Into Pond**

Pumping Rate For Pumping Into Pond (gpd) 4000000

Pump Off Elevation For Pumping Into Pond (ft) 48

Pumping Into Pond Can Not Occur If The Following Discharge Structures Are Simultaneously Pumping:

Discharge Structure 1  
 Discharge Structure 2  
 Discharge Structure 3

**Pumping Out Of Pond**

Pumping Rate For Pumping Out Of Pond (gpd) 0

Pump Off Elevation For Pumping Out Of Pond (ft) 46.907

**Pumping Occurs During The Following Antecedent Moisture Conditions:**

<p>AMC I</p> <p><input checked="" type="radio"/> Don't Pump</p> <p><input type="radio"/> Pump In</p> <p><input type="radio"/> Pump Out</p>	<p>AMC II</p> <p><input type="radio"/> Don't Pump</p> <p><input checked="" type="radio"/> Pump In</p> <p><input type="radio"/> Pump Out</p>	<p>AMC III</p> <p><input type="radio"/> Don't Pump</p> <p><input checked="" type="radio"/> Pump In</p> <p><input type="radio"/> Pump Out</p>
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**Definition Of Antecedent Moisture Conditions**

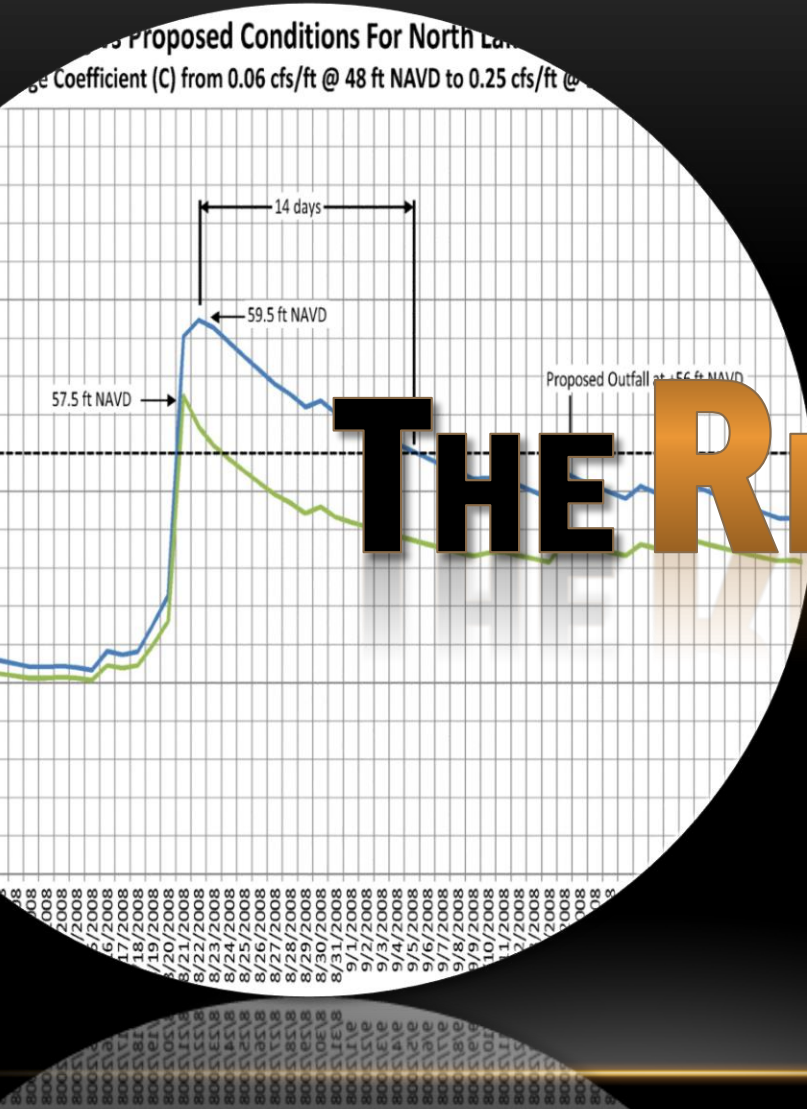
Use Default SCS Antecedent Moisture Definitions Used For Runoff Calculation

<b>Dormant Season:</b>	AMC I < 0.5	<= AMC II <= 1.1	< AMC III
<b>Growing Season:</b>	AMC I < 1.4	<= AMC II <= 2.1	< AMC III

Note: the conditional pump is only valid for continuous simulation hydrographs.

Ready DATA IS UNLOCKED

# REUSE IN: NEW DISCHARGE STRUCTURE TYPE IN PONDS 3.3



**ROUND NUMBERS ONLY, BACK OF THE ENVELOPE HAND CALC**

**CRANES ROOST AS A PUMPED & RECONFIGURED  
BATHTUB DURING TS FAY**

**Storm event = TS Fay, 12.89 inches of rainfall in 6 days (Aug 18 to 23, 2008)**

▪ **NEGATIVES**

-Loss of storage volume in Cranes Roost from geometric contraction due to I-4 = -16.7 ac-ft

-North Lake transfer & I 4 Related additional runoff TS Fay = -97 ac-ft

1 -28.3 ac-ft from North Lake

2 -59.7 ac-ft Additional I-4 Runoff

3 -9.1 ac-ft additional discharge from Lake Adelaide

**TOTAL INCREASE IN STORMWATER RUNOFF = -97 ac-ft total**

▪ **POSITIVES**

-Initial stage credit of 1.5 ft at start of storm (49.0 vs 50.5) = +72 ac-ft

-Pumped Discharge (Harvest) During Storm = 3,000,000 gpd (400,000 cubic feet per day) × 6 days

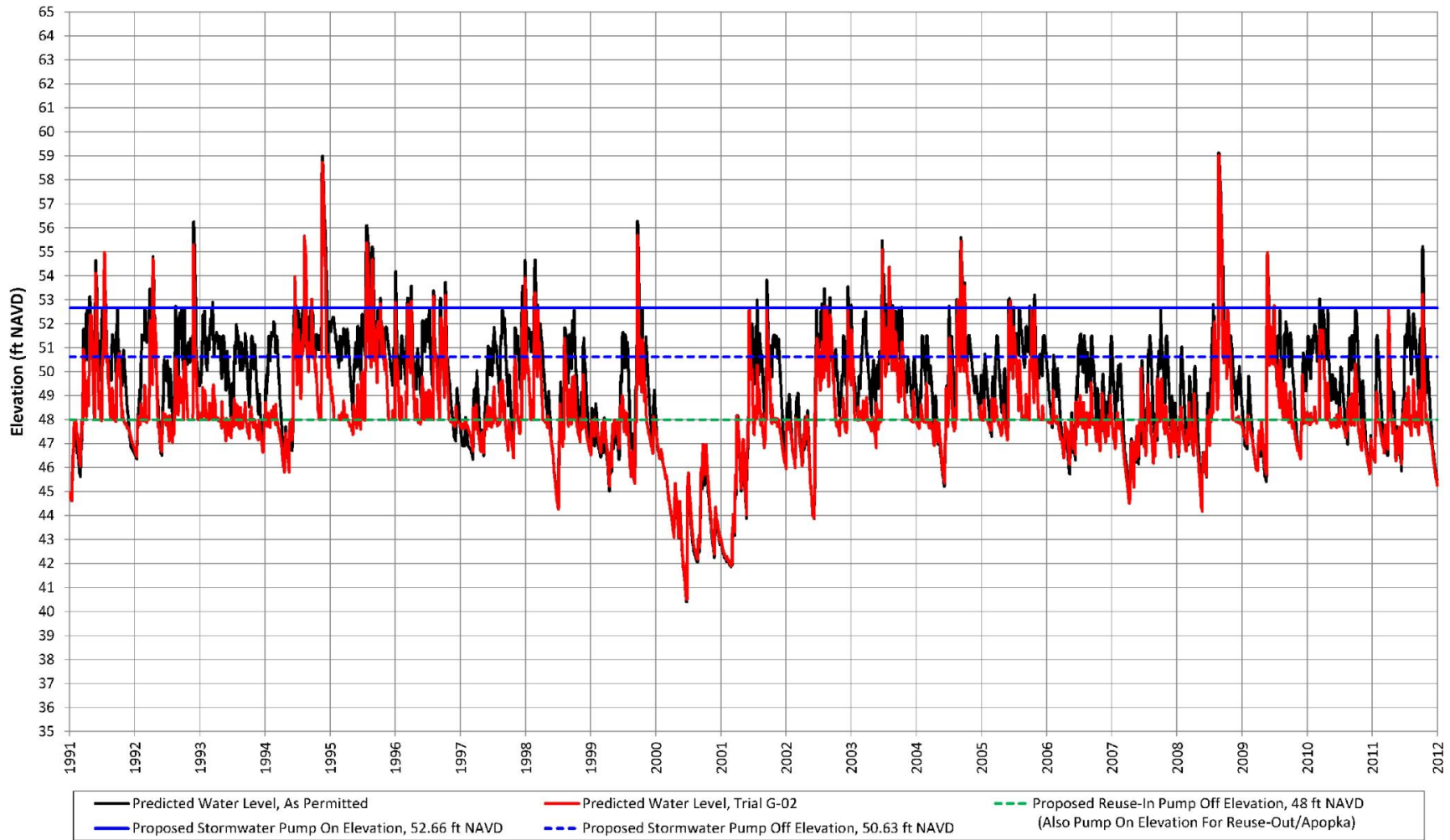
duration of TS Fay = +55 ac-ft

▪ **NET GAIN IN STORAGE DURING TS FAY**

**Net Volume = -16.7 + 72 + 55 - 97 = +13.3 ac-ft, which translates into a maximum betterment of 0.2 ft in stage**

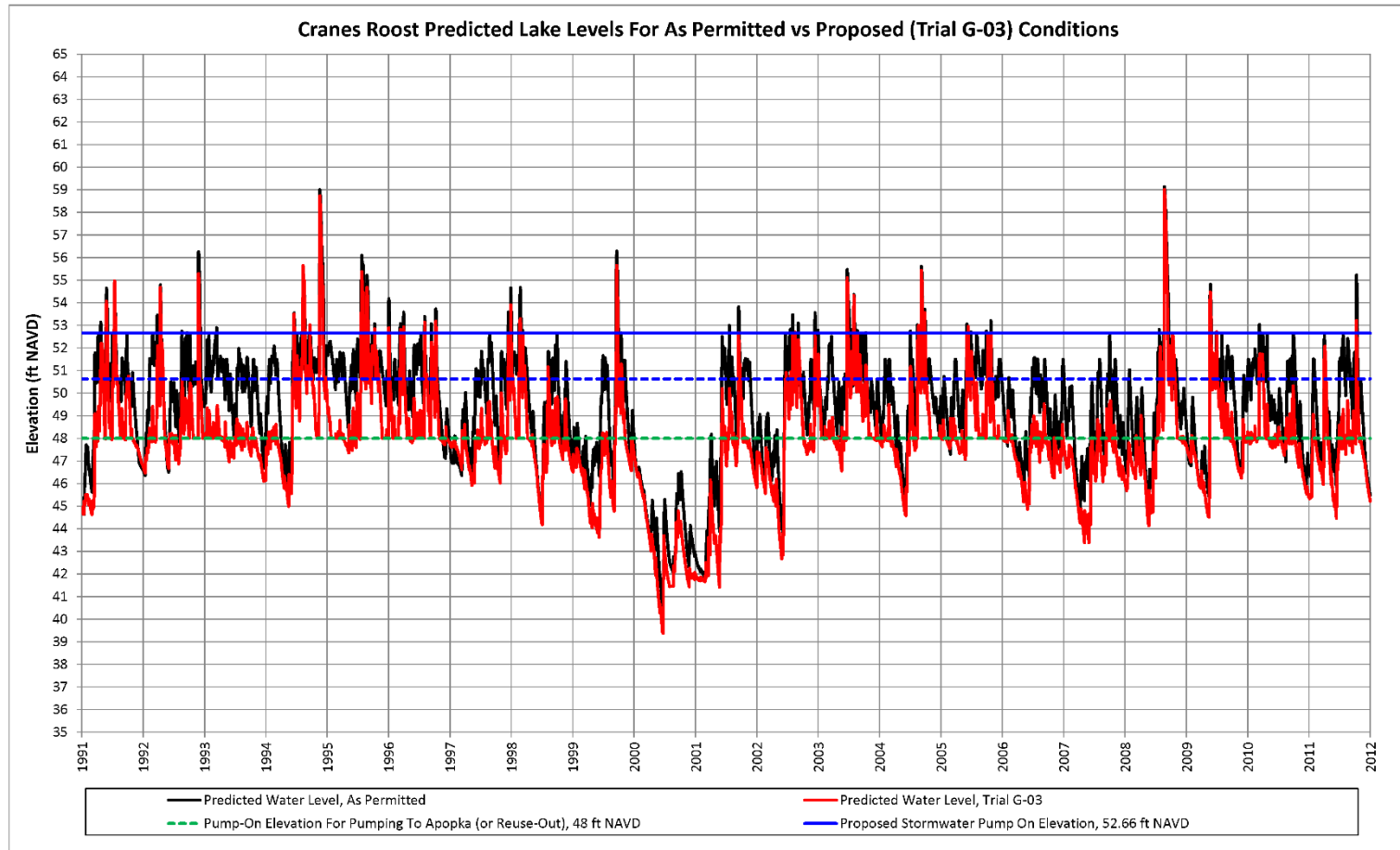
# EXISTING VS PROPOSED HYDROPERIOD

Cranes Roost Predicted Lake Levels For As Permitted vs Proposed (Trial G-02) Conditions



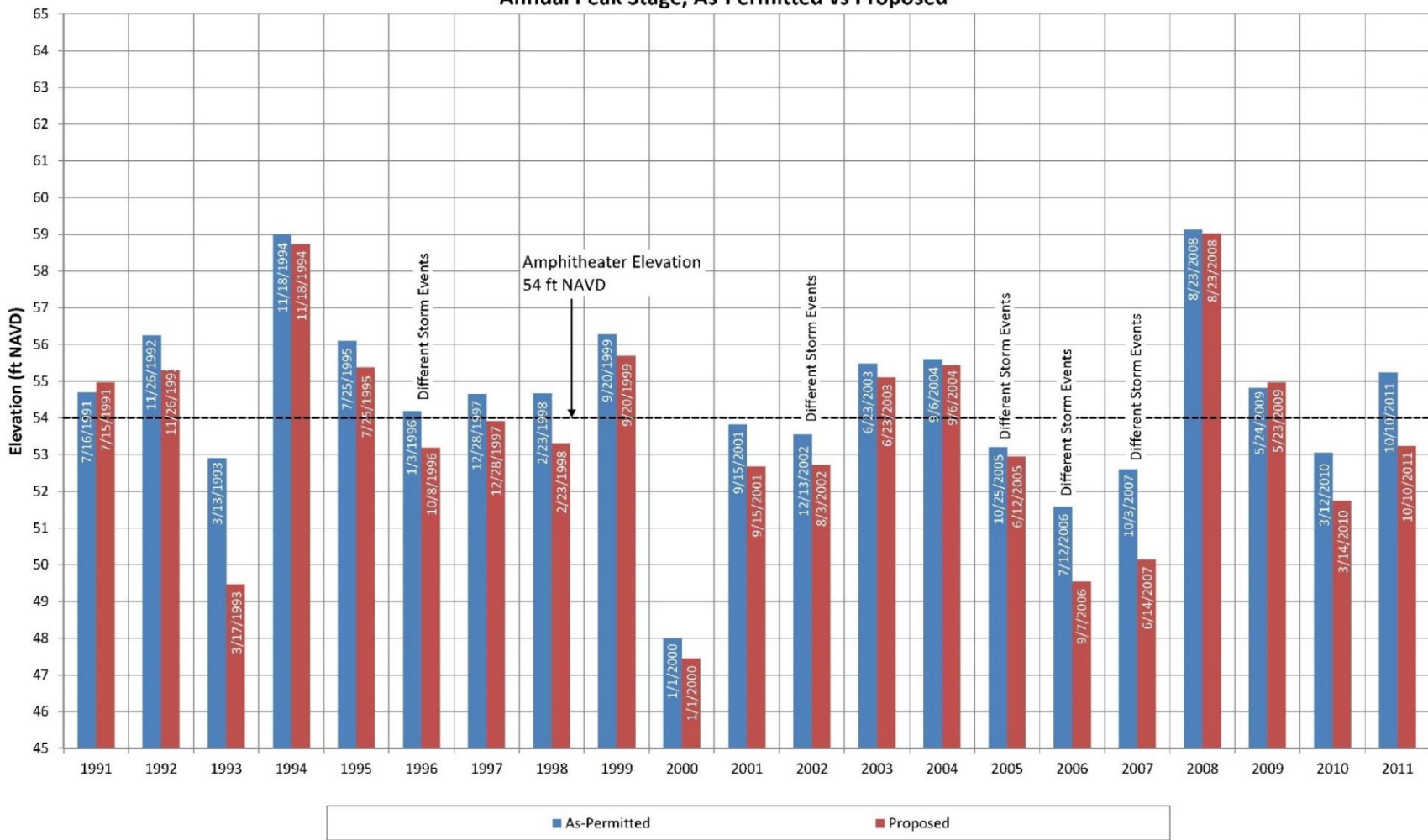


# EXISTING VS PROPOSED HYDROPERIOD



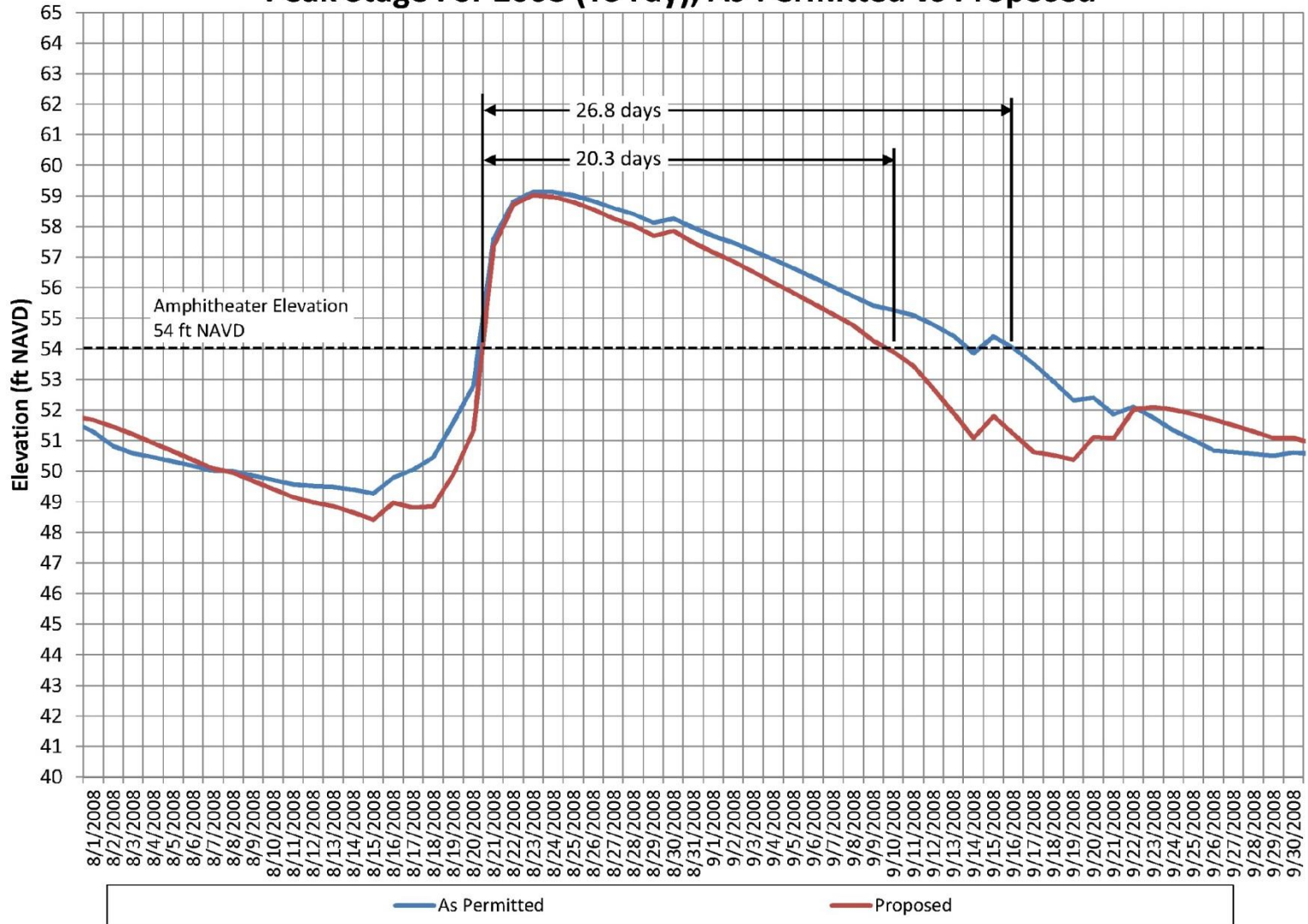
# As-PERMITTED VS PROPOSED ANNUAL PEAK STAGE

Annual Peak Stage, As-Permitted vs Proposed



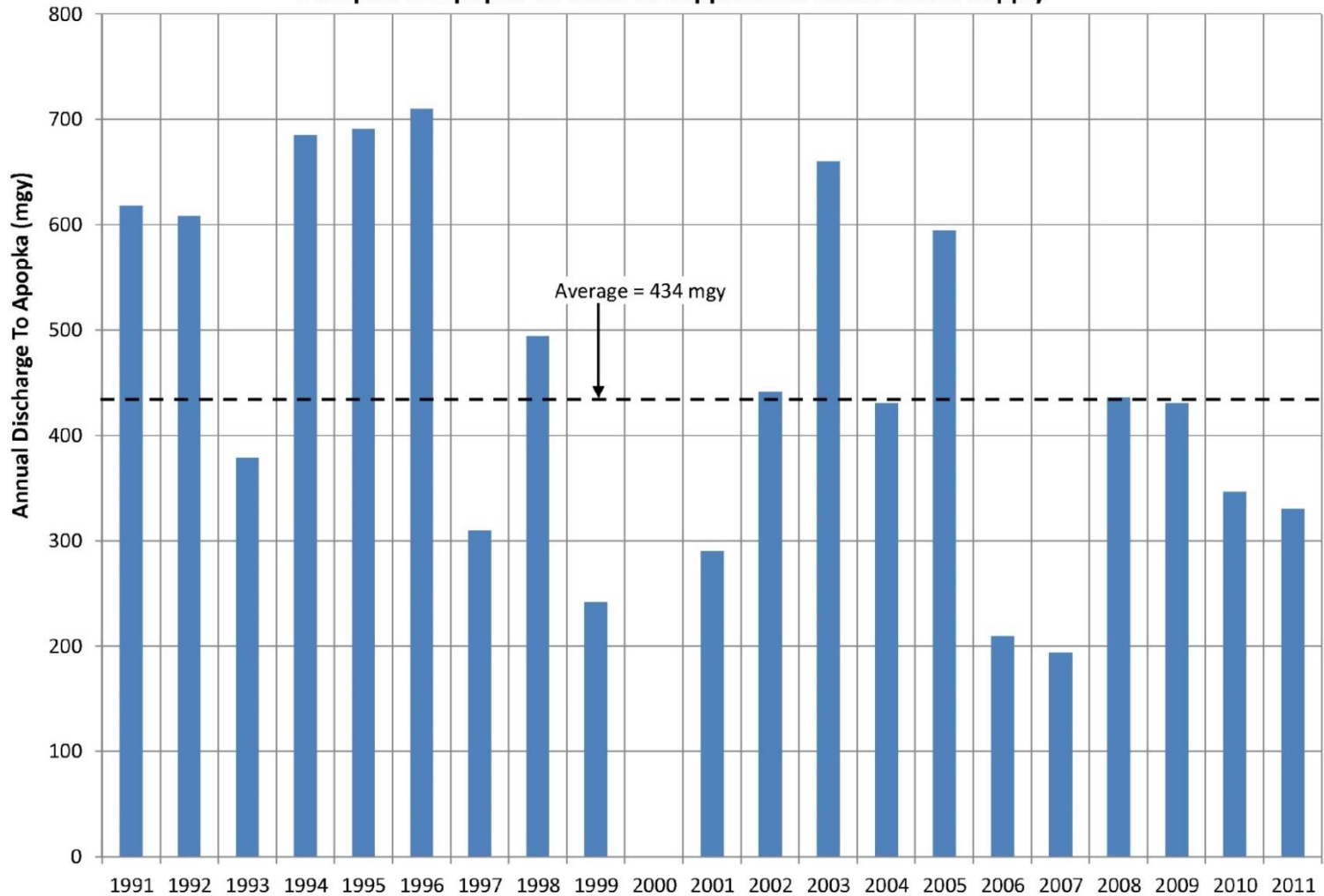
# AS-PERMITTED VS PROPOSED PEAK STAGE FOR TS FAY

## Peak Stage For 2008 (TS Fay), As-Permitted vs Proposed



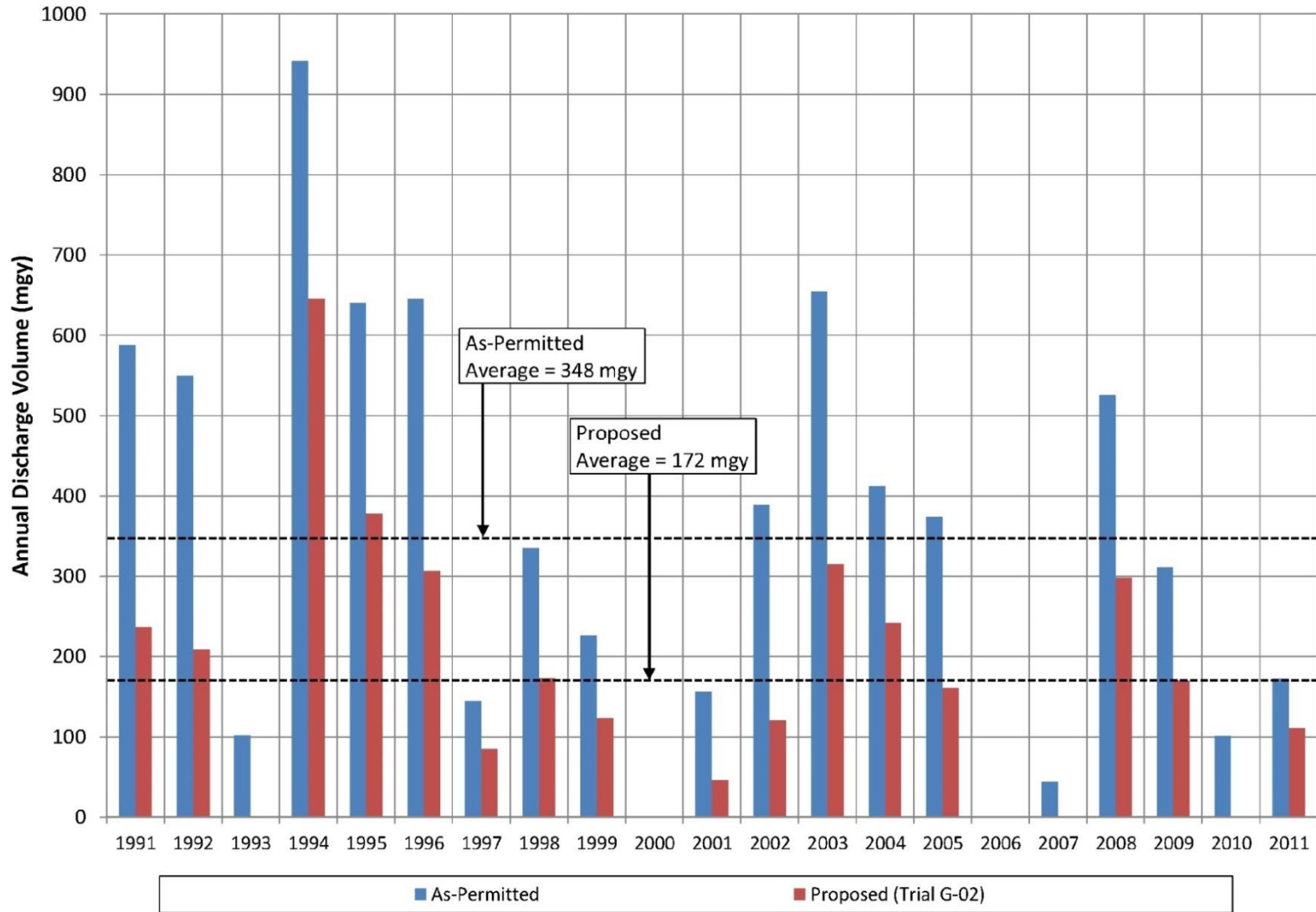
# AVAILABLE SUPPLEMENTAL REUSE WATER

Trial G-02 - Predicted Annual Discharge  
Pumped To Apopka Or Used To Supplement Reuse Water Supply



# PREDICTED STORMWATER DISCHARGE TO LWR

## Predicted Stormwater Pumping To Little Wekiva River, As-Permitted vs Trial G-02





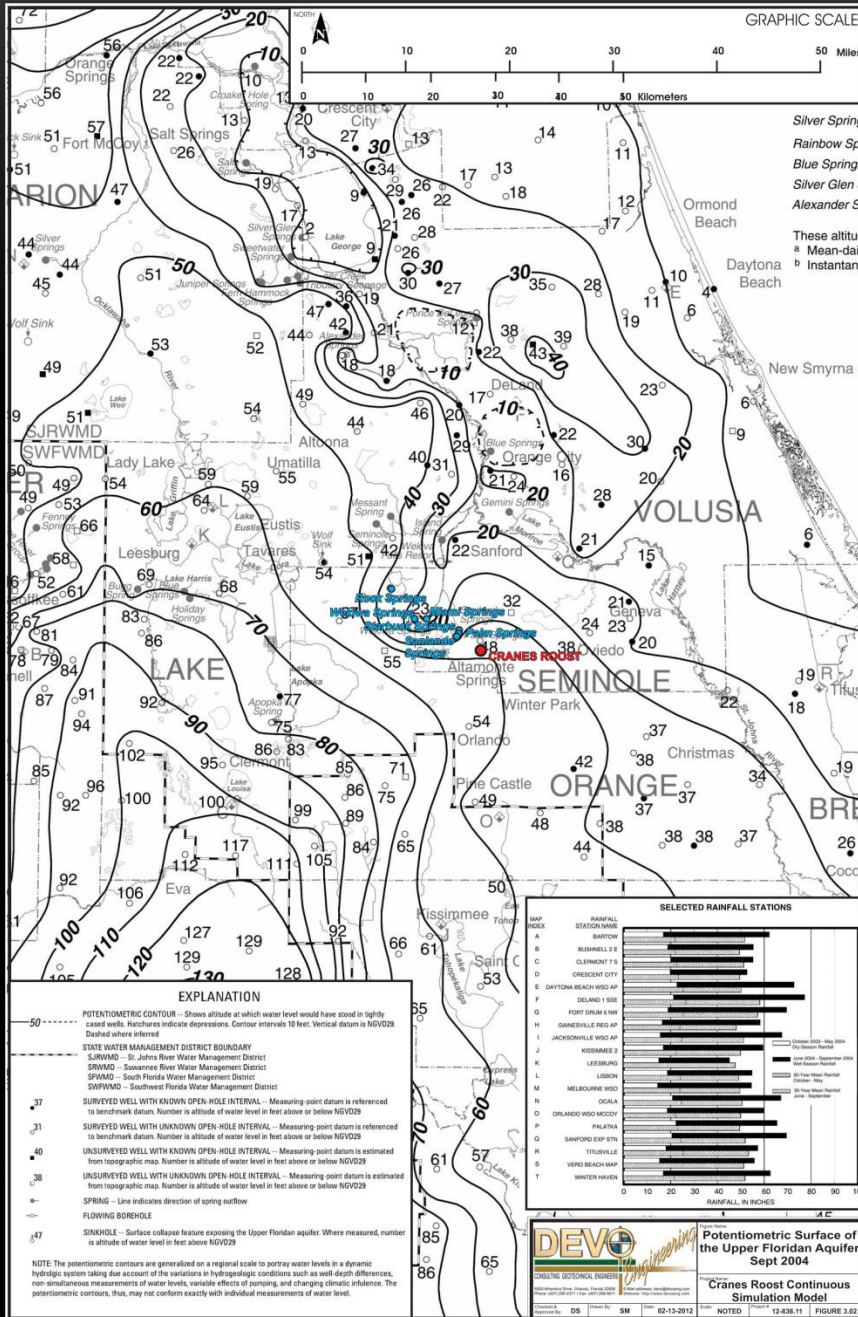
# THE BENEFITS

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# THE BENEFITS

- Elimination of I-4 retention pond & bridge
- 50% reduction in pumping discharge to Little Wekiva River
- Reduction in time that Cranes Roost facilities are not available due to high water/flood conditions
- Reduction in City's reliance on groundwater (Floridan aquifer) augmentation during periods when irrigation demand exceeds the supply of reclaimed water
- Provision of high level outfall for North Lake
- 434 million gallons per year (average) harvest volume now available to Apopka and Altamonte Springs
- Still allows for storage of excess reclaimed water in Cranes Roost when water levels fall below elevation +48 ft NAVD



# STORMWATER AND RECLAIMED WATER INTEGRATED PLANS

## POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER SEPT.2004



Table 3. Summary of Results For Recommended Operating Conditions

Trial Number	As Permitted	Trial G-02	Trial G-03
Max. Pumping Rate to Little Wekiva River (gpm)	7,500	7,500	7,500
Max. Pumping Rate to Apopka (gpm)	N.A.	2,083	2,083
Combined Max. Pump-Out Rate at High Water Level, LWR + Apopka (gpm)	7,500	9,583	9,583
Stormwater Pump-Off Elevation (ft NAVD)	<b>50.63</b>	<b>50.63</b>	<b>50.63</b>
Reuse-In Nominal Pumping Rate (MGD)	<b>4</b>	<b>4</b>	<b>0</b>
<b>Reuse Pumping</b>			
Reuse-In Cutoff Elevation (ft NAVD)	51.5	48	N.A.
Reuse-Out/Apopka Cutoff Elevation (ft NAVD)	46.91	48	48
Reuse-In Nominal Pumping Rate (MGD)	4	4	0
Reuse-Out/Apopka Nominal Pumping Rate (MGD)	1	3	3
Ratio of Reuse In / Reuse Out	4	1.33	N.A.
<b>Stormwater Pumping To Little Wekiva River</b>			
Stormwater Pump-On Elevation (ft NAVD)	52.66	52.66	52.66
Stormwater Pump-Off Elevation (ft NAVD)	<b>50.63</b>	<b>50.63</b>	<b>50.63</b>
Max. Pump Capacity Available For Pumping to Little Wekiva River (gpm)	7,500	7,500	7,500
Cumulative Discharge to LWR For 21 Year Model Period (ac-ft)	22,446	11,113	10,859
Long Term Average Annual Stormwater Discharge (ac-ft/yr)	1069	529	517
Change in Stormwater Pumping Compared to Baseline (%)	N.A.	50.5	51.6
Days with Non-zero Stormwater Pumping To Little Wekiva River (days)	936	399	388
Days with Non-zero Stormwater Pumping To Little Wekiva River (%)	12.2	5.2	5.1
<b>Leakage</b>			
Cumulative Leakage For 21 Year Model Period (ac-ft)	27,141	18,073	15,460
Average Long Term Annual Leakage (ac-ft/yr)	1292	861	736
Change in Leakage From Baseline Conditions (%)	N.A.	33.4	43.0
<b>Reuse-In Pumping</b>			
Reuse In, Cumulative Volume For Model Duration (ac-ft)	15,240	4,593	0
Average Yearly Reuse In Volume (ac-ft/yr)	726	219	0
Maximum Reuse-In Annual Volume (ac-ft/yr)	1115	512	0
Minimum Reuse-In Annual Volume (ac-ft/yr)	320	5	0

# MODEL RESULTS

Table 3. Summary of Results For Recommended Operating Conditions

Trial Number	As Permitted	Trial G-02	Trial G-03
<b>Pumping To Apopka (or Reuse-Out)</b>			
Cumulative Discharge To Apopka Or Reuse-Out For 21 Year Model Period (ac-ft)	12,548 (reuse out)	27,940	26,240
Average Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	598	1330	1250
Average Yearly Discharge As Percentage Of Maximum Potential Discharge (%)	N.A.	39.6	37.2
Maximum Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	816	2,180	2,174
Minimum Yearly Discharge To Apopka/Reuse-Out (ac-ft/yr)	30	0	0
Average Yearly Net Reuse-Out [Reuse-Out minus Reuse-In] (ac-ft/yr)	-128	1112	1250
Average Yearly Net Reuse-Out [Reuse-Out minus Reuse-In] (mg/y)	-42	362	407
<b>Days With Pumping</b>			
Total Days In Model Period	7670	7670	7670
Days with Non-zero Stormwater Pumping To Little Wekiva River (days)	936	399	388
Days with Non-zero Stormwater Pumping To Little Wekiva River (%)	12.2	5.2	5.1
Days With Reuse-In Pumping (days)	1402	756	0
Days With Reuse In-Pumping (%)	18.3	9.9	0.0
Days With Pumping To Apopka or Reuse-Out (days)	4151	3698	3466
Days With Pumping To Apopka or Reuse-Out(%)	54.1	48.2	45.2
Days with No Pumping (days)	1466	52	4205
Days with No Pumping (%)	19.1	0.7	54.8
<b>Cranes Roost Water Level Highs And Lows</b>			
Number Of Days With Stage Greater Than 54 Ft NAVD	169	109	105
Number Of Days With Stage Less Than 47.5 Ft NAVD	1763	2132	2740
Highest Peak Stage (ft NAVD) [Aug 2008, TS Fay, 12.89 inches in 6 days]	59.1	59.0	59.0
Second Highest Peak Stage (ft NAVD) [Nov 1994, Gordon, 9.61 inches in 4 days]	59.0	58.7	58.7
Third Highest Peak Stage (ft NAVD) [Sep 1999, 6.67 inches in 3 days]	56.3	55.7	55.7
Lowest Drought Stage (ft NAVD) [Jun 2000]	40.4	40.5	39.4
Second Lowest Drought Stage (ft NAVD) [May 2002]	43.9	43.9	42.7
Third Lowest Drought Stage (ft NAVD) [Jun 1998]	44.4	44.3	44.2

**MODEL RESULTS (CONT'D.)**