DRAINAGE CALCULATIONS
HARTWOOD MARSH PHASE 1-POND 2
Lake County, Florida

Prepared for:

SJRWMD
(St. Johns River Water Management District)

Prepared by:

LAKE COUNTY
FLORIDA

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
437 ARDICE AVE.
EUSTIS, FLORIDA 32726

August, 2009

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AUG. 2 4 2009

DEPARTMENT OF PUBLIC WORKS

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LAKE COUNTY
FLORIDA

JOB ____HARTWOOD MARSH PHASE 1 – POND 2____

SHEET NO. ____2____ OF ____12____

CALCULATED BY ____PMM____ DATE ____8–7–09____

CHECKED BY ____TJM____ DATE ____8–7–09____

SCALE ____NTS____

MODIFIED BASIN 2
HARTWOOD MARSH PHASE 1

POST DEVELOPMENT DRAINAGE BASIN DATA						
BASIN NAME	OUTFALL LOCATION	AREA (AC.)	IMPERVIOUS AREA (AC.)	CURVE NUMBER (AC-FT)	TC (MIN.)	CALCS BY
FIRST BAPTIST CHURCH	REMOVED	REMOVED	REMOVED	REMOVED	REMOVED	HNTB
2 (ROAD)	POND 2	8.23	6.34	82.4	17.26	HNTB
2-1 (OFFSITE)	POND 2	0.08	0	39.0	9.92	HNTB
2-2 (OFFSITE)	POND 2	0.30	0.08	54.7	9.50	HNTB
2-3 (OFFSITE)	POND 2	0.14	0.01	43.2	8.75	HNTB
2-4 (POND 2)	POND 2	2.00	0.44	76.71	NA	LCPW
TOTAL		10.75	6.87			

TABLE 1

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JOB	HARTWOOD MARSH PHASE 1 – POND 2		
SHEET NO.	3	OF	12
CALCULATED BY	PMM	DATE	8–7–09
CHECKED BY	TJM	DATE	8–7–09
SCALE	NTS		

POND 2 STAGE-AREA-STORAGE CALCULATIONS

HARTWOOD MARSH PHASE 1 - POND 2

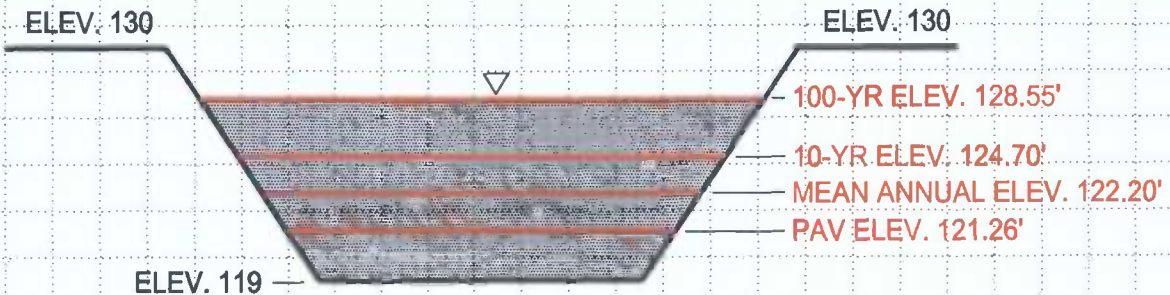| POND 2 STAGE-AREA-STORAGE TABLE					
STAGE (FT)	SURFACE AREA (FT^2)	AVERAGE SURFACE AREA (FT^2)	CUMULATIVE VOLUME (FT^3)	CUMULATIVE VOLUME (AC-FT)	REMARKS
119	18,981		0	(0)	
120	21,906	20,444	20,444	(0.47)	
121	24,910	23,408	43,852	(1.01)	
121.26			50,576	(1.16)	PAV ELEV.
122	28,123	26,517	70,369	(1.62)	
122.20			76,230	(1.75)	MEAN ANNUAL
123	31,311	29,717	100,086	(2.30)	
124	34,668	32,990	133,076	(3.06)	
124.70			158,559	(3.64)	10-YR ELEV.
125	38,145	36,407	169,483	(3.89)	
126	41,728	39,937	209,420	(4.81)	
127	45,388	43,558	252,978	(5.81)	
128	49,148	47,268	300,246	(6.89)	
128.55			328,443	(7.54)	100-YR ELEV.
129	53,009	51,079	351,325	(8.07)	
130	56,970	54,990	406,315	(9.33)	

TABLE 2

FIGURE 1

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JOB ___HARTWOOD MARSH PHASE 1 – POND 2___
SHEET NO. ___4___ OF ___12___
CALCULATED BY ___PMM___ DATE ___8-7-09___
CHECKED BY ___TJM___ DATE ___8-7-09___
SCALE ___NTS___

POND 2
POLLUTION ABATEMENT VOLUME (PAV)

Data: DA = 10.75 Acres
Imp. Area = 6.87 Acres
Pervious Area = 3.88 Acres

OFF-LINE SYSTEM

Retention of one half inch of runoff from the drainage area (DA) or 1.25 inches of runoff from the impervious area, whichever is greater.

ON-LINE SYSTEM

Retention of an additional one half inch of runoff from the drainage area over the off-line volume above.

CALCULATIONS:

Off-Line Retention:

$PAV_1 = 0.5"/12 (10.75)(43560) = 19,512$ CF

$1.25"/12 (6.87)(43560) = 31,173$ CF (GREATER)

Add for On-Line Retention:

$PAV_2 = 0.5"/12 (10.75)(43560) = 19,512$ CF

ON-LINE RETENTION

PAV = 31,173 CF + 19,512 CF = 50,685 CF

(Refer to Table 1)

Pollution Abatement Volume (PAV) Pond Elevation @ Elev. 121.26'

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JOB ___HARTWOOD MARSH PHASE 1 — POND 2___

SHEET NO. ___5___ OF ___12___

CALCULATED BY ___PMM___ DATE ___8-7-09___

CHECKED BY ___TJM___ DATE ___8-7-09___

SCALE ___NTS___

POND 2
MEAN ANNUAL RUNOFF VOLUME ESTIMATION

Data: DA = 10.75 Acres
Imp. Area = 6.87 Acres (63.91%)
Pervious Area = 3.88 Acres
P = 4.2 inches (Mean Annual, 24-hr Storm)
S = 3.04 Inches

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad \text{Runoff Equation (inches)}$$

$$S = \frac{1000}{CN} - 10 \quad \text{Watershed Storage (inches)}$$

CALCULATIONS:

$$CN = \frac{39(3.88) + 98(6.87)}{10.75} = 76.71$$

$$S = \frac{1000}{76.71} - 10 = 3.04 \text{ Inches}$$

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} = \frac{[4.2 - 0.2(3.04)]^2}{4.2 + 0.8(3.04)}$$

R = 12.90/6.63 = 1.95 Inches

= 1.95"/12 (10.75 Acres) = 1.75 Ac-Ft

R = 1.75 Ac-Ft x 43,560 SF/ Ac = 76,230 CF

(Refer to Table 1)
Mean Annual storm Pond Elevation @ Elev. 122.20'

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JOB ___HARTWOOD MARSH PHASE 1 – POND 2___

SHEET NO. ___6___ OF ___12___

CALCULATED BY ___PMM___ DATE ___8-7-09___

CHECKED BY ___TJM___ DATE ___8-7-09___

SCALE ___NTS___

POND 2
10-YEAR RUNOFF VOLUME ESTIMATION

Data: DA = 10.75 Acres
Imp. Area = 6.87 Acres
Pervious Area = 3.88 Acres
P = 6.7 inches (10-yr, 24-hr Storm)
S = 3.04 Inches

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} \qquad \text{Runoff Equation (inches)}$$

$$S = \frac{1000}{CN} - 10 \qquad \text{Watershed Storage (inches)}$$

CALCULATIONS:

$$CN = \frac{39(3.88) + 98(6.87)}{10.75} = 76.71$$

$$S = \frac{1000}{76.71} - 10 = 3.04 \text{ Inches}$$

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} = \frac{[\,6.7 - 0.2(3.04)\,]^2}{6.7 + 0.8(3.04)}$$

R = 37.09/9.13 = 4.06 Inches

= 4.06"/12 (10.75 Acres) = 3.64 Ac-Ft

R = 3.64 Ac-Ft x 43,560 SF/ Ac = 158,559 CF

(Refer to Table 1)
10-year Pond Elevation @ Elev. 124.70'

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JOB __HARTWOOD MARSH PHASE 1 – POND 2__
SHEET NO. __7__ OF __12__
CALCULATED BY __PMM__ DATE __8-7-09__
CHECKED BY __TJM__ DATE __8-7-09__
SCALE __NTS__

POND 2
100-YEAR RUNOFF VOLUME ESTIMATION

Data: DA = 10.75 Acres
Imp. Area = 6.87 Acres
Pervious Area = 3.88 Acres
P = 11.4 inches (100-yr, 24-hr Storm)
S = 3.04 Inches

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad \text{Runoff Equation (inches)}$$

$$S = \frac{1000}{CN} - 10 \quad \text{Watershed Storage (inches)}$$

CALCULATIONS:

$$CN = \frac{39(3.88) + 98(6.87)}{10.75} = 76.71$$

$$S = \frac{1000}{76.71} - 10 = 3.04 \text{ Inches}$$

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)} = \frac{[11.4 - 0.2(3.04)]^2}{11.4 + 0.8(3.04)}$$

R = 116.45/13.83 = 8.41 Inches

= 8.42"/12 (10.75 Acres) = 7.54 Ac-Ft

R = 7.54 Ac-Ft x 43,560 SF/ Ac = 328,443 CF

(Refer to Table 1)
100-year Pond Elevation @ Elev. 128.55'

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And Robert D. Casper

Retention Pond Recovery Analysis

I.   Job Information

     Job Name: HARTWOOD MARSH PHASE 1 - POND 2, PAV RECOVERY
     Engineer: PMM
     Date: 8-7-2009

II. Input Data

     Equivalent Pond Length, [L] (ft):   306.00
     Equivalent Pond Width, [W] (ft):   83.00
     Pond Bottom Elevation, [PB] (ft above datum):   119.00
     Porosity Of Material Within Pond, [p] (%):   100.00

     Base Of Aquifer Elevation, [B] (ft above datum):   107.00
     Water Table Elevation, [WT] (ft above datum):   108.00
     Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day) 25.00
     Fillable Porosity of Aquifer, [n] (%):   30.00
     Vertical Unsaturated Infiltration, [Iv] (ft/day):   25.00

     Runoff Volume, [V] (cubic feet)   50685.00
     Percent Recovery Of Runoff Volume, [PV] (%)   100.00

III. Results

     UNSATURATED FLOW

         Recovery Time From Unsaturated Flow, [T1] (days):   0.0798
         Recovered Volume From Unsaturated Flow, [V1] (ft^3): 50685.00

     SATURATED FLOW

         Recovery Time From Saturated Flow, [T2] (days):   0.0000
         Recovered Volume From Saturated Flow, [V2] (ft^3):   0.00
         Maximum Radius of Influence, [R] (ft):   0.00
         Maximum Driving Head, [Hmax] (ft):   0.000
         Minimum Driving Head, [Hmin] (ft):   0.000

     TOTAL

         Total Recovery Time, [T] (days):   0.0798
         Total Recovered Volume, [V] (ft^3):   50685.00

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Retention Pond Recovery Analysis

I.   Job Information

     Job Name: HARTWOOD MARSH PHASE 1 - POND 2, 100 YR RECOVERY
     Engineer: PMM
     Date: 8-7-2009

II. Input Data

     Equivalent Pond Length, [L] (ft):   372.00
     Equivalent Pond Width, [W] (ft):   144.00
     Pond Bottom Elevation, [PB] (ft above datum):   119.00
     Porosity Of Material Within Pond, [p] (%):   100.00

     Base Of Aquifer Elevation, [B] (ft above datum):   107.00
     Water Table Elevation, [WT] (ft above datum):   108.00
     Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day)   25.00
     Fillable Porosity of Aquifer, [n] (%):   30.00
     Vertical Unsaturated Infiltration, [Iv] (ft/day):   25.00

     Runoff Volume, [V] (cubic feet)   328443.00
     Percent Recovery Of Runoff Volume, [PV] (%)   100.00

III. Results

     UNSATURATED FLOW

         Recovery Time From Unsaturated Flow, [T1] (days):   0.1320
         Recovered Volume From Unsaturated Flow, [V1] (ft^3): 176774.40

     SATURATED FLOW

         Recovery Time From Saturated Flow, [T2] (days):   1.4339
         Recovered Volume From Saturated Flow, [V2] (ft^3):   151668.60
         Maximum Radius of Influence, [R] (ft):   77.03
         Maximum Driving Head, [Hmax] (ft):   13.831
         Minimum Driving Head, [Hmin] (ft):   11.000

     TOTAL

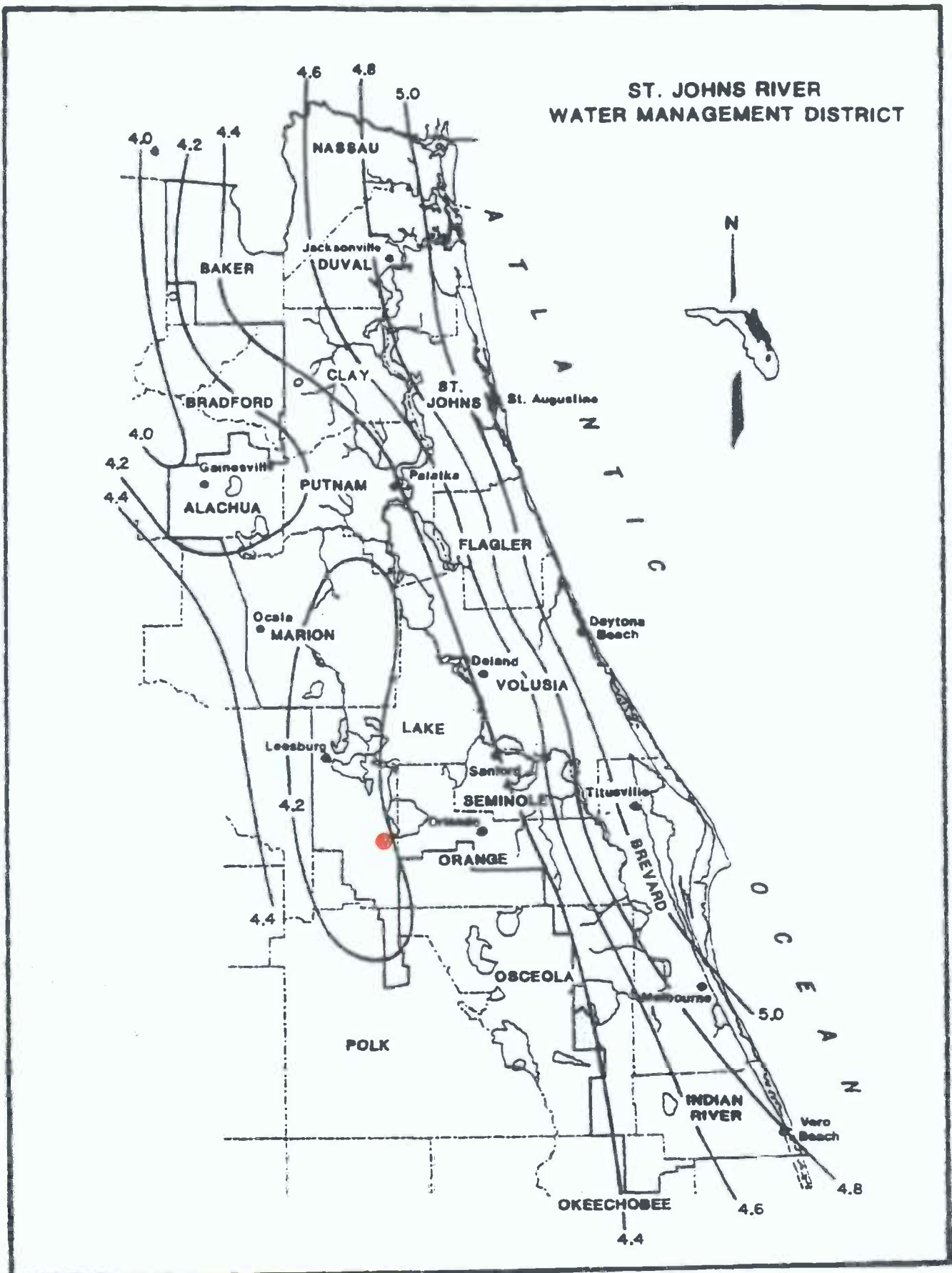   Total Recovery Time, [T] (days):   1.5659
         Total Recovered Volume, [V] (ft^3):   328443.00

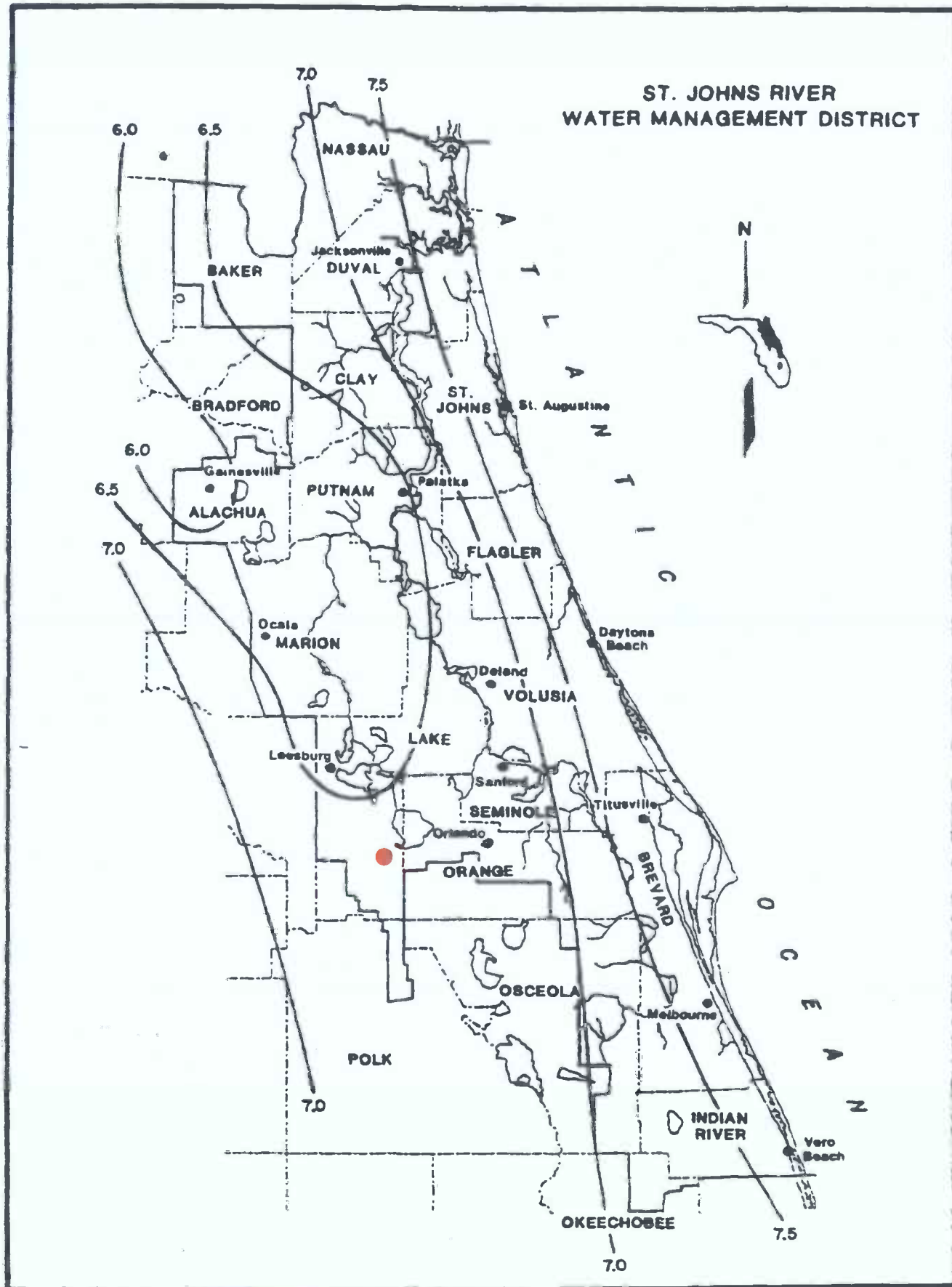**Figure 6.** Mean annual 24-hour maximum rainfall for northeast Florida in inches
Source: Rao 1988a

Figure 3. <mark>10-year 24-hour</mark> maximum rainfall for northeast Florida in inches
Source: Rao 1988a

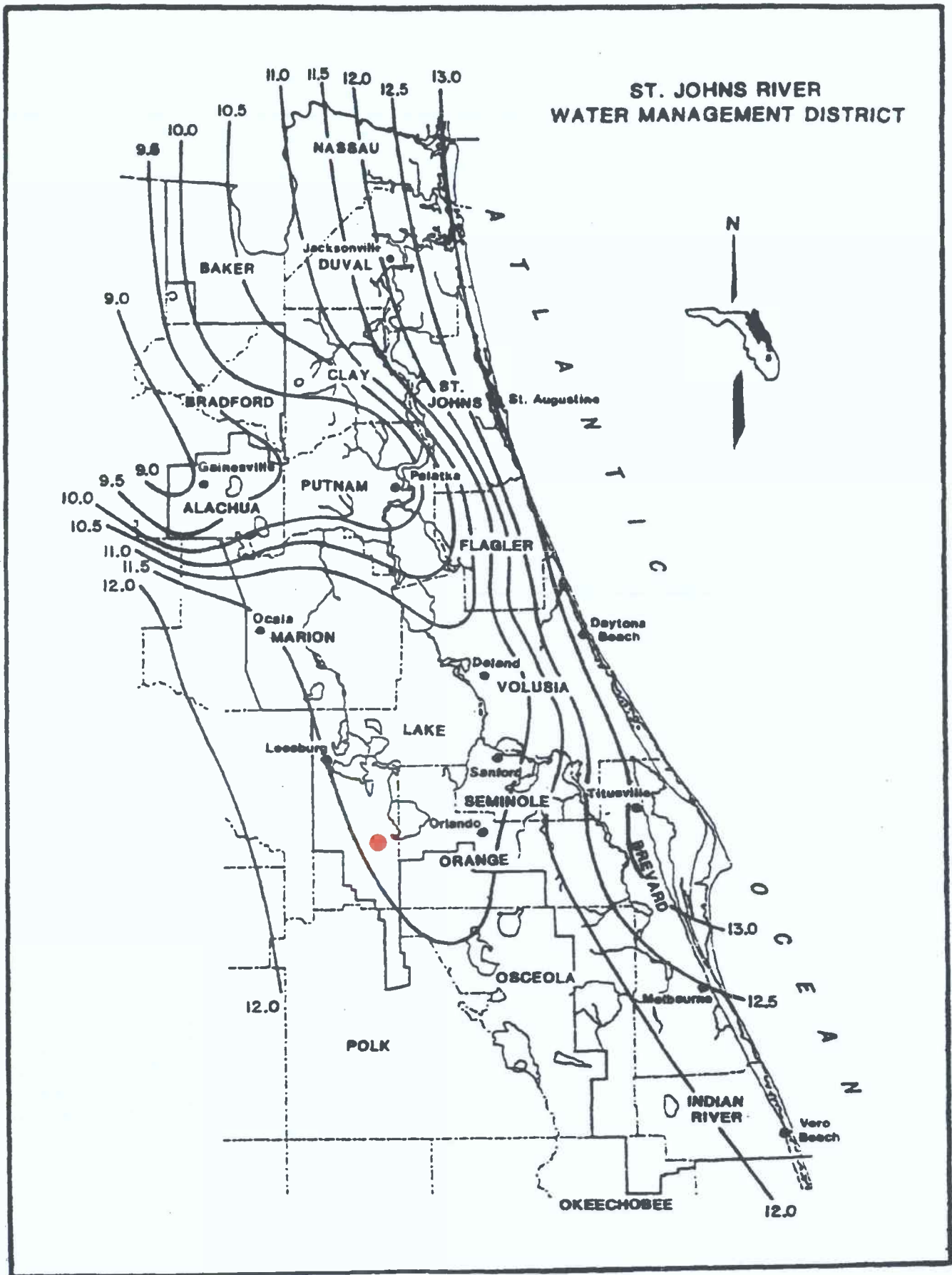**ST. JOHNS RIVER WATER MANAGEMENT DISTRICT**

Figure 5. 100-year 24-hour maximum rainfall for northeast Florida in inches
Source: Rao 1988a

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