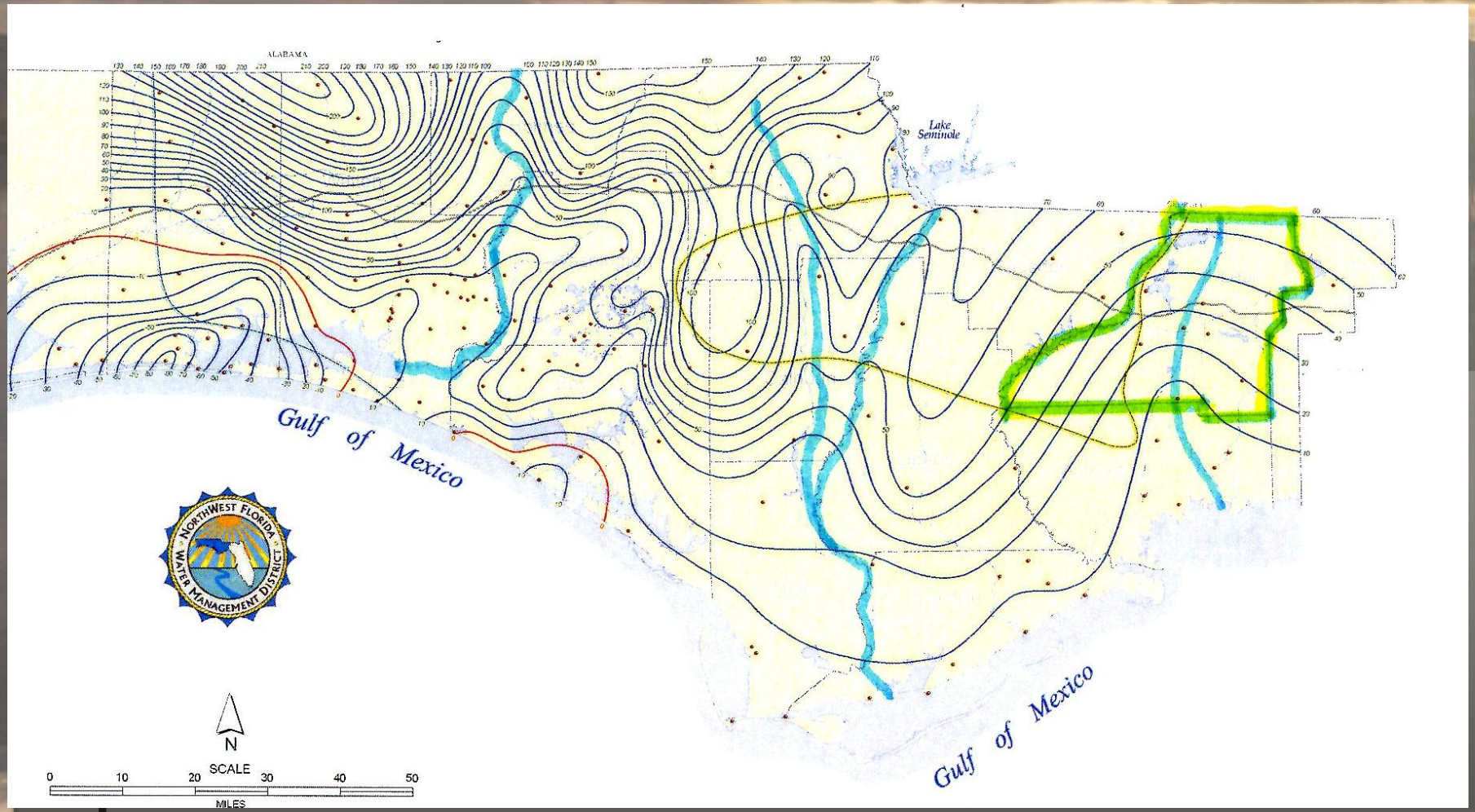
Hydrogeology of Lake Jackson

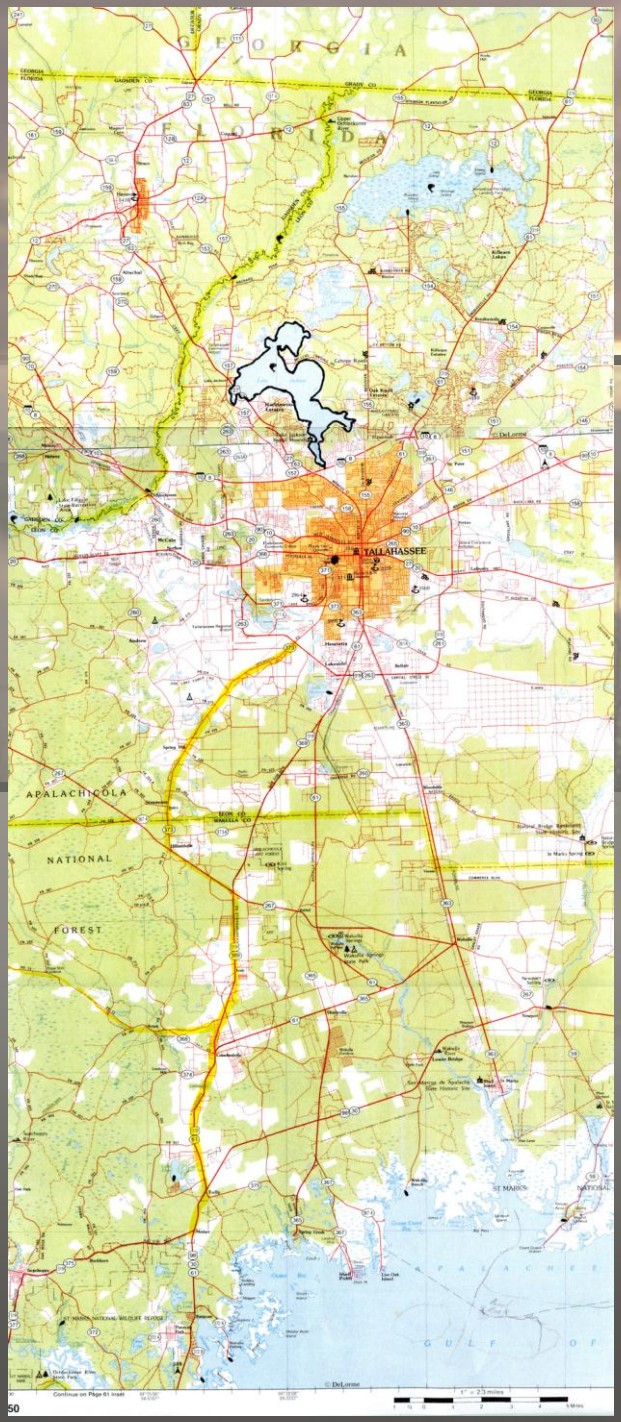
Thomas Kwader, PhD, PG
Alan Niedoroda, PhD, PG

Potentiometric Surface of Floridan Aquifer, NWF

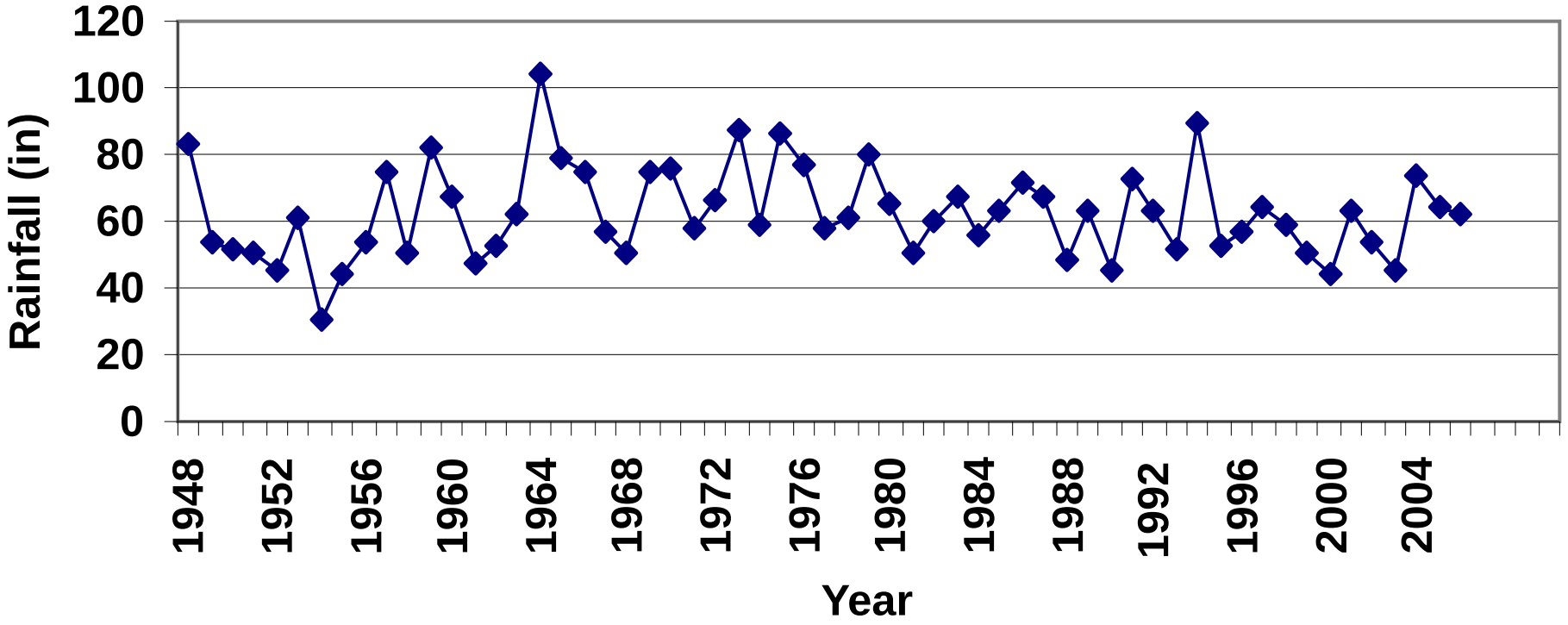



70
60
50
GEORGIA
Leon
Gadsden
Liberty
Wakulla
Franklin
JEFFERSON CO

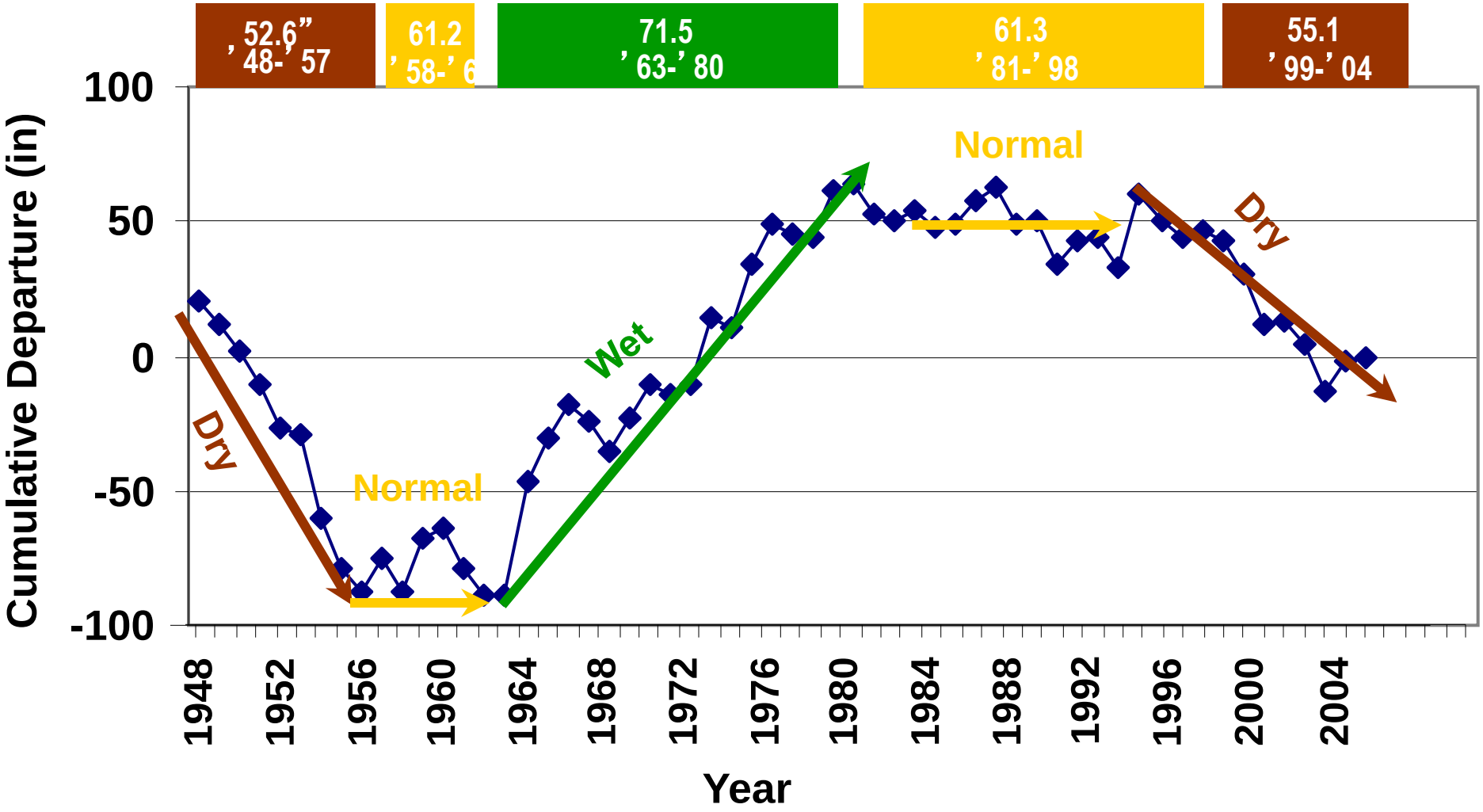
Lake Jackson,
Tallahassee-Gulf of Mexico



Tallahassee Rainfall

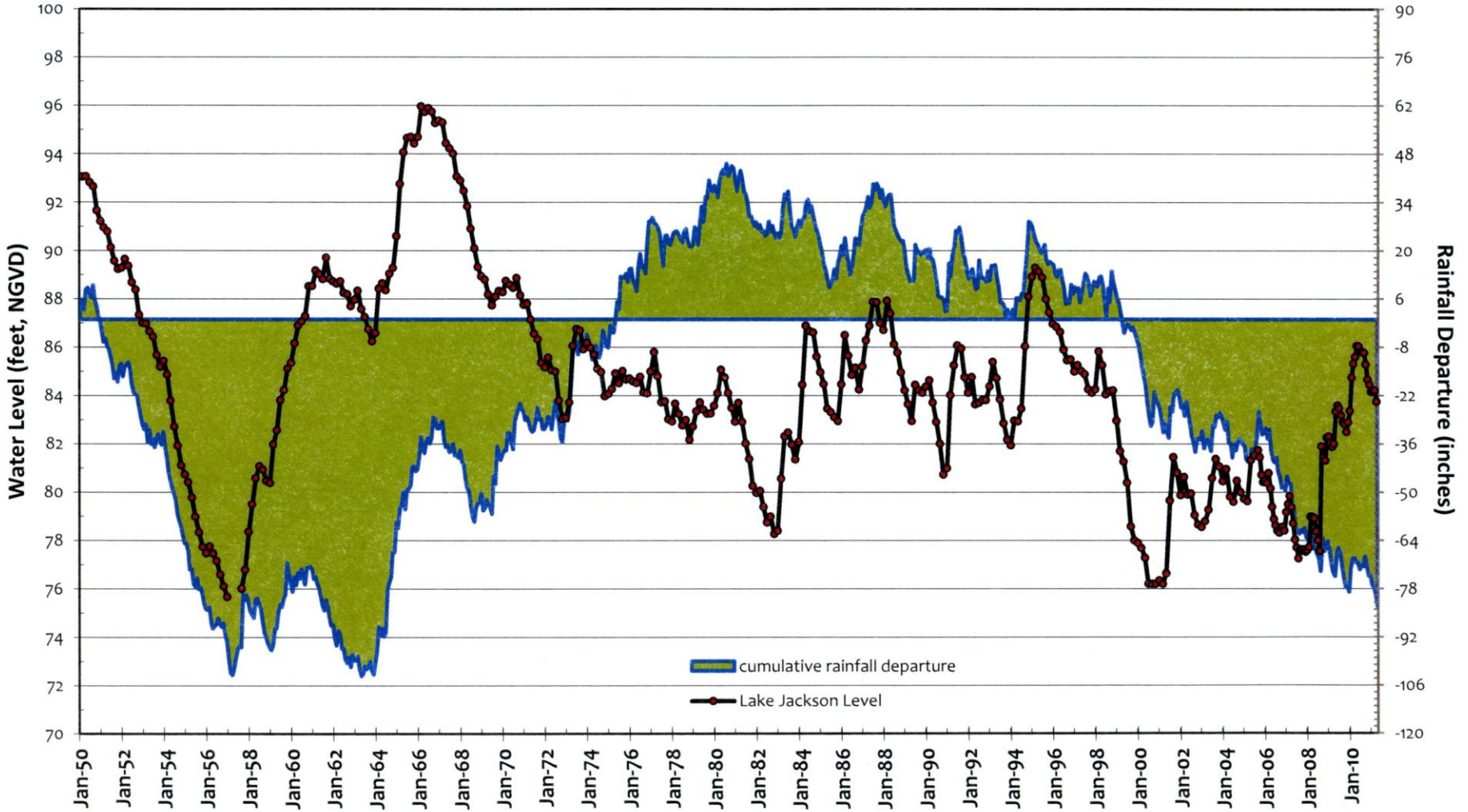


Cumulative Departure From Mean (1948-2004)



Lake Jackson

Water Level and Cumulative Rainfall Departure 1950-2010

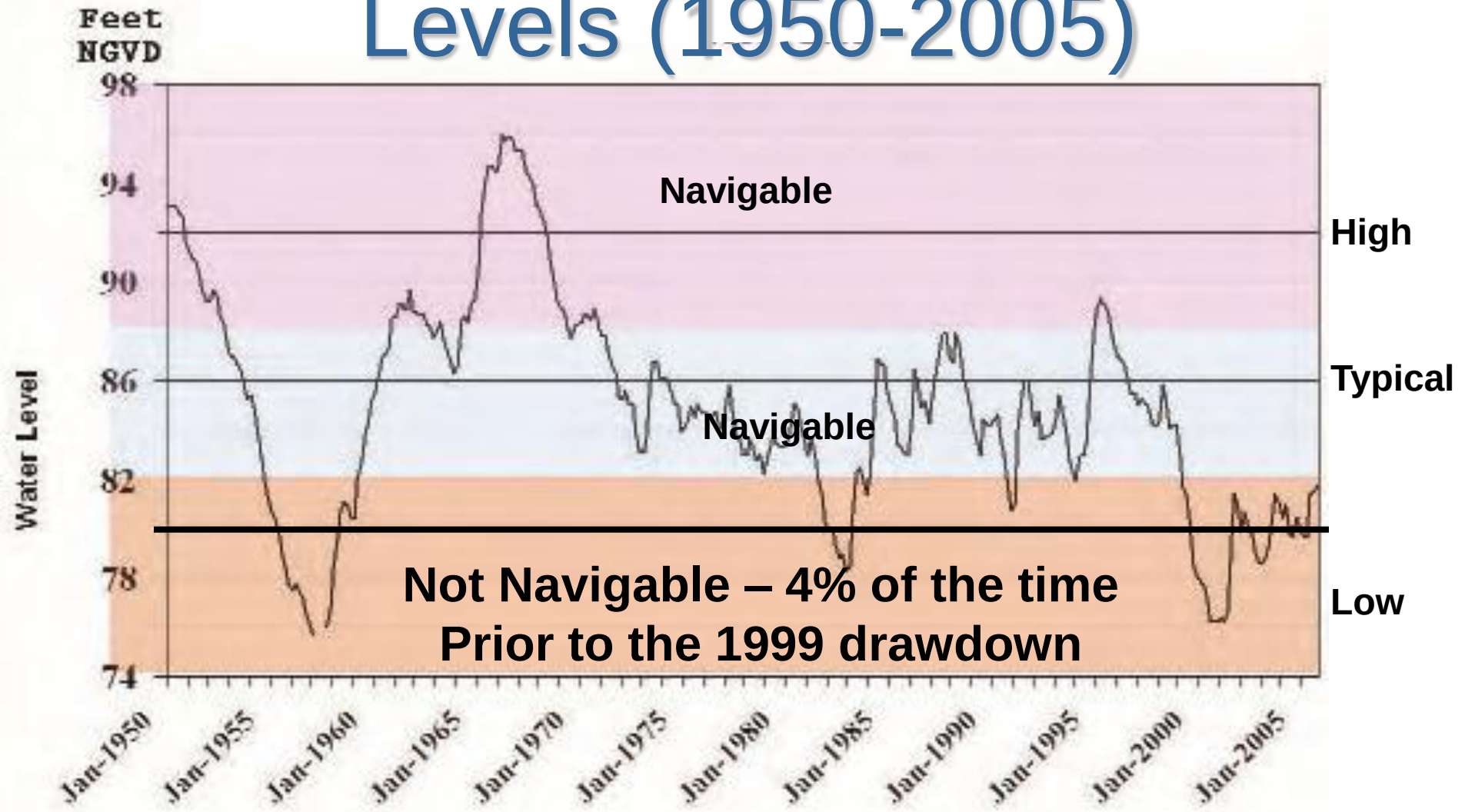



1995


2003

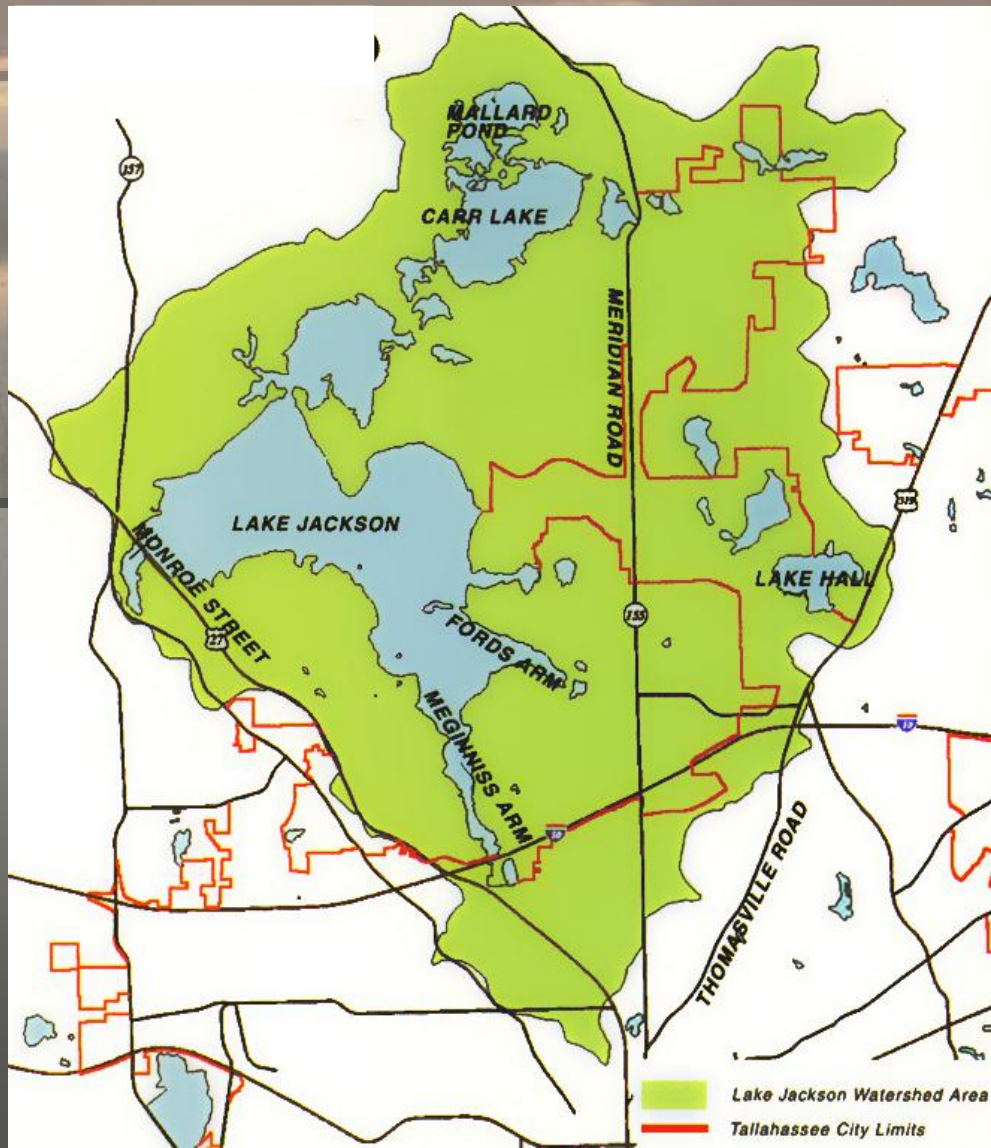

2012

Lake Jackson Water Levels (1950-2005)



Lake Jackson & Watershed

- ***Basin:*** 43 Sq Mi
- ***Lake Area:*** 6.5 Sq Mi
- ***Closed Basin:*** Water level controlled by:
  - Direct rainfall
  - Surface run-off
  - Shallow aquifers seepage
  - Evaporation
  - Loss to deeper aquifer




Famous for Bass Fishing
1995

Sink Hole History – 1950s

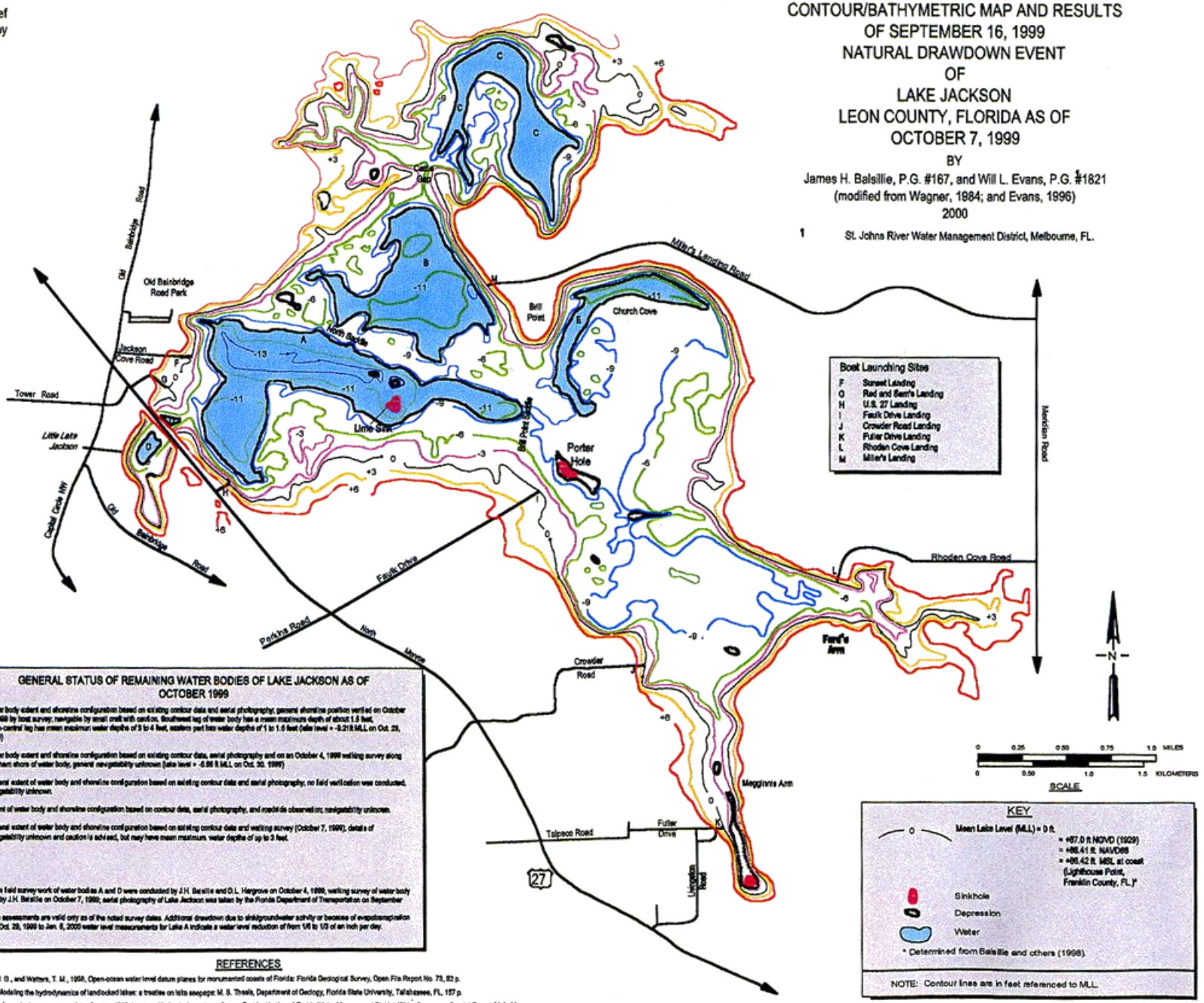
- ***1957:*** Lime sink opened
- ***September 1982:*** Porter Hole #1 opened, plugged itself
- ***September 1999:*** Porter Hole #2 opened and stayed opened until 2005
- ***Summer 2007:*** Porter Hole #1 reopened

Walter Schmidt
State Geologist and Chief
Florida Geological Survey

CONTOUR/BATHYMETRIC MAP AND RESULTS OF SEPTEMBER 16, 1999 NATURAL DRAWDOWN EVENT OF LAKE JACKSON LEON COUNTY, FLORIDA AS OF OCTOBER 7, 1999

BY
James H. Balsillie, P.G. #167, and Will L. Evans, P.G. #1821[1]
(modified from Wagner, 1984; and Evans, 1996)
2000

[1] St. Johns River Water Management District, Melbourne, FL.



GENERAL STATUS OF REMAINING WATER BODIES OF LAKE JACKSON AS OF OCTOBER 1999

Water Body	
A	Water body extent and shoreline configuration based on existing contour data and aerial photography; general shoreline position verified on October 4, 1999 by boat survey; navigable by small craft with caution. Southwest leg of water body has a mean maximum depth of about 1.5 feet; north-central leg has mean maximum water depths of 3 to 4 feet, eastern part has water depths of 1 to 1.5 feet (lake level = -0.21 ft M.L.L on Oct. 28, 1999)
B	Water body extent and shoreline configuration based on existing contour data, aerial photography and on an October 4, 1999 walking survey along southern shore of water body; general navigability unknown (lake level = -0.86 ft M.L. on Oct. 30, 1999)
C	General extent of water body and shoreline configuration based on existing contour data and aerial photography; no field verification was conducted, navigability unknown.
D	Extent of water body and shoreline configuration based on contour data, aerial photography, and roadside observation; navigability unknown.
E	General extent of water body and shoreline configuration based on existing contour data and walking survey (October 7, 1999); details of navigability unknown and caution is advised, but may have mean maximum water depths of up to 3 feet.

Boat and roadside field survey work of water bodies A and D were conducted by J.H. Balsillie and D.L. Hargrove on October 4, 1999; walking survey of water body E was conducted by J.H. Balsillie on October 7, 1999; aerial photography of Lake Jackson was taken by the Florida Department of Transportation on September 23, 1999).

NOTE: The above assessments are valid only as of the noted survey dates. Additional drawdown due to shallow groundwater activity or because of evapotranspiration may occur. From Oct. 28, 1999 to Jan. 6, 2000 water level measurements for Lake A indicate a water level reduction of from 1/6 to 1/3 of an inch per day.

REFERENCES

Balsillie, J. H., Carlon, J. G., and Watters, T. M., 1998, Open-ocean water level datum planes for monumented coasts of Florida: Florida Geological Survey, Open File Report No. 73, 82 p.

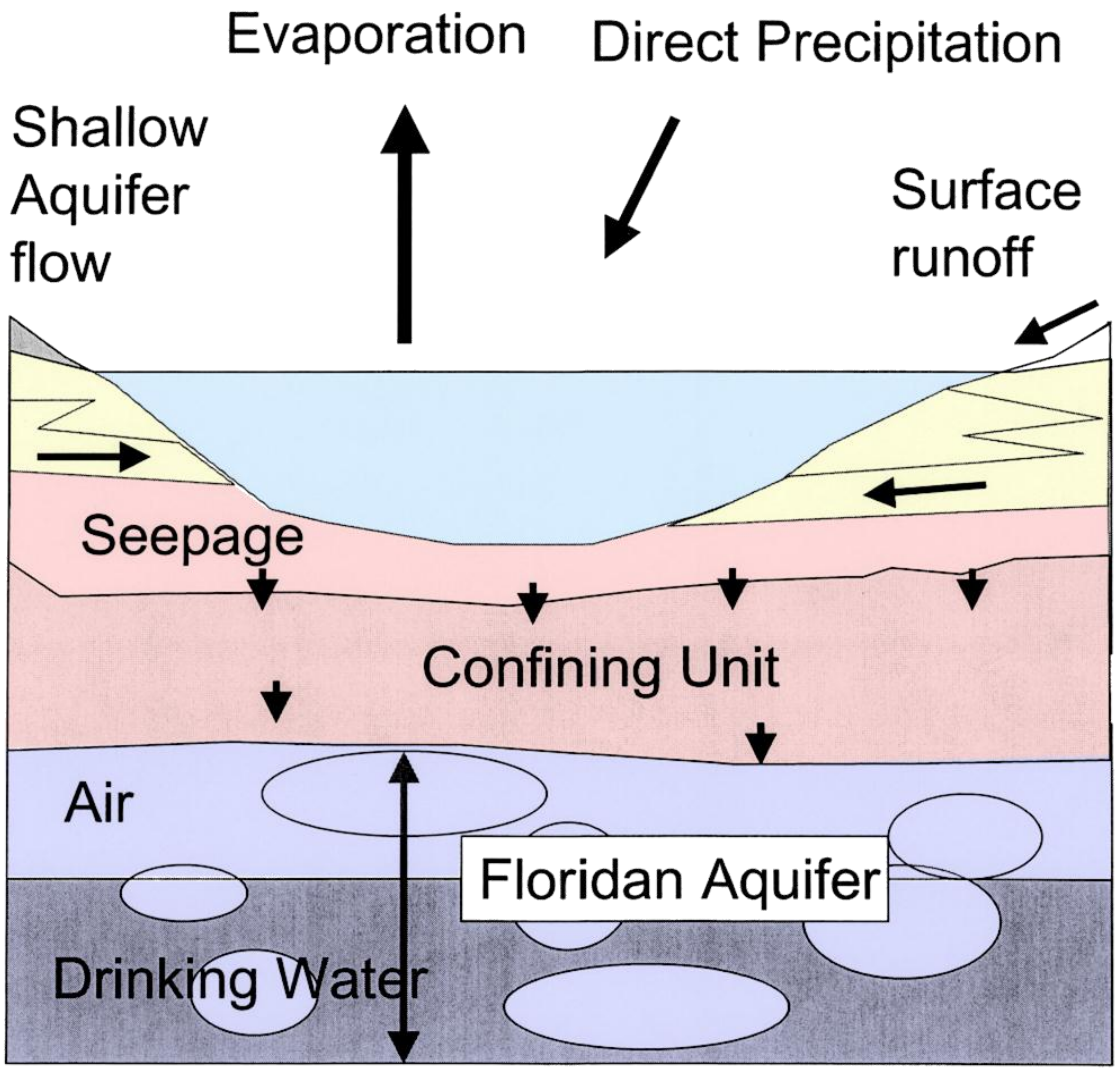
Evans W. L., II, 1996, Modeling the hydrodynamics of landlocked lakes: a treatise on lake seepage: M. S. Thesis, Department of Geology, Florida State University, Tallahassee, FL, 157 p.

Wagner, J. R., 1984, Hydrogeologic assessment of the October 1982 draining of Lake Jackson, Leon County Florida: Northwest Florida Water Management District, Water Resources Special Report 84-1, 44 p.

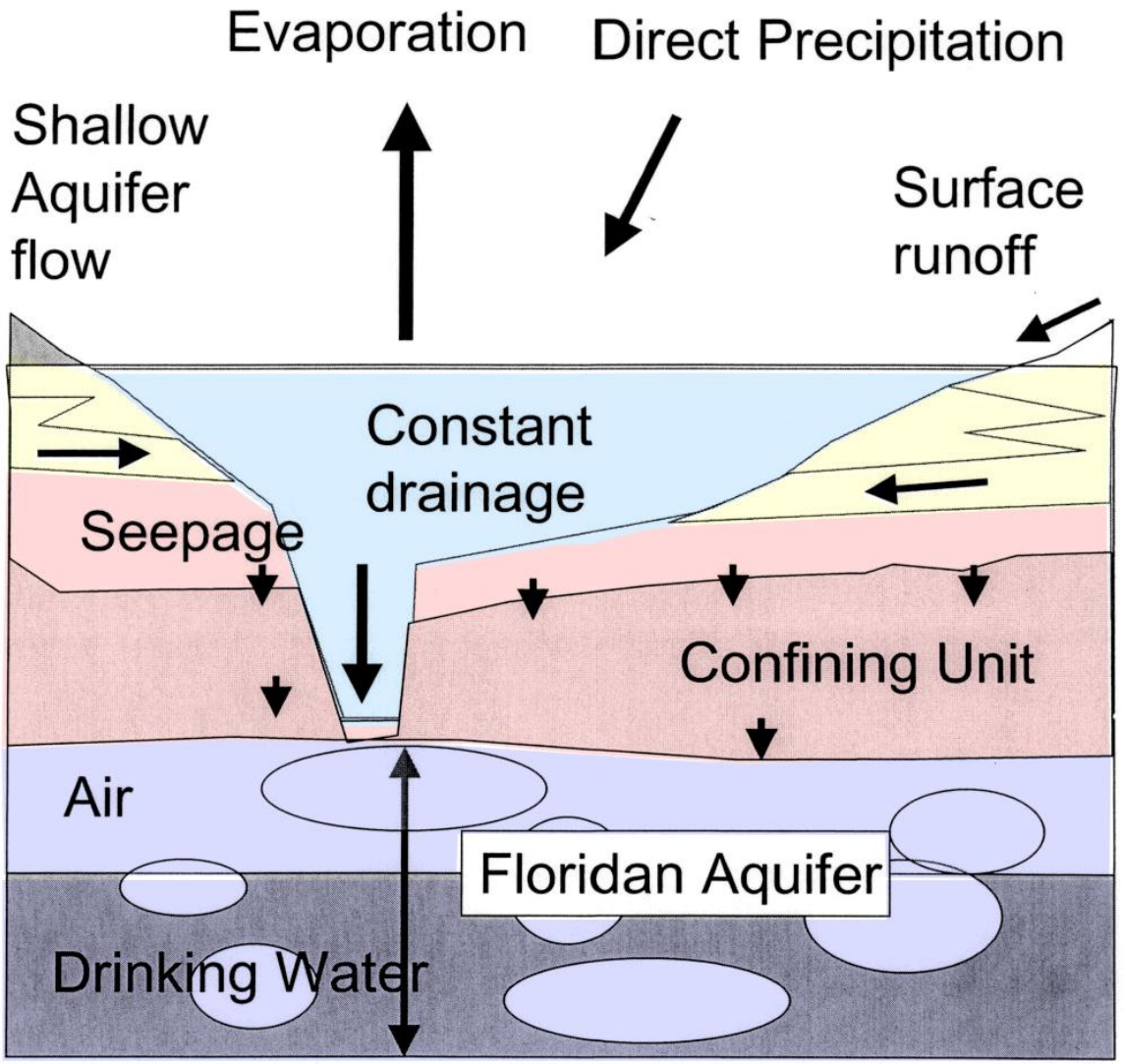

Beginning of Drawdown
Fall 1999

Sink Hole Draining Lake

Perched Lake
Lake Jackson – Without Sink Hole



Perched Lake
Lake Jackson – With Sink Hole



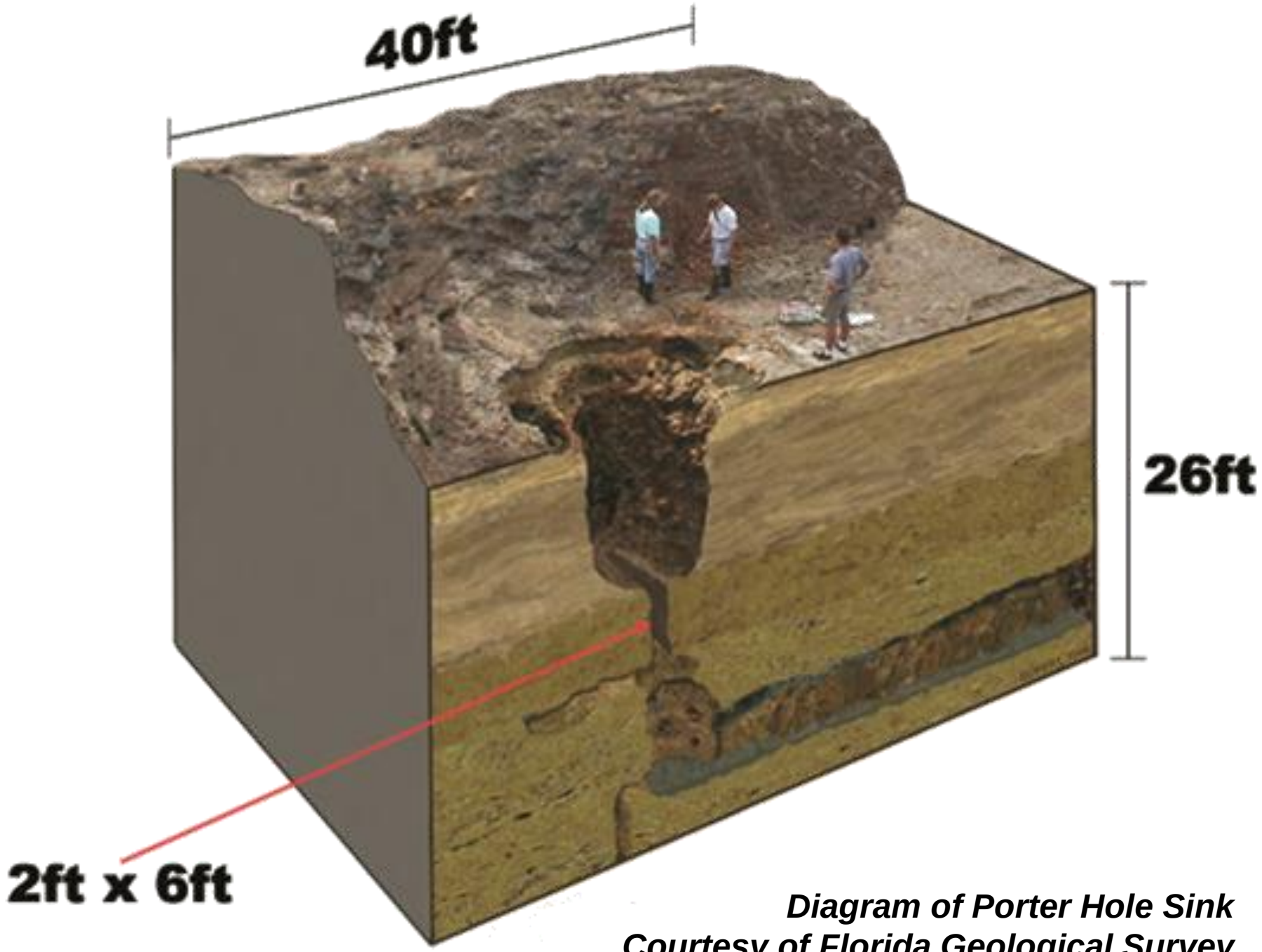
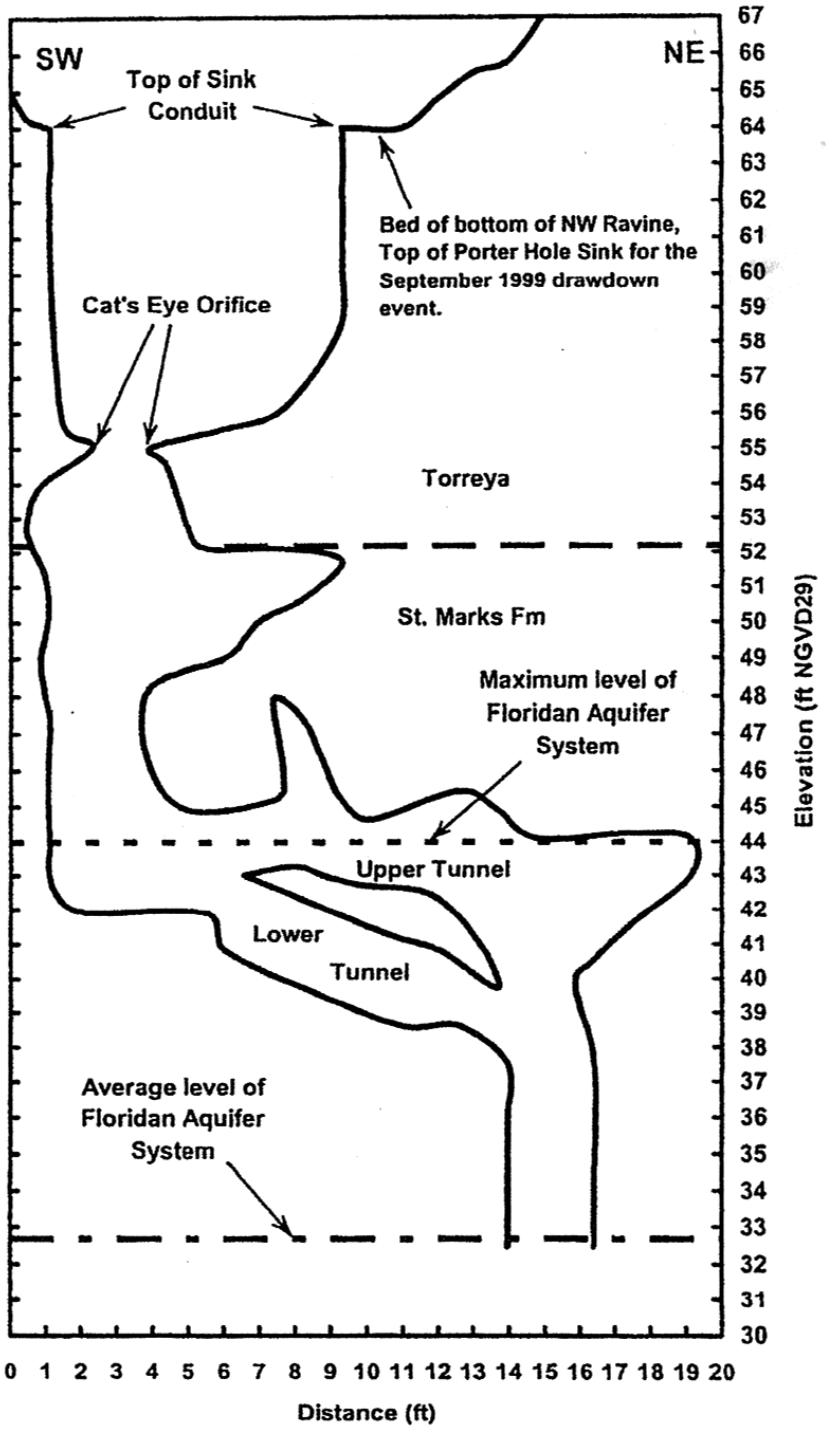


Diagram of Porter Hole Sink
Courtesy of Florida Geological Survey


Fall 1999


SW
NE
Top of Sink Conduit
Bed of bottom of NW Ravine, Top of Porter Hole Sink for the September 1999 drawdown event.
Cat's Eye Orifice
Torreya
St. Marks Fm
Maximum level of Floridan Aquifer System
Upper Tunnel
Lower Tunnel
Average level of Floridan Aquifer System
Elevation (ft NGVD29)
Distance (ft)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67

Cross Section of Soil Eroded into Sink Hole
2005

Direct Funding

- Direct funding for the restoration:
  - Leon County: $4,460,250
  - Florida Legislature: $2,650,000
  - Northwest Florida WMD - $500,000
  - Florida FWCC- $396,633
  - Florida DEP - $250,000
- In addition to the direct funding, the project partners provided substantial staffing and services

Sediment Scraping
2001

North Towards Brill Point
August 2007


Crowder Road
August 2007

Highway 27 North Boat Ramp
August 2007

Sunset Landing/Shuckers
August 2007

To Plug or Not To Plug - Pros

- ***Safety Hazard:*** Deep open hole 30 – 40 feet deep

To Plug or Not To Plug - Pros

- ***Recreational Value:*** Most valuable natural resources of Leon County and by far the largest and best for:
  - Outstanding Florida Water and designated aquatic preserve
  - Fishing - famous bass fishing lake - $10M in revenue 1980
  - Boating
  - Water sports
  - Recreation – swimming/canoeing


MERCURY
WHALER

Public Access Points

1 Red and Sams
2 Sunset Landing
3 Marjorie Turnbull Park
4 Miller's Landing
5 Rhoden Cove
6 Meginnis Arm
7 Fuller Rd
8 Meginnis Arm Blvd
9 Crowder Rd
10 Faulk Drive
11 North Monroe St


TRACKER


Laser

Economic Value of Lake Jackson 1993 Recreational Use

- 53,441 people visited Lake Jackson yearly
- 28,843 were from Leon County and 24,598 were from outside Leon County
- One out of five Leon County residents visited Lack Jackson
- Lake Jackson had more activity picnicking, boating, and swimming/sunbathing than fishing

1993 Spending, Wages, Employment

- Lake Jackson-related goods and services spending includes:
  - $2.7M - Leon County residents
  - $7.9M - Tourists
  - $10.6M – Lake Jackson related purchases

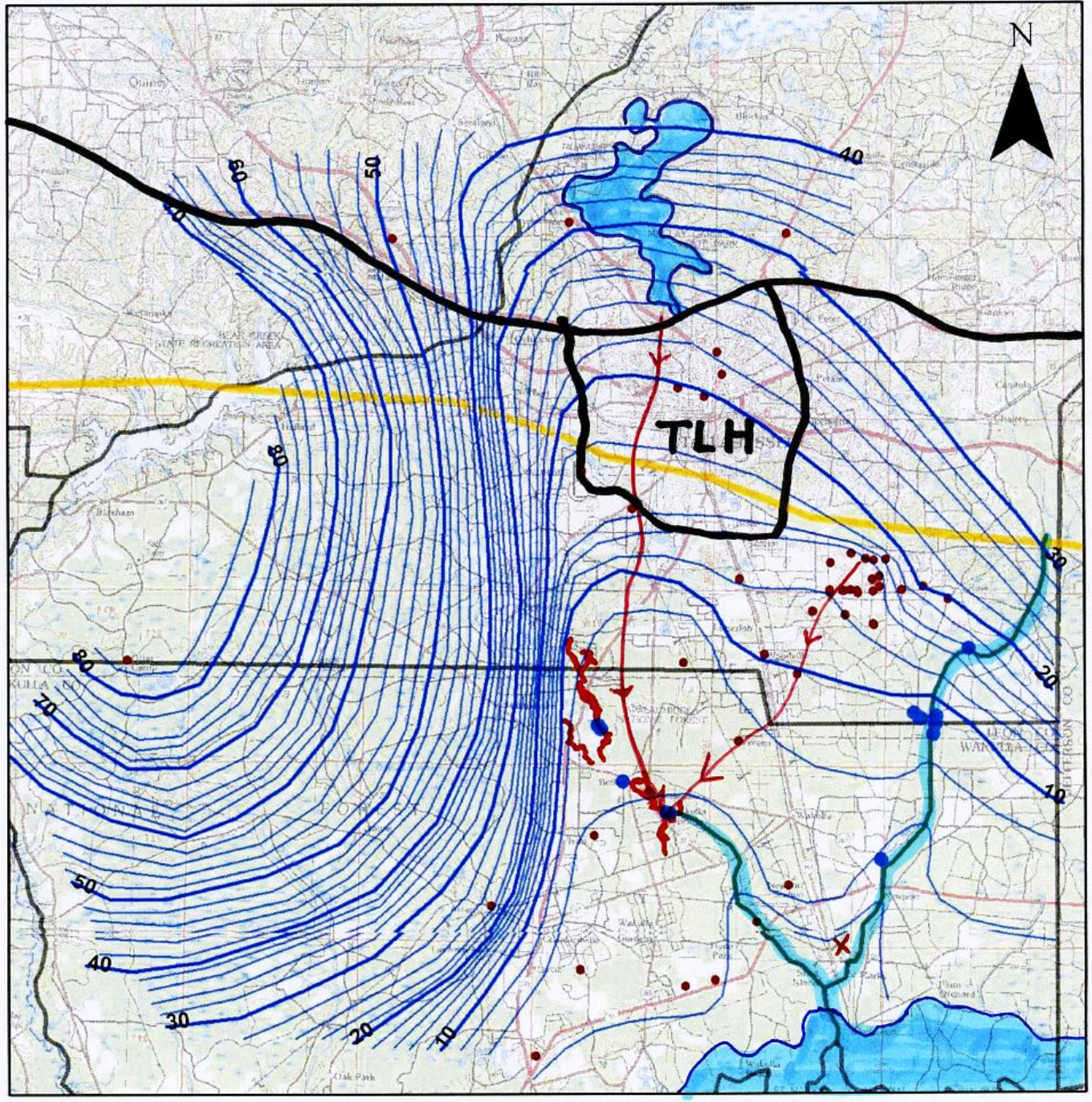
Recreational Value

- Recreational services related to Lake Jackson are by and large free to the public
  - Picnicking
  - Boating
- Economists call these recreational services non-market goods (not bought and sold); however, these services have substantial value to Leon County

To Plug or Not To Plug - Pros

- ***Water Quality Concern:*** Direct conduit for possible contamination of Floridan Aquifer from stormwater runoff containing
  - petroleum products
  - nutrients from fertilizers (nitrates)
  - herbicides
  - pesticides
  - bacteria
  - viruses
  - toxic algae (microcystis)
  - animal waste


10 14 '06

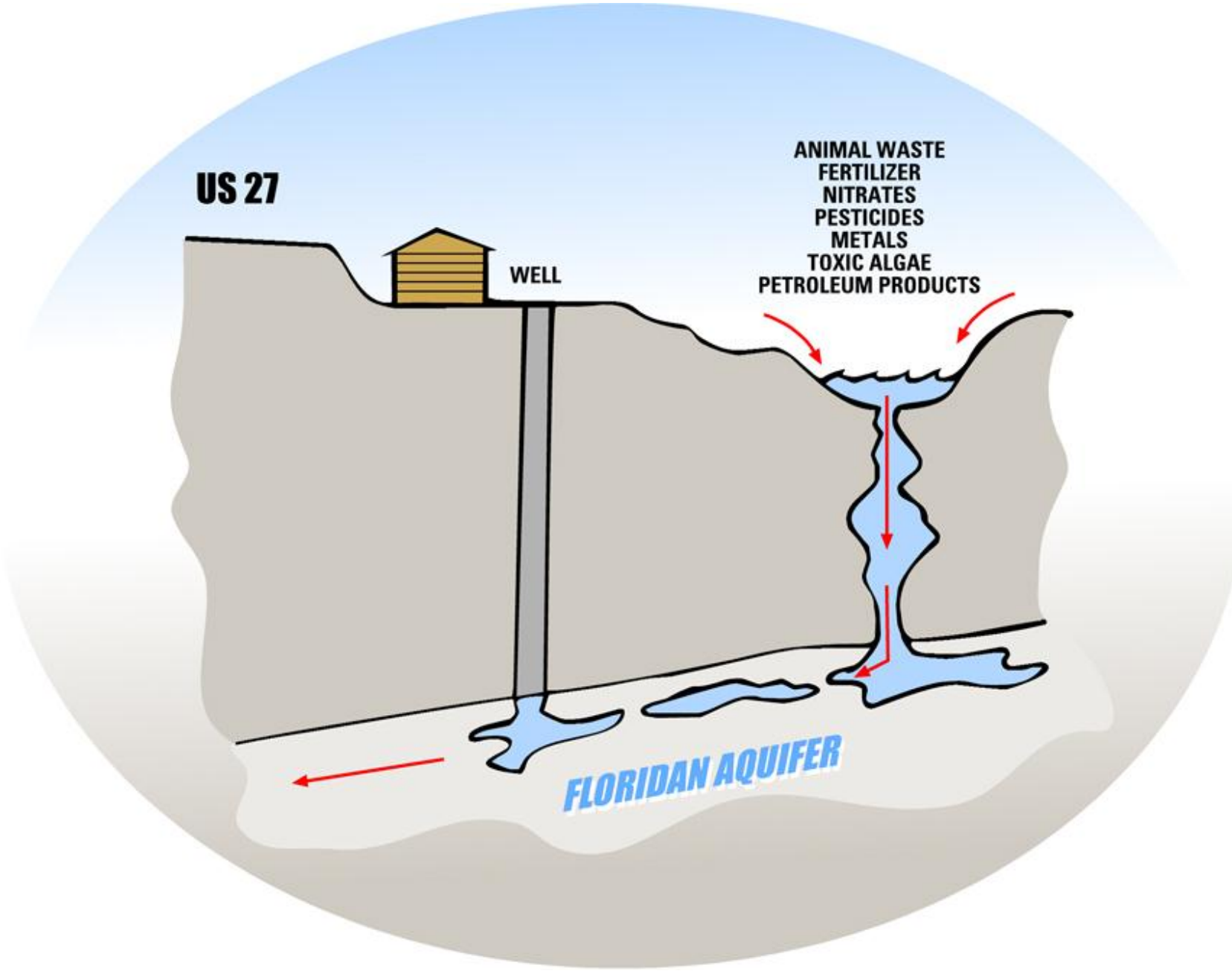


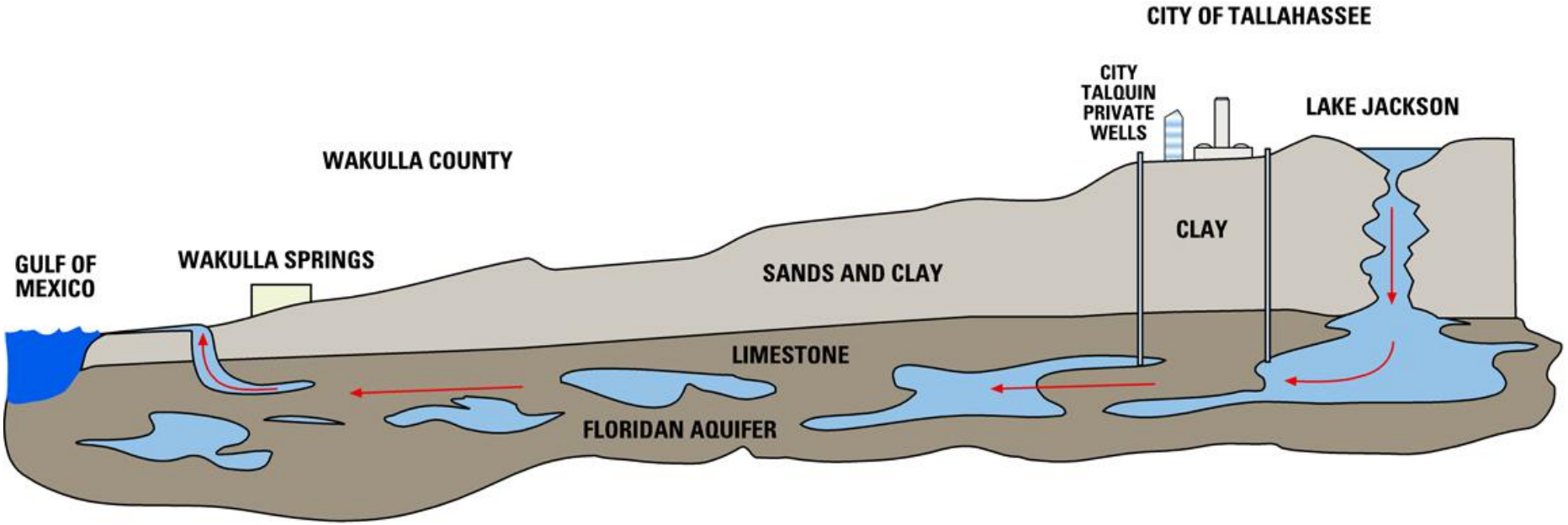
Legend

- Spring Location
- Well Location
- Water Level Altitude , in feet above sea level
- Mapped Cave
- Cody Scarp

0 2.5 5 10 Miles

Ground-water altitude in the Uppr Floridan aquifer in June, 2006.


US 27
WELL
ANIMAL WASTE
FERTILIZER
NITRATES
PESTICIDES
METALS
TOXIC ALGAE
PETROLEUM PRODUCTS
FLORIDAN AQUIFER


CITY OF TALLAHASSEE
CITY TALQUIN PRIVATE WELLS
LAKE JACKSON
WAKULLA COUNTY
CLAY
GULF OF MEXICO
WAKULLA SPRINGS
SANDS AND CLAY
LIMESTONE
FLORIDAN AQUIFER

To Plug or Not To Plug - Cons

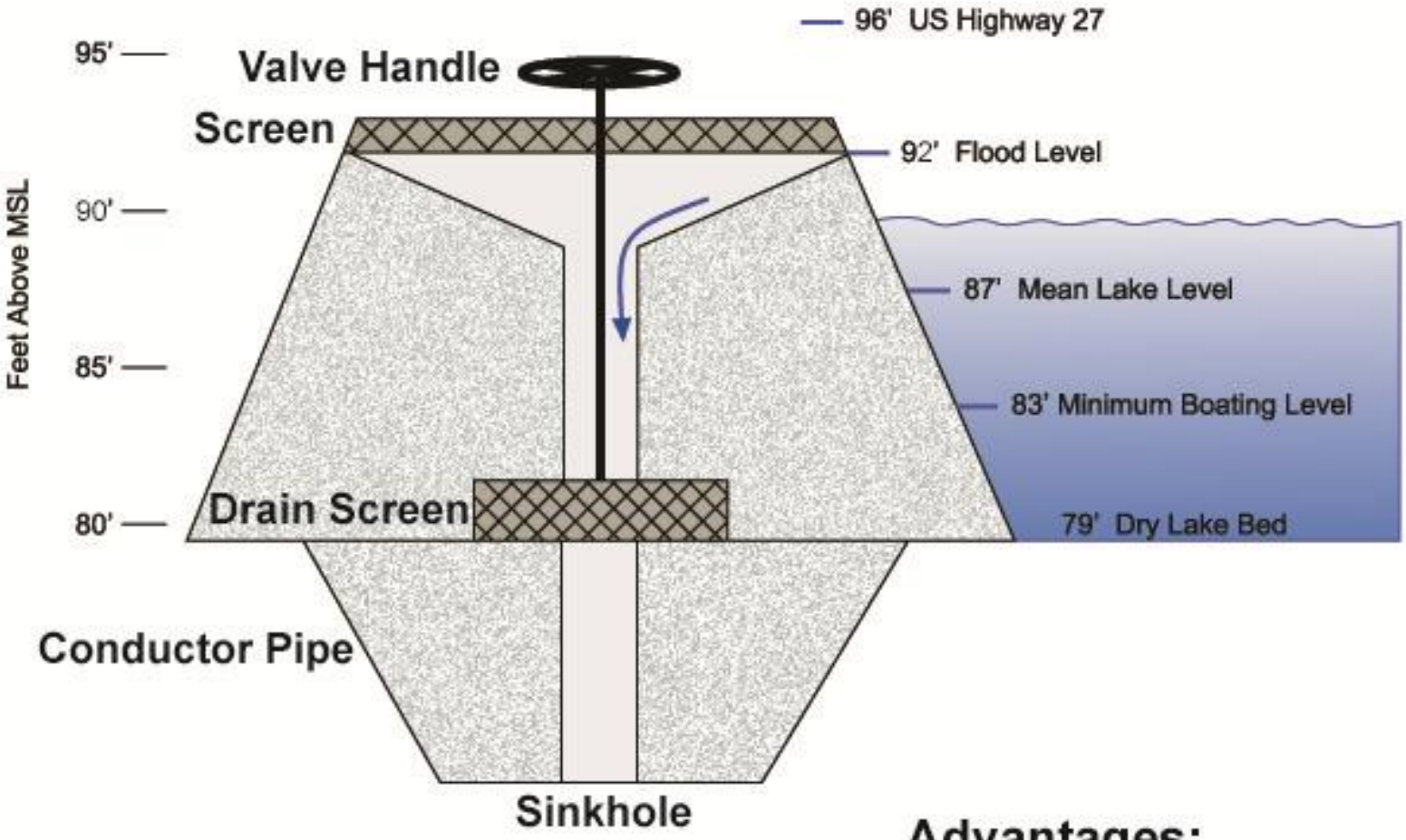
- ***Flooding:*** Helps control flooding by draining water
- ***Draining:*** Period draining of lake is good to reduce vegetation

To Plug or Not To Plug - Compromise

- Build a levee or berm around sinkhole with:
  - Overflow capabilities – to drain during flood events
  - Gates - to drain lake dry if so desired

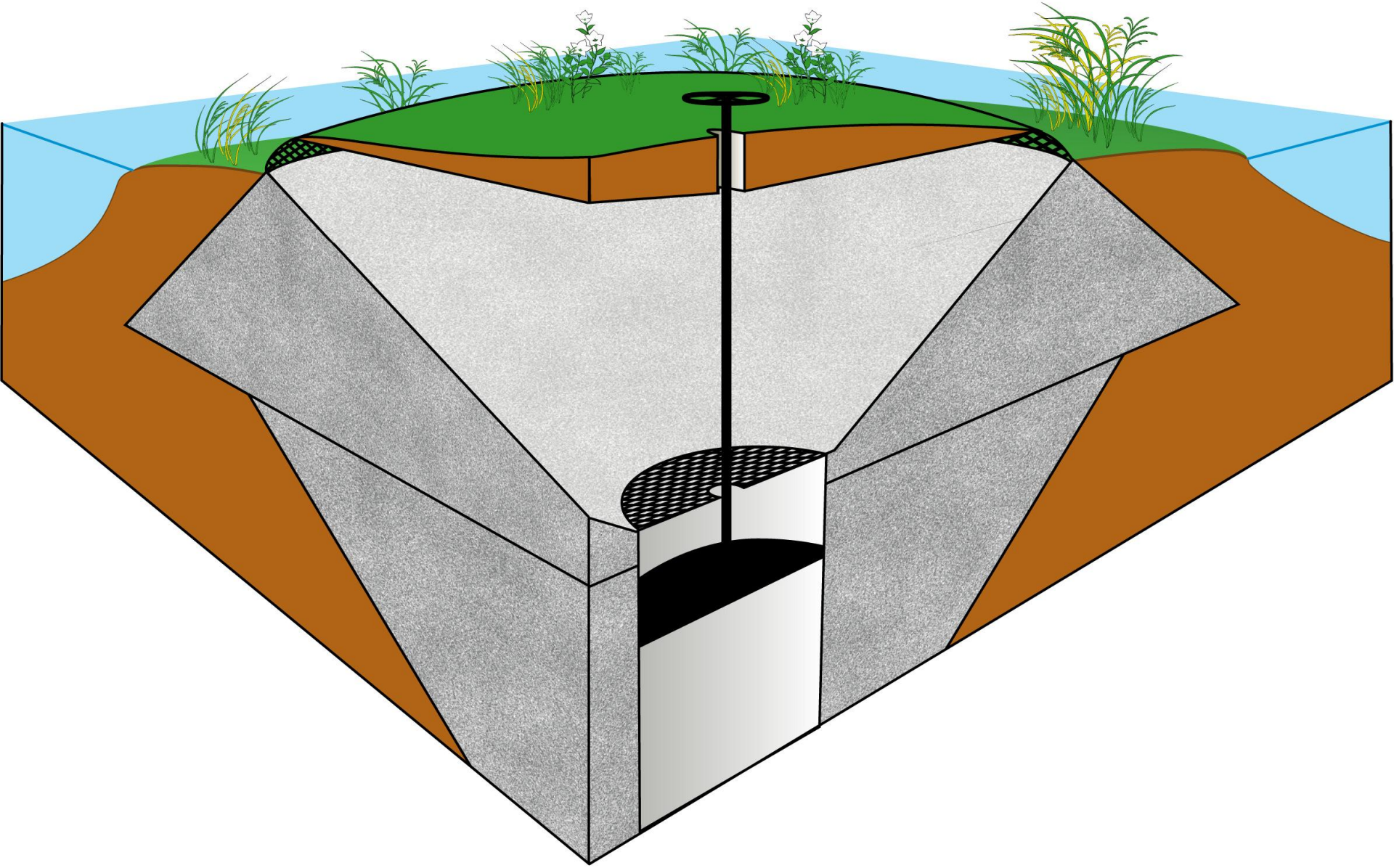
Conceptual Drawing of Berm

Function:
- Pop off to minimize potential for flooding
- Valve to drain lake to desired level



Advantages:
- Safety
- Water level flexibility
- Protects groundwater quality

Ecologically Adapted to Blend with the Natural Habitat




Typical Lake Level
1997

Cumulative Departure From Mean (1886-2004)