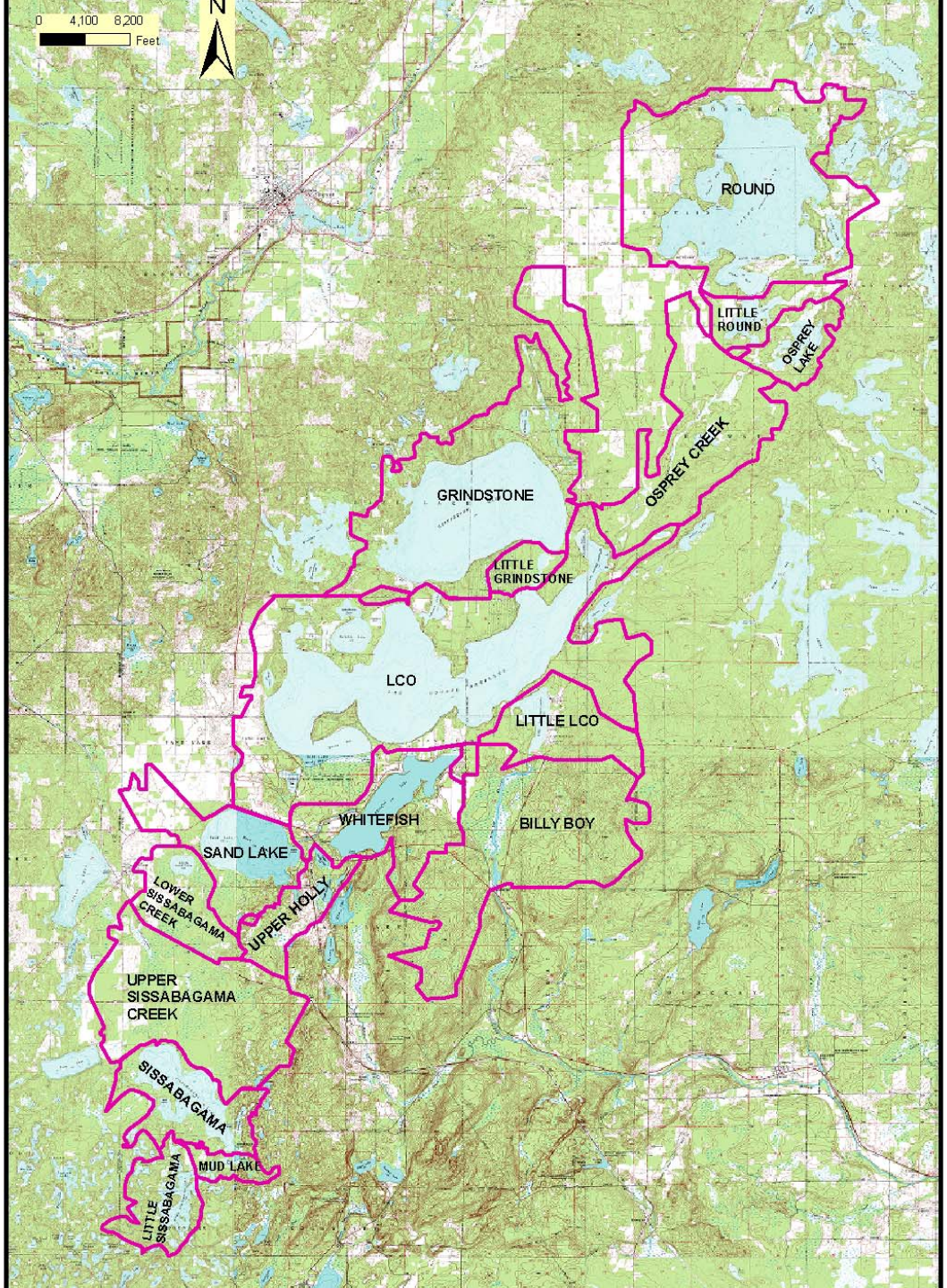
Billy Boy Dam Failure and Regional Flood Determination of Upstream Lakes

Sawyer County, Wisconsin

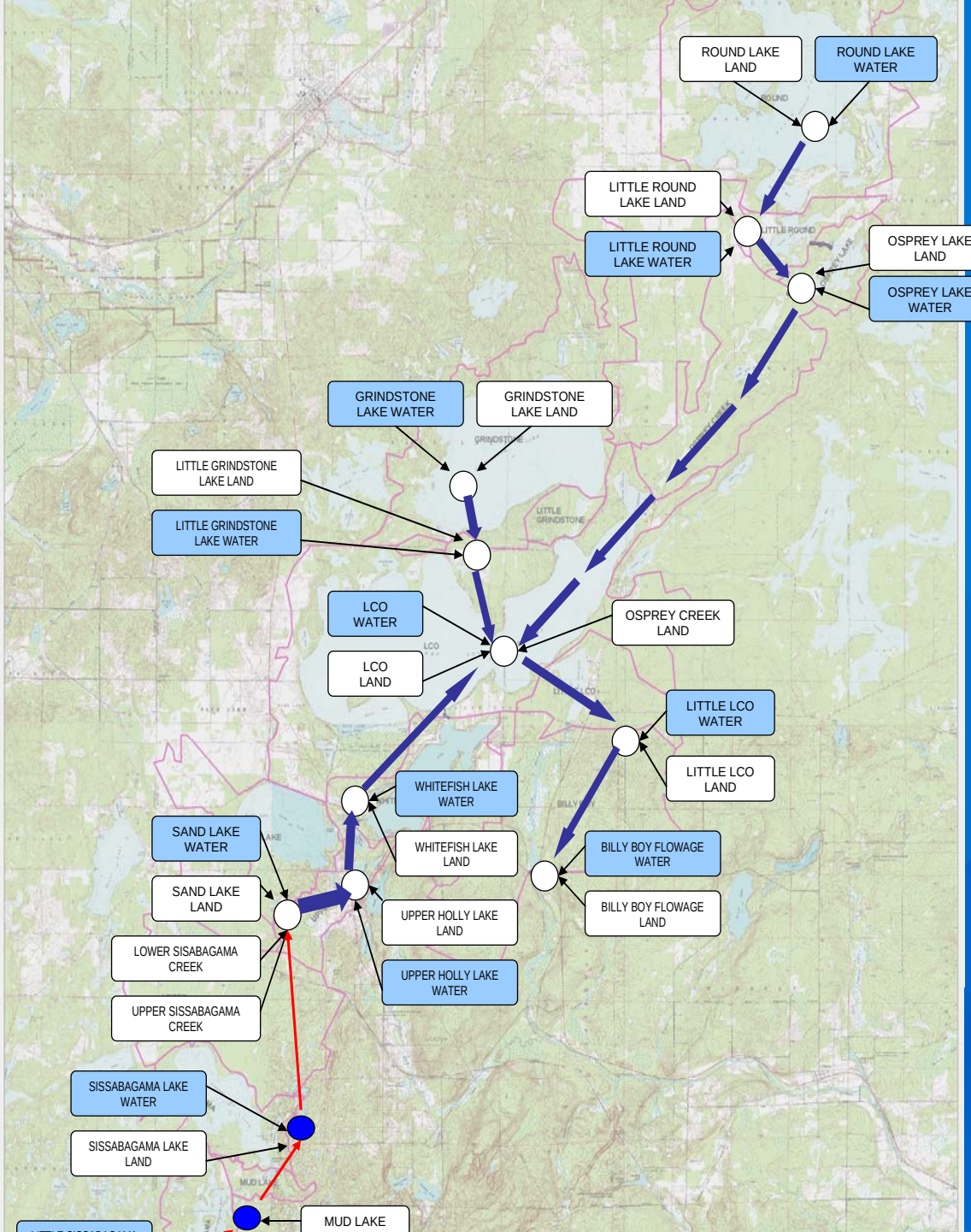
December, 2006

SEH

Watersheds


0 4,100 8,200
Feet
N
ROUND
LITTLE ROUND
OSPREY LAKE
OSPREY CREEK
GRINDSTONE
LITTLE GRINDSTONE
LCO
LITTLE LCO
WHITEFISH
BILLY BOY
SAND LAKE
LOWER SISSABAGAMA CREEK
UPPER HOLLY
UPPER SISSABAGAMA CREEK
SISSABAGAMA
MUD LAKE
LITTLE SISSABAGAMA

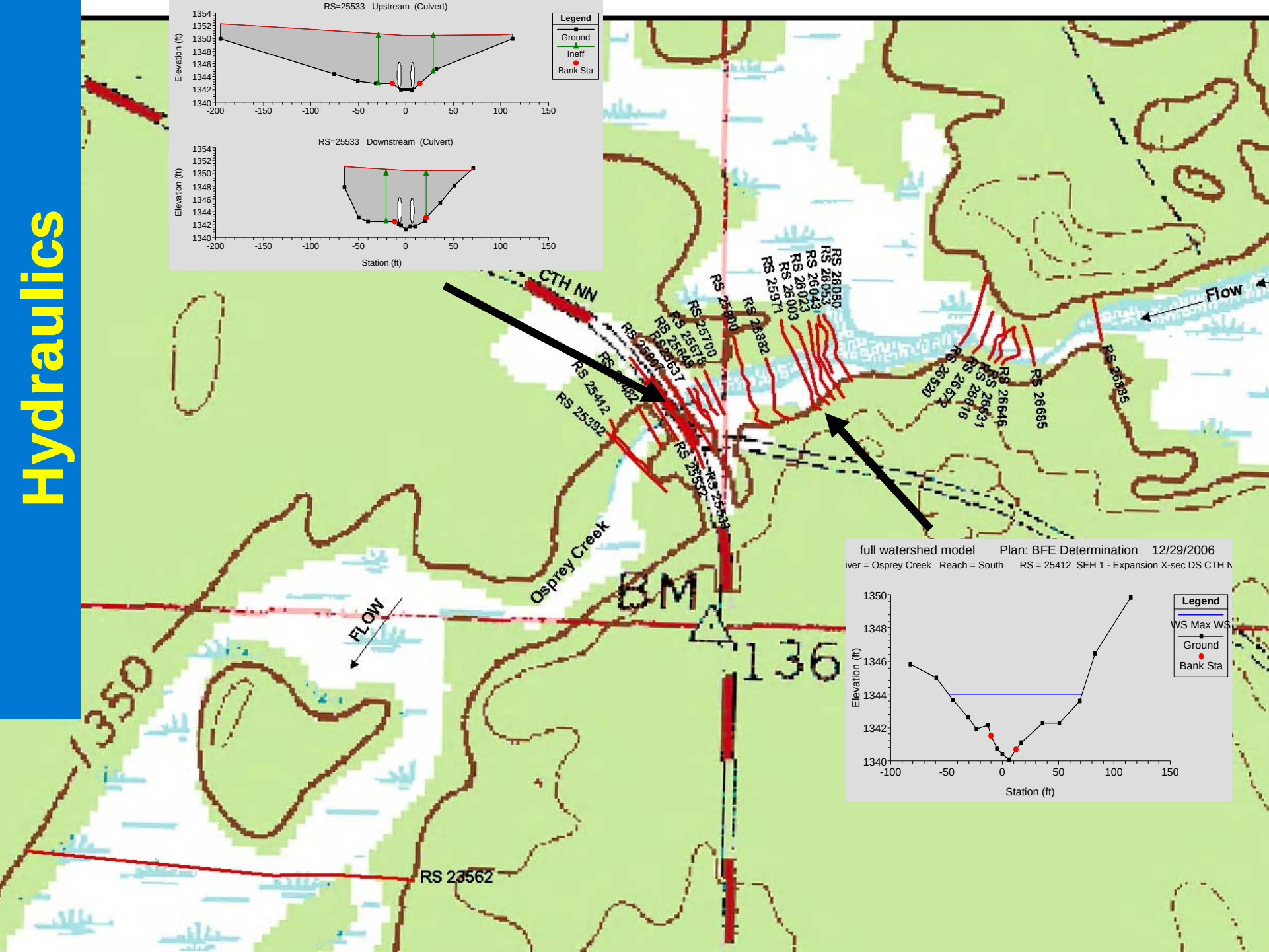
Model Schematic



Hydrology Inputs

Hydrologic Sub Basin	Basin Area (sq. mi.)	SCS Curve Number	% Impervious	Lag Time (hr.)	Tc (hr.)
Round Lake land	7.82	64	0	2.5	4.2
Round Lake water surface	5.19	100	100	0.1	0.2
Little Round Lake land	1.06	64	0	2.7	4.5
Little Round Lake water surface	0.30	100	100	0	0.0
Osprey Lake land	1.00	55	1	3.7	6.2
Osprey Lake water surface	0.52	100	100	0.1	0.2
Osprey Creek	8.48	68	6.05	2.8	4.7
Whitefish Lake land	3.07	60	1.85	4.86	8.1
Whitefish Lake water surface	1.26	100	100	0	0.0
Grindstone Lake land	8.05	59	4.55	2.56	4.3
Grindstate Lake water surface	5.01	100	100	0	0.0
Little Grindstone Lake land	0.74	61	0	2.26	3.8
Little Grindstone Lake water surface	0.04	100	100	0	0.0
LCO land	10.58	60	9.84	2.02	3.4
LCO water surface	8.05	100	100	0	0.0
Little LCO land	2.31	66	0	1.84	3.1
Little LCO water surface	0.34	100	0	0	0.0
Billy Boy Flowage land	8.16	66	100	1.89	3.2
Billy Boy Flowage water surface	0.34	100	0	0	0.0
Sand Lake land	5.09	68	0	1.8	3.0
Sand Lake water surface	1.49	100	100	0	0.0
Upper Holly Lake land	1.55	65	5.9	1.8	3.0
Upper Holly Lake water surface	0.05	100	100	0	0.0

Hydraulics


RS=25533 Upstream (Culvert)
Elevation (ft)
Legend
Ground
Ineff
Bank Sta
RS=25533 Downstream (Culvert)
Elevation (ft)
Station (ft)
CTH NN
Flow
Osprey Creek
FLOW
BM
136
1350
RS 23562
full watershed model Plan: BFE Determination 12/29/2006
iver = Osprey Creek Reach = South RS = 25412 SEH 1 - Expansion X-sec DS CTH N
Elevation (ft)
Legend
WS Max WS
Ground
Bank Sta
Station (ft)

Storage Areas

Lake	Storage Area (square miles)	Storage Area (acre)
Round Lake	5.19	3322
Little Round Lake	0.30	192
Osprey Lake	0.52	333
Whitefish Lake	1.26	806
Grindstone Lake	5.01	3206
Little Grindstone Lake	0.04	26
Lac Courte Oreilles	8.05	5152
Little Lac Courte Oreilles	0.34	218
Billy Boy Flowage	0.34	218

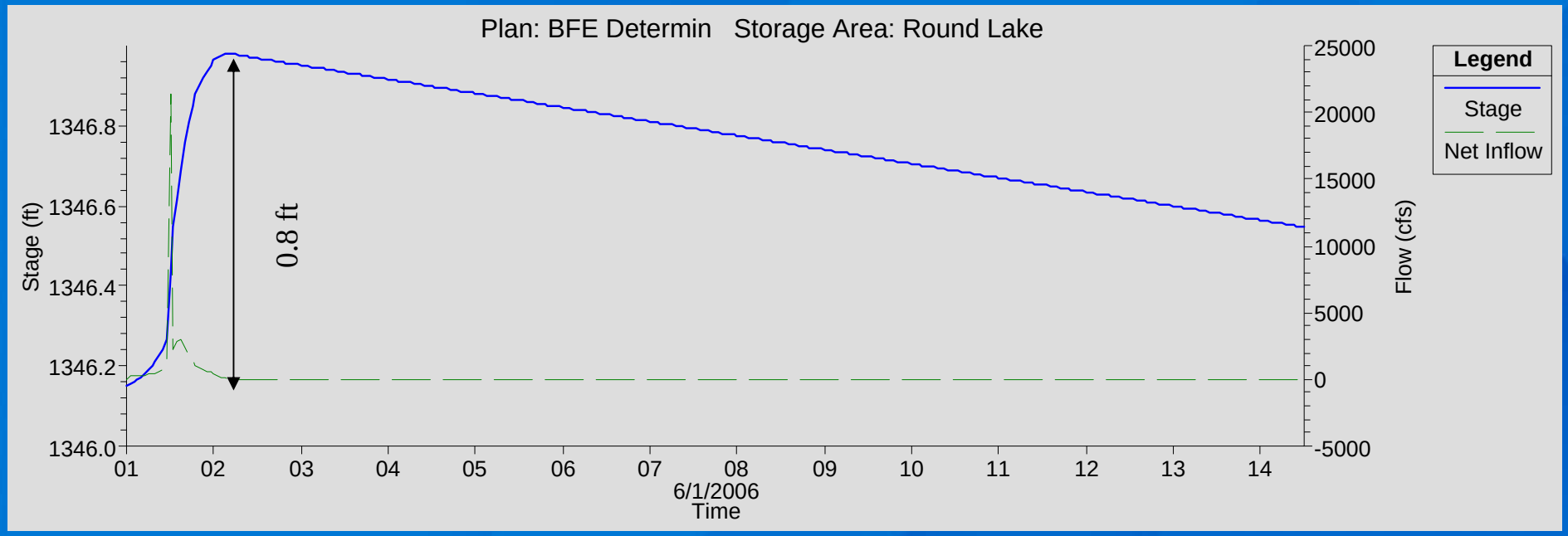
Starting Elevations

Lake	Initial Water Surface Elevation	Observation Notes	USGS "Normal" Water Surface Elevation
Round Lake	1346.15	Highest recorded (1943, 1944, 1945);1347.0 recorded during CTH B culvert installation (1942)	1346
Little Round Lake	1346.15		1346
Osprey Lake	1345.86	Based on measured slope from Little Round Lake to Osprey Lake	1344
Whitefish Lake	1288.0	Highest recorded = 1287.9 (1981)	1288
Grindstone Lake	1288.8	Value is highest recorded (1969)	1287
Little Grindstone Lake	1288.4		
LCO	1288.0	Value is highest recorded (1974, 2002)	1287
Little LCO	1288.0	Value is highest recorded (1974, 2002)	1287
Billy Boy Flowage	1288.0	Highest recorded = 1287.8 (1933)	
Sand Lake	1301.6	Value is highest recorded (1973)	1300
Upper Holly Lake	1300.0	Limited data available; USGS quad value used	1300

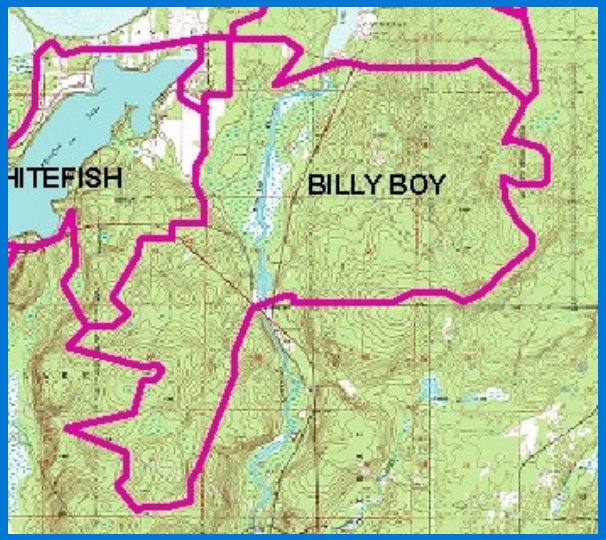
Determining Starting Flow in a Reach

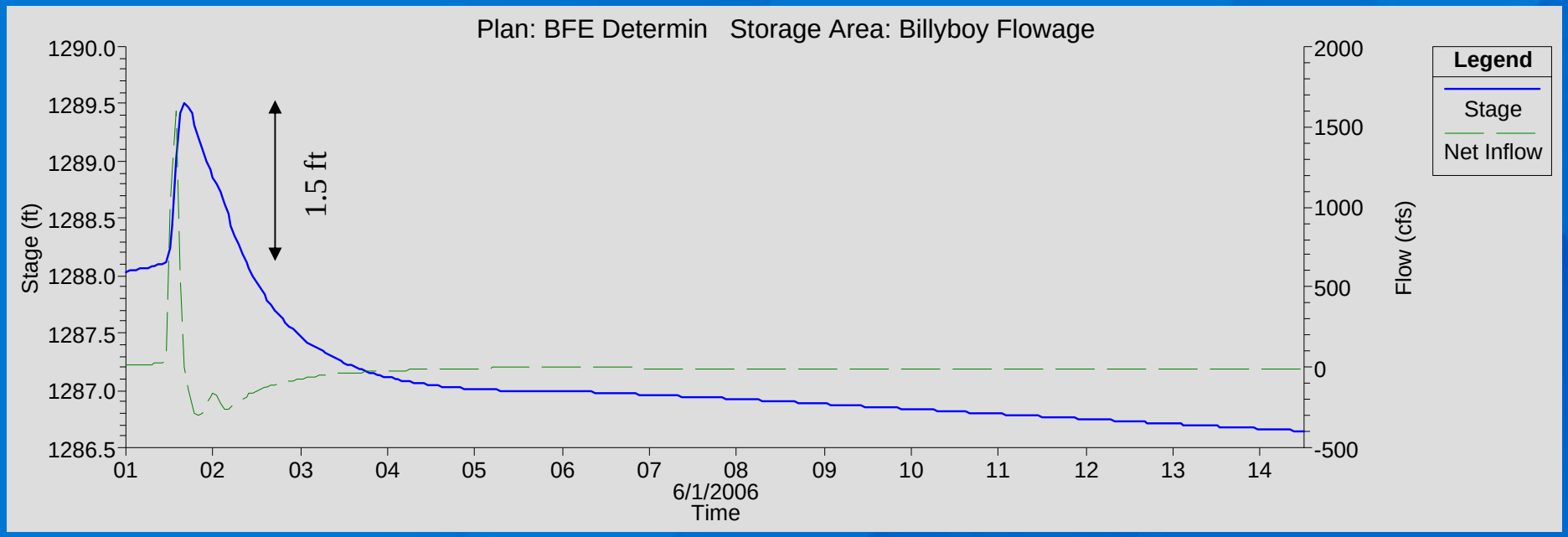
- Fix Downstream Lake at Historically Determined Starting Elevation (fixed boundary condition)
- Add Increasing Flow Volume to Upstream End of Reach
- When Upstream Lake Elevation Matches Historically Determined Starting Elevation, We Have Determined Starting Flow

Model Results-Round Lake

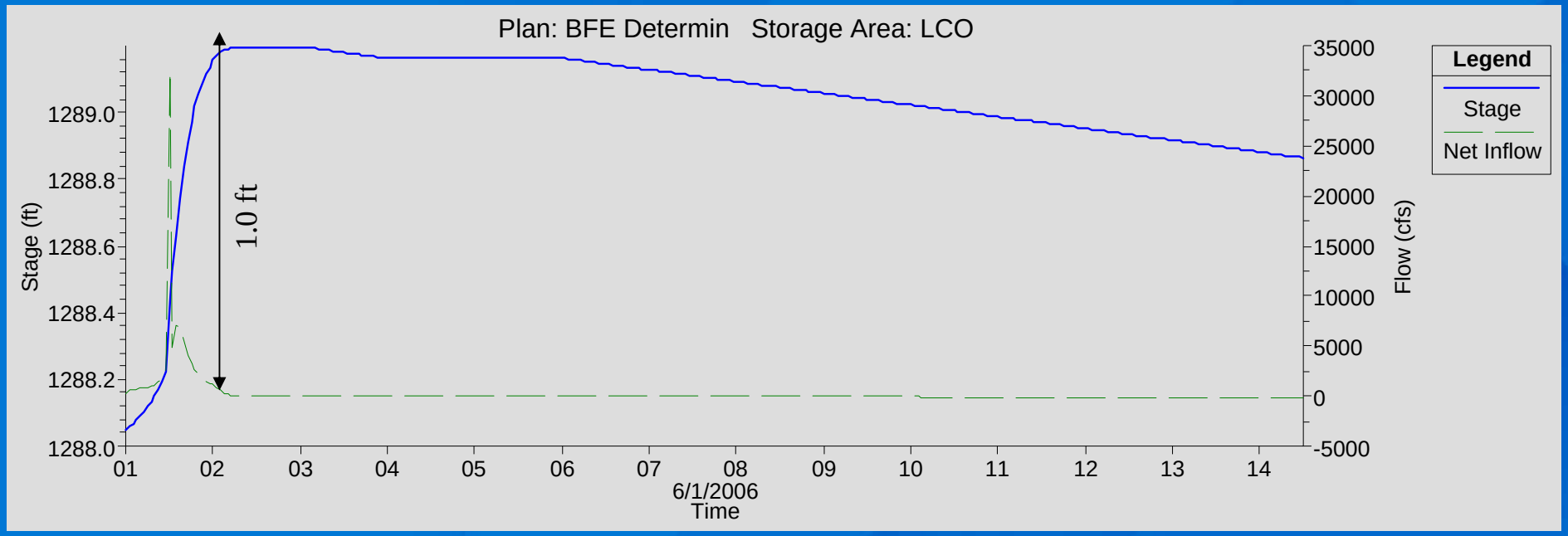


Model Results- Billy Boy Flowage

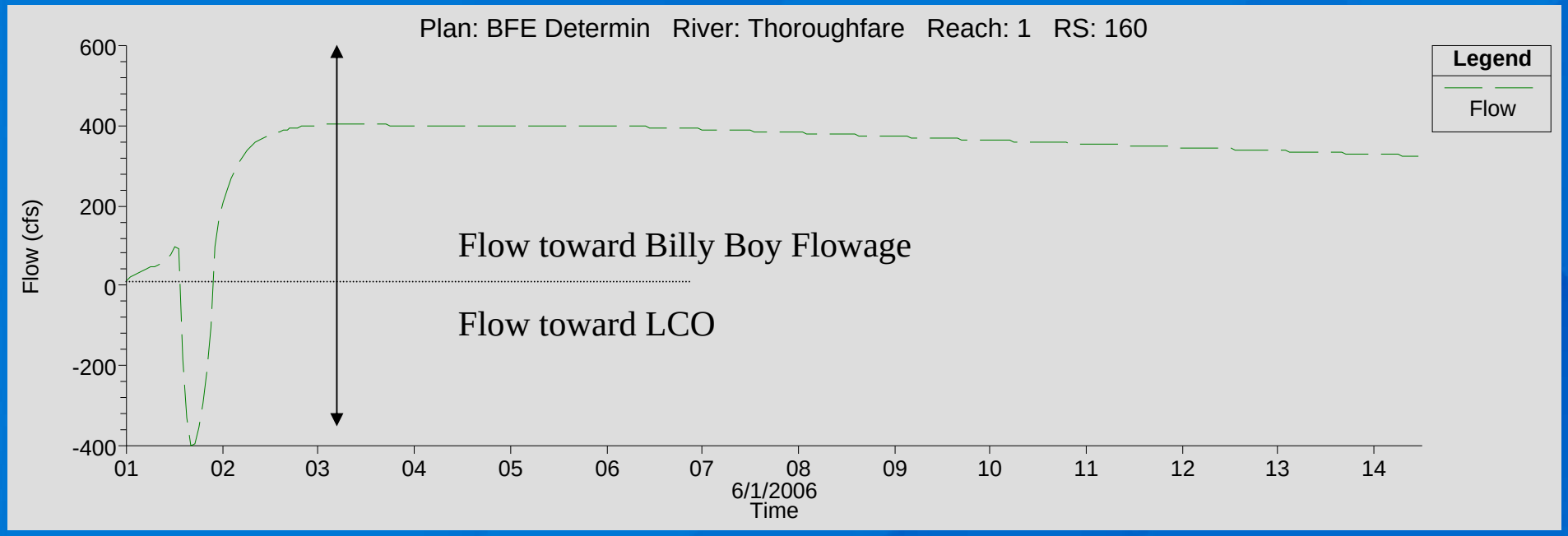




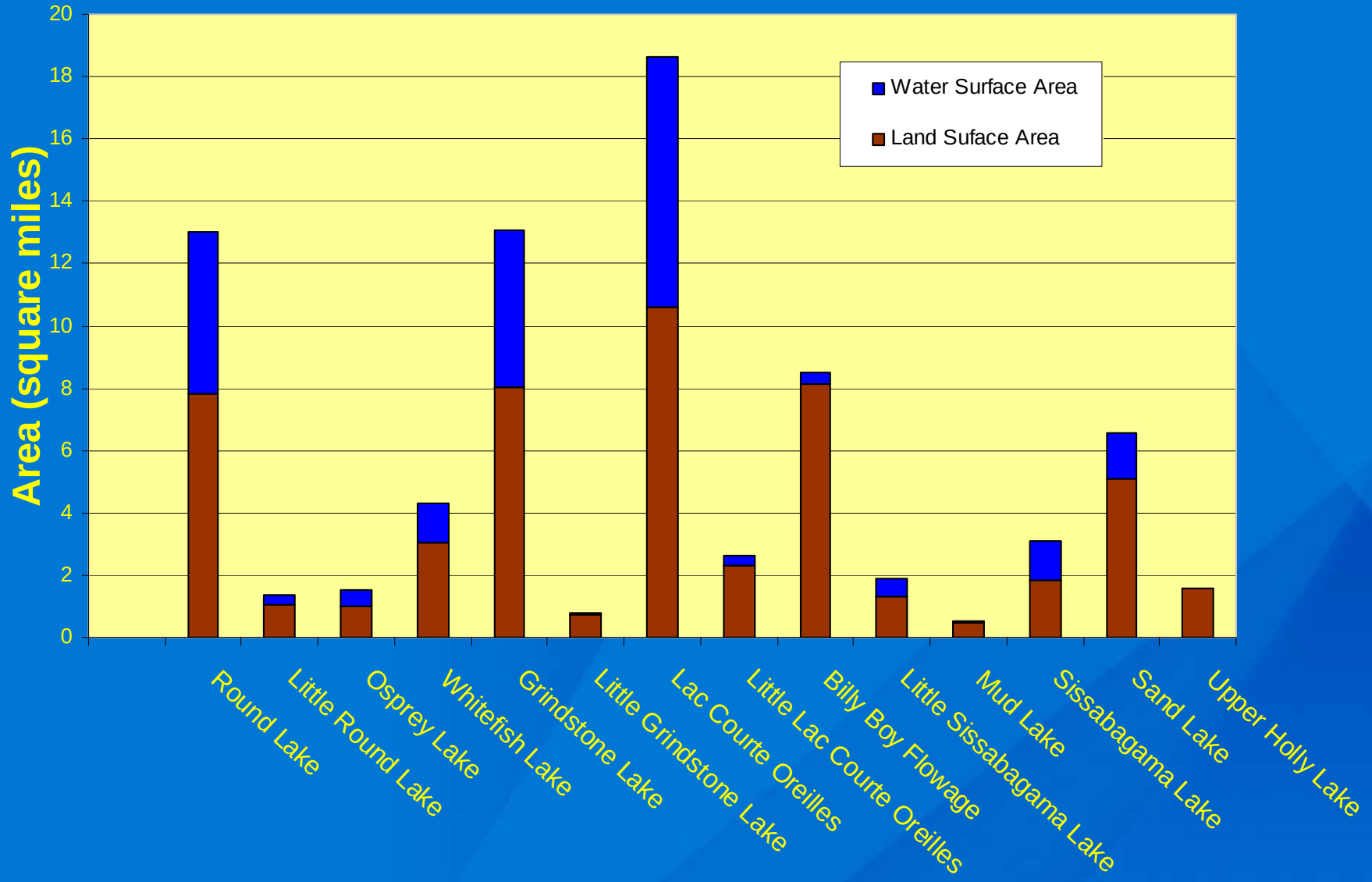
Model Results - LCO



Model Results - Throroughfare Rd



Comparison of Hydrologic Sub Basin Water Surface & Land Surface Areas

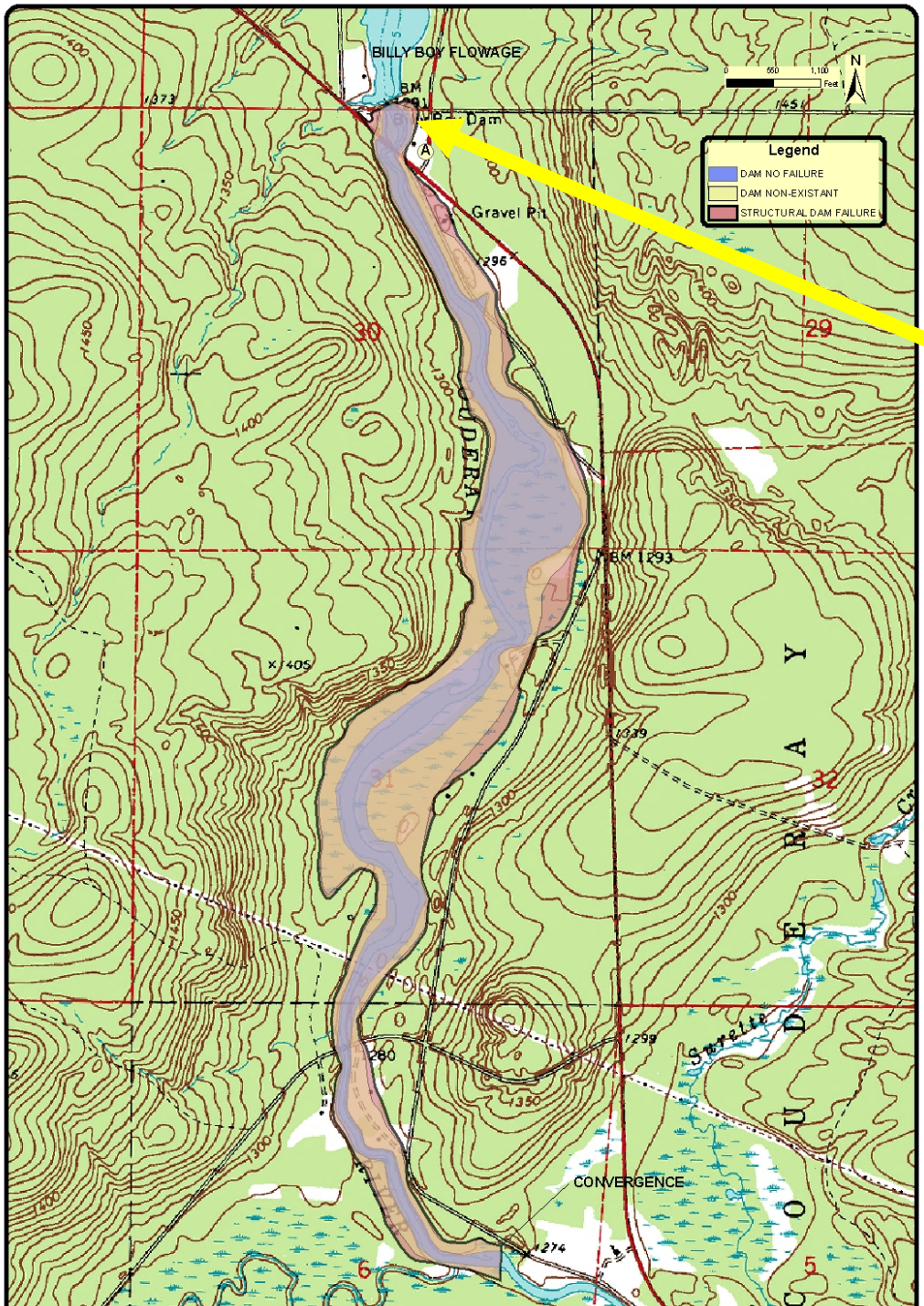


Submitted Regional Flood Elevations

Water Body		Regional Flood Elevation
1	Little Sissabagama Lake	--
2	Mud Lake	--
3	Sissabagama Lake	--
4	Round Lake	**1346.98**
5	Little Round Lake	**1346.97**
6	Osprey (Squaw) Lake	**1346.53**
7	Sand Lake	**1303.76**
8	Upper Holly Lake	**1302.92**
9	Whitefish Lake	**1290.55**
10	Grindstone Lake	**1289.52**
11	Little Grindstone Lake	**1289.31**
12	Lac Courte Oreilles	**1289.19**
13	Little Lac Courte Oreilles	**1289.48**

-- = Lakes with established RFEs

Dam Failure Flood Shadow



Area of Greatest Flooding is Upstream of Hwy 70

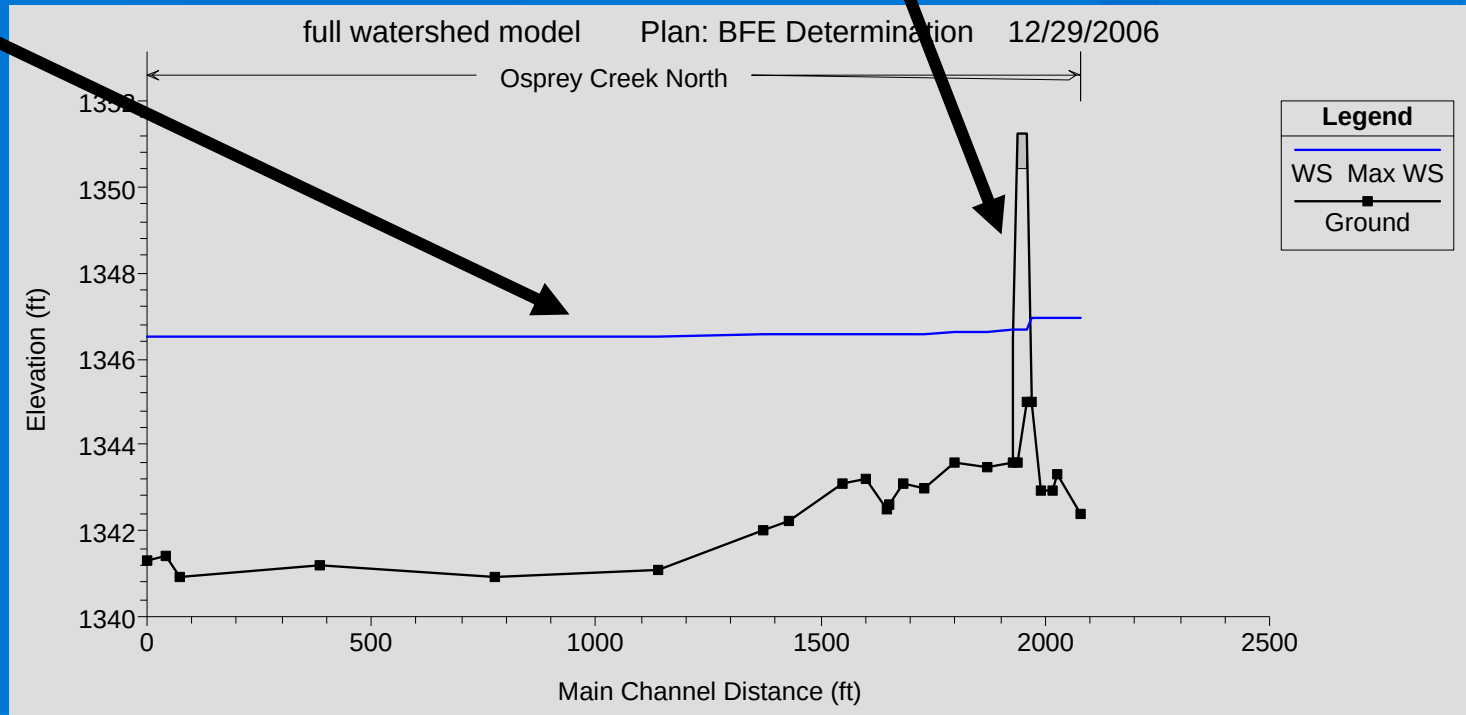
RFE Determination: Take Home Points

- The ratio of land surface to lake surface is important
- How fast water can leave a lake varies by what's downstream
- The elevation of the lake when an event occurs is important
- Available storage is large in this system
- SEH met the deadline!

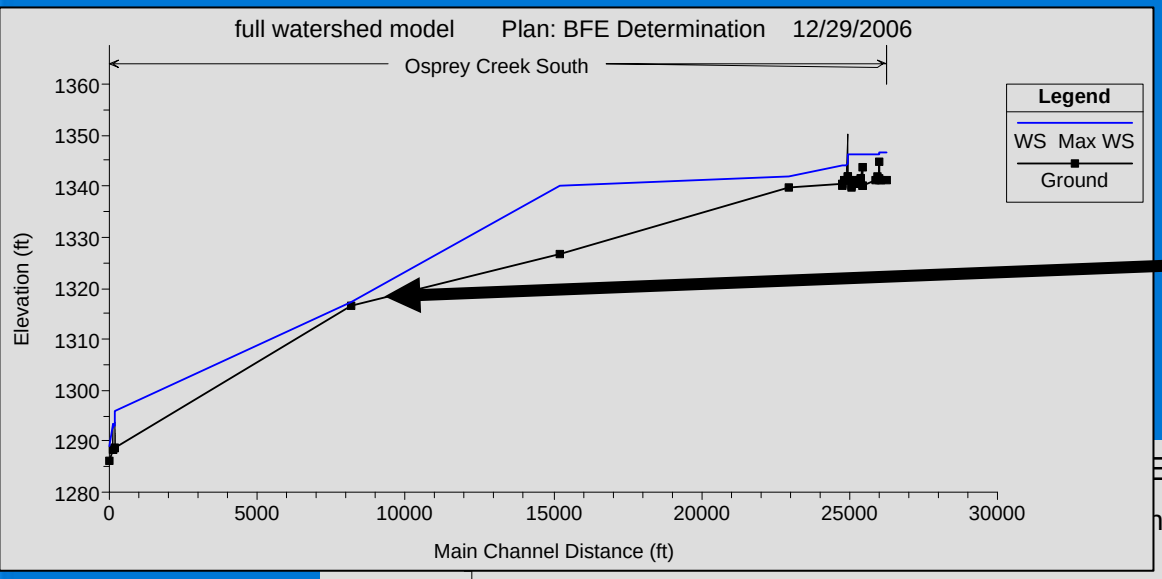
Looking Toward Task Three: Evaluating Controls on the Round Lake Chain

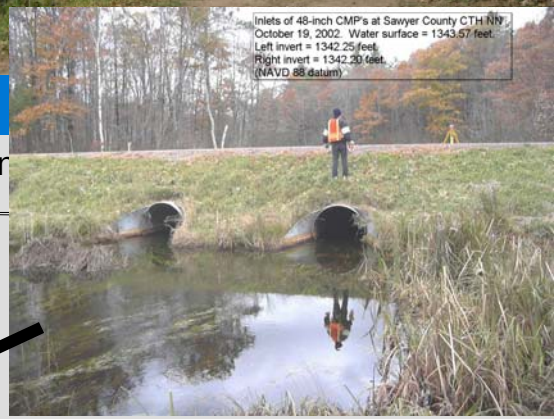
Due March 15th

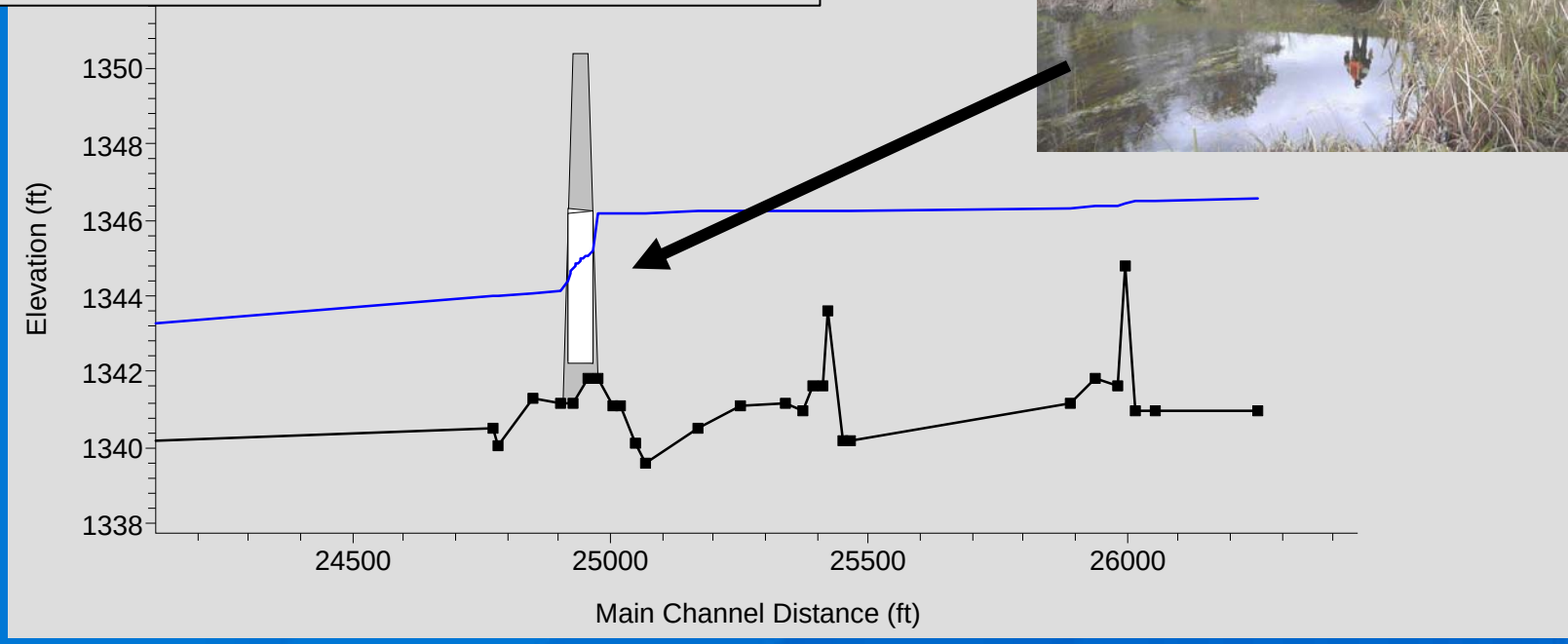
Outlet Channel: Little Round



Outlet Channel: Osprey Creek







SEH/Sawyer County Contract: Task 3

- At what range of flows does the Little Round Lake Dam Control the lake levels?
  - What are the associated lake elevations during that period?
- What other hydraulic controls or combination of hydraulic controls impact Round Lake elevations?
  - What are the associated flows and lake elevations for these controls?
- How would lowering the NN culverts change the hydraulic controls that impact Round Lake elevations?
- Under what range of flows does the east diversion channel into Osprey contain flow?