



# DO TMDL Advisory Committee Meeting

## June 8, 2017

Meghan Lunney  
Aquatic Resource Specialist

# Longitudinal Structure

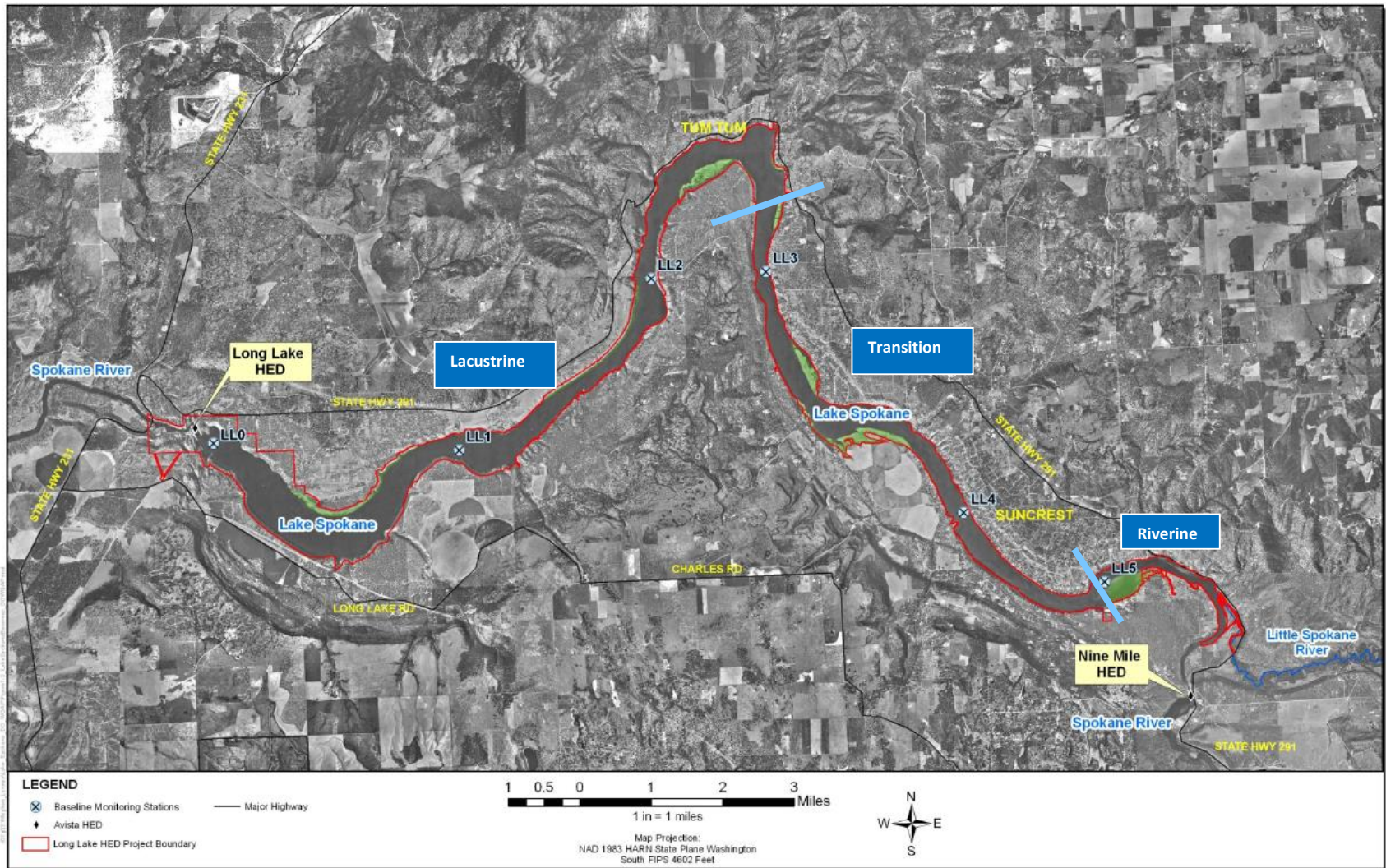
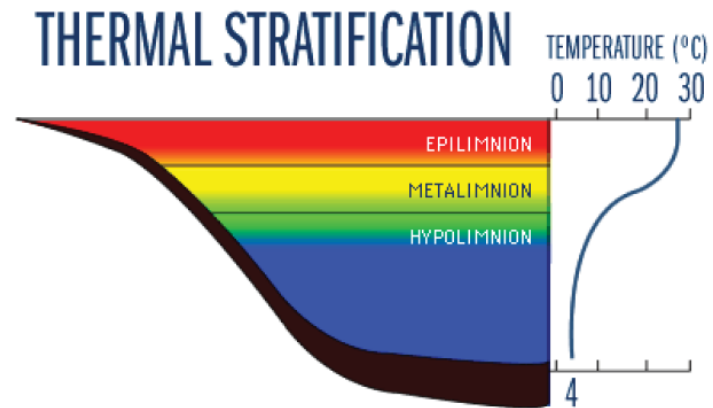
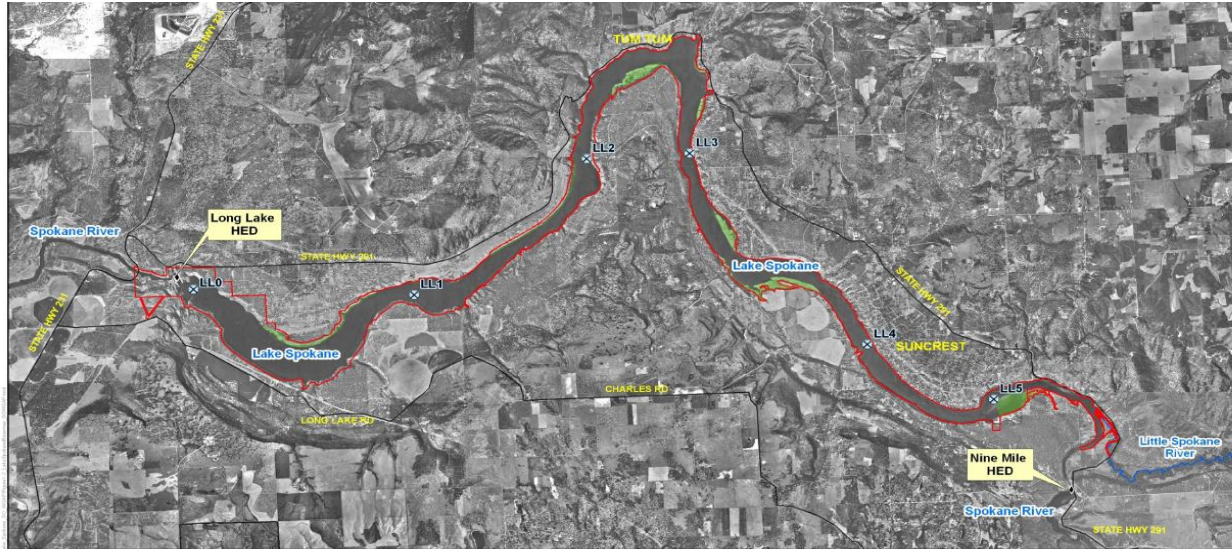


Figure 1. Lake Spokane Baseline Monitoring Stations



# Vertical Structure



# Discrete Depth Sampling Stations

Lake Spokane Sampling Station and Discrete Depth						
	LL0	LL1	LL2	LL3	LL4	LL5
Dep ths	0.5	0.5	0.5	0.5	0.5	0.5
	5	5	5	5	4	B-1
	15	20	15	10	B-1	
	30	B-1	B-1	B-1		
	B-1					

## 2016 Sample Dates:

- May 17-18
- June 6-7
- June 21-22
- July 5-6
- July 19-20
- August 10-11
- August 24-25
- Sept. 6-7
- Sept. 19-20
- October 12-13

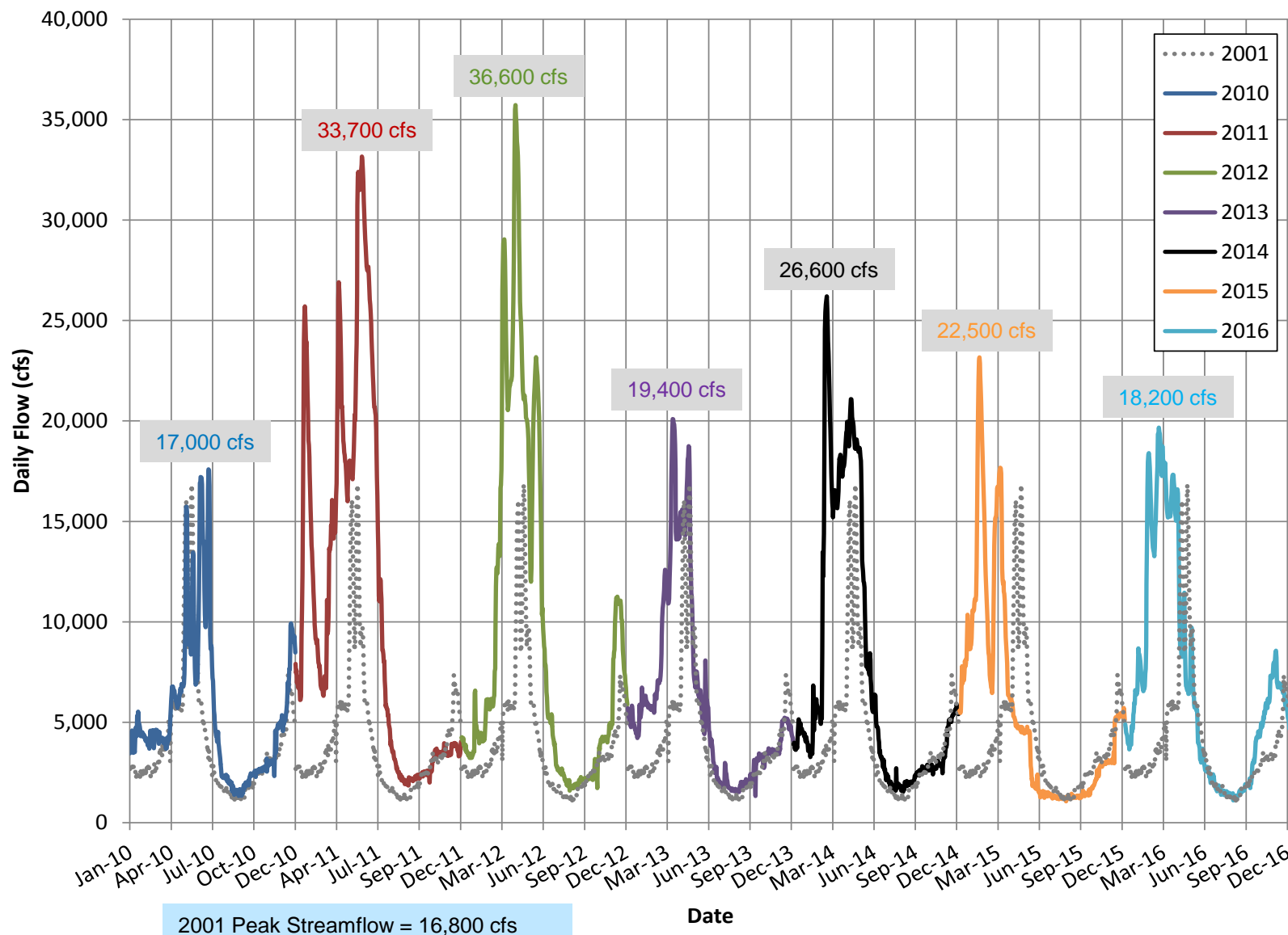
## Lab Analyses

- Nitrate plus nitrite
- Total persulfate nitrogen (TN)
- Soluble reactive phosphorus (SRP)
- Total phosphorus (TP)
- Chlorophyll *a* (chl)
- Phytoplankton
- Zooplankton

## In Situ

- Water temperature
- Dissolved oxygen
- pH
- Conductivity
- Secchi Disc Depth

# Lake Spokane Inflow



2001 Peak Streamflow = 16,800 cfs

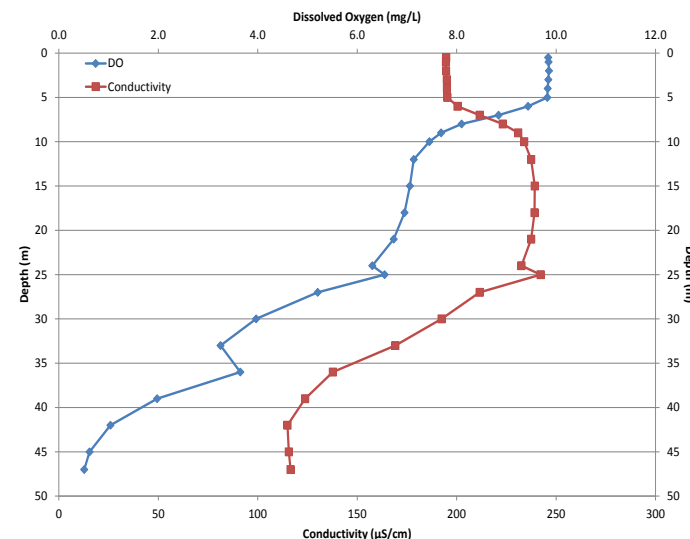
\*2001, 2010-2016 Peak Streamflows from USGS, Spokane River @ Spokane Gage

# 2016 Weather Observations

- Drought-like conditions June and into September
- August warmest month of year
- Precipitation above normal during early spring and late winter
  - October above normal precipitation (broke daily and monthly rainfall records in Spokane).

# 2016 Lake Spokane Monitoring

- Dissolved Oxygen
  - Max conc. ~11.4 to 12.2 mg/L
  - Ave conc. 7.3 to 10.2 mg/L
  - **Min conc. 0 mg/L**
  - July – Sept. volume weighted hypolimnetic ave. ranged from 6.1 to 7.7 mg/L



Ave. DO & Conductivity for LL0, LL1, LL2 (late July – Sept.)

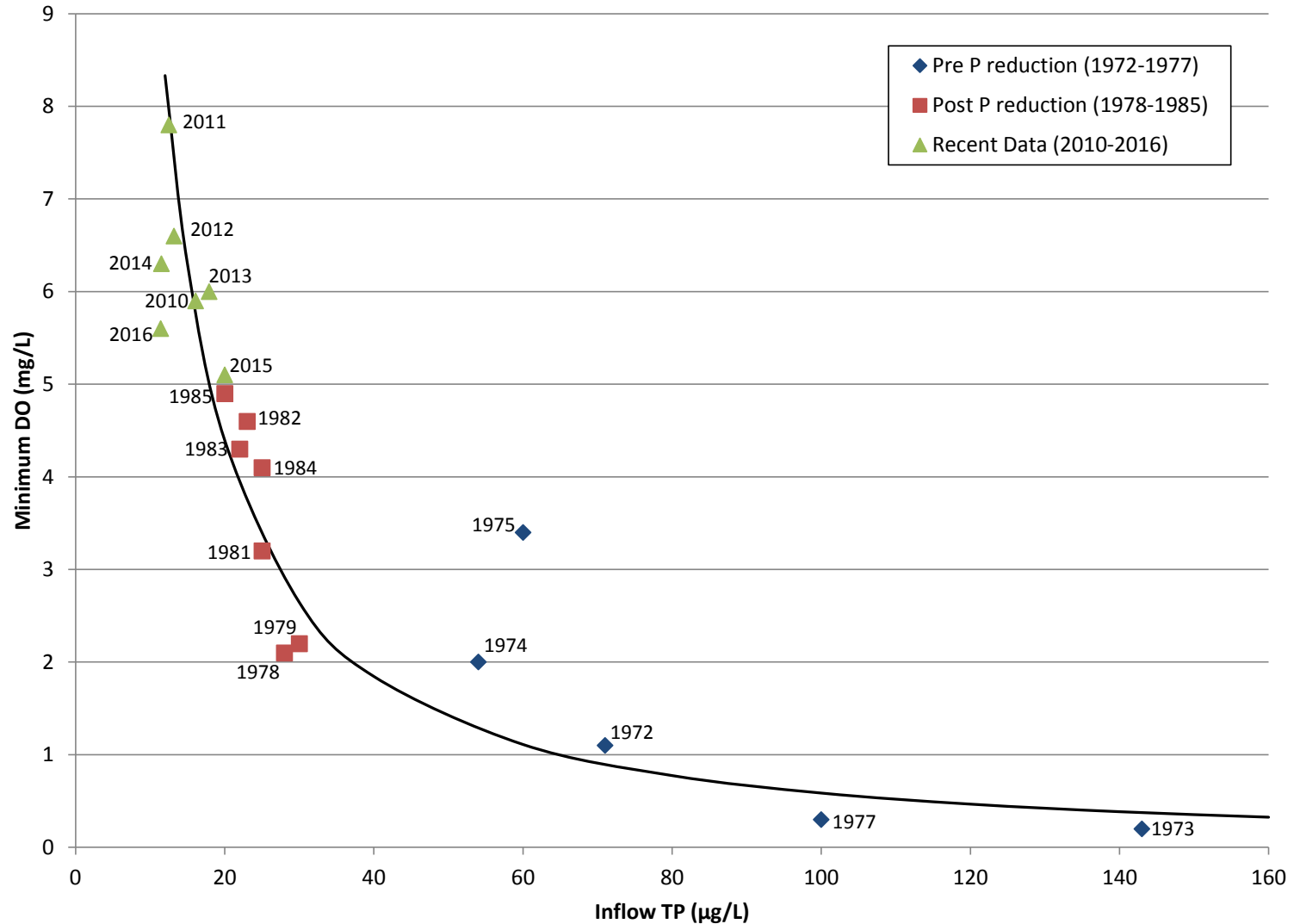
- Total Phosphorus
  - Ranged from 3 to 122 µg/L
  - Volume weighted water column TP conc. <25 µg/L
- Soluble Reactive Phosphorus
  - Ranged from non-detect (1.0 µg/L) to 56 µg/L

# 2016 Lake Spokane Monitoring

- Nitrogen
  - Ranged from 450 to 2,760  $\mu\text{g/L}$
  - Most of the TN consisted of nitrate + nitrite
- Chlorophyll-a
  - Ranged from 0.5 to 14.4  $\mu\text{g/L}$
  - Often highest at ~16 ft depth
- Transparency
  - Ranged from 7 to 30 ft depth
- Phytoplankton
  - diatoms and green algae greatest biovolume
  - algal scums were not observed between LL5 and LL4



## June – October Volume Weighted Mean Inflow TP Concentrations related to Volume Weighted Hypolimnetic DO Concentrations before and after advanced wastewater treatment.



Source: Avista 2017 (Lake Spokane Dissolved Oxygen Water Quality Attainment Plan Five Year Report)

# DO WQAP Implementation

- Carp Removal Pilot
- Bulkhead Rmvl/Reducing lawn areas
- Grazing land lease
- Wetlands/Floating Treatment Wetland
- Planting trees
- Education
- Habitat Assessment



# Rainbow Trout Population and Habitat Utilization

- Stock 155,000 rainbow trout annually (FERC License requirement)
- Identify locations of where rainbow trout occupy
- Determine whether stocked rainbow trout survive summer and maintain healthy body conditions



# 2017 Carp Removal Pilot

	Winter Event	Spring Event**
Timeframe	1 Week	2 Weeks
Method	Gill Netting	Gill Netting & Electrofishing
Number Carp Removed	149	1,072
Max Weight *	13 lbs	22 lbs
Ave Weight*	7 lbs	8.6 lbs
Max Length*	29 in	34 in
Ave Length*	23 in	25 in

Note:

\* = Measurements are approximate

\*\* = Estimate of TP removed during spring event is ~44 lbs



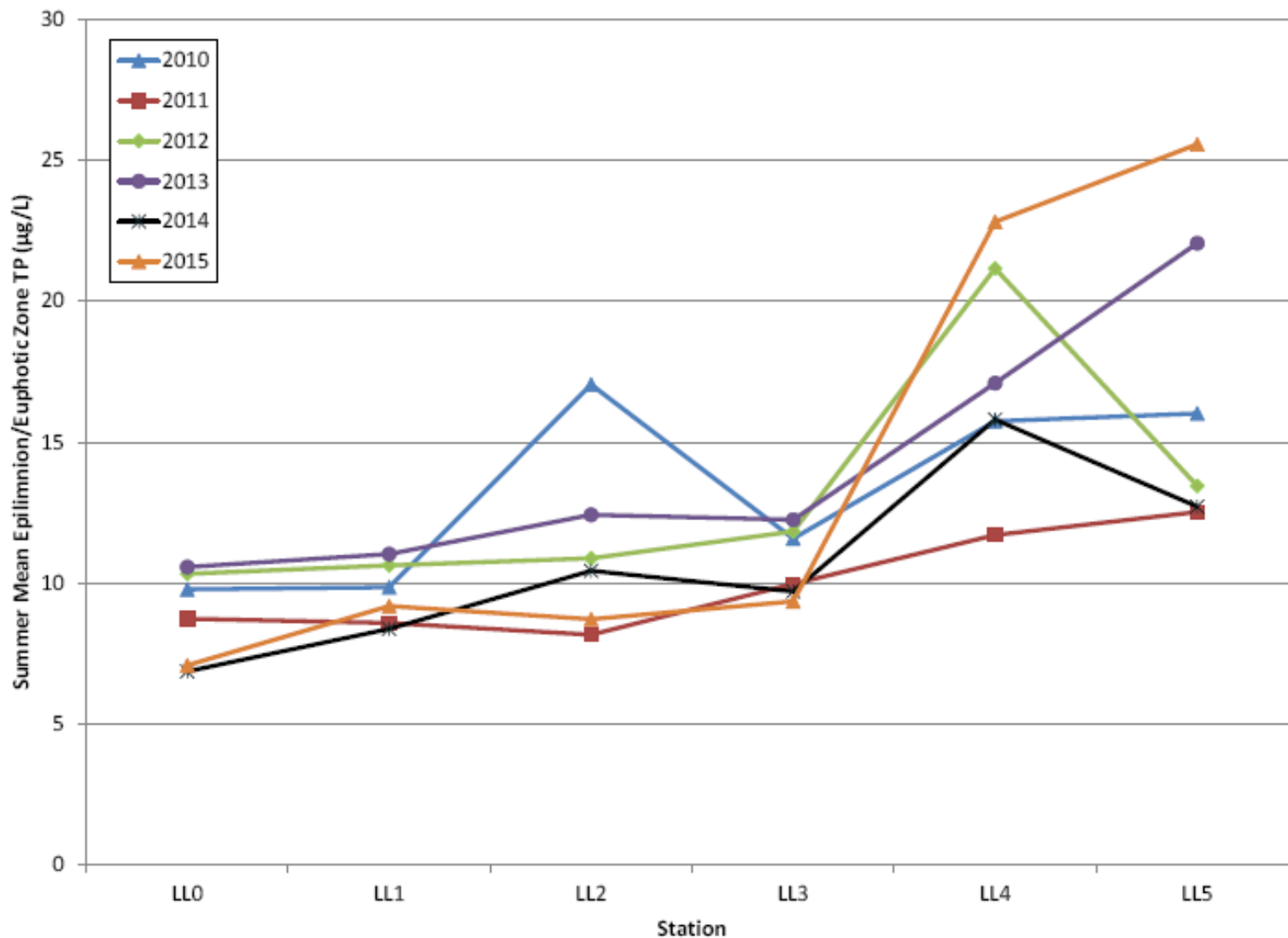
# Questions?





# Lake Spokane Residence Times

Year	Total Annual Flow Volume (cf x10 <sup>6</sup> )	Annual Mean Daily Flow (cfs)	Mean Daily Summer (June-October) Flow (cfs)	Residence Time <sup>1</sup> Whole Reservoir (days)	Residence Time <sup>1</sup> Transition/Riverine Zones (days)
2001	125,782	3,989	2,413	46.3	8.7
2010	167,113	5,299	4,671	23.9	4.5
2011	337,576	10,704	7,828	14.4	2.7
2012	293,971	9,296	5,768	19.4	3.6
2013	189,846	6,020	3,035	36.8	6.9
2014	234,999	7,452	3,581	31.3	5.9
2015	171,137	5,427	1,595	70.1	13.2
2016	216,855	6,858	2,523	43.3	8.1



**Figure 103. Summer (June-September) Mean Epilimnion/Euphotic Zone TP Concentrations, 2010-2015**  
(Data is presented from down-reservoir to up-reservoir, left to right.)