4-30-2009

The Effect of Draining Forge Pond on the Assonet River

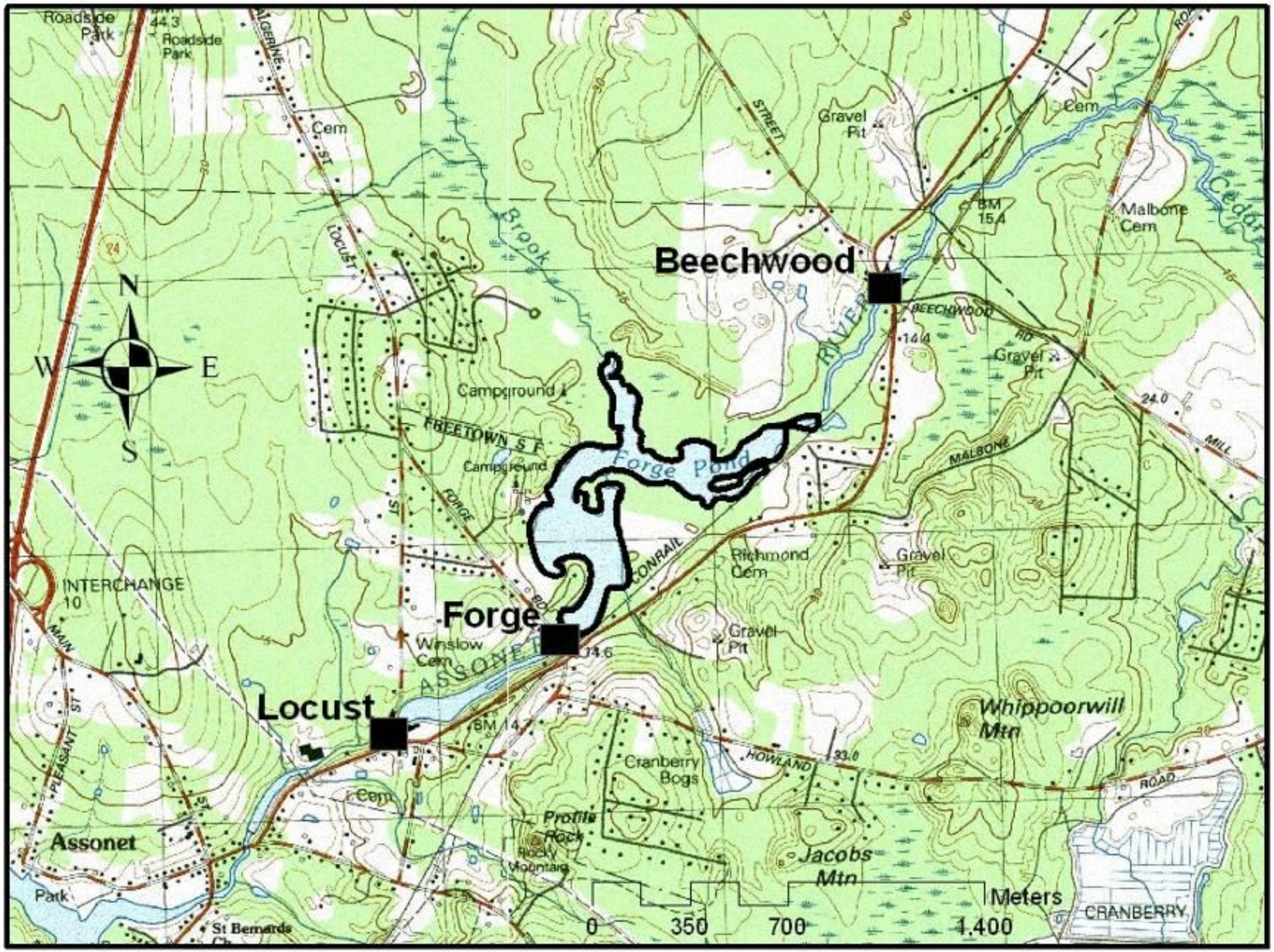
The Effects of Draining Forge Pond on the Assonet River

Group Members: Alyssa Barbosa, Brianne Beckman, Jessica Carreiro, Kristen Maltais, Brandon Riendeau, Adrianna Wright and Brieanne Young

Question for Investigation:

HOW DOES THE DRAINING OF FORGE POND EFFECT THE ASSONET RIVER????

Assonet Forge Pond Outline 08-09



History of the Assonet River

- 18th century - American Revolutionary War.
- 19th century - fishing and cargo ships
- Assonet Bay Shores is a peninsula formed by Assonet Bay, Payne Cove, and Shepherd's Cove. Across Shepherd's Cove is an abundance of higher-end homes.

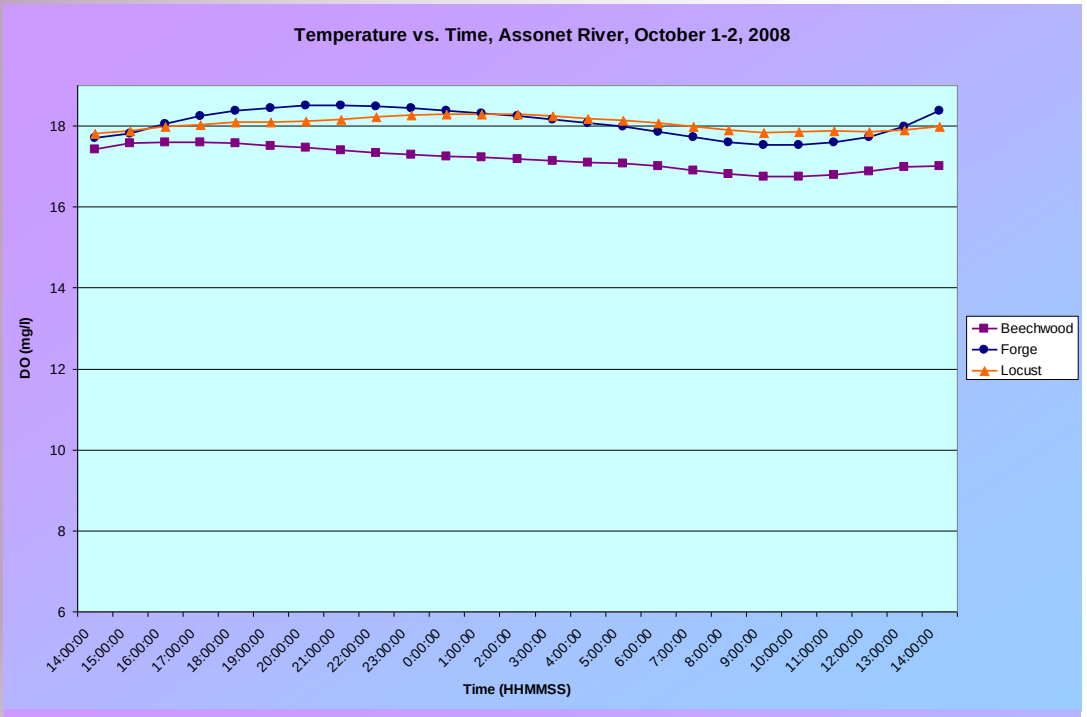
The Draining of Forge Pond

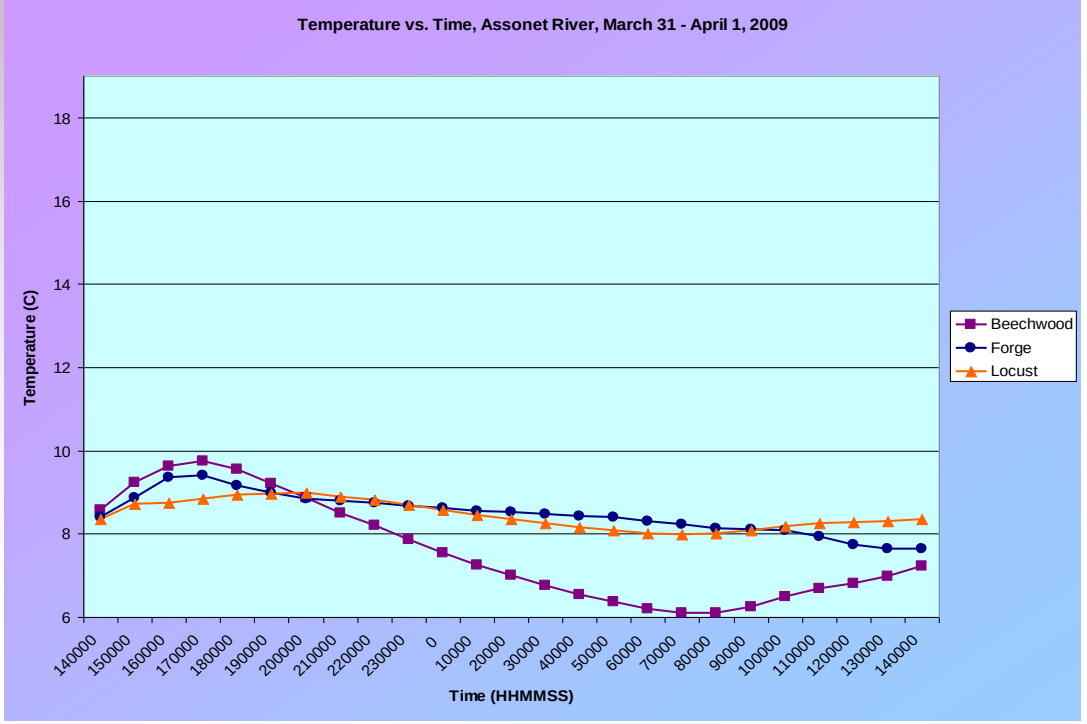
- **1703-** The Forge Pond dam was built
- **Mid 1800's-** the dam powered a manufacturing plant.
- **July 2007-** lowering the level of the pond by cutting wooden planks inside concrete sluiceways. They will continue doing so until they drain 3-4 feet of water.
- **Today-** The pond has crested above the dam. The water has also begun to filter through the massive rocks that make up the dam. If one of these rocks were to become dislodged, the entire dam would break.


BEECHWOOD RD

Beechwood Temperature

- Beechwood consistently has the lowest temperature of the three sets.
- ***Why?***
  - Ground water from wetlands.
  - The temperatures show a diurnal change.



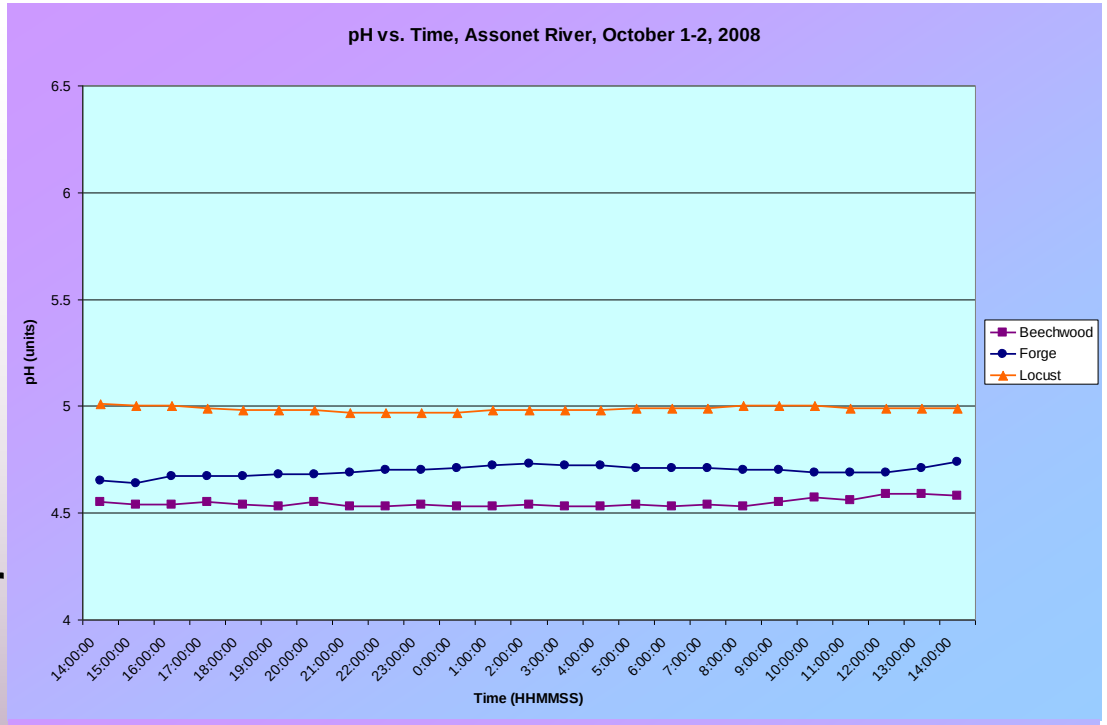


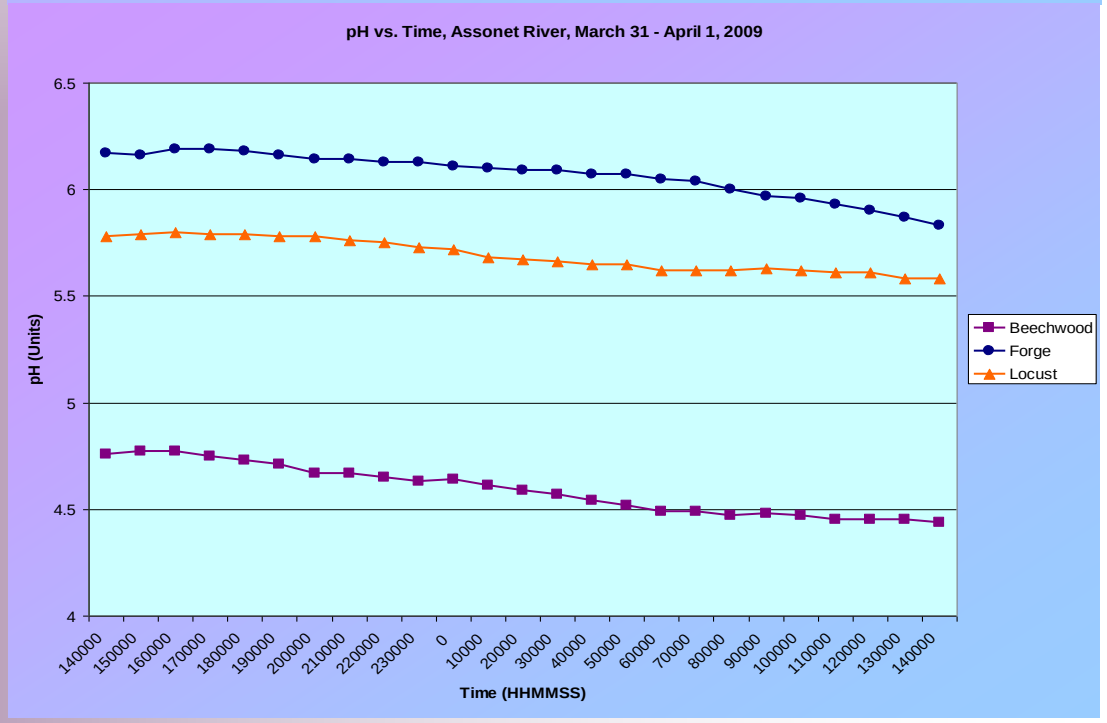
pH of the Assonet River

- Factors that increase pH:
  - Surrounding minerals in rock and soil
  - Atmospheric deposition (Acid Rain)
- Factors that decrease pH:
  - Direct atmospheric decomposition
  - Acid mining drainage
  - Industrial discharge
  - Optimal Ranges for Aquatic Organisms: 6.5 - 8.5
- ALL SITES ARE UNDER OPTIMAL RANGE!

Beechwood pH

- Beechwood always maintains the lowest pH values for October and March
  - Why?
    - Cellular respiration
    - Drainage of upstream wetlands
    - Production of CO_2 with decomposition





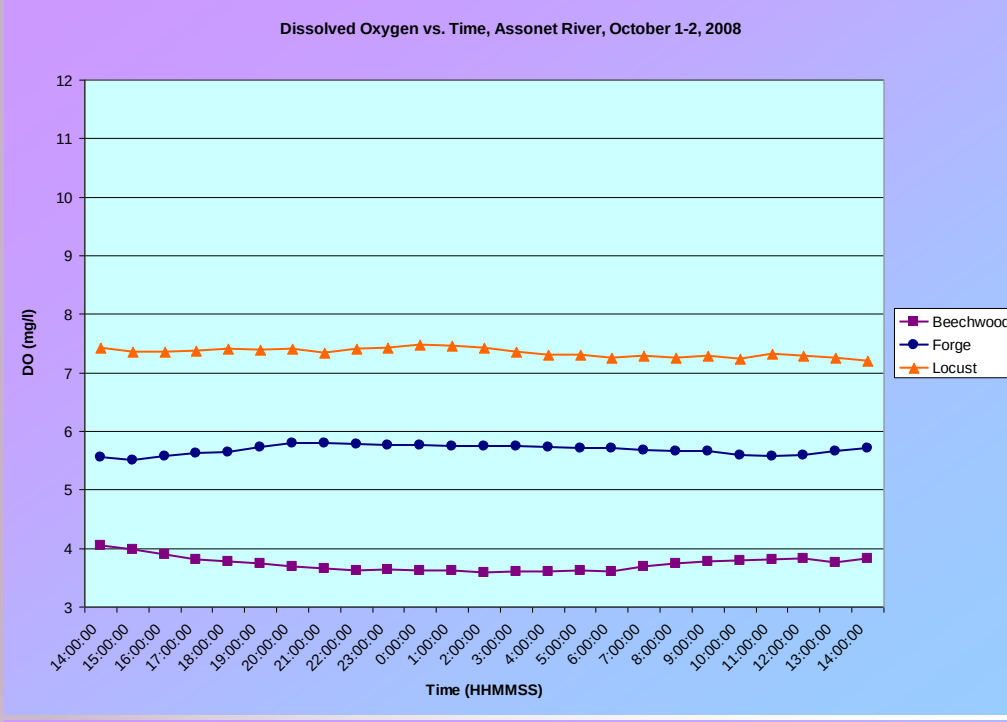
Dissolved Oxygen

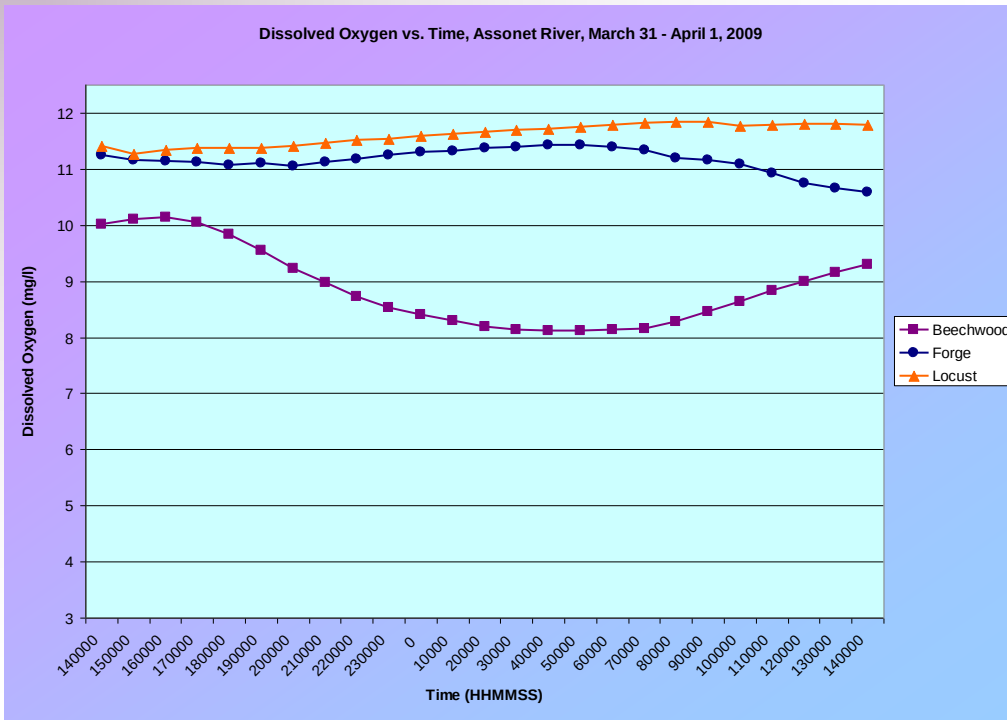
Upstream Site

- Overall, there is less DO than other 2 sites on both sampling dates

Why?

- The water has not yet been aerated by dams
- Upstream from Beechwood is a wetlands area



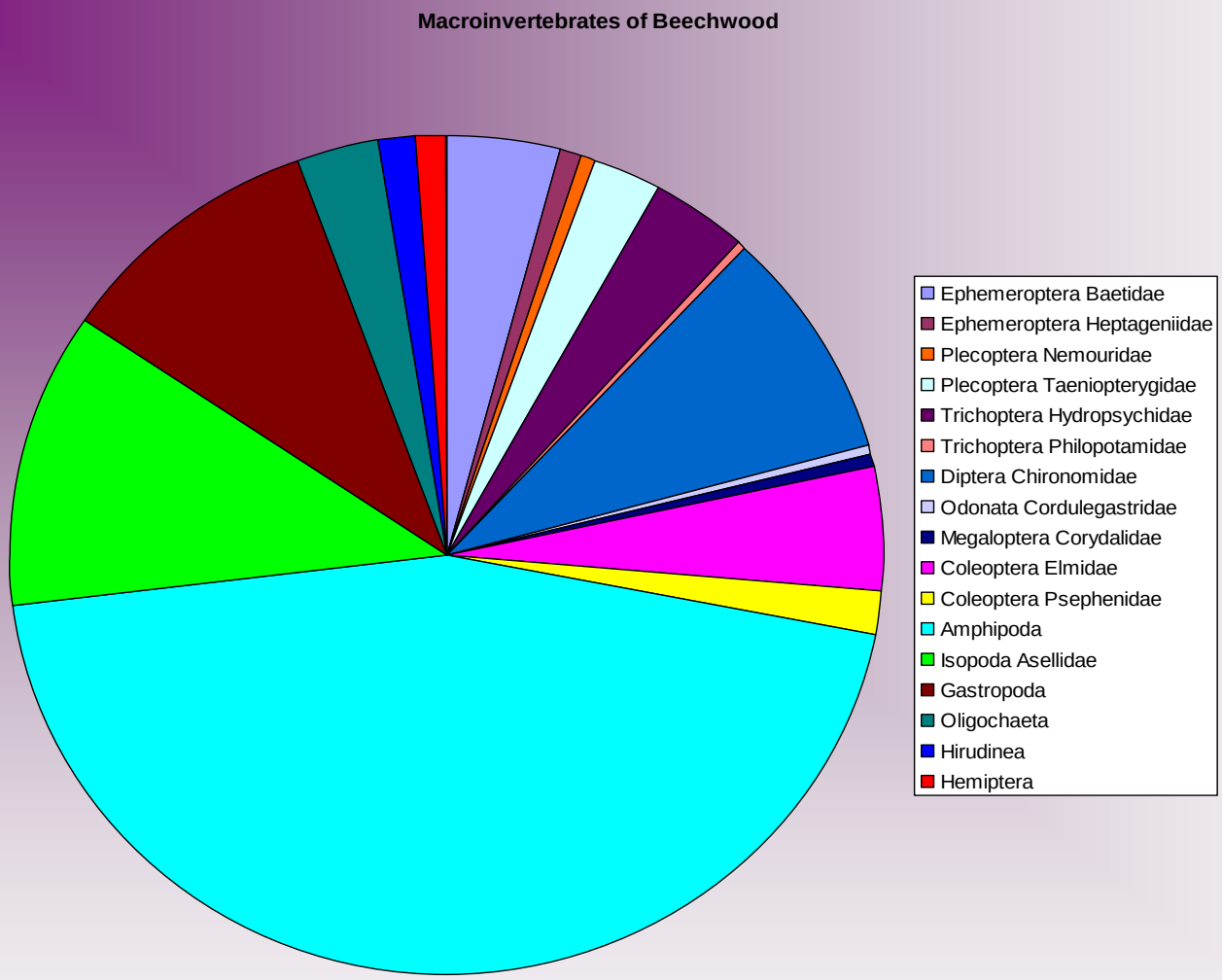


Beechwood Site Discharge

- Beechwood's velocity, although it is the upstream site, is decreased compared to the Forge site.
- ***Why?***
  - Forge has a dam
  - Forge pond adds excess water to the downstream sites

Macroinvertebrates of Beechwood

Major Group or Family	Count Replicate 1	Count Replicate 2	Average Count	Average Density	Group or Family %	Tolerance Value	Total X Average Original Density
Ephemeroptera Baetidae	0	12	6	17	4	4	68
Ephemeroptera Heptageniidae	1	1	1	3	0.74	4	12
Plecoptera Nemouridae	2		1	3	0.74	2	6
Plecoptera Taeniopterygidae	0	7	3.5	10	2	2	20
Trichoptera Hydropsychidae	6	4	5	14	3	3	42
Trichoptera Philopotamidae	1	0	0.5	1	0.3	3	3
Diptera Chironomidae	3	22	12.5	36	9	7	252
Odonata Cordulegastridae	1	0	0.5	1	0.3	3	3
Megaloptera Corydalidae	0	2	1	3	0.74	2	6
Coleoptera Elmidae	11	2	6.5	19	5	4	76
Coleoptera Psephenidae	3	2	2.5	7	2	4	28
Amphipoda	79	49	64	183	45	7	1281
Isopoda Asellidae	9	24	16.5	47	12	8	376
Gastropoda	2	26	14	40	10	7	280
Oligochaeta	9	0	4.5	13	3	9	117
Hirudinea	1	3	2	6	1	10	60
Hemiptera	0	3	1.5	4	0.98	8	32



PERCENT TOLERANCE

- The percent tolerant macro-invertebrates for Beechwood is 80.42%.
- The tolerance levels for this category are from 7-10.

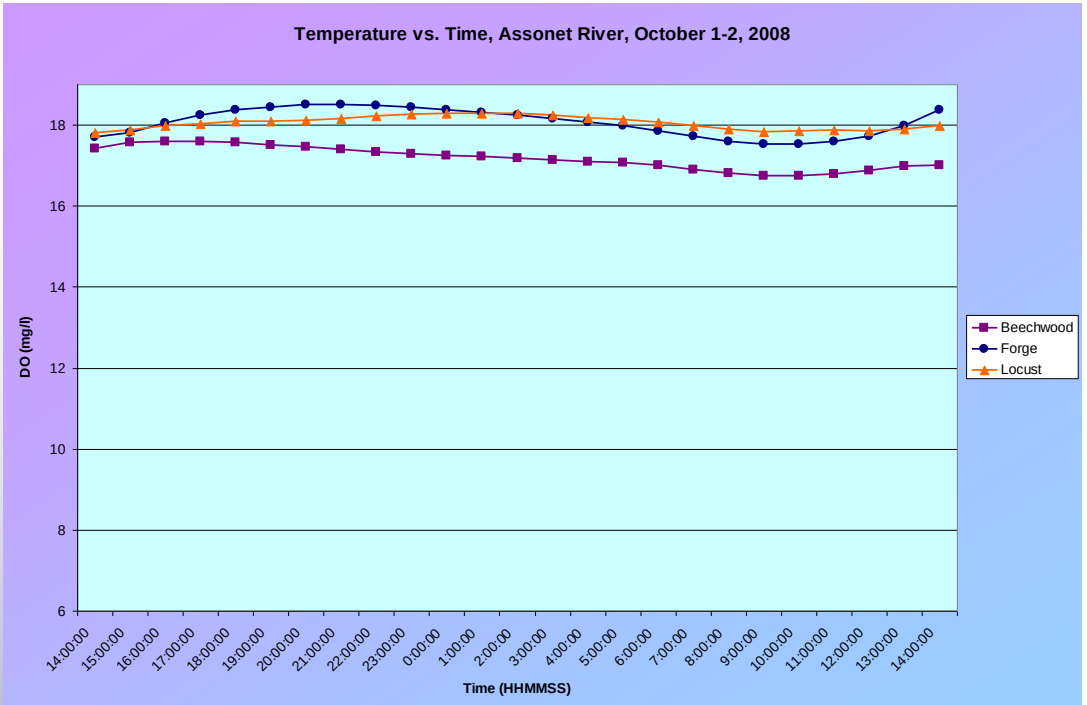
PERCENT INTOLERANCE

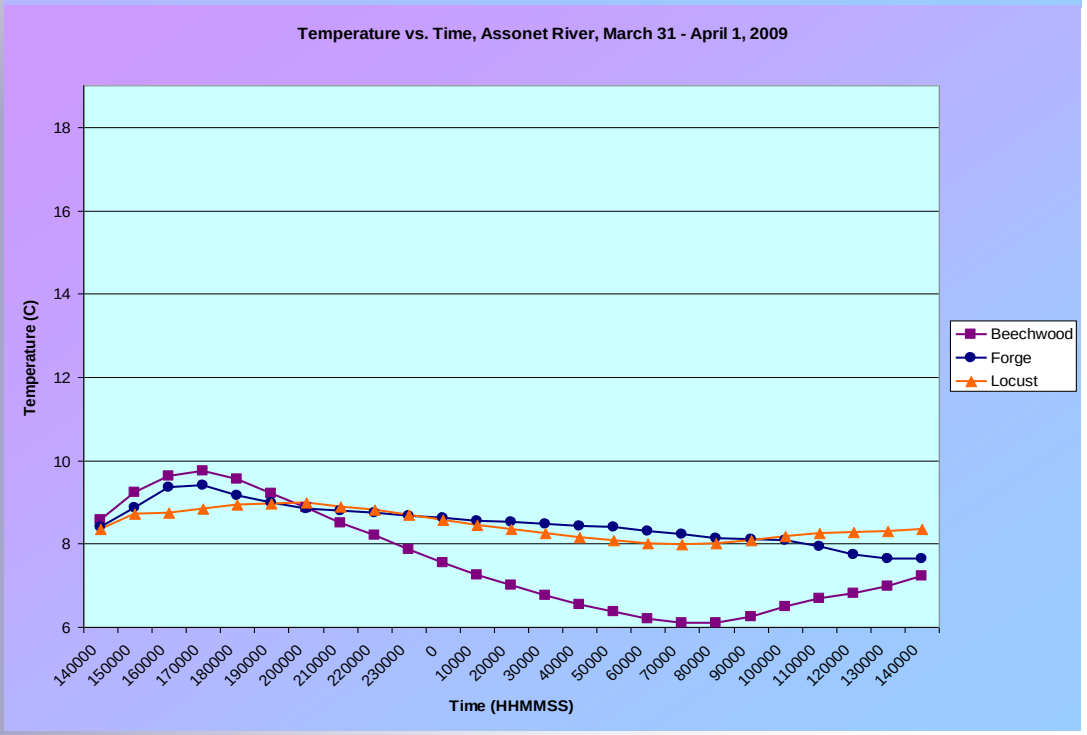
- The percent intolerant for Beechwood is 8.04%
- The tolerance levels for this category range from 0-3.
- **Because the number of tolerant bugs surpasses the number of intolerant bugs, the water quality for Beechwood is poor, with an FBI of 6.51**


FORGE
RD

Forge Site Temperature

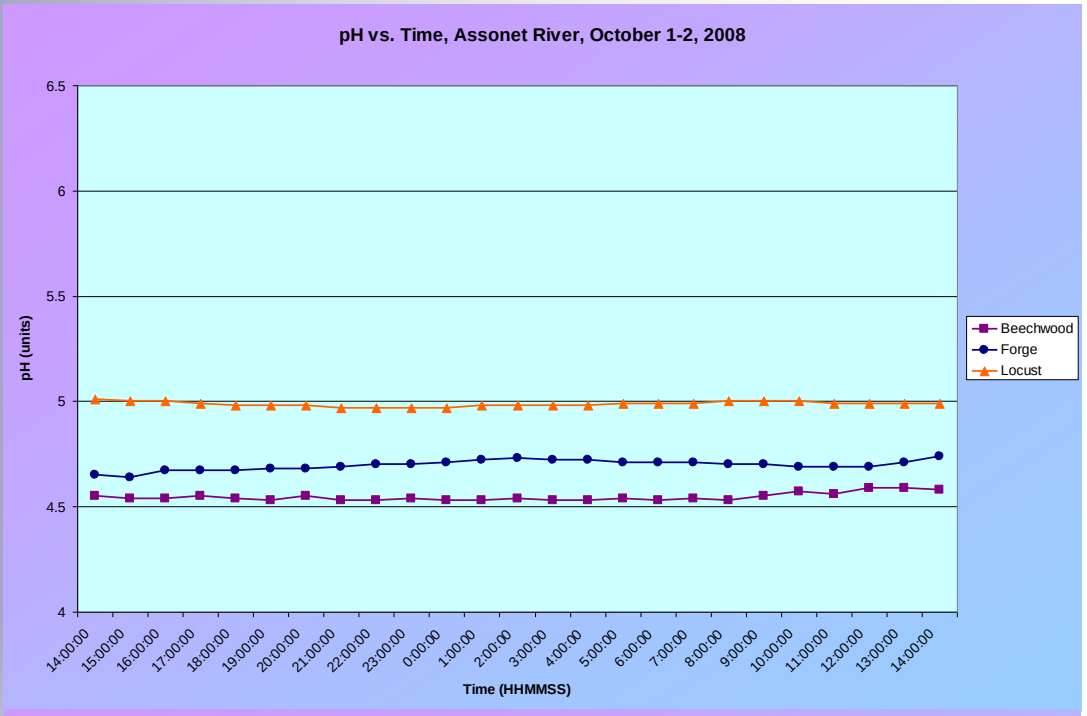
- There is an increase in temperature between the Beechwood Site and Forge site.
- ***Why?***
  - Impoundment upstream from the bridge
  - Forge Pond

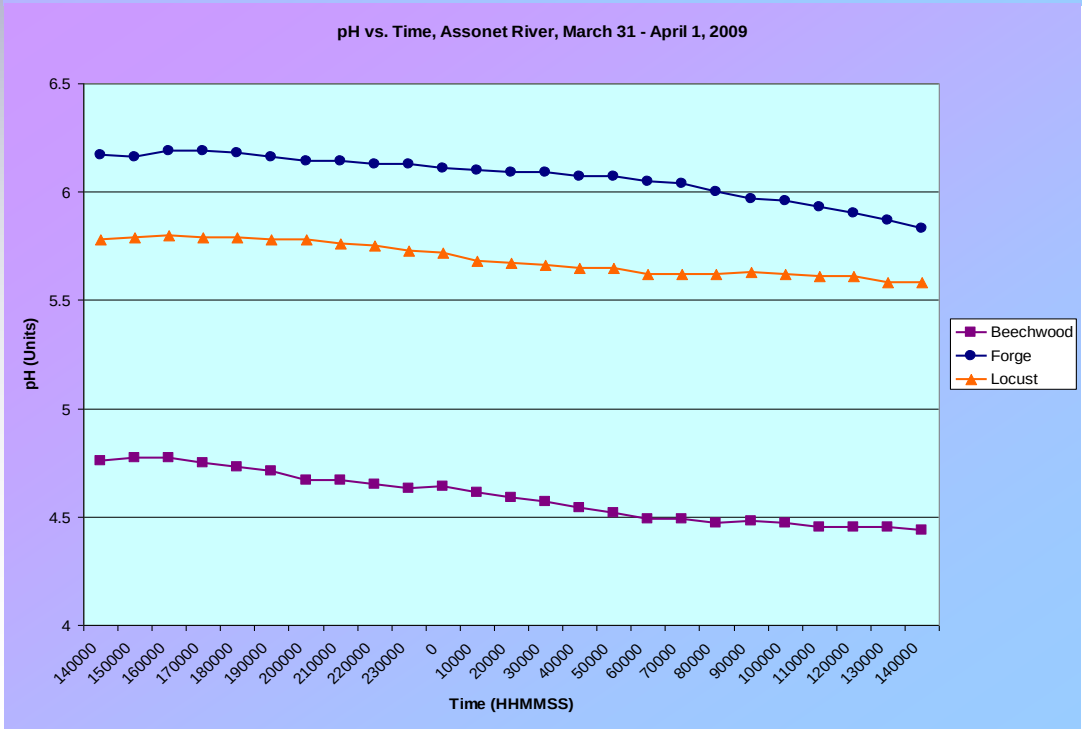




Forge pH

- pH at Forge is higher than Beechwood
  - Why?
    - Less cellular respiration
- Forge is the only site whose pH increases in March
  - Why?
    - Water temperature increases in March
    - More cellular respiration
    - Wetland-like conditions

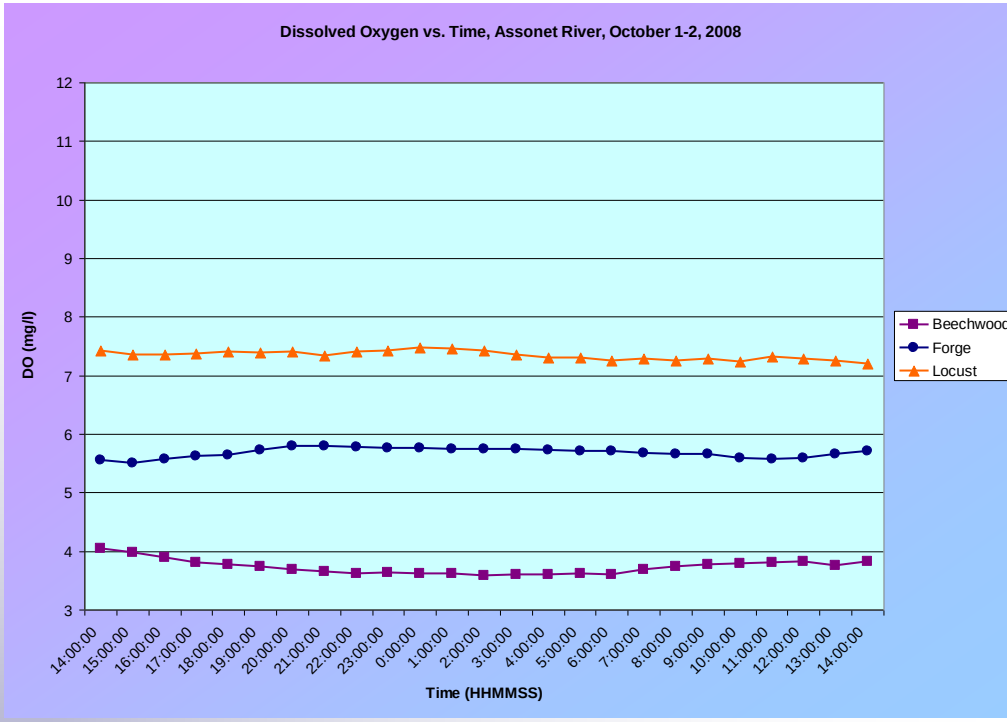


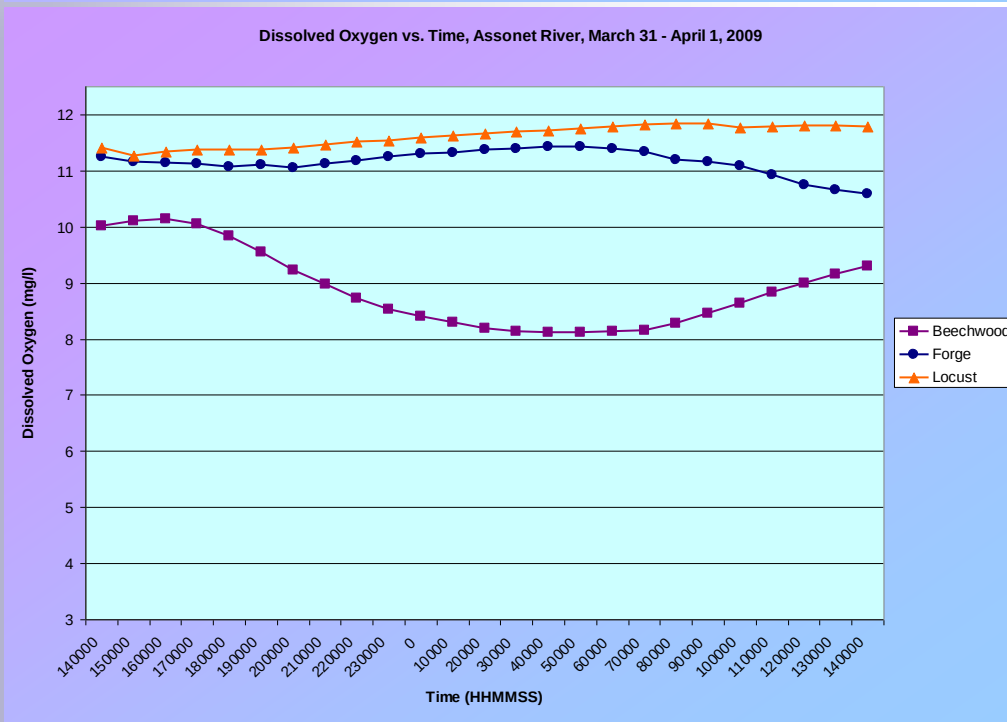


Dissolved Oxygen

Midstream Site

- DO is higher than Beechwood but lower than Locust
- <u>Why?</u>
- Higher than Beechwood because water has gone through a dam
- Lower than Locust because water has heated up in Forge Pond due to large surface area



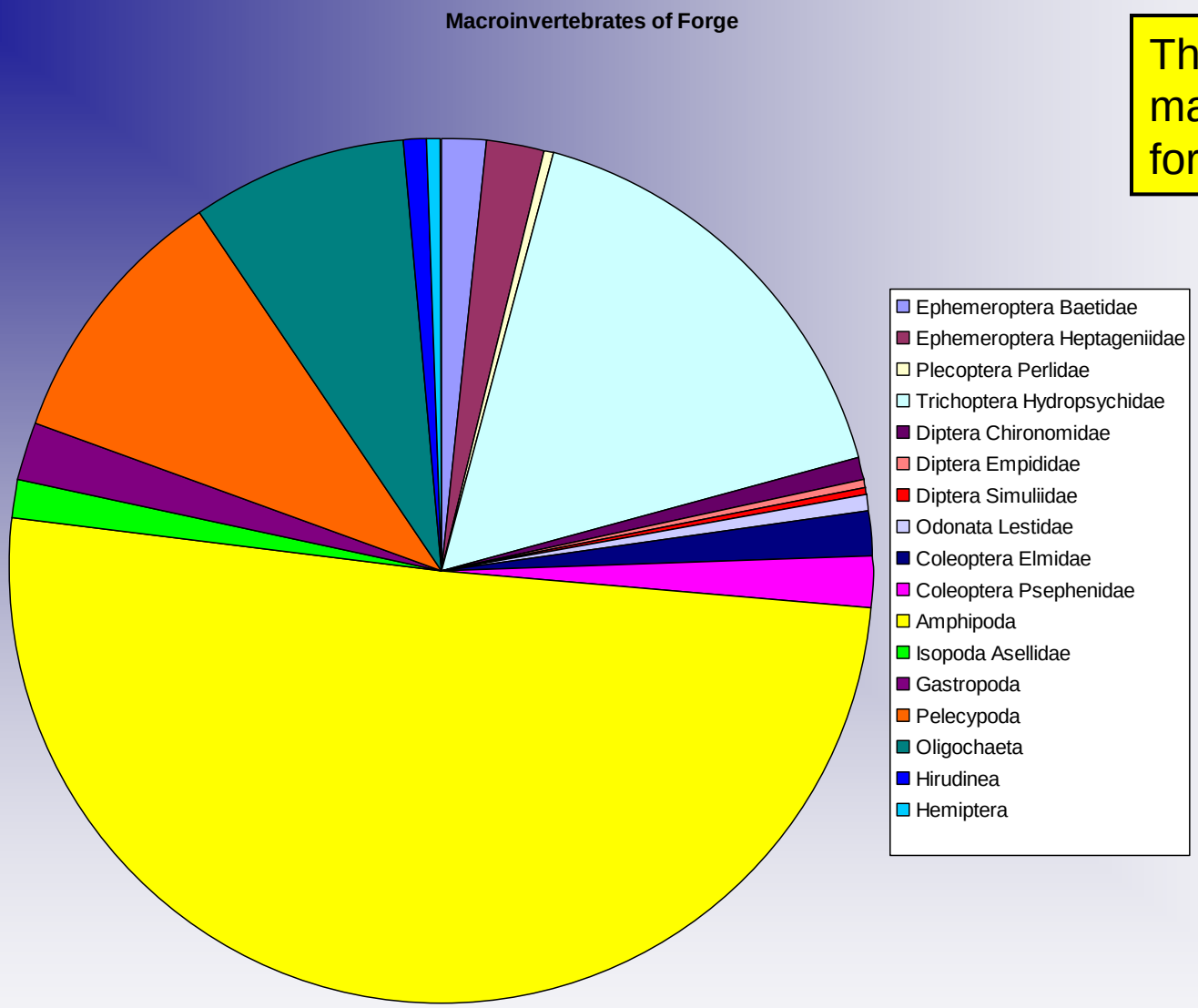


Forge Site Discharge

- Forge, although being the midstream site has the highest discharge due to the excess water being removed from Forge Pond.
- ***Why?***
  - Wall
  - Channels

Macroinvertebrates of Forge

Major Group or Family	Count Replicate 1	Count Replicate 2	Average Count	Average Density	Group or Family %	Tolerance Value	Total X Average Original Density
Ephemeroptera Baetidae	1	8	4.5	9	2	4	36
Ephemeroptera Heptageniidae	6	4	5	10	2	4	40
Plecoptera Perlidae	1	0	1	2	0.4	1	2
Trichoptera Hydropsychidae	68	16	42	87	17	3	261
Diptera Chironomidae	2	2	2	4	0.8	7	28
Diptera Empididae	0	1	1	2	0.4	6	12
Diptera Simuliidae	0	1	1	2	0.4	6	12
Odonata Lestidae	1	0	1	2	0.4	3	6
Coleoptera Elmidae	6	2	4	8	2	4	32
Coleoptera Psephenidae	0	5	5	10	2	4	40
Amphipoda	65	191	128	265	50	7	1792
Isopoda Asellidae	4	0	4	8	1.5	8	64
Gastropoda	7	4	5.5	11	2	7	77
Pelecypoda	0	25	25	52	10	7	364
Oligochaeta	8	33	20.5	42	8	9	378
Hirudinea	0	2	2	4	0.8	10	40
Hemiptera	1	2	1.5	3	1	8	24



The percent tolerant macro-invertebrates for Forge is 74.31%.

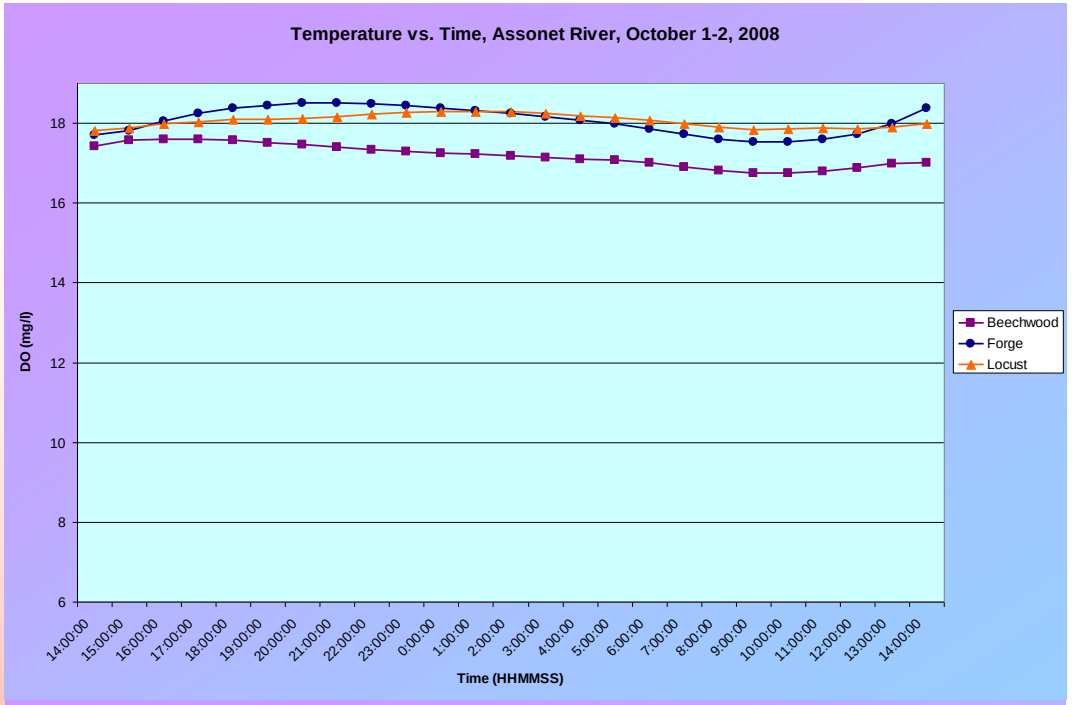
Because the number of tolerant bugs surpasses the number of intolerant bugs, the water quality for Forge is still poor with an FBI of 6.76.

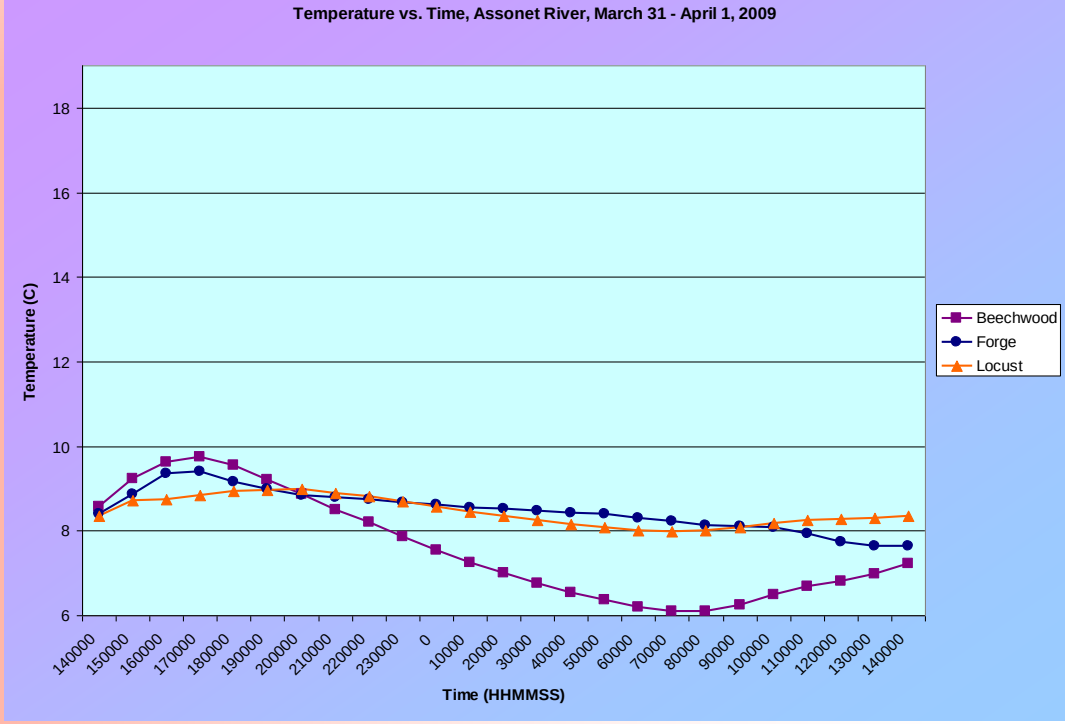
The percent intolerant for Forge is 17.25%.


LOCUST ST

Locust Site Temperature

- The Locust and Forge Sites have very similar temperatures.
- ***Why?***
  - Less than one-mile apart
  - Scarce canopy





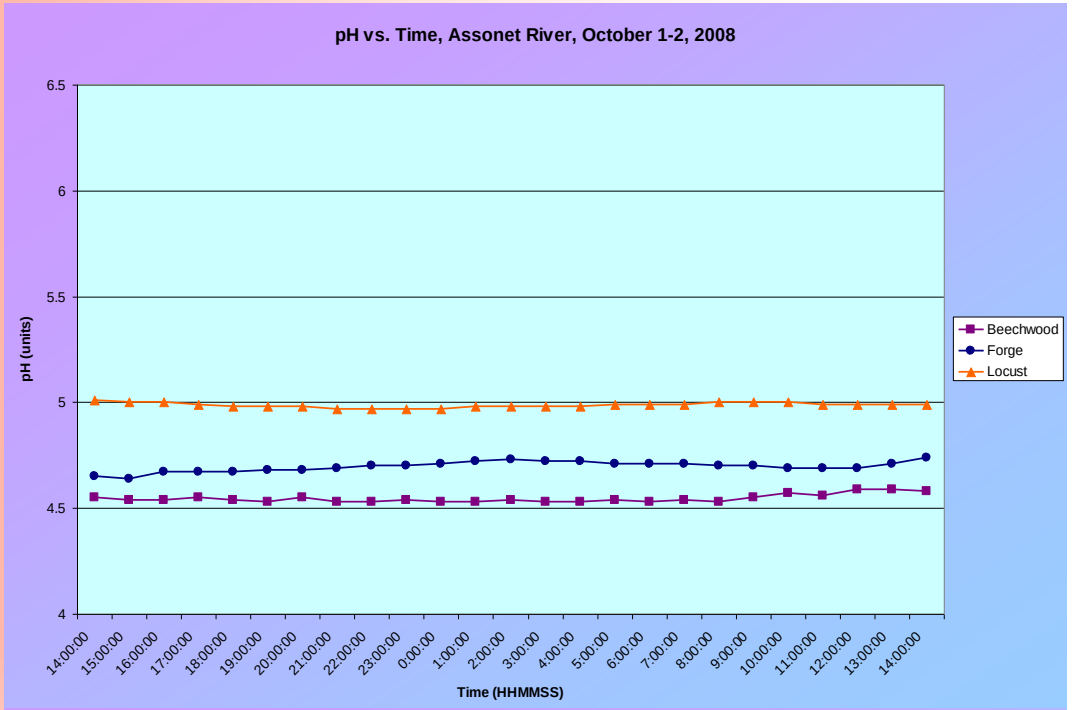
Locust pH

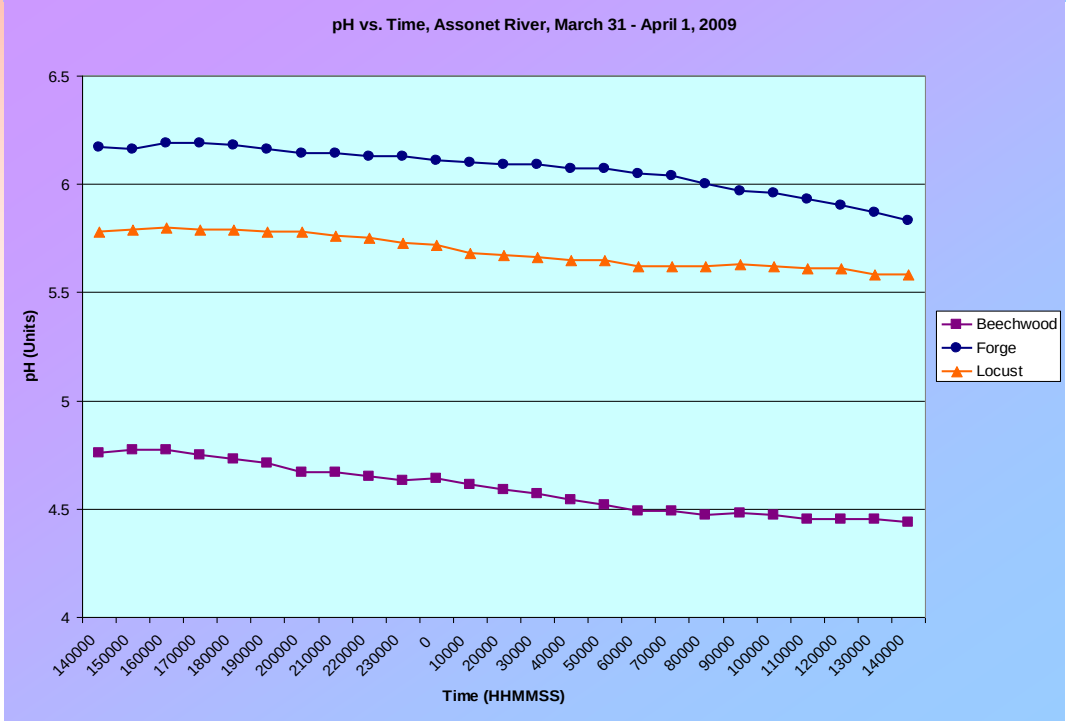
- pH stays generally the same for October and March, and is below optimal range
  - Why?
    - Presence of in stream vegetation
    - Decaying organic matter

Historical

- According to historical data for Beechwood and Locust, pH was acidic (<5.0) in November of 2006.

So… the data from 2008-2009 is consistent with the historical data.





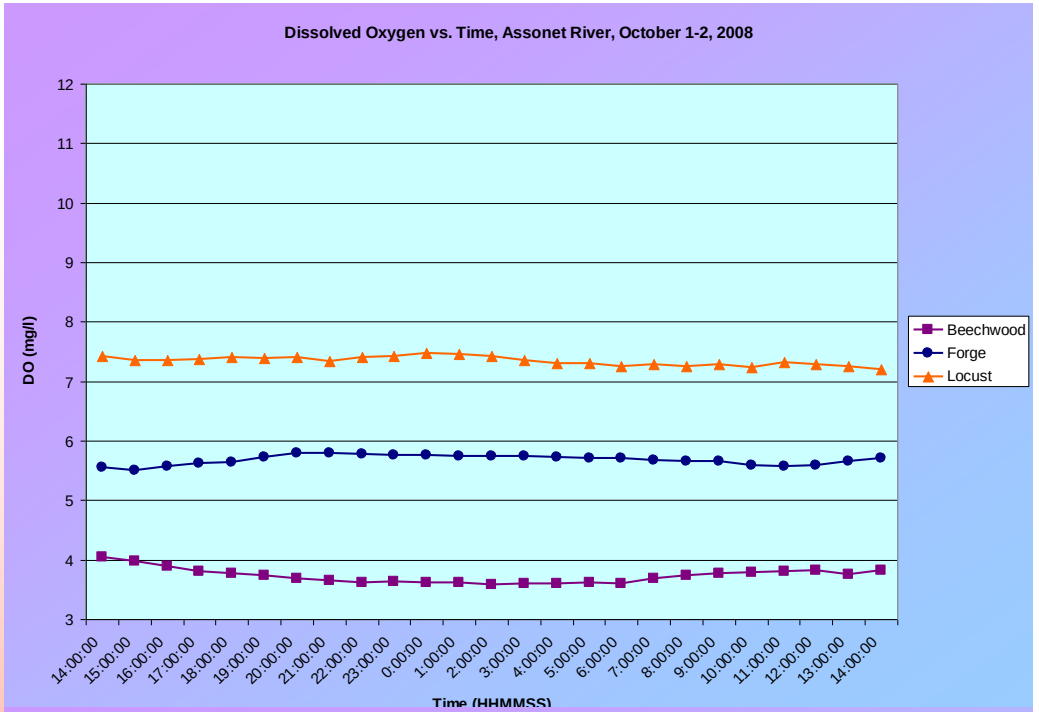
Dissolved Oxygen

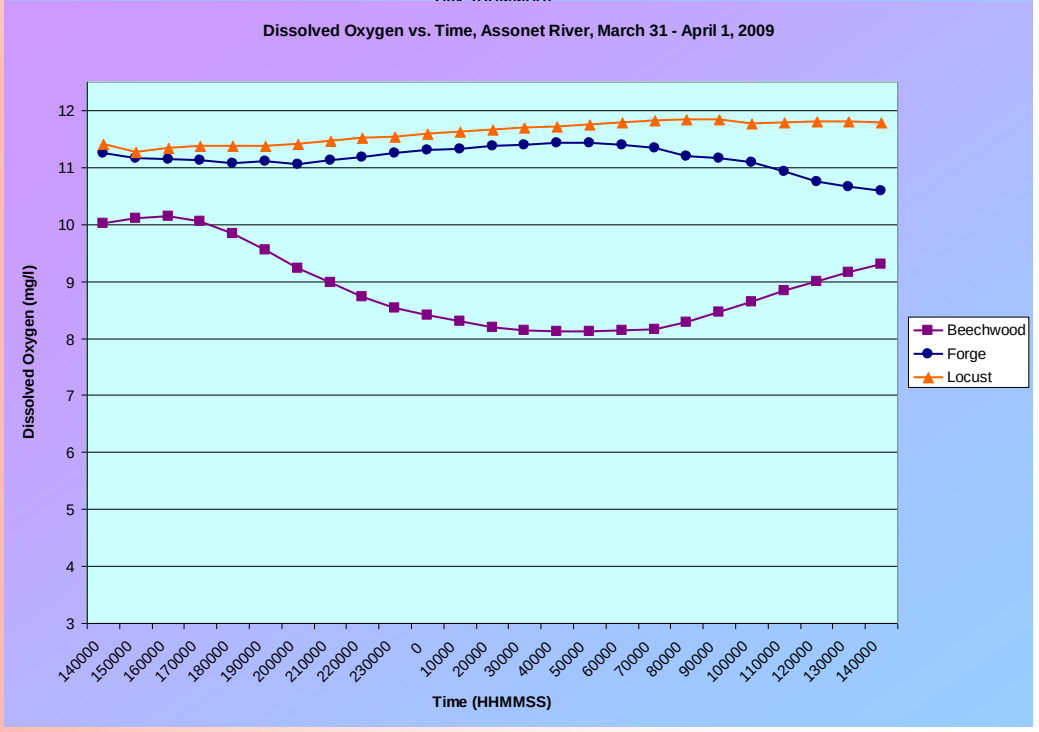
Downstream Site

- Has the most DO in both March and October

Why?

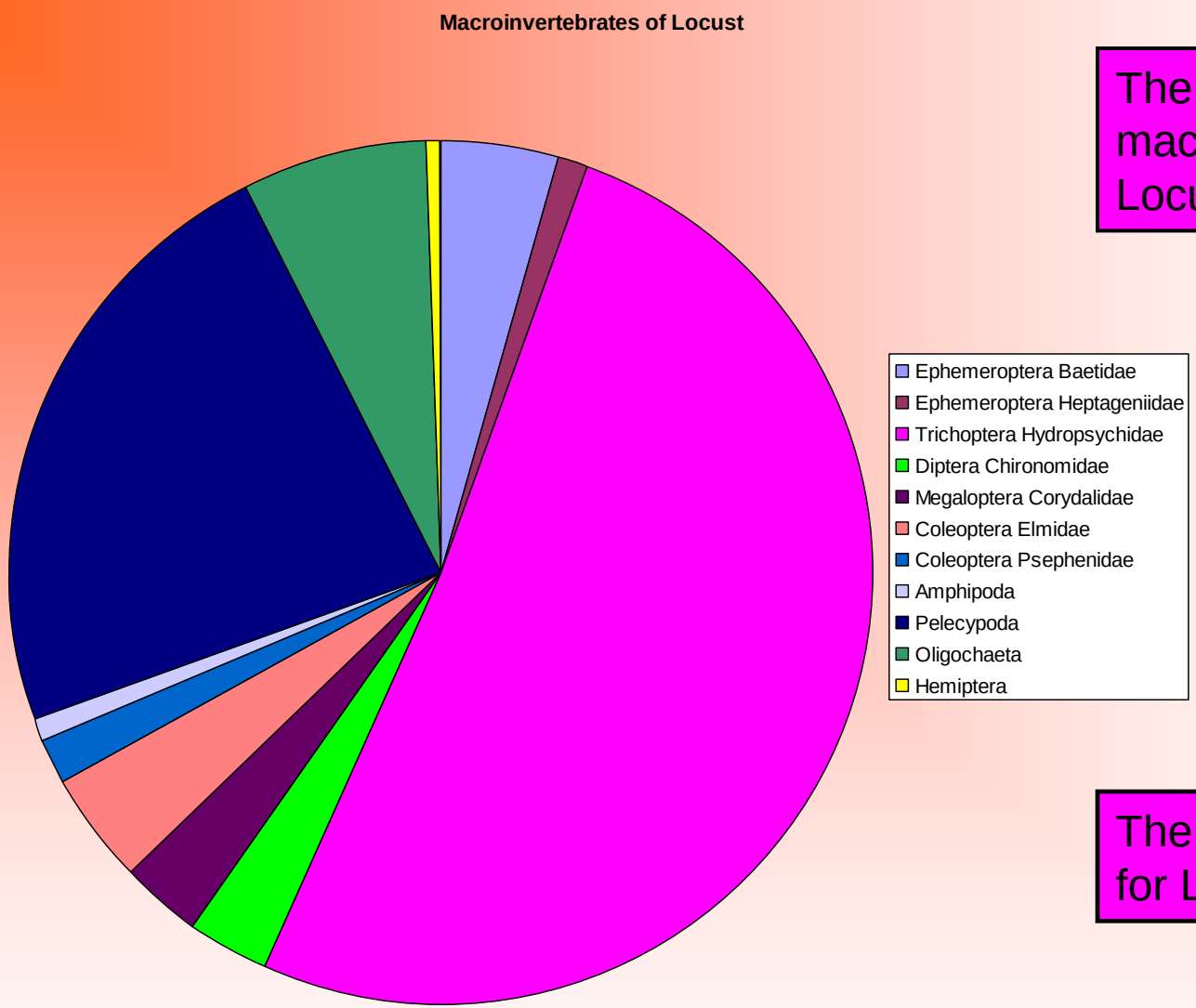
- Water has travelled far, all the while being aerated
- Large rocks and boulders were present, increasing riffling
- Dam upstream has a higher drop with more rocks at its spillway
- A lot of vegetation





Macroinvertebrates of Locust

Major Group or Family	Count Replicate 1	Average Count	Average Density	Group or Family %	Tolerance Value	Total X Average Original Density
Ephemeroptera Baetidae	10	10	23	4	4	92
Ephemeroptera Heptageniidae	3	3	7	1	4	28
Trichoptera Hydropsychidae	117	117	269	51	3	807
Diptera Chironomidae	7	7	16	3	7	112
Megaloptera Corydalidae	7	7	16	3	2	32
Coleoptera Elmidae	9	9	21	4	4	84
Coleoptera Psephenidae	4	4	9	2	4	36
Amphipoda	2	2	5	1	7	35
Pelecypoda	53	53	122	23	7	854
Oligochaeta	16	16	37	7	9	333
Hemiptera	1	1	2	0.4	8	16



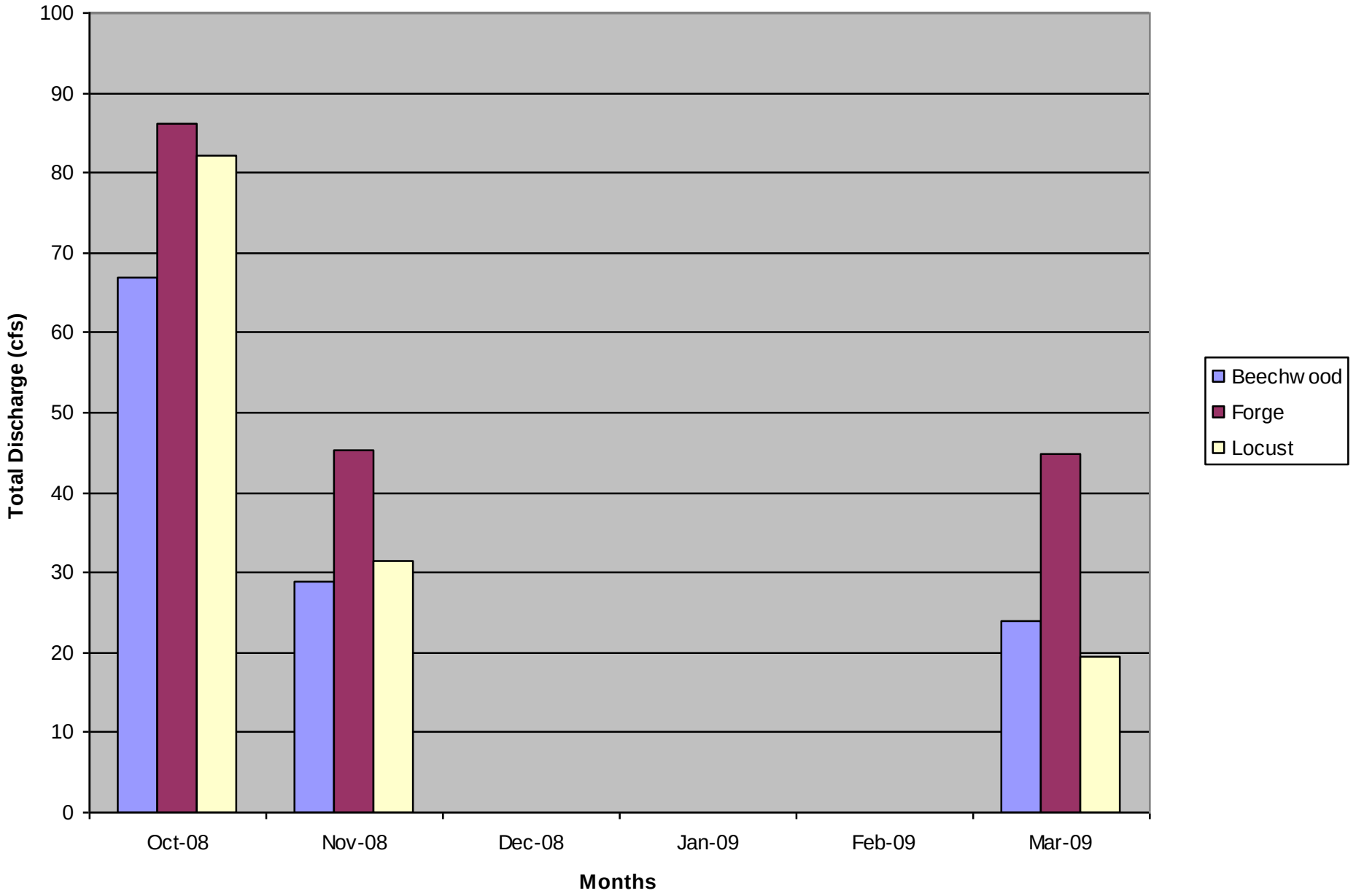
The percent tolerant macro-invertebrates for Locust is 34.06%.

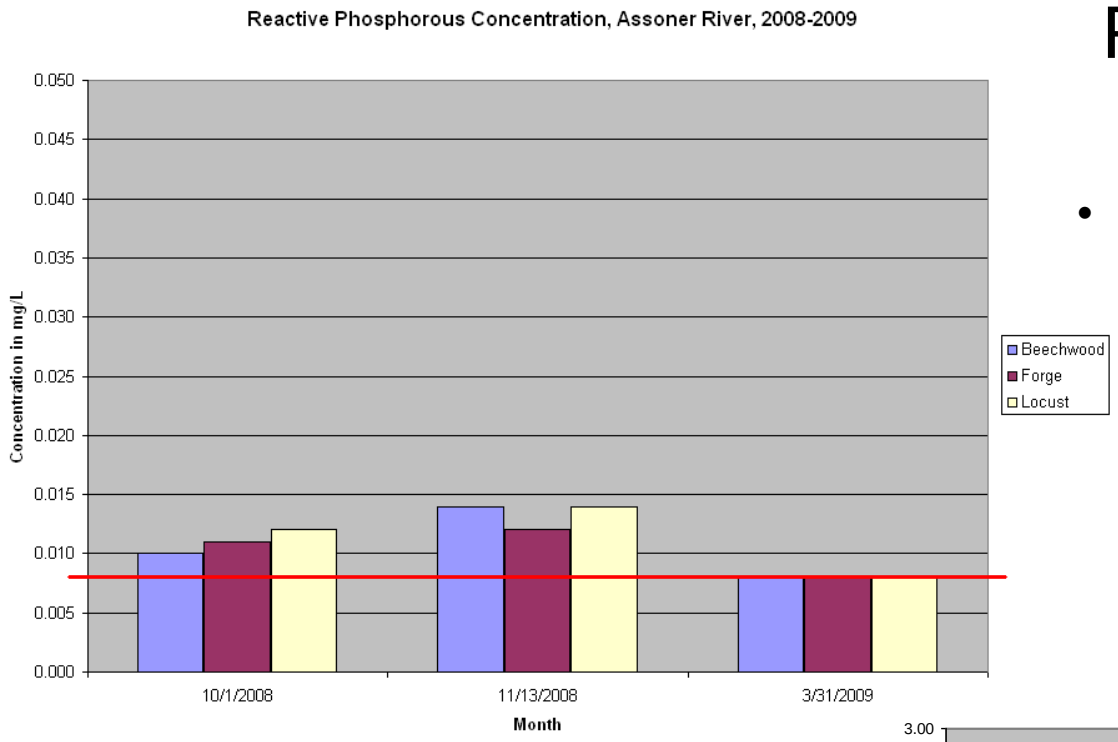
The percent intolerant for Locust is 54.15%.

Because the number of intolerant bugs is very high, and surpasses the number of tolerant bugs, the water quality for Locust is good with an FBI of 4.61.

Locust Site Discharge

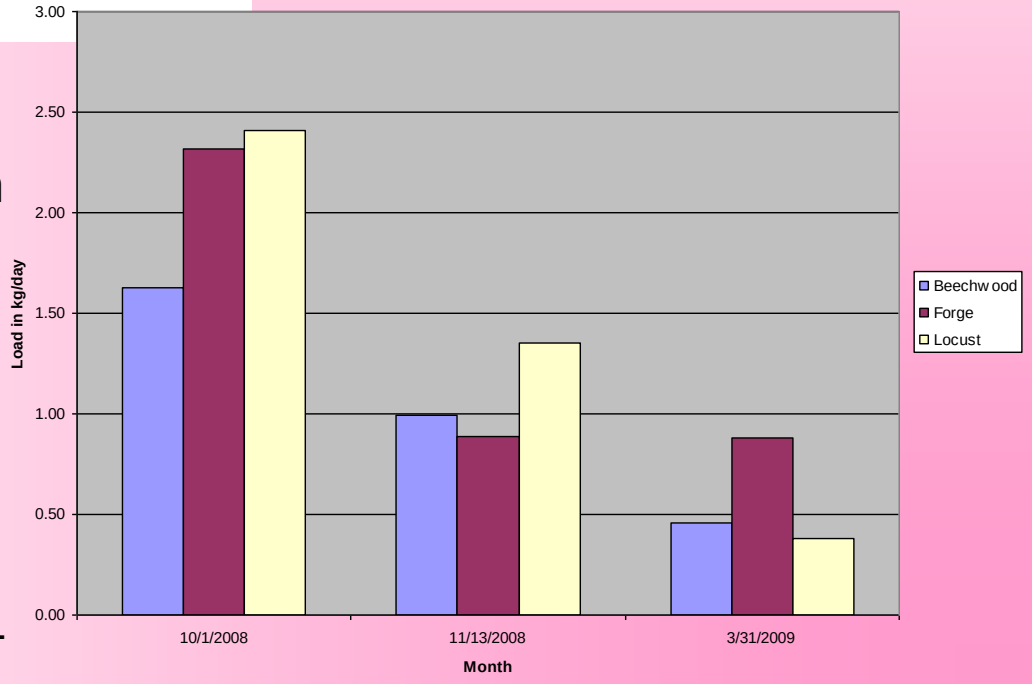
- Locust, originally expected to have the fastest velocity, has the slowest due to a change in the river's width.
- ***Why?***
  - Forge site's wall ends
  - Width of the river increases


Discharge of Assonet River, 2008-2009
Total Discharge (cfs)
100
90
80
70
60
50
40
30
20
10
0
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Months
Beechwood
Forge
Locust



Reactive Phosphorus Load

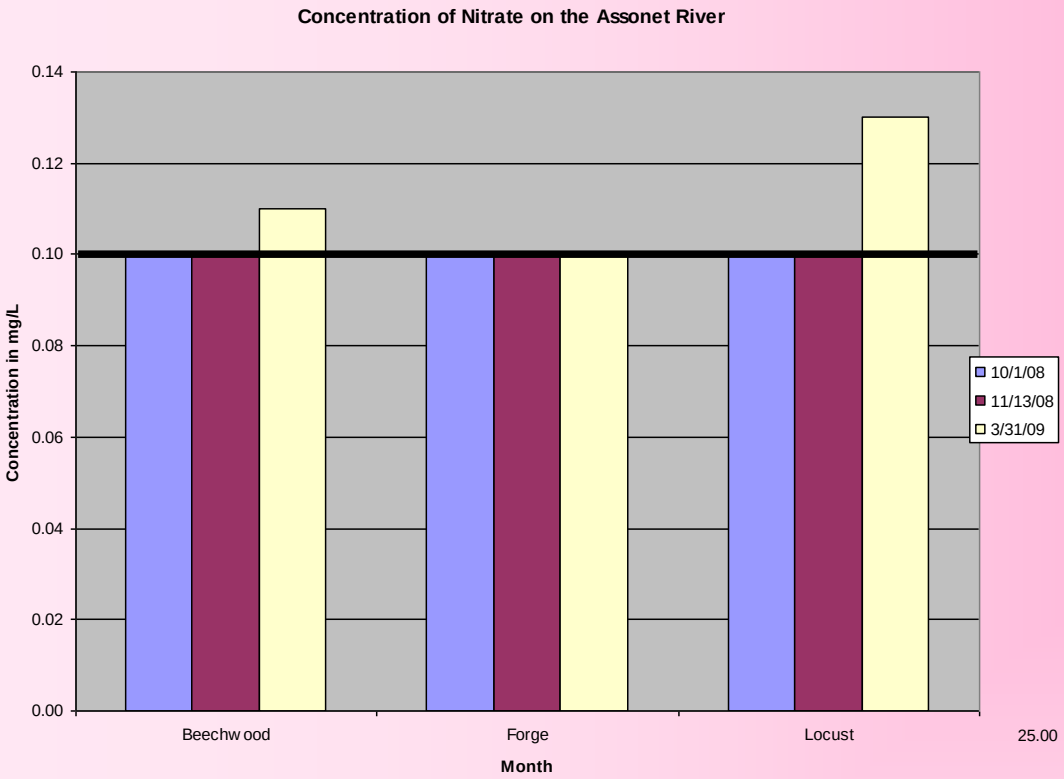
- Loads changed considerably between Oct to March
  - Changes in discharge
  - Weather prior to sampling
  - Forge higher load
    - Larger discharge but similar concentration



Reactive Phosphorus Concentrations

- Concentrations were a lot higher than detected in October due to dilution effect
- Smaller amount of rain in Nov + March
  - Nearly equal at each sample site
  - Concentrations are within the normal range less than 0.05 mg/L

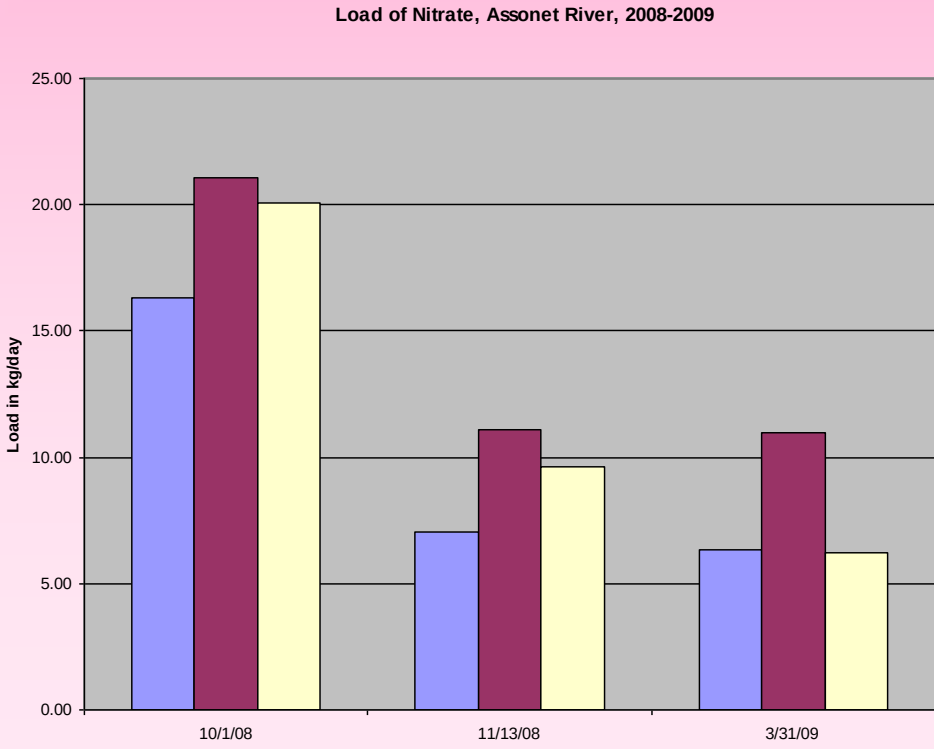
Nitrate Load



- Locust loads were equal between March and Nov. due to similar discharges
- Dilution effect in Oct

Nitrate Concentrations

- All within normal range between 0.1-2.0 mg/L
- Concentrations for October and November were below BDL
- Dilution effect present in Oct



Conclusion

The draining of Forge Pond does not affect the water quality of the Assonet River because…

- The pH of the river is in the acidic range just like the historical data.
- The Dissolved Oxygen is consistent with the physical features of the river.
- The Nitrates and Phosphates are within the low normal ranges.
- Macroinvertebrate are inconclusive because the data does not match historical data for the reasons stated.

The Draining of Forge Pond Does Effect…

- Economics – campground
- Aesthetics – backyards, property values
- Recreation on the river

Asonet Thanks...

Kim McCoy. The Roberts Family. Mrs. McNally. Mr. Lincoln