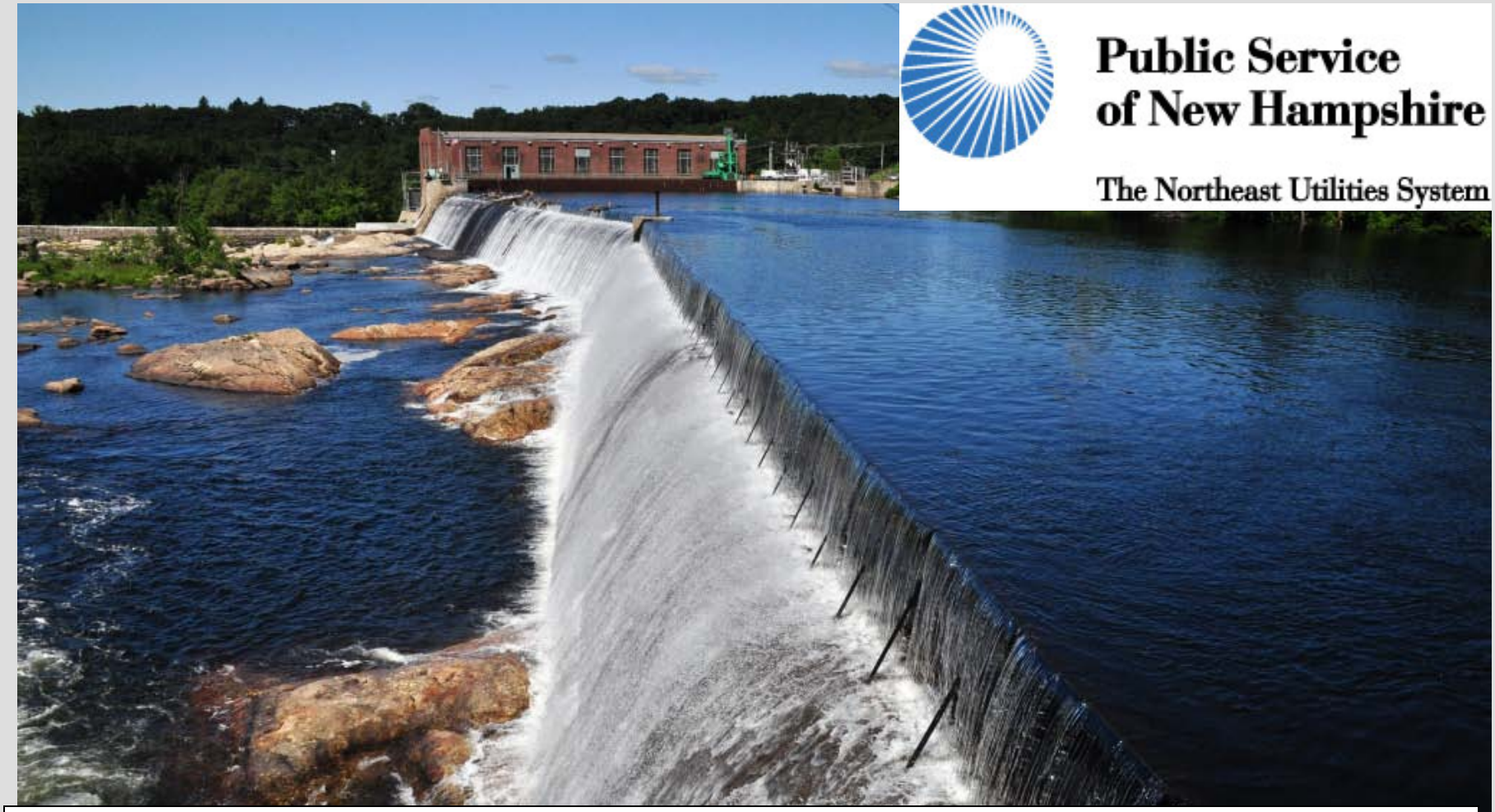


Public Service of New Hampshire

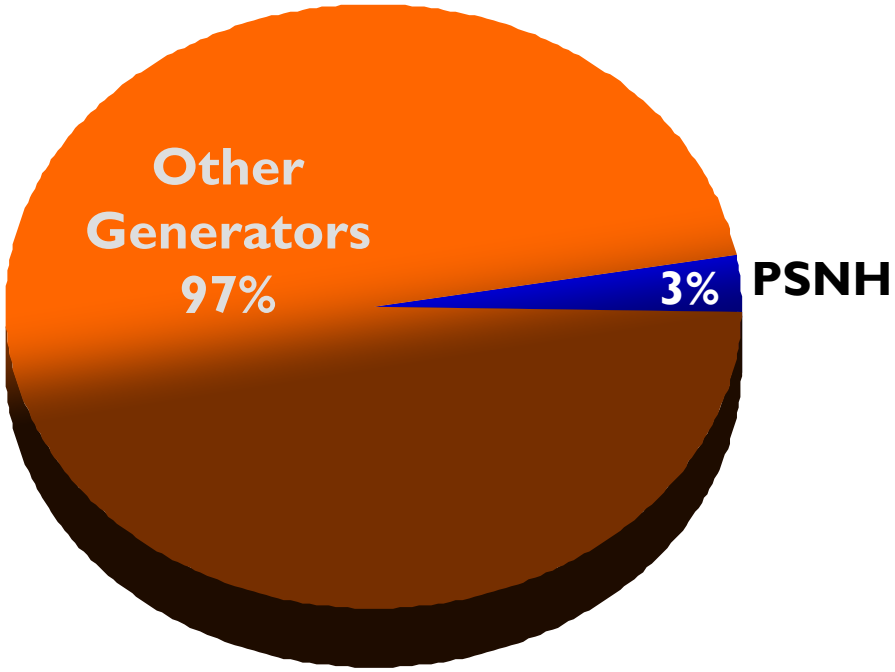
The Northeast Utilities System

Run of River Experience on the Merrimack River in the Manchester, NH area

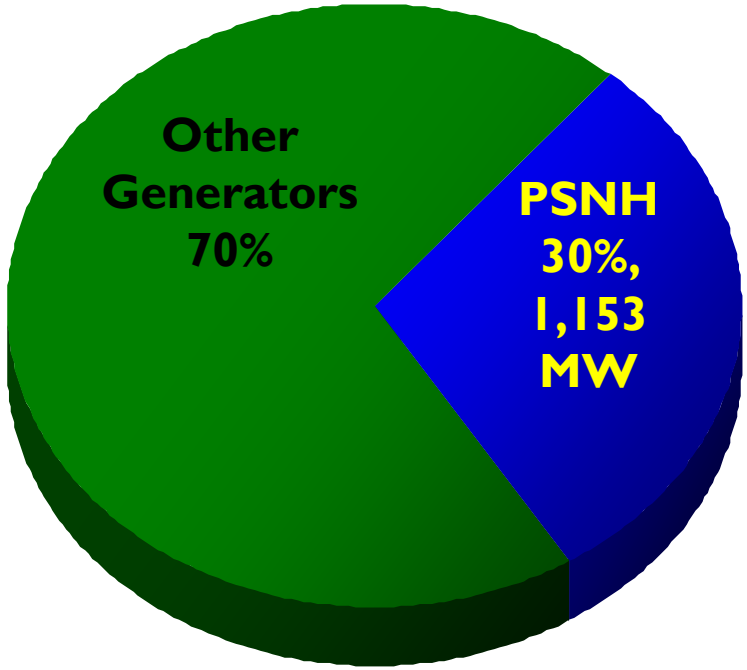
Bob Gundersen, PSNH Hydro Manager

PSNH is a Regulated Public Utility Serving ~490,000 Customers in New Hampshire. Its Generation Capacity Plays a Small but Important Role in the Region.

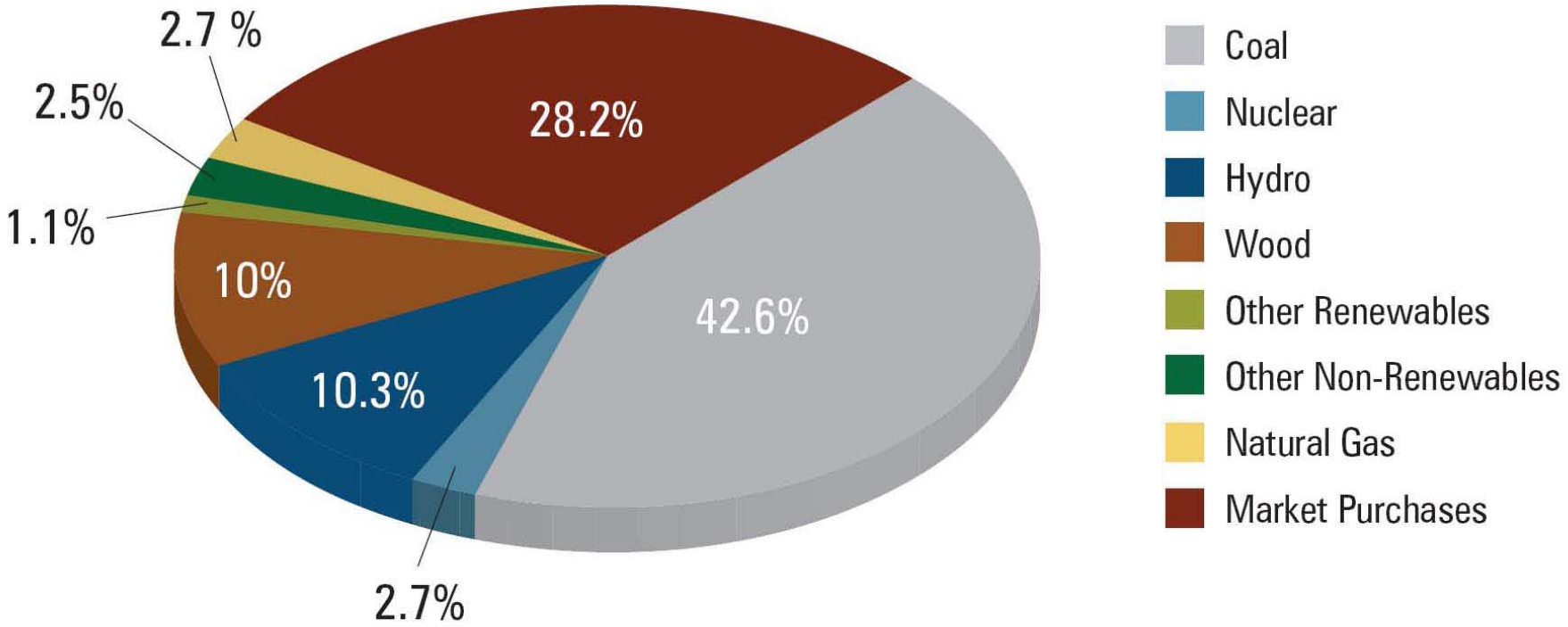
New England Capacity



New Hampshire Capacity



PSNH's Energy Supply Portfolio 2009



- **The Hydro fleet has:**
  - 20 units at 9 sites throughout New Hampshire, 69 megawatts total
  - All are remotely dispatched from Manchester

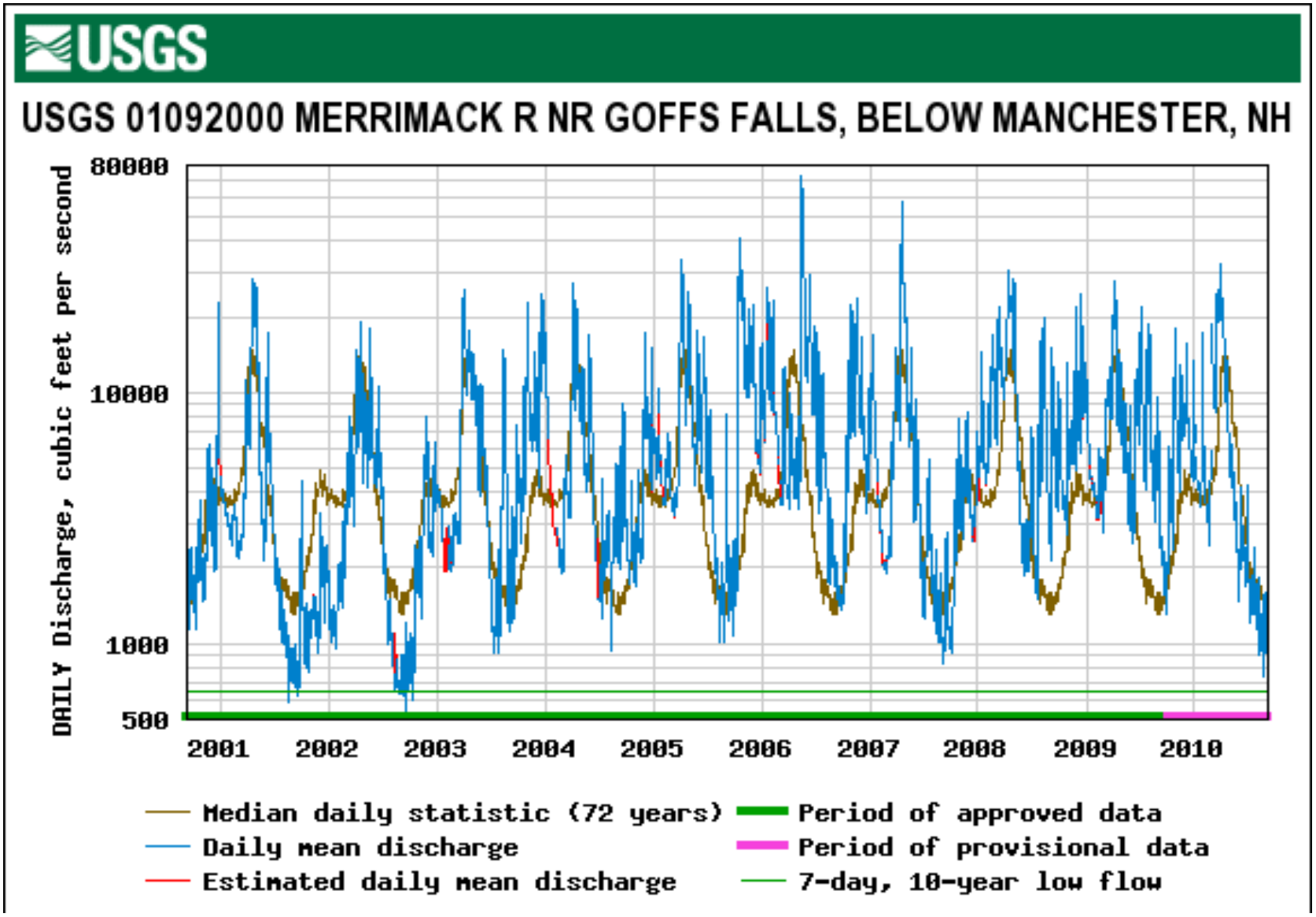
- Under PSNH's new FERC license (May, 2007) and accompanying Run of River Plan PSNH is required to maintain headpond levels within +/- 0.125 feet (1.5 inches) of the top of the flashboards at Amoskeag, Hooksett and Garvins Falls.

GARVINS FALLS – 12.4 MW

Hooksett Hydro – 1.6 MW

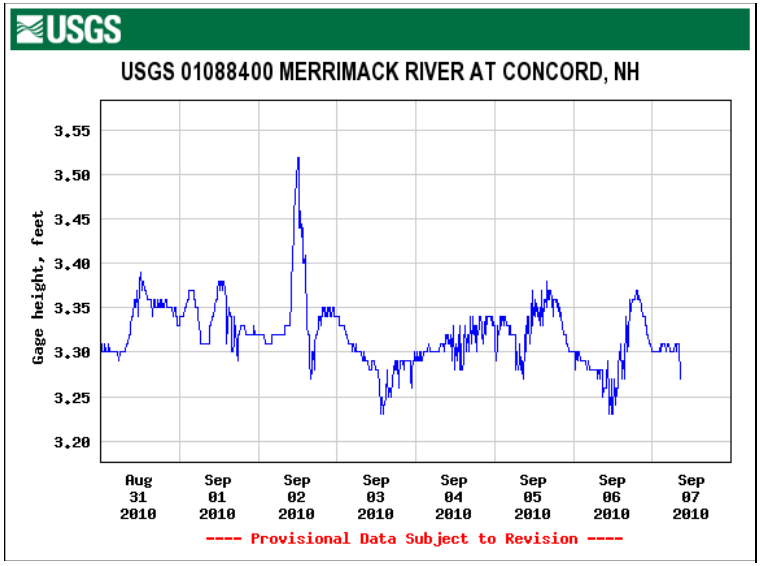
AMOSKEAG – 17.5 MW

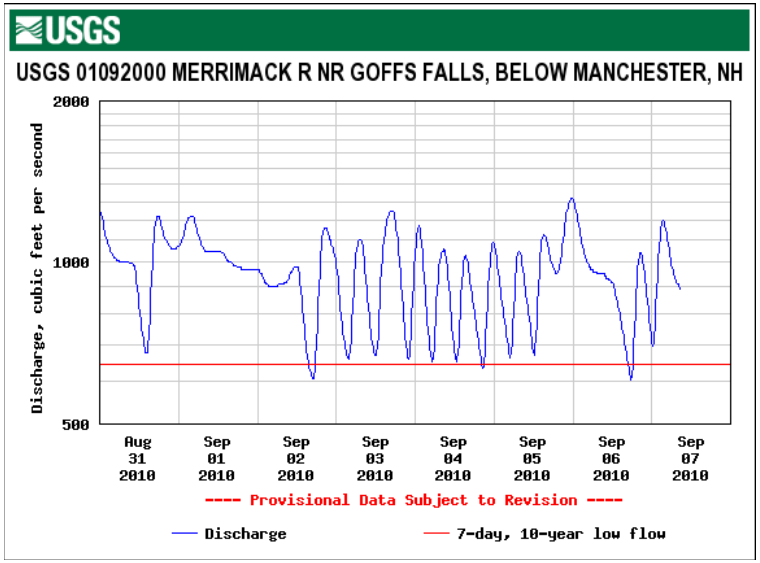
Average flow sinks to ~1100 cfs in the summer, but in 2010 it went below 800



Keeping such tight control on the ponds has proven difficult during low river flows or when automatic pond controls are not operating and adjustments must be made manually. Large downstream fluctuations were experienced.

Despite our great ability to maintain a stable pond level, downstream flow varies greatly when river flows are low.





Site (farthest upriver 1st), Reservoir Volume & Area	Flow (CFS) @ Start-up	Unit Nominal KW Capacity [a]	Station Flow (CFS) @ Nominal Capacity
Garvins Falls **2700 AC-Ft** **640 AC**	G1=800	3,300	5,950
	G2=800	3,300	
	G3=700	2,500	
	G4= 1000	3,300	
Hooksett **1650 AC-Ft** **350 AC**	G1=500	1,600	1,550
Amoskeag **4320 AC-Ft** **480 AC**	G1=700	6,500	4,545
	G2=700	5,500	
	G3=700	5,500	

The 3 reservoirs are small and riverine.

Start-up flow can be a large proportion of river flow.

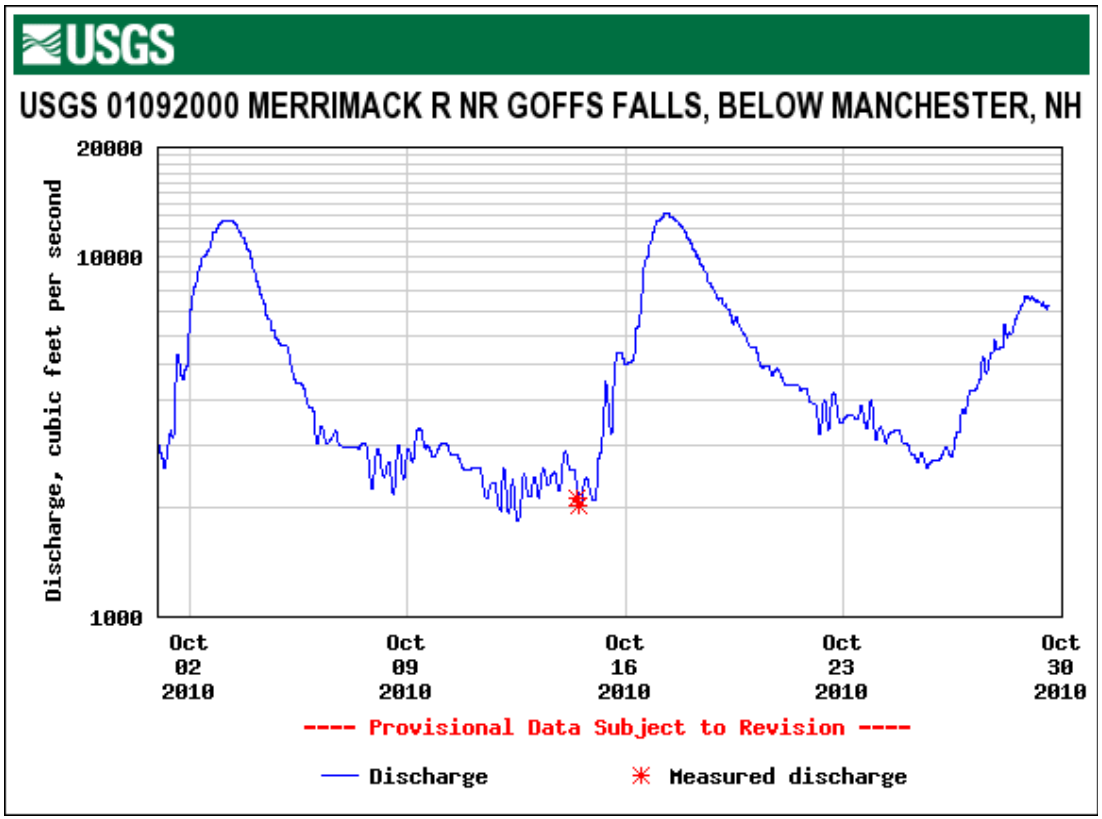
The distances between sites is short.

STATION TO STATION	DISTANCE	TIME @ Normal Flows
Garvins to Hooksett	5 Miles	2 Hours
Hooksett to Amoskeag	7 Miles	3 Hours

Experience Summary

The tight pond level range in this cascading hydro system increases the frequency of fluctuations and aggravates the affects of unit starts, which further influences and perturbs downstream pond levels and river flows.

Late this summer, we met with the USFW, NHFG and NHDES seeking a temporary test period during which allowable pond variation would expand from the +/- 1.5 inch range to +/- 3.0 inches in order to allow smoother transitions. This was approved for a 1 month period and the new temporary ranges were instituted on October 5, 2010.



Various Pond Control PLC parameters were tweaked to take best advantage of the temporarily expanded range when adjusting load or turning units on or off to control pond level.

However, since these changes, river flows have risen dramatically and results are inconclusive. We plan to asked for another testing period after the spring freshet next year.

Questions?

Garvins Falls dam

Garvins’ boards

Hooksett – new boards up

Add’l pictures

- Hooksett notched boards

Shellfish move w/ pond level @ Hooksett

Inflatable Flashboards @ Amoskeag

Amoskeag Min bypass gate

Siphons used @ Amoskeag during deep maintenance drawdowns