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December 12, 2008

Department of Public Works
Town of Durham
100 Stone Quarry Drive
Durham, New Hampshire 03824
Attention: Mr. Dave Cedarholm

**Re: Relative Cost Comparison of Rehabilitation vs. Decommissioning
Based on Preliminary Estimates of Costs
Oyster River (aka Mill Pond) Dam
Durham, New Hampshire**

Ladies and gentlemen:

For your consideration of relative costs in determination of a course of action for Oyster River Dam, Stephens Associates Consulting Engineers, LLC (“SA,” “we,” “our,” or “us”) of Brentwood, NH has estimated costs to rehabilitate, operate and maintain, as well as to decommission, the Dam assuming a 30-year design life, in 2008 dollars. We estimate about \$1.4M to rehabilitate, operate and maintain the Dam and impoundment for the next 30 years, compared to about \$0.7M for decommissioning the Dam. A range of costs, as well as more details and assumptions are presented in this letter and in Table 1 (attached).

In our research of costs, SA interviewed representatives of the New Hampshire Department of Environmental Services who indicated that there is substantial interest in decommissioning from NHDES, New Hampshire Department Fish & Game, United States Fish & Wildlife Service and other government and private, non-profit organizations, and that substantial funding for decommissioning may be available through grants from these organizations. Grants may be available for historic preservation as well, however, at this time we are unaware of potential sources.

Background

The Town of Durham (“Town,” “Owner,” “Client,” “you,” “your,” etc.) has received a Letter of Deficiency (LOD, dated December 10, 2002) from the New Hampshire Department of Environmental Services (NHDES), Water Division, Dams Bureau, to make repairs to Oyster River (a.k.a. Mill Pond) Dam in Durham, NH (“Dam,” “Site,” or “Project”). The Town has retained SA to inspect the Dam, evaluate stability and evaluate options for addressing NHDES’s concerns. Among the options for consideration are rehabilitation, replacement and decommissioning. To assist the Town in its considerations, SA has preliminarily (without the

benefit of detailed design) estimated relative costs for rehabilitation and decommissioning at the request of Messrs. Mike Lynch, Director of the Department of Public Works, Durham, New Hampshire and Dave Cedarholm, PE, Town Engineer under our Agreement dated April 1, 2008. For comparison with decommissioning costs, SA assumed rehabilitation to include construction of repairs as well as Dam operation and maintenance, and impoundment maintenance (dredging) over an assumed design life of 30 years, as described below.

SA did not consider costs of Dam replacement in detail, as discussed later. Further, SA has yet to design either the rehabilitation or decommissioning of the Dam. Our estimate is made for the Town's consideration prior to making a sizable investment in design of either alternative, to save money unnecessarily spent on detailed design of an alternative not selected. The cost estimate for rehabilitation is therefore based largely on *concepts* of repairs (not detailed designs) anticipated from results of our visual dam inspection, and on varied sources of typical costs for those repairs.

The Dam was repaired extensively in the early 1970s, as mentioned below. SA considered that NHDES issued the LOD about 30 years after the repairs, and therefore assumed a 30-year design life for the rehabilitation, if implemented. We therefore estimated costs for operation and maintenance over the 30-year design life. We note additional assumptions throughout this letter and on the attached Table 1 – Cost Estimate, for rehabilitation, operation and maintenance as well as for decommissioning. Costs for decommissioning are largely based on experience on similar dams. The costs are intended for relative comparison of alternatives. Market forces are continually changing, and costs are therefore intended to illustrate relative expense of the alternatives, not absolute costs. Actual costs may also differ depending on the results of further analyses and designs, and decisions made by the Town.

SA cannot anticipate legal challenges to either approach, if any, and has therefore considered neither legal fees nor other costs of such challenges.

Finally, because of the performance of the Dam during recent flooding as well as the LOD and attention to the Dam by the NHDES, Dams Bureau, the option of doing nothing was not considered.

Replacement

SA did not estimate costs to replace the dam. It is important to note, however, that, in our opinion, based on the design life of repairs with respect to the estimated costs of those repairs, if the Town's sole purpose were to preserve the impoundment (i.e., if the historic aspect of the Dam were not a consideration) the Town would likely be best served by demolition and replacement. The New Hampshire Department of Transportation typically assumes a design life of 50 years or more. If this structure were a bridge, it is likely that the Town or NHDOT would determine that the best value for design life is complete replacement. Preservation of the impoundment without the existing historic Dam has not been mentioned to us as the sole, or even operative, concern. SA therefore assumed that the Town is not considering demolition and construction of a new Dam, either in current or different configuration, nor significant design changes that would alter the Dam's historical appearance/configuration,

Rehabilitation

We understand the Town is considering the option of rehabilitating the Dam, to maintain the impoundment and to retain/preserve the existing structure for its historic value.

SA visually inspected the Dam under dewatered conditions in September 2008 and reviewed photographs of flooding taken in May 2006 and April 2007 by the right abutter, Ms. Andrea Bodo, as well as photos taken by SA before and after the floods. In general, the Dam is in poor condition. SA observed significant concrete cracking, spalling, erosion and/or efflorescence, as well as exposed corroded rebar on the downstream face inside the cells, on the ribs between cells, and on the right abutment. We understand that previous repairs to the Dam were performed ca. 1974 in conjunction with construction of the fish ladder at the left abutment. SA observed some deterioration of these previous repairs during our visual inspection. Photos and our discussions with the Town and the right abutter, as well as our own observations of the 2006 and 2007 floods and aftermath, indicated substantial damage to the right downstream training stone masonry walls and embankment occurred in the floods. The right abutter subsequently repaired the damage by extending the height of a stone masonry training wall downstream of the right abutment and filling over the damaged area.

If not removed, the Dam needs repair to prolong its lifespan and address the deficiencies noted by NHDES in their LOD, and by SA during our visual inspection. We conceptualize that repairs to the Dam would likely consist of:

- Removing and replacing deteriorated concrete;
- Sealing the new and existing concrete to reduce seepage and water penetration into and through the concrete that would accelerate further damage;
- Repairing the gates;
- Armoring the right and left abutments to improve the stability of the abutments against erosion when overtopped in the design flood; and
- Reconstructing the right downstream stone masonry wall with appropriate filters to reduce erosion/washout risk.

SA estimated construction costs for these conceptual repairs using data from NHDOT¹, RS Means², professional contacts, and our previous cost estimate prepared for Wiswall Dam. Table 1 summarizes our cost estimates, showing low, average, and high estimates of repairs in 2008 dollars. To properly compare cost to decommissioning, the Town should consider operation and maintenance costs over the design life. We included costs for operation of the NHF&G Fish Ladder at the Dam, but did not include repairs if needed. SA estimated operation and maintenance costs for the Dam and impoundment assuming a 30-year design life based on performance of the previous repairs made ca. 1974. After 30 years, we anticipate the Town would need to perform further repairs of similar or greater magnitude, demolish and reconstruct the Dam, or decommission it.

¹ "NHDOT Weighted Average Unit Prices for Projects in Years: 2008 Qtr 3, 2008 Qtr 2, 2008 Qtr 1, 2007 Qtr 4," published November 6, 2008 (<http://www.nh.gov/dot/business/engineers.htm>).

² "RSMeans Heavy Construction Cost Data, 21st Annual Edition," 2007, RSMeans Kingston, MA.

Dam Decommissioning

Table 1 also shows our cost estimate for Dam decommissioning. SA estimated costs for Dam decommissioning based on our experience and correspondence with NHDES, American Rivers, and others. We estimated order-of magnitude costs for feasibility/preliminary studies, engineering design, permitting, and construction.

NHDES and American Rivers indicated that there is significant interest from state and federal agencies and private organizations for removing Oyster River Dam. They further indicated that significant funding is available for removal of this dam, whereas little funding is likely available for dam rehabilitation. The cost to the Town, therefore, would likely be significantly less than the cost estimated in Table 1.

We trust that this preliminary cost estimate is sufficient to assist in your current considerations. Please contact us with any questions.

Sincerely,
Stephens Associates Consulting Engineers, LLC



James E. Turner
Project Engineer



Robert S. Stephens, PE, PG
Principal Engineer

RSS:tgbg
Attachments: Table 1 – Preliminary Cost Estimate

Original Work:

By: J. Turner Date: 12/11/2008

Checked By: RSS Date: 12/11/2008

Item	Quant.	Unit	Unit Cost (\$)- Low	Unit Cost (\$)- Avg	Unit Cost (\$)- High	Source ¹	Total Cost (\$)- Low	Total Cost (\$)- Avg	Total Cost (\$)- High
REHABILITATION - Construction^{2,3}									
1. Engineering design	1	LS	65,000	75,000	85,000	SA	65,000	75,000	85,000
2. Permitting	1	LS	60,000	70,000	80,000	NHDES	60,000	70,000	80,000
3. Haybales and Silt Fencing	300	LF	9.00	11.88	16.00	NH 645.5	2,700	3,564	4,800
4. Erosion/ Sedimentation Control Plan	1	LS	2,000	3,500	5,000	NH 645.7	2,000	3,500	5,000
5. Sediment Exc. and disposal (uncontaminated)	250	CY	9.75	11.00	20.00	NH 203.1	2,438	2,750	5,000
6. Environmental Testing of sediment	1	LS	5,000	10,000	15,000	allowance	5,000	10,000	15,000
7. Field Office (NHDOT Type C)	1	month	1,000	1,600	2,100	NH 698.1	1,000	1,600	2,100
8. Dewatering	1	LS	6,000	8,000	11,000	RSM & NH	6,000	8,000	11,000
9. Cofferdams	1	LS	15,000	20,000	25,000	Port-a-dam	15,000	20,000	25,000
10. Replace gates, tune up operating mechanisms	1	LS	5,000	7,500	10,000	RSMMeans	5,000	7,500	10,000
11. Concrete Repair Preparations	200	SY	500	670	1,500	NH 512.01	100,000	134,000	300,000
12. Concrete for repairs (in-place) (NHDOT Type AA)	22	CY	830	1,350	2,500	NH 520	18,260	29,700	55,000
13. Concrete Sealer	5,800	SF	8.66	15.00	20.00	536.11- Nixon	50,228	87,000	116,000
14. Construction Management	1	LS	20,000	25,000	30,000	RSMMeans	20,000	25,000	30,000
15. Mob/Demob	1	LS	4,000	5,000	6,000	RSMMeans	4,000	5,000	6,000
16. Stone Revetment	106	SY	35	38	40	NH 585.2	3,710	3,975	4,240
17. Rebuild right D/S training wall with filter	1	LS	20,700	27,600	34,500	J. Wastrom	20,700	27,600	34,500
18. Contingency 25%	1	LS	--	--	--	--	95,259	128,547	197,160
19. Engineering construction observation	1	LS	15,000	17,500	20,000	SA	15,000	17,500	20,000

Subtotal Construction \$492,000 \$661,000 \$1,006,000

REHABILITATION - Operation and Maintenance^{2,3}

Town O&M Costs over 30 years in 2008 dollars

	Annual Cost (\$)	30 year Cost (\$)
20. Town Personnel to operate gates, remove debris, observe and inspect Dam, Test EAP (annual) ⁴	300	9,000
21. Town Engineer management/consultation ⁴	1,200	36,000
22. Insurance (annual) ⁴	1,000	30,000
23. Regulatory (e.g. NHDES) fees (annual)	1,000	30,000
24. Dredging (periodic) ⁴		240,000

Subtotal Town Operation and Maintenance costs for 30 years \$345,000

Subtotal Town Rehabilitation (Construction, Operation and Maintenance) costs for 30 years \$1,006,000

Other O&M Costs over 30 years in 2008 dollars

25. NHF&G personnel to operate fish ladder (annual) ⁵	11,000	330,000
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TOTAL REHABILITATION (Construction, Operation and Maintenance) Low Average High \$1,182,000 \$1,336,000 \$1,696,000

DECOMMISSIONING^{2,6}

1. Preliminary Studies (feasibility, historical, cultural, environmental, etc.)	80,000 to 100,000
2. Engineering Design	80,000 to 100,000
3. Permitting	100,000 to 100,000
4. Sediment Sampling, Testing, and Reporting	5,000 to 10,000
5. Construction	200,000 to 300,000
6. Engineering Observation during Construction	15,000 to 20,000
7. Contingency, 25%	120,000 to 157,500

TOTAL DECOMMISSIONING \$600,000 to \$788,000

NHDES projects readily-available funding by outside grants to defray much of decommissioning costs

NOTES:

¹ Sources: "NHDOT Weighted Average Unit Prices for Projects in Years: 2008 Qtr 3, 2008 Qtr 2, 2008 Qtr 1, 2007 Qtr 4," published November 6, 2008 (<http://www.nh.gov/dot/business/engineers.htm>). NHDOT data includes a high bid, low bid, and average bid. NHDOT standard number is listed in source column.

"RSMMeans Heavy Construction Cost Data, 21st Annual Edition," 2007, RSMMeans Kingston, MA. RSMMeans unit costs listed here include adjustment for the city cost index for Portsmouth New Hampshire of 90.1% of RSMMeans base costs.

SA estimated costs for cofferdams and dry stone masonry walls based on costs we estimated for our work on Wiswall Dam by contacting Port-a-Dam, Inc. and Mr. J. Wastrom. SA estimated costs for concrete sealer by NH DOT 536.11 and professional contact with R. Nixon.

² This estimate is preliminary and presents order of magnitude level costs in 2008 dollars based on concepts of potential repairs and decommissioning. No designs have been prepared. These cost comparisons are intended for qualitative comparison of alternatives. Market forces are continually changing, and costs are therefore intended to illustrate relative expense of the alternatives, not absolute costs. Subtotals and totals in Table are rounded up to nearest \$1,000. These costs should be considered in conjunction with the text in SA's letter to the Town of Durham.

³ Rehabilitation costs consist of construction of current repairs and operations and maintenance over an assumed 30-year design life (based on lifespan of previous repairs). Rehabilitation is to maintain the Dam in the current configuration.

⁴ Cost provided by Town of Durham

⁵ Cost provided by NH Fish & Game, owner of fish ladder. Costs currently borne by NHDF&G

⁶ SA estimated costs for decommissioning through contact with NHDES Dam Bureau and River Restoration Program and through American Rivers