146 cys
3/2/81

No Stock

MASTER

DOE/RA/23210-TJ

Small-Scale Hydroelectric Power Demonstration Project

Brown-New Hampshire, Inc.
Sawmill Hydrostation Redevelopment

First Annual Report

Department of Energy, Idaho Operations Office

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Printed in the United States of America

Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
NTIS Price Codes: Printed Copy A05
Microfiche A01

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DOE/RA/23210
UC-97e

BROWN-NEW HAMPSHIRE, INC.
SAWMILL HYDROSTATION REDEVELOPMENT
FIRST ANNUAL REPORT

by

BROWN COMPANY
ENGINEERING DEPARTMENT
BERLIN, NEW HAMPSHIRE

November 1980

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Prepared for the
U.S. Department of Energy
Under Contract DE-FC07-79RA23210

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

FIRST ANNUAL REPORT

TABLE OF CONTENTS

1. Introduction
2. Compliance with P.O.N. Application Statements
3. Compliance with D.O.E. Agreement
4. Compliance with Project Management Plan
5. Progress for First Year
 - A. Licensing & Permits
 - B. Environmental Concerns
 - C. Engineering & Design
 - D. Safety
 - E. Material & Equipment Procurement
 - F. Construction
 - G. Publicity
 - H. Photographs
6. Management
7. Legal
8. Costs
9. Project Return On Investment Update
10. Summary
11. Appendix
 - A. Specification E1.3 - 1978
 - B. Comparison of Proposals
 - C. Army Permit
 - D. Department of the Interior Letter
 - E. Letter to Corps of Engineers

BROWN-NEW HAMPSHIRE, INC.
SAWMILL HYDROSTATION REDEVELOPMENT
FIRST ANNUAL REPORT

1. INTRODUCTION

This First Annual Report, written primarily as a requirement of a Cooperative Agreement between Brown-New Hampshire and the United States Department of Energy, will have as its objective the discussion of all facets of project planning and how accurate these plans have been to date.

One of the major objectives of the Department of Energy is to determine how accurately a low-head hydroelectric project can be analyzed for feasibility, so the author of this report will therefore try to self-analyze his Company's own venture in planning and constructing a hydroelectric plant of the low-head classification.

It must be understood by all reading the following report that the project site was at one time a fully operational hydroelectric generating facility (direct-current power), and the water storage of and the waterflow in the Androscoggin River is and has been operated with strict water conservation procedures since the late 1800's. These two (2) situations have given Brown-New Hampshire an excellent data bank for determining what the site under development is capable of producing for electricity. This report cannot compare actual production to planned production however, because the project will not be operational until early January of 1981.

2. COMPLIANCE WITH P.O.N. APPLICATION STATEMENTS

Brown-New Hampshire's proposal to develop a low-head hydroelectric demonstration project under the guidelines of Program Opportunity Notice ET-78-N-07-1711 was made using ideas and cost figures available in the fall of 1978. The ideas and design concepts that were ultimately incorporated in the project have been modified somewhat, with the net result that there are fewer but larger generators. Cost increases have been minimal with annual generation expected to be more than proposed in 1978.

The early concept to rehabilitate this site called for the installation of a generator and turbine in each of the five (5) flumes within the powerhouse. The preliminary design, using the new pre-engineered Allis-Chalmers tube-turbine, allowed for a maximum turbine size of 1750 mm that could be installed in the twelve-foot (12') wide flumes. Under this concept, the five (5) turbines could utilize a maximum of 2340 cfs

2. COMPLIANCE WITH P.O.N. APPLICATION STATEMENTS (Continued)

river flow and could develop 2800 kilowatts. As a matter of economics, Allis-Chalmers studied the size of the existing water pits and the design of their tube turbines, finally deciding that 2,000 mm units could fit in the pits. Consequently, they ended up proposing four (4) 2,000 mm units that could utilize 2502 cfs river flow and could develop 3,174 kilowatts.

In our determination of return on investment in the P.O.N. Application, Brown-New Hampshire did not (for Corporate Policy reasons) include such annual costs as insurance, City taxes, and assessments. An updated return on investment calculation, compared with the 1978 calculation in our P.O.N. Application, is shown below.

	1978 <u>Estimate</u>	1980 <u>Estimate</u>
Installed Capacity	2800 KW	3174 KW
Estimated Project Cost	\$ 4,150,000	\$ 4,600,000
Annual Energy Production	20,358,000 KWH	23,300,000 KWH
Purchased Power Value	34.80 Mil/KWH	48.50 Mil/KWH
Deferred Purchases Value	\$ 708,458	\$ 1,130,050
Maintenance Costs	\$ 60,000	\$ 43,300
Annual Depreciation	\$ 103,750	\$ 115,000
Fixed Annual Costs (Taxes, Etc.)	-	\$ 122,000
Net Annual Income	\$ 544,708	\$ 849,700
Return On Investment	13.1%	18.5%
Production Cost	8.0 Mil/KWH	12.03 Mil/KWH

The capital investment cost for installed generation as proposed in 1978 was \$1,482.00 per kilowatt. For the actual design, this cost will be about \$1,449.00 per kilowatt.

Actual cost per kilowatt-hour for electricity produced is expected to be about 12.03 mils (including fixed cost with 40-year amortization), where the cost was stated as 8.0 mils in the P.O.N. Application.

The P.O.N. Application stated that all designs and estimates were based on using Allis-Chalmers tube-turbines but we would seek competitive bids from several suppliers before proceeding with the project. Bids were solicited from four (4) prospective suppliers for a turn-key proposal. Each was sent a copy of Brown Company Specifications El.3 - 1978 (see AppendixA) and drawings of the facility as it then existed in order to have each work on a common basis with equal guidelines. A prebid meeting and tour of the facilities was held with each, and each made a presentation

2. COMPLIANCE WITH P.O.N. APPLICATION STATEMENTS (Continued)

of his proposal to us in our offices. A preliminary choice of two (2) proposals was made for further study, discussion, and fine-tuning of details. Allis-Chalmers and General Electric had basic proposals of good generation potential and low costs, while Madden Corporation (proposing Tampella and Stromberg equipment) and Morrison-Knudsen (proposing Allis-Chalmers equipment) had similar proposals costing at least \$1,000,000 (25%) more. The final choice of tube-turbines by Allis-Chalmers over vertical turbines by General Electric was made after a lengthy comparison of proposals. This comparison is provided in Appendix B of this report.

3. COMPLIANCE WITH D.O.E. AGREEMENT

Brown-New Hampshire entered into Agreement No. DE-FC07-79RA23210 on June 26, 1979, and has since that time done a fairly good job of meeting the requirements contained therein. The low number of qualified personnel employed by Brown-New Hampshire that are working on the reporting requirements of the Agreement has caused delays in developing such items as the Project Management Plan and this First Annual Report.

Although we managed to eventually comply with such Agreement Articles as XXV - Patent Rights, XXVI - Rights in Technical Data, and Attachment B - Procurement Standards, they caused a considerable amount of trouble and delay in developing a turn-key contract with Allis-Chalmers.

Besides the steadfast attitude of their lawyers, we have found our working relationship with the Department of Energy's personnel to be excellent.

Brown-New Hampshire expects to comply fully with all aspects of this Agreement by the July 1, 1983 termination date.

4. COMPLIANCE WITH THE PROJECT MANAGEMENT PLAN

The Project Management Plan for this project, which was issued by Brown-New Hampshire in November of 1979, contains design and cost figures that are still quite accurate. We will not be exceeding our cost estimates.

The schedule of objectives as appears on page 8 of the Project Management Plan cannot be met. The Allis-Chalmers strike prevented us from meeting the turbine start-up dates of September 5 and October 3. The November 7 start-up date for the third turbine may not see the first on line.

4. COMPLIANCE WITH THE PROJECT MANAGEMENT PLAN (Continued)

The first year of work on the project has produced the following partial results in meeting the seven (7) objectives of this demonstration project.

- a. "Demonstrate that the commercially available technology is economically viable in a commercial-sized plant for low-head hydroelectric power generation" - The term economically viable has different meanings for the industries. A company with high cash flows can make an investment with a 15.0% return on investment, and a company with a low cash flow would be more interested in 50% to 100% return on investment. Although Brown-New Hampshire's parent company, Brown Company, is a low-cash flow industry primarily interested in the 50% to 100% return on investment projects, I think they will agree at the end of the demonstration period (1983) that this project was worth more than they had originally anticipated.
- b. "Obtain realistic cost data from which commercial production costs can be predicted with a high degree of confidence" - This project has not yet been started up.
- c. "Address specific marketing environmental, legal, and institutional concerns" - There have been no specific problems yet that can be called concerns.
- d. "Identify opportunities for direct participation of the private and public sectors in development and demonstration of low-head hydroelectric energy" - Several small tours and a one-hour talk with slides have been offered to the public regarding this project. The number of people responding has been surprisingly low, but then interest is usually higher when there is a finished product to show. We should see more interest when the project is operational. A large quantity of the supportive equipment, such as, inlet gates, trash rake, trash racks, ventilating systems, and railings have been made locally with excellent results.
- e. "Demonstrate that low-head hydroelectric resource utilization is compatible with other uses of water" - This project will be operated on a fully-regulated river that presently has seven (7) hydro sites within ten (10) miles downstream, and on which there will eventually be two (2) more upstream. Construction has been designated to minimize turbidity and to forego the necessity of changing normal river flows or levels. We have not generated any complaints or problems to date.

4. COMPLIANCE WITH THE PROJECT MANAGEMENT PLAN (Continued)

- f. "Provide data on dam safety and structural integrity" - An examination of the dam was not performed as it has been rebuilt, studied, repaired, and inspected routinely over the years. The powerhouse, having a granite block foundation set on firm ledge and having withstood a 100-year flood level in 1936, was not revised or rebuilt. The new intake structure (rackhouse) was designed to withstand this same type of flood on a stand-alone basis. A detailed discussion of structural integrity will be presented in the final report of 1983.
- g. "Disseminate initial economic and financial data regarding the cost of operating and maintaining low-head hydroelectric power facilities" - Economic and financial data presentations have been appearing in all monthly reports, will appear in this and subsequent annual reports, and will be covered thoroughly in the final report in 1983.

5. PROGRESS FOR THE FIRST YEAR

The progress of various elements of the project for the period of July 1, 1979 through July 1, 1980 are discussed below by subject, including licensing and permits, environmental concerns, engineering and design, safety, material and equipment procurements, construction, publicity, and photographs.

A. Licensing and Permits

The licensing and permit phase of this project was rather easy as hydroelectric projects are concerned. The project was already licensed by Brown-New Hampshire, Inc. as a generating facility, even though the old D.C. generators had last been used in 1961. The F.E.R.C. licensing procedure involved the submission of a Request for Amendment to license with an environmental impact statement that professed "no impact". The Application of Amendment was filed in Washington on June 22, 1979 and approved on July 18, 1979.

We planned to utilize existing structures on the project so permits from the Army Corps of Engineers were needed only for temporary cofferdams, dredging the bottom of the dewatered forebay, and disposing of the dredgings. An initial Section 404 Permit for cofferdams and dredging was applied for on June 7, 1979 and was issued on July 25, 1979. A second Section 404 Permit for disposing of dredgings in an adjacent log pond was applied for on September 26, 1979 and was issued on March 28, 1980.

A. Licensing and Permits (Continued)

State and local permits were required from the City of Berlin and the New Hampshire Special Board. A Building Permit was applied for with the City of Berlin on June 22, 1979 and was issued on June 27, 1979. On June 6, 1979, an Application was filed with the Special Board of the State of New Hampshire for dredging and filling work in the Androscoggin River with the Permit issued by the Board on June 12, 1979.

As can be seen by the relatively short approval periods, favorable government decisions and an already-licensed hydroelectric project were extremely beneficial to the starting date of construction.

B. Environmental Concerns

Environmental concerns regarding this project were limited to water turbidity during placement and removal of cofferdams, the disturbance of possible historical artifacts during cleaning of the forebay, and the destruction of a portion of aqueous habitat in the river as forebay dredgings were deposited in the adjacent log pond.

River turbidity caused no problems since there were no industrial or municipal water intakes or recreational areas on the river for many miles downstream from the project.

The New Hampshire State Historic Preservation Officer determined that "the proposed project will not have an effect on known architectural, historical, archaeological or other cultural resources if the cofferdam work is performed with care to avoid excessive disturbance on the stream banks."

The September 26, 1979 Application to the Army Corps of Engineers for a Section 404 Permit to permanently fill the log pond with forebay dredgings generated the only real objection to our procedures on this project. The Concord, New Hampshire office for the United States Department of the Interior - Fish and Wildlife Service - Ecological Services requested that the extent of our proposed fill "be limited to that necessary for stabilizing the existing bulkhead" with the remainder to be disposed of in an upland area away from the river. Our response to this request apparently satisfied any objections, as the Permit was issued per our original request. Appendices C, D, and E are copies of our Permit Application, the Ecological Services letter of comment, and our letter of response regarding this transaction.

C. Engineering & Design

The goal of this redevelopment was to install enough generating capacity at the site for run-of-river operation while using as much of the old powerhouse as could be safely utilized. Allis-Chalmers provided the information available from their standard tube-turbine line, and the engineering firm of Kleinschmidt & Dutting assumed the burden of the complete architectural and structural evaluation and design for the installation. The old rackhouse and inlet structure were discarded as totally inadequate. The main powerhouse proved to be quite sound with only the roof deck and some exterior brick actually in need of replacement. The granite block foundation, sitting firmly on river bed ledge, lent itself quite well to the adaptation of tube-turbines. The major portion of new architectural work was then the design and construction of a new rackhouse and intake gate structure. A very minimum amount of ledge excavation was required - some for the new rackhouse and some for the draft tubes. All facets of this work appear to have been handled in a very precise and professional manner with optimum use of existing works and a minimum of construction cost nicely balanced.

The use of this engineering firm appears to be perfect for small hydroelectric projects.

D. Safety

Construction safety is always a touchy subject with contractors. Any safety-related work is viewed by the field-level foremen as an extra cost that can be avoided by alert employees. Brown-New Hampshire employees spent a good portion of time at the start of construction in 1979 trying to get hard hats, eye protection, ear protection, life jackets, safe ladders, safety lines, cleated scaffolding boards, railings, fire extinguishers, and proper gas bottle storage a daily routine. Once in force, the procedures have been followed quite well. Weekly appraisals have been and still are necessary.

The New York office of the Federal Energy Regulatory Commission has made monthly safety inspections of the construction in order to appraise the structural integrity of the cofferdams and structural designs. They have not, to our knowledge, discovered any problems.

An O.S.H.A. team inspected the project on October 28, 1980 with very few resultant infractions. An unguarded hand grinder, improper electrical outlet boxes on extension cords, absence of G.F.I. breakers for leader cords, and a reverse-polarity extension cord were the only comments by the team.

There have been no serious accidents to date on the project.

E. Material & Equipment Procurement

The only major purchase on the part of Brown-New Hampshire was for a turn-key redevelopment by Allis-Chalmers. This order for engineering, equipment, and construction has been very satisfactory. Quality has been excellent on all facets, and comments for improvements by us have been incorporated in general at no additional cost. The firm price, which was part of the package, has allowed us to see the project through to completion with a generous portion of available funds still uncommitted.

Some of the equipment provided by Allis-Chalmers has been manufactured locally, a procedure that helps boost area involvement. The major items provided locally include the trash racks (Berlin, the trash rake (Berlin), the intake gates and structural steel (from a Maine firm, and heating and ventilating (from a Maine firm). The speed increasers are Philadelphia, the generators are Beloit Power Systems, the governors are Woodward, the switchgear and control panels are by Powercon, metering and relays are General Electric, excitation and synchronizing controls are Basler, generator circuit breakers (in Powercon Gear) are Siemens-Allis, and water level control is Trola.

F. Construction

Construction of the project has been the responsibility of Cianbro of Pittsfield, Maine. They have proved to be excellent with unlimited equipment of excellent quality and with highly-skilled (non-union) tradesmen. Subcontracted work has included:

Painters - From Berlin, New Hampshire

Electricians - From the local area employed by E. S. Boulos of Portland, Maine

Masons - From Berlin, New Hampshire

Roofers - From St. Johnsbury, Vermont

Most of Cianbro's carpenters, welders, machinists, and laborers have been from Coos County. The project has essentially been built with local tradesmen.

G. Publicity

Publicity has not been as active during the engineering and construction phase as Brown-New Hampshire had planned on. Lack of available personnel and a decided public disinterest during construction have been the causes. It is felt that the general public is much more inclined to view and ask questions about the "finished product".

Publicity activities during the past year of construction have been:

1. Monthly progress photos and numerous daily construction photos.
2. Providing photo prints to E. G. & G. - Idaho, and the Department of Energy's Information Office in Washington, D. C.
3. An eight by twelve (8 x 12) foot pictorial project information sign at the main entrance in full public view.
4. Information presentations at two (2) consecutive annual energy fairs at the New Hampshire Vocational Technical College in Berlin.
5. A slide show and tour of the project for about twenty-five (25) Coos County residents interested in alternate forms of energy.
6. Project data to several individuals throughout the United States who were interested in details of the project.
7. A tour of the project by members of the New England Construction Users' Council.
8. A tour by industrial electrical students of the New Hampshire Vocations Technical College in Berlin.

H. Photographs

Some of the more than 450 color photographs depicting progress are presented on the following pages. The fourteen (14) shown are:

- Photograph No. 1 - Of the old rackhouse area taken prior to dewatering.
- Photograph No. 2 - Of the tailrace area taken prior to dewatering.
- Photograph No. 3 - Of the powerhouse interior taken prior to cleaning and start of construction.
- Photograph No. 4 - Of the forebay area immediately after dewatering. Note the old wooden trash racks and debris.

H. Photographs (Continued)

- Photograph No. 5 - Of the old rackhouse during demolition. Some of the wooden support beams, steel trash racks, and gate stems are visible.
- Photograph No. 6 - Of removal of rackhouse foundation granite. The granite blocks were very hard. Note the old granite walled water pits.
- Photograph No. 7 - Of removal of rackhouse foundation granite that approaches completion.
- Photograph No. 8 - Shows bedrock ready to receive a foundation for the new rackhouse.
- Photograph No. 9 - Of foundation form work for the new rackhouse. The four (4) turbine inlet rings are shown in the foreground.
- Photograph No. 10 - Is a winter view of the completed rackhouse taken across a dewatered and cleaned forebay.
- Photograph No. 11 - Shows the dirt-filled timber-cribbing used in the tailrace for a cofferdam and for a crane-support platform.
- Photograph No. 12 - Showed the dewatered tailrace with most of the required ledge removal complete. The close proximity of the cofferdam allowed a crane to reach most areas of the project.
- Photograph No. 13 - Of a turbine tube being lowered into the powerhouse through a temporary roof hatch. The new bridge crane was used to place all tubes.
- Photograph No. 14 - Of a tube in its final position. Note the tight fit of the tube edges and the old granite pit walls. The tubes were imbedded in concrete after alignment.

PHOTOGRAPH NO. 1 - OLD RACKHOUSE

PHOTOGRAPH NO. 2 - OLD TAILRACE

PHOTOGRAPH NO. 3 - POWERHOUSE INTERIOR

PHOTOGRAPH NO. 4 - OLD FOREBAY DEWATERED

PHOTOGRAPH NO. 5 - RACKHOUSE DEMOLITION

PHOTOGRAPH NO. 6 - RACKHOUSE DEMOLITION

PHOTOGRAPH NO. 7 - RACKHOUSE DEMOLITION

PHOTOGRAPH NO. 8 - READY FOR NEW FOUNDATION

PHOTOGRAPH NO. 9 - NEW RACKHOUSE FOUNDATIONS

PHOTOGRAPH NO. 10 - NEW RACKHOUSE COMPLETE

PHOTOGRAPH NO. 11 - TAILRACE COFFERDAM CRIBBING

PHOTOGRAPH NO. 12 - TAILRACE DEWATERED

PHOTOGRAPH NO. 13 - A TUBE ENTERS POWERHOUSE

PHOTOGRAPH NO. 14 - A TUBE IN POSITION

6. MANAGEMENT

Management of the project has been carried out in accordance with the organizational chart presented in the Project Management Plan. This chart is included on the following page for convenient reference. This organization has worked well for this project.

Demonstration responsibilities as presented in Section "D" of the Project Management Plan have proved adequate for effective control of the project administration. No criticism of the assignments to Brown Company, Brown-New Hampshire, the Department of Energy, E. G. & G. - Idaho, Kleinschmidt & Dutting, Allis-Chalmers or Cianbro have been made by anyone.

It is interesting to note that this turn-key project has generated some interesting lessons for Allis-Chalmers and Kleinschmidt & Dutting. For Allis-Chalmers, the internal organization necessary to ultimately ship a standard tube-turbine in less than a year has not yet overcome unique obstacles. They are used to shipping large and custom-built units on a two or three (2 or 3) year schedule. Kleinschmidt & Dutting did not have a good idea of the number of man-hours required to engineer the project and, consequently, spent considerable more man-hours than planned.

DEMONSTRATION PROJECT MANAGEMENT ORGANIZATION

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

7. LEGAL

There have been no legal proceedings necessary on this project.

8. COSTS

The projected cost of this demonstration project was defined in the Project Management Plan, Tables II and III, as \$4,829,000.00. Brown-New Hampshire's best present estimates of final cost indicate a final figure of about \$4,600,000.00. The \$229,000.00 underrun is attributable to the use of a 15% contingency on all project cost estimates that has not proved fully necessary. The project was basically a turn-key redevelopment with "refinements" added as the work progressed. These refinements, added to the Contract as the availability of contingency funds became obvious, included such items as:

- A. Bricking the exterior of the rackhouse block wall.
- B. Replacement of the outer course of damaged brick on the powerhouse west wall.
- C. Sealing up the adjacent garage wall.
- D. Fixing up the powerhouse west foundation wall with a new concrete facing.
- E. Sealing up the opening in the foundation at the southeast end of the tailrace wall.
- F. Placing a new concrete cap and safety railing on the west retaining wall of the tailrace.
- G. Adding a relay-protected, battery-operated, oil circuit breaker to the primary of the outdoor power transformer.

The Table II costs in the Project Management Plan are presented below with the added column, which represents our present estimate of final costs.

8. COSTS (Continued)Project Management Plan Table II

	<u>PMP Costs</u>	<u>Estimated Actual Costs</u>
Engineering, Design & Administration	\$ 400,000	\$ 350,000
Mechanical & Electrical Equipment	2,500,000	2,600,000
Construction	1,859,000	1,600,000
Environmental Improvements	20,000	0
Spare Parts	<u>50,000</u>	<u>50,000</u>
Total	\$4,829,000	\$ 4,600,000

The Table III costs in the Project Management Plan are presented below with an added column that represents our present estimate of final costs.

Project Management Plan Table III

<u>FERC Account</u>	<u>Item</u>	<u>PMP Costs</u>	<u>Estimated Actual Costs</u>
	Hydroelectric Plant Accounts:		
330	Land & Land Rights	0	0
331	Structures & Improvements	\$ 1,349,000	\$ 1,200,000
332	Reservoirs, Dams, & Waterways	300,000	314,000
333	Water Wheels, Turbines, & Generators	2,000,000	1,850,000
334	Accessory Electrical Equipment	500,000	500,000
335	Miscellaneous Power Plant Equipment	200,000	311,000
336	Roads, Railroads, & Bridges	<u>20,000</u>	<u>5,000</u>
Subtotal - Direct Cost Plant		\$ 4,369,000	\$ 4,180,000

8. COSTS (Continued)

<u>FERC Account</u>	<u>Item</u>	<u>PMP Costs</u>	<u>Estimated Actual Costs</u>
	Transmission Plant Accounts:		
350	Land for Rights of Way	0	0
352	Structures & Improvements	\$ 10,000	\$ 0
353	Station Equipment	<u>50,000</u>	<u>70,000</u>
Subtotal - Direct Cost Transmission		\$ <u>60,000</u>	\$ <u>70,000</u>
Subtotal - All Direct Costs		\$ 4,429,000	\$ 4,250,000
Overhead Costs (Engineering & Administration)		<u>400,000</u>	<u>350,000</u>
TOTAL CONSTRUCTION COST		\$ 4,829,000	\$ 4,600,000

On the following page is a curve of Plan Versus Actual Costs, which has been appearing in the Monthly Progress Reports. The solid curve, representing Plan Costs, was derived from the Estimated Cash Flow Schedule in the Project Management Plan - Table V. The broken line curve represents Actual Costs as incurred during construction. The relatively wide deviation after June of 1980 has been due primarily to the two-month labor strike at the York Plant of Allis-Chalmers.

All indications are that this demonstration project has not been nor will it be in financial trouble.

9. PROJECT RETURN ON INVESTMENT UPDATE

The operating costs and equivalent energy costs were presented briefly in Part 2 of this report. Our present estimated project cost and operating cost yield an Return on Investment of 18.5% and an energy cost of 12.03 mils/KWH.

Table IV of the Project Management Plan, Estimated Equivalent Annual Cost is presented below with our current estimated figures for a comparison.

<u>Annual Cost:</u>	<u>PMP Estimate</u>	<u>Current Estimate</u>
Fixed Charges -		
Capital Write-Off (40 Years)	\$ 120,725	\$ 115,000
Interim Replacements	13,000	13,000
Insurance	4,800	4,800
Taxes (City)	<u>165,000</u>	<u>104,200</u>
Total	\$ 303,525	\$ 237,000
Operating Costs -		
Operators	\$ 14,300	\$ 14,300
Maintenance	28,000	28,000
Assessments (FERC)	<u>1,000</u>	<u>1,000</u>
Total	\$ 43,300	\$ 43,300
Total Annual Cost	\$ 346,825	\$ 280,300
Energy Cost (Mils/KWH)	14.89 Mils	12.03 Mils

Two (2) fixed cost reductions have contributed to the 19.2% decrease in the production cost per kilowatt-hour, a lower capital cost, and lower anticipated City taxes.

The Return On Investment, based on current estimates and costs, is:

$$\frac{(23,300,000 \times \$0.0485 - \$280,300)}{\$4,600,000} \times 100 = 18.47\%$$

In reality, the inclusion of the \$1,022,000 Department of Energy payment to Brown-New Hampshire will yield an ACTUAL Return on Investment to the Company of:

$$\frac{(23,300,000 \text{ KWH} \times \$0.0485 - \$280,300) + \$1,022,000/40}{\$4,600,000 - \$1,022,000} \times 100 = 24.46\%$$

For this particular investment and demonstration income.

9. PROJECT RETURN ON INVESTMENT UPDATE (Continued)

It must be mentioned here that the Capital Funds required to finance this project originated with the Owner of Brown-New Hampshire - Brown Company. Brown Company, a pulp and paper manufacturer, has by virtue of its size and age, a limited amount of cash flow to finance projects and, therefore, prefers to make investments in manufacturing with Return On Investments of 50% or more. Brown Company had to delay projects with 50% or greater Return on Investments to proceed with this 24.46% project and the decision to do so was very hard indeed. The financial situation of many smaller companies makes hydro development a back-burner idea to consider at a time when fuel costs are finally too high or when some cash shows up with no better payback than hydro can provide. Brown Company's decision to proceed with this project had two (2) motivators - first, the award of a Department of Energy Agreement worth \$1,022,000; and second, legal pressure from the Federal Energy Regulatory Commission to redevelop the already licensed project site. It is Brown-New Hampshire's opinion that Brown Company would not otherwise have funnelled cash into this project at this time.

10. SUMMARY

The demonstration project has, to date, functioned well with the project objectives, organization, and control as defined in the Project Management Plan. There have been times when communications between some participants directly involved with design and construction should have been better, but the time table is still being met and the costs are below plan.

This project should provide excellent cost and production reports during the ensuing two (2) years of on-line electrical generation. Brown-New Hampshire has confidence in the design and the long-term durability of all structures and equipment, and is pleased with all costs and progress to date.

Further information, photographs, or clarifications are available by contacting the individual below.

David L. Dunham
Vice President & Project Manager
Brown-New Hampshire, Inc.
650 Main Street
Berlin, New Hampshire 03570

DLD:maj
11/11/80

APPENDIX "A"

Written by D. L. Dunham

Date: December 8, 1978

BROWN COMPANY

Berlin, New Hampshire

SPECIFICATIONS E1.3--1978

SAWMILL DAM REDEVELOPMENT

A. GENERAL

These special specifications are issued primarily for the purpose of soliciting proposals from interested parties for the Redevelopment of Brown-New Hampshire's Sawmill Dam (F.E.R.C. Licensed Project No. 2422) as a run-of-river hydroelectric generating station. It is the intent of these specifications to provide enough guidelines on various aspects of our requirements to enable proposers to understand and bid on a turn-key proposal for this redevelopment. It is the proposer's responsibility to clarify any questions he may have regarding the following brief guidelines, as he is to propose a package that includes management, engineering, materials and equipment, demolition and construction, start-up and checkout, and training of operating and maintenance personnel.

B. PRESENT STATUS OF CIVIL WORK

1. An on-site inspection is required of all prospective proposers.
2. Copies of F.E.R.C. Project Number 2422, Exhibit L prints are attached to provide a general graphic description of the existing project.

B. PRESENT STATUS OF CIVIL WORK (Continued)

3. In general, the dam is in excellent shape and is presently used for ponding and mill water supplies.
4. The forebay upstream from the powerhouse has some old wooden structures and wooden trash racks that were at one time used for handling sawmill wood. The bay itself is fouled with muck and water-logged wood.
5. A major portion of an earthen forebay cofferdam exists.
6. The existing station rackhouse, steel trash racks, and head gates are in poor condition.
7. The building interior is completely stripped--no heat, no lights, old broken windows, no facilities.
8. A traveling bridge and rails for a bridge-crane exists but are in disrepair.
9. The tailrace has an old rock-filled timbercrib training wall, which is in poor shape.

C. BASIC REDEVELOPMENT REQUIREMENTS

1. It is desired to eliminate spillage from the center section of the dam by adding about 143 feet of 18-inch high, wooden flashboards.

C. BASIC REDEVELOPMENT REQUIREMENTS (Continued)

2. Unit sizing and quantities will be made, using a total head of 17.5 feet for run-of-river operation, at a maximum usable flow of about 2,400 c.f.s, and in such a manner as to minimize civil work in the powerhouse.
3. The station will be designed as a run-of-river operation.
4. Synchronous generators will be installed.
5. The station will be designed for operation and protection in such a manner that it may be unattended.
6. The project is presently licensed as a hydroelectric generating plant. Brown-New Hampshire will handle all required licensing procedures with the F.E.R.C., New Hampshire Water Resources Board, and other State and Federal agencies as may be required.

D. FOREBAY, TAILRACE, DAM, AND BUILDING EXTERIOR REQUIREMENTS

1. Install a temporary water intake pipe for fire pump suction to adjacent buildings. Remove line after completion of project.
2. Install upstream and downstream cofferdams and dewater station. All cofferdam material will be removed from the river at the end of the project.
3. Remove and dispose of all old trash racks and wood handling structures presently located in the forebay.
4. Excavate all pulpwood and muck down to original riverbed, from the powerhouse to the remaining portion of the upstream cofferdam, and from the dam to the west shoreline.

D. FOREBAY, TAILRACE, DAM, AND BUILDING EXTERIOR REQUIREMENTS (Continued)

5. Repair leaks in the westerly forebay wall by forming up and placing a concrete wall against the existing stone masonry.
6. Install 143 feet of wood flashboards on the center section of the dam to a height of 18 inches above the present concrete crest.
7. Construct a new concrete facing on the granite walls of the power station.
8. Gunitite the face of the existing granite walls of the tailrace.
9. Demolish and remove existing tailrace training wall, and install a new one of reinforced concrete.

E. GENERAL POWERHOUSE REQUIREMENTS

1. The existing wood timber roof will be removed and replaced with a new sealed cavity-deck roof.
2. All masonry will be pointed up and all steel cleaned and painted. The walls will be sand-blasted and painted.
3. New windows and doors will be installed.
4. Adequate ventilation by wall fans will be installed for summer cooling.
5. The existing easterly floor depression and any of the existing five (5) flumes not used in the development will be properly sealed and filled to floor level.
6. The floor will be finished in a smooth, stepless, sealed-concrete finish.

E. GENERAL POWERHOUSE REQUIREMENTS (Continued)

7. Catwalks, ladders, and safety railings will be installed as required in and around the generators and wheel pits.
8. A new motorized hoist, trolley drive, and bridge drive of adequate size for all generator maintenance is required.
9. A station grounding network is required to provide adequate grounding for all electrical equipment.
10. Adequate dry-type transformer capacity is required for all lighting and general service requirements.
11. High-pressure sodium lighting will be installed to provide 75 initial footcandles of light at floor level.
12. Emergency lighting, fed from the stationary battery, will be installed.
13. Adequate 110-volt outlets and 3-phase, 460-volt outlets will be provided for service tools and welding machines.
14. Adequate electric heaters will be installed in the station to prevent freeze-ups in the event the generators must be down during the winter.
15. Permanent toilet and wash facilities are not required within the powerhouse, but utility water for fire protection must be installed at both ends of the powerhouse. Underground fire mains are available near by.

E. GENERAL POWERHOUSE REQUIREMENTS (Continued)

16. Door and window switches will be installed and incorporated into an intrusion alarm system.
17. A building smoke and fire alarm system will be installed and incorporated into the station alarm system.

F. RACKHOUSE AND TRASHRACK REQUIREMENTS

1. Existing trash racks and flume head gates will be removed.
2. The gatehouse will be rebuilt to protect the racks and gates from the weather. Provisions must be made for removal of debris from the rackhouse floor at the west end wall.
3. New steel trash racks will be installed across the intakes of the new generators.
4. An electric, one-ton cable hoist will be installed on a continuous Monorail for the removal of heavy debris from the racks.
5. New motor-driven head gates will be provided for each of the new generator intakes.
6. Adequate lighting will be installed to maintain a level of 25 footcandles at floor level.
7. Provisions must be made for supplying some heat to the rackhouse. Air forced from the powerhouse into the rackhouse is usually adequate to maintain a temperature above freezing.

G. TURBINE REQUIREMENTS

1. Turbine, tube, and tailrace design will be such as to optimize efficiency and minimize structural and civil work.
2. Turbines will be of cast or fabricated steel.
3. Turbines and/or guide vanes will be so designed as to allow proper synchronizing and load control of generators.
4. Bearings shall be oil-lubricated antifriction where possible.
5. Governors will be supplied for speed control and synchronizing with adequate response time to prevent turbine and generator damage during load rejections. Governors will have adequate hydraulic fluid reservoirs to allow for complete shutdowns and start-ups during power failures.
6. The overall design shall be such that equipment can be removed for repairs.

H. SPEED INCREASER REQUIREMENTS (If Applicable)

1. Geared speed increasers will be designed for minimum losses.
2. Increasers shall be capable of withstanding turbine runaway speeds without adverse effects.
3. Increasers shall be capable of withstanding the torsional shock stresses caused by the inadvertant application of generators to the line out of phase.

SPEED INCREASER REQUIREMENTS (If Applicable) (Continued)

4. Increases shall have overtemperature and lubrication failure protection incorporated with the general control scheme of the generators.

GENERATOR REQUIREMENTS

1. Synchronous generators will be used that are designed for rated kilowatt output at an overexcited power factor of 0.70 lagging.
2. Generators will be open, air-cooled, with cooling fans mounted on shafts or rotors that are adequate to cool the generators in an ambient air condition of 100°F.
3. Generator excitation may be brushless static, external static, shaftmounted commutating exciter, or external M-G set.
4. Generators may be direct-coupled, low speed, or may be high speed driven by geared speed increasers.
5. Generator rotors and shaft-driven equipment must be physically capable of withstanding runaway turbine speeds or must be suitably protected from excessive speeds by a mechanical declutching device.
6. Generators will be wound for operation at 2300 volts, 3-phase, 60-Hertz, with windings connected wye. The neutrals will be brought out and grounded with resistors.
7. Each generator will have surge protection, installed in switchgear or at the generators.

J. SWITCHGEAR AND CONTROL REQUIREMENTS

1. Fault current available at the powerhouse at the 22,000-volt transmission line level is presently 450 MVA symmetrical for a bolted 3-phase fault. Future changes in our ties with the utility could increase this value to 650 MVA. Any power equipment installed in this project must be properly designed to handle the fault currents from this new development and the possible future 650 MVA level at the transmission line.
2. Generator and station breakers may be air, oil, or vacuum type. All breakers, buswork, and power wiring must be sized and braced to withstand available fault currents.
3. All control circuits, protection circuits, and alarm circuits will be on 125 volts D.C., supplied by a stationary battery and static charger.
4. Station service voltage will be 460, 3-phase, 60-Hertz.
5. Each generator will be protected by relaying for:
 - a. Generator Ground Fault
 - b. Generator Winding Fault
 - c. Loss of Field
 - d. Generator Motorizing
 - e. Generator Overcurrent
 - f. Generator Stator Overtemperature
 - g. Field Ground
 - h. Overspeed
 - i. Overvoltage

J. SWITCHGEAR AND CONTROL REQUIREMENTS (Continued)

6. Each generator will have metering for:
 - a. Field Voltage
 - b. Field Current
 - c. Generator Terminal Amperes
 - d. Power Factor
 - e. Kilowatt Output
 - f. Kilowatt-Hour Production
7. Station Metering will include:
 - a. Transformer Current
 - b. Station Bus Voltage
 - c. Power Factor
 - d. Kilowatt Output
 - e. Kilowatt-Hour Production
8. Each generator will be capable of manual or automatic synchronizing. Each generator will be capable of synchronization using a single station panel having a bus voltmeter, oncoming generator voltmeter, and clock-type synchroscope. In addition, a set of speed control, phase-checking, and synchronizing relays will be provided for remote automatic start of generators.
9. An adequately sized stationary lead-acid battery and charger will be provided for the operation of all controls and some emergency lighting.

J. SWITCHGEAR AND CONTROL REQUIREMENTS (Continued)

10. The generator control wiring will be so arranged on terminal blocks within the station to allow the future installation of cables for the remote control and reading of:
 - a. Generator Stopping and Starting
 - b. Generator Speed Control
 - c. Generator Excitation Control
 - d. Pond Water Level
 - e. Generator Pit Water Level
 - f. Pertinent Station Alarms
11. Each generator and the station will have an alarm panel for displaying first- and second-out problems.
12. Each generator will have a voltage regulator with adjustable setpoints.
13. Due to normal operating problems with racks plugging by ice, instrumentation and alarms will be provided to protect the trash racks from excessive differential water elevations. Severe plugging could shut down a generator.

K. WIRING REQUIREMENTS

1. All panel wiring will be type SIS switchboard wire.
2. All control wiring will be stranded copper.
3. Power wiring may be aluminum if Owner-approved, multiple-compression terminators are used.

K. WIRING REQUIREMENTS (Continued)

4. All control circuit runs will be cabled--no lengthy runs of single-conductor wires will be allowed for control purposes.
5. Cables may be in conduit, tray, or armored.

L. TRANSMISSION REQUIREMENTS

1. The station bus will be at 2300 volts. Aerial or ducted cables will carry this power to an outdoor step-up power transformer.
2. There exists some 500 feet south of the powerhouse a set of three (3) single-phase power transformers rated 1250 KVA each at 2400/4160 volts secondary and 23,000 volts primary. These transformers are mounted on concrete pads and the existing 22,000-volt transmission line run-up to an overhead wooden bus structure. The transformer primary protection was fuses. These transformers, if used for this redevelopment, should be tested and overhauled since they have not been used since 1972.
3. If the proposal includes a new transformer, it shall be oil-cooled.
4. There is no existing secondary wiring or wireways from these transformers to the powerhouse.
5. The transmission line is adequately sized for this redevelopment.

M. SAFETY REQUIREMENTS

All engineering, equipment and construction will be performed in such a manner that all A.S.M.E., N.E.C., N.E.S.C. and O.S.H.A. regulations regarding personnel safety will be adhered to as are in effect up to the completion of the project.

N. ENGINEERING AND SUPERVISION REQUIREMENTS

1. Engineering will be in a complete and concise manner with a minimum of "as-built" decisions. All work will be permanently recorded on reproducible drawings of standard Brown Company dimensions.
2. All final design tracings or reproducibles will be provided to Brown Company for their permanent records.
3. Six (6) complete sets of instruction manuals, spare parts lists, and dimension prints as supplied by equipment manufacturers will be provided to Brown Company at or before completion of the project.
4. Six (6) complete operating manuals will be supplied to the Owner that describes in a complete and concise manner the operation and periodic maintenance of all station equipment. All hazards and possible equipment damage from poor operating and maintenance techniques will be clearly defined.
5. All design drawings will be approved by the Owner prior to release for fabrication or construction.
6. All construction phases of the project will be adequately supervised by manufacturer's and/or proposer's engineering personnel.
7. Knowledgeable personnel will supervise the checkout phase of the station operation and training of adequate duration to ensure capable operation and maintenance by Brown-New Hampshire personnel.
8. Engineering progress reports will be submitted monthly to Brown Company.

APPENDIX "B"

SAWMILL DAM & POWERHOUSE REDEVELOPMENTCOMPARISON OF PROPOSALS

June 5, 1979

<u>Comparison Item</u>	<u>General Electric</u>	<u>Allis-Chalmers</u>
1. Length of Project	15 Months	18 Months
2. Project Cost	\$3,675,000 Firm	\$4,004,072 Firm
3. Annual Generation	22,300,000 KWH	23,300,000 KWH
4. Number of Units	Two (2)--4800 H.P.	Four (4)--4900 H.P.
5. Type of Turbines	Vertical Kaplan	Horizontal Propeller
6. Water Passage	Open Flume	Tube
7. Quoted Turbine Efficiency at Best Load	92.0%	92.4%
8. Speed Increaser Efficiency	None (100%)	98.5%
9. Type of Generator	Vertical Synchronous Pump-Type Motor	Horizontal Synchronous Motor with Dovetailed Pole Pieces
10. Excitation	Metal-Clad Static	Brushless Static
11. Quoted Generator Efficiency	94.1%	95.6%
12. Composite Station Efficiency	86.6%	87.0%
13. Peak H.P./KW Rating	4800 HP/3325 KW	4900 HP/3174 KW
14. Peak Usable Flow	2900 C.F.S.	2600 C.F.S.
15. Maintenance Costs	See Discussion	See Discussion
16. Switchgear	Metal-clad Vacuum	Metal-clad Airblast
17. Rebuild Rackhouse	Yes	Yes
18. Stop-log Slots	No	Yes
19. Back-up Auxiliary Heat	Electrical	Oil Furnace
20. Throttle Control	Full Kaplans	Two (2) Units--Adjustable Blade
21. Governors	Woodward Type UG	Woodward Type UG
22. Proposal Preparation	See Discussion	See Discussion
23. Staging Area	Room for 1/2 Unit	Room for 1 Unit
24. Black Start	Yes	No
25. Trash Rake	Optional	Optional
26. Test Borings Allowed	Yes	Yes
27. Construction Power	By Brown	By Contractor
28. Turbine Manufacturer	Dominion	Allis-Chalmers
29. Gear Manufacturer	--	Philadelphia
30. Generator Manufacturer	General Electric	E.M.
31. Switchgear Manufacturer	General Electric	PowerCon
32. Engineering Firm	General Electric	Kleinschmidt & Dutting
33. Construction Firm	?	Cianbro
34. Project Administrator	General Electric	Allis-Chalmers

SAWMILL DAM AND POWERHOUSE REDEVELOPMENT
COMPARISON OF PROPOSALS

DISCUSSION:

Referring to the preceding list of comparison items by number, the following comments are made, which lead to a choice of developer:

1. Project length does, of course, have a bearing on when pay back starts. General Electric's proposed 15-month project does not, however, appear credible in the opinion of our Engineering Department. We do not feel that General Electric can supply and install Kaplan-type hydraulic turbines in the quoted 15-month period, and they have not provided us with a project schedule or critical path to aid in a better analysis. We are, therefore, considering that General Electric has no advantage on this item.
2. Project costs on the part of General Electric for a firm \$3,675,000 are as submitted on May 29 in response to our request for a firm price. The price does reflect the addition of the task of rebuilding the rackhouse, but is otherwise identical to their April 16 proposal for two (2) 2400 H.P. Kaplan units with an annual generation of 22,300,000 KWH. General Electric has an economic advantage here of \$329,072, which equals \$8,226.80 annually on a 40-year amortization.
3. Predicted annual generation as compared to unit sizing is proportionately higher for Allis-Chalmers than for General Electric. This is reflected in station efficiencies (item 12) and station H.P./KW ratings (Item 13). Allis-Chalmers has an economic advantage, based on a comparison of proposed annual generation of \$47,380 (1,000,000 KWH x \$0.04738).
4. The larger number of Allis-Chalmers units (4) than General Electric units (2) represents a maintenance advantage in that the loss of one (1) General Electric unit (50% of station capacity) has considerable

DISCUSSION: (Continued)

more impact on station production than the loss of one (1) Allis-Chalmers unit (25% of station capacity). Assuming that each General Electric and each Allis-Chalmers generator will have to be overhauled every ten (10) years and each overhaul requires two (2) months of unit downtime, the largest General Electric generation losses result in a present-worth 10-year loss in revenue (at 47.38 mils) of \$83,000. This results in an annual cost deference of \$8,300 in favor of Allis-Chalmers.

5. Vertical Kaplan units are basically better machines in quality and design and should result in a better economic investment. There is no good basis, however, to develop a good economic comparison of qualities between Kaplan units and tube units, especially where two (2) different manufacturers are involved.
6. No comment on comparison of water passages.
7. The higher Allis-Chalmers efficiency at best load might reflect better design, since a Kaplan unit (General Electric) is normally the more efficient unit. The Kaplan units are definitely more efficient than tube turbines at less than full load, but General Electric's proposed annual generation does not reflect this fact! General Electric may be conservative on annual generation.
8. No comment on speed increaser efficiency.
- 9.
- 10.

DISCUSSION: (Continued)

11. The higher speed Allis-Chalmers units are more efficient as they should be. Excitation units are quite different, but both will serve the purpose adequately. The small, high-speed Allis-Chalmers generators would be considerably less expensive to repair or rewind than the larger, slower General Electric units.
12. The best load efficiency of the Kaplan station should be higher than tube-turbines with speed increasers. If efficiencies are correct, Allis-Chalmers has done a better job of unit design.
- 13.
14. The higher peak KW rating of General Electric (3,325 KW) should indicate higher annual generation, but again General Electric appears conservative.
15. The maintenance costs of a two-unit Kaplan station versus a four-unit tube station have been the subject of considerable discussion in the Engineering Department, with the end result being that we feel overall long-term costs will be fairly equal between the two. First of all, we do not expect either type of unit to have more frequent major overhauls than the other. Allowing a two-month shutdown at ten-year intervals for both types of units, the major cost differential here would be the difference in lost station production during unit downtime. As mentioned in Item 4, above, this represents an \$8,300 annual cost advantage in favor of the Allis-Chalmers proposal.

DISCUSSION: (Continued)

Second, for periodic repairs, it is felt that a Kaplan unit would be more expensive per incident. These being one-half the number of Kaplan units than tube units as proposed, however, we feel that the long-term repair costs for two (2) Kaplans and four (4) tubes will be about equal.

One item worth considering also is the available head room in the powerhouse. We do not feel enough head room exists under the bridge crane to assemble and disassemble the Kaplan units without using a second hoist to tilt the shafts during lifts. General Electric has not proposed a second hoist, nor have they satisfactorily convinced us that head room is not a problem.

16. General Electric's vacuum metal-clad switchgear is, in our opinion, the better quality equipment here.
17. Both General Electric and Allis-Chalmers now propose to rebuild the rackhouse for the prices noted in Item 2, above. Rebuilding the rackhouse has one (1) major advantage in that it allows the installation of floor rails and a traveling Berry hydraulic trash rake (optional). The existing rackhouse is much too narrow to allow such an installation. With the development of this station, it will become the first (or more upstream) dam with operational trash racks. All heavy debris that presently appears at the Riverside Hydro rackhouse will be caught by the trash racks at the Sawmill Powerhouse. It is most important to have a good, mechanized means of removing heavy trash.

DISCUSSION: (Continued)

18. Allis-Chalmers proposed to make stop-log slots in all inlet and discharge areas--General Electric does not. Based on our experience with the infrequent need for dewatering our other 17 generators, we feel Allis-Chalmers' proposed stop-log slots have an annual economic advantage to us of about \$1,250 with respect to dewatering costs.
19. No comments on auxiliary heat.
20. Full Kaplan units are more efficient at partial throttle and should, therefore, provide better flow utilization and net annual KWH production. Our comparison, however, must include unit sizing, efficiencies, and proposed annual KWH production. This comparison in dollars has already been made in Item 3, above.
21. Both proposed governors are identical.
22. The extensive, detailed proposal of Allis-Chalmers gives us a much better idea of what we get for our money than does the General Electrical proposal. The brief General Electric proposal leaves considerable doubt as to materials, construction techniques, and generator performance; and could conceivably allow quite a number of heated discussions between General Electric and Brown Company on interpretations of the proposed redevelopment. We feel considerably more comfortable with the Allis-Chalmers proposal; if we judge final outcome on the basis of proposal quality, Allis-Chalmers will do a more commendable job.
23. Staging area for unit disassemblies is an important part of maintenance procedures. The Allis-Chalmers development will allow room for the layout of a complete disassembled unit, while the General

SAWMILL DAM AND POWERHOUSE REDEVELOPMENT
COMPARISON OF PROPOSALS

Page 6

DISCUSSION: (Continued)

Electric development (using larger units) will allow room for only 1/2 of a unit. We feel this item would result in an annual economic advantage to us of about \$1,000 in favor of Allis-Chalmers.

24. The General Electric proposal allows for starting the generators with a dead station bus. The Allis-Chalmers units require station service to start. Considering the type of load this station feeds, it is our feeling that a black start is not required even though it might be handy from time-to-time. Although General Electric has an advantage here, I do not deem it critical or I would ask Allis-Chalmers to price a change to include a black start concept.
25. Previously discussed--see Item 17, above.
26. No comment.
27. Contrary to Brown Company's specifications, General Electric has allowed that Brown Company will supply construction power. We feel that the installation and energy costs will amount to about \$5,000 during the construction phase. Amortized over 40 years, this results in an annual economic advantage to us of \$125 in favor of Allis-Chalmers.
- 28.
- 29.
- 30.

SAWMILL DAM AND POWERHOUSE REDEVELOPMENT
COMPARISON OF PROPOSALS

Page 7

DISCUSSION: (Continued)

31. A complete review of the designers and manufacturers of all major components has been made. All are entirely acceptable, with any appropriate comments having already been made in the preceding items.
32. As mentioned in Item 22, above, regarding proposals, we feel more confident of the work that Allis-Chalmers can do regarding this project. Kleinschmidt & Dutting are more familiar with this dam and powerhouse and have done a much more thorough preliminary engineering job in preparing their proposal data. We feel their thoroughness will result in fewer surprises during the development of the project.
33. Cianbro is a familiar and acceptable firm.
34. We believe either corporation is fully capable of properly administering this project.

ECONOMIC SUMMARY:

The economic advantages can be summarized on a comparable annual basis by amortizing capital costs on a 40-year basis and by considering future expenses on an annual basis:

<u>Item</u>	<u>General Electric</u>	<u>Allis-Chalmers</u>
2.	\$8,226	
3.		\$47,380
4.		8,300
18.		1,250
23.		1,000
27.		125
		<hr/>
Annual Total	\$8,266	\$58,055

In summary, we believe Allis-Chalmers to be the best overall choice for redeveloping the Sawmill site. The initial capital outlay will be about \$320,000 more than for a General Electric development, but the composite long-term costs are clearly in favor of an Allis-Chalmers development. We, therefore, recommend that an order be issued to Allis-Chalmers for this turn-key project.

June 5, 1979

David L. Dunham
Chief Electrical Engineer

Application No. 26-79-489 Permit No. NH-BERL-80-086

APPENDIX "C"

Name of Applicant Brown - New Hampshire, Inc.

Effective Date 28 March 1980

Expiration Date (If applicable) _____

DEPARTMENT OF THE ARMY
PERMIT

Referring to written request dated 26 September 1979 for a permit to:

() Perform work in or affecting navigable waters of the United States, upon the recommendation of the Chief of Engineers, pursuant to Section 10 of the Rivers and Harbors Act of March 3, 1899 (33 U.S.C. 403);

(X) Discharge dredged or fill material into waters of the United States upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 404 of the Federal Water Pollution Control Act (86 Stat. 816, P.L. 92-500);

() Transport dredged material for the purpose of dumping it into ocean waters upon the issuance of a permit from the Secretary of the Army acting through the Chief of Engineers pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (86 Stat. 1052; P.L. 92-532);

Brown - New Hampshire, Inc.
650 Main Street
Berlin, NH 03570

is hereby authorized by the Secretary of the Army:

to Place fill in an abandoned log pond. Fill will consist of approximately 5000 c.y. yards of muck and debris excavated from a forebay, 2000 c.y. of gravel fill from an existing cofferdam, and 500 c.y. of heavy riprap obtained off site.

in Androscoggin River

at Berlin, NH

In accordance with the plans and drawings attached hereto which are incorporated in and made a part of this permit (on drawings: give file number or other definite identification marks.) Plans entitled, "Proposed Log Pond Flood Control in Androscoggin River at Berlin New Hampshire Coos County, New Hampshire," in one sheet dated, "August 28, 1979."

subject to the following conditions:

I. General Conditions:

a. That all activities identified and authorized herein shall be consistent with the terms and conditions of this permit; and that any activities not specifically identified and authorized herein shall constitute a violation of the terms and conditions of this permit which may result in the modification, suspension or revocation of this permit, in whole or in part, as set forth more specifically in General Conditions j or k hereto, and in the institution of such legal proceedings as the United States Government may consider appropriate, whether or not this permit has been previously modified, suspended or revoked in whole or in part.

that all activities authorized herein shall, if they involve, during their construction or operation, any discharge of pollutants into, of the United States or ocean waters, be at all times consistent with applicable water quality standards, effluent limitations and standards of performance, prohibitions, pretreatment standards and management practices established pursuant to the Federal Water Pollution Control Act of 1972 (P.L. 92-500; 86 Stat. 816), the Marine Protection, Research and Sanctuaries Act of 1972 (P.L. 92-532, 86 Stat. 1052), or pursuant to applicable State and local law.

c. That when the activity authorized herein involves a discharge during its construction or operation, of any pollutant (including dredged or fill material), into waters of the United States, the authorized activity shall, if applicable water quality standards are revised or modified during the term of this permit, be modified, if necessary, to conform with such revised or modified water quality standards within 6 months of the effective date of any revision or modification of water quality standards, or as directed by an implementation plan contained in such revised or modified standards, or within such longer period of time as the District Engineer, in consultation with the Regional Administrator of the Environmental Protection Agency, may determine to be reasonable under the circumstances.

d. That the discharge will not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species.

e. That the permittee agrees to make every reasonable effort to prosecute the construction or operation of the work authorized herein in a manner so as to minimize any adverse impact on fish, wildlife, and natural environmental values.

f. That the permittee agrees that he will prosecute the construction or work authorized herein in a manner so as to minimize any degradation of water quality.

g. That the permittee shall permit the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

h. That the permittee shall maintain the structure or work authorized herein in good condition and in accordance with the plans and drawings attached hereto.

i. That this permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to property or invasion of rights or any infringement of Federal, State, or local laws or regulations nor does it obviate the requirement to obtain State or local assent required by law for the activity authorized herein.

j. That this permit may be summarily suspended, in whole or in part, upon a finding by the District Engineer that immediate suspension of the activity authorized herein would be in the general public interest. Such suspension shall be effective upon receipt by the permittee of a written notice thereof which shall indicate (1) the extent of the suspension, (2) the reasons for this action, and (3) any corrective or preventative measures to be taken by the permittee which are deemed necessary by the District Engineer to abate imminent hazards to the general public interest. The permittee shall take immediate action to comply with the provisions of this notice. Within ten days following receipt of this notice of suspension, the permittee may request a hearing in order to present information relevant to a decision as to whether his permit should be reinstated, modified or revoked. If a hearing is requested, it shall be conducted pursuant to procedures prescribed by the Chief of Engineers. After completion of the hearing, or within a reasonable time after issuance of the suspension notice to the permittee if no hearing is requested, the permit will either be reinstated, modified or revoked.

k. That this permit may be either modified, suspended or revoked in whole or in part if the Secretary of the Army or his authorized representative determines that there has been a violation of any of the terms or conditions of this permit or that such action would otherwise be in the public interest. Any such modification, suspension, or revocation shall become effective 30 days after receipt by the permittee of written notice of such action which shall specify the facts or conduct warranting same unless (1) within the 30-day period the permittee is able to satisfactorily demonstrate that (a) the alleged violation of the terms and the conditions of this permit did not, in fact, occur or (b) the alleged violation was accidental, and the permittee has been operating in compliance with the terms and conditions of the permit and is able to provide satisfactory assurances that future operations shall be in full compliance with the terms and conditions of this permit; or (2) within the aforesaid 30-day period, the permittee requests that a public hearing be held to present oral and written evidence concerning the proposed modification, suspension or revocation. The conduct of this hearing and the procedures for making a final decision either to modify, suspend or revoke this permit in whole or in part shall be pursuant to procedures prescribed by the Chief of Engineers.

l. That in issuing this permit, the Government has relied on the information and data which the permittee has provided in connection with his permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, this permit may be modified, suspended or revoked, in whole or in part, and/or the Government may, in addition, institute appropriate legal proceedings.

m. That any modification, suspension, or revocation of this permit shall not be the basis for any claim for damages against the United States.

n. That the permittee shall notify the District Engineer at what time the activity authorized herein will be commenced, as far in advance of the time of commencement as the District Engineer may specify, and of any suspension of work, if for a period of more than one week, resumption of work and its completion.

d. That if the activity authorized herein is not started on or before N/A day of 19 the year from the date of issuance of this permit unless otherwise specified) and is not completed on or before 31st day of December, 19 83, (three years from the date of issuance of this permit unless otherwise specified) this permit, if not previously revoked or specifically extended, shall automatically expire.

p. That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require authorization by the Congress or other agencies of the Federal Government.

q. That if and when the permittee desires to abandon the activity authorized herein, unless such abandonment is part of a transfer procedure by which the permittee is transferring his interests herein to a third party pursuant to General Condition t hereof, he must restore the area to a condition satisfactory to the District Engineer.

r. That if the recording of this permit is possible under applicable State or local law, the permittee shall take such action as may be necessary to record this permit with the Register of Deeds or other appropriate official charged with the responsibility for maintaining records of title to and interests in real property.

s. That there shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein.

t. That this permit may not be transferred to a third party without prior written notice to the District Engineer, either by the transferee's written agreement to comply with all terms and conditions of this permit or by the transferee subscribing to this permit in the space provided below and thereby agreeing to comply with all terms and conditions of this permit. In addition, if the permittee transfers the interests authorized herein by conveyance of realty, the deed shall reference this permit and the terms and conditions specified herein and this permit shall be recorded along with the deed with the Register of Deeds or other appropriate official.

11. Special Conditions: (Here list conditions relating specifically to the proposed structure or work authorized by this permit):

following Special Conditions will be applicable when appropriate:

STRUCTURES IN OR AFFECTING NAVIGABLE WATERS OF THE UNITED STATES:

a. That this permit does not authorize the interference with any existing or proposed Federal project and that the permittee shall not be entitled to compensation for damage or injury to the structures or work authorized herein which may be caused by or result from existing or future operations undertaken by the United States in the public interest.

b. That no attempt shall be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the activity authorized by this permit.

c. That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law, such lights and signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee.

d. That the permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the authorized structure or work, shall, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the waterway to its former conditions. If the permittee fails to comply with the direction of the Secretary of the Army or his authorized representative, the Secretary or his designee may restore the waterway to its former condition, by contract or otherwise, and recover the cost thereof from the permittee.

e. Structures for Small Boats: That permittee hereby recognizes the possibility that the structure permitted herein may be subject to damage by wave wash from passing vessels. The issuance of this permit does not relieve the permittee from taking all proper steps to insure the integrity of the structure permitted herein and the safety of boats moored thereto from damage by wave wash and the permittee shall not hold the United States liable for any such damage.

MAINTENANCE DREDGING:

a. That when the work authorized herein includes periodic maintenance dredging, it may be performed under this permit for _____ years from the date of issuance of this permit (ten years unless otherwise indicated),

b. That the permittee will advise the District Engineer in writing at least two weeks before he intends to undertake any maintenance dredging.

DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES:

a. That the discharge will be carried out in conformity with the goals and objectives of the EPA Guidelines established pursuant to Section 404(b) of the FWPCA and published in 40 CFR 230;

b. That the discharge will consist of suitable material free from toxic pollutants in other than trace quantities;

c. That the fill created by the discharge will be properly maintained to prevent erosion and other non-point sources of pollution; and

d. That the discharge will not occur in a component of the National Wild and Scenic River System or in a component of a State wild and scenic river system.

DUMPING OF DREDGED MATERIAL INTO OCEAN WATERS:

a. That the dumping will be carried out in conformity with the goals, objectives, and requirements of the EPA criteria established pursuant to Section 102 of the Marine Protection, Research and Sanctuaries Act of 1972, published in 40 CFR 220-228.

b. That the permittee shall place a copy of this permit in a conspicuous place in the vessel to be used for the transportation and/or dumping of the dredged material as authorized herein.

This permit shall become effective on the date of the District Engineer's signature.

Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

PERMITTEE
David L. Dunham, Vice President

DATE

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer
~~XXXXXX~~
~~XXXXXX~~

DATE

Transferee hereby agrees to comply with the terms and conditions of this permit.

TRANSFEEEE

DATE

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

NOV 21 1979

Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

We have reviewed Public Notice 26-79-489, dated October 11, 1979. Brown-New Hampshire, Inc., has requested a permit to place fill in the Androscoggin River at Berlin, New Hampshire.

This is the report of the Department of the Interior and the Fish and Wildlife Service on the application, submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The proposed filling will eliminate about one-half acre of aqueous habitat. Two purposes for the filling, to provide flood protection and stabilize a deteriorated bulkhead, could be accomplished with use of riprap along the bulkhead. A third purpose, to dispose of muck and debris, could be accomplished by utilizing existing upland disposal areas, as identified in a previous application.

Thus, we recommend that fill be limited to that necessary for stabilizing the existing bulkhead, and the remainder disposed of upland.

Please advise us of any action taken on our recommendations.

Sincerely yours,

Gordon E. Beckett
Supervisor

26 NOV 1979

1. 5000 cy muck and debris excavated from forebay
2. Gravel fill from cofferdam 2000 cy.
3. Heavy rip rap slope protection 500 cy.

INEL-A-17 154

APPENDIX "E"

BROWN-NEW HAMPSHIRE INC.
650 Main Street
Berlin, New Hampshire

January 21, 1980

File: 94-140-1935

Mr. Robert J. Desista
Acting Section Chief
Regulatory Branch--Operations Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Subject: Application for Permit - No. 26-79-489

Dear Mr. Desista:

Concerning your letter of December 17, 1979, and a U.S. Fish & Wildlife Service letter of November 21, 1979, we are pleased to submit the following detailed information regarding the proposed filling of the log pond in the forebay area of the Sawmill Hydroelectric Redevelopment Project.

1. Responding to Mr. Beckett's (U.S. Fish & Wildlife Service) comments in paragraph three (3) of his letter:
 - (a) The installation of a riprap along the deteriorated bulkhead would not provide the density of fill required to build an effective levee against flooding.
 - (b) The disposal of dredgings at an upland site would, among other undesirable attributes explained below, in all probability be prohibited by the Environmental Protection Agency.
2. Two (2) panoramic views of the entire forebay area of the subject project are enclosed for an in-absentia view of the area being dredged and the area being filled. The narrow picture (PAN A) was taken from point "A" on the enclosed drawing (No. 16838-7), and the wide picture (PAN B) was taken from point "B". Please carefully note the condition of the log pond area (proposed to be filled).
3. A plan view of the area--drawing No. 16838-7--is enclosed. Note the red-hatched area to be filled, and the temporary earth cofferdam.

4. Much of the forebay area to be dredged out and the log pond to be filled in were man-made, as evidenced by the rooted tree stumps existing in both areas. Both areas were found to have a large quantity of silt, 4-foot pulpwood, and logs as long as forty (40) feet. The log pond area proved to be very shallow in depth, due in part to a higher level of original base land. Infiltration of water and sewage was found in the log pond area, apparently originating from leaking City water and sewer lines. Very large concrete structures are present in the log pond area.
5. The old log pond is not required for efficient operation of the power station, but the logs and pulpwood in this area have to be either removed or covered to keep them from moving into the forebay area and racks of the powerhouse. The cost of dredging the log pond area would be very high, since there appears to be a large quantity of removable material, and the transportation of same to an alternate disposal area over public roads would, in our opinion, be a public nuisance and a waste of now-precious automotive fuels. In addition, Brown Company (Owner of Brown-New Hampshire) has found it increasingly difficult to obtain Environmental Protection Agency's approval to dump refuse from its plants on land in the area. A suitable dump site for dredgings from the forebay and log pond would require the Environmental Protection Agency's approval (among others), and we are of the opinion that such approval would be extremely difficult to obtain.
6. The west banks of the river and the log pond area are very low with respect to flood flows. The flood of March, 1936, overflowed this area, washed out the railroad tracks, and cut deep channels in the Brown Company mill yards. The elevation of the 1936 flood was 1,096.6 feet M.S.L. in this area, and the adjacent land and railroad tracks are at about elevation 1,096.0 feet M.S.L. or about a half-foot (1/2') below the 1936 flood crest. We are also raising the operating crest of the dam six inches (6") for optimum power generation, as approved in licensing procedures with the Federal Energy Regulatory Commission for Licensed Project No. 2422. In connection with all of the preceding, we are proposing to fill the log pond to sufficient elevation and with sufficient slope, distance, and thickness to ensure against flood leakage or channeling through the proposed levee.
7. The timber sheathing supporting the river bank adjacent to the railroad tracks and road traffic has deteriorated to an extent considered unsafe for stabilizing land. Filling the log pond will stabilize the bank as required for safe rail and vehicular traffic.
8. The area proposed to be filled is natural--it is bound by land on two (2) sides (west and north), by a cut-stone retaining wall and log haul-up on the southerly side, and partially by concrete foundations and rock-filled timber cribbing on the easterly or river side.

Mr. Robert J. Desista
Corps of Engineers

Page 3
January 21, 1980

9. Both the Special Board and the Wetlands Board of the State of New Hampshire have approved the proposed filling of the log pond area by letter signed by George McGee, Sr.--Chairman, dated November 29, 1979, a copy of which is enclosed. Members of the State of New Hampshire Wetlands Board include such personnel as Director--Fish & Game; Biologist--Inland Fisheries; Director--Water Pollution; Biologist--Water Pollution, etc.
10. During and after drainage of the log pond area, we found no evidence of plant life or bottom-dwelling animal life that would support a contention that the area was a good "aqueous habitat." What fish life that existed in the area prior to drainage could surely find cleaner water and better feeding grounds in other parts of the river.

We hope the foregoing provides a clearer understanding of what we wish to accomplish. We feel we have carefully considered all alternatives to accomplishing our specific goals, and we have chosen the alternative that results in the least undesirable impact on our environment.

We are by copy of this letter providing a duplicate set of all enclosures to Mr. Beckett of the United States Fish & Wildlife Service in Concord, New Hampshire.

Very truly yours,

BROWN-NEW HAMPSHIRE, INC.

David L. Dunham
Vice President

Enc.

cc: Mr. R. A. Baillargeon
Mr. P. E. Johnson
Mr. R. E. Moores
Mr. G. E. Beckett, Supervisor
United States Department of the Interior
Fish & Wildlife Service
Ecological Services
P.O. Box 1518
Concord, New Hampshire 03301