

**MASTER**

DRAFT FINAL REPORT  
CANTON HYDROELECTRIC PROJECT  
FEASIBILITY STUDY  
MAY 1979  
VOLUME II - APPENDICES

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APPENDIX A

WATER RIGHTS AND BASIC DATA



AN ACT AMENDING THE CHARTER OF THE METROPOLITAN DISTRICT, CONCERNING THE COLEBROOK RIVER DAM.

SECTION 1. The Metropolitan District, for the purpose of improving and increasing the water supply of the towns and the inhabitants thereof to which said districts shall furnish water, is authorized to enter into an agreement with the United States to the effect that the said district may share in the benefits of and the expense of construction of, a multi-purpose dam and reservoir, including provisions for flood control and water supply, to be constructed by the United States on the west branch of the Farmington River above the Hogback, in the manner provided in the act of Congress known as the Water Supply Act of 1958, as amended, this act being part of Public Law 85-500 (72 Stat. 319) as amended by Public Law 87-88 (75 Stat. 210).

SEC. 2. The Metropolitan District may use water stored in the reservoir created by such multi-purpose dam for water supply of the towns and the inhabitants thereof, and may release any part of the water therein stored which is not needed for its water supply system for the purpose of returning to the Farmington River, at convenient times, water for compensation to riparian owners for the diversion of water, and the powers granted the said district in sections 1 through 3 of number 444 of the special acts of 1949 shall be applicable to the said multi-purpose reservoir and the waters stored therein.

SEC. 3. The powers granted by this act shall not affect the limitation on storage of waters of the west branch of the Farmington River nor shall it affect the obligation of the said district to maintain at all times at its dam at the Hogback, a minimum flow; both as provided in section 4 of number 444 of the special acts of 1949.

SEC. 4. The provisions of section 12 of number 444 of the special acts of 1949 providing for boating, hunting and fishing and the regulation thereof on the Hogback reservoir shall be applicable to property of the said district within the watershed of the said multi-purpose reservoir as well as to the Hogback reservoir.

SEC. 5. The provisions of section 13 of number 444 of the special acts of 1949 relative to lands and rights in Massachusetts shall be applicable to the project authorized under this act.

SEC. 6. The powers granted under this act shall be in addition to, and not in derogation of the powers granted to the Metropolitan District in number 444 of the special acts of 1949.

Approved June 6, 1963.

[House Bill No. 3081.]

[141.]

AN ACT CONCERNING THE POWERS OF THE METRO-  
POLITAN DISTRICT RESPECTING WATER.

Section 4 of number 444 of the special acts of 1949 is amended to read as follows: No riparian owner on said Farmington river below said proposed dam authorized by section 1 hereof shall be required, in order to reserve his rights, to assert any claim for loss or damage arising from the construction of said dam and said new reservoir prior to the time when water is actually diverted from said reservoir for use in the water system of said district and the failure to assert such a claim for loss or damage prior to the actual diversion of said water from said west branch of said river shall not constitute laches or waiver or a bar by limitation of time. Before said district shall divert from said reservoir any of the water of said west branch of said river for use in the water system of said district it shall either agree with riparian owners on said Farmington river below the dam of said reservoir upon the compensation to be made to them in lieu of damages by reason of such diversion or it shall by condemnation proceedings acquire the right to divert said water and make just compensation for the water so diverted to any of such riparian owners with whom no agreement for such compensation has been made. The minimum flow through or over the dam of the proposed Hogback reservoir shall not be allowed to fall below fifty cubic feet per second regardless of the actual natural minimum flow.

Approved June 19, 1963.

## SPECIAL ACT NO. 444

## AN ACT INCREASING THE POWERS OF THE METROPOLITAN DISTRICT, RESPECTING WATER.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

SECTION 1. The Metropolitan District, for the purpose of improving and increasing the water supply of the towns and the inhabitants thereof to which said district shall furnish water, is authorized to take, hold, conserve, store, utilize, divert and convey to, into and through its system of water works the waters of the so-called main stream or west branch of the Farmington river and its tributaries, which enter said main stream at or north of the Hogback, so-called, for said purposes or for compensation, and for said purposes to build, erect and maintain a dam on said west branch of the Farmington river, at or about the Hogback, so-called, and may take and hold by purchase, condemnation or otherwise any lands, water rights, flowage rights, rights of way or easements or other rights of property, which said district may deem necessary or convenient for constructing said dam, a reservoir, aqueducts, pipe lines, tunnels or other works for the purpose of storing, distributing and utilizing such water supply, for conveying the same between reservoirs or from reservoirs to any part of said district or to any other place which is, or under authority of law may be, supplied with water by said district, and for protecting the purity of said waters and which may be necessary or convenient for the purpose of carrying out the provisions hereof. The provisions of this section shall be subject to the provisions as to minimum stream flow set forth in section 4 hereof.

SEC. 2. Said district may construct and maintain, on land so taken, a dam, a reservoir, dikes, spillways, flumes, canals, aqueducts, wheel-pits, waste-weirs, races, buildings and other works and structures which said district may deem necessary or convenient for taking, storing, purifying, controlling, measuring and distributing the waters hereinbefore authorized to be taken, or for any other purpose hereby permitted, and, for the purpose of conveying the waters of said west branch of the Farmington river and utilizing the same to increase its water supply, may construct, lay, carry, maintain and repair such canals, tunnels, pipes, telephone and electric power wires,

or other works, as may be necessary or convenient for such purpose, through or over any lands, rivers or other water courses, railroads, street railways or public or private ways, and over and upon any public bridge now existing or hereafter built; may contract with the public authorities owning or controlling any public bridge or bridges hereafter built for adaptation thereof to the uses herein provided, under such terms as may be agreed upon, for the purposes of this act; may open the ground in any private or public way in any city or town in which any portion of said works is located, under the approval of the selectmen or other proper authority thereof or, if control be exercised by the state over any highway so opened, under the approval of the highway commissioner, in such manner as to cause no unreasonable hindrance to public travel, and shall hold the party responsible for such highway harmless from all liability for, and indemnify it against, all damages suffered and expenses incurred by it from any cause resulting from such acts of said district.

SEC. 3. If said district shall construct said works as authorized by section 1 hereof upon the west branch of the Farmington river, said district may use any part of the water therein stored, which is not needed for its water supply system, for the purpose of returning to said Farmington river at convenient times water in lieu of that, in whole or in part, diverted, and may install such necessary spillways, locks, gates and appliances for regulating the discharge and flow of water in said river for the purpose of maintaining in said river a more constant flow regardless of seasonal variation, and said district may make and enter into contracts and agreements with any person or corporation affected by any such diversion providing that the water so stored, ponded and returned to said river from said reservoir shall be in lieu, in whole or in part, of damages resulting to such person or corporation by reason of such diversion or holding back of said water and may make any and all contracts, agreements and conveyances which may be necessary or convenient to provide for the maintenance, care, operation and control of said reservoir for said purposes; but said district shall retain the right to enforce such limitations on operations as may be necessary for the protection of the primary purpose of the use of said works as a part of its water supply system; and said district is authorized to purchase electric power and to make and enter into contracts and agreements with any person or corporation affected by the diversion of water from said west branch whereby said electricity so purchased by said district shall be delivered or

supplied in lieu, in whole or in part, of damages resulting to such person or corporation by reason of such diversion or by reason of the storing or ponding of the waters in said river and for the purpose of furnishing compensation in kind to persons and corporations damaged by the diversion of water under the authority given herein. In substituting electricity, in whole or in part, for water, said district shall supply such electricity through and by agreement with the electric light and power companies authorized to distribute and sell electricity within said territory.

SEC. 4. No riparian owner on said Farmington river below said proposed dam authorized by section 1 hereof shall be required, in order to reserve his rights, to assert any claim for loss or damage arising from the construction of said dam and said new reservoir prior to the time when water is actually diverted from said reservoir for use in the water system of said district and the failure to assert such a claim for loss or damage prior to the actual diversion of said water from said west branch of said river shall not constitute laches or waiver or a bar by limitation of time. Before said district shall divert from said reservoir any of the water of said west branch of said river for use in the water system of said district it shall either agree with the riparian owners on said Farmington river below the dam of said reservoir upon the compensation to be made to them in lieu of damages by reason of such diversion or it shall by condemnation proceedings acquire the right to divert said water and make just compensation for the water so diverted to any of such riparian owners with whom no agreement for such compensation has been made. The natural flow of the water of the west branch of the Farmington river shall not be held back at the dam of the proposed Hogback reservoir, except such flow of said west branch as shall be in excess of one hundred fifty cubic feet per second above the dam site exclusive of any water discharged from the Otis reservoir watershed; and the minimum flow shall not be allowed to fall below fifty cubic feet per second through or over the dam regardless of the actual natural minimum flow.

SEC. 5. If any highway or any section of highway is to be overflowed, abandoned or discontinued by reason of the construction or reconstruction of the reservoir under authority given hereby and a substitute highway or section of highway is to be constructed therefor, before any change of location or grade of any highway shall be made said district shall cause a detailed plan to be made indicating the grade and location of the new highway, which may be a town or state aid or trunk

line highway, which it proposes as a substitute so as to show fully all changes proposed to be made. If any highway to be flooded or abandoned is a town road and the highway to be substituted therefor is to be a town road, plans as provided herein shall be presented to the selectmen of each town within which highway alterations are to be made. Such selectmen, within fifteen days thereafter, shall issue a call for a meeting of the legal voters of such town to be held within ten days after the issuing of said call and shall submit said plan to such meeting for its consideration. Said meeting may adopt, modify or reject such plan or any part thereof and, within ten days after said meeting and in accordance with the vote thereof, such selectmen shall notify said district of the decision of said meeting thereon or of such modifications therein as have been made. If the plans presented are modified or rejected, said district may at its option thereupon present other plans to such selectmen for presentation to a meeting of the legal voters of such town in accordance with the procedure hereinbefore provided. The proceedings, orders and decisions of any town as aforesaid shall be in writing and shall be recorded in the records of such town. If said district and any town affected by any change of location of any highway hereinbefore described shall not agree upon any plan submitted or if such selectmen of any town shall fail to act thereon as hereinbefore provided, said district may petition the superior court for the county in which such highway or such part thereof is located or, if such court is not in session, any judge thereof, asking said court or such judge to approve one of said plans as presented. Said court or such judge may thereupon cause such notice of such petition to be given as said court or such judge shall prescribe. Unless the parties shall agree as to the judgment to be rendered, said court or such judge shall fully hear said district and all parties interested and shall thereupon approve such plan or make such changes therein as it may decide to be necessary for the purpose of carrying out the provisions hereof, and said district may thereupon proceed with the construction of such highway in accordance with said plan as approved. If any highway to be flooded or abandoned is a trunk line or state aid highway or if the highway to be substituted for any highway to be flooded or abandoned is to be a trunk line or state aid highway, a plan prepared as herein provided shall be submitted to the state highway commissioner and the approval of said commissioner as to location, grade, specification and general details of the highway to be constructed shall be sufficient, or if said district, acting

through its district board, and the state, acting through said commissioner, shall enter into an agreement in writing, either with or without conditions, that the state will accept the new highway after construction according to said plans and specifications as a state aid or trunk line highway, then only the approval of said commissioner as to location, grades, specifications and general details shall be necessary. No such highway so proposed to be changed shall be in any way discontinued or obstructed, nor shall public travel thereon be interfered with, until a new highway in lieu thereof has been constructed in accordance with the provisions of this act.

SEC. 6. Said district shall have power to make any contract of purchase for acquiring title to any land, water right, franchise or other property required for or affected by the reservoir or other works herein provided and for acquiring title in the respective towns of rights of way for such highways. Any land on the watershed under the control of the state park and forest commission may be left in such control subject to the rules and regulations of the state department of health regarding public water supplies.

SEC. 7. If said district cannot agree with any owner of land, water rights or other property to be taken for such dam, reservoir and appurtenant works, or for aqueducts, pipe lines or transmission lines, or for the use of water herein provided, or for the construction of highways in lieu of those overflowed, taken, abandoned or altered under the provisions of this act, as to the amount of damages which ought to be awarded to any party claiming to be injured by the doings of said district hereunder, said district may petition the superior court for the county wherein such property so to be taken or damaged is located, or, if said court is not in session, any judge thereof, praying that such compensation may be determined. Said court or such judge may thereupon cause such notice of such petition to be given as said court or such judge shall prescribe and shall appoint a state referee to examine the property which is to be taken or damaged by the acts of said district hereunder, including all damages for any land or water right, title, privilege, easement, franchise or other property which may be required, taken or impaired for the purposes hereof. Such referee, having given at least ten days' notice to the parties interested of the time and place of hearing, shall determine the amount of compensation which said owner or parties affected shall receive and report the same in writing to said court. Any party may remonstrate against the acceptance of said report in accordance with the rules of the superior court.

Said court may confirm the doings of such committee and render judgment accepting the report or take such other action as it may determine to be proper. Said district shall pay the amount provided in such judgment, in such manner as said court may prescribe, in full compensation for the property acquired or the injury done by the acts of said district and thereupon said district may proceed with the construction of the dam, reservoir and other works provided for by this act, without any liability upon any further claim for compensation for damages.

SEC. 8. If, to carry out the purpose of this act, any cemetery or land owned for cemetery purposes is to be taken by said district and it shall become necessary to remove such cemetery from its present location and to establish it in another place, the owner or owners of such cemetery, or if there is no known owner or owners, or if such owner or owners shall neglect or refuse to act under the provisions of this act, said district, if land therefor cannot be acquired otherwise, may petition the superior court for the county in which such cemetery is located for authority to take other land which such owner or owners or said district, as the case may be, may consider suitable to be used for cemetery purposes in lieu of that taken under the provisions of this act; and said court may appoint a committee of three disinterested persons who, after examining the premises and hearing the parties, shall report to the court as to the quantity, boundaries and value of the land which such committee shall deem suitable to be taken for said purposes, and the damages resulting from such taking; and if the court shall accept such report, it shall render judgment thereon and execution may be issued thereon accordingly, in favor of the person in whose favor damages are assessed, for the amount thereof; and upon payment thereof the title of the land shall, for such purposes, be vested in such owner or owners of the cemetery taken under the provisions hereof, if known, or, if not known, in the name of the town in which such cemetery is located; but such land shall not be taken until such damages shall be paid to the owner, or deposited with the treasurer of the county for the use of such owner, which payment or deposit shall be made within thirty days after such report shall be accepted. If such application shall be denied, the owner of the land shall recover from the applicant or applicants costs, to be taxed by the court, and the court may issue execution therefor. The owner or owners of such cemetery, or, in the event that such owner or owners shall neglect or refuse to act, said district shall have authority to lay out and establish a new cemetery in place of any taken



hereunder, and, in all cases in which the friends or relatives of those buried in any cemetery so taken shall not otherwise provide, to remove the bodies buried in such cemetery, together with the monuments and other property of such cemetery, and place them in suitable manner in the new cemetery herein provided for. Said district shall pay all costs incurred under the provisions of this section and shall reimburse the owner or owners of any such cemetery so taken for all expense or liability incurred in the taking, laying out, or establishing of any new cemetery or in removing the bodies, monuments and other property from such cemetery so taken to any established in place thereof, and shall also bear all expense incurred in the removal of bodies and monuments, by friends or relatives, to cemeteries other than those hereinbefore referred to.

SEC. 9. When lands, rights or other property, or any interest therein, taken or affected under the provisions of this act, shall be owned by an infant, or an insane person, or by a person unknown or absent from this state, or where any person shall be the owner of a contingent or uncertain interest therein, the superior court, or any judge thereof, may make such order for service of process upon such person, or for giving notice to any such person of the pendency of proceedings under this act, or for the appointment of a guardian, conservator, trustee, or other representative for such person, as said court or such judge shall determine, and thereupon all proceedings hereunder shall be binding upon the interest of such person in such lands, rights and property, and said court or such judge may make orders to protect the rights, title and interest of any such person taken or affected by or under the provisions of this act.

SEC. 10. Said district is authorized, after notice to the owner when practicable, to enter upon any land or water for the purpose of making surveys necessary to be made for the purposes of this act, and shall pay all damages caused thereby. Said district shall pay all costs, including costs of committees, incurred in the taking of lands, rights of way and property for any purpose under the provisions of this act, not otherwise provided for herein; and all land taken for any of said purposes shall be set in the list for taxation in the town in which said land is situated, to The Metropolitan District, and assessed for taxation at the average assessed valuation per acre of the improved farming land in such town.

SEC. 11. If after the construction of the reservoir authorized by this act the water in Bushnell or Mill brook, so-called, shall, in the opinion of The Metropolitan District or of the state

department of health, become unfit for drinking purposes, said district shall at its own expense divert said brook so that it shall enter the west branch of the Farmington river below said Hogback dam so that the use and improvement of the watershed around the sources of said brook, including Hartland pond and the Pinehurst lakes and their tributaries in the town of Hartland, for domestic and recreational purposes shall remain undisturbed.

SEC. 12. Said district shall not develop for water supply purposes said west branch of the Farmington river below the Hogback dam site to and including Satan's Kingdom, or Sandy brook, Mad river or Still river or any other tributary of said west branch which enters said river between said points and shall not have any right of eminent domain in respect to land or property rights upon, beneath, along or bordering said west branch between said points, except for the construction, repair and maintenance of pipe lines for water supply purposes. Said district shall not impose any restrictions on swimming or other recreational activities in the towns of Colebrook, Norfolk, Winchester, and New Hartford within the territory of the watershed of said streams. Boating, hunting and fishing shall be allowed upon the reservoir to be constructed under the provisions of this act and within the limits of land owned by the district and located within the watershed of said reservoir and Greenwood's pond. Said activities shall be subject to proper regulations to be determined from time to time by a commission of seven members consisting of one member of the state department of health to be appointed by the Connecticut public health council, one member of the state board of fisheries and game to be appointed by said board, one member of the water bureau of the district to be appointed by the district chairman, and one representative from each of the towns of Colebrook, Barkhamsted, New Hartford and Hartland to be appointed by the board of selectmen of each of said towns, such representative, as far as possible, to be selected from a sportsmen's organization. The members of said commission shall serve without compensation.

SEC. 13. Said district is authorized to acquire by purchase, hold title to, maintain and operate and exercise all privileges of ownership of any land, water right, franchise or other property in Massachusetts required for or affected by the proposed reservoir or other works on either branch of said Farmington river, or necessary or convenient for the protection thereof or of the water supply system connected thereto, and to negotiate and enter into agreements with the commonwealth of

Massachusetts or any of its governmental or administrative subdivisions, agencies, commissions or boards, or owners or occupants of real estate necessary or convenient for the protection of the water supply system and the operation thereof, including sanitation and elimination of pollution of any natural waterway or any and all of their tributary waterways or watersheds within said commonwealth of Massachusetts, the alteration, relocation or reconstruction of highways and appurtenances, and as to the payment of taxes on any such land, water right, franchise or other property or for compensation in lieu of such taxes. Said district is authorized to comply with any law of said commonwealth or subdivision thereof which may be applicable to it as owner of any such land, water right, franchise or other property. All purchases of land, water rights, franchises and other property heretofore made by said district within said commonwealth are validated.

SEC. 14. The Metropolitan District is authorized so far as is compatible with the primary purposes of creating and maintaining a pure public water supply and compensation to cooperate with the work of the state board of fisheries and game in promoting the increase of the supply of fish and game.

SEC. 15. It shall be the duty of The Metropolitan District and it shall have the right upon passage of this act to proceed forthwith to acquire title by purchase, condemnation or otherwise, to all private land in the town of Colebrook situated within the area bounded on the north by the Massachusetts line, east and south by the town of Hartland, and west by the Farmington river. When said town of Colebrook shall have been notified by said district that said title has been acquired it shall proceed forthwith to discontinue and abandon the town and state aid roads in said area. Said town shall also convey to said district all right and title of the town in and to public lands and all bridges and culverts upon the roads in said area and the bridge on the west side of the river at Brownell's and the triangular piece of land on the west side at the junction of Beech road and the west side highway. The town shall have the right to remove and use the material from any of the cul-

verts on the abandoned roads. Upon performance by said town as hereinbefore described said district shall pay to said town the agreed sum of twenty thousand five hundred dollars.

SEC. 16. Said district may begin to exercise forthwith the rights herein granted to take property by purchase or otherwise.

SEC. 17. The provisions of an agreement dated April 18, 1949, between The Metropolitan District and The Allied Connecticut Towns, Incorporated, so far as they are beyond the corporate powers of either party thereto, are ratified and confirmed and made obligatory upon the said parties. The provisions of said agreement shall become effective only upon the effective date of this act.

*Certified as correct by*

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*Engrossing Clerk.*

---

*President of the Senate.*

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*Speaker of the House.*

Approved \_\_\_\_\_, 1949.

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*Governor.*

Substitute House Bill No. 8351

**SPECIAL ACT NO. 75-55**

**AN ACT CONCERNING THE POWERS OF THE METROPOLITAN DISTRICT RESPECTING WATER.**

Number 141 of the special acts of 1963 is repealed and the following is substituted in lieu thereof:

No riparian owner on said Farmington river below said proposed dam authorized by section 1 hereof shall be required, in order to reserve his rights, to assert any claim for loss or damage arising from the construction of said dam and said new reservoir prior to the time when water is actually diverted from said reservoir for use in the water system of said district and the failure to assert such a claim for loss or damage prior to the actual diversion of said water from said west branch of said river shall not constitute laches or waiver or a bar by limitation of time. Before said district shall divert from said reservoir any of the water of said west branch of said river for use in the water system of said district it shall either agree with riparian owners on said Farmington river below the dam of said reservoir upon the compensation to be made to them in lieu of damages by reason of such diversion or it shall by condemnation proceedings acquire the right to divert said water and make just compensation for the water so diverted to any of such riparian owners with whom no agreement for such compensation has been made. THE DISTRICT SHALL PASS [The] A minimum flow through or over the dam of the [proposed] Hogback reservoir AND SAID MINIMUM FLOW shall not be allowed to fall below fifty cubic feet per second regardless of the actual natural minimum flow. WATER RELEASED BY THE ARMY CORPS OF ENGINEERS AT THE REQUEST OF THE CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION FROM THE TWO FISHERIES STORAGE POOLS BEHIND THE COLEBROOK RIVER DAM SHALL NOT BE COUNTED AS PART OF THE DISTRICT'S LOW FLOW OBLIGATION. IN ORDER TO PROVIDE WATER TEMPERATURES SUITABLE FOR SALMONID FISHES BETWEEN MAY 15 AND SEPTEMBER 30 OF EACH YEAR, THE DEPARTMENT OF ENVIRONMENTAL PROTECTION SHALL DETERMINE ON MONDAY OF EACH WEEK, DURING SAID PERIOD, THE MANNER BY WHICH THE MINIMUM FLOW OBLIGATION OF THE DISTRICT AND THE WATER RELEASES OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION SHALL BE RELEASED AT THE HOGBACK DAM. THE DEPARTMENT OF ENVIRONMENTAL PROTECTION MAY REQUIRE THAT THESE RELEASED WATERS BE PASSED OVER OR THROUGH THE DAM OR ANY COMBINATION OF THESE TWO METHODS.

Approved June 30, 1975

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ADDENDUM

(Minutes of The Metropolitan District Commission, July 10, 1961).

Water Bureau

RIPARIAN AGREEMENT

The Farmington River Power Company

The Collins Company

The Hartford Electric Light Company

The Riparian Company

At its meeting held on June 5, 1961, the District Board approved and authorized the District Chairman to sign a revised agreement with The Riparian Owners.

On July 13, 1961, this revised agreement was signed by all concerned, a copy of which follows:

RIPARIAN AGREEMENT

MEMORANDUM OF AGREEMENT made and concluded this 13th day of July, 1961, by and between The Metropolitan District, a municipal corporation organized and existing under Special Acts of the General Assembly of the State of Connecticut and having territorial limits within the County of Hartford, State of Connecticut, party of the first part, (hereinafter called the "District"); and The Collins Company, The Farmington River Power Company, The Hartford Electric Light Company and The Riparian Company, Connecticut corporations, jointly and severally parties of the second part (hereinafter called the "Riparian Owners" or "Owners"):

Whereas, The District is charged under said several acts with the duty of supplying to the inhabitants of said district and to certain other towns and persons water for domestic and other purposes; and

Whereas, two certain contracts and one Memorandum of Agreement now exist: one contract dated May 1, 1911 by and between The Board of Water Commissioners of the City of Hartford of the State of Connecticut and The Collins Company, The Union Water Power Company and its Lessees, and The Farmington River Power Company; and the other contract dated October 13, 1925 by and between said Water Commissioners and The Collins Company, The Union Electric Light and Power Company, The Farmington River Power Company, and The Riparian Company; and the Memorandum of Agreement dated March 31, 1931 by and between the Metropolitan District and Landers, Frary and Clark, The Collins Company, The Union Electric Light and Power Company, and The Farmington River Power Company; and

Whereas, the District has assumed the performance and obligations under said contracts of said Board of Water Commissioners; and

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Whereas, the purpose of said contracts and of said Memorandum of Agreement was to assure to said Riparian Owners and to the inhabitants of the Farmington River Valley a proper and equitable supply of water through the Farmington River and its tributary streams for commercial and other purposes; and

Whereas, there now exist on the Farmington River watershed two reservoirs primarily for District water supply purposes: Nepaug Reservoir on Nepaug River and on Phelps Brook, (tributaries of the Farmington River); and Barkhamsted Reservoir on the East Branch of the Farmington River; and

Whereas, there now exist on the East Branch of the Farmington River a compensating reservoir at Richard's Corner, and a reservoir on the West Branch at Hogback for compensation in kind and ultimately for water supply purposes; and

Whereas, Special Act No. 444 of 1949 of the General Assembly of the State of Connecticut restricts the impounding of the natural flow of the West Branch of the Farmington River at the dam of the Hogback Reservoir to flows in excess of 150 cubic feet per second above the dam site exclusive of any water discharged from the Otis Reservoir watershed; and said Special Act No. 444 specifies that the minimum flow shall not be allowed to fall below 50 cubic feet per second through or over the dam regardless of the actual natural minimum flow; and

Whereas, it is expected that the diversion of water from the said reservoirs and the restrictions noted in said Special Act No. 444 will result in damage to the Riparian Owners at their several mill sites along the Farmington River below the confluence of the East and West Branches thereof; and

Whereas, in the opinion of the parties the ascertainment of these damages in cash will be long, difficult and expensive; and

Whereas, instead of defraying said damages in cash, it is proposed to control the flow of water in said Farmington River by creating a regulated flow, at the cost of the District, through the operation of the Nepaug, the Barkhamsted, the East Branch Compensating and the Hogback Reservoirs; all of which will be in the nature of compensation in kind and in lieu of any cash damages to which the Riparian Owners may be entitled, as well as affording such improvement to the river that the entire community will be benefited; and

Whereas, the District, for its corporate purposes, now desires to enter into a new agreement with the Riparian Owners because certain conditions of the Memorandum of Agreement of March 31, 1931 cannot be met by reason of the restrictions contained in said Special Act No. 444, and because of the impracticability of fulfilling the terms of said Memorandum of Agreement regarding drainage area tributary to the specified compensating reservoirs;

NOW THEREFORE, It is agreed:

- 
1. The parties intend by this Agreement to amend the said two contracts and Memorandum of Agreement, and hereby do amend said contracts and Agreement, to the extent necessary to enable the District to provide compensation in kind to the Riparian Owners instead of immediate cash payments, and by improving the river to secure lasting benefits to the community. The agreements, obligations, and performances on the part of the District hereinafter set forth shall inure to the benefit of and be binding in favor of each of the said Riparian Owners, severally, and their respective successors and assigns, owners of the water powers now owned by them.
  2. Subject to the limitations hereinafter contained, compensation shall be made by the District to the Riparian Owners through the regulation of flows of water in the Farmington River in the amounts and at the time directed by the Riparian Owners.
  3. The total annual amount of such compensation to be made by the District to the Riparian Owners shall be not less than 21.7 billion gallons of water, delivered subject to the following conditions:
    - a. Between May 15 and October 31 (both dates inclusive) the District is not obligated to deliver more than 17.4 billion gallons of water. However, nothing herein shall preclude delivery of an additional 0.6 billion gallons in this period by mutual agreement. This additional amount over 17.4 billion gallons shall be credited against the total delivery of 21.7 billion gallons for the water year.
    - b. Between November 1 and March 15 of the following year (both dates inclusive) the District is not obligated to deliver more than the total of 4.3 billion gallons of water, and the difference between the amount of compensating water delivered by the District in the preceding May 15 - October 31 period and 17.4 billion gallons of water. However the amount of this difference shall not exceed 3 billion gallons in any single period.
    - c. Between March 16 and May 14 of any year (both dates inclusive) the District is not obligated to deliver any water.
    - d. The District is not obligated to deliver more than 2.0 billion gallons of water in any calendar week nor more than 400 million gallons in any one day. For the purposes of this agreement a day is defined as the twenty-four hour period beginning at 12:01 o'clock A.M.
    - e. The District is not obligated to deliver compensating water at any time at a rate in excess of 800 million gallons of water per day.
    - f. The compensating water to be delivered by the District to the Riparian Owners shall be from the Nepaug Reservoir, the Barkhamsted Reservoir, the East Branch Compensat-



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ing Reservoir, and/or the Hogback Reservoir, at the discretion of the District, and shall be delivered to the Riparian Owners and shall be deemed delivered to the Riparian Owners immediately below the dam of the Nepaug Reservoir, the East Branch Compensating Reservoir, and/or the Hogback Reservoir, as the case may be.

- g. The District, at its cost, shall obtain and furnish such data and shall keep such records as shall be reasonably necessary to enable the parties hereto to determine performance under this agreement. The District will provide the Riparian Owners with copies of such records as the Riparian Owners shall request.
4. The delivery of water by the District in accordance with paragraph 3 above shall be in the nature of compensation in kind and in lieu of any cash damages to which the Riparian Owners may now be entitled, as well as affording such improvement to the river that the entire community will be benefited. In the event of termination of this agreement, as hereinafter provided, the Riparian Owners shall not be deemed to have waived any rights with respect to the kind or amount of compensation to which they are entitled. The acceptance by the Riparian Owners of compensation in kind, pursuant to this agreement, is based upon the presently existing dams and reservoirs of the District and the watershed supporting each such reservoir, except as provided for in paragraph 8.
5. If, on demand, the District fails to deliver at least 17.4 billion gallons of compensating water in the period May 15 through October 31 or the total amount of compensating water which the District is obligated to deliver in the period November 1 through March 15, the District shall compensate the Riparian Owners as soon as possible after demand by the Riparian Owners with electrical energy or cash, computed on each Owner's costs to obtain an amount of electrical energy equivalent to the amount of electrical energy which could have been generated by that Owner with the compensating water which the District had failed to deliver. If for three consecutive periods of May 15 through March 15, the District, on demand, fails to deliver a total of at least 17.5 billion gallons of water per each ten month period, such failure shall indicate the District's inability to fulfill this agreement and the Riparian Owners shall have any and all rights which they now or in the future may have, including without limitation the right to terminate this agreement. The District, moreover, shall compensate the Riparian Owners, with electrical energy or cash as provided in this paragraph.
5. Construction or any other work of the United States Government or the State of Connecticut which prevents the District

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from delivering at least 17.5 billion gallons in a ten month period of May 15 through March 15 will not be considered an inability on the part of the District to perform under this agreement and such ten month period will not be considered in computing the three consecutive ten month periods hereinabove described, but the District shall be obligated to compensate the Riparian Owners with electrical energy or cash as hereinabove described.

6. If the Riparian Owners do not call on the District to deliver the amounts of water to which the Owners are entitled under this agreement, then the Owners shall have forfeited for that particular water-year (May 15 through March 15) only the water not demanded.
7. Nothing in this agreement shall prevent the District from furnishing all the water required for the needs of its inhabitants and of others who may be entitled thereto, from any or all of the reservoirs listed hereinbefore; and if, in a year of subnormal run-off, it shall become absolutely necessary, in order to supply water to the inhabitants of any territory served by said District for drinking or sanitary purposes, or for such uses as in accordance with present practice would be permitted in times of drought, delivery to the Riparian Owners may be temporarily reduced below 21.7 billion gallons of water as hereinbefore set forth, but in any such case compensation shall be made as provided for in Paragraph 5.
8. Nothing in this agreement shall prevent the District from entering into an agreement with the United States Government or the State of Connecticut for the construction of the dual purpose reservoir (presently under consideration) on the West Branch of the Farmington River upstream from the present Charles A. Goodwin dam; nor shall it prevent the District from constructing a tunnel in transmitting therein water from the Hogback Reservoir to the Barkhamsted Reservoir. The completion of one or both of these projects shall not confer on the Riparian Owners the right of requesting a renegotiation of the agreed upon amounts of water as set forth hereinbefore, but shall not relieve the District from its obligation to deliver not less than 21.7 billion gallons of water as hereinabove set forth or the compensation in lieu thereof as described in paragraph 5 above. The provisions of this paragraph 8 shall not operate as a limitation of the rights retained by the Riparian Owners as described in Paragraph 10 herein.
9. The direction as to amounts and time of delivery of compensation water shall be by the Riparian Owners, who for said purpose may act through the agency of The Riparian Company, (who for such purpose has executed this agreement), or of some similar agent as may be appointed by the Riparian

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Owners. The District shall retain the right of choice of source of such compensation water as specified in paragraph 3 and the right to enforce such limitations on operation as are provided herein and as may be reasonably necessary for the protection of its works.

10. The Riparian Owners agree to waive and do hereby waive all their rights at common law and under the provisions of said contracts dated May 1, 1911 and October 13, 1925 and of said Memorandum of Agreement dated March 31, 1931, in respect to the free flow of the East Branch of the Farmington River above the Richard's Corner dam; and to the free flow of the West Branch of the Farmington River above the Charles A. Goodwin dam except for the discharge from the Otis Reservoir watershed and except for the natural flows of the stream up to 150 cubic feet per second at the said Charles A. Goodwin dam, as long as the District, or its successors, shall fully comply with and perform the provisions of this Agreement. This waiver shall not operate to prevent the assertion of any or all such rights by the Riparian Owners if the District defaults in its performance of the provisions of this agreement, and such default shall continue for an unreasonable period.

IN WITNESS WHEREOF, the Parties hereto have hereunto caused this Agreement to be duly executed and their respective corporate seals affixed, by their duly authorized officers, in quintuplicate, at Hartford, Connecticut on the day and year first above written.

THE METROPOLITAN DISTRICT  
By EDWARD J. McDONOUGH, JP.

THE FARMINGTON RIVER POWER COMPANY  
By ALLEN MOORE, President

THE COLLINS COMPANY  
By CLAIR M. ELSTON, President

THE HARTFORD ELECTRIC LIGHT COMPANY  
By H. WARREN LAWRENCE, Vice President

THE RIPARIAN COMPANY  
By H. BISSELL CAREY, President

METROPOLITAN DISTRICT

HARTFORD COUNTY, CONNECTICUT

6/AH/BO

From: Executive Engineer

District Clerk

SUBJECT: The Collins Co. -  
Release

copy  
WATER BUREAU  
ENGINEERING OFFICE

Date: February 13, 1967

Copy to: HAP, MJL, G.d'Av., F-7

File: 152-H

Attached for District files is a copy of a Release of riparian and other water rights in the Farmington River from The Collins Co. to The Metropolitan District.

Please acknowledge receipt on the enclosed copy of this memorandum and return to A. Helt.

*Henry A. Phillips*  
Henry A. Phillips,  
Executive Engineer

Attach.

*[Handwritten initials]*

RELEASE

KNOW ALL MEN BY THESE PRESENTS, That THE COLLINS COMPANY, a corporation organized and existing under the laws of the State of Connecticut, with its principal office in the Town of Canton, Hartford County, Connecticut (hereinafter sometimes called "the Releasor"), for divers good causes and considerations thereunto moving, especially one dollar (\$1.00) received to its full satisfaction of THE METROPOLITAN DISTRICT, a municipal corporation specially chartered by the General Assembly of the State of Connecticut, with its principal office in the Town of Hartford, Hartford County, Connecticut (hereinafter sometimes called "the District"), does by these presents for itself and its successors release and relinquish unto the said THE METROPOLITAN DISTRICT, its successors and assigns forever, all such rights and privileges as it the said The Collins Company has under and by virtue of (1) a certain Memorandum of Agreement dated July 13, 1961 by and between the said The Metropolitan District, as party of the first part, and the said The Collins Company, The Farmington River Power Company, The Hartford Electric Light Company and The Riparian Company, as parties of the second part, (2) a certain Memorandum of Agreement dated March 31, 1931 by and among the said The Metropolitan District, Landers, Frary & Clark, the said The Collins Company, The Union Electric Light and Power Company and The Farmington River Power Company, (3) a certain contract dated October 13, 1925 by and among The Board of Water Commissioners of the City of Hartford of the State of Connecticut, the said The Collins Company, The Union Electric Light and Power Company, The Farmington River Power Company and The Riparian Company, and (4) a certain contract dated May 1, 1911 by and among The Board of Water Commissioners of the City of Hartford of the State of

Connecticut, the said The Collins Company, The Union Water Power Company and its Lessees, and The Farmington River Power Company, including, but not limited to, any rights and privileges under any of such Memorandums of Agreement or contracts with respect to (a) discharges from the District's reservoirs, including natural stream flows up to 150 cubic feet per second at the Charles A. Goodwin Dam, (b) discharges from the Otis Reservoir and (c) payment in the form of electrical energy or cash, insofar as such rights and privileges apply to landholdings of the Releasor along the Farmington River in the Towns of Canton, Burlington and Avon, being all of the landholdings of the Releasor along the said Farmington River.

Together with any and all rights that the Releasor may have to divert or impound water on lands (1) on the watershed of the District's Nepaug Reservoir, (2) on the watershed of the East Branch of the Farmington River and its tributaries above the District's Richards Corner Dam, which dam is situated in the Town of New Hartford and (3) on the watershed of the West Branch of the Farmington River and its tributaries above the District's Goodwin Dam, which dam is situated in the Town of Hartland.

IN WITNESS WHEREOF, THE COLLINS COMPANY has caused these presents to be executed in its corporate name by its President, hereunto duly authorized, and its corporate seal to be affixed hereto this 9<sup>th</sup> day of February, 1967.

Signed, sealed and delivered  
in the presence of:

THE COLLINS COMPANY

Clair M. Elston

Clair M. Elston

By Clair M. Elston  
Clair M. Elston, President

STATE OF CONNECTICUT )  
: ss.: Canton, February 7, 1967  
COUNTY OF HARTFORD )

On this the 7<sup>th</sup> day of February, 1967, before me  
Elliott C. Miller, the undersigned officer, personally appeared  
CLAIR M. ELSTON, who acknowledged himself to be the President of  
The Collins Company, a corporation, and that he, as such President,  
being authorized so to do, executed the foregoing instrument for  
the purposes therein contained, by signing the name of the corpo-  
ration by himself as President.

In witness whereof, I hereunto set my hand.

Elliott C. Miller

Notary Public

My Commission expires March 31, 1967

2/7/1967 Not necessary to record per last part of file -

150-14

LAW OFFICES

ROBINSON, ROBINSON & COLE

750 MAIN STREET

HARTFORD, CONNECTICUT 06103

TELEPHONE 249-5821

AREA CODE 203

LUCIUS F. ROBINSON, JR.  
ERNEST MCCORMICK  
JOHN C. PARSONS  
WILLIAM W. FISHER  
FRANK CHAPMAN  
WILLIAM K. COLE  
BRUCE W. MANTERNACH  
CHARLES J. COLE  
HENRY S. ROBINSON, JR.  
LEE C. FIELDEN  
LUCIAN E. BALDWIN  
JOHN M. DONAHUE  
REGINALD E. FRANCKLYN  
GEORGE C. HASTINGS  
R. REONER ARVIDSON  
JOHN W. HINCKS

March 17, 1967

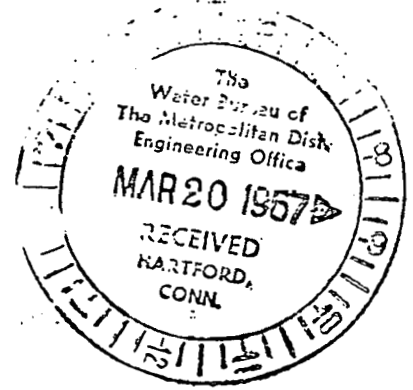
*MR*  
LUCIUS F. ROBINSON  
1887-1941

JOHN T. ROBINSON  
1896-1937

COUNSEL

FRANCIS W. COLE  
BARCLAY ROBINSON

ELLIOTT C. MILLER  
EDWARD F. HENNESSEY, III  
BARCLAY ROBINSON, JR.  
JOHN D. GARRISON, JR.  
ALAN R. SPIER  
JEROME D. ELBAUM  
JAMES A. WADE  
STEVEN R. HUMPHREY



Mr. Gilbert U. Gustafson  
Metropolitan District Commission  
115 Broad Street  
Hartford, Connecticut

Dear Mr. Gustafson:

Enclosed is a certified copy of an excerpt from the minutes of a meeting of the board of directors of The Collins Company held March 10, 1967, ratifying the action of the president in releasing the Company's rights under the riparian agreement dated July 13, 1961.

Very truly yours,

*Lucius F. Robinson*

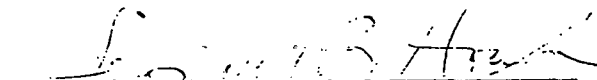
*Handwritten notes on the left margin, including 'MAR 20 1967' and other illegible scribbles.*



THE COLLINS COMPANY  
CERTIFICATE OF SECRETARY

I, L. B. HOUGH, Secretary of The Collins Company, hereby certify that attached hereto is a true copy of a resolution duly adopted by the Board of Directors of The Collins Company at a meeting held March 10, 1967.

IN WITNESS WHEREOF, I hereunto set my hand this  
16th day of March, 1967.

  
Secretary

RESOLVED: That the actions of the President in executing in favor of and delivering to The Metropolitan District, for a consideration of \$25,000, a release dated February 9, 1967 of all of the Company's rights and privileges under a certain Memorandum of Agreement dated July 13, 1961, between the said The Metropolitan District and certain so-called "Riparian Owners" including the Company, are hereby ratified and confirmed as the actions of the Company.

TABLE J-26

PERTINENT DATA  
HARTFORD METROPOLITAN DISTRICT RESERVOIRS  
FARMINGTON RIVER WATERSHED

<u>Item</u>	<u>Unit</u>	<u>Barkhamsted</u>	<u>East Branch</u>	<u>Nepaug</u>	<u>West Branch</u>
Drainage Area	Sq. mi.	53.8	7.4	31.9	120
Storage Capacity	Mil. gal.	31,761	2,938	9,684	2,900 <sup>(1)</sup>
Surface Area at Spillway Crest	Acres	2,276	390	851	200 <sup>(1)</sup>
Spillway					
Elevation	Ft, msl	530.0	420.5	482.5	641.0
Length	Feet	200	302	180	900
Design Flow	Cfs/sq. mi.	500	500	-	800
Tcp of Dam Elevation	Ft, msl	545.0	433.0	494.5	656.0
Storage Use <sup>(2)</sup>		W, C	C, R	W	C, R <sup>(3)</sup>
Location		Barkhamsted, Hartland	New Hartford, Barkhamsted	New Hartford, Burlington, Canton	Colebrook, Hartland
Date of Completion		1940	1920	1918	1960

- (1) Not including portion now stored behind Colebrook River Dam.  
(2) W = Water Supply, C = Riparian Compensation, R = Recreation.  
(3) Future use will include water supply.

TABLE J-22

IRRIGATION DATA  
SUCKER BROOK DAM AND RESERVOIR

<u>LOCATION</u>	Sucker Brook, Winchester, Connecticut
<u>DRAINAGE AREAS</u>	Sucker Brook Dam 3.43 square miles Highland Lake Dam 7.0 square miles Highland Lake Stream 7.3 square miles
<u>RESERVOIR STORAGES</u>	
	<u>Flood Control</u> <u>Pool</u>
Full Pool Elevation (ft, msl)	935.0
Capacity (acre-feet)	1,480
(inches)	8.1
Full Pool Area (acres)	53.5
<u>EMBANKMENT FEATURES</u>	
Type	Rolled earth fill with rock slope protection
Length (ft)	1,160
Top Elevation (ft, msl)	949
Maximum Height (ft)	68
Top Width (ft)	20
Slopes	1 on 2.5 to 1 on 3
<u>SPILLWAY FEATURES</u>	
Type	Chute spillway, ogee weir
Crest Length (ft)	60
Crest Elevation (ft, msl)	935.0
<u>SPILLWAY DESIGN FLOOD</u>	
Peak Inflow (cfs)	6,500
Peak Outflow (cfs)	6,400
Maximum Surge (ft. above crest)	9.2 (El. 944.2) (1)
<u>OUTLET WORKS</u>	
Type	Reinforced concrete
Size of Conduit	3'-0" x 3'-0"
Length of Conduit (ft)	426
Conduit Inlet Invert Elevation (ft, msl)	881.0
Number of Gates	None (2)
Capacity Discharge of Outlet, Reservoir at Spillway Crest (cfs)	115
Downstream Channel Capacity (cfs)	Discharges into Highland Lake
<u>LAND ACQUISITION</u>	
Fee Taking Elevation (ft, msl)	940 (5 ft. above spillway crest) or 300 ft. horizontally from full pool, whichever is greater.
<u>MAXIMUM POOL LEVEL</u>	Dam Not Completed
<u>PROJECT COST</u>	\$2,460,000 (Est.)
<u>DATE OF COMPLETION</u>	June 1970 (Est.)
<u>MAINTAINED BY</u>	State of Connecticut

(1) At maximum surge elevation 944.2 ft, msl, the total storage utilized is 1,995 a.f. (10.9 in.) and area inundated is 61.5 acres.

(2) No flood control gates; a 3' x 3' sluice gate locked in a partially open setting of about one foot to control the desired discharge.

Note: Diverted brook is carried into the reservoir area in a 48" diameter corrugated metal pipe, approximately 530 feet in length.

TABLE J-20

PERTINENT DATA  
MAD RIVER DAM AND RESERVOIR

<u>LOCATION</u>	Mad River, Winchester, Connecticut		
<u>DRAINAGE AREA</u>	18.2 square miles		
<u>RESERVOIR STORAGES</u>			
	<u>Conservation Pool</u>	<u>Flood Control Pool</u>	<u>Total at Spillway Crest</u>
Full Pool Elevation (ft, msl)	872.0	983.0	983.0
Capacity (acre-feet)(net)	190	9,510	9,700
(inches)(net)	0.2	.9.8	10.0
Full Pool Area (acres)	10	188	188
<u>EMBANKMENT FEATURES</u>			
	<u>Main Dam</u>		<u>Dike</u>
Type	Rolled earth fill with rock slope protection		Rolled earth fill with rock slope protection
Length (ft)	940		2,310
Top Elevation (ft, msl)	996.0		996.0
Maximum Height (ft)	178		60
Top Width (ft)	25		25
Slopes	1 on 2.5		1 on 2.5
<u>SPILLWAY FEATURES</u>			
Type	Chute spillway, ogee weir		
Crest Length (ft)	340		
Crest Elevation (ft, msl)	983.0		
<u>SPILLWAY DESIGN FLOOD</u>			
Peak Inflow (cfs)	30,000		
Peak Outflow (cfs)	29,600		
Maximum Surge (ft. above crest)	8.0 (El. 991.0) (1)		
<u>OUTLET WORKS</u>			
Type	Circular conduit		
Size of Conduit	3'-9" diameter		
Length of Conduit (ft)	923		
Conduit Inlet Invert Elevation (ft, msl)	855.0 (2)		
Number of Gates	None		
Capacity Discharge of Outlet, Reservoir at Spillway Crest (cfs)	550		
Downstream Channel Capacity (cfs)	500-600 (Est.)		
<u>LAND ACQUISITION</u>			
Fee Taking Elevation (ft, msl)	992 (155 acres in fee, 62 acres in easement)		
<u>MAXIMUM POOL LEVEL</u>	April 1969 - 50.3 ft. (905.3 ft, msl)		
<u>PROJECT COST</u>	\$5,440,000		
<u>DATE OF COMPLETION</u>	June 1963		
<u>MAINTAINED BY</u>	State of Connecticut		

(1) At maximum surge elevation 991.0 ft, msl, the total storage utilized is 11,300 a.f. (11.6 in.) and area inundated is 210 acres.

(2) No flood control gates, a 2'-6" x 4'-0" manually operated sluice gate in conservation weir only.

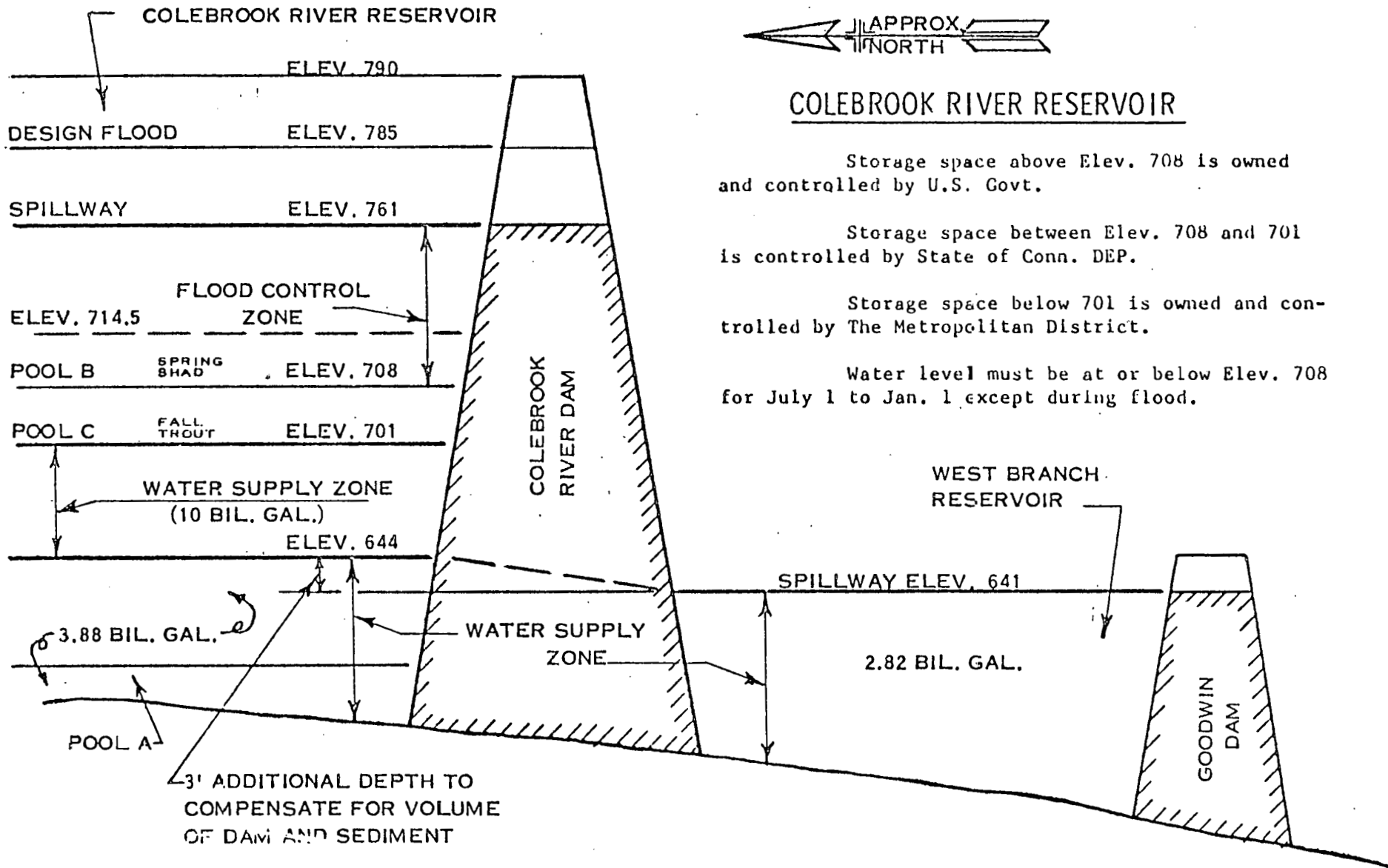
TABLE J-24

PERTINENT DATA  
SCS PROJECTS - CLAM RIVER WATERSHED

<u>Item</u>	<u>Unit</u>	<u>Abbey Lake</u>	<u>Clam* Lake</u>	<u>North Silver Lake</u>	<u>South Silver Lake</u>	<u>West Lake</u>
Drainage Area	sq. mi.	1.75	10.78	3.71	1.08	1.46
Floodwater Storage Capacities	acre feet	327	2310	861	304	340
	inches	3.5	4.0	4.4	5.3	4.4
Principal Spillway Data						
Low stage elevation	ft, msl	1164	1113.3	1302.5	1168	1566
High stage elevation	ft, msl	1168.3	1153	1328	1180	1568
Size of conduit	diameter	36"	66"	48"	30"	36"
Low stage discharge	cfs	28	180	61	27	19
	csm	16	17	16	-	13
High stage discharge	cfs	184	947	463	105	122
	csm	105	88	125	97	84
Emergency Spillway Data						
Crest elevation	ft, msl	1172	1173	1332	1183.5	1571
Crest width	ft.	50	250	100	32	100
Type		Veg.	Veg.	Rock	Veg.	Veg.
Top of Dam Elevation	ft, msl	1179	1181	1341	1191	1575
Maximum Height of Dam	ft.	37	91	71	29	25
Reservoir Storage Use**		R,F	R,F	R,F	F	R,F
Date of Completion		Oct. 1967	Oct. 1972	Oct. 1970	Sept. 1969	Oct. 1967

\*Project still pending

\*\*R = Recreation F = Floodwater



COLEBROOK RIVER RESERVOIR

Storage space above Elev. 708 is owned and controlled by U.S. Govt.

Storage space between Elev. 708 and 701 is controlled by State of Conn. DEP.

Storage space below 701 is owned and controlled by The Metropolitan District.

Water level must be at or below Elev. 708 for July 1 to Jan. 1 except during flood.

- POOL A 5,000 AC - FT = 1.63 BIL. GAL. - HOLDOVER POOL
- POOL B 5,000 AC - FT = 1.63 BIL. GAL. - FISHERY POOL
- POOL C 5,000 AC - FT = 1.63 BIL. GAL. - FISHERY POOL

COLEBROOK RIVER RESERVOIR AND DAM  
Multi-Purpose Storage Zones

01187860 FARMINGTON RIVER AT COLLINSVILLE, CONN.

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant, 6.0 mile south of Collinsville, and at mile 39.8.

DRAINAGE AREA.--354 sq mi.

PERIOD OF RECORD.--November 1962 to September 1970.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft above mean sea level.

AVERAGE DISCHARGE.--7 years (1963-70), 578 cfs (22.14 inches per year), adjusted for storage and diversion.

EXTREMES.--Maximums and minimums (discharge in cubic feet per second, gage height in feet) for the water years 1966-70 are contained in the following table:

Wtr yr	Date	Maximum Discharge	G.H.	Date	Minimum Discharge	G.H.
1966	Mar. 25, 1966	2,850	7.92	Aug. 18, 1966	4.7	2.06
1967	Apr. 4, 1967	2,310	7.38	Sept. 27, 28, 1967	45	-
1968	Mar. 19, 1968	6,720	10.90	Aug. 20, 1968	46	5.02
1969	Aug. 5, 1969	12,200	13.79	Oct. 3, 1968	43	2.83
1970	Apr. 2, 1970	6,700	10.69	Oct. 13, 1969	113	3.41

Period of record: Maximum discharge, 12,200 cfs Aug. 5, 1969 (gage height, 13.79 ft); minimum, 4.7 cfs Aug. 18, 1966 (gage height, 2.06 ft); minimum daily, 5.6 cfs July 11, 1965.  
Flood of Aug. 19, 1953, reached a stage of 35.6 ft, from floodmark (discharge, 140,000 cfs, by slope-area measurement half a mile downstream).

REVISIONS.--Figures of maximum discharge for the water years 1963 and 1964 have been revised to 3,520 cfs Apr. 3, 1963 (gage height, 8.54 ft) and 3,510 cfs Jan. 23, 1964 (gage height, 8.53 ft), superseding figures published in WSP 1901.

REMARKS.--Records good except those for periods of no gage-height record, which are fair. Flow regulated by powerplant until August 1966, by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhausted, East Branch and Nepong Reservoirs (see elsewhere in this report), and by diversion for municipal supply from Barkhausted and Nepong Reservoirs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	100	194	350	300	600	700	464	243	100	41	32
2	62	98	184	370	300	1,140	650	506	179	70	39	27
3	137	95	205	450	300	843	610	439	181	50	42	23
4	108	101	157	500	280	756	605	338	181	50	44	53
5	71	100	159	450	100	822	648	359	117	50	136	244
6	85	62	193	450	80	473	594	325	131	50	27	155
7	67	52	170	400	250	790	640	283	159	50	35	103
8	155	219	120	250	300	607	670	276	220	50	28	79
9	206	154	143	250	300	532	665	403	200	50	27	84
10	123	175	144	250	300	509	605	538	1,100	50	23	60
11	124	182	141	280	400	545	575	402	700	50	13	47
12	112	179	107	250	450	580	564	354	490	89	60	46
13	119	94	194	210	600	498	550	501	300	91	48	44
14	119	76	320	260	1,200	489	530	487	320	40	21	45
15	110	104	361	159	1,150	494	523	409	260	68	19	62
16	159	180	400	69	1,050	431	521	349	270	49	14	82
17	153	163	350	129	1,000	419	485	342	230	39	60	77
18	120	179	200	174	650	499	493	320	180	35	48	47
19	114	135	200	182	400	688	480	409	160	87	36	64
20	107	104	300	198	250	1,090	423	551	170	161	34	50
21	98	91	300	191	300	1,150	462	512	180	94	30	92
22	78	124	270	152	300	1,110	459	532	140	70	28	564
23	98	175	260	109	330	1,040	437	540	125	52	33	364
24	112	146	200	100	289	1,320	554	508	125	44	43	41
25	96	129	110	300	245	2,100	937	437	125	44	42	23
26	80	142	200	300	255	1,850	694	359	120	48	43	132
27	70	142	500	300	233	1,300	530	325	115	59	37	110
28	84	420	600	280	243	875	424	322	90	68	31	81
29	75	322	550	95	---	853	374	314	50	66	32	74
30	70	273	500	120	---	737	397	289	100	42	28	142
31	80	---	450	200	---	691	---	252	---	48	35	---
TOTAL	3,182	4,488	8,208	7,774	11,875	24,781	16,801	12,449	6,921	1,936	1,294	3,051
MEAN	103	150	265	251	424	804	560	402	231	63.1	41.7	102
MAX	206	420	600	900	1,200	2,100	937	551	1,100	161	153	564
MIN	28	74	107	69	80	419	376	752	90	35	13	23
MEAN*	152	150	284	261	502	1,220	750	565	315	59.6	42.2	149
CFS**	.43	.42	.80	.74	1.42	3.45	2.12	1.65	.89	.17	.12	.42
IN.**	.50	.47	.92	.85	1.48	3.98	2.36	1.90	.89	.19	.14	.47

CAL YR 1965 TOTAL 72,341.6 MEAN 194 MAX 1,200 MIN 5.4 MEAN\* 262 CFS\*\* .74 IN\* 10.05  
WTR YR 1966 TOTAL 104,742.0 MEAN 287 MAX 2,100 MIN 13 MEAN\* 372 CFS\*\* 1.35 IN\* 14.25

\* Adjusted for diversions from and change in contents in lakes and reservoirs listed in REMARKS paragraph of station description.

NOTE.--No gage-height record Dec. 16 to Jan. 14, Jan. 23 to Feb. 23, June 8 to July 11.



0118780 FARMINGTON RIVER AT COLLINSVILLE, CONN.--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1966 TO SEPTEMBER 1967

Table with columns for months (MAY, OCT, NOV, DEC, JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP) and rows for years 1966 and 1967. Includes summary statistics like TOTAL, MEAN, MAX, MIN, and CFS#.

at abandoned hydroelectric plant.
adjusted for storage and diversion.
height in (feet) for the water years
Minimum Discharge G.M.
0. 1966 4.7 2.06
7. 21, 1967 88
1. 1968 46 3.02
1. 1968 43 2.83
1. 1968 125 3.41

Table with columns for months (MAY TO SEPTEMBER 1966) and rows for various years (1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030).

CAL YR 1966 TOTAL 135,429 MAX 2,100 MIN 13 MEAN 371 MEAN# 458 CFS# 1.29 IN# 17.57
WTR YR 1967 TOTAL 182,754 MAX 2,150 MIN 65 MEAN 501 MEAN# 631 CFS# 1.78 IN# 24.16

\*Adjusted for diversions from and change in contents in lakes and reservoirs listed in REMARKS paragraph of station description.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

Table with columns for months (MAY, OCT, NOV, DEC, JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP) and rows for years 1967 and 1968. Includes summary statistics like TOTAL, MEAN, MAX, MIN, and CFS#.

CAL YR 1967 TOTAL 181,086.0 MEAN 498 MAX 2,300 MIN 45 MEAN# 641 CFS# 1.81 IN# 24.57
WTR YR 1968 TOTAL 200,444.0 MEAN 548 MAX 2,300 MIN 45 MEAN# 642 CFS# 1.81 IN# 24.40

\* Adjusted for diversions from and change in contents in lakes and reservoirs listed in REMARKS paragraph of station description.
NOTE:--No gage-height record Nov. 14 to Dec. 20.

reservoirs listed in REMARKS paragraph of
to July 11.



CONNECTICUT RIVER BASIN

61187980 Farmington River at Collinsville, Conn.

LOCATION.--Lat 41°47'57", Long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant; three quarters of a mile south of Collinsville, and at mile 39.8.

DRAINAGE AREA.--354 sq mi.

PERIOD OF RECORD.--November 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft above mean sea level.

AVERAGE DISCHARGE (adjusted for storage and diversion).--8 years, 577 cfs (22.10 inches per year).

EXTREMES.--Current year: Maximum discharge, 2,370 cfs May 14 (gage height, 7.46 ft); minimum 76 cfs Aug. 10 (gage height, 3.11 ft).

Period of record: Maximum discharge, 12,200 cfs August 5, 1969 (gage height, 13.79 ft); minimum 4.7 cfs August 18, 1966 (gage height, 2.06 ft); minimum daily, 5.6 cfs July 11, 1955.

Flood of August 19, 1955, reached a stage of 35.6 ft from floodmark (discharge, 140,000 cfs, by slope-area measurement half a mile downstream).

REMARKS.--Records good. Flow regulated by Otis Reservoir, Colebrook River Reservoir, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. 83), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	151	174	159	243	300	885	651	820	505	514	200	472
2	143	232	288	249	270	773	770	618	358	504	400	508
3	144	221	204	255	250	688	1,580	864	368	400	250	507
4	148	316	267	252	240	641	1,460	1,330	363	300	100	497
5	155	235	350	340	230	624	1,060	1,120	330	150	90	469
6	158	197	350	391	225	561	798	740	275	150	90	491
7	150	167	300	301	220	567	793	755	291	365	100	488
8	313	124	250	252	250	698	944	773	296	370	200	525
9	327	136	300	238	280	888	715	1,140	363	351	100	699
10	307	163	350	218	320	834	905	1,710	297	344	77	710
11	291	170	400	222	370	761	928	1,190	218	345	92	702
12	298	182	400	208	300	765	1,240	649	252	357	100	796
13	322	226	350	185	260	750	1,410	1,090	115	348	150	771
14	311	351	400	166	240	737	1,610	1,800	160	339	150	1,070
15	310	358	400	227	784	748	1,550	1,360	300	327	140	527
16	407	268	329	210	668	824	1,450	1,020	280	325	130	338
17	312	172	291	202	559	941	1,150	1,350	250	340	130	300
18	264	154	320	198	500	831	895	1,260	300	348	127	150
19	313	192	294	190	460	750	940	901	250	347	110	110
20	257	282	291	180	462	716	1,200	661	120	352	97	250
21	272	280	290	170	521	670	1,280	719	200	347	95	250
22	229	161	266	160	506	640	1,110	731	200	355	97	709
23	443	231	306	150	554	638	841	689	250	299	93	736
24	406	250	291	180	540	568	737	630	200	150	87	689
25	304	200	281	210	607	436	637	580	430	166	87	635
26	271	150	267	228	560	440	750	559	430	166	150	609
27	255	300	260	250	872	417	724	491	427	166	494	653
28	200	250	267	265	978	420	731	455	419	110	1,290	662
29	170	300	267	270	-----	501	1,020	440	423	180	811	652
30	143	206	263	250	-----	620	1,170	395	424	300	629	610
31	137	-----	258	230	-----	634	-----	466	-----	250	512	-----
TOTAL	7,911	6,648	9,309	7,090	12,326	20,966	31,129	27,306	9,094	9,365	7,178	16,585
MEAN	255	222	300	229	440	676	1,038	881	303	302	232	553
MAX	443	358	400	391	978	941	1,610	1,800	505	514	1,290	1,070
MIN	137	124	159	150	220	417	637	395	115	110	77	110
(1)	-69	+167	+21	+112	+210	+242	+922	+295	-98	-203	+4	-148
MEAN#	186	389	321	341	650	918	1,960	1,176	205	99	236	405
CFSM#	0.53	1.10	0.91	0.96	1.84	2.59	5.54	3.33	0.58	0.28	0.67	1.14
INH.	0.61	1.23	1.05	1.11	1.92	2.99	6.18	3.84	0.65	0.32	0.77	1.27

CAL YR 1970 TOTAL 207,312 MEAN 568 MAX 4,590 MIN 124 MEAN# 619 CFSM# 1.75 IN# 23.59  
 WTR YR 1971 TOTAL 164,907 MEAN 452 MAX 1,800 MIN 77 MEAN# 572 CFSM# 1.42 IN# 21.22

Change in contents in Otis Reservoir, Colebrook River Reservoir, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second; furnished by the Metropolitan District Commission, Corps of Engineers, Union Pin Company, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

#Adjusted for change in contents and diversion.

CONNECTICUT RIVER BASIN

01187980 Farmington River at Collinsville, Conn.

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant three quarters of a mile south of Collinsville, and at mile 39.8.

DRAINAGE AREA.--360 sq mi (revised).

PERIOD OF RECORD.--November 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 285.22 ft above mean sea level.

AVERAGE DISCHARGE (adjusted for storage and diversion).--9 years; 625 cfs (23.56 inches per year).

EXTREMES.--Current year: Maximum discharge, 6560 cfs June 30 (gage height, 10.80 ft); minimum daily 150 cfs Aug. 21.

Period of record: Maximum discharge, 12,200 cfs August 5, 1969 (gage height, 13.79 ft); minimum, 4.7 cfs August 18, 1966 (gage height, 2.06 ft); minimum daily, 5.6 cfs July 11, 1965.

Flood of August 19, 1955 reached a stage of 35.6 ft from floodmark (discharge, 140,000 cfs by slope-area measurement half a mile downstream).

REMARKS.--Records good. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. 64), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	609	430	782	502	374	832	728	1,800	2,200	3,420	238	519
2	601	526	607	632	362	853	1,030	1,500	1,750	2,100	216	507
3	580	574	500	734	363	1,760	909	1,100	1,440	2,330	250	498
4	580	433	439	735	790	1,290	795	1,000	1,550	3,370	287	491
5	603	391	371	757	647	736	758	1,400	2,070	2,850	212	494
6	583	366	372	553	530	740	689	1,300	1,620	2,750	200	503
7	570	400	801	561	466	721	614	1,400	1,610	2,840	198	504
8	562	459	1,290	477	417	811	775	1,500	1,410	3,040	303	499
9	553	419	760	442	411	689	726	1,300	1,270	3,020	240	491
10	933	388	728	782	357	661	731	1,250	2,470	2,790	220	476
11	1,190	370	989	766	329	579	698	1,250	1,690	2,580	190	470
12	803	340	975	811	306	588	725	1,250	1,380	2,440	173	494
13	699	310	742	796	633	738	1,060	1,200	1,340	2,100	156	509
14	707	290	726	840	1,710	721	1,620	1,000	1,130	1,720	350	515
15	530	280	685	728	964	711	1,410	780	1,060	1,330	802	455
16	429	310	739	538	736	670	1,140	1,300	799	1,030	379	478
17	404	330	611	525	664	1,380	2,130	1,900	652	905	254	497
18	371	310	734	566	595	2,070	2,590	2,200	690	805	216	503
19	286	300	521	567	584	2,500	2,440	1,700	942	449	210	585
20	282	290	587	551	554	1,520	3,950	1,400	1,120	412	163	554
21	352	260	565	525	520	1,190	2,930	1,200	840	377	150	524
22	366	275	574	507	506	2,000	2,230	1,000	1,450	328	250	522
23	471	270	605	483	597	3,790	2,770	900	2,300	329	475	509
24	481	265	706	569	817	2,500	2,760	800	4,190	316	455	496
25	600	260	735	685	734	1,750	2,730	700	2,640	283	497	503
26	595	320	665	686	720	1,350	3,000	540	2,350	257	482	514
27	483	310	645	573	773	1,010	2,770	479	2,290	215	435	533
28	425	355	753	524	779	768	2,600	435	2,370	192	619	507
29	431	488	775	483	804	761	2,300	394	2,080	175	541	506
30	425	1,390	705	427	-----	935	2,100	361	3,910	175	518	516
31	359	-----	670	386	-----	823	-----	583	-----	168	532	-----
TOTAL	16,863	11,729	21,622	18,791	18,062	37,447	51,708	34,922	52,613	45,149	10,292	15,172
MEAN	544	391	697	606	623	1,208	1,724	1,127	1,754	1,456	332	506
MAX	1,190	1,390	1,290	840	1,710	3,790	3,950	2,200	4,190	3,420	802	585
MIN	282	260	371	386	306	579	614	361	652	168	150	455
( $\pm$ )	-154	+89	+488	+203	+65	+366	+259	+116	+265	-186	-87	-376
MEAN $\pm$	390	480	1,185	809	688	1,574	1,983	1,243	2,019	1,270	245	130
CFSM $\pm$	1.08	1.33	1.29	2.24	1.91	4.37	5.51	3.45	5.61	3.53	0.68	0.36
IN $\pm$	1.24	1.48	3.73	2.58	2.06	5.04	6.15	3.98	6.26	4.07	0.78	0.40

CAL YR 1971 TOTAL 191,253 MEAN 524 MAX 1,800 MIN 77 MEAN  $\pm$  635 CFSM  $\pm$  1.76 IN  $\pm$  24.16  
 NTR YR 1972 TOTAL 334,370 MEAN 914 MAX 4,190 MIN 150 MEAN  $\pm$  1,002 CFSM  $\pm$  2.78 IN  $\pm$  37.84

†Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second, furnished by the Metropolitan District Commission, Corps of Engineers, Union Pin Company, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

‡Adjusted for change in contents and diversion.

CONNECTICUT RIVER BASIN

01187980 Farmington River at Collinsville, Conn.

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant three quarters of a mile (1.21 km) south of Collinsville, and at mile 39.8 (64.0 km).

DRAINAGE AREA.--360 mi<sup>2</sup> (932 km<sup>2</sup>).

PERIOD OF RECORD.--November 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft (74.741 m) above mean sea level.

AVERAGE DISCHARGE (adjusted for storage and diversion).--10 years. 664 ft<sup>3</sup>/s (18.80 m<sup>3</sup>/s), 25.03 in/yr (636 mm/yr).

EXTREMES.--Current year: Maximum discharge, 6,740 ft<sup>3</sup>/s (191 m<sup>3</sup>/s) Feb. 2, gage height, 10.91 ft (3.325 m); minimum daily, 168 ft<sup>3</sup>/s (4.76 m<sup>3</sup>/s) Aug. 1.

Period of record: Maximum discharge, 12,200 ft<sup>3</sup>/s (346 m<sup>3</sup>/s) Aug. 5, 1969, gage height, 13.79 ft (4.203 m); minimum, 4.7 ft<sup>3</sup>/s (0.13 m<sup>3</sup>/s) Aug. 18, 1966, gage height, 2.06 ft (0.628 m); minimum daily, 5.6 ft<sup>3</sup>/s (0.16 m<sup>3</sup>/s) July 11, 1965

Flood of Aug. 19, 1955, reached a stage of 35.6 ft (10.85 m), from floodmark; discharge, 140,000 ft<sup>3</sup>/s (3,960 m<sup>3</sup>/s) by slope-area measurement 0.5 mi (0.8 km) downstream.

REMARKS.--Records good. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. 67), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	504	601	1,450	2,450	421	813	1,000	417	994	2,320	168	554
2	446	252	1,290	2,370	1,400	814	2,500	747	494	1,440	410	552
3	513	344	1,030	1,550	5,250	415	2,230	657	694	1,190	404	556
4	567	321	1,000	1,330	3,050	1,170	1,430	786	447	1,420	789	549
5	516	242	1,120	1,300	2,050	1,340	2,720	704	446	2,000	524	561
6	524	273	1,740	1,030	1,740	1,340	2,200	639	466	2,330	426	640
7	1,040	264	2,450	740	1,900	1,140	2,210	546	437	1,970	364	584
8	1,050	355	1,720	781	2,040	1,750	1,670	602	349	1,700	324	562
9	779	1,260	2,030	751	1,910	1,400	1,700	774	376	1,400	345	545
10	270	640	2,150	704	1,500	1,020	2,450	419	325	1,150	394	545
11	645	400	1,440	673	1,510	460	2,150	1,440	310	1,050	374	567
12	744	444	1,480	633	1,210	916	1,440	1,720	300	425	392	650
13	740	343	1,420	541	717	1,010	1,740	1,500	350	545	376	628
14	715	454	1,350	534	734	971	1,570	2,040	450	424	315	630
15	715	1,360	1,230	530	724	1,260	1,030	432	400	441	321	705
16	724	402	1,210	522	712	1,330	475	494	320	441	704	635
17	722	702	1,010	514	576	1,640	441	474	310	334	414	626
18	735	505	1,020	527	550	2,260	441	1,540	300	294	439	674
19	646	572	450	563	540	1,840	401	1,540	310	274	414	644
20	472	1,340	920	1,110	564	1,740	320	1,340	320	245	530	640
21	672	1,160	605	914	571	1,840	441	2,200	320	270	434	621
22	654	415	1,150	774	503	1,540	545	2,500	320	304	435	615
23	648	407	1,300	2,740	644	432	375	2,000	350	321	424	643
24	663	742	1,100	1,670	665	435	655	1,500	340	244	764	677
25	673	710	444	1,310	625	747	572	1,500	300	224	744	664
26	643	2,000	434	1,050	434	1,240	745	1,200	300	143	644	645
27	598	2,050	474	924	437	1,370	1,200	1,100	345	149	604	635
28	365	1,380	494	407	790	1,170	1,500	1,000	466	321	642	635
29	342	1,040	647	926	-----	1,050	1,470	1,100	1,140	247	543	631
30	374	444	740	924	-----	441	1,140	1,140	3,340	204	540	622
31	437	-----	640	404	-----	444	-----	1,120	-----	144	544	-----
TOTAL	20,050	24,067	34,554	32,444	35,674	30,773	42,657	36,431	10,574	25,477	15,210	18,502
MEAN	647	702	1,116	1,044	1,154	1,021	1,377	1,174	352	820	491	617
MAX	1,050	2,050	2,450	2,740	5,250	2,260	2,720	2,500	3,340	2,640	404	705
MIN	374	252	140	514	506	147	372	500	300	143	164	545
(1)	-294	-512	+317	+273	+36	+232	+130	+81	+46	-9	-186	-399
MEAN†	353	1,314	1,593	1,321	1,310	1,483	1,552	1,272	598	811	305	218
CFSM†	0.98	3.62	4.42	3.67	3.64	4.12	4.31	3.53	1.66	2.25	0.85	0.61
IN†	1.13	4.07	5.10	4.23	3.79	4.75	4.81	4.07	1.85	2.59	0.98	0.68

CAL YR 1972 TOTAL 367,437 MEAN 1,005 MAX 4,140 MIN 150 MEAN† 1,101 CFSM† 3.06 IN† 41.62  
 WTR YR 1973 TOTAL 345,898 MEAN 948 MAX 5,250 MIN 168 MEAN† 1,016 CFSM† 2.82 IN† 38.05

† Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic foot per second; furnished by the Metropolitan District Commission, Corps of Engineers, Union Pin Company, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

Adjusted for change in contents and diversion.

## CONNECTICUT RIVER BASIN

01167980 Farmington River at Collinsville, Conn.

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant 0.8 mi (1.3 km) south of Collinsville, and at mile 39.8 (64.0 km).

DRAINAGE AREA.--360 mi<sup>2</sup> (932 km<sup>2</sup>).

PERIOD OF RECORD.--November 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft (74.743 m) above mean sea level.

AVERAGE DISCHARGE (adjusted for storage and diversion).--11 years, 678 ft<sup>3</sup>/s (19.20 m<sup>3</sup>/s), 25.56 in/yr (649 mm/yr).

EXTREMES.--Current year: Maximum discharge, 13,100 ft<sup>3</sup>/s (371 m<sup>3</sup>/s) Dec. 21, gage height, 14.23 ft (4.337 m); minimum daily 115 ft<sup>3</sup>/s (3.26 m<sup>3</sup>/s) Oct. 17.

Period of record: Maximum discharge, 13,100 ft<sup>3</sup>/s (371 m<sup>3</sup>/s) Dec. 21, 1973, gage height, 14.23 ft (4.337 m); minimum, 4.7 ft<sup>3</sup>/s (0.13 m<sup>3</sup>/s) Aug. 18, 1966, gage height, 2.06 ft (0.628 m); minimum daily, 5.6 ft<sup>3</sup>/s (0.16 m<sup>3</sup>/s) July 11, 1965.

Flood of Aug. 19, 1955, reached a stage of 35.6 ft (10.85 m), from floodmark, discharge, 140,000 ft<sup>3</sup>/s (3,960 m<sup>3</sup>/s) by slope-area measurement 0.5 mi (0.8 km) downstream.

REMARKS.--Records good except those for period of no gage-height record Jan. 3-28, and for the period August to September, which are fair. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. 73), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

## DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	604	561	313	1,250	1,760	1,390	968	830	413	590	524	504
2	650	489	266	1,150	1,770	1,290	992	665	366	532	496	458
3	673	418	232	1,060	1,110	1,130	1,060	656	406	577	512	529
4	648	365	250	1,000	939	1,030	1,430	725	402	336	500	1,080
5	657	318	252	916	934	1,120	1,730	581	370	271	484	909
6	651	325	774	876	992	1,120	2,070	559	346	761	484	637
7	626	300	511	650	752	1,070	1,720	670	319	432	480	319
8	583	434	502	734	665	1,040	1,460	680	285	336	480	329
9	612	436	755	765	635	1,010	1,440	708	268	521	484	254
10	408	440	1,430	721	579	985	1,340	847	291	522	472	246
11	610	430	854	768	608	974	1,170	921	399	515	456	464
12	591	429	441	779	677	962	1,140	803	391	513	245	771
13	600	439	556	750	642	680	1,300	2,030	303	529	452	756
14	566	430	1,166	700	514	825	1,360	1,640	613	571	452	740
15	508	365	1,120	700	459	641	1,770	1,410	604	721	448	710
16	139	369	762	735	407	488	1,770	1,400	609	238	444	613
17	115	371	742	568	411	1,630	1,660	1,300	735	312	464	680
18	172	366	714	606	340	1,020	1,510	869	326	171	464	705
19	130	366	573	681	393	847	1,410	777	254	167	440	637
20	134	386	593	755	759	766	1,120	730	217	195	429	651
21	143	373	6,130	574	735	1,300	1,020	685	222	130	421	756
22	135	212	4,180	1,050	1,000	2,050	915	609	352	132	432	762
23	138	194	1,910	1,190	2,000	1,500	792	551	271	176	488	504
24	158	185	1,350	1,160	1,270	1,300	730	581	271	167	488	249
25	244	240	1,170	978	1,180	1,210	670	573	525	702	468	222
26	260	295	1,100	638	1,490	1,190	637	538	577	190	452	219
27	249	292	2,010	1,220	1,490	1,030	525	492	632	181	448	204
28	250	344	2,120	2,070	1,380	710	498	464	584	188	468	217
29	268	484	1,490	2,350	-----	646	484	425	496	243	484	1,470
30	1,020	396	1,660	1,950	-----	627	460	421	546	538	559	968
31	773	-----	1,390	1,910	-----	844	-----	406	-----	525	559	-----
TOTAL	13,467	11,044	37,950	31,596	25,831	32,636	35,299	24,534	12,373	11,307	14,681	17,597
MEAN	434	365	1,224	1,014	823	1,053	1,177	742	412	365	474	587
MAX	1,020	561	6,130	2,350	2,000	2,050	2,070	2,030	735	761	559	1,470
MIN	115	185	232	568	340	488	460	406	217	130	421	209
(1)	-186	+61	+982	+182	+61	+195	+158	+101	-70	-195	-274	-27
MEANS	248	429	2,706	1,201	984	1,248	1,315	893	342	170	200	560
CFSMI	0.69	1.19	6.13	3.34	2.73	3.47	3.65	2.48	0.95	0.47	0.56	1.56
INI	0.80	1.33	7.07	3.85	2.84	4.00	4.07	2.86	1.06	0.54	0.65	1.74

CAL YR 1973 TOTAL 324,687 MEAN 890 MAX 6,130 MIN 115 MEANS 986 CFSMI 2.74 INI 36.95  
 WFR YR 1974 TOTAL 208,319 MEAN 735 MAX 6,130 MIN 115 MEANS 816 CFSMI 2.27 INI 30.81

Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second; furnished by the Metropolitan District Commission, Corps of Engineers, Union Pin Company, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

Adjusted for diversion and change in contents.

01187980 FARMINGTON RIVER AT COLLINSVILLE, CONN.

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, on left bank at abandoned hydroelectric plant 0.8 mi (1.3 km) south of Collinsville, and at mile 39.8 (64.6 km).

DRAINAGE AREA.--360 mi<sup>2</sup> (932 km<sup>2</sup>).

PERIOD OF RECORD.--Discharge: November 1962 to current year.

Chemical analyses: October 1974 to September 1975.

Water temperatures: October 1974 to September 1975.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft (74.743 m) above mean sea level.

AVERAGE DISCHARGE (adjusted for storage and diversion).--12 years, 699 ft<sup>3</sup>/s (19.80 m<sup>3</sup>/s), 26.35 in/yr (669 mm/yr).

EXTREMES.--Current year: Maximum discharge, 12,000 ft<sup>3</sup>/s (340 m<sup>3</sup>/s) Sept. 26, gage height, 13.69 ft (4.173 m); minimum daily, 146 ft<sup>3</sup>/s (4.13 m<sup>3</sup>/s) Aug. 22.

Specific conductance: Maximum recorded, 131 micromhos Jan. 19; minimum recorded, 41 micromhos Sept. 26.

Water temperatures: Maximum, 27.0°C Aug. 3; minimum, 1.0°C on many days during winter periods.

Period of record: Maximum discharge, 13,100 ft<sup>3</sup>/s (371 m<sup>3</sup>/s) Dec. 21, 1973, gage height, 14.23 ft (4.337 m); minimum, 4.7 ft<sup>3</sup>/s (0.13 m<sup>3</sup>/s) Aug. 18, 1966, gage height, 2.06 ft (0.628 m); minimum daily, 5.6 ft<sup>3</sup>/s (0.16 m<sup>3</sup>/s) July 11, 1965.

Specific conductance: Maximum recorded, 131 micromhos Jan. 19, 1975; minimum recorded, 41 micromhos Sept. 26, 1975.

Water temperatures: Maximum, 27.0°C Aug. 3, 1975; minimum, 1.0°C on many days during winter periods.

Flood of Aug. 19, 1955, reached stage of 35.6 ft (10.85 m), from floodmark, discharge, 140,000 ft<sup>3</sup>/s (3,960 m<sup>3</sup>/s) by slope-area measurement 0.3 mi (0.8 km) downstream.

REMARKS.--Records good except those for period of no gage-height record Apr. 3-24, which are fair. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p.211), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	665	592	480	500	877	958	1080	451	202	285	337	469
2	528	515	895	480	766	860	1080	436	291	217	285	469
3	454	473	1090	447	709	815	3000	458	271	197	250	511
4	433	480	815	450	548	787	2800	477	350	170	280	600
5	418	544	604	440	550	755	2700	866	306	168	370	536
6	367	669	557	404	550	787	3500	771	793	166	462	508
7	367	565	511	465	520	782	3500	988	919	158	591	504
8	370	519	931	462	520	837	2500	944	694	173	755	504
9	390	488	2040	591	520	766	1200	729	540	154	677	544
10	429	436	1200	798	492	745	1200	907	476	210	600	500
11	411	425	854	1030	500	809	900	988	373	170	504	436
12	458	451	776	1680	500	1130	800	793	528	173	469	447
13	340	734	724	1740	500	1190	750	1640	1470	250	462	477
14	363	714	699	1600	500	1130	750	2270	1550	1880	488	422
15	393	627	665	1100	500	524	750	1740	1240	1290	477	436
16	574	596	646	900	500	473	750	1410	1100	1020	488	433
17	739	544	637	750	500	508	850	956	981	776	484	436
18	536	532	798	944	504	540	850	804	724	508	492	536
19	433	532	697	1350	540	591	900	709	565	390	484	557
20	373	544	660	1270	528	3870	900	734	515	433	477	574
21	363	913	600	1000	469	2300	900	665	370	1530	407	565
22	370	889	574	793	458	2090	800	613	387	1430	146	565
23	360	689	548	750	492	1680	650	544	390	1120	215	623
24	519	627	528	700	1460	1400	700	411	393	877	373	1170
25	532	627	536	739	2640	1570	684	318	353	889	393	2900
26	540	604	515	1270	2080	1440	709	318	325	776	404	4040
27	515	565	524	1110	1380	1370	627	340	301	623	418	6080
28	492	544	504	969	1080	1400	574	377	309	582	350	3290
29	536	504	510	1000	---	1320	548	306	297	519	327	2240
30	532	492	510	1090	---	1260	515	288	315	484	565	2060
31	745	---	500	975	---	1220	---	370	---	418	641	---
TOTAL	14545	17434	22330	27797	21203	35900	37467	23621	17338	18036	13871	33432
MEAN	469	581	720	897	757	1158	1249	762	576	582	447	1114
MAX	745	913	2040	1740	2640	3870	3500	2270	1550	1880	877	6080
MIN	340	425	480	404	458	473	515	288	202	154	146	422
(†)	+47.5	+134.2	+325.2	+173.8	+213.3	+381.9	+104.1	+115.2	+36.1	+117.3	-81.8	+294.0
MEANS	516	715	1045	1071	970	1540	1353	877	614	699	365	1408
CFSMI	1.43	1.99	2.90	2.98	2.69	4.28	3.76	2.44	1.71	1.94	1.01	3.91
INT	1.65	2.22	3.34	3.44	2.80	4.93	4.20	2.81	1.91	2.24	1.16	4.36

CAL YR 1974 TOTAL 260167 MEAN 713 MAX 2350 MIN 130 MEANS 765 CFSMI 2.12 INT 28.82  
WTR YR 1975 TOTAL 282974 MEAN 775 MAX 6080 MIN 146 MEANS 930 CFSMI 2.58 INT 35.06

†Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second; furnished by the Metropolitan District Commission, Corps of Engineers, Union Pin Company, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

‡Adjusted for diversion and change in contents.

## 01107980 FARMINGTON RIVER AT COLLINSVILLE, CT

LOCATION.--Lat 41°47'57", Long 72°55'33", Litchfield County, Hydrologic Unit 01080207, on left bank at abandoned hydroelectric plant 0.8 mi (1.3 km) south of Collinsville, and at mile 39.8 (64.0 km).

DRAINAGE AREA.--360 mi<sup>2</sup> (932 km<sup>2</sup>).

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft (74.743 m) above mean sea level.

REMARKS.--Records excellent. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. 255), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

AVERAGE DISCHARGE (adjusted for storage and diversion).--13 years, 719 ft<sup>3</sup>/s (20.36 m<sup>3</sup>/s), 27.11 in/yr (689 mm/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,100 ft<sup>3</sup>/s (371 m<sup>3</sup>/s) Dec. 21, 1973, gage height, 14.23 ft (4.337 m); minimum, 4.7 ft<sup>3</sup>/s (0.13 m<sup>3</sup>/s) Aug. 18, 1966, gage height, 2.06 ft (0.628 m); minimum daily, 5.6 ft<sup>3</sup>/s (0.16 m<sup>3</sup>/s) July 11, 1965.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Aug. 19, 1955, reached a stage of 35.6 ft (10.85 m), from floodmark, discharge, 140,000 ft<sup>3</sup>/s (3,960 m<sup>3</sup>/s) by slope-area measurement 0.5 mi (0.8 km) downstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,020 ft<sup>3</sup>/s (227 m<sup>3</sup>/s) Jan. 27, gage height, 11.71 ft (3.569 m); minimum, 119 ft<sup>3</sup>/s (3.37 m<sup>3</sup>/s) June 6, gage height, 3.41 ft (1.039 m); minimum daily, 164 ft<sup>3</sup>/s (4.64 m<sup>3</sup>/s) July 20-23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1850	862	1250	1040	2080	1670	2250	716	415	660	883	422
2	1510	836	1180	894	3250	1550	2620	1900	480	629	679	484
3	946	823	1066	860	2350	1410	2250	1420	500	571	565	492
4	864	813	970	827	2100	1180	1790	1220	445	530	519	480
5	802	792	816	598	2000	1320	1670	993	370	500	548	480
6	869	686	659	450	1800	1580	1670	812	273	480	536	477
7	884	610	639	430	1600	1370	1200	657	307	450	548	469
8	855	537	613	420	1440	1210	804	1500	323	598	582	492
9	700	545	656	410	1180	1080	733	891	296	469	636	484
10	577	588	1390	400	927	1030	651	742	305	209	2430	484
11	543	1120	1550	400	628	788	627	690	290	189	1360	500
12	797	1060	1310	420	791	688	600	1050	293	183	745	504
13	771	2210	1180	493	758	957	557	1030	221	181	492	504
14	840	2330	1090	1090	731	1200	505	1040	238	181	484	519
15	1030	2110	929	1190	673	993	487	970	267	181	390	544
16	1190	1810	817	1120	746	1010	509	898	260	181	714	532
17	1200	1640	752	998	1240	1140	554	859	420	178	508	540
18	1990	1450	740	820	1460	1020	507	729	338	175	400	574
19	2670	1060	592	750	2030	975	469	1710	345	171	390	532
20	2960	968	477	730	2540	1040	427	1850	371	164	343	515
21	1910	1290	450	720	2170	1350	385	1790	368	164	321	519
22	2250	2450	440	689	2630	1530	381	1640	305	162	297	515
23	2090	1850	420	627	3120	1020	481	1360	295	162	360	469
24	1950	1590	410	580	2730	911	395	900	347	268	515	465
25	1840	1390	546	550	2520	617	424	739	474	202	532	477
26	1820	1030	748	519	2160	775	984	680	466	277	444	473
27	1680	1230	1350	2060	2100	790	529	628	474	465	477	582
28	1600	1540	1120	5480	1930	944	843	578	542	462	496	544
29	1570	1350	947	3220	1770	877	743	472	573	447	477	465
30	1270	1300	1040	2350	---	831	670	421	426	488	444	511
31	1010	---	1160	2180	---	774	---	426	---	484	433	---
TOTAL	42838	37870	27301	33315	51654	33830	27135	31321	11027	10461	18548	15040
MEAN	1382	1262	881	1075	1781	1091	905	1010	368	337	598	502
MAX	2960	2450	1550	5480	3250	1670	2620	1900	573	660	2430	582
MIN	543	537	410	400	673	688	381	421	221	162	297	422
(t)	-48.8	+91.9	+91.7	+189	-28.6	+191	+164	+117	-75.4	-158	+119	-328
MEAN <sub>1</sub>	1333	1354	973	1264	1752	1282	1069	1127	293	179	717	174
CFSM <sub>1</sub>	3.70	3.76	2.70	3.51	4.87	3.56	2.97	3.13	0.81	0.50	1.99	0.48
IN <sub>1</sub>	4.27	4.20	3.11	4.05	5.25	4.10	3.31	3.61	0.90	0.58	2.29	0.54
CAL YR 1975 TOTAL	336674		MEAN 922	MAX 6080	MIN 146	MEAN <sub>1</sub> 1045	CFSM <sub>1</sub> 2.90	IN <sub>1</sub> 39.45				
WTR YR 1976 TOTAL	340348		MEAN 930	MAX 5480	MIN 162	MEAN <sub>1</sub> 958	CFSM <sub>1</sub> 2.66	IN <sub>1</sub> 36.21				

†Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Highland Lake, Barkhamsted, East Branch, and Nepaug Reservoirs, Mad River and Sucker Brook Detention Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second; furnished by the Metropolitan District Commission, Corps of Engineers, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

‡Adjusted for diversion and change in contents.



*These data (1971) not yet published but are accurate.*

CONNECTICUT RIVER BASIN

01187980 FARMINGTON RIVER AT COLLINSVILLE, CT

LOCATION.--Lat 41°47'57", long 72°55'33", Litchfield County, Hydrologic Unit 01080207, on left bank at abandoned hydroelectric plant 0.8 mi (1.3 km) south of Collinsville, and at mile 39.8 (64.0 km).

DRAINAGE AREA.--360 mi<sup>2</sup> (932 km<sup>2</sup>).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1962 to September 1977 (discontinued).

GAGE.--Water-stage recorder. Datum of gage is 245.22 ft (74.743 m) above mean sea level.

REMARKS.--Records good. Flow regulated by Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Mad River Detention Reservoir, Sucker Brook Detention Reservoir, Highland Lake, Barkhamsted, East Branch and Nepaug Reservoirs (see p. ), and by diversion for municipal supply from Barkhamsted and Nepaug Reservoirs.

AVERAGE DISCHARGE (adjusted for storage and diversion).--14 years, 722 ft<sup>3</sup>/s (20.45 m<sup>3</sup>/s), 27.22 in/yr (691 mm/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,100 ft<sup>3</sup>/s (371 m<sup>3</sup>/s) Dec. 21, 1973, gage height, 14.23 ft (4.337 m); minimum, 4.7 ft<sup>3</sup>/s (0.13 m<sup>3</sup>/s) Aug. 18, 1966, gage height, 2.06 ft (0.628 m); minimum daily, 5.6 ft<sup>3</sup>/s (0.16 m<sup>3</sup>/s) July 11, 1965.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Aug. 19, 1955, reached a stage of 35.6 ft (10.83 m), from floodmark, discharge, 140,000 ft<sup>3</sup>/s (3,960 m<sup>3</sup>/s) by slope-area measurement 0.5 mi (0.8 km) downstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,950 ft<sup>3</sup>/s (168 m<sup>3</sup>/s) Mar. 13 gage height, 10.40 ft (3.170 m); minimum, 105 ft<sup>3</sup>/s (2.97 m<sup>3</sup>/s) July 18, 19 gage height, 3.33 ft (1.015 m); minimum daily, 114 ft<sup>3</sup>/s (3.25 m<sup>3</sup>/s) Sept. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	536	570	300	380	150	483	3560	1230	291	369	277	533
2	514	502	290	315	150	395	2840	1190	358	334	628	567
3	770	473	330	265	147	369	2850	998	317	319	514	551
4	692	429	340	250	145	377	2870	737	258	321	512	530
5	344	400	375	235	145	1080	3610	1020	235	388	570	529
6	293	415	420	220	143	897	3890	993	235	574	598	1730
7	285	430	500	202	140	629	3440	788	307	573	569	1220
8	280	380	1200	190	140	505	3110	649	280	585	585	681
9	388	360	900	185	138	500	2390	1560	265	578	567	282
10	872	355	830	180	135	843	1660	2620	665	562	578	157
11	518	355	680	178	133	1220	1410	2680	805	564	545	117
12	413	350	510	175	130	1370	1010	2850	369	638	501	114
13	343	350	440	172	130	2640	963	2690	307	686	518	138
14	364	335	400	170	160	4370	860	2030	272	909	600	153
15	380	310	500	170	210	2490	795	1770	259	556	591	168
16	409	330	485	168	186	1670	822	1630	237	222	558	169
17	374	370	480	167	171	1300	770	1310	200	175	581	331
18	318	410	450	166	160	1080	710	899	217	131	576	315
19	337	400	415	165	148	790	587	929	545	138	569	643
20	349	400	400	164	135	698	549	985	351	176	544	1000
21	677	400	461	162	130	674	450	957	332	216	524	1200
22	562	390	440	162	125	841	423	871	270	227	553	700
23	486	380	470	160	121	1250	501	726	221	191	563	450
24	440	380	390	160	120	1140	1820	530	266	185	607	410
25	445	340	350	160	638	1020	2910	493	249	246	540	1000
26	565	300	360	160	767	931	2220	461	240	318	560	1500
27	567	290	335	157	588	968	2040	409	236	197	534	2200
28	518	295	360	157	547	1270	1930	296	247	175	507	1700
29	496	300	380	157	---	2730	1620	218	257	153	509	1050
30	449	310	350	155	---	3970	1320	246	367	148	505	800
31	499	---	370	152	---	4200	---	258	---	145	522	---
TOTAL	14503	11309	14511	5859	6032	42610	53930	35023	9458	10999	17105	20930
MEAN	468	377	468	189	215	1375	1798	1130	315	355	552	698
MAX.	872	570	1200	380	767	4370	3890	2850	805	909	628	2200
MIN	280	290	290	152	120	369	423	218	200	131	277	114
(†)	+101	-58.4	-15.2	+24.3	+47.9	+1071	+216	+41.2	+24.0	-169	-386	+230
MEAN†	569	319	453	213	263	2446	2014	1171	339	186	166	928
SM†	1.58	0.89	1.26	0.59	0.73	6.79	5.59	3.25	0.94	0.52	0.46	2.58
	1.82	0.99	1.45	0.68	0.76	7.83	6.24	3.75	1.05	0.60	0.53	2.88

YR 1976 TOTAL 272667 MEAN 745 MAX 5480 MIN 147 MEAN† 764 CFSM† 2.12 IN† 28.89  
YR 1977 TOTAL 242274 MEAN 694 MAX 4370 MIN 114 MEAN† 760 CFSM† 2.11 IN† 28.58

Change in contents in Otis Reservoir, Colebrook River Lake, West Branch Reservoir, Highland Lake, Barkhamsted, East Branch, and Nepaug Reservoirs, Mad River and Sucker Brook Detention Reservoirs, and diversion from Barkhamsted and Nepaug Reservoirs, equivalent in cubic feet per second; furnished by the Metropolitan District Commission, Corps of Engineers, and Massachusetts Department of Natural Resources, Division of Forests and Parks.

†Adjusted for diversion and change in contents.

# FOUNDATION SCIENCES, INC.

LE ADDRESS: FOUNSCIENCE  
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TEL. 503-224-4435

December 26, 1978

Development and Resources Corporation  
455 Capitol Mall  
Sacramento, CA 95814

Attention: Mr. Clarence Korhonen

Dear Mr. Korhonen

Enclosed for your use and distribution is one copy of each of our Final Reports entitled, "Reconnaissance Engineering Geologic Investigation, Phillips Hydroelectric Project, Croton Falls, New York" and "Reconnaissance Engineering Geologic Investigation, Canton Hydroelectric Project, Collinsville, Connecticut", dated December 26, 1978.

If you have any questions regarding our reports or require consultation, please do not hesitate to contact our office. We appreciate the opportunity to be of service to you on this project and the continued confidence you have in our services.

Very truly yours,

FOUNDATION SCIENCES, INC.



Robert L. Nelson  
Certified Engineering Geologist (Oregon No. E502)

RLN:bh

Enclosures: 2 Final Reports  
Quadrangle Report No. 16 (Canton Encl. No. 4)  
Map (Canton Encl. No. 5)

INITIAL	ACTION	USED	FILE
_____ JJS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ EMBE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ RMC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ G...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
_____ LFM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ WEG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ RVLG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ FAV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____ RRB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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REC'D DEC 28 1978

APPENDIX B

GEOLOGY

RECONNAISSANCE ENGINEERING GEOLOGIC  
INVESTIGATION

CANTON HYDROELECTRIC PROJECT  
COLLINSVILLE, CONNECTICUT

FOR

DEVELOPMENT AND RESOURCES CORPORATION  
SACRAMENTO, CALIFORNIA

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### LIMITATIONS

This reconnaissance evaluation of the foundation conditions as related to the present adequacy or deficiency of the dams and appurtenant works is based on conditions which are mostly underground and cannot actually be seen, nor were they tested.

There is some historical information available on the design and construction of the dams, but no information on the original site investigation or their operational performance. It must be understood, therefore, that the conclusions and recommendations presented are based in large part on indirect and incomplete information about the actual foundation conditions, even to a much larger degree than if an adequate subsurface investigation had been performed. The information in this study is not a certification or guarantee of the present suitability of the existing structures for their intended purposes or of the foundation conditions of proposed structures.

## I. Regional Geology

The Canton Hydroelectric Project is located in the crystalline uplands of western Connecticut, part of an extensive area of structurally complex metamorphic and igneous rocks known collectively as the Appalachian Highlands. The crystalline uplands represent rocks of sedimentary origin, possibly silty shales, sandstones and carbonates which have been highly folded and faulted. The geologic history of the area from the (Cambrian) sedimentary origin is complex and involves at least one major period of crustal deformation and associated metamorphism and igneous intrusion which occurred during the Acadian Orogeny (Middle and Late Devonian). This mountain building produced the folds and gneiss domes which are characteristic of the area. The time from the end of the Acadian Orogeny to the Triassic Period was a period characterized by more or less gradual elevation of the rocks with erosion and deposition over the central and possibly western portions of Connecticut. These sedimentary rocks were then faulted and tilted eastward. A portion of these red Triassic sediments lie just east of the project site along the fault contact with the underlying metamorphic rocks. After this period of deformation in the late Triassic Period, continued erosion reduced the area to one of relatively low relief, caused development of major stream valleys like the Connecticut and exposed the complex crystalline rocks formed during the earlier geologic history. These rocks, some of which are exposed along the stream bed of the Farmington River at the site, consist of schists, gneisses and intrusives including granitic, pegmatitic and ultramafic rocks.

## II. Site Geology

### Geomorphology

The maximum relief at the site from the river bed to the adjacent hills is about 400 feet with hillsides sloping at approximately 25° to 30°. The height of the river bank in the lower right side of the reservoir area is about 15 feet. On the left side of the lower reservoir the river bank rises to the maximum elevation of the adjacent hills. Slopes around the upper reservoir immediately adjacent to the shore are relatively flat with 5 to 10 feet of relief adjacent to the flood plain areas. The river has a gradient of about 1.5° in the project area and has a rocky bed with numerous bedrock outcrops.

### Lithology and Structure

Material at the site consists of bedrock, natural river bed alluvium, alluvium deposited as a result of the dams, rip rap (and other bank protection) and colluvium from the adjacent hillsides. These materials in relation to the existing facilities are shown on Figure 1.

The exposed bedrock consists of medium hard to hard, gray, medium grained garnite - muscovite - biotite - quartz - feldspar schist and gneiss with lenses of amphibolite and graphite - mica - quartz gneiss.

The rock hardness terminology used is :

- medium hard -- can be picked with moderate blows of the geology hammer.
- hard -- cannot be picked with geology hammer but can be chipped with moderate blows of the hammer.

The attitude of the bedrock foliation ( bedding) and major joints was measured at three locations; just downstream from the sluice house at the lower dam, at the vicinity of the power house at the upper dam and at the highway cut on Rt. 179 just south of Collinsville.

Table 1 summarizes these measurements.



TABLE 1

Lower Dam Area

<u>Bedding</u>		<u>Joints</u>					
Strike	Dip	<u>Set 1</u>		<u>Set 2</u>		<u>Set 3</u>	
		Strike	Dip	Strike	Dip	Strike	Dip
337°	64° SW					306°	75° NE
353°	66° SW						
345°	56° SW						

Upper Dam Area

020°	69° NW	020°	38° SE	327°	59° NE	308°	54° NE
024°	79° NW	013°	68° SE				
027°	60° NW						
000°	37° W						

Highway Cut

005°	67° NW	028°	48° SE	358°	24° NE		
015°	71° NW	055°	52° SE	340°	16° SW		

The information in Table 1 indicates that the attitude of the bedding displays a general north-south strike and a relatively steep westerly dip. This orientation is determined by the Collinsville Dome which is the main structural feature in the area. The table also indicates that there are possibly three predominant joint sets. It was not possible to determine, with the time available for study, which were the major and minor sets. In general, the joints are tight and spaced moderately close (1' - 3').

The natural river bed alluvium exposed along the banks consists of sandy gravel and rounded cobbles. In addition, there are accumulations of silty to clean fine sand deposited on the inside of bends in the river between the upper and lower dam and above the upper dam on the left side of the reservoir, north of the old railroad bridge. Also, there appears to be sandy gravel and cobbles at the water's edge around most of the upper reservoir. It is likely that the fine sandy alluvium was deposited as a result of the dam construction.

It was not possible to observe the material deposited directly upstream of the two dams but it likely consists of saturated, possibly loose fine sand. This material presumably extends to the original bottom elevation of the reservoir adjacent to the upstream face of the dams.

The rip rap and other bank protection placed around the reservoir consists of subangular to rounded cobbles and boulders, stone walls constructed of quarry rock and concrete walls. Bedrock is exposed along large segments of the river bank between the upper and lower dams, forming natural shoreline protection.

The colluvium, primarily exposed on the left shore of the reservoir upstream from the lower dam, consists of micaceous silty sand with scattered cobbles and boulders. Bedrock probably occurs at a shallow depth beneath the colluvium.

### III. SEISMICITY

Because of their similar regional geology and earthquake history, the Phillips and Canton sites will be considered together in the following discussion of seismicity. The earthquake history of the area was reviewed using current information from the National Geophysical and Solar-Terrestrial Data Center of the National Oceanic and Atmospheric Administration and is summarized on Figure 2. Figure 2 shows the location of all earthquakes with an intensity of V or greater which have occurred from 1643 to 1978 within a 150 kilometer radius at each site. Based on this data, there have been a total of 44 seismic events in the last 335 years.

Table 2 summarizes this data relative to the total number and approximate frequency of occurrence of earthquakes of each intensity.

TABLE 2 -- Earthquake Frequency

Maximum Intensity *	V	VI	VII	VIII
Total number of Earthquakes	33	5	4	2
Approximate Frequency of Occurrence	10/50 yrs.	2/50 yrs.	1/50 yrs.	1/100 yrs.

\*Modified Mercalli Intensity Scale of 1931.

To obtain design parameters for assessing the performance of existing or proposed structures under seismic loading, it is customary to discuss two hypothetical earthquakes, namely the maximum probable and maximum credible earthquake. Although the definitions of these two terms and the method of assigning a value to each are not consistent in practice, they are generally described as follows.

The maximum probable earthquake is the intensity at the site from the strongest earthquake that has ever occurred. This event is considered to have a reasonable possibility of occurrence during the design life of the structure and is based on the earthquake history and geology of the area. All structures should be designed to remain functional during such an earthquake, although minor repairs may be required.

The maximum credible earthquake is the strongest earthquake that can be expected to ever occur at the site based on understandable mechanisms, such as movement along a nearby large fault. Generally, the primary use of the maximum credible earthquake is to check the capability of the dam to retain water without catastrophic structural failure. The dam crest may be displaced significantly, and control structures may be rendered inoperable as long as they do not rupture and result in total failure of the dam. Repairs may be major.

The maximum probable earthquake is considered to be an intensity VIII event occurring at a distance of about 40 kilometers from the site. This was an actual earthquake which occurred SE of the Canton site (see Figure 2) although it is not possible to tell which fault may have caused the earthquake.

The maximum credible earthquake is considered to be an event occurring along a 25 kilometer straight line segment of a fault just south of the Phillips site within 10 kilometers of the dam. Although no historic earthquakes are known to have occurred along this fault, it is considered the most critical fault for the purpose of this study. A fault with at least the same straight line segment length occurs just east of the Canton site.

Table 3 summarizes the data used for these two earthquakes and presents related parameters.

The maximum probable earthquake developed in this summary as indicated in Table 3 produces a maximum bedrock acceleration at the site of .075 g. This acceleration is consistent with the seismic risk map of the Uniform Building Code which places the sites in Zone 1 (minor damage).

Because of the proximity of seismic risk Zones 2 and 3 to the project sites (see Seismic Risk Map, U.B.C.), the maximum credible earthquake with a resulting maximum bedrock acceleration of .2 g as developed in this summary is not considered overly conservative.

TABLE 3

## Earthquake Design Parameters

	<u>Fault Length</u>	<u>Fault Distance</u>	<u>Earthquake * Intensity</u>	<u>Earthquake * Intensity at Site</u>	<u>Maximum * Bedrock Acceleration at Site -g</u>
Maximum Probable Earthquake	?	40 (Kilometers)	VIII	VI	.075
Maximum Credible Earthquake	25 (Kilometers)	10 (Kilometers)	IX	IX	.20

\*Earthquake intensities, bedrock accelerations and attenuations based on data developed by Seed, Idriss and Kiefer, Characteristics of Rock Motion During Earthquakes, 1969.

#### IV. FOUNDATION CONDITIONS

##### Observations

Upper Power House -- There appears to be no cracking of the brick walls or concrete foundation. The concrete foundation and training walls for the power house are in contact with bedrock on the downstream side of the structure. Bedrock outcrops also occur immediately upstream from the power house. The left training wall on the river side is in contact with bedrock. Some cracks are visible on the inside of the left training wall. Leaks occur at the contact of the training wall and bedrock and in the stone wall which serves as the right training wall. Overtlow water from the forebay strikes the adjacent bridge pier with high velocity. The main forebay walls just upstream from the power house are constructed directly on bedrock. The rest of the forebay walls were submerged and their condition or construction could not be observed.

Lower Power House and Gate House -- There appears to be no cracking of the brick walls, concrete foundation or concrete outlet works. No bedrock is actually visible in direct contact with concrete foundations of these two structures, however.

Power Canal -- Minor irregular cracks and deterioration occur on the right wall of the power canal every 10-15 feet  $\pm$ . Cracking and one inch  $\pm$  of vertical separation of a joint occurs about 200' downstream from the power house where a slight bend in the wall was constructed. Most of the left side of the power canal is a quarry-rock wall (no mortar).

Sluice House -- There appears to be no cracking of the concrete foundation. The concrete foundation, in direct contact with bedrock, is visible on the downstream wall. There are bedrock outcrops both up and downstream from the sluice house. Leaks occur between the bedrock and concrete foundation on the downstream wall. The bedrock cliff downstream from the sluice house is very damp. A concrete retaining wall extends upstream from the sluice house for a considerable distance. It shows no bulging or settlement near the sluice house. Above the wall, sloping up to the abandoned railroad bed, rocks and boulder rubble are exposed.

Lower Dam -- The crest appears straight (no bulging in downstream direction) and level (no sags when viewed from upstream). It was

not possible to examine the contact of the dam structure with the gate house or sluice house wall because of flowing water.

The even flow of water over the dam crest is disturbed by horizontal jets or sprays of water coming from the face of the dam. The sprays of water appear to be concentrated on the lower 1/3 of the dam face and arranged in continuous, somewhat irregular horizontal lines. No actual inspection at the concrete mortar composing the dam could be made because of flowing water.

Upper Dam -- No bulging of the dam or settlement of the dam crest is apparent. No leakage appears to occur from between the stone blocks of the structure, however, water flowing over the crest prevented a more accurate determination. Bedrock is visible in direct contact with the stone blocks at each abutment and along most of the downstream toe of the dam. Some water was flowing from between the stone blocks and bedrock at the left abutment. Directly upstream from the right dam abutment for about 100 feet there is a sloping concrete slab which joins the highway bridge abutment. The shoreline upstream from the left dam abutment has rip rap for a considerable distance.

Bedrock -- Bedrock is exposed, in general over the whole area downstream of the upper dam and in the proposed fish ladder location. Bedrock is not observed directly upstream of the dams except at the right abutment of the lower dam. Where bedrock is not exposed at the riverbed, it is expected to occur from 5 to 15 feet below the surface.

All of the schist and gneiss bedrock outcrops appear very hard and durable throughout the project area.

The strike of the bedding is oriented generally up and downstream or roughly perpendicular to the dam axes. The dip of the bedding is generally steep in a westerly direction. The strike of the joints is also generally perpendicular to the dam axes with the dip of the joint planes in a general upstream direction. The strike of the bedding and joints are generally parallel to portions of the forebay and canal walls which are oriented in a north-south direction. Joint and foliation planes intersect moderately frequently.

Reservoir Areas -- There was no evidence of slope movement or the potential for landsliding within the reservoir areas either between the upper and lower dams or upstream from the upper dam.

Old Railroad Bed -- From the lower dam to approximately 1500' upstream, the railroad bed appears to be constructed of rock rubble excavated from the nearby highway cut or is constructed directly on or very close to bedrock. The slope above the old railroad bed appears to be composed of large angular rocks excavated from the highway cut. From this point, to the old railroad bridge, the railroad bed becomes a slightly elevated embankment of sand and gravel.



## V. CONCLUSIONS

### Foundation Material

The foundation material beneath all the structures (dams, power houses, sluice house, forebays, power canals and etc) generally appears to have been of sufficient strength to support the loads imposed by these structures and other forces up to the present time. This is based on the fact that no settlement is detected along the dam crests. Also, no cracking is observed on any of the buildings. Most of the cracks on the right power canal wall, and on the training walls and foundations at the base of the upper power house and lower sluice house are likely related to erosion by water, or deterioration along joints and seams between successive concrete pours, and not to inadequate foundations. This conclusion is further supported by the hard and durable appearance of the bedrock throughout the area. Also, the available construction drawings indicate that the lower dam, together with the gate, power and sluice houses are founded on bedrock.

Regarding the apparent settlement in the right power canal wall, it is considered unlikely that poor foundation material has been the cause.

Although there are no drawings showing the upper dam foundation, it is considered very likely that the dam and appurtenant structures are all founded on bedrock. Drawings of the highway bridge, just downstream from the dam, indicate that the bridge footings are founded on hard bedrock. Also as mentioned previously, bedrock outcrops are extensive in the area.

### Horizontal Movement

The attitude of the foliation and joints appears to present no adverse orientation which would cause horizontal movement of the dam or adjacent facilities along bedrock discontinuities. However, local variations in the attitude of these discontinuities are likely to occur. The effect of such variation on the stability of the bedrock foundation is impossible to assess without more detailed subsurface information.

### Leakage

Significant leakage through the lower dam may be indicated by what appears to be horizontal jets or sprays coming from the

face of the dam. It is also possible that such an appearance could be caused by water flowing over the crest, striking a rough spot on the face and being deflected outward. Without close examination of these areas of apparent leakage it is not possible to determine if they are detrimental to the strength or stability of the dam. Other areas of leakage observed, appear to present no serious threat to the structures involved since the water is flowing out between non-erosive material. If water flowing through the dam was causing progressive erosion of the masonry concrete, serious structural problems, could, of course, result.

#### Uplift Pressures

Uplift pressures in excess of normal tailwater conditions could occur if there is a confined zone of seepage beneath the structures, either between the structure and the bedrock or through the bedrock foundation. It was not possible to observe the areas immediately downstream from the structures for indication of seepage. As a consequence, and without any peizometers to monitor, it is impossible to determine if uplift pressures exist. The near vertical orientation of many of the foliation and joint planes in the rock, however, may tend to drain sufficiently to prevent the buildup of excess hydrostatic pressure at the toe of the dam.

#### Potential Penstock Location on Railroad Bed

The abandoned railroad bed appears to be constructed of material which would provide an adequate penstock foundation (see previous description).

#### Slope Stability

There appears to be a very low potential for landsliding from seismic loading or other causes within the reservoir areas or at the dams and appurtenant structures.

#### Liquifaction

It is possible that the material deposited directly upstream of the dams could liquify during an earthquake. This would cause maximum lateral earth pressures to develop against the base of the dams from the liquified sand (together with the horizontal earthquake loading).

## VI. RECOMMENDATIONS

### Foundation

Before final assessment of the adequacy of the foundations, it is recommended to inspect those areas of the facilities which were either not visible or inaccessible at the time of this study. These areas include mainly the interior foundations of the power houses, gate house and sluice house, and the face of the dams, forebay walls and other areas which were covered by flowing water. (Possibly inspect during low flow.)

### Leakage

If possible, before final assessment of the seepage or leakage conditions is made, the dams should be observed during periods when there is a full head but water is not flowing over the crest.

### Excavation

Rock excavation techniques will be required in bedrock. It is very difficult to assess the potential for damage to the existing structures from blasting without better knowledge of the particle velocity propagation characteristics of the site and integrity of nearby masonry concrete or stone block structures. Based on studies by Nicholls, Johnson and Duval ("Blasting Vibrations and Their Effects on Structures", Bureau of Mines Bulletin 656, 1971), a safe blasting limit based on a scaled distance\* of 50 ft/lbs<sup>1/2</sup> may be used provided a particle velocity of 2.0 inches per second is not exceeded in the foundation soil and/or rock affected by the blasting.

Before any blasting is undertaken, however, it is recommended that samples of the concrete be obtained from nearby structures for evaluation of its condition and the extent of alkali-silica reaction which has taken place. In addition, the face of the stone block structures should be examined closely for evidence of horizontal movement at joints. Also, instrumented blasts should be conducted at the site to determine the particle velocity propagation characteristics. This is especially important if excavation for a fish ladder is required very close to existing structures (the dam structure and highway bridge, for example).

---

\*Scaled distance is obtained by dividing the distance in feet by the square root of the charge weight per delay interval in pounds.

If excavation is made close to the base of existing foundations, great care must be exercised to avoid under-cutting foliation planes, joint planes or other rock defects which could cause failure of the over-lying material by slippage along the defect.

Because rock excavation near the base of the dam could create a high risk situation regarding structure stability, it is recommended to investigate fish ladder designs which do not require rock excavation. It is recommended, therefore, to perform an accurate topographic survey of the rock surface in the area involved. It may be possible then, to choose an alignment for the fish ladder which will provide the required entry elevation and location, and at the same time require no, or very limited rock excavation.

If rock excavation is necessary, it is recommended to orient the line drilling along the planes of foliation. The rock will split easier in this direction.

#### Stability Analyses

It is recommended to perform stability analyses of the dam structure under both the maximum probable and maximum credible seismic loading. These should include other extreme loading conditions such as: maximum hydrostatic head, water flowing over crest and lateral loading due to possible liquefaction of the sand which has accumulated against the upstream face of the dam.

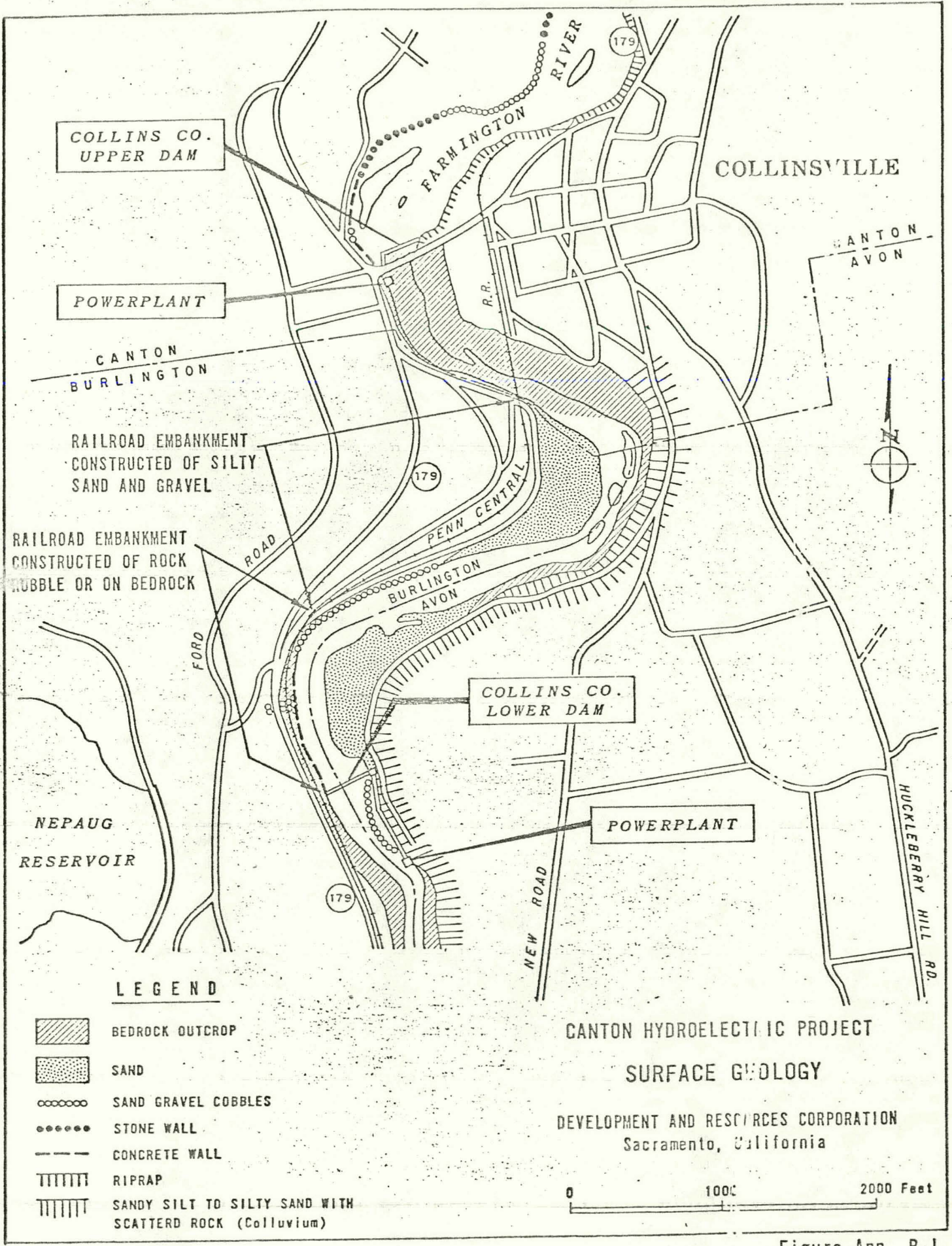


Figure App. B-1

CANTON HYDROELECTRIC PROJECT  
REGIONAL TECTONIC AND  
SEISMICITY MAP

DEVELOPMENT AND RESOURCES CORPORATION  
Sacramento, California

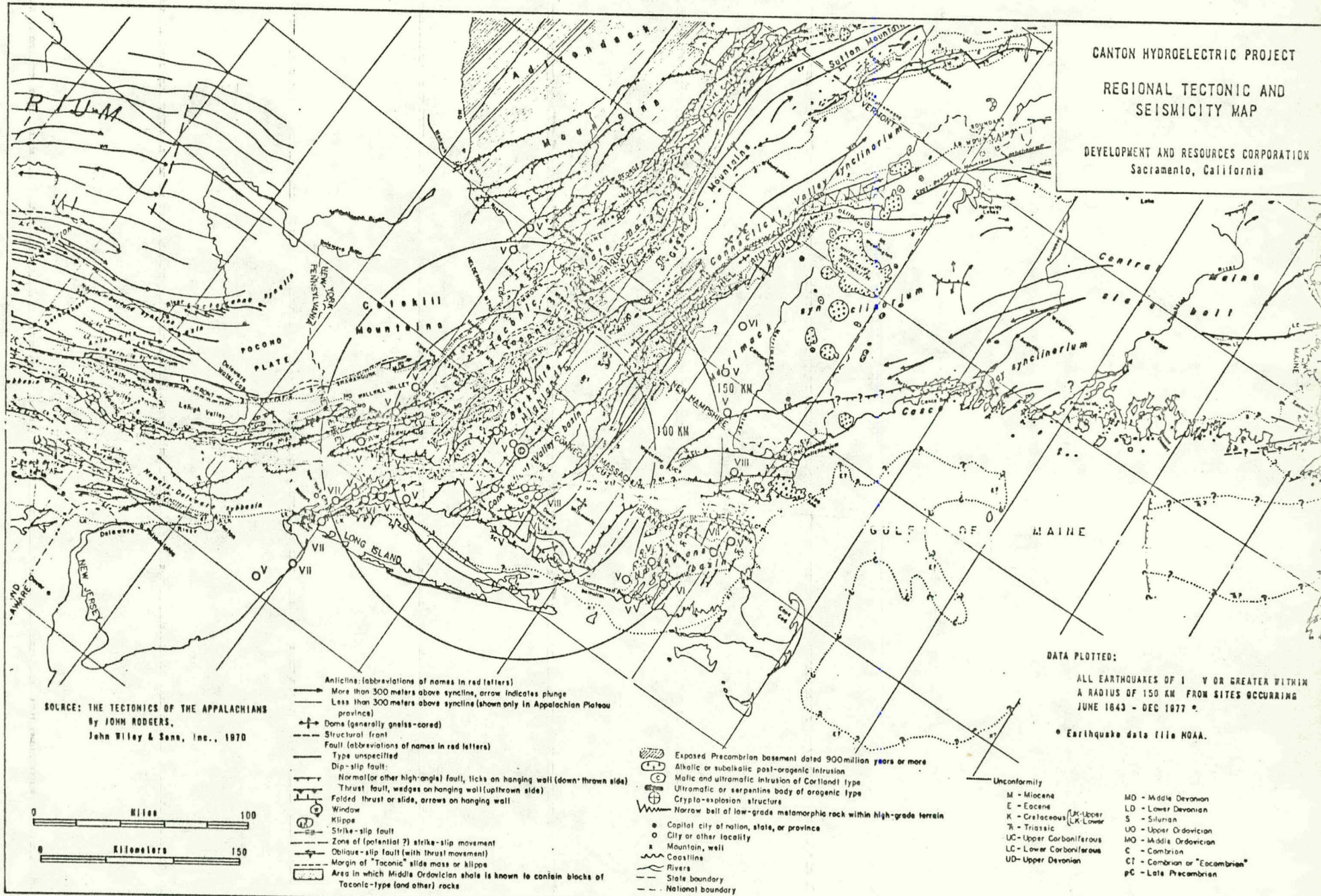


Figure App. B-11

APPENDIX C  
WATER QUALITY

# WATER QUALITY SAMPLING PROGRAM

 STATION NO. CFS-2

 LOCATION FARMINGTON RIVER
Collinsville

DATE	PH	ALKALINITY			DISSOLVED SOLIDS			TEMPERATURE °C	D.O.	BOD	TOC	TOTAL CARBON	SODIUM CHLORIDE	TOTAL HARDNESS	SULFATE	SPECIFIC COND.	AMMONIA N.	PHOSPHATE	A B S	IRON	COPPER	ZINC	COLOR	TURBIDITY
		HYDROXIDE	CARBONATE	BICARBONATE	TOTAL	FIXED	VOLATILE																	
6-3-70	7.2	0	0	12	91	16	75	19 20	3.1 2.2	1.1	5	8	16	23	1	110	0.1	0.1	4.05	0.2	4.1	4.1	25	2
	7.2	0	0	13	83	27	56	21 22	2.3 2.3	0.9	6	8	14	24	1	110	0.1	0.1	4.05	0.2	4.1	4.1	25	2
7-13-70	7.2	0	0	12	91	63	28	16 16	9.0 9.4	0.9	6	8	44	27	10	180	0.3	0.2	4.05	0.2	4.1	4.1	30	2
	6.9	0	0	12	64	39	25	16 17	9.6 9.8	0.9	6	8	66	25	5	100	0.3	0.1	4.05	0.1	4.1	4.1	27	2
10-5-70	5.8	0	0	17	91	31	60	14 15	6.7 2.5	1.2			17	28	9	130	0.2	0.2	4.05	0.4	4.1	4.1	29	3
	6.1	0	0	20	95	53	42	16 16	5.9 2.6	1.5			20	26	10	100	0.2	0.2	4.05	0.4	4.1	4.1	28	3
5-12-71	6.6	0	0	2	77	30	47	14 14	10.2 10.1	1.9	5	7	10	24	15	90	0.3	4.1	4.05	0.1	4.1	4.1	21	1
	6.6	0	0	2	75	27	48	14 14	10.1 10.1	1.1	6	7	12	25	18	80	0.2	4.1	4.05	0.2	4.1	4.1	22	1
7-14-71	6.9	0	0	12	84	46	38	16 16	8.7 2.2	1.0	8	11	16	32	17	100	0.3	0.1	4.05	0.2	0.1	0.1	27	1
	6.9	0	0	10	109	62	47	17 17	9.0 2.9	1.0	8	11	17	26	16	100	0.2	0.1	4.05	0.2	0.1	0.1	27	0
9-22-71	7.2	0	0	13	82	48	34	17 17	9.2 9.4	1.3	6	10	15	24	5	140	0.1	4.1	4.05	0.3	4.1	4.1	32	1
	7.1	0	0	12	76	40	36	18 18	9.6 9.7	1.1	7	10	16	23	5	130	0.1	4.1	4.05	0.3	4.1	4.1	32	1



# WATER QUALITY SAMPLING PROGRAM

 STATION NO. CS-2

 LOCATION FARMINGTON RIVER
Collinsville

DATE	pH	ALKALINITY			DISSOLVED SOLIDS			TEMPERATURE °C	D.O.	BOD	TOC	TOTAL CARBON	SODIUM CHLORIDE	TOTAL HARDNESS	SULFATE	SPECIFIC COND.	AMMONIA N.	PHOSPHATE	A B S	IRON	COPPER	ZINC	COLOR	TURBIDITY
		HYDROXIDE	CARBONATE	BICARBONATE	TOTAL	FIXED	VOLATILE																	
8-9-67	7.3	0	0	17	66	31	35			2.0		17	26	10		0.5	0.2	0.04	3.2	0.1	0.1	60	8	
	6.8	0	0	18	70	29	41			3.0		16	25	10		0.4	0.3	0.05	1.2	0.1	0.1	47	4	
10-4-67	6.6	0	0	20	70	55	15			0.7		30	36	12		0.3	0.3	0.04	0.9	0.3	4.1	37	4	
	6.6	0	0	20	68	43	25			0.7		6	34	12		0.2	0.3	0.04	1.0	0.3	4.1	35	3	
5-27-68	6.9	0	0	15	79	29	50			0.7		13	23	14	84	0.5	0.1	0.02	0.4	4.1	4.1	46	4	
	7.1	0	0	13	74	40	34			1.3		12	21	14	84	0.5	0.1	0.03	0.4	4.1	4.1	36	6	
8-19-68	7.0	0	0	23	76	60	16			1.3		27	34	6	106	0.4	0.2	0.05	0.2	4.1	4.1	25	2	
	6.6	0	0	20	71	54	17			1.0		22	31	6	106	0.3	0.2	0.05	0.2	4.1	4.1	25	2	
9-23-68	6.3	0	0	10	46	4	42			1.1		12	18	4	65	0.2	0.1	0.05	0.2	4.1	4.1	21	3	
	6.2	0	0	10	72	43	29			1.1		14	22	4	66	0.2	0.1	0.05	0.3	4.1	4.1	20	2	
6-9-69	7.1	0	0	14	82	39	43			1.0		15	25	5	80	0.5	0.2	0.05	0.5	4.1	4.1	33	1	
	6.9	0	0	12	76	39	37			1.8		13	24	7	80	0.4	0.3	0.05	0.5	4.1	4.1	34	1	
7-16-69	7.1	0	0	3	52	35	17			0.7		12	23	5	85	0.2	0.2	0.05	0.2	4.1	4.1	34	0	
	6.8	0	0	13	61	40	21			1.1		13	22	5	85	0.2	0.2	0.06	0.2	4.1	4.1	38	0	
9-8-69	6.5	0	0	18	87	41	46			0.7		19	29	7	110	0.4	0.3	0.05	0.5	4.1	4.1	40	1	
	6.8	0	0	17	79	44	35			0.5		19	28	7	110	0.3	0.3	0.05	0.5	4.1	4.1	38	1	



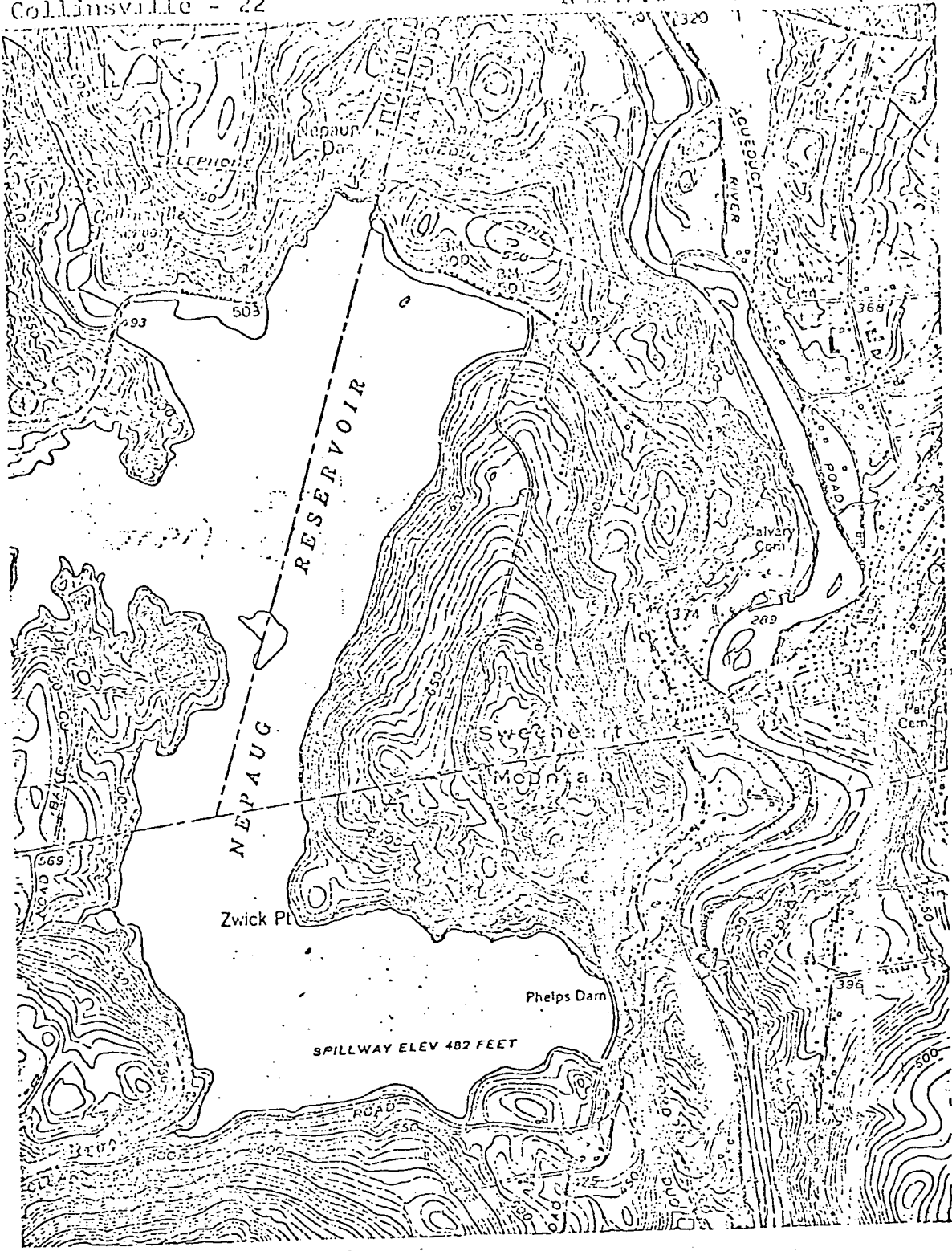
# WATER QUALITY SAMPLING PROGRAM

STATION NO CFS-2

LOCATION FARMINGTON RIVER - COLLINSVILLE

DATE	TIME	TEMP °C	DO	COLIFORM		E. COLI	
				MPN PER 100 ML	MF PER 100 ML	MPN PER 100 ML	MF PER 100 ML
8-9-67	1000	23	7.4				
	1245	23	9.6		2600		
	200	23	9.4				
	400	23	8.6		1200		
10-4-67	830	16	8.6				
	1145	17	9.2		2400		
	100	19	9.0				
	400	19	9.6		1400		
5-27-68	915	15	9.0		4100		
	1115	15	9.7		3600		
	115	16	9.5		3500		
	315	16	9.5		3300		
8-19-68	915	23	7.7	>24000	5300	150	<100
	1100	23	7.8	11000	2700	43	<100
	100	22	8.2	2400	2000	240	<100
	300	22	8.2	11000	1500	460	100
-23-68	800	19	9.4	4600	900	460	300
	1045	19	9.0	2400	1300	240	200
	130	20	8.8	460	800	240	100
	345	20	8.7	4600	900	240	100
-9-69	900	16	8.0	1300	1300		
	1100	18	8.5	510	510		
	130	19	8.6	630	630		
	300	20	8.6	1300	1600		
7-16-69	800	20	8.2	4600	770	91	
	1000	20	7.6	430	430	230	
	1200	21	8.0	430	2400	150	
	200	21	8.0	2400	710	210	
-8-69	950	19	7.5	11000	11000	11000	
	1145	19	7.5	2400	3900	2400	
	145	19	7.6	11000	3300	2400	
	450	19	7.7	2400	2500	230	
1-3-70	925	19	8.1	4600	4600	240	
	1125	20	8.2	1100	4000	240	
	125	21	8.3	1100	4000	93	
	325	22	8.3	240	1200	240	
-13-70	900	16	9.0	460	360	93	
	1100	16	9.4	460	290	150	
	100	16	9.6	460	340	93	
	230	17	9.8	240	260	43	
10-5-70	940	14	6.7	>24000	18000	240	
	1140	15	8.5	Bottle Broken			
	140	16	8.9	4600	9400	43	
	340	16	8.6	>24000	13000	1000	





IN ORDER TO GET TO THE LOWER DAM, PRESENTLY  
 HAVE TO GO THROUGH THE OLD COLLINS CO. FACTORY  
 ROADS - (ROAD TO DAM IS CHAINED OFF)

CFS-2      Collinsville-22      Farmington R.

Upstream end of canal at lower  
 Collinsville Dam in Avon, 600 feet  
 upstream from Wing Dam. 0.3 miles  
 due west from the north end of  
 Phelps Dam (Neпаug Reservoir)

APPENDIX D  
FISH FACILITIES

FARMINGTON RIVER ATLANTIC SALMON PROGRAM

AND

FISH PASSAGE REQUIREMENTS

AT

THE COLLINSVILLE DAMS

Prepared by:

The Department of Environment Protection

Farmington River Atlantic Salmon Program

and

Fish Passage Requirements

At

The Collinsville Dams

The development of an appreciable run of Atlantic salmon in the Connecticut River and Farmington River is feasible and possible. While the success of the program is highly probable it is impossible to put this type of development on a predictable time table. While it is not possible to predict the ultimate size of the salmon run in the Farmington River it should be possible given adequate numbers of suitable salmon smolts for stocking to develop an annual run of 4,000 fish.

On such short notice we were unable to come up with any current value figures for Atlantic salmon fisheries. Approximately 15 years ago one of the maritime provinces (New Brunswick) estimated that anglers expenditures totaled approximately \$20 for every pound of Atlantic salmon taken by angling. Two ocean winter salmon average about 10 pounds and these fish would be expected to make up the bulk of the salmon catch. At \$20 per pound each fish would represent angler expenditures of about \$200. Assuming an angler harvest of 50 percent of the run or about 2,000 fish this would represent angler expenditures of \$400,000 most of which would be spent in Farmington River Valley. Angler costs today probably average at least \$30 per pound which would indicate an annual expenditure closer to \$600,000.

Based on an extensive visual survey of the entire river from the West Branch Reservoir Dam downstream to its confluence with the Connecticut River and careful mapping of potential salmon angling water we have determined that



the Farmington River can support 40,000 man days of salmon fishing once the run is adequate to support a sport fishery. It should be possible to increase fishing pressure well above the figure of 40,000 man days, however, to do so will probably decrease the quality of the experience. The very recently released "1975 National Survey of Hunting, Fishing and Wildlife Associated Recreation" reports that on the average U. S. anglers fishing for anadromous fish spent \$17.40 per man day of fishing. Applying this figure to the estimated 40,000 man days of fishing results in an estimated expenditure of \$696,000 which very closely approximates the \$600,000 figure which is based on anticipated catch.

Much of the dollar expenditures generated by an Atlantic salmon fishery will be left in the valley and represent potential income to merchants, restaurants, motels, gas stations, etc.

As the run of American shad increases this fishery can also be expected to contribute appreciably to the economy of the valley. Most of the financial contributions to the economy resulting from shad will accrue to the area downstream of the Collinsville dams while most of the financial gain from the potential salmon fishery will be up stream of the Collinsville dams.

Installation of a generator at the upper Collinsville dam will make it necessary to install two fishways at this site. One fishway would be located on the east side of the river at the dam. The other fishway would have to be located at the outfall of the generator. During periods of generation the major area of attraction would be at the generator outfall, the area of maximum flow. Even so, some fish would move upstream to the dam itself

and during periods of no generation most fish would move upstream to the dam.

Mortality of small fish (salmon smolts or shad smolts) through a turbine varies considerably, but on the average is probably in excess of 10 percent. Mortality of adults through a turbine is for all practical purposes total. The turbine intake would have to be screened and downstream migrant facilities provided.

Downstream movement of juvenile salmon (smolts) would occur in March, April, May and possibly June. Downstream movement of juvenile shad would be during late July, August, September and part of October. Downstream movement of adult salmon would be during late October, November, late February, March and April. Downstream movement of adult shad would be during late June, July and August. There are probably only two months of the year, December and January when there would be little or no downstream movement of either shad or salmon.

Upstream movement of adult shad can be expected in April, May, June and early July. Upstream movement of adult salmon can be anticipated in May, June, July, August, September and October. Upstream runs of adult salmon may develop in March and April if we can adapt salmon from the British Isles to the Farminton River. We presently have some Scottish salmon (pre-smolts) whose parents entered their home river in early February.

It would only be reasonable that the owner and operator of a hydro powered generator would be required to install fish passage facilities, both upstream and downstream as well as the operation and maintenance of such facilities.

Without such a stipulation or requirement it would be a case of a single town benefiting from a state-owned facility and a natural resource at the expense of all of the other valley towns and in fact, all of the people of the state.

While conditions at the lower Collinsville dam are somewhat different than at the upper dam the basic premises and requirements are the same. Two fishways would be required as well as downstream migrant facilities. Installation, operation and maintenance of such facilities would of necessity be the responsibility of the user agency. Because of the distance between the dam and the power house a minimum flow of 80 cfs in addition to the fishway flows would be necessary to protect both salmon and shad. In addition, downstream migrant facilities would be required at the power house near the lower fishway.

Upper Collinsville Dam

Without generation:

Fishway \$94,000

No downstream migrant facilities required.

With generation:

Fishway at dam \$94,000

Fishway at power house 121,000

Downstream migrant facilities (including screening of intake) 150,000

Total \$365,000

Flows required:

Upper fishway at attraction water

80 cfs

Power house fishway

20 cfs

Downstream migrant facility

20 cfs

Total flow requirements

120 cfs

APR 1 - Oct  
- March to Oct

Lower Collinsville Dam:

Without Generation:	
Breeching Dam	\$50,000
Fishway (alternate)	121,000
With Generation:	
Fishway (including stubb fishway from canal into fishway at the dam)	\$161,000
Power house fishway	135,000
Downstream migrant facilities (including screening of intake)	<u>150,000</u>
Total	\$446,000

Flows Required:

Upper fishway at dam and minimum flows	100 cfs
Lower fishway	20 cfs
Downstream migrant facility	<u>20 cfs</u>
Total Flow Requirements	140 cfs

In all cases fishways and flow requirements are based on no ponding of water, no drawdown simple run of the river operation with no water use in excess of inflows.

The above listed cost estimates are approximate and are based on available 1978 cost figures. A minimum 10 percent annual increase in cost can be anticipated due to inflation.

MILO C. BELL

Consulting Engineer  
BOX 23  
MUKILTEO, WASHINGTON 98275

January 27, 1979

Mr. Rick Bettis  
Senior Associate  
Development and Resources Corporation  
455 Capitol Mall  
Sacramento, California 95814

Dear Mr. Bettis:

Enclosed you will find my initial report on the examination of the two dams on the Farmington River regarding the possible installation of fishways.

To cost these is difficult, unless the route of the structure is chosen and proved. I have attempted to indicate a possible route that would have the minimum cost.

The report provides an estimate of the flow requirements of the presently-designed fishway for the upper dam and a first estimate of the alternate flows that would be required by a pool and ladder type of fishway. A means of providing the necessary attraction flow through pumping is also described.

I shall continue to review my own report in light of some of the questions I have raised in it, but I believe that the figures contained therein will give your designers the opportunity to develop a feel for the necessary water diversions from the pools and, possibly, an overall structural cost, assuming that they agree with the routing that I have suggested.

The problem of providing adequate fish passage, both up and downstream, is probably complicated mostly by the cost of the fishway structures and by the water needs as outlined in the report, as there is no question that physical structures can be designed, installed and operated.

	INITIAL	ACTION	INFO	FILE
	Q JJS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Encl	EMM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RLH	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	CEK	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	BFH	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WHG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	RAE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	FRW	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MBR	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sincerely yours,  
*Milo Green*

*Fike Canton Hydro.*

## REPORT ON FARMINGTON RIVER DAMS FOR FISHWAY INSTALLATION

### Statement of introduction:

It is assumed, for purposes of this report, that the total project will be described in the over-all project development report by the Development and Resources Corporation.

### Data on fish run sizes not available in the reports submitted:

It is possible to develop physical structures for upstream and downstream passage of fish; however, there is no data base given to establish numbers of fish that may be expected as affecting structure sizes, based on (1) records of the historical fisheries, (2) records of the historical spawning areas and (3) current environmental conditions.

### Data from Connecticut River Basin Study may be of value in establishing run sizes:

There is a model for shad reproduction in the main Connecticut River, which may or may not be applicable to the Farmington River. This is presented in the publication, "Connecticut River Basin - A Framework for Environmental Impact Evaluation," prepared for the Federal Power Commission, December 1975.

Knowledge of run sizes is essential if a large population of fish is expected to return to the areas above these dams, as a fishway's size should accommodate the maximum run without significant delay.

Using an area comparison basis (Farmington River to total Basin), which is valid only for a general idea, the Farmington River might support as many as 40,000 shad in its full length and 1,600 Atlantic salmon. It is assumed that all of the Atlantic salmon would go above the Collingsville Dam, but 50 per cent or more of the shad would spawn downstream.

Temperature changes resulting from water storage that may affect fish passage time:

As higher temperatures (60 F for salmon and 70 F for shad) are critical in passage, and lower temperatures (42 F) in salmon passage, data on any changes from normal river temperature brought about by upstream storage would be most useful in projecting passage time for shad and Atlantic salmon.

Passage time in Lower Connecticut River:

It is reported that in the Holyoke area of the main Connecticut River, the shad runs should begin at approximately the first of May and extend through the first part of July. The Atlantic salmon runs extend from the middle part of April to the end of June, with a projected fall movement from the middle part of September to the first part of November.

As temperature is a factor in movement, it must be assumed that the shad will not begin to appear until the river temperatures are at 41-42 F. They begin to spawn at about 58 F. and can continue to spawn until the temperature reaches 68 F. The Atlantic salmon probably will start moving at the same lower temperature range, but they have a spawning range of up to approximately 55 F. These temperatures are

important for two reasons: (1) if the fish were to be held below the dams in too warm water they would die, or they might not survive to and through their spawning periods, and (2) as the shad have a much higher temperature tolerance, they would be less affected if held at higher temperatures. Chronological aging, however, might stop their movement.

#### General spawning requirements:

Both species are selective spawners and, apart from the necessary temperature gradients, they also require specific hydraulic conditions by which the pavement of the beds is formed and maintained, as well as water velocities over the spawning beds necessary for oxygen delivery. This means that if fish are required to pass above a dam for survival, then the efficiency of the fish passage must be considerably greater than if the adult fish could find suitable spawning areas and the juvenile fish suitable living areas below a dam.

For shad, velocities of .5 fps over spawning areas with sand bottoms are needed and, for salmon, velocities of .75 to 1.75 fps over spawning areas with depths ranging from .75 to 2 fps are required.

#### Behavioral patterns of salmon and shad during passage in a fishway:

The behavior patterns are demonstratively different for the two species. Salmon will ascend fishways as individuals and may prefer subsurface orifices to surface flows for passage. Shad are more gregarious, they tend to linger in the fishway pools, they tend to school and, hence, pass in schools rather than individuals, and they prefer surface passage to orifice passage. These differences must be provided



for in a fishway system and sufficient allowance made in the pools for the fish to rest and to accumulate.

Based on body length, both salmon and shad are strong swimmers. A fishway system designed to pass both species must be designed to allow for the conditions best suited to the species that require the greatest assistance. In tests of the Denil-type fishway, salmon were found to pass with better than 90 per cent efficiency, whereas, under the same conditions, shad passed with only 30 per cent efficiency, the shad requiring many more hours of passage time.

Four turbines to be installed:

The data sent indicate that two turbines, with a combined flow of up to 1,100 cfs, may be installed at each dam.

Use of hydrographic data for determining the time of fishway use:

Based on the hydrographs sent to me, as related to the passage time as mentioned in the year 1966, it is shown that there would have been no spill at either structure with the above water uses and, hence, a fishway at the dam itself (without an attraction spill) would not have resulted in proper passage. Conversely, in June, 1968, there were periods of spill when the fish would have been attracted to the spillway section of the dam.

Agency requirements:

The current requests of the agencies under the conditions at the dams have been to require fishway passage facilities at the powerhouse, as well as the spillway dams.

The reason for these requirements is that in the event of spills in excess of the power requirements, the fish would be trapped between the spillway and the tail race. It is indicated that there is a river channel, as well as a powerhouse channel, which would aggravate this condition. Conversely, if all of the water were to be taken through the power wheels throughout most of the year, there then would be little or no attraction at the spillway dam, unless water were spilled specifically for that purpose or the fishway flow augmented. The fish would be trapped in the tailrace area.

To obtain passageway, then, fishways would be needed to receive fish in the spillway area when there is a spill and at all times in the tailrace when the powerhouse is operating.

Types of fishways that could be recommended:

The pool- and weir-type fishway with surface attraction and the Denil-type are the two best suited. As the Denil-type already has been presented for possible installation at the upper dam, the criteria for such will be discussed before leading into the general discussion of alternate designs, flow requirements, and sources for attraction water.

The designed fishway for the upper dam:

The fishway shown by the Macchi Engineers for the Department of Environmental Protection is of the Denil-type. The design, apparently, is predicated on the lower dam being removed and no power installation at the upper dam and, hence, one fishway for the total system. The design calls for a velocity through the slotted section of approximately

4 feet per second and an operating depth of 4 feet, requiring 16 cubic feet per second. Without the 2 feet of splash board, the flow requirement would be 8 second feet. The design provides for an entrance with an adjacent attraction flow through a spill. It has a fish collecting and sorting area at the upper end. The upper section of the fishway is important to the agencies but not important in the passage of fish. The general slope is 1 to 8 and it has an interior width of 4 feet and a total drop of 12 feet.

The general advantage of this design is that it would operate without a flow control section at the upper end.

The disadvantage of the Denil fishway is that there are no resting areas, except the entrance, turns and exits. The fish must pass from the exit to the turn and from the turn to the outlet without pausing.

The fishway run length shown here is at the upper limit for shad, and shad would require approximately 60 seconds to pass through one leg. Approximately 30 fish per hour could be expected, which would give a passage of between 300 and 400 fish per day. This would allow for a run of between 18,000 and 24,000 fish in a season. Shad would linger in the turn pool and there could be delays and accumulation of 1 to 2 hours, so the turn pool would have to be materially increased (by almost ten-fold).

For Atlantic salmon, based upon an estimation of 1,600 in a season, the turn pool's capacity would only have to be doubled in size.

One of the problems in passing shad is to accumulate and hold them at the entrance. The current fishway design does not provide for an accumulation pool of any major size.

Without some method of accumulating shad, the efficiency of the total system would be less than 50 per cent. Discharges from the entrance probably should be made parallel to the discharge from the auxiliary water slot, in order that this would not mask out the entrance attraction flow. This could be accomplished within the design parameters shown, and is no problem.

The upper holding pool is not described here as, as previously stated, it has no effect on fish passage. Generally, once the fish have ascended the dam and are in the pool, they can be trapped and held, if required.

The major problem with this installation is that it is at the spillway dam and would have to depend upon an attraction flow, in addition to the 16 second feet, to draw the fish away from the turbines. If this attraction flow were as much as 16 second feet, giving a total attraction flow of approximately 32 second feet (fishway and spillway), the minimum flow of the river would at times be required at this point for the fishway system.

Other types of fish passage systems that might be considered:

Mechanical lifts. The advantage of this type of system would be that it would not require water from the forebay and the attraction water could be pumped. The disadvantage is that it requires maintenance and, at this time, such systems are manually controlled, although automatic equipment could be installed. The system would have to include a crowder in the collection area to insure that the fish could be quickly delivered to the bucket and the bucket raised for dumping into the forebay. This would require some measurement of the numbers involved to insure that there would be no over-crowding.

Locks. This type of fish passage would not be generally recommended. A lock could be primarily a steel tank and the fish could be raised in the same manner that a boat is brought to an upper surface. The disadvantage of locks is that they require mechanical maintenance and, at this time, such systems are manually controlled. Automatic equipment has been tried but has not been found completely successful. The system would have to include a crowder in the collection area in order to insure that the fish could be quickly delivered to the lock and the lock raised to forebay level. This would require some measurement of the numbers involved to insure that there be no over-crowding.

#### River levels as related to fish passage:

I understand that the river has been brought under control and that a reasonably low flood level can be anticipated. If the records furnished are representative of the current situation, an upper level of about 2,000 cfs for an operating range could be established. This would not produce water levels a great deal different than those created at lower flows by the use of flash boards, thus an operating range of approximately 2.5 feet could be utilized. Above this level the fishway system could become inoperative, but the records indicate this as occurring only at 1- or 2-day intervals during the fish passage time.

#### Use of a powerhouse canal for fish passage:

The most economical location for a fishway or any device for fish passage at the powerhouse would include the utilization of the power canal as the river transport system. If the average velocity in the canal does not exceed 3 fps, it could be expected that the natural shore line velocity would be in the 2 fps or less range, which is

satisfactory for upstream movement. There probably also would be resting areas. The figures given to me indicate that the canal velocities would be less than 3 fps, and it may be accepted that the power canals, with twice the average flow of the river, would constitute acceptable passageway.

Criteria for a pool and overfall fishway:

The drop between pools should not exceed 1 foot. A satisfactory pool size can be 8 to 10 feet long, 5 feet wide and 5 feet deep, or any other dimensions that would give a pool volume of approximately 240 cubic feet, with a minimum of 30 inches of depth. The upper range of discharges through this pool can vary from 16 to 20 cfs and give satisfactory passage conditions.

The fishway will work satisfactorily if it is 5 or 6 feet wide, with notches approximately 18 inches wide at each side and with the weir center blocked out. This gives flexibility in operation in the following fashion: During the maximum passage time both notches should remain open, but during the early and late part of the runs it would be possible to close the notches on one side. The flow pattern with both notches open requires 9 second feet and, with one side open, 4.5 second feet. Each pool provides resting areas. A pool would accommodate 125 shad, either resting or moving, or, in a ladder with 20 pools, up to 2,000 fish. Allowing 2 hours of passage time in 20 feet of elevation, this would accommodate the accumulated fish as, probably, the maximum number in a given pool would not exceed 100 during the maximum hour of movement.

The Atlantic salmon, being relatively few in numbers compared with the shad, would not be so affected by space as, probably not more than 64 fish would appear in a maximum hour and would pass in an hour.

The amount of fishway attraction flow needed, of course, varies when measured against the counter attraction flows. It can be assumed to be 3 per cent of a counter attraction flow, requiring approximately 30 second feet in the powerhouse channel and a limit of 60 second feet at the spillway. The added attraction flow at the spillway would come from overflow discharge and not from power water. The added flow in the powerhouse channel would come from pumping, for which only 1 foot, plus frictional loss, in the system is needed.

Assuming that the fishway system supplies a maximum of 9 cfs, approximately 20 cfs would be required to be pumped. These figures can be altered, depending on the ability to create satisfactory entrance conditions, based on known physical factors in the prototype, which are not available for this initial report.

A point that would be well worth spending additional research time on, and something for which, at this time, I do not have satisfactory data for the Connecticut River, is the time of day in which the shad do pass and the time of day in which they do not pass. Assuming that the shad of the Columbia River react the same as the shad of the Connecticut River, the night counts at Bonneville Dam would disclose whether the shad continue to move in the fishway system during the night period. Of more importance is whether they continue to enter the fishway during the darkness period. Insofar as salmon are concerned, they do not move into the fishway at night but continue to move within a fishway structure, probably to the upper pools. They do not exit into the river.

Assuming that the fish react as described above, there would be no need for supplying attraction water during the dark period. The fishway must continue to operate, as there would be fish in the structure or in the entrance bay. Assuming a 12-hour period of daylight and darkness, this could result in a 12-hour passage day or the attraction of fish from the river into the fishway system, requiring a 12-hour period of attraction flows.

The counter attraction flows, again, are based on the average flows in the river and, to refine these figures further would require power studies showing the specific times in which maximum and minimum flows would be passed through the turbines. It would be possible to reduce the amount of the attraction flow proportionately to the counter attraction flow during periods of reduced power production. A precaution, however, in regard to flow manipulations would be that a minimum night discharge would be needed through the power wheels to maintain suitable environmental conditions to hold the fish in the vicinity of the powerhouse tailrace.

#### Routing:

A fishway entrance is needed to attract the fish from the tail races of the powerhouses.

A fishway entrance would be needed at the spillway dam only if sufficient spill occurs during the upstream migration period to trap significant numbers of fish.

The power canals appear to provide river passage conditions, if the fish are introduced into a canal.



An alternative to providing a separate fishway for the spillways would be to eliminate all spills below 2,000 second feet at those points. (This quantity is subject to further review or study.)

The amount of spill would be that quantity less the power water use.

Spillways are indicated at both dams in the canals immediately upstream from the powerhouses. Investigations should be made of these to determine whether they can discharge the quantity above the power requirements (to 2,000 cfs) or be reconstructed to accomplish this.

On the river side of the powerhouse, at both the upper and lower dams, it is suggested that a channel be created with a "V" trap entrance. This channel need not be over 6 feet wide and a minimum of 3 feet deep at low river flow.

The fishway proper would be a series of steps, utilizing one wall of the canal, if possible, with only one new outer wall. It would be roofed over at the canal spillway area. It then would follow along the canal wall until it reached the elevation of the spillway, plus 2 feet (flash board regulation). If the foundation of the canal wall would not permit the use of the wall at the downstream end, the fishway would be constructed through the native rock at that point. The elevation of the outer wall at the downstream end would be equivalent to a discharge of 3,000 cfs in the natural river channel.

It would be proposed to enter the canal by two gated orifice openings, one in use when the flash boards are not in place and one for use when the pool is regulated by flash boards.

A control section would be needed and can be designed if this routing is satisfactory.

It appears that at the upper dam the canal wall is used as an extension of the spillway. To utilize this route would require that the canal wall be raised along the fishway route to the head equivalent to 2,000 second feet of discharge.

If it were not possible to spill the difference in power water, and there continued to be a spill at the spillway dam, it is suggested that an examination be made of the possibility of creating a channel, sloping upstream with a 180° entrance at the base of the spillway structure. This channel would enter the fishway system at the proper level by a "Y" connection, with additional water from the forebay added at this point to supply the necessary attraction water down the canal leading the fish to the fishway built from the tailrace.

The report prepared by the Department of Environmental Protection gives cost figures for one and two fishways. I have not checked these but they indicate a cost of between \$6,000. and \$8,000. per vertical foot.

The figures given in that report for the screening of the power intake indicate that a fixed type of screen was considered, which would have to be a louver type and, if so, should be combined with a trash rack to eliminate the need of two structures.

#### General downstream fish passage problems:

The heads at the dams will not create velocities in the spills greater than 40 feet per second at which velocity shearing injuries commence.

To determine the success of passage through any turbine, additional details such as RPM, negative pressure, blade clearance,

machine efficiency and fish size are required. The fish sizes will depend on food supply and temperature. The young shad should range from 3 to 5 inches in length. The young salmon should range from 5 to 7 inches in length.

The downstream migration times for shad are October and November, and for salmon April, May, June, October and November.

As there will be no spill in October, years of no spill in November and years of little spill time during April, May and June, it must be assumed that the fish must pass through the turbines or that special by-passes will be required.

Additional information will be required to determine the use of a trash rack as a diverting louver, which would be the least expensive screen if screening were to be requested or considered. The louvers are the least efficient of the fish screens and only a judgment as to the combination of the effectiveness of louver guidance and a basic reasonable loss in the turbines would make it possible to determine whether the cost of providing complete fish screening could be borne by the project.

Obviously, any water from the forebay used for the fishways might be considered as a fish by-pass supply.

I suggest at this time that this subject be left open until the question of whether upstream passage can be successfully answered.

Milo C. Dell  
January 27, 1979

MILO C. BELL

Consulting Engineer  
BOX 23  
MUKILTEO, WASHINGTON 98275

February 14, 1979

Mr. Rick Bettis  
Senior Associate  
Development and Resources Corporation  
455 Capitol Mall  
Sacramento, California 95814

Dear Mr. Bettis:

I telephoned Dean Porterfield from Boston and arranged to meet him on February 2 in his office in Canton Center. We had lunch together and spent that time discussing general problems. He then drove me to the two dams for site inspections.

I find that they are quite concerned with the fisheries problems as they may have first priority on the water, but would like to utilize it as long as possible, or as much as possible, for hydro purposes.

During lunch the following points were disclosed. The storage dams upstream do block the fish and there is no plan at this time for fish passage at those projects; on the other hand, there is no reason that it could not be added if the fish runs developed. There are temperature data available, which would help in determining the environmental conditions below the storage dams and above the low head dams under discussion. The flash boards used at the upper dam apparently are installed annually by a local group who utilize the pond for water skiing, boating etc.

From the field inspection the following facts are evident:

1. The flash boards leak badly, which is no problem as long as the water is not being used for any purpose.
2. There is a new housing development within the floodplain upstream from the upper dam.
3. An ice jam has formed in the area above the upper dam--there were chunks of ice in the outlying brush.
4. Generally, except for the above-mentioned new housing, everything else is out of the floodplain.
5. In view of the controlled flood conditions, it might be possible to install more permanent-type flash boards, with little or no leakage, and still maintain the flood backwater levels. This would provide easier annual operations and make more practical the suggestion for a fishway only at the powerhouse.

I found at the upper dam something that I had not understood, and that was that on the left bank there is a spillway crest with flash boards and a possible

RECD FEB 16 1979

Mr. Rick Bettis  
February 14, 1979  
Page two

gated area. The gated spillway could be used to help in maintaining pond levels up to 2,000 cfs. This would also hold the fish in the area near the power wheels.

At the lower dam, where I had assumed that there might be a wall and that the dirt shown on the plan was from materials cleaned from the ditch, I find that this is not so as it is obvious that this was a part of the original construction and that there is no wall and, hence, the fishway would have to be a complete flume in the lower section above the powerhouse.

There was no opportunity to examine in detail the spill gates, but it appeared that both could be utilized by roofing over the fishway adjacent to them where the proposed fishway route would pass under their outflow.

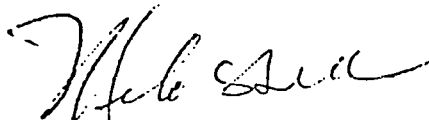
As the lower pool is apparently is not used for recreational purposes, it might be possible to have a foot or so of regulation in this pool if the dam height were increased by some permanent type of flash board.

Mr. Porterfield was of the opinion that a meeting with the State officials who are interested in the project would be fruitful and he asked if I were to return to the area whether I would consider meeting with them. I advised him that I would be prepared to do so and that it was possible that I would be back in the Boston area in about 6 weeks.

He made an interesting comment that it might be possible for a time to haul fish from the Rainbow Dam around the present projects until the return run was assured. In any event, we discussed the question of timing and it is obvious that if only Atlantic salmon and shad are to be considered, there would be no point in operating the fishway system until fish had ascended Rainbow Dam and perhaps with two days of travel time allowed between Rainbow Dam and the lower of the two dams. This means that the actual run time can be given a thorough study and that water need not be passed at these dams simply on a calendar basis.

He also advised me that in one of the storage pools there is a reserve quantity of water equal to a flow of 150 cfs for 21 days for fisheries purposes. I assume that this could be used to augment various flow levels and would not necessarily be discharged at any specific period in a water year. He felt that the fisheries use might guarantee the downstream flows to some extent and act as some check on further water appropriations from the reservoir.

Sincerely yours,



Milo C. Bell

APPENDIX E  
UTILITY RATE DATA

# THE HARTFORD ELECTRIC LIGHT COMPANY

CO-GENERATION

RATE 90

Page 1 of 3

## APPLICABILITY

This rate is applicable to any customer who has a permanent electric service connection to the Company and who has electric generating equipment installed for the purpose of supplying all or part of the Customer's electricity requirements. For purposes of this rate schedule the customer's electric generating equipment shall not exceed 1000 kW, or the customer sell more than 1,500,000 kWh of surplus energy, annually to the Company.

## PARALLEL OPERATION

The customer's generating equipment may be operated in parallel with the Company provided that the customer complies with the Company's specifications for parallel operation. The customer is responsible for all costs associated with the installation and the connection of the generating equipment to the Company's lines. The customer must provide automatic protective equipment, approved by the Company, such as, but not limited to, over current protection, over and under voltage protection, over and under frequency protection, and automatic synchronization. Complete detailed engineering drawings of the connection of the generating equipment to the Company's facilities must be submitted to the Company. Parallel operation will not be allowed until written approval is given by the Company to the customer. The Company may, at its option, periodically inspect, test, and recertify in writing the customer's compliance with the Company's specifications for parallel operation. A customer's failure to maintain certification will cause immediate termination of parallel operation until such time as new certification can be received.

## PURCHASE OF CUSTOMER SURPLUS GENERATION

A customer who desires to supply surplus electricity to the Company must operate in parallel with the Company. The Company will purchase electricity supplied from the customer's generating equipment in accordance with the following:

The Company will purchase electricity supplied from the customer's generating equipment at a price per kilowatthour equal to the Company's average fossil fuel cost less 20%. Said average fossil fuel cost shall be determined in accordance with the fossil fuel costs and kilowatthours as filed with The Connecticut Public Utilities Control Authority in support of the Company's Fossil Fuel Adjustment Clause rate, based on the second month preceding the billing month in which a purchase by the Company takes place.

The Company may, by giving at least six hours' prior notice (which may be by telephone), refuse to purchase electricity from the customer when the cost of incremental energy available to the Company is expected to be less than the price which would be applicable to energy supplied by the customer. The Company shall not be obligated to pay for inadvertent flow of electricity from the customer's generating equipment.

Effective:

THE HARTFORD ELECTRIC LIGHT COMPANY

CO-GENERATION

RATE 90

Page 2 of 3

The Company will install own and maintain the metering equipment necessary to measure the electricity purchased by the Company from the customer. The Company shall be responsible for reading this meter monthly, computing the number of kilowatthours so purchased and submitting appropriate billing data and payment to the customer.

Each month, whether electricity is supplied by the customer to the Company or not, there shall be a \$6.00 charge to the single phase customer and a \$9.00 charge to the three phase customer to cover the cost of metering and administration.

COMPANY BACKUP/STANDBY TO CUSTOMER GENERATION

The Company will provide backup/standby service to the customer's own generating equipment used to supply a portion of the customer's electricity requirements. The customer shall submit a written request to the Company specifying the nature of the backup/standby service required in sufficient detail to permit the Company to confirm that such backup/standby service will not have an adverse impact on service to the Company's other customers.

Non-Residential customers taking backup/standby service, and residential customers at their option, will be billed in accordance with either Small General Electric Service Rate 22 or Large General Electric Service Rate 50. However, if the rated capacity of the customer's generating equipment, excluding the capacity of the customer's own standby and/or emergency generating equipment, exceeds 5% of the customer's maximum annual peak load, the customer shall pay an additional monthly charge of \$3.50 per kw of backup/standby service required. Notwithstanding the foregoing, in lieu of paying such a monthly charge the customers may elect to have the rate 22 or rate 50, as appropriate, billing demand determined as follows:

The billing demand shall be the greater of the following:

- 1) the maximum demand that occurred during the current month;
- 2) 70% of the maximum demand that occurred in any of the months of February, March, April, May, October and November during the previous eleven months;
- 3) the maximum demand that occurred in any of the months of January, June, July, August, September and December during the previous eleven months.

Residential customers taking a backup/standby service who do not elect to take service on rate 22 or 50 will be billed in accordance with Residential Electric Service Rate 1 or Residential Time-of-Day Electric Service Rate 7 and shall pay an additional monthly charge of \$3.50 per kW of backup/standby service required.

Effective:



THE HARTFORD ELECTRIC LIGHT COMPANY

CO-GENERATION

RATE 90

Page 3 of 3

The term of contract for backup/standby service under this tariff is one year and thereafter may be terminated by one month's written notice. In the event that the customer terminates backup/standby service, the Company thereafter will not provide backup/standby service to the same customer for a period of one year from date of termination.

Effective:

THE CONNECTICUT LIGHT AND POWER COMPANY  
THE HARTFORD ELECTRIC LIGHT COMPANY

Docket No. 780719

Testimony of  
Dr. H. Edwin Overcast

Q. Please state your name and business address.

A. H. Edwin Overcast, Northeast Utilities Service Company, (Service Company), Selden Street, Berlin, Connecticut.

Q. Please state your position with the Service Company.

A. I am a Rate Economist.

Q. What is your educational and business background?

A. I graduated cum laude from King College with a BA degree in Economics and received the Doctor of Philosophy degree in Economics from Virginia Polytechnic Institute and State University. My principal fields of study included Economic Theory, Public Finance, and Industrial Organization with supporting fields in Econometrics and Statistics. I have taught courses at both the graduate and undergraduate level in Microeconomic Theory, Managerial Economics, and Public Finance. In addition, I have taught courses in Mathematical Economics, Economics of Regulation, and Money and Banking. While a faculty member at East Tennessee State University I was appointed to the Graduate Faculty and subsequently directed thesis programs for graduate students.

In 1975, I joined the Tennessee Valley Authority as an Economist in the Distributor Marketing Branch. I held successively higher positions as an Economist in the Rate Research Section of the Rate Branch and was ultimately Supervisor of the Economics Staff of the Rate Branch. In that capacity, I was the principal staff advisor on and responsible for work in the following areas: economic analysis of rate-making policies as they affect TVA; analysis of the impact of utility rate structures, pricing concepts, and load management programs upon the economic, social, or environmental sectors at both the regional and national level; determination of the need for basic research required in rate design and cost of service; evaluation of the effectiveness of the rate research effort; and design and analysis of experiments to test alternative pricing and load management options.

In May of this year I joined Northeast Utilities as a Rate Economist in the Rate Research Department. In that capacity, I am responsible for the economic analysis of rate policies in the electric, gas and other commodity markets; providing assistance in the development of overall pricing objectives and policies for the NU system; preparation of expert testimony related to rate research fundtions; and other duties wherein economic expertise is required such as cost analysis, rate design, and analysis of current trends in the industry.

Q. Under what terms and conditions are customers of The Connecticut Light and Power Company and The Hartford Electric Light Company with generating equipment presently served?

A. Section 6.1 of the Rules and Regulations of both Companies reads in part: "Where the customer has apparatus for the generation of electric energy, his wiring must be so arranged as to make it impossible, by the closing of switches or otherwise, to connect such apparatus with the Company's service unless such wiring arrangements have been approved in writing by the Company."

Q. Do the Companies now wish to further modify this arrangement?

A. Yes, Exhibit 1 sets forth a proposed Co-Generation Service Rate 90 for both Companies applicable to small customers. This rate is intended to modify and expand the potential for co-generation in the respective service territories.

Q. Does Rate 90 as contained in Exhibit 1 differ from the June 27, 1978 filing?

A. Yes. Minor changes have been made in the rate to reflect informal discussion with the Authority's staff. These include specification of the maximum size of customer which might receive service under the rate, clarification of the Companies' right to periodically certify the compliance of the customer's equipment with Company specifications for parallel operation, and the special treatment of large co-generators. In addition, the backup/standby charge has been changed to reflect recently completed cost of service studies.

Q. What is Co-generation?

A. Strictly speaking, co-generation refers to the simultaneous production of electric power and process heat, usually in the form of steam. While this is a technically correct definition, the term co-generation has recently been given a broader meaning to include any non-utility owned generating equipment which can be used to meet all or part of a customer's electric energy requirements and which may during certain hours of the day or at certain times of the year produce surplus electric energy to be sold to an electric utility.

Q. What types of co-generation arrangements would be covered under Rate 90?

A. In the development of Rate 90 we have attempted to cover all possible co-generation arrangements which would include any customer who might economically produce surplus energy for sale to CL&P or HELCO. We do not intend to limit the co-generation rate to combined thermal plants but rather the Companies have endeavored to design a rate which would produce economically correct price signals for all customers regardless of their generating source.

Q. Has Rate 90 been designed to accommodate and encourage the expansion of co-generation in the Companies' service area?

A. This rate has been designed to reflect as nearly as practicable the economic benefits which the Companies might receive. To the extent that a co-generator finds that cost based rates are attractive, then the co-generation schedule accommodates and encourages co-generation. As discussed below, the Companies are particularly concerned that the co-generation schedule reflect the full costs of this type of arrangement and that no additional costs be imposed on existing customers (i.e. no subsidy be provided to a co-generator). In this way the full resource cost of a co-generation arrangement is reflected.

Q. What types of co-generation arrangements do the Companies anticipate?

A. At this time, the Companies do not anticipate a large number of customers on this rate. However, as co-generation is most economical when power production and process heat functions are combined, it is likely that potential customers will come primarily from those industries which have large process heat requirements such as the pulp and paper industry, the chemical industry, or the primary metals industry. In addition, there may be some existing hydroelectric sites which may be refurbished to provide residential energy with some surplus energy available for sale to the Companies. Other potential sources of co-generation include windmills, burning refuse, and solar collectors. In most cases, the hydroelectric, solar, and windmill applications will be relatively small sources of generation. Co-generation, where large process heat requirements exist, offers the greatest promise for significant generation

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and would most likely require a special contract between the Company and the customer because of the potentially larger amount of energy available for sale to the Company, the possible desirability of entering into special arrangements for economic dispatch of the customer's generation, and the likelihood that the Company would provide large backup/standby service for a customer owned generator.

Q. Why do the Companies distinguish between large and small co-generators?

A. There are a variety of possible arrangements for metering, administration and billing co-generators ranging from a simple kilowatthour exchange to highly complex hour by hour dispatch. The Companies recognize that a co-generation arrangement where the price is based on a simple average cost would not be in the best interest of the customer, or of the Companies and their remaining customers, where relatively large amounts of energy are available. When large quantities of energy are bought and sold, metering and billing costs, while high in absolute dollars, make up a relatively small portion of the total costs and therefore have smaller and perhaps even insignificant effects on co-generation economics. Furthermore, because we are dealing with large quantities of energy, it is particularly important that the prices paid by the customer for capacity and energy furnished by the Companies and the prices paid by the Companies reflect economic costs. In addition, it is necessary that the Companies monitor the cost of energy from the co-generator to ascertain that at all times the energy flowing to the Companies are no more costly

than the incremental energy available to the Companies from its own sources or from NEPOOL thereby guaranteeing to all customers that rates are as low as feasible.

As a practical matter, the carrying charges, for metering, as discussed below, are such that the installation of sophisticated metering facilities on small co-generators would cause the project to be economically infeasible. This situation is analagous to billing of residential customers on a one dial kWh meter rather than on some form of a demand meter using both demand and energy charges. The revenues collected from (and in this case paid to) small customers would not justify the metering expense necessary for any complex billing schemes nor would the administrative costs be justified. Thus an expensive and complicated billing and metering scheme for small co-generators would make it virtually impossible for such a customer to recover the monthly metering costs, his own costs, and earn a return on his investment sufficient to encourage the development of the co-generation arrangement. It was the Companies' feeling that no potential co-generation arrangement should be precluded by an unreasonably cumbersome billing or metering requirement.

Without separation of customers into large and small categories it is possible and indeed probable that some potential co-generation projects would be discouraged and/or all customers would be forced to pay electric rates higher than they otherwise would.



Q. What is the basis for determining whether a customer is a large or small co-generator?

A. Ideally this determination would be made on a case by case basis after considering all the technical design factors associated with the co-generation arrangement. In particular we would be concerned with the firm load capacity of the generating unit, its likely capacity factor, the total load and load pattern of the customers, the potential surplus energy available to the Companies, the likely load pattern of the energy available to the Companies, and any other factors necessary to fully evaluate the costs and benefits of a particular co-generation project. However, rather than develop a detailed analysis of each customer and in order to provide some certainty with respect to rates for small co-generators, the upper bound has been established at 1000 kW of capacity and 1,500,000 kWh of surplus energy annually for sale by the customer to the Company. However, the Companies reserve the right to consider special cases and waive these limitations if the operating characteristics mentioned above make it practical to do so.

Q. What is the basis for the determination of the purchase price of customer generation at average fossil fuel costs less twenty (20) percent?

A. Typically, co-generation customers will provide energy to the Companies during off-peak hours. This occurs for two reasons: First, during peak hours (both the Companies' and the customer's

tend to coincide) the implicit value of the customer's generation is higher for him particularly where the customer is subject to time-of-day rates and/or to ratcheted demand charges; Second, the typical industrial co-generator has larger electric requirements during the peak load hours than can be furnished by his own unit. Thus, there normally would be no surplus generation for sale to the Company during these periods. Rather, excess energy usually would be available only during the Company's off-peak periods when this generation is of less value to the Company.

Given the assumption that most of the energy purchases from co-generators would come in off-peak periods, two considerations influenced the determination of the price paid for purchases from the customer. First, the price paid to the customer should not exceed the Companies' incremental fuel costs in the off-peak period. ✓

This consideration is obviously designed to guarantee that co-generation arrangements do not result in penalties for all other customers. At the same time, the price paid to the customer should reflect the value of energy to the Companies and its other customers, ✓ so that decisions regarding a co-generation option can be made in the most economically correct fashion, thereby guaranteeing optimum resource allocation.

A determination of the Companies' incremental fuel costs in off-peak periods requires a review of the NU system operating characteristics. The system, as presently operated, fully utilizes all the

nuclear energy available and in addition oil-fired units must operate in virtually all hours of the year. Thus, any reduction in customer load caused by the contribution from the customer's co-generation facility would require less operation from the system's oil-fired capacity, and if the co-generation facility contributed energy directly to the utility system it would also displace the use of oil-fired capacity.

Given these operating characteristics, the 20% discount factor is comprised of two components.

First, it is envisaged that any owner of a co-generation facility will utilize its electric output to supply his own electric demand first, and will contribute to the supply of the Companies' other loads during periods when his generation is in excess of his requirements. Typical daily load shapes of most customers on the Northeast Utilities system peak during the period between 8 am and 8 pm. Therefore, to the extent that a co-generation facility would contribute to reduction of a customer's load and have the greatest cost benefit to that customer, it can reasonably be assumed that the facility would be fully utilized for his own load requirement during the peak load period mentioned. If the co-generation facility continues operation during the remaining evening and night low load level hours, the off-peak period, this excess energy would be supplied to the electric utility's system. This would be true whether the co-generation facility supplied steam or heat in addition to electricity. During the off-peak period, evening and night

hours, it can be anticipated that the fossil unit heat rates might be 9,500 BTU's per kilowatthour. This value compares to the average of oil-fired fossil unit heat rates in the order of 10,500 BTU's. However, in any one hour the ratio between off-peak heat rate and the system's average heat rate could be significantly different than indicated above. This ratio depends upon the load levels experienced and the availability of nuclear or major fossil units. If all nuclear units are available and the load levels in the hours of the evening or early morning are very low, as is usually experienced during the spring and fall, then the off-peak displacement rate could be significantly less, perhaps approaching 8,000 BTU's per kilowatthour. However, there would, of course, be a corresponding reduction in the average fossil fuel rate during that same time period. At other periods of the year if nuclear units were not operating because of refueling, scheduled maintenance or forced outage, then the displacement heat rate of oil-fired units in the off-peak hours could be 10,000 BTU's per kilowatthour with a corresponding increase in the average fossil fuel rate during that period.

1 unit  
HE 1000

What is intended by this discussion is to point out that careful analysis on an hour-by-hour basis is required to identify precisely which units are being displaced by the energy from the cogeneration facility. Computer studies performed by Northeast Utilities on an hour-by-hour basis have indicated that it can be expected that the incremental fossil unit's heat rate will be about 10 percent lower during the off-peak periods when compared to the system average heat rate.

Second, all generating units in New England are under NEPEX dispatch, meaning that the New England area is dispatched as one large power pool. Northeast Utilities is a member of the New England Power Pool and as such is entitled to economic interchange transactions. Such arrangements permit Northeast Utilities to purchase economy power at a net price below its own alternate source (decremental rate). Such economy power is purchased at a rate equal to our decremental rate less a "savings share". Each savings share is presently worth about 2.5 mills/KWH, which is equivalent to about 10 percent of current average fossil fuel price of about 23 mills/KWH. While it is difficult to specifically identify for each hour when this economic transaction would have taken place and therefore to quantify when Northeast Utilities would be entitled to a savings share, our system is typically a purchaser "against" our fossil units in off-peak periods. Accordingly, it is appropriate to recognize that the true off-peak cost is typically less than what would be predicted from analysis of our own system operation. The co-generation facility by its contribution to the utility system's energy requirement could reduce Northeast Utilities' entitlements in economic interchange transactions and accordingly in a share of pool savings. Another way of looking at this is that instead of Northeast Utilities buying from the co-generation facility, it could buy at the same rate from the New England Power Pool and, in addition, receive a discount of 2.5 mills/KWH for entering into such a transaction.

Pool  
Share

It is on these two premises that Northeast Utilities has come to the conclusion that the appropriate pricing signal for power obtained from co-generation facilities would be the average fossil fuel price less 20%. This discount is comprised of a 10% reduction due to the expected co-generation facilities' contribution during the off-peak periods, and of an approximately 10% reduction due to recognition of the opportunity to purchase economy power.

Q. Why do the Companies reserve the right to refuse to purchase electricity on six hours' notice?

A. During certain limited periods of the year, the combination of available generation both from our own system and/or in the form of purchases from neighboring utilities with low load requirements could result in nuclear or other extremely low cost base load units providing the incremental load. Also, due to unexpected changes in system energy costs, the cost-less 20% formula could be rendered uneconomical. Thus the real cost of incremental energy to the Companies at those times could be considerably below the average fossil fuel cost less 20%, which the Companies have set as the purchase price. In order to provide maximum economy for delivered energy to all customers, the Companies must be able to refuse to purchase energy from these higher cost energy sources. Thus all customers would benefit from the Companies purchasing the lowest cost energy available.

Q. Why have the Companies not included a capacity credit for co-generators?

A. As I have indicated previously, co-generation customers receive an implicit capacity credit in the form of reduced demand charges which they must pay. This capacity credit, while not a direct payment by the Companies, is nonetheless a dollar credit for the customer.

Q. Why do the Companies require that all metering equipment be owned by the Companies?

A. Normally the Companies would agree that its supplier should provide its own meter and billing at its own cost. As a practical matter, however, the Companies have both technical expertise and economies of scale with respect to purchasing, installation, testing, maintenance, and reading meters which relatively small customers, such as those expected to have surplus energy available, could not otherwise obtain. The necessary equipment for meter testing is expensive and further, the Companies typically would be the only readily available source of meter testing for a customer. These constraints make it impractical for the customer to own the metering equipment and his ownership, at least for small installations, would tend to increase the costs above those of the Companies.

Q. What is the basis for the \$6.00 per month charge for metering equipment and administration to single phase customers and the \$9.00 per month charge to three phase customers?

A. Metering carrying charges (composed of the cost of capital, depreciation, operation, maintenance, and taxes) amount to approximately thirty-one (31) percent per year. The required metering installation, excluding customer provided socket, for single phase co-generation customers would, on average, represent an investment of \$121 and an investment of \$220 for three phase customers. Using the 31% carrying charge, the monthly metering costs would be about \$3 and \$6 respectively. "Handling" costs for reading, billing, and payment would be about \$3.00 per month resulting in a charge of \$6.00 per month for single phase and \$9.00 per month for three phase service.

Q. Why have the Companies included a backup or standby provision in the tariff?

A. As with any mechanical device, there will be times when the customer's generating equipment is out of service for maintenance or for emergency repairs. As these events represent a combination of random occurrences and scheduled events, the customer at his option may deem it feasible to insure his own continuous operation by obtaining backup/standby service from the Companies. Backup/standby service is basically an "insurance policy" which protects the customer against unavailability of the customer's generating equipment.

In the case of residential co-generators, where the cost of providing duplicate facilities would be prohibitive, provision of backup/standby service insures continuous operation of residential



appliances and minimizes inconveniences which might otherwise result from a failure of the customer's generation. For industrial customers, backup facilities may or may not be required depending on the nature of the production process, the customer's individual requirements and the nature of the customer's generating facilities.

Q. Why does the tariff provide for an additional monthly demand charge of \$3.50 per kW for backup/standby service?

A. The Companies incur incremental costs in providing sufficient generation, transmission, and distribution capacity to serve the customer's maximum requirements at such time as backup/standby service is required. As these costs are fixed and incurred whether or not the service is required, the costs must be recovered. In addition, these costs are directly assignable to the co-generation customer and should, therefore, be recovered from these customers.

Q. What is the basis for determination of the \$3.50 charge for backup/standby service?

A. Recently completed embedded cost of service studies show that the Companies' costs of having transmission and distribution facilities available for the customer with backup/standby service exceed \$3.00 per kW per month. In addition, the cost of providing backup/standby generation is at least \$.50 per kW per month.

The estimate of \$.50 per kW per month is arrived at by assuming that such backup service would be provided by peaking type generation. However, it is likely that one such peaking unit could provide backup service to several customers because one can assume that, depending on the mix of generating types, simultaneous outages are unlikely. The cost of gas turbine capacity, including an allowance for delivery losses, is about \$18 per kilowatt per year or \$1.50 per month. Allowing for diversity, a charge equal to 1/3 of the total cost or \$.50 per kilowatt per month has been used.

It must be recognized that this is a minimum estimate of potential capacity costs associated with backup/standby generation. There is presently insufficient data to arrive at a more economically correct charge which would consider the precise probability that unit outages would create peak demand requirements. Such a determination would be based in part on the size, type, age, and operating characteristics of the customer's generating equipment, all of which is presently unknown.

- Q. What is the basis for determining the alternative billing demands for backup/standby service as set forth in the rate?
- A. As I discussed above, customer generation outages can be random occurrences or scheduled events. Billing demand determination is designed to reflect the potential impact such a random occurrence might have on the system. During the potential peak months of January, June, July, August, September and December there is a 100%

ratchet to reflect the impact on the generating system and to provide to the customer a signal that scheduled maintenance should be performed outside those peak months. Random outages during peak periods could have a tendency to spike the peak thus creating additional generating requirements and to some extent the 100% ratchet provides that signal. The 70% ratchet of the remaining months reflects optimum periods for scheduled outages and the lesser likelihood of creating capacity requirements.

Q. Why do the Companies allow customers to choose to pay for backup/standby service at a fixed rate of \$3.50 per kW or alternatively to select a special demand determination which is the billed on one of the two general service rates.

A. The tariff permits customers to receive backup/standby service on the Small General Electric Service Rate or the Large General Electric Service Rate subject to the billing demand determination as provided in Rate 90. This affords the customer the opportunity to choose between a certain fixed charge for the service and a potentially variable charge associated with a ratcheted maximum demand. The customer has maximum flexibility in choosing alternatives and may adjust his own loads to minimize the cost of customer generation outages.

Q. What is the basis for requiring a one-year contract for backup/standby service?

A. Provision of backup/standby service requires incremental investment by the utility in generation, transmission, and distribution facilities. As these incremental costs relate directly to the provision of the service, they are assignable costs and must be recovered. Although one year is too short a period in which to recover these costs, it is the minimum period over which a demand ratchet would apply and is thereby consistent with potential billing alternatives available to the customer.

Q. Does this complete your testimony?

A. Yes, it does.

THE HARTFORD ELECTRIC LIGHT COMPANY  
RULES AND REGULATIONS

SECTION I SCHEDULE OF RATES

1.1 FILING. The Company furnishes its various services in accordance with the applicable Rules and Regulations of the Public Utilities Control Authority of the State of Connecticut (the "Authority"). The Company's Schedule of Rates, which includes these Rules and Regulations, is on file with the Authority and is also open to inspection at the offices of the Company.

1.2 REVISION. The Schedule of Rates may be revised, amended, supplemented and otherwise changed from time to time, and such changes when effective will supersede the present Schedule of Rates.

1.3 APPLICATION. The provisions of these Rules and Regulations and of the Schedule of Rates apply to everyone receiving service from the Company without regard to whether a service application has been made by the customer or accepted by the Company under Section III hereof. Receipt of service shall constitute the receiver a customer of the Company as the term is used in the Schedule of Rates and in these Rules and Regulations.

1.4 RULES AND REGULATIONS. These Rules and Regulations shall be deemed to be a part of every contract for service entered into by the Company, and shall govern all classes of service where applicable, unless specifically modified by a provision or provisions contained in a particular rate or special written contract with a customer.

1.5 STATEMENTS BY AGENTS. No representative of the Company has authority to modify any rule, provision, or rate contained in this Schedule of Rates, or to bind the Company for any promise or representation contrary thereto.

1.6 CHOICE OF RATE. Every customer is entitled to request service under the lowest rate applicable to the service supplied during each calendar year, and the Company will provide its customers with information upon request to aid such customers in selecting the most advantageous rate available. Unless specifically stated to the contrary, all rates are based on the supply of service to the customer throughout the twelve months of the year, and changes from one rate to another will not be made for periods of less than twelve months. The Company will not be liable for any claim that service provided to any customer might have been less expensive or more advantageous to such customer if supplied under a different rate.

SECTION II SERVICE LIMITATIONS

2.1 CHARACTER OF SERVICE. The character of service which the Company will supply will be that available in the locality in which the service is to be furnished. Except as may be especially provided in a particular rate, the Company does not offer to supply service of non-standard characteristics.

2.2 SINGLE POINT OF DELIVERY. Where service is supplied to a customer at more than one point of delivery, each point of delivery will be considered an independent customer, and the bill will be rendered accordingly unless otherwise specifically provided for in the rate.

2.3 COMPLIANCE WITH AVAILABILITY. The use of the Company's service shall not be for purposes other than those covered by the Availability provision of the particular rate under which service is supplied.

2.4 RESIDENTIAL SERVICE. Separate dwelling units whether within the same building or in separate buildings on the same premises shall be considered as separate customers and metered individually wherever practicable. If a residence is converted to more than a single dwelling unit, or if for some other reason it is impractical in the judgment of the Company to separately meter individual dwelling units, service may be supplied through one meter under the applicable residential or general service rate.

2.5 REFUSALS TO SERVE. The Company reserves the right to refuse to supply service to new customers or to supply additional load to any existing customer if it is unable to do so under a standard rate or if it is unable to obtain the necessary equipment and facilities or capital required for the purpose of furnishing such service. The Company may refuse to supply service to loads of unusual characteristics which might affect the cost or quality of service supplied to other customers of the Company. The Company may require a customer having such unusual loads to install special regulating and protective equipment in accordance with the Company's specifications as a condition of service.

2.6 UNMETERED SERVICE. When, in the judgment of the Company, supply of electric service on an unmetered basis is justified, billing will be rendered for estimated use in accordance with the terms of the rate applicable to the service supplied and the regulations of the Authority. Unauthorized acceptance of unmetered service by a customer or service supplied through a meter which has been tampered with or rendered inaccurate by a customer shall be considered unauthorized use and shall subject such customer to liability for such service on an estimated basis, in addition to any other applicable regulatory, civil and criminal liabilities which might be imposed upon such customer.

### SECTION III SERVICE APPLICATIONS

3.1 SERVICE APPLICATIONS. The Company may require a prospective customer to make written application for service. Such application shall be made on standard forms provided by the Company and shall include such information as the Company may deem essential to the proper supplying of service to the applicant.

3.2 PLACE OF APPLICATION. Prospective customers should make application for service at the nearest office of the Company or authorized Company representative.

3.3 SERVICE INFORMATION FROM COMPANY. Upon receipt of an application from a prospective customer setting forth the location of the premises to be served, the extent of service to be required and other pertinent information, the Company will advise the customer of the type and character of the service it will furnish, the point at which service will be delivered and the location to be provided for the Company's metering equipment.

3.4 ACCEPTANCE OF APPLICATION OR CONTRACT. If an application for service is accepted by the Company's duly authorized agent, or if service is supplied according to the provisions of such application or pursuant to contract either without modification or with supplemental agreement, it shall constitute an agreement between the customer and the Company for the supply of service.

3.5 SPECIAL CONTRACTS. In the event that the service desired by a customer is not available under any standard rate of the Company, such service (including auxiliary or parallel operation service, service for abnormally large or fluctuating loads, and other types of service under unusual circumstances) may be obtained, in the sole discretion of the Company, through special contract with the Company to the extent permitted under applicable Rules and Regulations and provided that no discrimination against other customers would result thereby. All such special contracts are subject to review and approval of the Authority.

3.6 UNAUTHORIZED USE. The use of service without notice to the Company to enable it to read its meter on the user's premises will render the user liable for any amount due for service supplied to the premises since the last reading of the meter, whether or not such reading may precede the said user's occupancy, as shown on the Company's books. Whenever any service has been obtained at any premises on an unmetered basis or any unauthorized service has been obtained at any such premises or for any other reason service has been provided to such premises to persons unknown or for which payment has not been made due to a question of customer identity, the owner of record of such premises shall be liable therefor to the Company.

#### SECTION IV PAYMENT TERMS AND CREDIT

4.1 BILLING PERIOD. The normal billing period shall be that on which the particular rate is based (usually one month). If the actual billing period is longer or shorter than normal, such bills will be computed by prorating on the basis of the elapsed time.

4.2 PAYMENT FOR SERVICE. All bills for electric service, gas service, repairs to customer appliances, and other services or facilities furnished by the Company to the customer shall be due and payable upon presentment.

4.3 FINAL BILL. The customer shall be liable for service taken after notice of termination has been received by the Company until such time as the meter is read and disconnected. The bill for service rendered up to the date of the last meter reading is due and payable upon presentment.

4.4 RECONNECTION CHARGE. A reconnection charge may be made to customers normally taking service under an all-year-round rate if the meter is disconnected and reconnected within twelve months.

4.5 INCREASE OR DECREASE IN RATE. In the case of any increase or decrease in the applicable rate to any customer authorized by the Authority, the effective date of said increase or decrease shall be reflected in bills on a prorated basis to the effective date using meter readings made after said effective date.

4.6 LATE PAYMENT CHARGE. Nonresidential bills, which are not paid within 28 days, and bills rendered to the state or any political subdivision thereof which are not paid within 60 days, shall be subject to a charge calculated on the unpaid balance at the rate of 1 percent per month from the date thereof to the date of payment.

## SECTION V SUPPLY AND USE OF SERVICE

5.1 QUALITY OF SERVICE. The Company endeavors to furnish adequate and reliable service, but does not guarantee continuous service, and it shall not be liable for direct or consequential damages of any kind resulting from any stoppage, interruption, variation or diminution of service caused by the customer's acts or omissions, acts of the public enemy, a state of war, requirements of Federal, State or Municipal authorities, strikes, acts of God or the elements, accidents, operating conditions or contingencies or other causes.

When a part or parts of the interconnected generation-transmission or distribution systems may be threatened by a condition which may affect the integrity of the supply of electric or gas service, or when a condition of actual or threatened shortage of available energy supplies and resources shall exist, the Company may, in its sole judgment, curtail, allocate, or interrupt such service to any customer or customers. Such curtailment, allocation or interruption shall, where possible or practicable, be in accordance with the terms and conditions of any applicable energy emergency or load curtailment plan which shall be on file with the Authority or other appropriate state agency from time to time or adopted by energy dispatching and control centers in which the Company is a participant.

The Company does not undertake to regulate the voltage, frequency or pressure of its service more closely than is standard commercial practice. If the customer requires regulation of voltage, frequency or pressure that is more refined, he shall furnish, install, maintain and operate the necessary apparatus at his own expense.

The Company cannot be and is not responsible for any loss or damage (direct, indirect or consequential) to any persons or property resulting in any way from any interruption of service or any change in characteristics of service, regardless of the cause of such interruption or change.

5.2 TEMPORARY SERVICE. Temporary service is available to any customer who can be served from the Company's existing lines or facilities.



For such temporary service the customer shall pay the total cost of connecting and disconnecting the service, including the cost of installation and removal of any poles, wires, transformers, meter equipment or other facilities that may be necessary. Service will be billed under any regular rate applicable to the type of service supplied. The Company may require an advance payment covering the estimated cost of installation and disconnection or the use of service or both.

5.3 SUSPENSION OF SERVICE FOR REPAIRS. The Company reserves the right to curtail or temporarily interrupt from time to time the customer's service in order that repairs, replacements or changes may be made in the Company's facilities either on or off the customer's premises. The customer will normally be notified in advance to the extent practicable except in cases of emergency. Nothing in this Section V shall be deemed to require the Company to make such repairs, replacements or changes at times other than the Company's normal business hours.

5.4 RESALE OF SERVICE. Any service rendered is furnished by the Company to the customer for the purpose and class of service specified, and such service shall not be resold to others or used for other purposes. This rule does not apply to duly authorized public utility companies which purchase service from the Company at wholesale.

5.5 RESUPPLY OF SERVICE. When service is resupplied to others by a retail customer of the Company, each building or premises will be considered as a separate customer, and the service will be furnished to the tenants as an incident to tenancy with the cost included as an integral part of the rent. The same rule shall apply to the greatest extent possible in the case of service supplied to any condominium or homeowner's association, where the cost of such service shall be incidental to the association's fee to its members. Resupply of service will require prior written consent of the Company.

## SECTION VI CUSTOMER'S INSTALLATION

6.1 SUITABILITY OF APPARATUS. All of the customer's apparatus shall be suitable for compatible operation with the service supplied by the Company, and the customer shall not use the service supplied for any purpose or with any apparatus which would cause a disturbance on the lines, mains or system of the Company sufficient to impair or render unsafe the service supplied by the Company to its other customers. The customer shall be liable for any damage resulting to the Company's apparatus or facilities or to other customers caused by failure to comply with any provision of this Section VI.

Where the customer has apparatus for the generation of electric energy, his wiring must be so arranged as to make it impossible, by the closing of switches or otherwise, to connect such apparatus with the Company's service unless such wiring arrangements have been approved in writing by the Company.

6.2 COMPLIANCE WITH ORDINANCES. Before the Company will furnish service, the customer shall comply with all applicable ordinances, codes and requirements of Federal, State or Municipal bodies and may be required to furnish to the Company satisfactory evidence of such compliance.

6.3 STATEMENT OF INSTALLER. Where the Municipal authorities issue no inspection certificate, the Company may require a written statement from the installer of the wiring or piping or other similar facilities that the same are suitable and proper for the safe and satisfactory reception and use of the service to be furnished and are in accordance with applicable building and safety codes.

6.4 RESPONSIBILITY OF CUSTOMER. In all cases the customer is responsible for maintaining facilities, wiring and appliances that are suitable and proper for the safe and satisfactory reception and use of the service to be furnished. Any effort of the Company to promote this condition is merely assistance rendered to the customer and shall not be deemed an assumption of liability on the part of the Company.

All apparatus or facilities provided by the Company to supply service shall remain its sole property whether or not affixed to the customer's property, and shall be returned by the customer in the condition received, ordinary wear and tear excepted. Any damages caused by the customer to the Company's property (including damage occurring as a result of the customer's failure to take reasonable precautions to protect such property from damage) shall be paid by the customer.

6.5 LIABILITY OF THE COMPANY. Service is delivered to the customer at the point where the service connection maintained by the Company terminates. The Company shall not be liable for direct, indirect or consequential damages of any kind, whether resulting from injuries to persons or property or otherwise, arising out of or that may be traceable to trouble or defects in the apparatus, piping, wiring, facilities or equipment or to any other cause occurring beyond the point where the service connection of the Company terminates. Liability, if any, for such damages shall be that of the customer.

6.6 CHANGES IN CUSTOMER'S CONDITIONS OR INSTALLATION. The customer shall give advance notice to the Company of any proposed change in the customer's load or other conditions of use or of any change of purpose or location of his installation. Such change in the customer's service conditions or installation shall not be made until such notice has been given and permission has been received from the Company. Failure to give notice of such changes shall render the customer liable for any damage to the meters or other apparatus and equipment of the Company caused by the changed conditions or installation.

## SECTION VII COMPANY'S SERVICE INSTALLATION

7.1 RIGHTS OF WAY. The Company shall not be required to extend its facilities for the purpose of rendering service until it has satisfactory rights of way or easements to permit the installation, operation and maintenance of its facilities. The customer, without expense to the Company, shall grant or secure for the Company such rights of way or easements whether across property controlled by the customer or by others.

7.2 RIGHTS ON CUSTOMER'S PREMISES. In accepting service the customer shall thereby agree to furnish the Company, without charge, a

suitable location for all of the property and equipment of the Company necessary in furnishing such service. The Company shall have access to the customer's premises at all reasonable times for the purpose of installing, reading, inspecting, repairing, removing, replacing, disconnecting, or otherwise maintaining its meters, equipment, and facilities, and for all other proper purposes.

7.3 CHANGES IN LOCATION. If the Company places its overhead wires underground or changes the location of any of its service facilities, it may require that such changes as may be necessary in the customer's portion of the service connection or which may directly or indirectly benefit the customer be made at the expense of the customer.

Effective: November 28, 1977

Supersedes General Terms and Conditions of Service and General Provisions Applying to Rates, effective May 1, 1977.

THE HARTFORD ELECTRIC LIGHT COMPANY

SMALL GENERAL ELECTRIC SERVICE

RATE 22

AVAILABLE to any customer for all uses of electricity at a single service location measured through one metering installation. Where the Company deems it impractical to deliver electricity through one service, or where more than one meter has been installed for billing under a withdrawn rate then the measurement of electricity may be by two or more meters.

MONTHLY RATE:

Customer Service Charge: \$7.00

Demand Charge:

First	2 KW of demand or less	No Charge
All over	2 KW of demand	\$3.78 per kW

Energy Charge:

First	1,000 kWh	65.83¢ per kWh
All over	1,000 kWh	4.14¢ per kWh

For all kWh between 200 and 400 times the demand	2.66¢ per kWh
All kWh over 400 times the demand	2.35¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

DETERMINATION OF DEMAND: The demand shall be the highest average 30 minute kilowatt demand recorded during the billing month, but not less than 2 kilowatts.

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Facilities Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$.20/KW
All over 1000 KW of demand	\$.10/KW

TERM OF CONTRACT: One year and thereafter until notice of termination.

Effective: November 28, 1977

Supersedes Rate 22, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

CHURCH AND SCHOOL ELECTRIC SERVICE

RATE 23

AVAILABLE for the total use of churches and tax exempt schools.

MONTHLY RATE:

Customer Service Charge: \$6.35

Energy Charge: 4.22¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Facilities Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$ .20/KW
All over 1000 KW of demand	\$ .10/KW

Effective: November 28, 1977

Supersedes Rate 23, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

RESIDENTIAL ELECTRIC SERVICE

RATE 1

AVAILABLE for the entire electrical requirements, except as noted below, in single-family residences, residential outbuildings, farms, individual apartments and general service use in apartment buildings. Where the customer has a controlled electric water heating system which is not the sole source of domestic hot water, the electric water heating use may be separately metered and billed in accordance with Controlled Water Heating Electric Service Rate 18.

This rate is not available for dwellings which not only use electric energy as the primary space heating source but also have not received service for electric space heating prior to January 1, 1979.

Where more than one apartment is served through the same meter, the number of kilowatthours in each block of the rate shall be multiplied by the number of individual apartments served through the same meter.

Single-phase service is normally supplied hereunder except that three-phase service may be supplied provided the customer agrees to pay an additional monthly charge sufficient to reimburse the Company for the increased costs involved.

MONTHLY RATE:

Customer Service Charge: \$4.32

Energy Charge:

First 300 kWh	4.855¢ per kWh
All over 300 kWh	3.90¢ per kWh

Where the Customer's sole source of domestic hot water is a storage-type water heater which meets the Company's specifications as to type, size and electrical characteristics and for which the top and bottom units are of conventional wattage and connected with thermostatic controls so that both units cannot operate at once, pricing beyond the first 300 kWh will be the next 600 kWh at 2.90¢ per kWh and the balance at 3.90¢ per kWh. The units shall be installed and wired for time control in accordance with the Company's specifications.

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

SPECIAL PROVISIONS:

Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.

Effective: November 28, 1977

Supersedes Rate 1, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

RESIDENTIAL TIME-OF-DAY ELECTRIC SERVICE

RATE 7

AVAILABLE for the entire electrical requirements in single-family residences, residential outbuildings, farms, individual apartments and general service use in apartment buildings.

This rate is available, without limitation, for customers who have a solar heating system which is used as a source of space heating and for which electricity provides backup.

This rate is not available for service to multi-family dwelling units except where each dwelling unit is metered and billed individually.

Single-phase service is normally supplied hereunder except that three-phase service may be supplied provided the customer agrees to pay an additional monthly charge sufficient to reimburse the Company for the increased costs involved.

MONTHLY RATE:

Customer Service Charge:		\$6.82
On-Peak Charge:	Weekdays from 8 a.m. to 8 p.m. EST	6.20¢ per kWh
Off-Peak Charge:	All Other Hours	2.60¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

TERM OF CONTRACT: One year and thereafter unless canceled by one month's written notice.

Effective: November 28, 1977.

THE HARTFORD ELECTRIC LIGHT COMPANY

CONTROLLED WATER HEATING ELECTRIC SERVICE

RATE 18

AVAILABLE only for controlled water heating electric service to any customer other than residential, except as noted herein. Available to residential customers where electricity supplies a portion of, but is not the sole source of, domestic hot water.

This rate is not available for any space heating or for commercial or industrial processes.

Controlled storage electric water heaters shall meet the Company's specifications as to type, size and electrical characteristics and shall have top and bottom units of conventional wattage with thermostatic controls so that both units cannot operate at once. These units shall be installed and wired for time control in accordance with the Company's specifications.

MONTHLY RATE:

Customer Service Charge: \$2.00

Energy Charge: 2.85¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

SPECIAL PROVISIONS:

Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.

TERM OF CONTRACT: One year and thereafter until notice of termination.

Effective: November 28, 1977

Supersedes Rate 18, Effective May 1, 1977



THE HARTFORD ELECTRIC LIGHT COMPANY

GENERAL ELECTRIC SERVICE

RATE 21

AVAILABLE to commercial and industrial customers located on the Company's distribution lines suitable for supplying the service requested. This rate is available only to present customers taking service on January 7, 1975.

MONTHLY RATE:

Customer Service Charge:       \$3.75

Energy Charge:

First	1,000 kWh	7.68¢ per kWh
All over	1,000 kWh	7.06¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Transformer Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$.20/KW
All over 1000 KW of demand	\$.10/KW

Effective: November 28, 1977

Supersedes Rate 21, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

TIME-OF-DAY GENERAL ELECTRIC SERVICE

RATE 27

AVAILABLE for any customer's entire use of electricity at a single service location measured through one metering installation.

MONTHLY RATE:

Customer Service Charge:	\$13.50
Daytime Charge: 9:00 a.m. - 8:00 p.m., EST	
Demand:	\$ 4.80 per KW
Energy:	4.30¢ per kWh
Nighttime Charge: 8:00 p.m. - 9:00 a.m., EST	
Energy:	2.60¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in base cost of fuel set forth in calculations submitted to the Authority for approval.

DETERMINATION OF DEMAND: The demands shall be the highest average 30 minute kilowatt demands recorded during the billing month in the Daytime and Nighttime hours as defined above.

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Facilities Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$.20/KW
All over 1000 KW of demand	\$.10/KW

TERM OF CONTRACT: One year and thereafter unless canceled by one month's written notice.

Effective: November 28, 1977

Supersedes Rate 27, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

LARGE GENERAL ELECTRIC SERVICE - OFF-PEAK

RATE 33

AVAILABLE on an annual basis to any customer contracting for service prior to January 7, 1975 for its entire electrical requirements where distribution facilities are suitable for the service requested, subject to the following conditions:

- (1) The maximum kilowatt demand shall be reduced at least 20% by a control device at the time of occurrence of the Company's peak and;
- (2) The total electric load is permanently connected to the Company's facilities at a single service location.

MONTHLY RATE:

Demand Charge:

First	200 KW of demand or less	\$650.00
Next	800 KW of demand	2.41 per KW
All over	1,000 KW of demand	1.85 per KW

Energy Charge:

First	200 times the demand	3.14¢ per kWh
Next	100 times the demand	2.65¢ per kWh
Next	100 times the demand	2.56¢ per kWh
All over	400 times the demand	2.28¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

DETERMINATION OF DEMAND: The demand for the current month shall be the maximum 30-minute kilowatt demand during the hours of 2 pm and 5 pm during the months of June through September (summer period) or between 4:30 pm and 6:30 pm during the months of October through May (winter period) or such other hours as the Company may specify from time to time but not less than 100% of the summer period maximum demand or 80% of the winter period maximum demand that occurred in the previous eleven months or less than 200 KW.

THE HARTFORD ELECTRIC LIGHT COMPANY

LARGE GENERAL ELECTRIC SERVICE - OFF-PEAK  
(Continued)

RATE 33  
Page 2

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Facilities Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$.20/KW
All over 1000 KW of demand	\$.10/KW

Effective: November 28, 1977

Supersedes Rate 33, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

SPACE HEATING ELECTRIC SERVICE

RATE 38 & 39

AVAILABLE on an annual basis to any customer contracting for service prior to January 7, 1975 except residential, where distribution facilities are suitable for the service requested for separately metered electric space heating, subject to the following conditions as to the structure to which the service is supplied:

- (1) There shall be a permanently installed, thermostatically controlled, electric heating system sufficient to meet accepted comfort heating standards for the entire structure.
- (2) Energy used for air conditioning may be billed on this rate providing the connected load of air conditioning does not exceed the connected load for heating.
- (3) Energy used by storage electric water heaters which meet Company specifications may be billed on this rate, providing the basic element capacity does not exceed 50 watts per gallon of tank capacity and the total element capacity does not exceed 100 watts per gallon of tank capacity. When either element exceeds 5 KW, elements shall be arranged for operation in successive steps, not exceeding 25 watts per gallon of tank capacity. The Company may require the heater to be time-controlled.
- (4) When the total incidental power and lighting load does not exceed 10% of the total connected load, the incidental load may be billed on this rate.

RATE 38

MONTHLY RATE:

Customer Service Charge: \$4.00

Day Period:

4.70¢ per kWh for energy used between 7 a.m. and 9 p.m., EST

Night Period:

3.50¢ per kWh for energy used between 9 p.m. and 7 a.m., EST

Excess Night Period:

3.15¢ per kWh for the excess kWh used during the night period over the day period.

THE HARTFORD ELECTRIC LIGHT COMPANY

SPACE HEATING ELECTRIC SERVICE  
(Continued)

RATE 38 & 39  
Page 2

RATE 39

If the electric heating equipment is controlled by a device supplied by the Company, so that it does not operate from 4 p.m. to 9 p.m. daily, the rate is as follows:

MONTHLY RATE:

Customer Service Charge: \$4.00

Day Period:

4.70¢ per kWh for energy used between 7 a.m. and 9 p.m., EST,  
from June through September

3.50¢ per kWh for energy used between 7 a.m. and 9 p.m., EST,  
from October through May

Night Period:

3.50¢ per kWh for energy used between 9 p.m. and 7 a.m., EST

Excess Night Period:

3.15¢ per kWh for the excess kWh used during the night period  
over the day period

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

Effective: November 28, 1977

Supersedes Rate 38 & 39, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

LARGE GENERAL ELECTRIC SERVICE

RATE 50

AVAILABLE for any customer's entire use of electricity at a single service location measured through one metering installation. Where the Company deems it impractical to deliver electricity through one service, or where more than one meter has been installed for billing under a withdrawn rate, then the measurement of electricity may be by two or more meters.

MONTHLY RATE:

Demand Charge:

First	50 KW of demand or less	\$261.50
Next	150 KW of demand	3.17 per KW
All over	200 KW of demand	2.40 per KW

Reactive Demand Charge:

All reactive KVa in excess of 50% of the demand	25¢ per kVa
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Energy Charge:

First	200 times the demand	3.14¢ per kWh
Next	100 times the demand	2.65¢ per kWh
Next	100 times the demand	2.56¢ per kWh
All over	400 times the demand	2.28¢ per kWh

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases and decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

DETERMINATION OF DEMAND: The demand shall be the highest average 30 minute kilowatt demand recorded during the billing month, but not less than 70% of the highest such kilowatt demand occurring during the preceding 11 months but not less than 50 kilowatts.

DETERMINATION OF REACTIVE DEMAND: The reactive demand shall be the highest average 30 minute reactive load in kilovolt amperes occurring during the billing month, provided that such demand may be determined in accordance with periodic tests conducted at reasonable intervals, in which case the determination by test will remain in effect until a new determination is made.

THE HARTFORD ELECTRIC LIGHT COMPANY

LARGE GENERAL ELECTRIC SERVICE  
(Continued)

RATE 50  
Page 2

SPECIAL PROVISIONS:

1. Primary Metering: If the service is metered on the primary side of the transformers supplying the customer, 2% of the metered kilowatt-hours will be deducted in computing the bill.
2. Facilities Ownership: If the service transformers and associated equipment, except metering, are furnished by the customer, a credit shall be applied to the bill equal to:

First 1000 KW of demand	\$.20/KW
All over 1000 KW of demand	\$.10/KW

TERM OF CONTRACT:

One year and thereafter unless cancelled by one month's written notice.

Effective: November 28, 1977

Supersedes Rate 50, Effective May 1, 1977



THE HARTFORD ELECTRIC LIGHT COMPANY

RIDER A APPLICABLE TO RATE 50  
OPTIONAL OFF-PEAK SERVICE

AVAILABLE to any customer whose off-peak nighttime kilowatt demand exceeds the on-peak daytime kilowatt demand.

DEFINITION OF ON-PEAK AND OFF-PEAK HOURS:

On-Peak Hours: 7 a.m. to 8 p.m. weekdays, excluding designated holidays

Off-Peak Hours: All other hours

As used herein the on-peak and off-peak hours shall be based on prevailing time. Other hours may be designated by the Company from time to time provided that the off-peak hours shall not be less than eleven hours per day.

BILL COMPUTATION: For purposes of computing the bill on Rate 50 using the Optional Off-Peak Service Rider, the charge applicable to the first 50 kilowatts of demand or less shall be increased by \$65 per month and the Demand Charge shall be calculated using the greater of:

- a) the maximum demand that occurred during the current month's on-peak hours
- b) 70% of the highest such demand that occurred in the previous eleven months' on-peak hours
- c) 50 kilowatts (hereafter referred to as the applicable on-peak demand)

plus 25% of the amount by which the maximum demand that occurred during the off-peak hours during the current month exceeds the applicable on-peak demand. The Energy Charge shall be computed using the applicable on-peak demand.

Effective: November 28, 1977

Supersedes Rate 50 Optional Off-Peak Service Clause,  
Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

RIDER B APPLICABLE TO RATE 50  
OPTIONAL LOAD CONTROL SERVICE

AVAILABLE to customers who can reduce their maximum kilowatt demand during hours specified by the Company. The hours are daytime hours during which total Company loads generally are at their highest level.

DEFINITION OF CONTROL HOURS:

As used herein the control hours shall be based on prevailing time and shall be the weekday hours in the following time periods or such other hours as may be designated by the Company from time to time provided that the control hours shall not be less than five hours per weekday, excluding designated holidays.

Summer Period (June - Sept)	11 a.m. to 4 p.m.
Winter Period (Oct-May)	9-12 a.m. and 5-7 p.m.

Non-control hours shall mean all other hours.

BILL COMPUTATION: For purposes of computing the bill on Rate 50 using the Optional Load Control Service Rider the charge applicable to the first 50 kilowatts of demand or less shall be increased by \$65 per month and the Demand Charge shall be calculated using the greater of:

- a) the maximum demand that occurred during the current month's control hours
- b) the maximum demand that occurred in the previous eleven months' control hours during the months of December, January, June, July, August or September
- c) 50 kilowatts (hereafter referred to as the applicable control hours' demand)

plus 25% of the amount by which the maximum demand that occurred during the non-control hours during the current month exceeds the applicable control hours demand. The Energy Charge shall be computed using the applicable control hours' demand.

Effective: November 28, 1977

Supersedes Rate 50 Optional Load Control Service Clause,  
Effective May 1, 1977.

THE HARTFORD ELECTRIC LIGHT COMPANY

RIDER C APPLICABLE TO RATE 50  
CURTAILABLE POWER SERVICE

AVAILABLE to any customer who agrees to curtail operation of designated equipment having a load of at least 2,000 kilowatts during periods when the Company's overall load obligations are expected to be at or near their maximum annual levels and during such other periods when the supply of electric service is threatened by a condition which affects the interconnected generation, transmission or distribution system.

DEFINITIONS OF HOURS OF CURTAILMENT: It is the intent of this Rider that load curtailment normally will be scheduled for two or more consecutive weekday hours and normally will not exceed 200 hours in any twelve month period, exclusive of interruptions of service specified in Section V, Supply and Use of Service of the Company's Rules and Regulations. The scheduling of the curtailment periods will be at the discretion of the Company and notification of curtailment normally will be provided to the customer not less than 24 hours in advance. Notwithstanding the foregoing, load curtailment may be scheduled during other periods and on shorter notice in the event that load obligations exceed those anticipated or that the supply of electric service is threatened by a condition which affects the interconnected generation, transmission or distribution system.

DETERMINATION OF KILOWATTS OF LOAD CURTAILED: The amount of Kilowatts of Load Curtailed in the month shall be the difference between the highest average 30-minute curtailable load in kilowatts coincident with the Kilowatt Demand during On-Peak Hours and the highest average 30-minute curtailable load in kilowatts during the designated hours of scheduled curtailment. In any month in which there are no designated hours the amount in Kilowatts of Load Curtailed shall be the highest average 30-minute curtailable load in kilowatts coincident with the Kilowatt Demand during On-Peak Hours. However, the monthly determination shall be reduced by the maximum amount in kilowatts of curtailable load, not curtailed, during the designated hours in the preceding 11 months. For purposes hereof On-Peak Hours shall be based on prevailing time and shall be the weekday hours from 7 a.m. to 8 p.m., or such other period of not less than thirteen hours as may be designated by the Company from time to time.

BILL COMPUTATION: For purposes of computing the bill on Rate 50 using the Curtailable Power Service Rider, the charge applicable to the first 50 kilowatts of demand or less shall be increased by \$100 per month and the Demand Charge shall be reduced by an amount equal to \$1.05 per Kilowatt of Load Curtailed. The Energy Charge shall be computed using the Kilowatt Demand during On-Peak Hours less the Kilowatts of Load Curtailed.

METERING: The demand of the curtailable equipment shall be registered by a submeter to the metering equipment registering the customer's total demand.

Effective: November 28, 1977

Supersedes Curtailable Power Service Rider, Rate 50, Effective May 1, 1977.

THE HARTFORD ELECTRIC LIGHT COMPANY

STREET AND SECURITY LIGHTING

RATE 60

AVAILABLE for street, highway, and off-street lighting.

MONTHLY RATE:

Overhead: Includes cost of conventional lighting fixture served overhead and mounted on an existing distribution supply pole.

<u>Lumen</u>	<u>Wattage</u>	<u>Mercury Vapor</u>	<u>H.P. Sodium</u>	<u>Incandescent*</u>	<u>Fluorescent*</u>
600	58			\$ 2.12	
1,000	103			2.91	
2,500 O	202			4.05	
2,500 C	202			4.49	
4,000	327			6.07	
4,250	122	\$ 4.11			
5,800	130				\$ 5.98
6,000	448			7.61	
8,000	205	5.50			
9,500	115		\$ 6.20		
10,000	690			10.37	
12,500	290	7.51			
13,000**	150		6.16		
16,000	175		7.11		
22,500	445	10.36			
24,000	500				11.87
25,500	320		10.05		
50,000	465		11.98		
60,000	1095	23.68			
140,000	1125		28.95		

Twin Lamps: Two times the above wattage and rate.

\* No additional lights of these sizes or types will be installed after January 7, 1975.

\*\* Installed in pre-existing 175 watt (8,000 lumen) mercury fixture only.

THE HARTFORD ELECTRIC LIGHT COMPANY

STREET AND SECURITY LIGHTING  
(Continued)

RATE 60  
Page 2

Underground: Includes cost of conventional lighting fixtures served underground and on a high mounting wood or metal ornamental pole.

<u>Lumen</u>	<u>Wattage</u>	<u>Mercury Vapor</u>	<u>H.P. Sodium</u>	<u>Incandescent*</u>	<u>Fluorescent*</u>
1,000	103			\$ 7.76	
2,500 O	202			8.90	
2,500 C	202			9.34	
4,000	327			10.92	
4,250	122	\$ 8.96			
5,800	130				\$10.83
6,000	448			12.46	
8,000	205	10.35			
9,500	115		\$11.05		
10,000	690			15.22	
12,500	290	12.36			
13,000**	150		11.01		
16,000	175		11.96		
22,500	445	15.21			
24,000	500				16.72
25,500	320		14.90		
50,000	465		16.83		
60,000	1095	28.53			
140,000	1125		33.80		

Flood Lighting: Includes cost of conventional flood light served overhead and mounted on an existing standard distribution supply pole.

<u>Lumen</u>	<u>Wattage</u>	<u>Mercury Vapor</u>	<u>H.P. Sodium</u>
22,500	445	\$13.82	
25,500	320		\$13.51
50,000	465		15.44
60,000	1095	27.14	
140,000	1125		32.41

Decorative Lighting: Includes cost of contemporary or traditional decorative light served underground on a low mounting wood, metal or fiber glass ornamental pole. This provision is applicable to new lights installed on and after the effective date hereof.

<u>Lumen</u>	<u>Wattage</u>	<u>Mercury Vapor</u>	<u>H.P. Sodium</u>
4,250	122	\$10.46	
8,000	205	11.85	
9,500	115		\$12.55
16,000	175		13.46

\* No additional lights of these sizes or types will be installed after January 7, 1975.

THE HARTFORD ELECTRIC LIGHT COMPANY

STREET AND SECURITY LIGHTING  
(Continued)

RATE 60  
Page 3

The Company will make a reduction in the above charges only for present customers as of the effective date hereof who are relieving the Company of either ownership and maintenance, or ownership, maintenance and lamp renewals.

OVERHEAD POLES ON PRIVATE PROPERTY: (Available only to present customers as of the effective date hereof): Where required only for streetlighting purposes, the customer will pay outright for overhead poles or in the case of a single wood overhead pole may pay a monthly charge of \$1.53.

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

The determination of monthly lighting kilowatthours for purposes of determining monthly sales and computing the fuel adjustment is as follows:

Wattage ÷ 1000 times monthly burning hours below:

January	433	July	269
February	365 (leap year - 377)	August	301
March	364	September	334
April	310	October	388
May	280	November	413
June	251	December	442

SERVICE AND SUPPLY OF FACILITIES: All street lights shall be operated continually each and every night from approximately one-half hour after sunset until one-half hour before sunrise. All poles, lamps, brackets, luminaires and related equipment shall be furnished and maintained by the Company. All energy and normal renewal of lamps shall be furnished and controlled by the Company at its expense. Broken, cracked and damaged lamps and other equipment shall be replaced by the Company at the customer's expense.

The Company shall supply street lights whenever requested by the customer, including the poles, lamps, brackets, luminaires and related equipment therefor. All such poles, lamps, brackets, luminaires and related equipment shall be of a modern type approved for normal use by the Company. The Company shall bear the full cost of such lights except that the cost of underground distribution facilities required to supply street lighting service shall be paid by the customer.

If at the request of the customer a luminaire is removed prior to being installed for at least fourteen (14) years, the customer upon removal of the luminaire will be billed an amount equal to the original installed cost less the depreciated cost and less the salvage value of the luminaire and related equipment.

Effective: November 28, 1977

Supersedes Rate 60, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

UNMETERED ELECTRIC SERVICE

RATE 62

AVAILABLE for traffic, airfield, navigation, sign lighting, and similar uses, where distribution facilities are suitable for the service requested, subject to the following conditions:

- (1) When such equipment is operated daily on a fixed schedule, the monthly demand and energy use of each installation will be computed.
- (2) The customer shall install, own, operate, and maintain all equipment.

MONTHLY RATE:

Demand Charge:	\$4.31 per KW
Energy Charge:	4.36¢ per kWh
Minimum Monthly Bill:	\$2.72 per Unit

FUEL ADJUSTMENT: This rate shall, in accordance with procedures approved by the Public Utilities Control Authority, be subject to increases or decreases reflecting changes in the cost of fuel set forth in calculations submitted to the Authority for approval.

Effective: November 28, 1977

Supersedes Rate 62, Effective May 1, 1977

THE HARTFORD ELECTRIC LIGHT COMPANY

FOSSIL FUEL ADJUSTMENT CLAUSE

Page 1 of 2

The rate per kWh shall be increased or decreased, as appropriate, in accordance with the following formula. The Fossil Fuel Adjustment for any month shall equal the product of:

$$\frac{(P_C - P_B) \times H_C \times F_C}{1 - L_C} - (S) \frac{1}{1 - T}; \text{ to operate if and only when}$$

$P_C - P_B$  does not equal zero and the final product of the FFAC equals or exceeds .002¢/kWh.

$P_C$  is the price of fossil fuel expressed in cents per million BTU for the Current Period ( $P_C$ ) or as included in the Base rates ( $P_B$ ).  $P_B$  equals 223.08¢/MBTU;

$H_C$  is the weighted average Heat Rate for the Current Period;

$L_C$  is the percent of System Loss calculated on a twelve month weighted average basis ending with the Current Period;

$F_C$  is the fractional portion of the total energy needs of the Company's customers which is supplied from fossil plants during the Current Period;

$S$  is net savings shares attributable to power received and delivered on an economic dispatch basis by the Company during the Current Period less the savings shares of .023¢/kWh included in the Base rates;

$T$  is Gross Receipts Tax rate and equals 0.05; all as defined below.

Definitions

**Current Period** The second calendar month preceding the month in which bills containing the Fossil Fuel Adjustment charge calculated hereunder shall be rendered.

**Base Rates** The rates of the Company established by the most recent Decision of the Public Utilities Control Authority to be charged customers of the Company.

**Price** Weighted average price expressed in ¢/MBTU of fossil fuel used in the generation of electricity for consumption by customers of the electric utility in the current period. Fossil fuel used in generation of electricity for consumption by customers of the electric utility shall be deemed to include only the fuel consumed in fossil fired plants owned or leased in whole or



THE HARTFORD ELECTRIC LIGHT COMPANY

FOSSIL FUEL ADJUSTMENT CLAUSE

Page 2 of 2

Price (Cont'd)

in part by the electric utility and its generating subsidiaries, plus the fuel attributable to power acquired by purchase, less fuel attributable to power disposed of through sale. Price shall be established on an alongside basis, FOB at the generating station, and shall be equal, except as adjusted herein, to that price used to establish costs entered into Account Numbers 501 and 547 of the Public Utilities Control Authority's Uniform System of Accounts that are cleared from Account 151. In no case will costs of the type that are cleared from Account 152 be included.

Heat Rate

The ratio of: (1) MMBTU's consumed in the production of energy at the Company's fossil-fired generating plants, plus the MMBTU's of fossil fuel identifiably contained in net energy purchased, to (2) the sum of kWh's of energy generated at fossil-fired generating plants and net fossil-fired energy purchased.

System Loss

The ratio of (1) total kilowatthours generated and purchased minus the sum of kilowatthour sales to customers and kilowatthours used by Company to (2) total kilowatthours generated and purchased.

Savings Shares

Savings Shares shall be equal to the savings in dollars actually realized by the Company in the current period as the result of its participation in economic dispatch systems transactions.

Effective: November 28, 1977

Supersedes Procedure for Calculation of Fossil Fuel Adjustment  
Effective May 1, 1977

APPENDIX F

ENVIRONMENTAL INVENTORY BY WILLIAM L. STODDARD,  
CANTON CONSERVATION COMMISSION-

APPENDIX F  
NATURAL ENVIRONMENTAL INVENTORY

The following inventories of plants, birds, fishes, insects and animals were compiled by William Stoddard, Jr., M.S. in Biology, B.S. in Zoology A member of the Canton Conservation Commission and staff ecologist at Taccott Mountain Center, Avon, Connecticut.

HERBACEOUS PLANTS

*Panicum* sp (Panic-grass)  
*Andropogon* sp (Beard Grass)  
*Dennstaedtia punctilobula* (Hayscented Fern)  
*Polystichum acrostichoides* (Christmas Fern)  
*Polypodium vulgare* (Common Polypody)  
*Onoclea sensibilis* (Sensitive Fern)  
*Phragmites communis* (Peed Grass)  
*Scirpus* sp (Wool Grass)  
*Cyperus* sp (Cyperus)  
*Juncus effusus* (Soft Rush)  
*Rubus* (Raspberry)  
*Rubus* sp (Blackberry)  
*Verbena hastata* (Blue Vervain)  
*Achillea millefolium* (Yarrow)  
*Asclepias syriaca* (Common Milkweed)  
*Asclepias incarnata* (Swamp Milkweed)  
*Apocynum* sp (Dogbane)  
*Aster* sp (Aster)  
*Oenothera biennis* (Evening Primrose)  
*Daucus carota* (Wild Carrot)  
*Rumex acetosella* (Sheep Sorrel)  
*Hypericum perforatum* (St. Johnswort)  
*Cuscuta gronovii* (Dodder)  
*Potentilla* sp (Cinquefoil)  
*Echinocystis lobata* (Wild Cucumber)  
*Bidens* sp (Beggar's Ticks)  
*Ambrosia* sp (Ragweeds)  
*Verbascum thapsus* (Common Mullein)  
*Convolvulus* sp (Bindweed)  
*Polygonum scandens* (Climbing False Buckwheat)  
*Rumex crispus* (Curled Dock)

*Phytolacca americana* (Pokeweed)  
*Saponaria officinalis* (Bouncing Bet)  
*Polygonum* sp. (Tearthumb)  
*Smilax rotundifolia* (Catbriar)  
*Lycopus* sp (Bugle weeds)  
*Plantago major* (Common Plantain)  
*Lobelia inflata* (Indian Tobacco)  
*Lythrum salicaria* (Purple Loosestrife)  
*Solidago* sp (Goldenrods)  
*Lilium* sp (Lily)  
*Polygonum cuspidatum* (Japanese Knotweed)  
*Lepidium campestre* (Peppergrass)

#### VINES

*Vitis* sp (Grape)  
*Celastrus scandens* (Climbing Bittersweet)  
*Toxicodendron radicans* (Poison Ivy)

#### TREES

*Pinus strobus* (White Pine)  
*Pinus resinosa* (Red Pine)  
*Tsuga canadensis* (Canadian Hemlock)  
*Juniperus virginiana* (E. Red Cedar)  
*Salix nigra* (Black Willow)  
*Populus deltoides* (E. Cottonwood)  
*Populus grandidentata* (Bigtooth Aspen)  
*Betula papyrifera* (White Birch)  
*Betula alleghaniensis* (Yellow Birch)  
*Betula populifera* (Gray Birch)  
*Prunus* sp (Cherry)  
*Quercus alba* (White Oak)  
*Quercus rubra* (Red Oak)  
*Quercus velutina* (Black Oak)  
*Ulmus americana* (American Elm)  
*Sassafras albidum* (Sassafras)  
*Platanus occidentalis* (Sycamore)  
*Malus* sp (Apple)  
*Gliditsia triacanthos* (Honey Locust)  
*Robinia pseudoacacia* (Black Locust)  
*Alanthus altissima* (Alanthus)  
*Acer saccharum* (Sugar Maple)  
*Acer rubrum* (Red Maple)  
*Acer saccharinum* (Silver Maple)  
*Catalpa speciosa* (Catalpa)  
*Aesculus hippocastanum* (Horse Chestnut)  
*Fraxinus americana* (White Ash)

## SHRUBS

*Alnus* sp (Alder)  
*Salix discolor* (Pussy Willow)  
*Carpinus caroliniana* (Blue Beech)  
*Rhus typhina* (Staghorn Sumac)  
*Cornus florida* (Flowering dogwood)  
*Cornus stolonifera* (Red Osier Dogwood)  
*Cornus femina* (Panicled Dogwood)  
*Sambucus canadensis* (Elderberry)  
*Lonicera* sp (Honeysuckle)  
*Berberis* sp (Barberry)  
*Ilex* sp (Winterberry)  
*Lindera benzoin* (Spicebush)  
*Hamamelis virginiana* (Witch-Hazel)  
*Kalmia latifolia* (Mountain Laurel)  
*Rosa* sp (Rose)

## BIRDS

Over 150 species either breed or regularly migrate through the area. All of these are common winter birds. Obviously, those that breed in the area would be the only ones really relevant to this project, and even this relevance is only minimal if not questionable. No survey data is available for this specific area. If absolutely required, a survey could be performed during the nesting season. The following species were noted on the inventory of December 11, 1978.

*Branta canadensis* (Canada Geese)  
*Anas platyrhynchos* (Mallard)  
*Buteo jamaicensis* (Redtailed Hawk)  
*Certhia familiaris* (Brown Creeper)  
*Sitta carolinensis* (White-breasted Nuthatch)  
*Parus bicolor* (Tufted Titmouse)  
*Parus atricapillus* (Black-capped Chickadee)  
*Corvus brachyrhynchos* (Crow)  
*Cyanocitta cristata* (Blue Jay)  
*Dendrocopus pubescens* (Downy Woodpecker)  
*Melospiza melodia* (Song Sparrow)  
*Junco Hymnalis* (Junco)

## FISHES

This inventory is the result of surveys published by the State Geological and Natural History Survey of Connecticut - Freshwater Fishes of Connecticut (1968, Whitworth, Berrien, and Keller, Bulletin 101)

*Anguilla rostrata* (American Eel)  
*Salmo gairdneri* (Rainbow Trout)  
*Salvelinus fontinalis* (Brook Trout)

*Esox americanus* (Redfin pickerel)  
*Esox niger* (Chain Pickerel)  
*Cyprinus carpio* (Carp)  
*Notemigonus crysoleucas* (Golden Shiner)  
*Notropis bifrenatus* (Bridled Shiner)  
*Notropis cornutus* (Common Shiner)  
*Notropis hudsonius* (Spottail Shiner)  
*Rhinichthys atratulus* (Blacknose Dace)  
*Rhinichthys cataractae* (Longnose Dace)  
*Semotilus atromaculatus* (Creek Chub)  
*Semotilus corporalis* (Fallfish)  
*Catostomus commersoni* (White Sucker)  
*Ictalurus nebulosus* (Brown Bullhead)  
*Morone americana* (White Perch)  
*Ambloplites rupestris* (Rock Bass)  
*Lepomis auritus* (Redbreast Sunfish)  
*Lepomis gibbosus* (Pumpkinseed)  
*Micropterus dolomieu* (Smallmouth Bass)  
*Micropterus salmoides* (Largemouth Bass)  
*Pomoxis nigromaculatus* (Black Crappie)  
*Etheostoma olmstedii* (Tessellated Darter)  
*Perca flavescens* (Yellow Perch)

The following species, although not surveyed in this area, now have access to this portion of the river with the completion and operation of the fishway at Rainbow Dam, Windsor. Their presence at the dams in question is anticipated in the near future, if not at present.

*Petromyzon marinus* (Sea Lamprey)  
*Alosa aestivalis* (Blueback Herring)  
*Alosa pseudoharengus* (Alewife)  
*Alosa sapidissima* (American Shad)  
*Osmerus eperlanus* (Rainbow Smelt)

#### INSECTS

No insects were noted on the day of the inventory. The river was frozen over so even nymphal stages were inaccessible. However, this stretch of the river is known to produce impressive hatches of Mayflies (Order Ephemeroptera, several families), Stoneflies (Plecoptera), Caddis (Trichoptera), and flies (Diptera). Again, an inventory could be conducted during the summer, if required.

AMPHIBIANS

No amphibians were noted on the inventory due to seasonal considerations.

REPTILES

No reptiles were noted on the inventory due to seasonal considerations.

MAMMALS

No mammals were noted on the inventory due to seasonal considerations.

APPENDIX G

STATE OF CONNECTICUT REGULATIONS





STATE OF CONNECTICUT  
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

WATER RESOURCES UNIT

GENERAL STATUTES OF THE STATE OF CONNECTICUT  
SUPERVISION OF DAMS AND RESERVOIRS

Section 25-110 POWERS AND DUTIES OF COMMISSIONER.  
(Public Act No. 571, 1975 Revision of the General Statutes)

All dams, dikes, reservoirs and other similar structures, with their appurtenances, without exception and without further definition or enumeration herein, which, by breaking away or otherwise, might endanger life or property, shall be subject to the jurisdiction conferred by this chapter. The Commissioner of Environmental Protection shall formulate all rules, definitions and regulations necessary to carry out the provisions of this chapter and not inconsistent therewith. The Commissioner or his authorized representatives may enter upon private property to make such investigations and gather such data concerning dams, watersheds, sites, structures and general conditions as may be necessary in the public interest for a proper inspection, review and study of the design and construction of such structures and the environmental impact of such structures on the inland wetlands of the state. The Commissioner may, when necessary, employ or make such agreements with geologists, other engineers, expert consultants and such assistants as may be reasonably necessary to carry out the provisions of this chapter. The owner of any dam, dike or similar structure under the jurisdiction conferred by this chapter shall notify the Commissioner, by registered or certified mail return receipt requested, of the transfer of ownership of any such dam, dike or similar structure not later than ten days after the date of such transfer.

Section 25-111 INSPECTION OF DAMS AND OTHER STRUCTURES.  
(1975 Revision)

Said Commissioner shall investigate and inspect or cause to be investigated and inspected all dams or other structures which, in his judgement, would, by breaking away, cause loss of life or property damage. Said Commissioner may require any person, firm or corporation owning or having the care and control of any such structure constructed subsequent to July 1, 1918, to furnish him with such surveys, plans, descriptions, drawings and other data relating thereto and in such form and to such reasonable extent as he directs. If such structure was constructed prior to July 1, 1918, such person, firm or corporation shall furnish the Commissioner with any plans and other data that he may possess or may obtain from others. Any person, firm or corporation in possession of such pertinent information shall afford the owner and the Commissioner access thereto. The Commissioner shall make or cause to be made such periodic inspections of all such structures as may be necessary to reasonably insure that they are maintained in a safe condition. Any person, firm or corporation which would suffer loss of life or property by the breaking away of any such structure may petition the Commissioner in writing for an inspection. If the Commissioner has reason to believe the petition is without merit, he may require a deposit not exceeding one hundred dollars to cover the cost of such inspection before making same. If the structure is found safe, the deposit shall be paid to the state treasurer for credit to the proper

fund, but, if the structure is found unsafe, the deposit shall be returned to the person, firm or corporation submitting the petition. If, after any inspection described herein, the Commissioner finds any such structure to be in an unsafe condition, he shall order the person, firm or corporation owning or having control thereof to place it in a safe condition or ~~the~~ remove it, and shall fix the time within which such order shall be carried out. When the Commissioner in his investigation finds that a dam or other structure should be inspected periodically in order to reduce a potential hazard to life and property, the owner of such structure shall cause such inspection to be made by a registered engineer at such intervals as are deemed necessary by the Commissioner and shall submit a copy of the engineer's finding and report to the Commissioner for his action.

Section 25-112 PERMITS FOR CONSTRUCTION.  
(Public Act No. 571, 1975 Revision of the General Statutes)

Before any person, firm or corporation constructs, alters, adds to, replaces or removes any such structure, such person, firm or corporation shall apply to the Commissioner for a permit to undertake such work. The application for such permit shall be in duplicate, the original of which, with necessary drawings, plans, specifications and other data, shall be submitted to the Commissioner, in the form and to the extent required by him. The Commissioner or his representative, engineer or consultant shall determine the environmental impact of the construction work on the inland wetlands of the state, in accordance with the provisions of Sections 22a-36 to 22a-45, inclusive, and examine the documents and inspect the site, and, upon approval thereof, the Commissioner shall issue a permit authorizing the proposed construction work under such conditions as the Commissioner may direct. A copy of the permit shall be sent to the town clerk. The Commissioner may require a fee of not less than one dollar nor more than ten dollars.

Section 25-113 SUPERVISION OF CONSTRUCTION. FINAL PLANS.  
(1975 Revision)

The Commissioner or his representative supervising the work on any dam or other like structure shall inspect the work or cause it to be inspected to the extent necessary to determine whether the structure will be safe and secure. The Commissioner may, when in his judgement circumstances warrant, place a competent inspector on the work, and the compensation for such inspector, shall be shared equally by the state and by the owner. When the work has been completed to the satisfaction of the Commissioner, the owner shall file with the Commissioner plans and descriptions of the work as actually constructed, together with any other pertinent data.

Section 25-114 CERTIFICATE OF APPROVAL.  
(1975 Revision)

When an existing structure is found by the Commissioner to be safe, or has been made safe pursuant to an order of the Commissioner, or a new structure has been constructed to the satisfaction of the Commissioner under a properly issued permit, the Commissioner shall issue a certificate to the

owner approving the structure but subject to such terms and conditions, if any, as the Commissioner deems necessary for the protection of life and property. Such certificates shall be filed by the owner in the land records in the town or towns in which such structure is located.

Section 25-115 LIABILITY OF OWNER OR OPERATOR.  
(1975 Revision)

Nothing in this chapter, and no order, approval or advice of the Commissioner, shall relieve any owner or operator of such a structure from his legal duties, obligations and liabilities resulting from such ownership or operation. No action for damages sustained through the partial or total failure of any structure or its maintenance shall be brought or maintained against the state, the Commissioner of Environmental Protection, or his employees or agents, by reason of supervision of such structure exercised by the Commissioner under this chapter.

Section 25-116 FORFEITURE FOR VIOLATIONS.  
(1975 Revision)

Any person, firm or corporation building, repairing to an extent substantially affecting stability, maintaining or using any such structure without complying with the provisions of this chapter, or failing to build, repair, maintain or remove any such structure when so ordered or directed by the Commissioner under authority of this chapter, shall forfeit to the state a sum not exceeding five hundred dollars, to be fixed by the court, for each offense. Each violation shall be a separate and distinct offense and, in case of a continuing violation, each day's continuance thereof shall be deemed to be a separate and distinct offense. The Attorney General, upon complaint of the Commissioner, shall institute an action to recover such forfeiture and to enjoin the construction and use of such structure.

Section 25-117 APPEAL.  
(1975 Revision)

Upon written request, any person, firm or corporation aggrieved by any decision of the Commissioner shall be given a hearing by the Commissioner. An appeal may be taken from any decision of the Commissioner to the court of common pleas for the county wherein such structure is located, within twenty days after the date of such decision.

Section 25-118 SURVEY AND MAPS.  
(1975 Revision)

The Commissioner shall cause a survey and maps to be made of each town showing the location of such structures, and shall file a copy of such map with the town clerk of each town.

Section 25-119 CHAPTER NOT TO LIMIT POWER OF OTHER AUTHORITY.  
(1975 Revision)

This chapter shall not be construed to prevent any other state authority from carrying out its legal duties.

## CONNECTICUT CLEAN WATER ACT

(Connecticut General Statutes, Chapter 474(a), Title 25, Water Pollution Control,  
Public Act No. 57 of 1967; Public Act No. 91 of 1972)

Administering Agency: Water Compliance Unit  
Department of Environmental Protection  
State Office Building  
Hartford, Conn. 06115

## PUBLIC ACT No. 57 of 1967

[As amended by Public Acts Nos. 63, 153, 384, and 486 of 1969; 433 and 872 of 1971; 29, 217, 222, 225, 237, and 252 of 1972; 73-38, 73-192, 73-265, 73-555, and 73-665 of 1973; 74-187, 74-311, and 74-338 of 1974; 76-9 of 1976]

AN ACT CONCERNING THE ELIMINATION OF  
POLLUTION OF THE WATERS OF THE STATE.

*Be it enacted by the Senate and House of Representatives  
in General Assembly convened:*

SEC. 1. [25-54a] It is found and declared that the pollution of the waters of the state is inimical to the public health, safety and welfare of the inhabitants of the state, is a public nuisance and is harmful to wildlife, fish and aquatic life and impairs domestic, agricultural, industrial, recreational and other legitimate beneficial uses of water, and that the use of public funds and the granting of tax exemptions for the purpose of controlling and eliminating such pollution is a public use and purpose for which public monies may be expended and tax exemptions granted, and the necessity and public interest for the enactment of this act and the elimination of pollution is hereby declared as a matter of legislative determination.

SEC. 2. [25-54b] As used in this chapter and in part II of Chapter 474: "Commissioner" means the commissioner of environmental protection; "waters" means all tidal waters, harbors, estuaries, rivers, brooks, watercourses, waterways, wells, springs, lakes, ponds, marshes, drainage systems, and all other surface or underground streams, bodies or accumulations of water, natural or artificial, public or private, which are contained within, flow through or border upon this state or any portion thereof; "wastes" means sewage or any substance, liquid, gaseous, solid or radioactive, which may pollute or tend to pollute any of the waters of the state; "sewage" means human and animal excretions and all domestic and such manufacturing wastes as may tend to be detrimental to the public health; "pollution" means harmful thermal effect or the contamination or rendering unclean or impure or prejudicial to public health of any waters of the state by

reason of any wastes or other material discharged or deposited therein by any public or private sewer or otherwise so as directly or indirectly to come in contact with any waters; "rendering unclean or impure" means any alteration of the physical, chemical or biological properties of any of the waters of the state, including, but not limited to, change in odor, color, turbidity or taste; "harmful thermal effect" means any significant change in the temperature of any waters resulting from a discharge therein, the magnitude of which temperature change does or is likely to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life; "person" means any individual, partnership, association, firm, corporation or other entity, except a municipality, and includes any officer or governing or managing body of any partnership, association, firm or corporation; "community pollution problem" means the existence of pollution which, in the sole discretion of the commissioner, can best be abated by the action of a municipality; "municipality" means any metropolitan district, town, consolidated town and city, consolidated town and borough, city, borough, village, fire and sewer district, sewer district and each municipal organization having authority to levy and collect taxes or make charges for its authorized function; "discharge" means the emission of any water, substance or material into the waters of the state, whether or not such substance causes pollution; "pollution abatement facility" means treatment works which are used in the treatment of waters, including the necessary intercepting sewers, outfall sewers, pumping, power and other equipment, and their appurtenances, and includes any extensions, improvements, remodeling, additions and alterations thereof; "disposal system" means a system for disposing of or eliminating wastes, either by surface or underground methods, and includes sewage systems, pollution abatement facilities, disposal wells and other systems; "federal water pollution control act" means the Federal Water Pollution Control Act, 33 U.S.C. section 466 et seq., including amendments thereto and regulations thereunder; "order to abate pollution" includes an order to abate existing pollution or to prevent reasonably anticipated sources of pollution.

SEC. 3. [25-54c] The commissioner shall have the following powers and duties: (a) To exercise general supervision of the administration and enforcement of this chapter and Part II of Chapter 474; (b) to develop comprehensive programs for the prevention, control and abatement of new or existing pollution of the waters of the state; (c) to advise, consult and cooperate with other agencies of the state, the federal government, other states and interstate agencies and with affected groups, political subdivisions and industries in furtherance of the purposes of this chapter; (d) to submit plans for the prevention and control of water pollution and to render reports and accounts to the administrator of the Environmental Protection Agency and to any other federal officer or agency on such forms containing such information as the said administrator or any other federal officer or agency, may reasonably require, in order to qualify the state and its municipalities for grants from the United States government; (e) to encourage, participate in or conduct studies, investigations, research and demonstrations, and collect and disseminate information, relating to water pollution and the causes, prevention, control and abatement thereof; (f) to issue, modify or revoke orders prohibiting or abating pollution of the waters of the state, or requiring the construction, modification, extension or alteration of pollution abatement facilities or any parts thereof, or adopting such other remedial measures as are necessary to prevent, control or abate pollution; (g) to hold such hearings as may be required under the provisions of this chapter and the Federal Water Pollution Control Act or other applicable federal law, for which he shall have the power to issue notices by certified mail, administer oaths, take testimony and subpoena witnesses and evidence; (h) to require the submission of plans, specifications and other necessary data for, and inspect the construction of, pollution abatement facilities and disposal systems in connection with the issuance of such permits or approvals as may be required by this chapter and the Federal Water Pollution Control Act; (i) to issue, continue in effect, revoke, modify or deny permits, under such conditions as he may prescribe, for the discharge of any water, substance or material into the waters of the state, or orders for or approval of the installation, modification or operation of pollution abatement facilities; (j) to require proper maintenance and operation of disposal systems; (k) to exercise all incidental powers necessary to carry out the purposes of this chapter, Part II of Chapter 474 and the Federal Water Pollution Control Act.

SEC. 4 [25-54d] The commissioner may require any person or municipality to maintain such records relating to pollution, possible pollution or the operation of pollution abatement facilities as he deems necessary to carry out the provisions of this chapter, Part II of Chapter 474 and the Federal Water Pollution Control Act. The commissioner or his authorized representative shall have access to such records, and may examine and copy any such records or memoranda pertaining thereto, or shall be furnished copies of such records on request.

SEC. 5. [25-54e] (a) The commissioner shall adopt, and may thereafter amend, standards of water quality applicable to the various waters of the state or portions

thereof as provided in section 7 of P.A. No. 872, Laws of 1971. Such standards shall be consistent with the federal water pollution control act and shall be for the purpose of qualifying the state and its municipalities for available federal grants and for the purpose of providing clear and objective public policy statements of a general program to improve the water resources of the state; provided no standard of water quality adopted shall plan for, encourage or permit any wastes to be discharged into any of the waters of the state without having first received the treatment available and necessary for the elimination of pollution. Such standards of quality shall: (1) Apply to interstate waters or portions thereof within the state; (2) apply to such other waters within the state as the commissioner may determine is necessary; (3) protect the public health and welfare and promote the economic development of the state; (4) preserve and enhance the quality of state waters for present and prospective future use for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes and agricultural, industrial and other legitimate uses; (5) be consistent with health standards as established by the state department of health. (b) Prior to adopting, amending or repealing standards of water quality, the commissioner shall conduct a public hearing. Notice of such hearing specifying the waters for which standards are sought to be adopted, amended or repealed and the time, date, and place of such hearing shall be published at least twice during the thirty-day period preceding the date of the hearing in a newspaper having a general circulation in the area affected and shall be given by certified mail to the chief executive officer of each municipality in such area. Prior to the hearing the commissioner shall make available to any interested person any information he has as to the water which is the subject of the hearing and the standards under consideration, and shall afford to any interested person the opportunity to submit to him any written material. At the hearing, any person shall have the right to make a written or oral presentation. A full transcript or recording of each hearing shall be made and kept available in the files of the department of environmental protection. (c) The commissioner shall establish the effective date of the adoption, amendment or repeal of the standards of water quality. Notice of such adoption, amendment or repeal shall be published in said law journal upon acceptance therefore by the federal government. (d) The commissioner shall monitor the quality of the subject waters to demonstrate the results of his program to abate pollution.

SEC. 6. [25-54f] No person or municipality shall cause pollution of any of the waters of the state or maintain a discharge of any treated or untreated wastes in violation of any provision of this act.

SEC. 7. [25-54g] If the commissioner finds that any municipality is causing pollution of the waters of the state, or that a community pollution problem exists, or that pollution by a municipality or a community pollution problem can reasonably be anticipated in the future, he may issue to the municipality an order to abate pollution. If the commissioner after giving due regard to regional factors, determines that such pollution can best be abated by the action of two or more adjacent municipi-

palties he may issue his order jointly or severally to such municipalities. If a community pollution problem exists in, or if pollution is caused by, a municipality geographically located all or partly within the territorial limits of another municipality, the commissioner may, after giving due regard to regional factors, determine which municipality shall be ordered to abate the pollution or may, after giving due regard to regional factors, issue an order to both such municipalities jointly to provide the facilities necessary to abate the pollution. Any order issued pursuant to this section shall include a time schedule for action by the municipality or municipalities, as the case may be, which may require, but is not limited to, the following steps to be taken by such municipality or municipalities: (a) Submission of an engineering report outlining the problem and recommended solution therefor for approval by the commissioner; (b) submission of contract plans and specifications for approval by the commissioner; (c) arrangement of financing; (d) acceptance of state and federal construction grants; (e) advertisement for construction bids; (f) start of construction; (g) placing in operation.

SEC. 8. [25-54h] If the commissioner finds that any person prior to May 1, 1967, has caused pollution of any of the waters of the state, which pollution recurs or continues after said date, he may issue an order to abate pollution to such person. The order shall include a time schedule for the accomplishment of the necessary steps leading to the abatement of the pollution. This section shall not apply to any person who is subject to the provisions of section 9 of this act.

SEC. 9. [25-54i] (a) No person shall, after May 1, 1967, and no municipality shall, after April 10, 1973, initiate, create or originate any new discharge of water, substance or material into the waters of the state without first obtaining a permit for such discharge from the commissioner. Application for such permit shall be on a form prescribed by the commissioner and shall include such information as the commission may therein require.

(b) No sooner than thirty days and not later than sixty days after the receipt of an application for a permit as required in subsection (a), the commissioner shall hold a public hearing on such application. Notice of the hearing shall be given by publication, at least twice during the twenty days immediately preceding the hearing in a newspaper having a substantial circulation in the area affected. If, after such hearing, the commissioner finds that such discharge would not cause pollution of any of the waters of the state, he shall issue a permit for such discharge. If the commissioner finds, after giving due regard to any proposed system to treat the discharge, that such discharge would cause pollution of any of the waters of the state, he shall deny the application and notify the applicant of such denial and the reasons therefor. If the commissioner finds that the proposed system to treat such discharge will protect the waters of the state from pollution, he shall require the applicant to submit plans and specifications and such other information as he may require and shall impose such additional conditions as may be required to protect such waters. If the commissioner finds that the proposed system to treat the discharge, as described by the plans and specifications, will

protect the waters of the state from pollution, he shall notify the applicant of his approval and, when such applicant has installed such system, in full compliance with the approval thereof, the commissioner shall issue a permit for such discharge. If the commissioner finds that the proposed system to treat such discharge, as described by the plans and specifications, will not protect the waters of the state, he shall promptly notify the applicant that its application is denied and the reasons therefor. If any applicant is denied a permit by the commissioner, such applicant shall have the right to a hearing and an appeal therefrom in the same manner as provided in sections 25-54o and 25-54p. The commissioner may, by regulation, exempt certain categories, types or sizes of discharge from the requirement for public hearing prior to approving or denying the application if such category, type or size of discharge is not likely to cause substantial pollution. The commissioner may hold a public hearing prior to approving or denying any application exempted under this subsection if in his discretion the public interest will be best served thereby, and he shall hold a hearing upon receipt of a petition signed by twenty-five persons.

(c) The permits issued pursuant to this section shall be for a period not to exceed five years, except that any such permit shall be subject to the provisions of section 25-54j. Such permits: (1) Shall specify the manner, nature and volume of discharge; (2) shall require proper operation and maintenance of any pollution abatement facility required by such permit; (3) may be renewable for periods not to exceed five years each in accordance with procedures and requirements established by the commissioner; and (4) shall be subject to such other requirements and restrictions as the commissioner deems necessary to comply fully with the purposes of this chapter and the Federal Water Pollution Control Act.

(d) If the commissioner finds that any person after May 1, 1967, or that any municipality after April 10, 1973, has initiated, created or originated any discharge into the waters of the state without a permit as required in subsection (a) hereof, or in violation of such permit, he may, notwithstanding any request for a hearing pursuant to section 25-54o or the pendency of an appeal therefrom, request the attorney general to bring an action in the superior court for Hartford county to enjoin such discharge by such person or municipality until the person or municipality has received a permit from the commissioner or has complied with a permit which the commissioner has issued pursuant to this section. Any such action brought by the attorney general shall have precedence in the order of trial as provided in section 52-191.

(e) When the commissioner determines that any person or municipality has complied with an order issued pursuant to sections 25-27, 25-54g, 25-54h, 25-54j or 25-54k, he may issue a permit which shall thereafter be deemed equivalent to a permit issued under subsection (b) of this section, provided a public hearing shall not be required prior to issuing such permit unless required by the Federal Water Pollution Control Act.

(f) The commissioner may, by regulation, establish categories of discharges, including but not limited to, household and small commercial disposal systems, residen-

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schedule therefor if he deems such modification or extension advisable or necessary, and any such modification or extension shall be deemed to be a revision of an existing order and shall not constitute a new order. There shall be no hearing subsequent to or any appeal from any such modification or extension.

SEC. 16 [25-54p] Any person or municipality aggrieved by any order of the commissioner other than an order under section 22a-6b to abate pollution or decision denying a permit under subsection (b) of section 25-54i may, after a hearing by the commissioner as provided for in section 25-54o, appeal from the final determination of the commissioner based on such hearing to the court of common pleas for Hartford county within fifteen days after the issuance of such final determination. Such final determination shall be sent by certified mail, return receipt requested, and shall be deemed issued upon deposit in the mail. Such appeal shall have precedence in the order of trial as provided in section 52-192. All appeals taken pursuant to this section shall be based solely upon the record of the hearing required in section 25-54o. The court shall determine whether the commissioner acted arbitrarily, unreasonably or contrary to law.

SEC. 17. [25-54q] (a) Any person or municipality which wilfully or negligently violates any provision of this chapter or Part II of Chapter 474 shall forfeit to the state a sum not to exceed ten thousand dollars, to be fixed by the court, for each offense. Each violation shall be a separate and distinct offense and, in case of a continuing violation, each day's continuance thereof shall be deemed to be a separate and distinct offense. The attorney general, upon complaint of the commissioner, shall institute a civil action to recover such forfeiture. The provisions of this section shall not apply to a person or municipality during the time when a hearing pursuant to section 25-54o or an appeal pursuant to section 25-54q is pending.

(b) Any person or municipality which wilfully or negligently violates any provision of this chapter, Part II of Chapter 474, or sections 22a-6 or 22a-7 shall be punished by a fine of not more than twenty-five thousand dollars per day for each day of violation or by imprisonment for not more than one year or both.

(c) Any person or municipality which knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this chapter, Part II of Chapter 474, or sections 22a-6 or 22a-7 or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this chapter, Part II of Chapter 474 or sections 22a-6 or 22a-7 shall upon conviction be fined not more than ten thousand dollars or imprisoned not more than six months or both.

SEC. 18. [25-54r] The commissioner shall make a grant to any municipality which, after May 1, 1967,

constructs, rebuilds, expands or acquires a pollution abatement facility. In the case of a municipality which, on said date, is in the process of constructing, rebuilding, expanding or acquiring such a facility, such grant shall apply only to that part of the facility constructed, rebuilt, expanded or acquired after said date. The grants under this section shall be subject to the following conditions: (1) No grant shall be made for any pollution abatement facility unless such facility, and the plans and specifications therefor, are approved by the commissioner, and such facility is constructed in accordance with a time schedule of the commissioner, and subject to such requirements as the commissioner shall impose. If the commissioner requires that the facility be approved by the federal environmental protection agency, such grant shall be conditioned upon the municipality complying with all of the requirements of said agency; (2) no grant shall be made until the municipality has agreed to pay that part of the total cost of the facility which is in excess of the applicable state and federal grants; (3) except as provided in subsection 4 of this section, the grant to each municipality shall equal thirty per cent of the cost of such facility, which cost shall be that cost which the federal environmental protection agency uses or would use in making a federal grant, except that where the commissioner has approved plans for a facility exceeding the requirements of the federal act, the grant shall be thirty per cent of the actual cost provided the percentage of the cost which is the grant under this section shall be reduced so that the total federal and state grants available to the municipality shall not exceed ninety per cent of the cost of such facility; (4) the state grant under this section may be increased, in the sole discretion of the commissioner, so that the total federal and state grant available to the municipality shall equal one hundred per cent of the cost of facilities required to remove nutrients which are causing excessive growth of aquatic freshwater plants in the inland waters of the state; (5) the state grant under this section shall be paid to the municipality in partial payments similar to the time schedule that such payments are or would be provided to the municipality by the federal environmental protection agency; (6) no grant shall be made unless the municipality assures the commissioner of the proper and efficient operation and maintenance of the pollution abatement facility after construction; (7) no grant shall be made unless the municipality has filed properly executed forms and applications prescribed by the commissioner; (8) any municipality receiving state or federal grants for pollution abatement facilities shall keep separate accounts by project for the receipt and disposal of such eligible project funds. Any funds advanced to a municipality prior to October 1, 1971, under the provisions of section 25-54r shall be considered a part of the total amount of the state grant provided for in this section.

SEC. 19. [25-54s] The commissioner may provide a grant to a municipality for the cost of those facilities which he determines to be essential to a storm and sanitary sewer separation program when he finds that such facilities are primarily for the separation of storm



and sanitary sewage and will eliminate a substantial source of pollution. The cost of the project used to determine the state grant in this section shall not include any cost for the acquisition of land or any rights or interests herein. For the purposes of this section and section 25-54r such facilities shall be considered pollution abatement facilities. The grants under this section shall be subject to all the conditions of grants made under section 25-54r.

[25-54t] The commissioner shall make a grant to any municipality which, prior to May 1, 1967, constructed, rebuilt, acquired or expanded a pollution abatement facility, which grant shall be thirty percent of the principal amount of bond or note obligations of such municipality, issued to finance such construction, rebuilding, acquisition or expansion and outstanding on said date, exclusive of all interest costs and for which grant application is made prior to October 1, 1969, on an application prescribed by the commissioner. Such grant shall be paid in equal annual installments at least thirty days prior to the date the municipality is obligated to make payment on such bonds or notes, provided any grant under this section shall be reduced by any amount payable to such municipality under the provisions of section 25-54r for the same construction, rebuilding, acquisition or expansion project, such reduction to be prorated over the period remaining for the payment of such bonds or notes.

SEC. 20. [25-54u] If federal funds are not available to the municipality at the time of its scheduled construction of a pollution abatement facility, the commissioner shall advance to such municipality, in addition to the state contribution provided for in section 25-54r, that sum of money which would equal the amount of the federal grant, provided the municipality shall agree that any federal contribution thereafter made for the project shall be forwarded to the state as reimbursement for the funds expended under this section. Prior to advancing the federal share, the commissioner shall require the municipality to agree in its project contract with the commissioner to do all that is necessary to qualify for the federal grant. The municipality shall also agree to pay over to the commission any installment of a grant received from the federal water pollution control administration on which the state has made an advance under this section. Said monies received from the municipality shall be deposited in a sinking fund which is hereby established for payment of the debt service costs of bonds issued under section 25-54z.

SEC. 21. [25-54v] If federal funds for contract plans and specifications for the construction of a pollution abatement facility are not available to the municipality at the time of its scheduled planning, the commissioner shall advance to such municipality a sum equal to seven percent of the estimated construction cost, said amount to be advanced by the municipality for the purpose of preparing contract plans and specifications; provided any remaining amount of the seven per cent advanced under this section shall be applied to the cost of construction of the facility. The funds advanced to the municipality under this section

shall be considered a part of the total amount of the state grant provided for in section 25-54r. Such facility shall be constructed in accordance with a schedule of the commissioner and shall be in conformance with an engineering report approved by the commissioner. Before approving the engineering report required in this section, and in section 25-54g, and as may be required under section 25-54j, the commissioner shall, among other factors, give due regard to whether such report is in conformance with his applicable guidelines, whether such report makes adequate recommendations concerning all existing and anticipated community discharges, whether such report conforms with existing planning studies and whether satisfactory considerations have been given to all regional problems outlined to the engineer in a pre-report conference with the commissioner.

SEC. 22. [25-54w] If federal funds for an engineering report are not available, and the schedule of the commissioner as provided for in section 25-54g requires that a municipality prepare such a report before July 1, 1968, and the commissioner finds that the charter of such municipality does not authorize a reasonable method for providing the required funds to proceed on such a report in time to accomplish its completion as scheduled, the commissioner may advance funds to such municipality in the amount necessary to provide such report, said funds to be used by the municipality for the purpose of preparing such report. Any funds advanced to the municipality under this section shall be considered a part of the total amount of the state grant provided for in section 25-54r.

SEC. 23. [25-54x] The commissioner of environmental protection is designated as the officer of the state to manage, administer and control funds appropriated by the general assembly or authorized by the state bond commission to carry out the provisions of this act. All grants made pursuant to this act shall be made only with the advice and consent of the commissioner and no grant shall be made under this act if such grant, together with all grants awarded prior thereto, exceeds the amount of funds available therefor.

SEC. 24. [25-54y] The commissioner of environmental protection is designated as the administrative agent of the state to apply for and accept any funds or other aid and to cooperate and enter into contracts and agreements with the federal government relating to the planning, developing, maintaining and enforcing of the program to provide clean water and pollution abatement of the waters of the state, or for any other related purpose which the Congress of the United States has authorized or may authorize. The commissioner is authorized in the name of the state to make such applications, sign such documents, give such assurances and do such other things as are necessary to obtain such aid from or cooperate with the United States or any agency thereof. The commissioner may enter into contracts and agreements and cooperate with any other state agency, municipality, person or other state when the same is necessary to carry out the provisions of this act. Such contracts shall be subject to the approval of the attorney general as to form.

SEC. 25. [25-54z] (a) The state bond commission is

empowered to authorize the issuance of bonds of the state in one or more series in an aggregate principal amount not exceeding three hundred twenty-five million dollars. The proceeds of the sale of said bonds shall be used for making of advances and grants under sections 25-54r to 25-54w, inclusive, and for the payment of expenses incurred by the department of environmental protection in carrying out the provisions of this act which are not otherwise provided for from the state general funds. Not more than one-half of one percent of said proceeds shall be used for payment of such expenses. Said bonds shall be used for payment of such expenses. Said bonds shall be issued in accordance with section 3-20 of the general statutes and the full faith and credit of the state are pledged for the payment of the principal of and interest on said bonds as the same become due.

(b) All of said bonds shall be payable at such place or places as may be determined by the treasurer pursuant to section 3-19 of the general statutes and shall bear such date or dates, mature at such time or times not exceeding twenty years from their respective dates, bear interest at such rate or different or varying rates and payable at such time or times, be in such denominations, be in such form with or without interest coupons attached, carry such registration and transfer privileges, be payable in such medium of payment and be subject to such terms of redemption with or without premium as, irrespective of the provisions of section 3-20 of the general statutes, may be provided in the determination authorizing the same or fixed in accordance therewith. Notwithstanding the provisions of said section 3-20, any of said bonds may be sold to the United States or any agency or instrumentality thereof in such manner and on such terms as may be provided in the determination authorizing the same or fixed in accordance therewith.

SEC. 25-54aa. All orders, directives or decisions of the water resources commission in existence on the effective date of this Act [July 1, 1971] shall continue in force until rescinded, amended or repealed by the commissioner.

SEC. 25-54cc. (a) The commissioner of environmental protection shall, to the extent possible, immediately, whenever there is discharge, spillage, seepage or filtration of oil or petroleum or chemical liquids or products upon any land or into any of the waters of the state or into any offshore or coastal waters, which may result in damage to beaches or coastal areas, cause such discharge, spillage, seepage or filtration to be contained and removed by whatever method said commissioner considers best and most expedient under the circumstances. The commissioner shall also determine the person, firm or cooperation responsible for causing such discharge, spillage, seepage or filtration. (b) The commissioner shall (1) license all terminals in the state for the loading or discharge of petroleum or chemical liquids or products from vessels and shall issue reasonable regulations in connection therewith for the purposes of protecting the public safety and for preventing the discharge or spilling of oil or petroleum or chemical liquids or products into the waters of the state. Each license issued under this section shall be valid for a period of not more than one year commencing July first, unless sooner revoked by the

commissioner, and they shall be charged for each such license or renewal thereof a fee of one hundred and twenty five dollars, (2) provide by regulations, in accordance with the provisions of subdivision (a) of section 22a-6 [P.A. No. 872, Laws of 1971], for the establishment and maintenance in operating condition and position of suitable equipment to contain as far as possible any oil, petroleum or chemical liquids or products spilled or discharged into the waters of the state, (3) inspect periodically all hoses, gaskets, tanks, pipelines and other equipment used in connection with the transfer, transportation or storage of oil, petroleum or chemical liquids or products to make certain that they are in good operating condition, and shall order the renewal of any such equipment found unfit for further use, (4) require by regulations, in accordance with said subdivision (a), that suitable equipment be readily available and in operating position to remove from the waters of the state any oil, petroleum or chemical liquids or products spilled or discharged therein, (5) require the payment of reasonable fees by any person, firm or corporation which directly or indirectly transfers, transports or stores any oil, petroleum or chemical liquids or products and such fees shall be used to reimburse the state for the cost of inspections required by sections 25-54bb to 25-54hh, inclusive, as herein amended. Any person, firm or corporation which operates any such terminal in this state after January 1, 1970, without a license to do so, issued by the commissioner, shall be fined one hundred dollars per day during any period of unlicensed operation of such terminal. (c) The commissioner may establish such programs and promulgate and enforce such regulations as he deems necessary to carry out the intent of sections 25-54bb to 25-54hh, inclusive, as amended.

SEC. 25-54dd. The master of any ship, boat, barge or other vessel, or the person in charge of any terminal for the loading or discharge of any oil, petroleum or chemical liquids or products, or the person in charge of any establishment, or the operator of any vehicle trailer or other machine which by accident, negligence or otherwise causes the discharge, spillage, seepage, filtration or other pollution or contamination of the waters of this state with oil or other petroleum or chemical liquids or products, shall immediately report such facts as the commissioner by regulation may require to the state police who shall, upon receipt of such report, take such action as the commissioner may require. Such report shall also be made to the United States Coast Guard, except that if the pollution and contamination does not occur in or affect the coastal waters of the state or any river or stream which flows into such waters and from the circumstances there is no possibility that such pollution or contamination will affect any such river or stream or coastal waters, the report required by this section may be made to the state police only. Any such report shall include, but shall not be limited to, the location of the polluting and contaminating oil or other petroleum or chemical liquid or product, the quantity, the date and cause of the pollution and contamination, the name and address of the owner of the ship, boat, barge or other vessel, terminal, establishment, vehicle, trailer or machine causing such pollution and contamination, and the name

and address of the person making the report and his relationship to the owner of the cause of the pollution and contamination. Any person who fails to make a report of pollution and contamination as required by sections 25-54bb to 25-54hh, inclusive, as herein amended, shall be fined not less than one thousand dollars and not more than five thousand dollars.

SEC. 25-54ee. Any person, firm or corporation which directly or indirectly causes pollution and contamination of any land or waters of the state through the discharge, spillage, seepage, filtration or otherwise of oil or any petroleum or chemical liquid or product shall be liable for all costs and expenses incurred by said commissioner in containing and removing such pollution and contamination provided, if such pollution or contamination was negligently caused, such person, firm or corporation may, at the discretion of the court, be liable for damages equal to one and one-half times the costs and expenses incurred by said commissioner. Upon request of the commissioner, the attorney general shall bring a civil action to recover all such costs and expenses. All costs and expenses so recovered shall be applied (1) to reimburse the state for all sums of money advanced or expended by it under sections 25-54bb to 25-54hh, inclusive, in containing and removing any such pollution and contamination and (2) for the general purpose of said sections without further appropriations.

SEC. 25-54ff (b). No person, firm or corporation which gratuitously renders assistance at the request of an officer, duly authorized by the commissioner, in removing oil or petroleum or chemical liquids or products, pollution or contamination from the waters of the state or adjoining shorelines or beaches shall be held liable, notwithstanding any other provision of law, for civil damages as a result of any act or omission by him in removing such oil or petroleum or chemical liquids or products, except acts or omissions amounting to gross negligence or wilful or wanton misconduct.

SEC. 25-54gg. The commissioner shall represent the state in its relations with the federal government and with any municipality and with any regional or interstate authority in all matters relating to oil or petroleum or chemical liquids or products, pollution or contamination in the waters of the state or off-shore or coastal waters of the state. Said commissioner may enter into agreements with the federal government, such municipalities or authorities, to coordinate supervisory activities and, subject to adequate appropriations, share reasonable costs. The commissioner may contract with any person, firm or corporation for such protective and clean-up services as it may require.

SEC. 25-54hh. No person shall engage in the business of collecting waste oil or petroleum or chemical liquids or products or of acting as a contractor to contain or remove spills of such material or shall dispose of waste oil or petroleum or chemical liquids or products in any waters of the state, without a permit from the commissioner. Such permit, which shall be in writing and valid for not more than one year beginning July first and

for which an annual charge not to exceed five dollars shall be made, shall not be granted unless the commissioner is satisfied that such disposition will not result in further pollution or contamination. He may conduct a program of study and research and demonstration, relating to new and improved methods of waste oil and petroleum or chemical liquids or products disposal.

SEC. 25-54ii. No individual, partnership, association, firm, corporation or other entity shall operate any ship, boat, barge or other vessel, whether or not self-propelled, in or entering upon the waters of this state with the purpose of discharging or receiving any cargo of any oil or bulk petroleum product in this state unless such individual, partnership, association, firm, corporation or other entity has posted with the [secretary of the state] Department of Environmental Protection a bond in the sum of fifty thousand dollars payable to the state. Such bond shall be with a surety licensed to do business in this state and conditioned that, to the amount of such bond, the state will be reimbursed for all costs arising in connection with the containing and removal of any pollution or contamination of the waters of this state arising from the discharge, spillage, seepage or filtration of any oil or petroleum product of any such ship, boat, barge or other vessel. Any amounts recovered under such bond may be in addition to any other remedies available to the state. No bond shall be released without the certification by the commissioner of environmental protection that the ship, boat, barge or other vessel in respect of which such bond was posted has not been a source of oil pollution.

SEC. 25-54jj. Other evidence of financial responsibility. The state may accept in lieu of such bond any other evidence of financial responsibility or insurance which in the opinion of the attorney general and the commissioner of environmental protection shall be sufficient to indemnify the state against such costs. [1971, P.A. 190, S.2; Effective July 1, 1971.]

SEC. 25-54kk. Penalty. Any individual, partnership, association, firm, corporation or other entity which operates any ship, boat, barge or other vessel in the waters of this state for the purposes of discharging or receiving any cargo of oil or bulk petroleum products in this state without being bonded as provided by section 25-54ii or without having submitted other evidence of financial responsibility as required under section 25-54jj shall be fined not more than five thousand dollars. [1971, P.A. 190, S. 3.; Effective July 1, 1971.]

SEC. 25-54ll. Sewer authority, mandatory establishment by municipality. Notwithstanding any provision of the general statutes, any special act or municipal charter provision to the contrary, including but not limited to any referendum provision, the legislative body of any municipality ordered by the commissioner of environmental protection, under the provisions of chapters 474 and 474a, to construct sewers or a disposal plant in order to abate or control water pollution shall establish a sewer authority and authorize the necessary funds to undertake and complete such construction project. [1971, P.A. 305, S.1.]

SEC. 25-54mm. Failure to establish, violation. Penalties. (a) The failure to comply with an order under section 25-54ll shall constitute a violation of said section 25-54ll and of this section.

(b) If any person or municipality violates section 25-54ll of this section, the commissioner may institute an action in the superior court for Hartford county to enjoin the continuance of such violation, such action to have precedence in the order of trial as provided in section 52-191; provided, in the case of a municipality, the commissioner, in lieu of instituting such action, may notify the public works commissioner to take such steps as are necessary to cause the discharge of such municipality to comply with any outstanding order to abate pollution, and the powers of such municipality shall be pro tanto suspended until completion and such municipality shall be obligated to pay to the state for the municipality's share of the cost of such steps plus one-tenth of one per cent of such share. The commissioner of environmental protection shall determine a schedule of payments for said obligation, which payments shall be made in not more than twenty equal annual instalments. If such municipality fails to pay any such instalment, the commissioner shall notify the comptroller who shall thereafter withhold his order for the payment of any form of state aid or grant to such municipality except those provided under title 10 and 17 until the total of such withheld payments equal the total of any such unpaid instalments.

(c) If any municipality violates the term of any injunction obtained in accordance with the provisions of this section, the commissioner may notify the public works commission, with a copy of such notice to such municipality to take such steps as are necessary to cause the discharge of such municipality to comply with the terms of such injunction, and the powers of such municipality shall be pro tanto suspended until completion, provided, however, that such municipality shall be obligated to pay to the state for the municipality's share of the cost of such steps plus one-tenth of one per cent of such share. The commissioner of environmental protection shall determine a schedule of payments for said obligation, which payments shall be made in not more than twenty equal annual instalments. If such municipality fails to pay any such instalment, the commissioner shall notify the comptroller who shall thereafter withhold his order for the payment of any form of state aid or grant to such municipality except those provided under title 10 and 17 until the total of such withheld payments equals the total of such unpaid instalments.

(d) If any person, municipality, or an agent thereof knowingly violates section 25-54ll of this section, the court, in an action instituted under subsection (b) of this section, shall order such person or municipality to pay to the state a sum not to exceed one thousand dollars for each day's continuance of each violation, provided that if such person or municipality has previously been ordered by the court to make payment to the state for the same violation, then the court shall order payment of a sum not less than five hundred dollars for each day's continuance of such violation. If a municipality fails to make such payment in accordance with the judgment, the

commissioner shall notify the comptroller who shall thereafter withhold his order for the payment of any form of state aid or grant to such municipality except those provided under titles 10 and 17 until the total of such withheld payments equals the amount of such payment. [1971, P.A. 305, S. 2)]

SEC. 25-54nn. Detergents: Definitions. As used in sections 25-54nn to 25-54pp, inclusive: (a) "Synthetic detergent" or "detergent" means any cleaning compound which is available for household use, laundry use, other personal uses or industrial use, which is composed of organic and inorganic compounds, including soaps, water softeners, surface active agents, dispersing agents, oil emulsifying agents, soluble oil compounds, foaming agents, buffering agents, builders, fillers, dyes, enzymes and fabric softeners, whether in the form of crystals, powders, flakes, bars, liquids, sprays or any other form; (b) "polyphosphate builder" or "phosphorus" means a water softening and soil suspending agent made from condensed phosphates, including pyrophosphates, triphosphates, tripolyphosphates, metaphosphates and glassy phosphates, used as a detergent ingredient; (c) "recommended use level" means the amount or concentration of synthetic detergent or detergent which the manufacturer thereof recommends for use, at which level such synthetic detergent or detergent will effectively perform its intended function; (d) "machine dishwasher" means equipment manufactured for the purpose of cleaning dishes, glassware and other utensils involved in food preparation, consumption or use, using a combination of water agitation and high temperatures; (e) "dairy equipment," "beverage equipment" and "food processing equipment" mean that equipment used in the production of milk and dairy products, foods and beverages, including the processing, preparation or packaging thereof for consumption; (f) "industrial cleaning equipment" means machinery and other tools used in cleaning processes during the course of industrial manufacturing, production and assembly. [1971, P.A. 248, S.1]

SEC. 25-54oo. Labeling of detergents. (a) No person, firm or corporation shall sell, offer or expose for sale, give or furnish any synthetic detergent or detergent, whether in the form of crystals, powders, flakes, bars, liquids, sprays or any other form, in the state of Connecticut (1) on and after February 1, 1972, unless the container, wrapper or other packaging thereof shall be clearly labeled with respect to its polyphosphate builder or phosphorus ingredient content, clearly and legibly set forth thereon in terms of percentage of phosphorus by weight, expressed as elemental phosphorus per container, wrapper or other packaging thereof, as well as grams of phosphorus, expressed as elemental phosphorus, per recommended use level and (2) on and after October, 1974, unless such person, firm or corporation files with the commissioner of environmental protection a written statement setting forth the chemical and common names of all ingredients. [1971, P.A. 248, S.2; 1973, P.A. 73-555, S.7]

(b) The commissioner of the department of environmental protection may require that the recommended

household, commercial, personal or industrial use or uses of each product and that the percent by weight and function of any ingredient in any product be provided in written statement within thirty days of a request for such information. Any information acquired by the commissioner under this subsection shall, upon written request, be kept confidential with respect to the product name.

(c) The commissioner of environmental protection may, by order, ban or restrict the sale or use of any synthetic detergent or detergent in the state or the use of any synthetic detergent or detergent in any geographical area of the state to protect the waters of the state.

(d) Any person who violates any provision of this section may be fined not less than one hundred dollars nor more than three hundred dollars for the first offense, and not less than three hundred dollars nor more than five hundred dollars for the second and each subsequent offense. A separate and distinct offense shall be construed to be committed each day on which such person shall continue or permit any such violation.

SEC. 25-54pp. Sale of certain detergents prohibited.

(a) No person, firm or corporation shall sell, offer or expose for sale, give or furnish any synthetic detergent or detergent containing more than eight and seven-tenths percent of phosphorus by weight, expressed as elemental phosphorus, within the state of Connecticut from and after February 1, 1972. No person, firm or corporation shall sell, offer or expose for sale, give or furnish any synthetic detergent or detergent which requires a recommended use level of such synthetic detergent or detergent which contains more than seven grams of phosphorus by weight expressed as elemental phosphorus, within the state of Connecticut from and after February 1, 1972. Notwithstanding the foregoing provisions of this subsection, synthetic detergents or detergents manufactured for use or to be used for medical, scientific or special engineering purposes or for use in machine dishwashers, dairy equipment, beverage equipment, food processing equipment and industrial cleaning equipment shall not be subject to the limitations set forth in this section.

(b) The concentration of phosphorus, by weight, expressed as elemental phosphorus in any synthetic detergent or detergent shall be determined by the current applicable method prescribed by the American Society for Testing and Materials. [1971, P.A. 248, S.3; 1973, P.A. 73-665]

(c) The provisions of subsection (b) and (c) of section 25-54q of the General Statutes, as amended by section 7 of number 73-38 of the Public Acts of 1973, shall not apply to violations of subsection (a) of this section.

SEC. 25-54qq. *Repealed by Public Act No. 311 of 1974.*

SEC. 26. Any town may, by ordinance, establish a special taxing district for the purpose of defraying, by taxes levied solely upon properties within such district, a portion of the costs of acquisition or construction of a sewerage system in accordance with the provisions of chapter 103 of the general statutes. Such special taxes shall

be based upon annual budget appropriations and estimates of receipts from special benefit assessments and use of charges levied with respect to such system approved by such town for the special taxing district in the manner required for the adopting of the annual budgets of such town and shall be included but shown separately in annual tax levies of such town. Such town may, from time to time, by ordinance, alter the boundaries of such special taxing district. To meet any costs of acquisition or construction, including planning, of any such sewerage system the town may issue its general or special obligation bonds in accordance with the laws applicable thereto, the principal and interest on which shall be paid from the budgets of such special taxing district. For the purposes of this section "town" means town, consolidated town and city and consolidated town and borough.

SEC. 27. Subsection (51) of section 12-31 of the 1965 supplement to the general statutes is repealed and the following is substituted in lieu thereof: [Any structure, building, machinery or other equipment after July 1, 1965, constructed, installed and used primarily for the purpose of eliminating industrial waste, or pollution of waters as defined in section 25-19. A certification by the water resources commission that such structure, building, machinery or other equipment is approved for the elimination of industrial wastes or for water pollution control shall require the assessors of the town where such property is located to exempt such property from taxation. This exemption shall not apply to any water company as defined by section 16-1.] Structures and equipment acquired after July 1, 1965, for the treatment of industrial waste before the discharge thereof into any waters of the state or into any sewerage system emptying into such waters, the primary purpose of which is the reduction, control or elimination of pollution of such waters, certified as approved for such purpose of the water resources commission. For the purpose of this subsection "industrial waste" means any harmful thermal effect or any liquid, gaseous or solid substance or combination thereof resulting from any process of industrial, manufacture, trade or business, or from the development or recovery of any natural resource.

SEC. 28. Section 12-412 of the general statutes is amended by adding subdivision (u) as follows: Sales of and the storage, use or other consumption of tangible personal property acquired for incorporation into facilities for the treatment of industrial waste before the discharge thereof into any waters of the state or into any sewerage system emptying into such waters, the primary purpose of which is the reduction, control or elimination of pollution of such waters, certified as approved for such purpose by the water resources commission. For the purposes of this subdivision "industrial waste" means any harmful thermal effect or any liquid, gaseous or solid substance or combination thereof resulting from any process of industry, manufacture, trade or business or from the development or recovery of any natural resource.

SEC. 29. There shall be allowed as a credit against tax imposed by chapter 208 of the general statutes in any income year an amount equal to the product of the tax

rate imposed by section 12-214 of the 1965 supplement to the general statutes for such income year multiplied by the amount of expenditures paid or incurred during such income year for the construction, rebuilding, acquisition or expansion of pollution abatement facilities, including the planning thereof, provided (a) such credit shall be

allowed only with respect to pollution abatement facilities approved as such by the water resources commission, the construction, rebuilding, acquisition or expansion of which was commenced after January 1, 1967; (b) the net income for such income year and succeeding income years shall be computed without any deductions for such

expenditures or for depreciation of such facilities, except to the extent the cost or other basis of such facilities may be attributable to factors other than such expenditures or in case a credit is allowable pursuant to this section for only a part of such expenditures, any deduction allowable under the federal internal revenue code for such expenditures or for depreciation of such facilities shall be proportionately reduced in computing net income for the income year and all succeeding income years; and (c) upon the sale or other disposition of such facilities in any income year the gain or loss on such sale or other disposition shall be the gain or loss which would have resulted if the cost or other basis of such facilities had been reduced by straight line depreciation based on the useful life of such facilities, except that, if such sale or other disposition occurs within three years after the date such facilities were placed in operation, the basis of such facilities for the purpose of determining gain or loss shall be zero.

SEC. 30. In determining gross income subject to tax under chapter 213 of the general statutes a taxpayer at its election may either deduct expenditures made or incurred for the construction, rebuilding, acquisition or expansion of pollution abatement facilities, including the planning thereof, in the income year in which such expenditures were paid or incurred, or amortize such expenditures over a period of not more than five taxable years commencing with the year in which such expenditures were paid or incurred, by deducting an equal portion thereof in each income year during such period, provided no such deduction shall be allowed with respect to expenditures made or incurred for pollution abatement facilities not approved as such by the water resources commission, or the construction, rebuilding, acquisition or expansion of which was commenced prior to January 1, 1967.

SEC. 31. There shall be allowed as a credit against the tax imposed by chapter 211 of the general statutes in any tax year an amount equal to the product of the tax rate imposed by section 12-258 of the 1965 supplement to the general statutes for such tax year multiplied by the amount of expenditures paid or incurred during such tax year for the construction, rebuilding, acquisition or expansion of pollution abatement facilities, including the planning thereof, provided such credit shall be allowed only with respect to pollution abatement facilities approved as such by the water resources commission, the construction, rebuilding, acquisition or expansion of which was commenced after January 1, 1967.

SEC. 32. There shall be allowed as a credit against the tax imposed by chapter 212 of the general statutes in any tax year an amount equal to the product of the tax rate imposed by section 12-264 of the general statutes for such tax year multiplied by the amount of expenditures paid or incurred during such tax year for the construction, rebuilding, acquisition or expansion of pollution abatement facilities, including the planning thereof provided such credit shall be allowed only with respect to pollution abatement facilities approved as such by the water resources commission, the construction, rebuilding, acquisition or expansion of which was commenced after January 1, 1967.

SEC. 33. Section 25-3a of the 1965 supplement to the

general statutes is repealed and the following is substituted in lieu thereof: In all cases wherein the water resources commission is required to hold hearings, public or otherwise, on any matter within its jurisdiction, said commission may hold such hearing sitting as a body or may designate a subcommittee consisting of not fewer than three members of said commission, or may designate a member of the commission or a member of its staff to act as a hearing examiner, said subcommittee or hearing examiner to hold such hearing at the time and place designated by said commission. When the commission designates a subcommittee to hold the hearing, one member of said subcommittee shall be designated as chairman. The subcommittee designated to hold such hearing shall be known as the hearing subcommittee. The hearing subcommittee chairman for any hearing before the subcommittee, or any member of the commission for any hearing before the commission, or the hearing examiner, may issue subpoenas, administer oaths and cause the attendance of witnesses and the production of evidence and testimony in any proceeding pending before it. The subcommittee or the hearing examiner shall, after each hearing, file with the commission a report including a finding of fact and recommendations. After considering the report of the subcommittee or the hearing examiner and the testimony of the hearing, the commission shall issue such order or permit as is applicable to the particular proceeding.

SEC. 34. All orders, directives or decisions of the water resources commission which are in existence on the effective date of this act shall continue in force until rescinded, amended or repealed by the commission.

SEC. 35. The commission shall make a grant to any municipality which, prior to the effective date for this act, constructed, rebuilt, acquired, or expanded a pollution abatement facility, which grant shall be thirty percent of the principal amount of bond or note obligations of such municipality, issued to finance such construction, rebuilding, acquisition or expansion and outstanding on said date, exclusive of all interest costs and for which grant application is made on an application prescribed by the commission. Such grant shall be paid in equal annual installments at least thirty days prior to the date the municipality is obligated to make payment on such bonds or notes, provided any grant under this section shall be reduced by any amount payable to such municipality under the provisions of section 18 of this act for the same construction, rebuilding, acquisition or expansion project, such reduction to be prorated over the period remaining for the payment of such bonds or notes.

SEC. 36. Sections 25-19 to 25-24, inclusive, of the general statutes, as amended, are repealed.

SEC. 37. This act shall take effect from its passage.

[Editor's note: The following are new sections enacted by the 1973 General Assembly in Public Act No. 73-665. As of November 1973 they had not been assigned section numbers or titles in the general statutes.]

Section 1. (NEW) (a) Any person who knowingly or negligently violates any provision of section 14-100b or 14-100c of the 1971 noncumulative supplement to the general statutes, subdivision (3) of subsection (b) of section 15-121 of the 1971 noncumulative supplement to

the general statutes, as amended by number 91 of the public acts of 1972, chapter 348 of the general statutes, as amended, sections 19-507, 19-508, 19-513a, 19-514, or 19-519, of the 1971 noncumulative supplement to the general statutes, section 19-517 of the 1971 noncumulative supplement to the general statutes, as amended by section 4 of number 103 of the public acts of 1972, section 19-519a of the 1969 supplement to the general statutes, section 1 of number 103 of the public acts of 1972, sections 19-524b, 19-524c, 19-524g, 19-524n, 22a-5, 22a-6 or 22a-7 of the 1971 noncumulative supplement to the general statutes, section 5 of number 155 of the public acts of 1972, sections 25-2, 25-4a, 25-4d, 25-4e, 25-4f, 25-7a, 25-7b, 25-7d, 25-7e, 25-8a, 25-8c, 25-10, 25-11, 25-12, 25-15, 25-26, 25-26a, 25-27, 25-54c to 25-54i, inclusive, or 25-54aa, of the 1971 noncumulative supplement to the general statutes, 25-54cc of the 1971 noncumulative supplement to the general statutes, as amended by section 1 of number 252 of the public acts of 1972, 25-54dd of the 1971 noncumulative supplement to the general statutes, 25-54ee of the 1971 noncumulative supplement to the general statutes, as amended by number 217 of the public acts of 1972, 25-54hh of said supplement, as amended by section 1 of number 237 of the public acts of 1972, 25-54ii, 25-54ll, 25-54oo, 25-54pp, or sections 25-110 to 25-114, inclusive of the 1971 noncumulative supplement to the general statutes or any regulation, order or permit adopted or issued thereunder by the commissioner of environmental protection shall be liable to the state for the reasonable costs and expenses of the state in detecting, investigating, controlling and abating such violation. Such person shall also be liable to the state for the reasonable costs and expenses of the state in restoring the air, waters, lands and other natural resources of the state, including plant, wild animal and aquatic life to their former condition insofar as practicable and reasonable, or, if restoration is not practicable or reasonable, for any damage, temporary or permanent, caused by such violation to the air, waters, lands or other natural resources of the state, including plant, wild animal and aquatic life and to the public trust therein. Institution of a suit to recover for such damage, costs and expenses shall preclude the imposition of a civil penalty for such violation as provided in section 3b of this act or in the schedule or schedules adopted pursuant thereto, but shall not preclude the application of any other remedies.

(b) Whenever two or more persons knowingly or negligently violate any provision of section 14-100b or 14-100c of the 1971 noncumulative supplement to the general statutes, subdivision (3) of subsection (b) of section 15-121 of the 1971 noncumulative supplement to the general statutes, as amended by number 91 of the public acts of 1972, chapter 348 of the general statutes, as amended, sections 19-507, 19-508, 19-513a, 19-514 or 19-519, of the 1971 noncumulative supplement to the general statutes, section 19-517 of the 1971 noncumulative supplement to the general statutes, as amended by section 4 of number 103 of the public acts of 1972, section 19-519a of the 1969 supplement to the general statutes, section 1 of number 103 of the public acts of 1972, sections 19-524b, 19-524c, 19-524g, 19-524n, 22a-5, 22a-6 or 22a-7 of the

1971 noncumulative supplement to the general statutes, section 5 of number 155 of the public acts of 1972, sections 25-2, 25-4a, 25-4d, 25-4e, 25-4f, 25-7a, 25-7b, 25-7d, 25-7e, 25-73, 25-8a, 25-8c, 25-10, 25-11, 25-12, 25-15, 25-26, 25-26a, 25-27, 25-54c to 25-54i, inclusive, or 25-54aa, of the 1971 noncumulative supplement to the general statutes, 25-54cc of the 1971 noncumulative supplement to the general statutes, as amended by section 1 of number 252 of the public acts of 1972, 25-54dd of the 1971 noncumulative supplement to the general statutes, 25-54ee of the 1971 noncumulative supplement to the general statutes, as amended by number 217 of the public acts of 1972, 25-54hh of said supplement, as amended by section 1 of number 237 of the public acts of 1972, 25-54ii, 25-54ll, 25-54oo, 25-54pp, or sections 25-110 to 25-114, inclusive of the 1971 noncumulative supplement to the general statutes or any regulation, order or permit adopted or issued thereunder by the commissioner and responsibility for the damage caused thereby is not reasonably apportionable, such persons shall, subject to a right of equal contribution, be jointly and severally liable under this section.

(c) Any person whose acts outside Connecticut contribute to environmental damage in Connecticut shall be subject to suit under this section if such person is subject to in personem jurisdiction within this state pursuant to section 52-59b of the 1971 noncumulative supplement to the general statutes, or if such person, in person or through an agent, expects or should reasonably expect his acts outside this state to have an effect upon the environment in this state and process upon any such person shall be served in the manner set forth in section 52-59b of the 1971 noncumulative supplement to the general statutes.

Sec. 2. (NEW) (a) The commissioner of environmental protection is authorized to adopt a schedule or schedules establishing the amounts, or the ranges of amounts, of the civil penalties which may become due under this section. Such schedule or schedules shall be adopted by the commissioner after public hearings pursuant to section 22a-6 of the 1971 noncumulative supplement to the general statutes and may be amended from time to time in the same manner as for adoption. The civil penalties established for each violation shall be of such amount as to insure immediate and continued compliance with applicable laws, regulations, orders and permits. Such civil penalties shall not exceed the following amounts:

(1) For failure to file any registration, plan, report or record, or any application for a permit, for failure to display any registration, permit or order, or file any other information required pursuant to any provision of section 14-100b or 14-100c of the 1971 noncumulative supplement to the general statutes, subdivision (3) of subsection (b) of section 15-121 of the 1971 noncumulative supplement to the general statutes, as amended by number 91 of the public acts of 1972, chapter 348 of the general statutes, as amended, sections 19-507, 19-508, 19-513a, 19-514, or 19-519, of the 1971 noncumulative supplement to the general statutes, section 19-517 of the 1971 noncumulative supplement to the general statutes, as amended by section 4 of number 103 of the public acts of 1972, section 19-519a of the 1969 supplement to the general statutes, section 1 of number 103 of the public



acts of 1972, sections 19-524b, 19-524c, 19-524g, 19-524n, 22a-5, 22a-6 or 22a-7 of the 1971 noncumulative supplement to the general statutes, section 5 of number 155 of the public acts of 1972, sections 25-2, 25-4a, 25-4d, 25-4e, 25-4f, 25-7a, 25-7b, 25-7d, 25-7e, 25-8a, 25-8c, 25-10, 25-11, 25-12, 25-15, 25-26, 25-26a, 25-27, 25-54c to 25-54l, inclusive, or 25-54aa, of the 1971 noncumulative supplement to the general statutes, 25-54cc of the 1971 noncumulative supplement to the general statutes, as amended by section 1 of number 252 of the public acts of 1972, 25-54dd of the 1971 noncumulative supplement to the general statutes, 25-54ec of the 1971 noncumulative supplement to the general statutes, as amended by number 217 of the public acts of 1972, 25-54hh of said supplement, as amended by section 1 of number 237 of the public acts of 1972, 25-54ii, 25-54ll, 25-54oo, 25-54pp, or sections 25-110 to 25-114, inclusive of the 1971 noncumulative supplement to the general statutes or any regulation, order or permit adopted or issued thereunder by the commissioner, and for other violations of similar character as set forth in such schedule or schedules, no more than one thousand dollars for said violation and in addition no more than one hundred dollars for each day during which such violation continues after receipt of a final order of the commissioner under subsection (c) of this section assessing the civil penalty for such violation;

(2) For deposit, placement, removal, disposal, discharge or emission of any material or substance in violation of any provision of section 14-100b or 14-100c of the 1971 noncumulative supplement to the general statutes, subdivision (3) of subsection (b) of section 15-121 of the 1971 noncumulative supplement to the general statutes, as amended by number 91 of the public acts of 1972, chapter 348 of the general statutes, as amended, sections 19-507, 19-508, 19-513a, 19-514, or 19-519, of the 1971 noncumulative supplement to the general statutes, section 19-517 of the 1971 noncumulative supplement to the general statutes, as amended by section 4 of number 103 of the public acts of 1972, section 19-519a of the 1969 supplement to the general statutes, section 1 of number 103 of the public acts of 1972, sections 19-524b, 19-524c, 19-524g, 19-524n, 22a-5, 22a-6 or 22a-7 of the 1971 noncumulative supplement to the general statutes, section 5 of number 155 of the public acts of 1972, sections 25-2, 25-4a, 25-4d, 25-4e, 25-4f, 25-7a, 25-7b, 25-7d, 25-7e, 25-8a, 25-8c, 25-10, 25-11, 25-12, 25-15, 25-26, 25-26a, 25-27, 25-54c to 25-54l, inclusive, or 25-54aa, of the 1971 noncumulative supplement to the general statutes, 25-54cc of the 1971 noncumulative supplement to the general statutes, as amended by section 1 of number 252 of the public acts of 1972, 25-54dd of the 1971 noncumulative supplement to the general statutes, 25-54ee of the 1971 noncumulative supplement to the general statutes, as amended by number 217 of the public acts of 1972, 25-54hh of said supplement, as amended by section 1 of number 237 of the public acts of 1972, 25-54ii, 25-54ll, 25-54oo, 25-54pp, or sections 25-110 to 25-114, inclusive of the 1971 noncumulative supplement to the general statutes or any regulation adopted thereunder by the commissioner, and for other violations of similar character as set forth in such sched-

ule or schedules, no more than twenty-five thousand dollars for said violation and in addition no more than one thousand dollars for each day during which such violation continues after receipt of a final order of the commissioner under subsection (c) assessing the civil penalty for such violation;

(3) For violation of the terms of any final order, except final orders under subsection (e) of this section and emergency orders and cease and desist orders as set forth in subdivision (4) of this subsection, of the commissioner, for violation of the terms of any permit issued by the commissioner, and for other violations of similar character as set forth in such schedule or schedules, no more than twenty-five thousand dollars for said violation and in addition no more than one thousand dollars for each day during which such violation continues after receipt of a final order of the commissioner under subsection (c) of this section assessing the civil penalty for such violation;

(4) For violation of any emergency order or cease and desist order of the commissioner, and for other violations of similar character as set forth in such schedule or schedules, no more than twenty-five thousand dollars for said violation and in addition no more than five thousand dollars for each day during which such violation continues after receipt of a final order of the commissioner under subsection (c) assessing the civil penalty for such violation.

(b) In adopting the schedule or schedules prescribed by this section, the commissioner shall consider the amounts, or ranges of amounts, of assessment necessary to insure immediate and continued compliance, and the character and degree of injury or impairment to, or interference with, (1) public health, safety or welfare, (2) the public trust in the air, water, land and other natural resources of the state, and (3) reasonable use of property which is caused or is likely to be caused by the type of activity described in such schedule or schedules.

(c) In addition, in setting a civil penalty in a particular case, the commissioner shall consider all factors which he deems relevant, including, but not limited to, the following:

(1) The amount of assessment necessary to insure immediate and continued compliance;

(2) The character and degree of impact of the violation on the natural resources of the state, especially any rare or unique natural phenomena;

(3) The conduct of the person incurring the civil penalty in taking all feasible steps or procedures necessary or appropriate to comply or to correct the violation;

(4) Any prior violations by such person of statutes, regulations, orders or permits administered, adopted or issued by the commissioner;

(5) The economic and financial conditions of such person;

(6) The character and degree of injury to, or interference with, public health, safety or welfare which is caused or threatened to be caused by such violation;

(7) The character and degree of injury to, or interference with reasonable use of property which is caused or threatened to be caused by such violation.

(d) If the commissioner has reason to believe that a

violation has occurred for which a civil penalty is authorized by this section, he may send to the violator, by certified mail, return receipt requested, or personal service, a notice which shall include:

(1) A reference to the sections of the statute, regulation, order or permit involved;

(2) A short and plain statement of the matters asserted or charged;

(3) A statement of the amount of the civil penalty or penalties to be imposed upon finding after hearing that a violation has occurred or upon a default; and

(4) A statement of the party's right to a hearing.

(e) The person to whom the notice is addressed shall have twenty days from the date of receipt of the notice in which to deliver to the commissioner written application for a hearing. If a hearing is requested then, after a hearing and upon a finding that a violation has occurred, the commissioner may issue a final order assessing a civil penalty under this section which is not greater than the penalty stated in the notice. If such a hearing is not so requested, or if such a request is later withdrawn, then the notice shall, on the first day after the expiration of such twenty day period or on the first day after the withdrawal of such request for hearing, whichever is later, become a final order of the commissioner and the matters asserted or charged in the notice shall be deemed admitted unless modified by consent order, which shall be a final order. Any civil penalty may be mitigated by the commissioner upon such terms and conditions as he in his discretion deems proper or necessary upon consideration of the factors set forth in subsection (b) hereof.

(f) All hearings under this section shall be conducted pursuant to sections 4-177, to 4-184, inclusive, of the 1971 noncumulative supplement to the general statutes. The final order of the commissioner assessing a civil penalty shall be subject to appeal as set forth in section 4-183 of the 1971 noncumulative supplement to the general statutes except that any such appeal shall be taken to the superior court for Hartford county and shall have precedence in the order of trial as provided in section 52-191 of the 1969 supplement to the general statutes. Such final order shall not be subject to appeal under any other provision of the general statutes. No challenge to any final order of the commissioner assessing a civil penalty shall be allowed as to any issue which could have been raised by an appeal of an earlier order, notice, permit, denial or other final decision by the commissioner. Any civil penalty authorized by this section shall become due and payable (i) at the time of receipt of a final order in the case of a civil penalty assessed in such order after a hearing, (ii) on the first day after the expiration of the period in which a hearing may be requested if no hearing is requested, or (iii) on the first day after any withdrawal of a request for hearing.

(g) Any person acting within the terms and conditions of a final order or permit issued to him by the commissioner shall not be subject to a civil penalty, under this section, for such actions.

(h) A civil penalty assessed in a final order of the commissioner under this section may be enforced in the same manner as a judgment of the superior court. Such final order shall be served in person or by certified mail,

return receipt requested. Any notice of violation or final order against a private corporation shall be served upon at least one of the individuals enumerated in section 52-57 of the general statutes. After entry, a transcript of such final order may be filed by the commissioner, without requiring the payment of costs as a condition precedent to such filing, in the office of the clerk of the superior court in any one or more of the following counties: Any county in which the respondent resides, any county in which the respondent has a place of business, any county in which the respondent owns real property and any county in which any real property which is a subject of the proceedings is located; or, if the respondent is not a resident of the state of Connecticut, in Hartford county. Upon such filing, such clerk or clerks shall docket such order in the same manner and with the same effect as a judgment entered in the superior court within the county. Upon such docketing, such order may be enforced as a judgment of such court.

(i) The provisions of this act are in addition to and in no way derogate from any other enforcement provisions contained in any statute administered by the commissioner. The powers, duties and remedies provided in such other statutes, and the existence of or exercise of any powers, duties or remedies hereunder or thereunder shall not prevent the commissioner from exercising any other powers, duties or remedies provided herein, therein, at law or in equity.

#### PUBLIC ACT NO. 91

#### AN ACT AUTHORIZING THE COMMISSIONER OF ENVIRONMENTAL PROTECTION TO ESTABLISH RESTRICTED ZONES FOR THE TRANSPORTATION OF HAZARDOUS MATERIALS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Subsection (b) of section 15-121 of the 1971 supplement to the general statutes is repealed and the following is substituted in lieu thereof: In the performance of his duties under part II the commissioner shall: (1) Classify all waters and all vessels for the purpose of establishing uniformity in the regulation of such waters and such vessels; (2) prescribe uniform navigation aids for state waters and regulate the use of such aids; (3) establish restricted zones or sea lanes within navigable waters and adopt regulations pertaining thereto for the purpose of protecting the natural ecology of such waters and the abutting shoreline from environmental damage resulting from marine accidents which cause the release of petroleum products or other hazardous substances and materials into the waters of the state, provided before establishing such lanes, zones and regulations the commissioner shall consider at least the following factors: (i) the danger in transporting the type of material; (ii) the evidence of deleterious incidents arising from the transportation of such hazardous materials; (iii) available alternatives; (iv) the public need; and (v) the effect on interstate commerce; and further provided any such regulations promulgated by the commissioner shall list and define the substances and materials which are classified as

hazardous; (4) prescribe uniform standards for safety devices and equipment required by part II and certify the types of devices and equipment which meet such standards; (5) designate and assist the several towns in designating prohibited and restricted boating areas and waters limited to special boating purposes and prescribe uniform standards for the marking and regulation of such areas; (6) adopt such regulations respecting water skiing and underwater swimming and diving as it finds necessary for public safety; (7) study, plan and recommend the development of boating facilities, safety education and means of improving boating safety; (8) in cooperation with the department of health, investigate matters relating to and recommend means of improving boating sanitation; (9) cooperate with the department of transportation and the

bureau of aeronautics concerning regulations governing the operation of seaplanes on state waters; (10) cooperate with the United States and the several states in promoting uniformity of boating laws and regulations and their administration and enforcement, and (11) subject to the provisions of section 4-168 to 4-173, inclusive, and sections 4-117 and the limitations of part II, adopt such regulations to provide for public safety and environmental quality as he finds necessary to administer and enforce the provisions of said part and to promote the safe use and protection of waters and the safe operation of vessels; provided the commissioner shall make no regulations respecting the operation of vessels on Long Island sound except as are necessary to secure inshore waters and establish and secure restricted areas.

## CONNECTICUT INLAND WETLANDS AND WATER COURSES ACT

(Public Act No. 155, Laws of 1972; Effective May 19, 1972 Amended by 1973 Legislature, Substitute House Bill 9078, Effective June 19, 1973)

Administering Agency: Department of Environmental Protection  
79 Elm St.  
Hartford, Conn. 06115

## AN ACT CONCERNING INLAND WETLANDS AND WATER COURSES.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. The inland wetlands and water are an indispensable and irreplaceable but fragile natural resource with which the citizens of the state have been endowed. The wetlands and water courses are an interrelated web of nature essential to an adequate supply of surface and underground water; to hydrological stability and control of flooding and erosion; to the recharging and purification of ground water; and to the existence of many forms of animal, aquatic and plant life. Many inland wetlands and water courses have been destroyed or are in danger of destruction because of unregulated use by reason of the deposition, filling or removal of material, the diversion or obstruction of water flow, the erection of structures and other uses, all of which have despoiled, polluted and eliminated wetlands and water courses. Such unregulated activity has had, and will continue to have, a significant, adverse impact on the environment and ecology of the state of Connecticut and has and will continue to imperil the quality of the environment thus adversely effecting the ecological, scenic, historic and recreational values and benefits of the state for its citizens now and forever more. The preservation and protection of the wetlands and water courses from random, unnecessary, undesirable and unregulated uses, disturbance or destruction is in the public interest and is essential to the health, welfare and safety of the citizens of the state. It is, therefore, the purpose of this act to protect the citizens of the state by making provisions for the protection, preservation, maintenance and use of the inland wetlands and water courses by minimizing their disturbance and pollution; maintaining and improving water quality in accordance with the highest standards set by federal, state or local authority; preventing damage from erosion, turbidity or siltation; preventing loss of fish and other beneficial aquatic organisms, wildlife and vegetation and the destruction of the natural habitats thereof; deterring and inhibiting the danger of flood and pollution; protecting the quality of wetlands and water courses for their conservation, economic, aesthetic, recreational and other public and private uses and values; and protecting the state's potable fresh

water supplies from the dangers of drought, overdraft, pollution, misuse and mismanagement by providing an orderly process to balance the need for the economic growth of the state and the use of its land with the need to protect its environment and ecology in order to forever guarantee to the people of the state, the safety of such natural resources for their benefit and enjoyment and for the benefit and enjoyment of generations yet unborn.

Sec. 2. This act shall be known and may be cited as "The Inland Wetlands and Water Courses Act."

Sec. 3. (a) The following operations and uses shall be permitted in wetlands and water courses, as of right:

(1) Grazing, farming, nurseries, gardening and harvesting of crops and farm ponds of three acres or less;

(2) A residential home (i) for which a building permit has been issued or (ii) on a subdivision lot, provided the permit has been issued or the subdivision has been approved as of the effective date of promulgation of the municipal regulations pursuant to subsection (b) of section 4 of this act;

(3) Boat anchorage or mooring;

(4) Uses incidental for the enjoyment and maintenance of residential property, such property defined as the largest minimum residential lot site permitted anywhere in the municipality, provided in any town, where there are no zoning regulations establishing minimum residential lot sites, the largest minimum lot site shall be two acres; and

(5) Construction and operation, by water companies as defined in section 16-1 or by municipal water supply systems as provided for in chapter 102, of dams, reservoirs and other facilities necessary to the impounding, storage and withdrawal of water in connection with public water supplies except as provided in sections 7 and 8 of this act.

(b) The following operations and uses shall be permitted, as a nonregulated use in wetlands and water courses, provided they do not disturb the natural and indigenous character of the land:

(1) Conservation of soil, vegetation, water, fish, shellfish and wildlife;

(2) Outdoor recreation including play and sporting areas, golf courses, field trials, nature study, hiking, horseback riding, swimming, skin diving, camping, boating, water skiing, trapping, hunting, fishing and shell-

fishing where otherwise legally permitted and regulated;

(c) Construction and operation of dams, reservoirs and other facilities necessary to the impounding, storage and withdrawal of water in connection with public water supplies or private dams and water control devices, including temporary authorization or diversion of water levels, or circulation for emergency maintenance, or aquaculture purposes;

(d) Grazing, farming, nurseries, gardening and harvesting of crops and farm ponds, three acres or less;

(e) Boat anchorage or mooring;

(f) Uses incidental for the enjoyment and maintenance of residential property, such property defined as the largest minimum lot site permitted by each municipality; and

(g) A residential home on a subdivision lot which subdivision has been approved as of the date of the promulgation of the municipal regulations.

#### Sec. 4. As used in this act:

(1) "Commissioner" means the commissioner of environmental protection;

(2) "Person" means any person, firm, partnership, association, corporation, company, organization or legal entity of any kind, including municipal corporations, governmental agencies or subdivisions thereof;

(3) "Municipality" means any metropolitan district, town, consolidated town and city, consolidated town and borough, city, borough, village, fire and sewer district, sewer district and each municipal organization having authority to levy and collect taxes or make charges for its authorized functions;

(4) "Inland wetlands agency" means a municipal board or commission established pursuant to and acting under section 3 of this act;

(5) "Soil scientist" means an individual duly qualified in accordance with standards set by the United States civil service commission;

(6) "Material" means any substance, solid or liquid, organic or inorganic, including, but not limited to soil, sediment, aggregate, land, gravel, clay, bog, mud, debris, sand, refuse or waste;

(7) "Waste" means sewage or any substance, liquid, gaseous, solid or radioactive, which may pollute or tend to pollute any of the waters of the state;

(8) "Pollution" means harmful thermal effect or the contamination or rendering unclean or impure of any waters of the state by reason of any waste or other materials discharged or deposited therein by any public or private sewer or otherwise so as directly or indirectly to come in contact with any waters;

(9) "Rendering unclean or impure" means any alteration of the physical, chemical or biological properties of any of the waters of the state including, but not limited to change in odor, color, turbidity or taste;

(10) "Discharge" means the emission of any water, substance or material into waters of the state whether or not such substance causes pollution;

(11) "Remove" includes, but shall not be limited to drain, excavate, mine, dig, dredge, suck, bulldoze, dragline or blast;

(12) "Deposit" includes, but shall not be limited to fill, grade, dump, place, discharge or emit;

(13) "Regulated activity" means any operation within or use of a wetland or water course involving removal or deposition of material, or any obstruction, construction, alteration or pollution, of such wetlands or water courses, but shall not include the specified activities in section 3 of this act.

(14) "License" means the whole or any part of any permit, certificate approval or similar form of permission which may be required of any person by the provisions of this act;

(15) "Wetlands" means land, including submerged land, not regulated pursuant to sections 22-7h to 22-7o, inclusive, of the 1969 supplement to the general statutes, as amended, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial and flood plain by the National Cooperative Soils Survey, as may be amended from time to time, of the Soil Conservation Service of the United States Department of Agriculture;

(16) "Water courses" means rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, public or private, which are contained within flow through or border upon this state or any portion thereof, not regulated pursuant to sections 22-7h to 22-7o, inclusive, of the 1969 supplement to the general statutes, as amended.

#### Sec. 5. The commissioner shall:

(a) Exercise general supervision of the administration and enforcement of this act;

(b) Develop comprehensive programs in furtherance of the purposes of this act;

(c) Advise, consult and cooperate with other agencies of the state, the federal government, other states and with persons and municipalities in furtherance of the purposes of this act;

(d) Encourage, participate in or conduct studies, investigations, research and demonstrations, and collect and disseminate information, relating to the purposes of this act;

(e) Retain and employ consultants and assistants on a contract or other basis for rendering legal, financial, technical or other assistance and advice in furtherance of any of its purposes, specifically including, but not limited to soil scientists on a cost-sharing basis with the United States soil conservation service for the purpose of (1) completing the state soils survey and (2) making on-site interpretations, evaluations and findings as to soil types;

(f) Promulgate such regulations as are necessary to protect the wetlands or water courses or any of them individually or collectively;

(g) Inventory or index the wetlands and water courses in such form, including pictorial representations, as the commissioner deems best suited to effectuate the purposes of this act; and

(h) Exercise all incidental powers necessary to enforce rules and regulations and to carry out the purposes of this act.

Sec. 6. In carrying out the purposes and policies of this act, including matters relating to regulating, licensing and enforcing of the provisions thereof, the commissioner

shall take into consideration all relevant facts and circumstances, including but not limited to:

- (a) The environmental impact of the proposed action;
- (b) The alternatives to the proposed action;
- (c) The relationship between short-term uses of the environmental and the maintenance and enhancement of long-term productivity;
- (d) Irreversible and irremediable commitments of resources which would be involved in the proposed activity;
- (e) The character and degree of injury to, or interference with, safety, health or the reasonable use of property which is caused or threatened; and
- (f) The suitability or unsuitability of such activity to the area for which it is proposed.

Sec. 7. (a) To carry out and effectuate the purposes and policies of number 155 of the public acts of 1972, it is hereby declared to be the public policy of the state to encourage municipal participation by means of regulation of activities affecting the wetlands and water courses within the territorial limits of the various municipalities or districts.

(b) Any municipality may acquire wetlands and water courses within its territorial limits by gift or purchase, in fee or lesser interest including, but not limited to, lease, easement or covenant, subject to such reservations and exceptions as it deems advisable.

(c) Any municipality, acting through its legislative body, may authorize any board or commission, as may be by law authorized to act, or may establish a new board or commission to promulgate such regulations, in conformity with the regulations promulgated by the commissioner pursuant to section 5 of number 155 of the public acts of 1972, as are necessary to protect the wetlands and water courses within its territorial limits. The ordinance establishing the new board or commission shall determine the number of members, the length of their terms, the method of selection and removal and THE MANNER FOR filling vacancies in the new board or commission. For the purposes of this section, the board or commission authorized by the municipality or district, as the case may be, shall serve as the sole agent for the licensing of regulated activities.

(d) Any municipality, pursuant to ordinance, may act through the board or commission authorized in subsection (c) of this section to join with any other municipalities in the formation of a district for the regulation of activities affecting the wetlands and water courses within such district.

(e) Municipal or district ordinances or regulations may embody any regulations promulgated hereunder, in whole or in part, or may consist of other ordinances or regulations in conformity with regulations promulgated hereunder. Any ordinances or regulations shall be for the purpose of effectuating the purposes of number 155 of the public acts of 1972 and this act and, a municipality or district, in acting upon ordinances and regulations shall give due consideration to the standards set forth in section 6 of number 155 of the public acts of 1972.

(f) (1) In the event that a municipality, by January 1, 1974, does not exercise its regulatory authority pursuant to this section, the commissioner may take such action,

including but not limited to the licensing of regulated activities, as is necessary to protect the wetlands and water courses within the territorial limits of such municipality.

(2) In the event that a municipality, by June 30, 1974, does not exercise its regulatory authority pursuant to this section, the commissioner shall take such action, including but not limited to the licensing of regulated activities, as is necessary to protect the wetlands and water courses within the territorial limits of such municipality.

(a) The inland wetlands agencies authorized in section 3 of this act, shall through regulation provide for the manner in which the boundaries of inland wetland areas in their respective municipalities shall be established and amended or changed.

(b) No regulations of an inland wetlands agency including boundaries of inland wetland areas shall become effective or be established until after a public hearing in relation thereto is held by the inland wetlands agency, at which parties in interest and citizens shall have an opportunity to be heard. Notice of the time and place of such hearing shall be published in the form of a legal advertisement, appearing in a newspaper having a substantial circulation in the municipality at least twice at intervals of not less than two days, the first not more than twenty-five days nor less than fifteen days, and the last not less than two days, before such hearing, and a copy of such proposed regulation or boundary shall be filed in the office of the town, city or borough clerk as the case may be, in such municipality, for public inspection at least ten days before such hearing, and may be published in full in such paper. Such regulations and inland wetland boundaries may be from time to time, amended, changed or repealed, by majority vote of the inland wetlands agency. Regulations or boundaries or changes therein shall become effective at such time as is fixed by the inland wetlands agency, provided a copy of such regulation, boundary or change shall be filed in the office of the town, city or borough clerk, as the case may be. Whenever an inland wetland agency makes a change in regulations or boundaries it shall state upon its records the reason why the change was made. All petitions submitted in writing and in a form prescribed by the inland wetland agency, requesting a change in the regulations or the boundaries of inland wetland area shall be considered at a public hearing in the manner provided for establishment of inland wetlands regulations and boundaries within ninety days after receipt of such petition. The inland wetland agency shall act upon the changes requested in such petition within sixty days after the hearing. The petitioner may consent to extension of the periods provided for in hearing and for adoption or denial or may withdraw such petition. The inland wetlands agency may require a filing fee to be deposited with the agency to defray the cost of publication of the notice required for a hearing.

(c) On and after the effective date of the municipal regulations promulgated pursuant to subsection (b) of this section, no regulated activity shall be conducted upon any inland wetland without a permit. Any person proposing to conduct or cause to be conducted a regulated activity upon an inland wetland shall file an application with the

inland wetlands agency of the town or towns wherein the wetland in question is located. The application shall be in such form and contain such information as the inland wetlands agency may prescribe. No sooner than thirty and not later than sixty days after the receipt of such application, the inland wetlands agency may hold a public hearing on such application. Notice of the hearing shall be published at least once not more than thirty days and not fewer than ten days before the date set for the hearing in a newspaper having a general circulation in each town where the affected wetland or any part thereof, is located. All applications and maps and documents relating thereto shall be open for public inspection. At such hearing any person or persons may appear and be heard. Action shall be taken on applications within forty-five days after the completion of a public hearing or in the absence of a public hearing within sixty days from the date of receipt of the application.

(d) In granting, denying or limiting any permit for a regulated activity the inland wetlands agency shall consider the factors set forth in section 6 of number 155 of the public acts of 1972. In granting a permit the inland wetlands agency may impose conditions or limitations designed to carry out the policy of the inland wetlands and water courses act. The agency may suspend or revoke a permit if it finds after giving notice to the permittee of the facts or conduct which warrant the intended action and after a hearing at which the permittee is given an opportunity to show compliance with the requirements for retention of the permit, that the applicant has not complied with the conditions or limitations set forth in the permit or has exceeded the scope of the work as set forth in the application. The applicant shall be notified of the agency's decision by certified mail within five days of the date of the decision and the agency shall cause notice of their order in issuance, denial, revocation or suspension of a permit to be published in a daily newspaper having a general circulation in the town wherein the wetland lies.

(g) Nothing contained in this section shall be construed to limit the existing authority of a municipality or any boards or commissions of the municipality.

Sec. 8. Any person aggrieved by any regulation, order, decision or action made pursuant to number 155 of the public acts of 1972 by the commissioner, district or municipality may, within fifteen days after publication of such regulation, order, decision or action appeal to the court of common pleas for the county where the land affected is located, and if located in more than one county, to the court of common pleas in any such county. Such appeal shall be made returnable to said court in the same manner as that prescribed for civil actions brought to said court. Notice of such appeal shall be served upon the inland wetlands agency. The appeal shall state the reasons upon which it is predicated and

shall not stay proceedings on the regulation, order, decision or action, but the court may on application and after notice grant a restraining order. Such appeal shall have precedence in the order of trial.

(a) If upon appeal pursuant to section 5 of this act, the court finds that the action appealed from constitutes the equivalent of a taking without compensation, it shall set aside the action or it may modify the action so that it does not constitute a taking. In both instances the court shall remand the order to the inland wetland agency for action not inconsistent with its decision.

(b) To carry out the purposes of this act, the commissioner, district or municipality may at any time purchase land or an interest in land in fee simple or other acceptable title, or subject to acceptable restrictions or exceptions, and enter into covenants and agreements with landowners.

Sec. 9. Any person who commits, takes part in, or assists in any violation of any provision of this act, including regulations promulgated by the commissioner and ordinances and regulations promulgated by municipalities or districts pursuant to the grant of authority herein contained, shall be fined not more than one thousand dollars for each offense. Each violation of this act shall be a separate and distinct offense, and, in the case of a continuing violation, each day's continuance thereof shall be deemed to be a separate and distinct offense. The superior court, in any action brought by the commissioner, municipality, district or any person, shall have jurisdiction to restrain a continuing violation of this act and to issue orders directing that the violation be corrected or removed. All costs, fees and expenses in connection with such action shall be assessed as damages against the violator. The moneys collected pursuant to this section shall be used by the commissioner of environmental protection to restore the affected wetlands or water courses to its condition prior to the violation, wherever possible.

Sec. 10. Any owner of wetlands and water courses who may be denied a license in connection with a regulated activity affecting such wetlands and water courses, shall upon written application to the assessor, or board of assessors, of the municipality, be entitled to a revaluation of such property to reflect the fair market value thereof in light of the restriction placed upon it by the denial of such license or permit, effective with respect to the next succeeding assessment list of such municipality, provided no such revaluation shall be effective retroactively and the municipality may require as a condition therefor the conveyance of a less than fee interest of it of such land pursuant to the provisions of sections 7-131b to 7-131k, inclusive, of the general statutes, as amended.

Sec. 11. This act shall take effect from its passage.

## CONNECTICUT PUBLIC UTILITY ENVIRONMENTAL STANDARDS ACT

(General Statutes, Chapter 277a; 1971 P.A. 575, Effective July 1, 1971; Amended by Public Acts 72-1, 72-108, 72-228, 73-41, 73-339, 73-340, 73-458, 75-375, 75-486, 75-509, 76-282, 76-317, 76-319, 76-320, 76-323, 76-359, 77-223)

Administering Agency: Power Facility Evaluation Council  
State Office Building Hartford,  
Conn. 06115

**Sec. 16-50g. Legislative finding and purpose.** The legislature finds that power generating plants and transmission lines for electricity and fuels have had a significant impact on the environment and ecology of the state of Connecticut; and that continued operation and development of such power plants and lines, if not properly planned and controlled, could adversely affect the quality of the environment, the ecological, scenic, historic and recreational values of the state. The purposes of this chapter are: To provide orderly processes for balancing the need for adequate and reliable public utility services with the need to protect the environment and ecology of the state and to minimize damage to scenic, historic, and recreational values; to provide environmental quality standards and criteria for the location, design, construction and operation of facilities for the furnishing of public utility services at least as stringent as the federal environmental quality standards and criteria, and technically sufficient to assure the welfare and protection of the people of the state; to encourage research to develop new and improved methods of generating, storing and transmitting electricity and fuel with minimal damage to the environment and other values described above; to require annual forecasts of the demand for electric power, together with identification and advance planning of the facilities needed to supply that demand and to facilitate local, regional, state-wide and interstate planning to implement the foregoing purposes. [1971, P.A. 575, S.1; P.A. 75-375, S.1, 12; P.A. 76-359, S. 1; 7]

**Sec. 16-50h. Short title.** This chapter shall be known and may be cited and referred to as the "Public Utility Environmental Standards Act." [1971, P.A. 575, S.2]

**Sec. 16-50i. Definitions.** As used in this chapter: (a) "Facility" means: (1) An electric transmission line of a design capacity of sixty-nine kilovolts or more, including associated equipment; (2) a fuel transmission facility except a gas transmission line having a design capability of less than two hundred pounds per square inch gauge pressure; (3) any electric generating or storage facility using any fuel, including nuclear materials, including associated equipment for furnishing electricity by electric utilities; and (4) such substations, switchyards, and other

facilities which may have a substantial adverse environmental effect as the council established under section 16-50j may, by regulation, prescribe; (b) "municipality" means a city, town or borough of the state and "municipal" has a correlative meaning; (c) "person" means any individual, corporation, joint venture, public benefit corporation, political subdivision, governmental agency or authority, municipality, partnership, association, trust or estate and any other entity, public or private, however organized; (d) "modification" means a significant change or alteration in the general physical characteristics of a facility. [1971, P.A. 575, S. 3; P.A. 73-41, S.1, 2; P.A. 73-458, S. 1; P.A. 76-317, S. 1, 2.]

**See 16-50j. Power Facility Evaluation Council. Regulations. Consultation with state agencies.** (a) There is established a "Power Facility Evaluation Council," hereinafter referred to as the "council."

(b) The council shall consist of: (1) The commissioner of environmental protection, or his designee; (2) the chairman, or his designee, of the public utilities control authority; (3) one designee of the speaker of the house and one designee of the president pro tempore of the senate; and (4) five members of the public, to be appointed by the governor, at least two of whom shall be experienced in the field of ecology, and not more than one of whom shall have affiliation, past or present, with any utility or governmental utility regulatory agency, or with any person owning, operating, controlling, or presently contracting with respect to a facility. Of the public members initially appointed, one shall serve for a term of one year, two for terms of two years, and two for terms of three years. Thereafter appointments shall be for terms of three years.

(c) The chairman of the council shall be appointed by the governor from among five public members, with the advice and consent of the house or senate, and shall serve as chairman at the pleasure of the governor.

(d) The public members of the council, including the chairman, and members appointed by the speaker of the house and president pro tempore of the senate, shall be compensated for their attendance at public hearings, ex-



ecutive sessions or such other council business as may require their attendance at the rate of fifty dollars per day, provided in no case shall the daily compensation exceed fifty dollars.

(e) The council shall, in addition to its other duties prescribed in this chapter, adopt, promulgate, amend, or rescind suitable regulations to carry out the provisions of this chapter and the policies and practices of the council in connection therewith, and appoint and prescribe the duties of such staff as may be necessary to carry out the provisions of this chapter.

(f) Prior to commencing any hearing pursuant to section 16-50m, the council shall consult with and solicit written comments from the department of environmental protection, the state department of health, the council on environmental quality, the public utilities control authority, the department of planning and energy policy, the department of commerce and the department of transportation.

In addition, the department of environmental protection shall have the continuing responsibility to investigate and report to the council on all applications which prior to October 1, 1973, were within the jurisdiction of said department of environmental protection with respect to the granting of a permit. Copies of such comments shall be made available to all parties prior to the commencement of the hearing. Subsequent to the commencement of the hearing, said departments, council and commissions may file additional written comments with the council within such period of time as the council designates. All such written comments shall be made part of the record provided by section 16-50o. [1971, P.A. 575, S. 4; 1972, P.A. 228; June 1972, P.A.I.S. 18; P.A. 73-458, S.2; P.A. 75-375, S.2, 12; P.A. 76-282, S.1, 3; 76-319, S. 1, 2.; 77-223, S.1]

**Sec. 16-50k. Certificate of environmental compatibility and public need. Transfer. Amendment. Excepted matters. Waiver.** (a) Except as provided in subsection (b) of section 16-50z, no person shall exercise any right of eminent domain in contemplation of, commence the preparation of the site for, or commence the construction or supplying of a facility, or any modification of a facility, that may, as determined by the council, have a substantial adverse environmental effect, in the state without having first obtained a certificate of environmental compatibility and public need, hereinafter referred to as a "certificate," issued with respect to such facility or modification by the council. Any facility with respect to which a certificate is required shall thereafter be built, maintained and operated in conformity with such certificate and any terms, limitations or conditions contained therein.

(b) A certificate may be transferred, subject to the approval of the council, to a person who agrees to comply with the terms, limitations and conditions contained therein. The council shall not approve any such transfer if it finds that such transfer was contemplated at or prior to the time the certificate was issued and such fact was not adequately disclosed during the certification proceeding.

(c) A certificate issued pursuant to this chapter may be amended as provided in this chapter.

(d) This chapter shall apply to any facility the construction of which is commenced on or after April 1,

1972, and to any facility the construction of which is approved by a municipality that has commenced the sale of bonds or bond anticipation notes on or after April 1, 1972, the proceeds or part of the proceeds of which are to finance such construction. This chapter shall apply to the modification of a facility constructed prior to or after April 1, 1972, whenever such modification either alone or in combination with existing or other proposed facility modifications may, as determined by the council, have a substantial adverse environmental effect. This chapter shall not apply to any matter over which any agency, department or instrumentality of the federal government has exclusive jurisdiction, or has jurisdiction concurrent with that of the state and has exercised such jurisdiction, to the exclusion of regulation of such matter by the state.

(e) Any person intending to construct a facility excluded from one or more provisions of this chapter may, to the extent permitted by law, elect to waive such exclusion by delivering notice of such waiver to the council. Such provisions shall thereafter apply to each facility identified in such notice from the date of its receipt by the council. [1971, P.A. 575, S.5; 1973 P.A. 73-458, S.3., P.A. 76-359, S.4, 7]

**Sec. 16-50l. Application for certificate. Notice. Amendment.** (a) An applicant for a certificate shall file with the council an application, in such form as the council may prescribe, accompanied by a fee of not more than twenty-five thousand dollars, which fee shall be established in accordance with section 16-50t, containing such information as the applicant may consider relevant and the council or any department or agency of the state exercising environmental controls may by regulation require, including the following information: (1) In the case of facilities described in subdivisions (1) and (2) of section 16-50i (a): (A) A description, including estimated costs, of the proposed transmission line, covering, where applicable underground cable sizes and specifications, overhead tower design and appearance and heights, if any, conductor sizes, and initial and ultimate voltages and capacities; (B) a statement and full explanation of why the proposed transmission line is necessary and how the facility conforms to a long-range plan for expansion of the electric power grid serving the state and interconnected utility systems, that will serve the public need for adequate, reliable and economic service; (C) a map of suitable scale of the proposed routing showing details of the rights-of-way in the vicinity of settled areas, parks, recreational areas, and scenic areas, and showing existing transmission lines within one mile of the proposed route; (D) justification for adoption of the route selected, including comparison with alternative routes which are environmentally, technically, and economically practical; (E) a description of the effect of the proposed transmission line on the environment, ecology, and scenic, historic and recreational values; (F) a justification for overhead portions, if any, including cost studies and effects described in subdivision (E) or undergrounding; (G) a schedule of dates showing the proposed program of right-of-way acquisition, construction, completion and operation; and (H) identification of each federal, state, regional, district and municipal agency with which

proposed route reviews have been undertaken, including a copy of each written agency position on such route; and (2) in the case of facilities described in subdivision (3) of section 16-50i(a): (A) A description of the proposed electric generating or storage facility; (B) a statement and full explanation of why the proposed facility is necessary; (C) a statement of loads and resources as described in section 16-50r; (D) safety and reliability information, including planned provisions for emergency operations and shutdowns; (E) estimated cost information, including plant costs, fuel costs, plant service life and capacity factor, and total generating cost per kilowatt-hour, both at the plant and related transmission, and comparative costs of alternatives considered; (F) a schedule showing the program for design, material acquisition, construction and testing, and operating dates; (G) available site information, including maps and description of present and proposed development, and geological, scenic, ecological, seismic, biological, water supply, population and load center data; (H) justification for adoption of the site selected, including comparison with alternative sites; (I) design information, including description of facilities, plant efficiencies, electrical connections to system, and control systems; (J) description of provisions, including devices and operations, for mitigation of the effect of the operation of the facility on air and water quality, for waste disposal, and for noise abatement, and information on other environmental aspects; (K) a listing of federal, state, regional, district and municipal agencies from which approvals either have been obtained or will be sought covering the proposed facility, copies of approvals received and the planned schedule for obtaining those approvals not yet received.

(b) Each application shall be accompanied by proof of service of a copy of such application on: (A) Each municipality in which any portion of such facility is to be located, both as primarily proposed and in the alternative locations listed, which copy shall be sent to the chief executive officer of the municipality and shall include notice of the date on or about which the application is to be filed and zoning commissions, planning commissions, planning and zoning commissions, conservation commissions and inland wetlands agencies of each such municipality, and the regional planning agencies which encompass each such municipality; (B) the attorney general; (C) each member of the legislature in whose assembly or senate district the facility or any alternative location listed in the application is to be located (D) any agency, department or instrumentality of the federal government that has jurisdiction, whether concurrent with the state or otherwise, over any matter that would be affected by such facility; (E) each state department, agency and commission named in section 16-50j (f); and (F) such other state and municipal bodies as the council may by regulation designate. A notice of such application to the general public, in municipalities entitled to receive notice under subdivision (A) of this subsection shall be given by the publication of a summary of such application and the date on or about which it will be filed, to be published under regulations to be promulgated by the council, in such form and in such newspapers as will serve substantially to inform the public of such application and

to afford interested persons sufficient time to prepare for and to be heard at the hearing prescribed in section 16-50m. Such notice shall be published in not less than ten point, bold face type.

(c) An application for an amendment of a certificate shall be in such form and contain such information as the council shall prescribe. Copies and notice of such an application shall be given as set forth in subsection (b) of this section.

(d) An application for a certificate shall contain information on the extent to which the proposed facility has been identified in the annual forecast reports required by section 16-50r and other advance planning has been carried out, and shall include an explanation for any failure to so identify the facility. [1971, P.A. 575.S.6; P.A. 73-458, S. 5; P.A. 75-375, S. 3, 12; 75-509, S. 1, 4; P.A. 76-359, S. 2, 7.]

**Sec. 16-50m. Hearing. Hearing on application. Notice. Return without prejudice.** (a) Upon the receipt of an application complying with section 16-50l the council shall promptly fix a commencement date and location for a public hearing thereon not less than thirty days nor more than one hundred fifty days after such receipt. At least one session of such hearings shall be held after six-thirty p.m. for the convenience of the general public. Such hearing shall be held at a location selected by the council, in the county in which the facility or any part thereof is to be located. If the proposed facility is to be located in more than one county, the council shall fix the location for a public hearing in whichever county it determines is most appropriate, provided the council may hold hearings in more than one county.

(b) On an application for an amendment of a certificate, the council shall hold a hearing in the same manner as a hearing is held on an application for a certificate if the change to be authorized in the facility would, in the opinion of the council, result in any material increase in any environmental impact of such facility, or would, in the opinion of the council, result in a substantial change in the location of all or a portion of the facility, other than as provided in the alternatives set forth in the original application for the certificate, provided the council may, in its discretion, return without prejudice an application for an amendment of a certificate to the applicant with a statement of the reasons for such return.

(c) The council shall cause notices of the date and location of each hearing to be mailed, within one week of the fixing of the date and location, to the applicant and each person entitled under subsection (b) of section 16-50l to receive a copy of the application. The general notice to the public shall be published in not less than ten point bold face type.

(d) Hearings, including general hearings on issues which may be common to more than one application, may be held before a majority of the members of the council.

(e) During any hearing on an application or amendment held pursuant to this section, the council may take notice of any facts found at a general hearing. [1971, P.A. 575, S. 7; P.A. 73-339, S. 1, 2; 73-458, S. 6; P.A. 75-375, S. 4, 12; 75-509, S. 2 — 4; P.A. 76-282, S. 2, 3.]

**Sec. 16-50n. Parties to certification proceedings. Counsel and consultants to council.** (a) The parties to a certification proceedings shall include; (1) The applicant; (2) each person entitled to receive a copy of the application under subsection (b) of section 16-501, if such person has filed with the council a notice of intent to be a party; (3) any domestic or qualified nonprofit corporation or association formed in whole or in part to promote conservation or natural beauty, to protect the environment, personal health or biological values, to preserve historical sites, to promote consumer interests, to represent commercial and industrial groups or to promote the orderly development of the areas in which the facility is to be located, if it has filed with the council, within twenty days after the date given in the notice published under subsection (b) of section 16-501, as the date for filing of the application, a notice of intent to be a party; and (4) such other persons as the council may at any time deem appropriate.

(b) The council in its discretion may provide for the grouping of parties with the same interests. If such a group does not designate an agent for the service of notice and documents, the council shall designate such an agent, and notice and documents need be served only on the designated agent. Notwithstanding the provisions of this subsection, any party who has been included in a group may, at any time by oral or written notice to the council, elect not to be a member of the group to the extent specified in such notice.

(c) The attorney general shall appoint an assistant attorney general or a special assistant attorney general to act as counsel for the power facility evaluation council.

(d) Upon receipt of the application, the council may employ one or more independent consultants to study and measure the consequences of the proposed facility on the environment. The council shall direct such consultant or consultants to study any matter that the council deems important to an adequate appraisal of the application. Any such study and any report issued as a result thereof shall be part of the record of the proceeding.

(e) Any person may make a limited appearance at a hearing held pursuant to the provisions of section 16-50m, as amended by section 6 of this act, prior thereto or within thirty days thereafter, entitling such person to file a statement in writing. All papers and matters filed by a person making a limited appearance shall become part of the record. No person making a limited appearance, and not otherwise entitled to be a party, shall be a party or shall have the right to present oral testimony or cross-examine witnesses or parties or be subject to cross examination. [1971, P.A. 575, S.8; 1973, P.A. 73-458, S.7.; P.A. 75-375, S.5, 12.]

**Sec. 16-50o. Record of hearing. Rights of parties.** (a) A record shall be made of the hearing and of all testimony taken and the cross-examinations thereon. Every party or group of parties as provided in section 16-50n shall have the right to present such oral or documentary evidence and to conduct such cross-examination as may be required for a full and true disclosure of the facts.

(b) A copy of the record shall be available at all reasonable times for examination by the public without

cost at the principal office of the council. A copy of the transcript of testimony at the hearing shall be filed at an appropriate public office, as determined by the council, in each county in which the facility or any part thereof is proposed to be located. [1971, P.A. 575, S.9.; P.A. 73-375, S.6, 12.]

**Sec. 16-50p. Decision. Criteria for Decision Publication.** (a) The council shall, within ten months from the date of application, render a decision upon the record either granting or denying the application as filed, or granting it upon such terms, conditions, limitations or modifications of the construction or operation of the facility as the council may deem appropriate. The council shall file, with its order, an opinion stating in full its reasons for the decision. The council shall not grant a certificate, either as proposed or as modified by the council, unless it shall find and determine; (1) A public need for the facility and the basis of the need; (2) the nature of the probable environmental impact, including a specification of every significant adverse effect, whether alone or cumulatively with other effects, on, and conflict with the policies of the state concerning, the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and water purity and fish and wildlife; (3) why the adverse effects or conflicts referred to in subdivision (2) of this subsection are not sufficient reason to deny the application; (4) in the case of an electric transmission line, (A) what part, if any, of the facility shall be located overhead, (B) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems, that will serve the interests of electric system economy and reliability, and (C) that the overhead portions of the facility, if any, are consistent with the purposes of this chapter with such regulations as the council may adopt pursuant to subsection 16-50t, and with the federal power commission "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any successor guidelines and any other applicable federal guidelines; (5) in the case of an electric or fuel transmission line, that the location of the line will not pose as undue hazard to persons or property along the area traversed by the line.

(b) If the council determines that the location of all or a part of the proposed facility should be modified, it may condition the certificate upon such modification, provided the municipalities, and persons residing or located in such municipalities, affected by the modification shall have had notice of the application as provided in section 16-501 (b).

(c) A copy of the order and opinion issued therewith shall be served upon each party and a notice of the order and opinion shall be published in such newspapers as will serve substantially to inform the public of such order and opinion. The name and address of each party shall be set forth in the order.

(d) In making its decision as to whether or not to issue a certificate, the council shall in no way be limited by the fact that the applicant may already have acquired land or

an interest therein for the purpose of constructing the facility which is the subject of its application. [1971, P.A. 575, S.10; P.A. 73-340, S.1, 2; 73-458, S.8; P.A. 75-375, S.7, 12; P.A. 76-320, S.1, 2; 76-359, S.3, 7.]

**Sec. 16-50q. Judicial review.** Any party may obtain judicial review of an order issued on an application for a certificate or an amendment of a certificate. Such review shall be brought in the court of common pleas for the county wherein the proposed facility is to be located. If such facility is to be located in more than one county, such review may be brought in any one but only one of such counties. Such review shall be initiated by the filing of a petition in said court within thirty days after the publication of such order, together with proof of service of a demand on the council to file with said court a copy of the record of the proceeding before the council and a copy of its order and opinion. Upon receipt of such petition and demand, the council shall forthwith deliver to the court a copy of the record and a copy of its order and opinion. Thereupon the court shall have jurisdiction of the proceeding and shall have power to grant such relief as it deems just and proper, including restraining orders and temporary and permanent injunctions, and to make and enter an order enforcing, modifying, and enforcing as so modified, remanding for further specific evidence or findings or setting aside in whole or in part such order. The appeal shall be heard on the record. The findings of fact on which such order is based shall be conclusive if supported by substantial evidence on the record considered as a whole. Any judicial review sought pursuant to this chapter shall be privileged in respect to assignment for trial in the court of common pleas. [1971, P.A. 575, S. 11; 1972, P.A. 108, S. 3; P.A. 73-458 S.9.]

**Sec. 16-50r. Report of forecast of loads and resources. Hearings.** Every person engaged in generating electric power in the state shall, annually, on or before January first, furnish a report to the council for its review containing a ten-year forecast of loads and resources, and each report required to be filed on or before January first in each even-numbered year shall contain a twenty-year forecast of loads and resources. The report shall describe the facilities that, in the judgment of such utility, will be required to supply system demands during the forecast period. The report shall cover the ten-year period and, where applicable, the twenty-year period next succeeding the date of the report. The report shall be made available to the public and shall be furnished to the chief executive officer of each municipality in the service area of such utility, the regional planning agency which encompasses each such municipality, the attorney general, each member of the general assembly, each state department, agency and commission named in subsection (f) of section 16-50j and such other state and municipal bodies as the council may by regulation designate. The report shall include: (1) A tabulation of estimated peak loads, resources and margins for each year; (2) a list of existing generating facilities in service; (3) a list of scheduled generating facilities for which property has been acquired, for which certificates have been issued and for which certificate applications have been filed; (4) a list of planned generating units at plant locations for which

property has been acquired, or at plant locations not yet acquired, that will be needed to provide estimated additional electrical requirements, and the location of such facilities; (5) a list of planned transmission lines on which proposed route reviews are being undertaken or for which certificate applications have already been filed; (6) a description of the steps taken to upgrade existing facilities and to eliminate overhead transmission and distribution lines in accordance with the regulations and standards described in section 16-50t. A full description of the methodology used to arrive at said load forecast shall also be filed with the council. The council shall hold a public hearing on such reports annually. At least one session of such hearing shall be held after six-thirty p.m. [1971, P.A. 575, S. 13; P.A. 75-486, S. 18. 69; P.A. 76-323, S. 1, 2]

**Sec. 16-50s. Expenditures by utilities as consideration in proceedings.** The council may give appropriate consideration in all proceedings to (1) the amounts expended by a utility for research on generation and transmission of the form of energy furnished by it and the environmental effect thereof, (2) the amounts expended by such utility for promotion, including advertising, of the use of the form of energy furnished by it and (3) the relationship between such expenditures. [1971, P.A. 575, S. 14.]

**Sec. 16-50t. Regulations and standards. Hearing. Certain expenditures excluded in computation of fair net return** (a) The council shall prescribe and establish such reasonable regulations and standards in accordance with the provisions of section 4-166 to 4-185, inclusive, as it deems necessary and in the public interest with respect to application fees, siting of facilities and environmental standards applicable to facilities, including, but not limited to, regulations or standards relating to: (1) Reliability, effluents, thermal effects, air and water emissions, protection of fish and wildlife and other environmental factors; (2) the methodical upgrading or elimination of facilities over appropriate periods of time to meet the standards established pursuant to this subsection or other applicable laws, standards or regulations; and (3) the elimination of overhead electric transmission and distribution lines over appropriate periods of time in accordance with existing applicable technology and the need to provide electric service of the lowest reasonable cost to consumers.

(b) The council may adopt regulations or standards in accordance with the provisions of sections 4-166 to 4-185, inclusive, with respect to subdivisions (1) and (2) of subsection (a) of this section. Such regulations or standards shall be in addition to and not in lieu of any regulation or standard adopted by any other state or local agency or instrumentality. No such regulation or standard shall be adopted by the council without one or more public hearings at which members of the public are given adequate opportunity to be heard.

(c) Expenditures by a utility shall not be considered a necessary and proper expense for the purpose of computing fair net return on invested capital, if such expenditures were incurred (1) for fines, forfeitures and other penalties, including legal fees and other expenses incurred in connection therewith, imposed for failure to

comply with any state or federal environmental or pollution standard or (2) in connection with any action described in section 16-50k (a) prior to issuance of a certificate therefor. [1971, P.A. 575, S. 15; 1973, P.A. 73-458, S. 10.; P.A. 75-375, 5.8, 12.]

**Sec. 16-50u. Enforcement of certificate and standards requirements.** The council shall take reasonable steps to insure that each facility for which a certificate has been issued is constructed, maintained and operated in compliance with such certificate and any other standards established pursuant to this chapter. Whenever the council deems it necessary to verify such compliance and whenever the meeting of any such other standards involves expenses, the person to whom such certificate has been issued shall be charged with and pay such expenses. The courts are authorized to grant such restraining orders, and such temporary and permanent injunctive relief, as may be necessary to secure compliance with this chapter and with a certificate issued pursuant to this chapter. The courts may assess civil penalties in an amount not less than one thousand dollars per day for each day of construction or operation in material violation of this chapter, or in material violation of any certificate issued pursuant to this chapter. Civil proceedings to enforce this chapter may be brought by the attorney general in the superior court for any county affected by the violation. The remedies and penalties in this section shall be cumulative and shall be in addition to any other penalties and remedies available at law, or in equity, to any person. [1971, P.A. 575, S. 16; 1973, P.A. 73-458, S. 11.]

**Sec. 16-50v. Expenses of administration.** (a) All expenses of administering this chapter, including the functions of the council and its staff, shall be financed by application fees paid pursuant to section 16-501 (a) and other assessments as provided in this section. The council shall, by regulation, adjust such fees to meet such expenses. In addition, the council shall make such other assessments on applicants during the pendency of the proceeding on the application as may be necessary to meet such expenses.

(b) The council shall obtain such full-time and part-time staff and consultants as may be appropriate to carry out its duties and the provisions of this chapter.

(c) The power facility evaluation council may undertake such studies as it deems necessary to carry out its duties pursuant to the subdivision (2) of subsection (a) of section 10 of this act, and may, from time to time, assess each public service company generating electric power and having yearly gross revenue in excess of one hundred thousand dollars for a pro rata share of the expenses of such studies based on the proportion which the gross revenue of such company for the calendar year immediately prior to such assessment bears to the aggregate gross revenues of all companies to be so assessed. [1971, P.A. 575, S. 17; 1973, P.A. 73-458, S. 12.]

**Sec. 16-50w. Conflicting provisions.** In the event of any conflict between the provisions of this chapter and any provisions of the general statutes, as amended, or any special act, this chapter shall take precedence. [1971, P.A. 575, S. 18.]

**Sec. 16-50x. Exclusive jurisdiction of council; excep-**

**tion. Eminent domain after certification. Municipal regulation of proposed location.** (a) Notwithstanding any other provision of the general statutes to the contrary, except as provided in section 16-243, the council shall have exclusive jurisdiction over the location and type of facilities and over the location and type of modifications of facilities subject to the provisions of subsection (d) of this section. In ruling on applications for certificates for facilities, the council shall give such consideration to other state laws and municipal regulations as it shall deem appropriate. Whenever the council certifies a facility pursuant to this chapter, such certification shall satisfy and be in lieu of all certifications, approvals and other requirements of state and municipal agencies in regard to any questions of public need, convenience and necessity for such facility.

(b) Whenever the council has certified a facility pursuant to this chapter, any person joining in the application for such certification shall be empowered to exercise its powers of eminent domain, granted by the general statutes or any special act, to acquire property for such facility for the benefit of all persons receiving such certificates.

(c) Whenever the council has certified a facility pursuant to this chapter and the applicant for such certificate thereafter initiates condemnation proceedings to acquire property for such facility, and it shall appear to the court or judge before whom such proceedings are pending that the public interest will be prejudiced by delay, said court or judge may direct that said applicant be permitted to enter immediately upon the property to be taken and devote it temporarily to the public use specified in the application instituting such proceeding upon the deposit with said court of a sum to be fixed by said court or judge, upon notice to the parties of not less than ten days, and such sum when fixed and paid shall be applied to the payment of any assessment of damages which may be made, with interest thereon from the date of such entry upon said property, and the remainder, if any, returned to said applicant. If such application is dismissed, no assessment of damages is made, or the proceedings are abandoned by said applicant, said court or judge shall direct that the money so deposited, so far as it may be necessary, shall be applied to the payment of any damages that the owner of said property or other parties in interest may have sustained by such entry upon and use of such property, including reasonable attorneys', engineers' and appraisers' fees and other reasonable expenses incurred by such owner or other parties in interest in connection with such proceedings, and the costs and expenses of such proceedings. Such damages shall be ascertained by said court or judge or a committee to be appointed for that purpose, and if the sum so deposited shall be insufficient to pay such damages and all costs and expenses so assessed, judgment shall be entered against said applicant for the deficiency to be enforced and collected in the same manner as a judgment in the superior court, and the possession of such property shall be restored to the owner or owners thereof.

(d) Any town, city or borough zoning commission and inland wetland agency may regulate and restrict the

proposed location of a facility as defined in subdivisions (3) and (4) of subsection (a) of section 16-50i. Such local bodies may make all orders necessary to the exercise of such power to regulate and restrict, which orders shall be made within thirty days of any application and shall be in writing and recorded in the records of their respective communities, and written notice of any order shall be given to each party affected thereby. Each such order shall be subject to the right of appeal within thirty days after the giving of such notice by any party aggrieved to the council, which shall have jurisdiction, in the course of any proceeding on an application for a certificate or otherwise, to affirm, modify or revoke such order or make any order in substitution thereof by a vote of six members of the council. [P.A. 73-458, S. 4; P.A. 75-375, S.9, 11, 12.]

**Sec. 16-50y. Location application for electric generating facilities.** Section 16-50y is repealed. [P.A. 73-458, S. 14; P.A. 76-359, S.5, 7.]

**Sec. 16-50z. Acquisition of real property for transmission facility. Regulations.** (a) No person engaged in the transmission of electric power or fuel in the state shall acquire real property in contemplation of a possible future transmission facility, other than a facility for which the council has issued a certificate or one which the council has found will have no substantial adverse environmental effect, except as provided in regulations adopted by the council. Such regulations shall permit such acquisition (1) to avoid hardship for an owner of

property; (2) to prevent substantial development along a possible transmission route until it becomes timely for the council to decide whether a certificate should be issued for a transmission facility along that route; and (3) to allow a modification of the boundaries between an existing right-of-way in fee and an adjoining parcel of land, or of the location of an existing easement right-of-way across a parcel of land, for the convenience of the owner of such parcel. Such regulations shall require that any such person intending to acquire such property shall, prior to entering any binding commitment therefor, file with the council a statement describing the property and the reason for its acquisition. Such acquisition may proceed unless the council gives notice within thirty days after such filing that a hearing will be held to review the conformity of the acquisition with its regulations, in which case such acquisition shall not proceed without the approval of the council.

(b) A person engaged in the transmission of electric power or fuel in the state may acquire real property, and exercise any right of eminent domain, granted by the general statutes or any special act therefor, for (1) relocation of a transmission facility or right-of-way required by a public highway project or other governmental action; (2) acquisition of additional rights or title to property already subject to an easement or other rights for electric transmission or distribution lines; or (3) widening a portion, not exceeding one mile in length, of a transmission right-of-way for reasons of safety or convenience of the public. [P.A. 75-359, S. 6, 7.]

APPENDIX H

ENERGY PRODUCTION STUDIES -- COMPUTER PRINTOUT

PART 1

ALL CASES ON HISTORICAL FLOW BASE



CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 1 - UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT.
1965 - 1966	2.33	0.0	0.03	0.15	0.16	0.35	0.75	0.46	0.32	0.09	0.0	0.0	0.03
1966 - 1967	4.56	0.29	0.53	0.40	0.30	0.21	0.44	0.99	0.74	0.34	0.25	0.06	0.00
1967 - 1968	4.58	0.18	0.26	0.67	0.28	0.28	0.66	0.61	0.52	0.85	0.18	0.0	0.10
1968 - 1969	6.11	0.06	0.50	0.63	0.41	0.33	0.53	1.02	0.69	0.44	0.72	0.73	0.07
1969 - 1970	6.28	0.16	0.78	0.72	0.26	0.72	0.65	0.89	0.67	0.55	0.31	0.37	0.21
1970 - 1971	4.16	0.14	0.06	0.26	0.10	0.34	0.63	0.86	0.75	0.18	0.25	0.12	0.46
1971 - 1972	7.46	0.47	0.30	0.66	0.55	0.53	0.87	0.92	0.90	0.99	0.66	0.23	0.38
1972 - 1973	8.52	0.58	0.62	1.00	0.82	0.75	0.99	0.90	0.92	0.40	0.54	0.45	0.54
1973 - 1974	6.83	0.32	0.28	0.77	0.86	0.69	0.93	0.88	0.65	0.32	0.26	0.39	0.48
1974 - 1975	6.93	0.40	0.47	0.64	0.78	0.53	0.87	0.78	0.62	0.47	0.44	0.39	0.56
1975 - 1976	8.03	0.93	0.89	0.83	0.72	0.94	0.96	0.62	0.81	0.28	0.22	0.48	0.38
1976 - 1977	4.84	0.39	0.22	0.18	0.05	0.08	0.85	0.88	0.76	0.17	0.26	0.50	0.5
12 YEAR AVERAGES	5.89	0.32	0.41	0.57	0.44	0.48	0.76	0.82	0.70	0.42	0.34	0.31	0.3

VARIANCE IN ENERGY PRODUCTION = 1.818

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 2 - UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATFP	YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966		2.15	0.0	0.03	0.15	0.16	0.31	0.62	0.45	0.32	0.08	0.0	0.0	0.0
1966 - 1967		4.04	0.27	0.49	0.40	0.29	0.21	0.40	0.69	0.64	0.33	0.25	0.06	0.0
1967 - 1968		3.93	0.17	0.26	0.56	0.28	0.28	0.50	0.50	0.49	0.62	0.17	0.0	0.1
1968 - 1969		5.16	0.04	0.45	0.58	0.40	0.33	0.42	0.70	0.63	0.40	0.61	0.53	0.0
1969 - 1970		5.52	0.16	0.61	0.62	0.26	0.61	0.59	0.70	0.58	0.52	0.31	0.37	0.2
1970 - 1971		3.81	0.14	0.06	0.26	0.10	0.33	0.62	0.69	0.62	0.18	0.25	0.11	0.4
1971 - 1972		6.26	0.45	0.29	0.63	0.55	0.51	0.70	0.69	0.66	0.70	0.48	0.23	0.3
1972 - 1973		6.94	0.56	0.52	0.73	0.66	0.61	0.73	0.67	0.70	0.37	0.41	0.44	0.5
1973 - 1974		5.31	0.31	0.28	0.60	0.70	0.56	0.70	0.65	0.59	0.32	0.26	0.39	0.4
1974 - 1975		6.95	0.40	0.47	0.59	0.63	0.46	0.68	0.66	0.54	0.41	0.38	0.38	0.4
1975 - 1976		6.53	0.71	0.67	0.64	0.60	0.68	0.73	0.53	0.65	0.28	0.22	0.46	0.3
1976 - 1977		4.14	0.39	0.22	0.18	0.05	0.08	0.65	0.65	0.59	0.17	0.25	0.49	0.4
12 YEAR AVERAGES		5.03	0.30	0.36	0.49	0.39	0.41	0.61	0.63	0.58	0.36	0.30	0.29	0.2

VARIANCE IN ENERGY PRODUCTION = 1.418

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 3 UPPER DAN

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.64	0.0	0.03	0.14	0.16	0.24	0.36	0.35	0.31	0.06	0.0	0.0	0.0
1966 - 1967	2.91	0.21	0.34	0.36	0.23	0.21	0.29	0.35	0.36	0.25	0.24	0.06	0.0
1967 - 1968	2.78	0.14	0.24	0.36	0.28	0.22	0.31	0.32	0.35	0.35	0.13	0.0	0.0
1968 - 1969	3.33	0.04	0.30	0.36	0.33	0.30	0.28	0.35	0.36	0.28	0.36	0.30	0.0
1969 - 1970	3.60	0.16	0.33	0.36	0.26	0.33	0.35	0.35	0.36	0.35	0.23	0.35	0.1
1970 - 1971	2.70	0.14	0.06	0.26	0.10	0.25	0.36	0.35	0.36	0.18	0.25	0.08	0.3
1971 - 1972	3.93	0.35	0.27	0.36	0.36	0.34	0.36	0.35	0.36	0.35	0.28	0.20	0.3
1972 - 1973	4.07	0.36	0.31	0.36	0.36	0.33	0.36	0.35	0.36	0.30	0.27	0.34	0.3
1973 - 1974	3.71	0.21	0.27	0.33	0.35	0.33	0.36	0.35	0.36	0.27	0.21	0.36	0.2
1974 - 1975	4.02	0.35	0.35	0.36	0.36	0.33	0.36	0.35	0.34	0.30	0.23	0.32	0.3
1975 - 1976	4.00	0.36	0.35	0.36	0.36	0.34	0.36	0.35	0.36	0.26	0.18	0.36	0.3
1976 - 1977	2.81	0.33	0.21	0.18	0.05	0.05	0.36	0.35	0.32	0.15	0.19	0.36	0.2
12 YEAR AVERAGES	3.30	0.22	0.26	0.32	0.27	0.27	0.35	0.35	0.35	0.26	0.21	0.23	0.2

VARIANCE IN ENERGY PRODUCTION = 0.734

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 4 UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.91	0.05	0.10	0.21	0.21	0.23	0.31	0.30	0.28	0.14	0.03	0.01	0.0
1966 - 1967	2.95	0.24	0.29	0.31	0.25	0.23	0.29	0.30	0.31	0.26	0.26	0.17	0.0
1967 - 1968	2.78	0.16	0.25	0.31	0.27	0.24	0.28	0.29	0.30	0.30	0.20	0.06	0.1
1968 - 1969	3.12	0.08	0.28	0.31	0.29	0.27	0.26	0.30	0.31	0.27	0.31	0.29	0.1
1969 - 1970	3.32	0.21	0.29	0.31	0.27	0.28	0.30	0.30	0.31	0.30	0.25	0.30	0.2
1970 - 1971	2.88	0.19	0.16	0.26	0.20	0.25	0.31	0.30	0.31	0.22	0.25	0.14	0.2
1971 - 1972	3.49	0.30	0.26	0.31	0.31	0.29	0.31	0.30	0.31	0.30	0.27	0.24	0.2
1972 - 1973	3.55	0.31	0.29	0.31	0.31	0.28	0.31	0.30	0.31	0.27	0.27	0.30	0.3
1973 - 1974	3.38	0.23	0.26	0.30	0.31	0.28	0.31	0.30	0.31	0.26	0.24	0.31	0.2
1974 - 1975	3.53	0.30	0.30	0.31	0.31	0.28	0.31	0.30	0.30	0.27	0.25	0.29	0.3
1975 - 1976	3.52	0.31	0.30	0.31	0.31	0.29	0.31	0.30	0.31	0.26	0.23	0.31	0.2
1976 - 1977	2.99	0.29	0.21	0.21	0.19	0.17	0.31	0.30	0.30	0.22	0.23	0.31	0.2
12 YEAR AVERAGES	3.12	0.22	0.25	0.29	0.27	0.26	0.30	0.30	0.31	0.26	0.23	0.23	0.2

VARIANCE IN ENERGY PRODUCTION = 0.471

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.5-UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	2.48	0.05	0.10	0.23	0.22	0.29	0.56	0.45	0.33	0.16	0.03	0.01	0.0
1966 - 1967	4.12	0.30	0.44	0.42	0.32	0.24	0.40	0.59	0.57	0.34	0.28	0.17	0.0
1967 - 1968	3.94	0.19	0.28	0.52	0.28	0.31	0.46	0.46	0.45	0.55	0.24	0.06	0.1
1968 - 1969	4.90	0.09	0.45	0.53	0.37	0.32	0.39	0.60	0.57	0.40	0.55	0.49	0.1
1969 - 1970	5.26	0.23	0.54	0.56	0.29	0.53	0.53	0.60	0.53	0.48	0.35	0.37	0.2
1970 - 1971	3.99	0.20	0.16	0.27	0.20	0.34	0.56	0.59	0.56	0.23	0.26	0.18	0.4
1971 - 1972	5.79	0.43	0.29	0.56	0.52	0.46	0.61	0.59	0.57	0.60	0.45	0.30	0.4
1972 - 1973	6.23	0.52	0.47	0.62	0.59	0.54	0.62	0.58	0.61	0.34	0.41	0.42	0.5
1973 - 1974	5.49	0.35	0.29	0.54	0.61	0.50	0.61	0.57	0.54	0.33	0.32	0.42	0.4
1974 - 1975	5.68	0.39	0.46	0.54	0.56	0.45	0.60	0.58	0.49	0.38	0.38	0.39	0.4
1975 - 1976	6.00	0.61	0.58	0.57	0.54	0.58	0.62	0.49	0.57	0.29	0.30	0.45	0.4
1976 - 1977	4.35	0.38	0.24	0.22	0.19	0.20	0.57	0.57	0.53	0.24	0.31	0.49	0.4
12 YEAR AVERAGES	4.85	0.31	0.35	0.46	0.39	0.40	0.54	0.56	0.53	0.36	0.32	0.31	0.3

VARIANCE IN ENERGY PRODUCTION = 1.102

COSTS OF CAPITAL STUDY - ALTERNATIVE NO. 4 (DPPFL DAM)

ELECTRIC PRODUCTION IN MILLIONS OF KWH

Year	TOTAL	OCF	SPV	OTC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1966 - 1966	2.64	0.01	0.07	0.24	0.22	0.33	0.69	0.89	0.35	0.15	0.01	0.01	0.0
1967 - 1967	0.6	0.35	0.07	0.46	0.35	0.25	0.46	0.80	0.75	0.58	0.30	0.15	0.0
1967 - 1968	0.57	0.19	0.30	0.63	0.29	0.34	0.57	0.57	0.52	0.71	0.27	0.01	0.1
1968 - 1968	0.88	0.08	0.51	0.62	0.21	0.36	0.38	0.32	0.88	0.48	0.28	0.03	0.1
1969 - 1969	6.29	0.25	0.55	0.53	0.30	0.47	0.64	0.76	0.54	0.56	0.59	0.40	0.2
1970 - 1971	0.4	0.18	0.18	0.28	0.22	0.38	0.55	0.78	0.66	0.24	0.29	0.16	0.4
1971 - 1972	7.01	0.0	0.31	0.58	0.59	0.53	0.72	0.77	0.75	0.30	0.58	0.33	0.4
1972 - 1972	7.72	0.08	0.52	0.94	0.74	0.87	0.43	0.76	0.79	0.39	0.80	0.47	0.5
1973 - 1973	0.57	0.26	0.31	0.57	0.77	0.62	0.29	0.74	0.63	0.35	0.35	0.46	0.5
1974 - 1975	0.81	0.28	0.32	0.52	0.71	0.53	0.77	0.72	0.59	0.45	0.47	0.43	0.5
1975 - 1975	1.45	0.0	0.76	0.71	0.86	0.77	0.82	0.55	0.72	0.31	0.33	0.50	0.4
1975 - 1977	5.19	0.42	0.25	0.22	0.20	0.23	0.74	0.74	0.68	0.25	0.34	0.54	0.4
1977 - 1977	0.78	0.36	0.41	0.55	0.46	0.47	0.68	0.71	0.64	0.42	0.37	0.34	0.3

1977 - 1977 = 1.45

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 7 - URBER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965	- 1966	1.49	0.01	0.06	0.18	0.18	0.20	0.24	0.23	0.24	0.11	0.01	0.01	0.0
1966	- 1967	2.64	0.21	0.23	0.24	0.22	0.21	0.23	0.23	0.24	0.22	0.23	0.15	0.0
1967	- 1968	2.25	0.11	0.22	0.24	0.24	0.21	0.23	0.23	0.24	0.23	0.19	0.01	0.1
1968	- 1969	2.49	0.04	0.22	0.24	0.24	0.22	0.23	0.23	0.24	0.23	0.24	0.23	0.1
1969	- 1970	2.65	0.17	0.22	0.24	0.23	0.22	0.24	0.23	0.24	0.23	0.21	0.24	0.1
1970	- 1971	2.49	0.16	0.15	0.23	0.21	0.21	0.24	0.23	0.24	0.20	0.21	0.09	0.2
1971	- 1972	2.77	0.24	0.23	0.24	0.24	0.22	0.24	0.23	0.24	0.23	0.23	0.22	0.2
1972	- 1973	2.60	0.24	0.23	0.24	0.24	0.21	0.24	0.23	0.24	0.23	0.23	0.24	0.2
1973	- 1974	2.69	0.17	0.22	0.24	0.24	0.22	0.24	0.23	0.24	0.22	0.21	0.24	0.2
1974	- 1975	2.78	0.24	0.23	0.24	0.24	0.22	0.24	0.23	0.24	0.23	0.21	0.23	0.2
1975	- 1976	2.77	0.24	0.23	0.24	0.24	0.22	0.24	0.23	0.24	0.23	0.21	0.24	0.2
1976	- 1977	2.55	0.24	0.17	0.18	0.20	0.18	0.24	0.23	0.24	0.21	0.21	0.24	0.2
12 YEAR AVERAGES		2.50	0.17	0.20	0.23	0.23	0.21	0.24	0.23	0.24	0.21	0.20	0.18	0.1

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 2 UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.48	0.0	0.0	0.06	0.01	0.16	0.73	0.34	0.10	0.05	0.0	0.0	0.0
1966 - 1967	3.28	0.18	0.36	0.16	0.15	0.0	0.31	1.16	0.73	0.20	0.04	0.0	0.0
1967 - 1968	3.75	0.10	0.08	0.63	0.01	0.16	0.72	0.54	0.44	0.93	0.10	0.0	0.0
1968 - 1969	5.45	0.0	0.44	0.60	0.16	0.09	0.47	1.17	0.69	0.33	0.65	0.84	0.0
1969 - 1970	5.46	0.03	0.84	0.71	0.01	0.75	0.58	0.97	0.62	0.40	0.27	0.17	0.1
1970 - 1971	3.00	0.0	0.0	0.0	0.0	0.22	0.58	0.90	0.72	0.01	0.03	0.11	0.4
1971 - 1972	7.41	0.31	0.07	0.62	0.52	0.43	0.97	1.11	0.94	1.21	0.73	0.17	0.3
1972 - 1973	8.56	0.53	0.58	1.07	0.86	0.86	1.08	1.05	1.01	0.17	0.53	0.28	0.5
1973 - 1974	6.27	0.31	0.01	0.84	0.88	0.69	0.94	0.96	0.63	0.15	0.21	0.23	0.4
1974 - 1975	6.34	0.19	0.38	0.63	0.72	0.55	0.97	0.83	0.52	0.33	0.41	0.23	0.5
1975 - 1976	8.00	1.09	1.01	0.76	0.67	1.18	0.99	0.57	0.82	0.06	0.16	0.38	0.3
1976 - 1977	4.29	0.20	0.05	0.01	0.0	0.08	0.89	1.05	0.79	0.06	0.18	0.49	0.5
12 YEAR AVERAGES	5.27	0.24	0.32	0.51	0.33	0.43	0.77	0.89	0.67	0.33	0.28	0.24	0.2

VARIANCE IN ENERGY PRODUCTION = 2.170



CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 9 UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.31	0.0	0.0	0.06	0.01	0.13	0.60	0.34	0.10	0.04	0.0	0.0	0.0
1966 - 1967	2.61	0.14	0.34	0.16	0.15	0.0	0.26	0.70	0.63	0.20	0.04	0.0	0.0
1967 - 1968	2.72	0.10	0.08	0.47	0.01	0.16	0.41	0.40	0.36	0.58	0.10	0.0	0.0
1968 - 1969	4.11	0.0	0.40	0.52	0.16	0.09	0.30	0.71	0.60	0.30	0.54	0.47	0.0
1969 - 1970	4.49	0.03	0.59	0.60	0.01	0.60	0.53	0.70	0.49	0.39	0.27	0.17	0.1
1970 - 1971	2.62	0.0	0.0	0.0	0.0	0.22	0.58	0.69	0.57	0.01	0.03	0.09	0.4
1971 - 1972	5.50	0.30	0.05	0.60	0.52	0.41	0.71	0.69	0.62	0.70	0.40	0.17	0.3
1972 - 1973	6.36	0.52	0.44	0.73	0.67	0.61	0.73	0.68	0.71	0.14	0.31	0.28	0.5
1973 - 1974	4.96	0.30	0.01	0.57	0.71	0.51	0.71	0.62	0.53	0.15	0.21	0.23	0.4
1974 - 1975	5.17	0.19	0.38	0.59	0.56	0.45	0.69	0.66	0.42	0.26	0.31	0.23	0.4
1975 - 1976	5.84	0.71	0.67	0.60	0.52	0.68	0.73	0.44	0.61	0.06	0.16	0.34	0.3
1976 - 1977	3.25	0.20	0.05	0.01	0.0	0.08	0.62	0.63	0.55	0.06	0.18	0.49	0.3
12 YEAR AVERAGES	4.0E	0.21	0.25	0.41	0.28	0.33	0.57	0.61	0.52	0.24	0.21	0.20	0.2

VARIANCE IN ENERGY PRODUCTION = 1.566

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.10-UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER	YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965	- 1966	2.66	0.05	0.10	0.23	0.22	0.33	0.69	0.45	0.33	0.17	0.03	0.01	0.0
1966	- 1967	4.65	0.33	0.49	0.42	0.34	0.24	0.44	0.85	0.68	0.36	0.28	0.17	0.0
1967	- 1968	4.55	0.20	0.28	0.62	0.28	0.31	0.59	0.57	0.49	0.74	0.25	0.06	0.1
1968	- 1969	5.82	0.09	0.49	0.59	0.39	0.32	0.49	0.88	0.65	0.44	0.66	0.66	0.1
1969	- 1970	6.07	0.23	0.70	0.66	0.29	0.66	0.61	0.80	0.62	0.52	0.35	0.37	0.2
1970	- 1971	4.38	0.20	0.16	0.27	0.20	0.35	0.60	0.77	0.68	0.23	0.27	0.20	0.4
1971	- 1972	6.92	0.45	0.30	0.61	0.54	0.50	0.77	0.80	0.78	0.86	0.61	0.30	0.4
1972	- 1973	7.74	0.54	0.58	0.88	0.74	0.67	0.88	0.79	0.82	0.38	0.52	0.43	0.5
1973	- 1974	6.47	0.36	0.29	0.69	0.77	0.62	0.83	0.78	0.61	0.33	0.32	0.42	0.4
1974	- 1975	6.57	0.39	0.47	0.61	0.71	0.51	0.78	0.71	0.57	0.44	0.46	0.40	0.5
1975	- 1976	7.42	0.83	0.79	0.72	0.66	0.81	0.85	0.57	0.72	0.29	0.30	0.47	0.4
1976	- 1977	5.01	0.39	0.24	0.22	0.19	0.21	0.76	0.77	0.70	0.24	0.31	0.49	0.4
12 YEAR AVERAGES		5.69	0.34	0.41	0.54	0.44	0.46	0.69	0.73	0.64	0.42	0.36	0.33	0.3

VARIANCE IN ENERGY PRODUCTION = 1.477

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 11 (COPPER DAM)

ELECTRIC PRODUCTION, IN BILLIONS OF KWH

Year	TOTAL	COI	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1966 - 1966	7.20	0.81	0.37	0.24	0.20	0.28	0.47	0.43	0.35	0.13	0.01	0.01	0.0
1967 - 1967	3.31	0.38	0.40	0.43	0.32	0.28	0.35	0.48	0.47	0.33	0.30	0.18	0.0
1967 - 1968	3.45	0.17	0.27	0.45	0.26	0.30	0.45	0.40	0.42	0.45	0.24	0.01	0.1
1968 - 1968	4.18	0.08	0.40	0.46	0.37	0.34	0.34	0.46	0.47	0.37	0.47	0.41	0.1
1968 - 1970	4.50	0.23	0.44	0.47	0.31	0.43	0.44	0.46	0.46	0.43	0.34	0.40	0.2
1970 - 1971	3.63	0.18	0.15	0.26	0.22	0.33	0.47	0.46	0.47	0.24	0.29	0.14	0.3
1971 - 1972	3.66	0.22	0.30	0.47	0.47	0.41	0.43	0.46	0.46	0.46	0.30	0.31	0.4
1972 - 1973	3.23	0.40	0.41	0.48	0.47	0.43	0.43	0.45	0.42	0.33	0.36	0.41	0.4
1973 - 1974	3.72	0.30	0.31	0.44	0.43	0.42	0.43	0.46	0.46	0.33	0.32	0.44	0.3
1974 - 1975	3.63	0.30	0.44	0.47	0.47	0.42	0.43	0.43	0.42	0.35	0.34	0.39	0.4
1975 - 1976	3.15	0.48	0.40	0.47	0.46	0.44	0.44	0.44	0.47	0.31	0.31	0.44	0.4
1976 - 1977	4.00	0.35	0.28	0.22	0.20	0.21	0.35	0.45	0.44	0.25	0.30	0.47	0.3
1966 - 1977 AVER. C.I.S.	4.29	0.28	0.33	0.41	0.38	0.35	0.45	0.45	0.45	0.33	0.30	0.39	0.2

PRICE OF ELECTRIC PRODUCTION = 0.892

GAZTOP OPERATIONAL STUDY - ALTERNATIVE 20.1 (RUPPER 060)

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.
1966 - 1966	2.34	0.0	0.02	0.10	0.14	0.32	0.73	0.49	0.32	0.08	0.0	0.0	0.0
1967 - 1967	4.83	0.20	0.54	0.96	1.23	0.19	0.46	1.05	0.77	0.32	0.24	0.94	0.0
1967 - 1968	5.59	0.15	0.25	0.71	0.70	0.77	0.71	0.63	0.55	0.91	0.17	0.0	0.0
1967 - 1969	5.00	0.14	0.51	0.63	0.80	0.84	0.49	1.09	0.72	0.45	0.75	0.79	0.0
1968 - 1968	6.00	0.17	0.72	0.75	0.24	0.75	0.64	0.84	0.71	0.55	0.32	0.40	0.2
1970 - 1971	6.11	0.12	0.06	0.20	0.85	0.53	0.64	0.89	0.71	0.17	0.24	0.10	0.0
1971 - 1972	7.00	0.63	0.20	0.50	0.58	0.24	0.99	0.90	0.95	1.07	0.71	0.23	0.4
1972 - 1973	7.91	0.50	0.55	1.00	0.80	0.30	1.06	0.90	0.97	0.41	0.50	0.46	0.5
1973 - 1974	7.88	0.37	0.70	0.70	0.67	0.72	0.96	0.90	0.82	0.30	0.27	0.45	0.0
1974 - 1975	7.50	0.42	0.51	0.67	0.02	0.58	0.93	0.81	0.83	0.47	0.46	0.01	0.0
1975 - 1976	7.05	1.00	0.95	0.85	0.75	1.02	1.00	0.65	0.84	0.27	0.25	0.52	0.4
1976 - 1977	5.94	0.40	0.23	0.18	0.65	0.08	0.61	0.95	0.80	0.14	0.25	0.53	0.5
12 YEAR AVERAGES	6.11	0.33	0.42	0.50	0.44	0.49	0.79	0.87	0.73	0.43	0.35	0.33	0.3

CANTON OPERATIONAL STUDY - ALTERNATIVE EQUIPPING CASE

ELECTRIC PRODUCTION IN MILLIONS OF KWH

DATE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
1966 - 1966	2.04	0.00	0.00	0.16	0.14	0.26	0.57	0.48	0.00
1966 - 1967	3.70	0.28	0.43	0.45	0.25	0.16	0.34	0.58	0.58
1967 - 1968	3.53	0.18	0.23	0.52	0.24	0.25	0.45	0.44	0.47
1968 - 1968	4.06	0.44	0.44	0.55	0.58	0.33	0.30	0.59	0.57
1968 - 1970	5.13	0.17	0.53	0.57	0.27	0.53	0.53	0.54	0.55
1970 - 1971	3.44	0.12	0.09	0.25	0.05	0.30	0.57	0.59	0.55
1971 - 1972	5.70	0.45	0.29	0.57	0.54	0.45	0.60	0.58	0.57
1972 - 1973	6.22	0.54	0.45	0.61	0.59	0.54	0.61	0.58	0.50
1973 - 1974	5.36	0.31	0.28	0.51	0.60	0.51	0.60	0.57	0.55
1974 - 1975	5.76	0.41	0.45	0.55	0.50	0.33	0.52	0.57	0.48
1975 - 1976	5.94	0.60	0.54	0.57	0.55	0.57	0.61	0.56	0.57
1976 - 1977	3.65	0.35	0.23	0.16	0.09	0.07	0.57	0.56	0.51
1977 - 1977	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1978 - 1978	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1979 - 1979	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1980 - 1980	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1981 - 1981	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1982 - 1982	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1983 - 1983	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1984 - 1984	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1985 - 1985	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1986 - 1986	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1987 - 1987	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1988 - 1988	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1989 - 1989	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1990 - 1990	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1991 - 1991	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1992 - 1992	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1993 - 1993	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1994 - 1994	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1995 - 1995	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1996 - 1996	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1997 - 1997	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1998 - 1998	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
1999 - 1999	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2000 - 2000	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2001 - 2001	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2002 - 2002	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2003 - 2003	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2004 - 2004	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2005 - 2005	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2006 - 2006	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2007 - 2007	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2008 - 2008	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2009 - 2009	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2010 - 2010	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2011 - 2011	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2012 - 2012	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2013 - 2013	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2014 - 2014	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2015 - 2015	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2016 - 2016	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2017 - 2017	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2018 - 2018	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2019 - 2019	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2020 - 2020	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2021 - 2021	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2022 - 2022	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2023 - 2023	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2024 - 2024	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2025 - 2025	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2026 - 2026	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2027 - 2027	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2028 - 2028	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2029 - 2029	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2030 - 2030	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2031 - 2031	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2032 - 2032	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2033 - 2033	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2034 - 2034	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2035 - 2035	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2036 - 2036	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2037 - 2037	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2038 - 2038	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2039 - 2039	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2040 - 2040	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2041 - 2041	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2042 - 2042	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2043 - 2043	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2044 - 2044	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2045 - 2045	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2046 - 2046	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2047 - 2047	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2048 - 2048	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2049 - 2049	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2050 - 2050	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2051 - 2051	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2052 - 2052	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2053 - 2053	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2054 - 2054	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2055 - 2055	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2056 - 2056	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2057 - 2057	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2058 - 2058	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2059 - 2059	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2060 - 2060	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2061 - 2061	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2062 - 2062	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2063 - 2063	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2064 - 2064	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2065 - 2065	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2066 - 2066	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2067 - 2067	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2068 - 2068	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2069 - 2069	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2070 - 2070	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2071 - 2071	4.61	0.29	0.33	0.46	0.35	0.35	0.53	0.58	0.55
2072 - 2072	4.61	0.29	0.33	0.46	0.35				

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 1-LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.56	0.0	0.02	0.12	0.14	0.27	0.56	0.37	0.27	0.08	0.0	0.0	0.0
1966 - 1967	3.57	0.23	0.41	0.33	0.25	0.19	0.35	0.66	0.55	0.29	0.22	0.08	0.0
1967 - 1968	3.50	0.14	0.23	0.50	0.23	0.24	0.47	0.45	0.40	0.58	0.16	0.0	0.0
1968 - 1969	4.55	0.03	0.39	0.48	0.32	0.26	0.40	0.69	0.52	0.34	0.53	0.52	0.0
1969 - 1970	4.79	0.14	0.54	0.54	0.22	0.53	0.50	0.63	0.50	0.43	0.26	0.31	0.1
1970 - 1971	3.31	0.13	0.06	0.22	0.12	0.29	0.49	0.62	0.54	0.17	0.20	0.10	0.3
1971 - 1972	5.49	0.37	0.24	0.50	0.44	0.41	0.62	0.62	0.62	0.66	0.47	0.22	0.3
1972 - 1973	6.27	0.46	0.46	0.71	0.60	0.55	0.71	0.62	0.65	0.31	0.41	0.35	0.4
1973 - 1974	5.14	0.28	0.22	0.55	0.62	0.51	0.67	0.61	0.49	0.26	0.22	0.33	0.3
1974 - 1975	5.26	0.32	0.39	0.50	0.58	0.41	0.62	0.57	0.46	0.36	0.33	0.32	0.4
1975 - 1976	5.87	0.65	0.62	0.58	0.53	0.65	0.69	0.46	0.58	0.23	0.19	0.38	0.3
1976 - 1977	3.76	0.32	0.19	0.16	0.06	0.10	0.61	0.59	0.55	0.17	0.22	0.42	0.3
12 YEAR AVERAGES	4.45	0.25	0.31	0.43	0.34	0.37	0.56	0.57	0.51	0.32	0.27	0.25	0.2

VARIANCE IN ENERGY PRODUCTION = 1.275

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 2-LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.71	0.0	0.02	0.12	0.14	0.24	0.45	0.37	0.27	0.07	0.0	0.0	0.0
1966 - 1967	3.13	0.21	0.36	0.33	0.24	0.19	0.32	0.46	0.46	0.27	0.21	0.08	0.0
1967 - 1968	3.02	0.13	0.23	0.42	0.23	0.23	0.37	0.36	0.37	0.42	0.16	0.0	0.0
1968 - 1969	3.83	0.03	0.36	0.44	0.31	0.25	0.32	0.46	0.46	0.31	0.44	0.38	0.5
1969 - 1970	4.14	0.14	0.42	0.46	0.22	0.44	0.44	0.47	0.42	0.39	0.26	0.31	0.1
1970 - 1971	3.00	0.13	0.06	0.22	0.12	0.28	0.46	0.47	0.45	0.17	0.20	0.09	0.3
1971 - 1972	4.62	0.36	0.24	0.47	0.43	0.38	0.50	0.46	0.45	0.46	0.35	0.22	0.3
1972 - 1973	5.06	0.44	0.38	0.50	0.48	0.44	0.50	0.45	0.48	0.28	0.32	0.35	0.4
1973 - 1974	4.36	0.27	0.22	0.44	0.50	0.41	0.49	0.44	0.44	0.26	0.22	0.33	0.3
1974 - 1975	4.56	0.32	0.38	0.45	0.45	0.37	0.48	0.46	0.39	0.31	0.27	0.31	0.3
1975 - 1976	4.74	0.47	0.45	0.46	0.43	0.46	0.50	0.39	0.46	0.23	0.19	0.36	0.3
1976 - 1977	3.23	0.31	0.19	0.16	0.06	0.10	0.46	0.44	0.41	0.16	0.22	0.42	0.3
12 YEAR AVERAGES	3.78	0.23	0.28	0.37	0.30	0.32	0.44	0.44	0.42	0.28	0.24	0.24	0.2

VARIANCE IN ENERGY PRODUCTION = 0.978

CANTON OPERATIONAL STUDY -- ALTERNATIVE NO. 3--LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.96	0.04	0.08	0.19	0.18	0.23	0.41	0.35	0.26	0.12	0.04	0.01	0.0
1966 - 1967	3.11	0.23	0.33	0.33	0.25	0.19	0.30	0.40	0.41	0.26	0.22	0.14	0.0
1967 - 1968	2.98	0.15	0.23	0.38	0.22	0.24	0.33	0.33	0.34	0.38	0.19	0.06	0.1
1968 - 1969	3.61	0.07	0.34	0.39	0.29	0.25	0.29	0.39	0.41	0.30	0.40	0.35	0.1
1969 - 1970	3.90	0.19	0.37	0.41	0.23	0.38	0.39	0.40	0.39	0.36	0.28	0.30	0.2
1970 - 1971	3.04	0.16	0.13	0.21	0.17	0.26	0.41	0.41	0.40	0.19	0.21	0.14	0.3
1971 - 1972	4.22	0.33	0.23	0.41	0.39	0.35	0.43	0.40	0.39	0.39	0.32	0.24	0.3
1972 - 1973	4.49	0.39	0.34	0.43	0.42	0.38	0.43	0.39	0.41	0.26	0.30	0.33	0.4
1973 - 1974	4.06	0.27	0.23	0.38	0.43	0.36	0.43	0.39	0.39	0.26	0.25	0.34	0.3
1974 - 1975	4.22	0.30	0.36	0.41	0.40	0.34	0.42	0.40	0.35	0.29	0.29	0.31	0.3
1975 - 1976	4.34	0.41	0.39	0.41	0.39	0.40	0.43	0.36	0.40	0.24	0.24	0.35	0.3
1976 - 1977	3.26	0.30	0.19	0.18	0.15	0.16	0.41	0.38	0.37	0.19	0.24	0.38	0.3
12 YEAR AVERAGES	3.60	0.24	0.27	0.35	0.29	0.30	0.39	0.38	0.38	0.27	0.25	0.25	0.2

VARIANCE IN ENERGY PRODUCTION = 0.749



CANAL OPERATIONAL STUDY - ALTERNATIVE NO. 4 - LOWER DAM

ELECTRIC PRODUCTION IN BILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	2.05	0.61	0.30	0.20	0.15	0.25	0.51	0.39	0.28	0.12	0.09	0.01	0.0
1966 - 1967	2.50	0.27	0.39	0.27	0.28	0.20	0.55	0.53	0.51	0.30	0.24	0.13	0.0
1967 - 1968	3.48	0.16	0.24	0.46	0.28	0.27	0.41	0.41	0.40	0.48	0.22	0.01	0.1
1968 - 1969	4.52	0.05	0.39	0.87	0.53	0.28	0.55	0.53	0.50	0.35	0.50	0.56	0.1
1969 - 1970	4.56	0.14	0.42	0.50	0.25	0.49	0.47	0.54	0.47	0.43	0.31	0.35	0.2
1970 - 1971	3.45	0.16	0.14	0.23	0.17	0.29	0.50	0.53	0.49	0.20	0.23	0.13	0.3
1971 - 1972	3.12	0.32	0.25	0.50	0.55	0.41	0.55	0.52	0.51	0.53	0.31	0.26	0.3
1972 - 1973	3.54	0.45	0.42	0.57	0.53	0.44	0.57	0.51	0.54	0.30	0.36	0.37	0.4
1973 - 1974	4.57	0.24	0.25	0.48	0.53	0.45	0.56	0.50	0.47	0.28	0.28	0.37	0.3
1974 - 1975	5.05	0.34	0.40	0.48	0.51	0.46	0.54	0.51	0.43	0.34	0.35	0.34	0.4
1975 - 1976	5.37	0.34	0.52	0.52	0.49	0.53	0.57	0.43	0.51	0.25	0.27	0.35	0.3
1976 - 1977	3.82	0.33	0.21	0.16	0.17	0.16	0.52	0.50	0.47	0.21	0.27	0.42	0.3
12 YEAR AVERAGES	4.27	0.28	0.31	0.41	0.35	0.35	0.49	0.49	0.47	0.31	0.29	0.27	0.2

CARIC OPERATIONAL STUDY - ALTERNATIVE NO. 2 - LOW FLOW DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.73	0.21	0.20	0.19	0.11	0.22	0.33	0.32	0.27	0.10	0.00	0.01	0.0
1966 - 1967	2.60	0.23	0.29	0.33	0.24	0.21	0.29	0.30	0.33	0.25	0.24	0.14	0.0
1967 - 1968	2.65	0.14	0.23	0.33	0.24	0.23	0.20	0.28	0.31	0.31	0.19	0.01	0.1
1968 - 1969	3.13	0.25	0.29	0.33	0.29	0.26	0.25	0.30	0.33	0.27	0.33	0.29	0.1
1969 - 1970	3.39	0.19	0.30	0.33	0.25	0.30	0.32	0.31	0.32	0.31	0.20	0.30	0.1
1970 - 1971	2.75	0.16	0.14	0.23	0.18	0.24	0.34	0.31	0.32	0.20	0.23	0.11	0.2
1971 - 1972	3.51	0.31	0.24	0.33	0.34	0.30	0.33	0.30	0.31	0.30	0.23	0.24	0.3
1972 - 1973	3.70	0.32	0.29	0.33	0.33	0.30	0.33	0.31	0.32	0.26	0.27	0.31	0.3
1973 - 1974	3.45	0.21	0.25	0.31	0.33	0.30	0.33	0.31	0.33	0.25	0.24	0.33	0.2
1974 - 1975	3.09	0.31	0.32	0.34	0.33	0.30	0.33	0.31	0.30	0.27	0.23	0.30	0.3
1975 - 1976	3.50	0.32	0.31	0.33	0.33	0.31	0.33	0.31	0.32	0.25	0.24	0.32	0.3
1976 - 1977	2.95	0.29	0.20	0.18	0.17	0.16	0.33	0.30	0.30	0.20	0.23	0.34	0.2
12 YEAR AVERAGES	3.14	0.21	0.24	0.30	0.27	0.26	0.32	0.31	0.31	0.25	0.23	0.22	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 6 - LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.37	0.0	0.0	0.06	0.04	0.14	0.57	0.33	0.11	0.05	0.0	0.0	0.0
1966 - 1967	2.70	0.15	0.30	0.29	0.15	0.01	0.25	0.80	0.55	0.17	0.04	0.0	0.0
1967 - 1968	2.83	0.08	0.08	0.51	0.01	0.13	0.49	0.41	0.35	0.65	0.08	0.0	0.0
1968 - 1969	4.19	0.01	0.38	0.47	0.16	0.09	0.33	0.81	0.52	0.28	0.54	0.58	0.0
1969 - 1970	4.37	0.06	0.62	0.55	0.04	0.55	0.45	0.69	0.52	0.37	0.23	0.20	0.1
1970 - 1971	2.35	0.0	0.0	0.0	0.0	0.20	0.46	0.66	0.57	0.01	0.02	0.09	0.3
1971 - 1972	5.50	0.28	0.07	0.48	0.42	0.34	0.69	0.75	0.69	0.82	0.50	0.14	0.3
1972 - 1973	6.36	0.43	0.43	0.78	0.64	0.61	0.78	0.72	0.72	0.16	0.39	0.26	0.4
1973 - 1974	4.94	0.25	0.03	0.60	0.65	0.51	0.71	0.71	0.49	0.13	0.18	0.33	0.3
1974 - 1975	5.00	0.18	0.36	0.49	0.59	0.44	0.70	0.50	0.40	0.26	0.32	0.22	0.4
1975 - 1976	6.07	0.74	0.71	0.61	0.53	0.80	0.73	0.44	0.60	0.09	0.17	0.34	0.3
1976 - 1977	3.26	0.18	0.07	0.02	0.0	0.06	0.66	0.71	0.58	0.04	0.15	0.41	0.3
12 YEAR AVERAGES	4.07	0.20	0.26	0.40	0.27	0.32	0.57	0.64	0.51	0.25	0.22	0.21	0.2

VARIANCE IN ENERGY PRODUCTION = 1.584

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 7--LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1966 - 1966	1.15	0.0	0.0	0.05	0.04	0.11	0.45	0.33	0.11	0.04	0.0	0.0	0.0
1966 - 1967	2.16	0.12	0.26	0.29	0.15	0.01	0.21	0.46	0.46	0.17	0.04	0.0	0.0
1967 - 1968	2.09	0.08	0.08	0.40	0.01	0.13	0.29	0.29	0.30	0.39	0.08	0.0	0.0
1968 - 1969	3.17	0.01	0.34	0.41	0.15	0.09	0.21	0.46	0.45	0.25	0.45	0.33	0.0
1969 - 1970	3.59	0.06	0.42	0.45	0.04	0.44	0.40	0.47	0.42	0.35	0.23	0.20	0.1
1970 - 1971	2.00	0.0	0.0	0.0	0.0	0.19	0.46	0.48	0.43	0.01	0.02	0.07	0.3
1971 - 1972	4.12	0.27	0.06	0.45	0.42	0.32	0.50	0.47	0.43	0.46	0.28	0.14	0.3
1972 - 1973	4.67	0.41	0.32	0.50	0.48	0.44	0.50	0.46	0.48	0.12	0.24	0.26	0.4
1973 - 1974	3.83	0.25	0.03	0.41	0.50	0.38	0.50	0.44	0.41	0.13	0.18	0.33	0.3
1974 - 1975	4.03	0.18	0.36	0.45	0.45	0.37	0.49	0.47	0.33	0.20	0.25	0.22	0.3
1975 - 1976	4.45	0.48	0.46	0.46	0.41	0.47	0.51	0.35	0.43	0.09	0.17	0.31	0.3
1976 - 1977	2.44	0.18	0.07	0.02	0.0	0.06	0.44	0.43	0.39	0.04	0.15	0.41	0.2
12 YEAR AVERAGES	3.15	0.17	0.20	0.33	0.22	0.25	0.41	0.43	0.39	0.19	0.17	0.19	0.2

VARIANCE IN ENERGY PRODUCTION = 1.144

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. B-LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.43	0.0	0.03	0.11	0.13	0.20	0.26	0.32	0.30	0.07	0.0	0.0	0.0
1966 - 1967	2.57	0.20	0.31	0.26	0.18	0.19	0.24	0.31	0.33	0.26	0.20	0.08	0.0
1967 - 1968	2.41	0.13	0.26	0.26	0.23	0.18	0.23	0.29	0.31	0.31	0.12	0.0	0.0
1968 - 1969	2.70	0.03	0.26	0.26	0.25	0.23	0.22	0.29	0.33	0.27	0.26	0.23	0.0
1969 - 1970	2.92	0.15	0.29	0.26	0.22	0.23	0.25	0.30	0.32	0.31	0.17	0.26	0.1
1970 - 1971	2.38	0.15	0.06	0.22	0.12	0.21	0.26	0.32	0.33	0.20	0.19	0.06	0.2
1971 - 1972	3.14	0.32	0.27	0.26	0.25	0.24	0.26	0.27	0.32	0.28	0.21	0.17	0.2
1972 - 1973	3.25	0.33	0.29	0.25	0.26	0.22	0.25	0.29	0.32	0.29	0.21	0.25	0.2
1973 - 1974	3.01	0.21	0.26	0.25	0.26	0.23	0.26	0.31	0.32	0.27	0.16	0.26	0.2
1974 - 1975	3.23	0.33	0.32	0.26	0.25	0.23	0.26	0.30	0.31	0.29	0.17	0.24	0.2
1975 - 1976	3.19	0.31	0.30	0.26	0.26	0.24	0.26	0.31	0.33	0.26	0.14	0.26	0.2
1976 - 1977	2.43	0.31	0.21	0.15	0.06	0.07	0.26	0.28	0.29	0.18	0.15	0.26	0.2
12 YEAR AVERAGES	2.72	0.21	0.24	0.23	0.21	0.21	0.25	0.30	0.32	0.25	0.17	0.17	0.1

VARIANCE IN ENERGY PRODUCTION = 0.528

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 9-LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER	YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966		2.11	0.04	0.08	0.12	0.19	0.25	0.51	0.36	0.26	0.13	0.04	0.01	0.0
1966 - 1967		3.54	0.26	0.38	0.33	0.27	0.19	0.34	0.57	0.51	0.28	0.23	0.14	0.0
1967 - 1968		3.43	0.16	0.23	0.46	0.22	0.25	0.43	0.41	0.38	0.51	0.20	0.06	0.1
1968 - 1969		4.33	0.07	0.38	0.45	0.31	0.25	0.36	0.59	0.48	0.34	0.49	0.47	0.1
1969 - 1970		4.57	0.19	0.49	0.49	0.23	0.49	0.46	0.56	0.46	0.41	0.28	0.30	0.2
1970 - 1971		3.38	0.16	0.13	0.21	0.17	0.28	0.47	0.55	0.49	0.19	0.21	0.16	0.3
1971 - 1972		5.09	0.35	0.24	0.47	0.42	0.39	0.56	0.55	0.54	0.57	0.43	0.24	0.3
1972 - 1973		5.64	0.42	0.42	0.62	0.54	0.49	0.62	0.54	0.57	0.29	0.38	0.34	0.4
1973 - 1974		4.82	0.28	0.23	0.49	0.56	0.46	0.59	0.54	0.45	0.26	0.26	0.34	0.3
1974 - 1975		4.93	0.31	0.37	0.46	0.52	0.39	0.56	0.51	0.43	0.33	0.34	0.32	0.3
1975 - 1976		5.41	0.57	0.54	0.52	0.48	0.57	0.61	0.42	0.52	0.24	0.24	0.37	0.3
1976 - 1977		3.76	0.31	0.19	0.18	0.15	0.17	0.54	0.53	0.50	0.20	0.25	0.39	0.3
12 YEAR AVERAGES		4.25	0.26	0.31	0.41	0.34	0.35	0.50	0.51	0.47	0.31	0.28	0.26	0.2

VARIANCE IN ENERGY PRODUCTION = 1.029

CALL TO OPERATIONAL STUDY - ALTERNATIVE NO. 10 - LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1955 - 1956	1.90	0.10	0.02	0.13	0.14	0.27	0.58	0.38	0.28	0.07	0.0	0.0	0.0
1966 - 1967	3.63	0.24	0.42	0.36	0.25	0.13	0.35	0.71	0.58	0.28	0.21	0.05	0.0
1967 - 1968	3.61	0.15	0.27	0.53	0.29	0.23	0.50	0.48	0.42	0.63	0.14	0.0	0.0
1968 - 1969	4.76	0.03	0.40	0.50	0.33	0.28	0.42	0.74	0.54	0.35	0.55	0.55	0.0
1969 - 1970	4.96	0.15	0.55	0.56	0.22	0.55	0.51	0.67	0.52	0.44	0.25	0.35	0.1
1970 - 1971	5.30	0.12	0.35	0.22	0.03	0.27	0.51	0.65	0.57	0.15	0.20	0.19	0.3
1971 - 1972	5.74	0.38	0.25	0.31	0.46	0.62	0.65	0.67	0.65	0.72	0.50	0.20	0.3
1972 - 1973	6.50	0.05	0.41	0.75	0.63	0.57	0.75	0.66	0.68	0.32	0.42	0.37	0.4
1973 - 1974	5.34	0.25	0.23	0.58	0.65	0.53	0.79	0.65	0.51	0.26	0.22	0.37	0.3
1974 - 1975	5.53	0.33	0.40	0.51	0.61	0.44	0.67	0.59	0.48	0.37	0.34	0.33	0.4
1975 - 1976	5.23	0.09	0.65	0.61	0.56	0.70	0.72	0.48	0.61	0.24	0.20	0.40	0.3
1976 - 1977	3.79	0.33	0.19	0.15	0.04	0.36	0.65	0.65	0.57	0.14	0.20	0.41	0.3
17 YEAR AVERAGES	4.61	0.25	0.33	0.45	0.35	0.38	0.58	0.61	0.54	0.33	0.27	0.26	0.2

REPLACE IN ENERGY PRODUCTION = 1.373

REACTOR OPERATIONAL STORY - ALTERNATIVE REACTOR-LOCFE-DAR

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1966 - 1966	1.88	0.0	0.02	0.13	0.14	0.23	0.31	0.37	0.28	0.06	0.0	0.0	0.0
1966 - 1967	2.37	0.29	0.34	0.36	0.22	0.18	0.29	0.33	0.41	0.25	0.20	0.35	0.0
1967 - 1968	3.75	0.13	0.22	0.35	0.24	0.21	0.32	0.35	0.35	0.37	0.13	0.0	0.0
1968 - 1969	3.92	0.13	0.33	0.40	0.39	0.27	0.29	0.38	0.41	0.30	0.40	0.32	0.0
1969 - 1970	3.79	0.15	0.30	0.41	0.22	0.33	0.39	0.39	0.39	0.35	0.25	0.33	0.1
1970 - 1971	2.70	0.12	0.05	0.22	0.08	0.26	0.41	0.40	0.40	0.15	0.29	0.08	0.5
1971 - 1972	4.19	0.33	0.24	0.41	0.40	0.36	0.42	0.39	0.39	0.38	0.30	0.20	0.3
1972 - 1973	4.45	0.40	0.34	0.42	0.42	0.38	0.42	0.39	0.41	0.27	0.27	0.34	0.4
1973 - 1974	3.93	0.22	0.23	0.32	0.42	0.36	0.42	0.38	0.40	0.26	0.22	0.37	0.3
1974 - 1975	4.27	0.33	0.35	0.41	0.40	0.36	0.42	0.40	0.35	0.29	0.24	0.32	0.3
1975 - 1976	4.31	0.40	0.34	0.41	0.40	0.34	0.42	0.37	0.40	0.24	0.19	0.37	0.3
1976 - 1977	2.96	0.32	0.19	0.15	0.34	0.05	0.40	0.38	0.35	0.13	0.19	0.41	0.2
12 YEAR AVERAGE	3.65	0.22	0.26	0.34	0.27	0.29	0.36	0.38	0.38	0.25	0.22	0.23	0.2

VIARIANCE IN ENERGY PRODUCTION = 0.865



CANYON OPERATIONAL STUDY - ALTERNATIVE NO. 1 - LOWER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.24	0.02	0.07	0.14	0.14	0.14	0.17	0.21	0.21	0.11	0.00	0.01	0.0
1966 - 1967	2.01	0.20	0.21	0.17	0.17	0.16	0.17	0.20	0.21	0.20	0.17	0.13	0.0
1967 - 1968	1.85	0.11	0.20	0.17	0.17	0.16	0.17	0.20	0.21	0.20	0.15	0.01	0.1
1968 - 1969	1.92	0.05	0.20	0.17	0.17	0.16	0.17	0.19	0.21	0.20	0.17	0.17	0.1
1969 - 1970	2.12	0.15	0.20	0.17	0.17	0.16	0.17	0.20	0.21	0.21	0.10	0.17	0.1
1970 - 1971	1.99	0.17	0.16	0.17	0.16	0.16	0.17	0.21	0.21	0.18	0.16	0.07	0.1
1971 - 1972	2.17	0.21	0.21	0.17	0.17	0.16	0.17	0.18	0.21	0.18	0.16	0.15	0.1
1972 - 1973	2.20	0.21	0.20	0.17	0.17	0.15	0.17	0.19	0.21	0.20	0.17	0.17	0.1
1973 - 1974	2.15	0.15	0.20	0.17	0.17	0.15	0.17	0.20	0.21	0.20	0.10	0.17	0.1
1974 - 1975	2.20	0.21	0.21	0.17	0.17	0.15	0.17	0.19	0.21	0.21	0.15	0.17	0.1
1975 - 1976	2.20	0.21	0.20	0.17	0.17	0.16	0.17	0.20	0.21	0.20	0.15	0.17	0.1
1976 - 1977	2.06	0.21	0.15	0.14	0.16	0.14	0.17	0.18	0.20	0.20	0.10	0.17	0.1
12 YEAR AVERAGES	2.02	0.15	0.18	0.17	0.17	0.15	0.17	0.20	0.21	0.19	0.15	0.13	0.1

VARIANCE IN ENERGY PRODUCTION = 0.268

PART 2

SELECTED CASES WITH PARTIAL DIVERSION OF FLOW

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.1-UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.56	0.0	0.01	0.06	0.07	0.19	0.60	0.29	0.24	0.07	0.0	0.0	0.0
1966 - 1967	2.62	0.27	0.46	0.30	0.21	0.07	0.26	0.91	0.69	0.28	0.16	0.01	0.0
1967 - 1968	3.65	0.16	0.14	0.57	0.13	0.17	0.54	0.47	0.46	0.83	0.12	0.0	0.0
1968 - 1969	5.29	0.03	0.45	0.51	0.31	0.21	0.37	0.95	0.66	0.39	0.67	0.70	0.0
1969 - 1970	5.45	0.13	0.75	0.61	0.17	0.66	0.46	0.79	0.63	0.51	0.24	0.31	0.1
1970 - 1971	3.10	0.10	0.01	0.03	0.02	0.22	0.45	0.73	0.71	0.12	0.18	0.11	0.4
1971 - 1972	6.61	0.42	0.18	0.52	0.49	0.44	0.74	0.83	0.87	0.99	0.63	0.17	0.3
1972 - 1973	7.80	0.55	0.57	0.92	0.76	0.70	0.90	0.82	0.88	0.34	0.49	0.39	0.4
1973 - 1974	6.03	0.29	0.21	0.67	0.80	0.63	0.78	0.79	0.60	0.24	0.20	0.37	0.4
1974 - 1975	6.15	0.37	0.42	0.53	0.74	0.47	0.78	0.65	0.54	0.40	0.40	0.32	0.5
1975 - 1976	7.30	0.92	0.86	0.69	0.67	0.93	0.83	0.46	0.76	0.21	0.19	0.43	0.3
1976 - 1977	4.11	0.34	0.18	0.04	0.01	0.06	0.73	0.81	0.72	0.11	0.20	0.41	0.4
12 YEAR AVERAGES	5.06	0.30	0.35	0.45	0.37	0.40	0.62	0.71	0.65	0.37	0.29	0.27	0.2

VARIANCE IN ENERGY PRODUCTION = 1.865

2-42" Leftel

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.45	0.0	0.01	0.06	0.07	0.16	0.53	0.24	0.24	0.06	0.0	0.0	0.0
1966 - 1967	3.21	0.24	0.43	0.50	0.21	0.07	0.23	0.67	0.61	0.27	0.16	0.01	0.0
1967 - 1968	3.06	0.15	0.14	0.48	0.13	0.17	0.38	0.39	0.43	0.61	0.12	0.0	0.0
1968 - 1969	4.49	0.03	0.41	0.47	0.31	0.21	0.28	0.70	0.60	0.36	0.58	0.50	0.0
1969 - 1970	4.85	0.13	0.59	0.53	0.17	0.57	0.44	0.64	0.55	0.49	0.24	0.31	0.1
1970 - 1971	2.84	0.10	0.01	0.03	0.02	0.21	0.45	0.61	0.59	0.12	0.18	0.10	0.4
1971 - 1972	5.51	0.41	0.17	0.50	0.48	0.43	0.60	0.62	0.64	0.69	0.45	0.17	0.3
1972 - 1973	6.47	0.53	0.47	0.72	0.63	0.56	0.71	0.62	0.68	0.31	0.37	0.39	0.4
1973 - 1974	5.23	0.28	0.21	0.52	0.67	0.52	0.66	0.61	0.54	0.24	0.20	0.37	0.4
1974 - 1975	5.42	0.37	0.42	0.50	0.61	0.42	0.61	0.56	0.48	0.35	0.33	0.32	0.4
1975 - 1976	6.02	0.70	0.65	0.58	0.57	0.66	0.69	0.39	0.63	0.21	0.19	0.41	0.3
1976 - 1977	3.50	0.34	0.18	0.04	0.01	0.06	0.57	0.59	0.57	0.11	0.20	0.41	0.4
12 YEAR AVERAGES	4.34	0.27	0.31	0.39	0.32	0.34	0.51	0.56	0.55	0.32	0.25	0.25	0.2

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AVG	SEPT
1965 - 1966	1.17	0.0	0.01	0.06	0.07	0.11	0.34	0.27	0.24	0.04	0.0	0.0	0.0
1966 - 1967	2.25	0.19	0.30	0.29	0.16	0.07	0.16	0.35	0.36	0.20	0.15	0.01	0.0
1967 - 1968	2.09	0.13	0.14	0.33	0.13	0.13	0.22	0.23	0.32	0.35	0.09	0.0	0.0
1968 - 1969	2.90	0.03	0.29	0.34	0.25	0.19	0.15	0.35	0.36	0.25	0.36	0.28	0.0
1969 - 1970	3.32	0.13	0.33	0.36	0.17	0.33	0.30	0.35	0.36	0.34	0.20	0.31	0.1
1970 - 1971	2.05	0.10	0.01	0.03	0.02	0.17	0.34	0.35	0.36	0.12	0.18	0.07	0.2
1971 - 1972	3.67	0.33	0.15	0.35	0.36	0.30	0.36	0.35	0.36	0.35	0.25	0.15	0.3
1972 - 1973	3.91	0.36	0.28	0.36	0.36	0.33	0.36	0.35	0.36	0.24	0.22	0.32	0.3
1973 - 1974	3.48	0.20	0.21	0.30	0.36	0.32	0.36	0.34	0.36	0.22	0.18	0.36	0.2
1974 - 1975	3.85	0.34	0.35	0.36	0.36	0.33	0.36	0.35	0.30	0.25	0.21	0.29	0.3
1975 - 1976	3.81	0.36	0.35	0.35	0.36	0.34	0.36	0.27	0.36	0.20	0.16	0.34	0.3
1976 - 1977	2.41	0.30	0.18	0.04	0.01	0.05	0.32	0.33	0.32	0.10	0.17	0.35	0.2
12 YEAR AVERAGES	2.91	0.21	0.22	0.27	0.22	0.22	0.30	0.33	0.34	0.22	0.18	0.21	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.4-UPPER DAM

1- OSBERGER

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.47	0.02	0.05	0.11	0.15	0.18	0.30	0.27	0.26	0.10	0.00	0.00	0.0
1966 - 1967	2.53	0.22	0.28	0.28	0.21	0.16	0.19	0.30	0.31	0.24	0.21	0.11	0.0
1967 - 1968	2.35	0.14	0.21	0.30	0.21	0.19	0.22	0.23	0.29	0.30	0.16	0.01	0.0
1968 - 1969	2.85	0.06	0.27	0.30	0.26	0.22	0.17	0.30	0.31	0.26	0.31	0.27	0.1
1969 - 1970	3.14	0.19	0.28	0.31	0.22	0.28	0.27	0.30	0.31	0.30	0.22	0.28	0.1
1970 - 1971	2.43	0.17	0.11	0.15	0.14	0.21	0.30	0.30	0.31	0.19	0.20	0.09	0.2
1971 - 1972	3.37	0.30	0.22	0.30	0.31	0.27	0.31	0.30	0.31	0.30	0.25	0.21	0.2
1972 - 1973	3.48	0.31	0.27	0.31	0.31	0.28	0.31	0.30	0.31	0.25	0.24	0.29	0.3
1973 - 1974	3.24	0.21	0.23	0.28	0.31	0.28	0.31	0.29	0.31	0.24	0.21	0.31	0.2
1974 - 1975	3.45	0.30	0.30	0.31	0.31	0.28	0.31	0.30	0.29	0.26	0.23	0.27	0.3
1975 - 1976	3.42	0.31	0.30	0.30	0.31	0.29	0.31	0.27	0.31	0.24	0.20	0.30	0.2
1976 - 1977	2.62	0.28	0.19	0.11	0.12	0.11	0.29	0.29	0.29	0.19	0.20	0.31	0.2
12 YEAR AVERAGES	2.86	0.21	0.23	0.25	0.24	0.23	0.27	0.29	0.30	0.24	0.20	0.20	0.2

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.78	0.02	0.05	0.11	0.16	0.23	0.48	0.30	0.28	0.12	0.00	0.00	0.0
1966 - 1967	3.47	0.29	0.41	0.30	0.27	0.16	0.26	0.58	0.55	0.31	0.22	0.11	0.0
1967 - 1968	3.31	0.17	0.23	0.44	0.22	0.24	0.37	0.38	0.42	0.54	0.19	0.01	0.1
1968 - 1969	4.40	0.07	0.41	0.44	0.32	0.25	0.28	0.60	0.54	0.38	0.52	0.46	0.1
1969 - 1970	4.74	0.20	0.52	0.49	0.22	0.51	0.43	0.57	0.50	0.45	0.30	0.32	0.2
1970 - 1971	3.29	0.17	0.11	0.15	0.14	0.27	0.44	0.55	0.53	0.19	0.21	0.12	0.4
1971 - 1972	5.30	0.41	0.24	0.48	0.47	0.41	0.54	0.55	0.56	0.59	0.42	0.25	0.3
1972 - 1973	5.93	0.50	0.45	0.62	0.56	0.51	0.61	0.54	0.60	0.31	0.37	0.38	0.4
1973 - 1974	5.04	0.32	0.24	0.48	0.59	0.47	0.58	0.53	0.50	0.29	0.27	0.36	0.4
1974 - 1975	5.16	0.36	0.41	0.46	0.54	0.40	0.54	0.51	0.46	0.36	0.34	0.34	0.4
1975 - 1976	5.59	0.61	0.57	0.52	0.51	0.57	0.60	0.39	0.55	0.26	0.24	0.40	0.3
1976 - 1977	3.77	0.36	0.20	0.11	0.12	0.13	0.52	0.53	0.51	0.21	0.25	0.44	0.3
12 YEAR AVERAGES	4.32	0.29	0.32	0.38	0.34	0.35	0.47	0.50	0.50	0.33	0.28	0.26	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.6-UPPER DAM

1-AC 1250mm + 1-AC 2000mm

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.89	0.90	0.03	0.11	0.15	0.27	0.57	0.33	0.30	0.10	0.0	0.0	0.0
1966 - 1967	3.97	0.30	0.47	0.32	0.29	0.18	0.30	0.77	0.67	0.35	0.23	0.10	0.0
1967 - 1968	3.80	0.18	0.25	0.53	0.23	0.25	0.46	0.45	0.47	0.69	0.18	0.0	0.1
1968 - 1969	5.16	0.04	0.47	0.51	0.35	0.26	0.33	0.80	0.63	0.43	0.63	0.60	0.1
1969 - 1970	5.45	0.19	0.65	0.58	0.24	0.62	0.48	0.71	0.60	0.53	0.30	0.34	0.2
1970 - 1971	3.61	0.15	0.08	0.15	0.13	0.31	0.48	0.68	0.65	0.20	0.20	0.12	0.4
1971 - 1972	6.34	0.46	0.26	0.54	0.52	0.46	0.67	0.71	0.73	0.79	0.54	0.26	0.4
1972 - 1973	7.24	0.56	0.54	0.81	0.70	0.63	0.79	0.70	0.77	0.36	0.46	0.41	0.5
1973 - 1974	5.93	0.34	0.24	0.59	0.73	0.57	0.73	0.68	0.59	0.31	0.27	0.40	0.4
1974 - 1975	6.04	0.39	0.46	0.53	0.67	0.46	0.68	0.61	0.54	0.42	0.39	0.37	0.5
1975 - 1976	6.80	0.79	0.74	0.64	0.62	0.75	0.76	0.46	0.69	0.28	0.23	0.44	0.4
1976 - 1977	4.26	0.39	0.21	0.10	0.08	0.08	0.66	0.68	0.66	0.23	0.25	0.48	0.4
12 YEAR AVERAGES	5.04	0.32	0.37	0.45	0.39	0.40	0.57	0.63	0.61	0.39	0.31	0.29	0.3



CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 7-UPPER DAM

1-AC 1250 mm

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.20	0.00	0.02	0.09	0.13	0.17	0.24	0.22	0.23	0.07	0.0	0.0	0.0
1966 - 1967	2.15	0.18	0.23	0.24	0.18	0.17	0.17	0.23	0.24	0.21	0.20	0.10	0.0
1967 - 1968	1.95	0.11	0.20	0.24	0.21	0.16	0.17	0.19	0.24	0.23	0.12	0.0	0.0
1968 - 1969	2.26	0.03	0.21	0.24	0.23	0.21	0.11	0.23	0.24	0.22	0.24	0.22	0.0
1969 - 1970	2.48	0.15	0.22	0.24	0.21	0.22	0.21	0.23	0.24	0.23	0.16	0.24	0.1
1970 - 1971	2.02	0.14	0.08	0.15	0.12	0.18	0.24	0.23	0.24	0.18	0.17	0.06	0.2
1971 - 1972	2.68	0.24	0.21	0.24	0.24	0.22	0.24	0.23	0.24	0.23	0.20	0.17	0.2
1972 - 1973	2.75	0.24	0.22	0.24	0.24	0.22	0.24	0.23	0.24	0.23	0.20	0.23	0.2
1973 - 1974	2.56	0.16	0.20	0.21	0.24	0.22	0.24	0.23	0.24	0.22	0.16	0.24	0.2
1974 - 1975	2.71	0.24	0.23	0.24	0.24	0.22	0.24	0.23	0.24	0.22	0.16	0.22	0.2
1975 - 1976	2.68	0.24	0.23	0.24	0.24	0.22	0.24	0.22	0.24	0.22	0.13	0.24	0.2
1976 - 1977	2.07	0.24	0.16	0.10	0.08	0.04	0.23	0.23	0.23	0.19	0.15	0.24	0.1
12 YEAR AVERAGES	2.29	0.16	0.19	0.20	0.20	0.19	0.21	0.23	0.24	0.20	0.16	0.16	0.1

CANTON OPERATIONAL STUDY - ALTERNATIVE NO.13 UPPER DAM

1-AG 2000 mm

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.35	0.0	0.01	0.07	0.07	0.14	0.47	0.28	0.22	0.05	0.0	0.0	0.0
1966 - 1967	2.58	0.22	0.40	0.30	0.19	0.06	0.20	0.57	0.56	0.25	0.13	0.0	0.0
1967 - 1968	2.74	0.15	0.14	0.44	0.10	0.16	0.33	0.33	0.41	0.54	0.0	0.0	0.0
1968 - 1969	4.07	0.04	0.41	0.46	0.26	0.19	0.24	0.59	0.55	0.34	0.52	0.42	0.0
1969 - 1970	4.55	0.12	0.52	0.51	0.16	0.52	0.42	0.57	0.52	0.46	0.27	0.31	0.1
1970 - 1971	2.67	0.05	0.01	0.03	0.02	0.22	0.44	0.56	0.54	0.12	0.17	0.09	0.4
1971 - 1972	5.20	0.42	0.15	0.49	0.50	0.41	0.56	0.56	0.56	0.58	0.38	0.18	0.4
1972 - 1973	5.83	0.53	0.43	0.61	0.57	0.52	0.60	0.55	0.59	0.23	0.30	0.38	0.5
1973 - 1974	4.91	0.30	0.19	0.47	0.59	0.48	0.58	0.52	0.52	0.24	0.23	0.40	0.3
1974 - 1975	5.18	0.38	0.45	0.48	0.54	0.42	0.55	0.52	0.43	0.31	0.30	0.33	0.4
1975 - 1976	5.51	0.60	0.57	0.53	0.52	0.56	0.60	0.37	0.56	0.19	0.20	0.42	0.4
1976 - 1977	3.25	0.35	0.17	0.03	0.0	0.07	0.50	0.51	0.49	0.09	0.19	0.47	0.3
12 YEAR AVERAGES	4.01	0.26	0.29	0.37	0.29	0.31	0.46	0.49	0.50	0.28	0.23	0.25	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 1-LOWER DAM

1-leaflet 42" + 1-leaflet 60"

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.32	0.0	0.01	0.06	0.06	0.19	0.46	0.24	0.20	0.06	0.0	0.0	0.0
1966 - 1967	2.85	0.21	0.37	0.25	0.18	0.07	0.20	0.63	0.52	0.24	0.15	0.01	0.0
1967 - 1968	2.78	0.13	0.14	0.43	0.13	0.16	0.37	0.34	0.36	0.57	0.11	0.0	0.0
1968 - 1969	3.97	0.03	0.34	0.40	0.26	0.19	0.27	0.66	0.49	0.31	0.50	0.48	0.0
1969 - 1970	4.16	0.12	0.53	0.46	0.15	0.49	0.37	0.57	0.46	0.40	0.21	0.25	0.1
1970 - 1971	2.51	0.10	0.03	0.05	0.02	0.19	0.36	0.54	0.52	0.13	0.16	0.08	0.3
1971 - 1972	4.91	0.35	0.17	0.42	0.39	0.35	0.54	0.57	0.60	0.66	0.44	0.14	0.2
1972 - 1973	5.80	0.44	0.42	0.67	0.57	0.51	0.65	0.56	0.63	0.28	0.36	0.31	0.4
1973 - 1974	4.58	0.24	0.18	0.48	0.60	0.47	0.59	0.56	0.46	0.22	0.17	0.28	0.3
1974 - 1975	4.68	0.30	0.34	0.40	0.55	0.35	0.57	0.48	0.42	0.32	0.30	0.26	0.3
1975 - 1976	5.38	0.63	0.60	0.52	0.50	0.64	0.62	0.35	0.56	0.19	0.15	0.34	0.2
1976 - 1977	3.13	0.29	0.15	0.03	0.02	0.05	0.53	0.55	0.51	0.10	0.17	0.35	0.3
12 YEAR AVERAGES	3.8*	0.24	0.27	0.35	0.29	0.30	0.46	0.50	0.48	0.29	0.23	0.21	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 2-LOWER DAM

2-letted 42"

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.22	0.0	0.01	0.05	0.08	0.16	0.40	0.24	0.20	0.05	0.0	0.0	0.0
1966 - 1967	2.49	0.19	0.33	0.25	0.17	0.07	0.18	0.45	0.44	0.23	0.15	0.01	0.0
1967 - 1968	2.36	0.12	0.14	0.37	0.13	0.15	0.27	0.28	0.33	0.42	0.11	0.0	0.0
1968 - 1969	3.36	0.03	0.31	0.36	0.25	0.19	0.20	0.46	0.44	0.29	0.43	0.35	0.0
1969 - 1970	3.68	0.12	0.41	0.40	0.15	0.42	0.34	0.46	0.40	0.37	0.21	0.25	0.1
1970 - 1971	2.29	0.10	0.03	0.05	0.02	0.18	0.36	0.44	0.43	0.12	0.16	0.07	0.3
1971 - 1972	4.14	0.33	0.16	0.40	0.38	0.34	0.45	0.43	0.44	0.46	0.32	0.14	0.2
1972 - 1973	4.78	0.42	0.34	0.50	0.46	0.42	0.50	0.43	0.47	0.25	0.27	0.31	0.4
1973 - 1974	3.94	0.23	0.18	0.38	0.49	0.39	0.47	0.42	0.41	0.22	0.17	0.28	0.3
1974 - 1975	4.11	0.30	0.33	0.38	0.44	0.31	0.45	0.41	0.37	0.28	0.25	0.26	0.3
1975 - 1976	4.41	0.47	0.45	0.43	0.42	0.46	0.49	0.30	0.45	0.19	0.15	0.32	0.2
1976 - 1977	2.68	0.29	0.15	0.03	0.02	0.05	0.42	0.41	0.39	0.10	0.17	0.35	0.3
12 YEAR AVERAGES	3.29	0.22	0.24	0.30	0.25	0.26	0.38	0.39	0.40	0.25	0.20	0.20	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 3-LOWER DAM

2-OSSBERGER

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.42	0.02	0.04	0.09	0.13	0.18	0.35	0.24	0.22	0.10	0.00	0.00	0.0
1966 - 1967	2.63	0.22	0.30	0.24	0.21	0.13	0.20	0.39	0.40	0.24	0.18	0.09	0.0
1967 - 1968	2.49	0.14	0.19	0.33	0.18	0.19	0.27	0.27	0.32	0.37	0.15	0.01	0.0
1968 - 1969	3.25	0.05	0.31	0.34	0.25	0.20	0.21	0.40	0.39	0.28	0.38	0.33	0.1
1969 - 1970	3.56	0.16	0.36	0.37	0.18	0.37	0.32	0.40	0.37	0.34	0.24	0.26	0.1
1970 - 1971	2.54	0.14	0.09	0.12	0.11	0.21	0.34	0.39	0.38	0.16	0.17	0.09	0.3
1971 - 1972	3.92	0.32	0.19	0.37	0.36	0.31	0.40	0.38	0.39	0.39	0.30	0.20	0.3
1972 - 1973	4.32	0.38	0.32	0.43	0.41	0.37	0.43	0.38	0.41	0.24	0.27	0.30	0.3
1973 - 1974	3.77	0.25	0.19	0.35	0.43	0.34	0.41	0.37	0.37	0.23	0.21	0.29	0.3
1974 - 1975	3.88	0.29	0.33	0.35	0.39	0.30	0.40	0.37	0.33	0.27	0.26	0.27	0.3
1975 - 1976	4.08	0.41	0.39	0.38	0.37	0.40	0.43	0.29	0.39	0.21	0.20	0.31	0.3
1976 - 1977	2.83	0.28	0.16	0.09	0.10	0.11	0.37	0.36	0.36	0.17	0.20	0.35	0.2
12 YEAR AVERAGES	3.22	0.22	0.24	0.29	0.26	0.26	0.34	0.35	0.36	0.25	0.21	0.21	0.2

CANTON OPERATIONAL STUDY - ALTERNATIVE NO. 4-LOWER DAM

1-AC 1250 + 1 AC 2000

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.49	0.00	0.02	0.09	0.13	0.21	0.43	0.27	0.24	0.08	0.0	0.0	0.0
1966 - 1967	3.03	0.24	0.36	0.26	0.23	0.14	0.23	0.52	0.49	0.27	0.19	0.08	0.0
1967 - 1968	2.85	0.14	0.20	0.40	0.19	0.20	0.33	0.32	0.36	0.48	0.15	0.0	0.0
1968 - 1969	3.84	0.04	0.36	0.39	0.28	0.21	0.23	0.54	0.48	0.33	0.47	0.42	0.1
1969 - 1970	4.13	0.16	0.46	0.44	0.19	0.46	0.37	0.50	0.44	0.40	0.25	0.28	0.1
1970 - 1971	2.80	0.12	0.07	0.13	0.11	0.24	0.38	0.49	0.47	0.17	0.16	0.09	0.3
1971 - 1972	4.67	0.36	0.21	0.42	0.41	0.36	0.49	0.49	0.50	0.52	0.38	0.21	0.3
1972 - 1973	5.29	0.44	0.39	0.57	0.51	0.46	0.56	0.48	0.53	0.27	0.33	0.33	0.4
1973 - 1974	4.45	0.27	0.20	0.43	0.53	0.42	0.53	0.47	0.44	0.25	0.22	0.32	0.3
1974 - 1975	4.56	0.31	0.36	0.41	0.49	0.36	0.49	0.45	0.40	0.31	0.29	0.29	0.3
1975 - 1976	4.97	0.54	0.51	0.47	0.46	0.52	0.55	0.34	0.49	0.23	0.20	0.35	0.3
1976 - 1977	3.26	0.31	0.17	0.09	0.11	0.09	0.47	0.46	0.46	0.18	0.21	0.38	0.3
12 YEAR AVERAGES	3.78	0.24	0.28	0.34	0.30	0.31	0.42	0.44	0.44	0.29	0.24	0.23	0.2

CANYON OPERATIONAL STUDY - ALTERNATIVE NO. 5-LOWER DAM

2-AC 1250 mm

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966	1.31	0.00	0.02	0.09	0.13	0.17	0.31	0.26	0.24	0.07	0.0	0.0	0.0
1966 - 1967	2.42	0.21	0.28	0.26	0.20	0.15	0.19	0.31	0.33	0.23	0.19	0.08	0.0
1967 - 1968	2.22	0.12	0.19	0.30	0.19	0.17	0.22	0.22	0.29	0.30	0.13	0.0	0.0
1968 - 1969	2.81	0.04	0.26	0.31	0.24	0.21	0.15	0.30	0.33	0.26	0.33	0.28	0.0
1969 - 1970	3.13	0.16	0.29	0.32	0.20	0.30	0.27	0.31	0.32	0.30	0.22	0.27	0.1
1970 - 1971	2.29	0.13	0.07	0.13	0.11	0.21	0.31	0.32	0.32	0.17	0.17	0.07	0.2
1971 - 1972	3.44	0.30	0.20	0.32	0.33	0.28	0.33	0.31	0.31	0.30	0.25	0.20	0.3
1972 - 1973	3.61	0.32	0.27	0.33	0.33	0.30	0.33	0.30	0.32	0.23	0.24	0.28	0.3
1973 - 1974	3.29	0.21	0.20	0.29	0.34	0.29	0.33	0.30	0.32	0.23	0.20	0.31	0.2
1974 - 1975	3.50	0.29	0.31	0.32	0.33	0.29	0.32	0.31	0.29	0.25	0.21	0.27	0.3
1975 - 1976	3.50	0.32	0.31	0.32	0.32	0.31	0.33	0.26	0.32	0.22	0.18	0.31	0.3
1976 - 1977	2.54	0.28	0.17	0.09	0.11	0.08	0.31	0.29	0.29	0.17	0.18	0.33	0.2
12 YEAR AVERAGES	2.84	0.20	0.22	0.26	0.24	0.23	0.28	0.29	0.31	0.23	0.19	0.20	0.2

APPENDIX I

OPTIONS 2 & 3 - ENERGY SUPPLY/USE STUDIES  
COMPUTER PRINTOUT



CANTON LOAD STUDY - ALTERNATIVE NO.1-UPPER DAM

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966													
PRODUCTION	2,3314	0.0	0.0265	0.1504	0.1600	0.3483	0.7454	0.4596	0.3194	0.0891	0.0	0.0	0.0328
SURPLUS	1.3728	0.0000	0.0118	0.0468	0.0574	0.1302	0.5318	0.3245	0.1856	0.0661	0.0	0.0000	0.0187
UTILIZED	0.9587	0.0000	0.0147	0.1036	0.1026	0.2181	0.2136	0.1351	0.1338	0.0230	0.0	0.0000	0.0141
BACKUP	1.0125	0.1097	0.1463	0.1124	0.1431	0.0808	0.0049	0.0042	0.0114	0.1020	0.0927	0.0872	0.1176
LOAD	1.9710	0.1097	0.1610	0.2160	0.2457	0.2990	0.2185	0.1393	0.1452	0.1251	0.0927	0.0872	0.1316
BACKUP DEMAND (KW)		760.8	861.9	1160.3	1152.6	977.8	569.2	393.0	735.7	671.4	509.5	345.6	819.2
DAYS BKUP REQ	302	31	29	30	22	19	16	14	22	27	31	31	30
1966 - 1967													
PRODUCTION	4.5564	0.2946	0.5303	0.4045	0.3016	0.2147	0.4387	0.9859	0.7363	0.3369	0.2538	0.0593	0.0
SURPLUS	3.1290	0.2266	0.3733	0.2044	0.1373	0.0343	0.2624	0.8496	0.5895	0.2349	0.1811	0.0357	0.0000
UTILIZED	1.4275	0.0680	0.1570	0.2000	0.1642	0.1804	0.1763	0.1363	0.1468	0.1020	0.0727	0.0237	0.0000
BACKUP	0.5413	0.0417	0.0041	0.0113	0.0867	0.1186	0.0422	0.0	0.0010	0.0230	0.0200	0.0636	0.1291
LOAD	1.9687	0.1097	0.1610	0.2114	0.2509	0.2990	0.2185	0.1363	0.1478	0.1251	0.0927	0.0872	0.1291
BACKUP DEMAND (KW)		760.8	397.3	671.0	1152.6	1240.3	1058.5	0.0	246.3	671.4	509.5	345.6	819.2
DAYS BKUP REQ	220	23	12	12	21	23	21	0	6	19	24	29	30
1967 - 1968													
PRODUCTION	4.5799	0.1753	0.2602	0.6692	0.2812	0.2843	0.6561	0.6112	0.5240	0.8457	0.1767	0.0	0.0962
SURPLUS	3.1651	0.1314	0.1336	0.4687	0.0850	0.0985	0.4710	0.4774	0.3792	0.7257	0.1380	0.0000	0.0565
UTILIZED	1.4143	0.0439	0.1265	0.2005	0.1962	0.1858	0.1851	0.1338	0.1448	0.1200	0.0386	0.0000	0.0397
BACKUP	0.5643	0.0681	0.0345	0.0062	0.0599	0.1255	0.0254	0.0084	0.0030	0.0007	0.0572	0.0859	0.0895
LOAD	1.9790	0.1120	0.1610	0.2067	0.2561	0.3113	0.2105	0.1422	0.1478	0.1207	0.0958	0.0859	0.1291
BACKUP DEMAND (KW)		760.8	861.9	683.5	895.7	1240.3	1058.5	585.2	399.4	182.0	509.5	345.6	819.2
DAYS BKUP REQ	219	26	18	9	18	23	13	13	13	6	22	31	27
1968 - 1969													
PRODUCTION	6.1081	0.0351	0.4957	0.6293	0.4094	0.3325	0.5345	1.0243	0.6947	0.4385	0.7159	0.7328	0.0656
SURPLUS	4.5243	0.0232	0.3538	0.4248	0.1885	0.0959	0.3508	0.8820	0.5505	0.3350	0.6201	0.6582	0.0415
UTILIZED	1.5837	0.0120	0.1419	0.2045	0.2209	0.2366	0.1837	0.1422	0.1442	0.1034	0.0957	0.0746	0.0241
BACKUP	0.3874	0.1022	0.0159	0.0068	0.0352	0.0624	0.0268	0.0	0.0010	0.0195	0.0001	0.0100	0.1076
LOAD	1.9711	0.1142	0.1578	0.2114	0.2561	0.2990	0.2105	0.1422	0.1452	0.1229	0.0958	0.0846	0.1316
BACKUP DEMAND (KW)		760.8	372.5	681.8	864.6	902.2	801.6	0.0	246.3	671.4	20.2	345.6	819.2
DAYS BKUP REQ	164	31	12	12	18	20	14	0	5	16	4	5	27

## 1969 - 1970

PRODUCTION	6.2825	0.1632	0.7788	0.7153	0.2623	0.7194	0.6458	0.8935	0.6660	0.5466	0.3094	0.3699	0.2125
SURPLUS	4.5795	0.1079	0.6314	0.5019	0.0946	0.4252	0.4410	0.7514	0.5248	0.4234	0.2431	0.2853	0.1496
UTILIZED	1.7030	0.0553	0.1474	0.2134	0.1677	0.2942	0.2048	0.1422	0.1411	0.1232	0.0663	0.0846	0.0629
BACKUP	0.2679	0.0590	0.0071	0.0026	0.0832	0.0048	0.0097	0.0001	0.0014	0.0018	0.0296	0.0	0.0687
LOAD	1.9709	0.1142	0.1545	0.2160	0.2509	0.2990	0.2145	0.1422	0.1426	0.1251	0.0958	0.0846	0.1316
BACKUP DEMAND (KW)		760.8	146.5	602.2	1152.6	637.7	722.2	63.0	246.3	322.6	509.5	0.0	819.2
DAYS BKUP REQ	144	27	3	10	19	13	17	1	7	9	15	0	23

## 1970 - 1971

PRODUCTION	4.1641	0.1353	0.0627	0.2646	0.0994	0.3360	0.6338	0.8641	0.7522	0.1833	0.2498	0.1239	0.4590
SURPLUS	2.8366	0.0828	0.0292	0.0921	0.0264	0.1169	0.4196	0.7219	0.6106	0.1058	0.1812	0.1046	0.3455
UTILIZED	1.3275	0.0525	0.0335	0.1725	0.0730	0.2191	0.2142	0.1422	0.1416	0.0775	0.0686	0.0194	0.1135
BACKUP	0.6431	0.0595	0.1243	0.0435	0.1727	0.0799	0.0043	0.0	0.0009	0.0476	0.0257	0.0665	0.0182
LOAD	1.9705	0.1120	0.1578	0.2160	0.2457	0.2990	0.2185	0.1422	0.1426	0.1251	0.0943	0.0859	0.1316
BACKUP DEMAND (KW)		760.8	861.9	865.8	1152.6	1240.3	569.2	0.0	246.3	671.4	509.5	345.6	819.2
DAYS BKUP REQ	226	26	25	15	22	23	20	0	5	26	22	25	17

## 1971 - 1972

PRODUCTION	7.4585	0.4657	0.3002	0.6617	0.5532	0.5277	0.8656	0.9226	0.8957	0.9949	0.6639	0.2318	0.3757
SURPLUS	5.5995	0.3597	0.1593	0.4494	0.3144	0.2464	0.6486	0.7862	0.7486	0.8699	0.5863	0.1760	0.2548
UTILIZED	1.8588	0.1060	0.1409	0.2123	0.2388	0.2813	0.2170	0.1363	0.1470	0.1251	0.0776	0.0557	0.1209
BACKUP	0.1217	0.0037	0.0201	0.0038	0.0069	0.0300	0.0016	0.0	0.0008	0.0	0.0152	0.0315	0.0082
LOAD	1.9805	0.1097	0.1610	0.2160	0.2457	0.3113	0.2185	0.1363	0.1478	0.1251	0.0927	0.0872	0.1291
BACKUP DEMAND (KW)		483.8	861.9	474.9	663.2	809.1	346.0	0.0	304.5	0.0	509.5	345.6	329.9
DAYS BKUP REQ	148	17	16	13	16	19	13	0	4	0	12	16	22

## 1972 - 1973

PRODUCTION	8.5196	0.5822	0.6237	1.0028	0.8156	0.7501	0.9950	0.8977	0.9239	0.3976	0.5445	0.4457	0.5410
SURPLUS	6.6008	0.4718	0.4706	0.7964	0.5635	0.4557	0.7806	0.7589	0.7762	0.2796	0.4705	0.3616	0.4156
UTILIZED	1.9186	0.1104	0.1532	0.2063	0.2521	0.2943	0.2144	0.1388	0.1477	0.1180	0.0741	0.0841	0.1254
BACKUP	0.0487	0.0016	0.0079	0.0003	0.0040	0.0046	0.0001	0.0005	0.0001	0.0049	0.0202	0.0032	0.0012
LOAD	1.9673	0.1120	0.1610	0.2067	0.2561	0.2990	0.2145	0.1393	0.1478	0.1229	0.0943	0.0872	0.1266
BACKUP DEMAND (KW)		297.6	391.2	173.9	559.8	558.8	72.1	215.4	71.8	356.0	509.5	345.6	173.0
DAYS BKUP REQ	93	7	5	3	12	13	2	3	2	18	12	1	15

1973 - 1974

PRODUCTION	4.8327	0.3181	0.2778	0.7685	0.8572	0.6950	0.9318	0.8825	0.6521	0.3164	0.2647	0.3899	0.4789
SURPLUS	5.0437	0.2514	0.1452	0.5681	0.6037	0.4088	0.7221	0.7411	0.5059	0.2132	0.2054	0.3040	0.3750
UTILIZED	1.7889	0.0666	0.1326	0.2004	0.2535	0.2862	0.2097	0.1414	0.1462	0.1032	0.0593	0.0859	0.1039
BACKUP	0.1801	0.0476	0.0285	0.0063	0.0026	0.0128	0.0007	0.0008	0.0016	0.0175	0.0365	0.0	0.0252
LOAD	1.9690	0.1142	0.1610	0.2067	0.2561	0.2990	0.2105	0.1422	0.1478	0.1207	0.0958	0.0859	0.1291
BACKUP DEMAND (KW)		760.8	861.9	459.4	461.4	754.9	228.5	362.3	253.3	671.4	509.5	0.0	819.2
DAYS BKUP REQ	136	21	19	5	10	14	6	4	9	17	17	0	14

1974 - 1975

PRODUCTION	6.9319	0.3977	0.4711	0.6351	0.7844	0.5257	0.8721	0.7809	0.6153	0.4663	0.4364	0.3854	0.5616
SURPLUS	5.0564	0.2887	0.3166	0.4288	0.5313	0.2513	0.6634	0.6396	0.4727	0.3498	0.3746	0.3058	0.4341
UTILIZED	1.8754	0.1090	0.1545	0.2063	0.2531	0.2744	0.2087	0.1414	0.1426	0.1165	0.0619	0.0796	0.1274
BACKUP	0.0957	0.0052	0.0032	0.0051	0.0030	0.0245	0.0017	0.0009	0.0026	0.0064	0.0339	0.0050	0.0042
LOAD	1.9711	0.1142	0.1578	0.2114	0.2561	0.2990	0.2105	0.1422	0.1452	0.1229	0.0958	0.0846	0.1316
BACKUP DEMAND (KW)		331.6	372.5	602.2	663.3	734.6	485.2	324.1	445.6	416.3	509.5	345.6	329.9
DAYS BKUP REQ	141	20	12	12	8	15	10	5	9	17	13	3	17

1975 - 1976

PRODUCTION	8.0263	0.9335	0.8913	0.7989	0.7168	0.9446	0.9604	0.6159	0.8054	0.2768	0.2213	0.4830	0.3791
SURPLUS	6.1351	0.8194	0.7370	0.5878	0.4736	0.6402	0.7424	0.4771	0.6634	0.1670	0.1720	0.3971	0.2583
UTILIZED	1.8916	0.1141	0.1543	0.2110	0.2432	0.3044	0.2179	0.1387	0.1420	0.1098	0.0494	0.0859	0.1208
BACKUP	0.0897	0.0001	0.0002	0.0050	0.0077	0.0011	0.0006	0.0035	0.0006	0.0152	0.0449	0.0	0.0109
LOAD	1.9813	0.1142	0.1545	0.2160	0.2509	0.3055	0.2185	0.1422	0.1426	0.1251	0.0943	0.0859	0.1316
BACKUP DEMAND (KW)		114.6	194.1	671.0	663.2	256.9	144.7	385.8	247.5	671.4	509.5	0.0	819.2
DAYS BKUP REQ	114	1	1	9	10	5	7	12	3	23	21	0	22

1976 - 1977

PRODUCTION	4.8445	0.3910	0.2173	0.1817	0.0492	0.0766	0.8570	0.8772	0.7579	0.1695	0.2559	0.4953	0.5158
SURPLUS	3.6573	0.2871	0.1252	0.0511	0.0177	0.0403	0.6422	0.7391	0.6273	0.1000	0.2032	0.4081	0.4159
UTILIZED	1.1872	0.1039	0.0921	0.1306	0.0315	0.0363	0.2148	0.1381	0.1306	0.0695	0.0526	0.0872	0.0999
BACKUP	0.7839	0.0058	0.0690	0.0854	0.2142	0.2627	0.0037	0.0012	0.0146	0.0555	0.0401	0.0000	0.0318
LOAD	1.9710	0.1097	0.1610	0.2160	0.2457	0.2990	0.2185	0.1393	0.1452	0.1251	0.0927	0.0872	0.1316
BACKUP DEMAND (KW)		488.1	861.9	870.2	1152.6	1240.3	577.6	362.3	735.7	671.4	509.5	13.0	819.2
DAYS BKUP REQ	193	19	20	24	25	26	9	4	7	26	19	1	13

PRODUCTION	5.8864	0.3243	0.4113	0.5735	0.4409	0.4796	0.7613	0.8179	0.6952	0.4218	0.3410	0.3098	0.3098
SURPLUS	4.3083	0.2542	0.2906	0.3850	0.2578	0.2453	0.5563	0.6791	0.5529	0.3225	0.2813	0.2530	0.2305
UTILIZED	1.5780	0.0701	0.1207	0.1885	0.1831	0.2343	0.2050	0.1389	0.1424	0.0993	0.0597	0.0567	0.0794
BACKUP	0.3947	0.0420	0.0384	0.0241	0.0683	0.0673	0.0101	0.0016	0.0033	0.0245	0.0347	0.0294	0.0510
LOAD	1.9726	0.1122	0.1591	0.2125	0.2513	0.3016	0.2152	0.1405	0.1456	0.1238	0.0944	0.0861	0.1304
BACKUP DEMAND (KW)	586.8	587.1	659.7	877.9	882.8	552.8	224.3	348.2	498.1	468.7	231.5	683.8	
DAYS BKUP REQ	175	20	14	12	16	17	12	4	7	17	17	11	21

VARIANCE IN ENERGY PRODUCTION = -1.818

CANTON LOAD STUDY - ALTERNATIVE NO. U<sub>1</sub>L<sub>1</sub>

ELECTRIC PRODUCTION IN MILLIONS OF KWH

WATER YEAR	TOTAL	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
1965 - 1966													
PRODUCTION	4.189	0.0	0.048	0.274	0.298	0.621	1.302	0.833	0.587	0.167	0.0	0.0	0.060
SURPLUS	3.108	0.000	0.031	0.157	0.168	0.350	1.084	0.693	0.444	0.135	0.0	0.000	0.046
UTILIZED	1.082	0.000	0.017	0.118	0.129	0.272	0.218	0.139	0.143	0.031	0.0	0.000	0.015
BACKUP	0.890	0.110	0.145	0.098	0.116	0.027	0.001	0.000	0.002	0.094	0.093	0.087	0.117
LOAD	1.971	0.110	0.161	0.216	0.246	0.299	0.219	0.139	0.145	0.125	0.093	0.087	0.132
BACKUP DEMAND (KW)		760.8	861.9	1160.3	1152.6	743.2	206.5	40.4	537.7	671.4	509.5	345.6	819.2
DAYS BKUP REQ	260	31	29	28	22	17	5	3	7	27	31	31	29
1966 - 1967													
PRODUCTION	8.122	0.526	0.939	0.733	0.554	0.409	0.788	1.646	1.290	0.625	0.472	0.140	0.0
SURPLUS	6.510	0.453	0.778	0.525	0.362	0.152	0.587	1.510	1.142	0.508	0.389	0.103	0.000
UTILIZED	1.612	0.073	0.161	0.209	0.192	0.256	0.201	0.136	0.148	0.116	0.083	0.037	0.000
BACKUP	0.357	0.037	0.000	0.003	0.059	0.043	0.017	0.0	0.0	0.009	0.010	0.050	0.129
LOAD	1.969	0.110	0.161	0.211	0.251	0.299	0.219	0.136	0.148	0.125	0.093	0.087	0.129
BACKUP DEMAND (KW)		760.8	44.9	318.3	1152.6	1043.2	865.9	0.0	0.0	470.3	509.5	345.6	819.2
DAYS BKUP REQ	151	14	6	10	17	22	15	0	0	12	6	19	30
1967 - 1968													
PRODUCTION	8.072	0.315	0.491	1.166	0.511	0.524	1.130	1.065	0.921	1.424	0.339	0.0	0.187
SURPLUS	6.489	0.269	0.344	0.961	0.269	0.291	0.934	0.924	0.774	1.303	0.287	0.000	0.135
UTILIZED	1.583	0.046	0.147	0.205	0.242	0.233	0.196	0.141	0.148	0.121	0.052	0.000	0.053
BACKUP	0.396	0.066	0.014	0.001	0.014	0.078	0.014	0.001	0.000	0.0	0.044	0.086	0.077
LOAD	1.979	0.112	0.161	0.207	0.256	0.311	0.210	0.142	0.148	0.121	0.096	0.086	0.129
BACKUP DEMAND (KW)		760.8	861.9	330.1	665.9	1240.3	1058.5	348.1	108.9	0.0	509.5	345.6	819.2
DAYS BKUP REQ	173	21	14	5	18	19	9	8	3	0	19	31	23
1968 - 1969													
PRODUCTION	10.653	0.062	0.889	1.110	0.731	0.594	0.933	1.711	1.214	0.779	1.247	1.254	0.129
SURPLUS	8.928	0.049	0.738	0.900	0.481	0.305	0.728	1.569	1.068	0.670	1.151	1.171	0.097
UTILIZED	1.725	0.013	0.151	0.210	0.250	0.290	0.205	0.142	0.145	0.110	0.096	0.082	0.033
BACKUP	0.246	0.101	0.007	0.001	0.006	0.009	0.006	0.0	0.0	0.013	0.0	0.002	0.109
LOAD	1.971	0.114	0.158	0.211	0.256	0.299	0.210	0.142	0.145	0.123	0.096	0.085	0.132
BACKUP DEMAND (KW)		760.8	146.5	328.4	610.8	609.2	571.8	0.0	0.0	671.4	0.0	154.5	819.2
DAYS BKUP REQ	115	28	2	5	13	19	12	0	0	8	0	3	2

	1969	1970												
PRODUCTION	11.068	0.304	1.323	1.256	0.484	1.250	1.149	1.523	1.161	0.977	0.573	0.675	0.393	
SURPLUS	9.279	0.240	1.176	1.040	0.271	0.951	0.936	1.381	1.018	0.852	0.502	0.591	0.320	
UTILIZED	1.789	0.064	0.147	0.216	0.213	0.299	0.213	0.142	0.143	0.125	0.070	0.085	0.073	
BACKUP	0.182	0.050	0.007	0.000	0.038	0.000	0.002	0.0	0.0	0.000	0.026	0.0	0.059	
LOAD	1.971	0.114	0.154	0.216	0.251	0.299	0.214	0.142	0.143	0.125	0.096	0.085	0.132	
BACKUP DEMAND (KW)		760.8	146.5	122.5	1152.6	123.6	430.7	0.0	0.0	21.5	509.5	0.0	819.2	
DAYS BKUP REQ	78	18	2	1	19	1	5	0	0	1	11	0	20	

	1970	1971												
PRODUCTION	7.469	0.263	0.126	0.482	0.218	0.630	1.128	1.479	1.296	0.348	0.447	0.220	0.834	
SURPLUS	5.957	0.198	0.081	0.282	0.099	0.355	0.910	1.337	1.153	0.255	0.377	0.200	0.710	
UTILIZED	1.512	0.065	0.045	0.200	0.119	0.275	0.218	0.142	0.143	0.093	0.069	0.019	0.124	
BACKUP	0.459	0.047	0.113	0.016	0.127	0.024	0.000	0.0	0.0	0.032	0.025	0.066	0.008	
LOAD	1.971	0.112	0.158	0.216	0.246	0.299	0.219	0.142	0.143	0.125	0.094	0.086	0.132	
BACKUP DEMAND (KW)		760.8	861.9	607.2	1152.6	1026.2	185.0	0.0	0.0	671.4	509.5	345.6	624.2	
DAYS BKUP REQ	157	23	24	15	22	17	3	0	0	15	8	24	6	

	1971	1972												
PRODUCTION	12.947	0.836	0.545	1.163	0.993	0.937	1.483	1.545	1.511	1.654	1.134	0.449	0.697	
SURPLUS	11.006	0.727	0.389	0.947	0.748	0.629	1.264	1.408	1.364	1.529	1.052	0.378	0.570	
UTILIZED	1.941	0.109	0.156	0.216	0.245	0.308	0.219	0.136	0.148	0.125	0.082	0.071	0.127	
BACKUP	0.040	0.000	0.005	0.0	0.000	0.004	0.0	0.0	0.0	0.0	0.011	0.016	0.003	
LOAD	1.981	0.110	0.161	0.216	0.246	0.311	0.219	0.136	0.148	0.125	0.093	0.087	0.129	
BACKUP DEMAND (KW)		238.7	651.6	0.0	310.2	455.4	0.0	0.0	0.0	0.0	509.5	345.6	114.7	
DAYS BKUP REQ	51	3	15	0	4	10	0	0	0	0	6	12	1	

	1972	1973												
PRODUCTION	14.783	1.038	1.086	1.715	1.419	1.295	1.703	1.513	1.571	0.709	0.949	0.798	0.986	
SURPLUS	12.831	0.926	0.925	1.508	1.163	0.996	1.489	1.374	1.423	0.587	0.866	0.714	0.860	
UTILIZED	1.952	0.112	0.161	0.207	0.256	0.299	0.214	0.139	0.148	0.122	0.083	0.084	0.127	
BACKUP	0.015	0.0	0.000	0.0	0.000	0.0	0.0	0.0	0.0	0.000	0.011	0.003	0.0	
LOAD	1.967	0.112	0.161	0.207	0.256	0.299	0.214	0.139	0.148	0.123	0.094	0.087	0.127	
BACKUP DEMAND (KW)		0.0	39.0	0.0	53.1	0.0	0.0	0.0	0.0	82.5	509.5	345.6	0.0	
DAYS BKUP REQ	21	0	2	0	4	0	0	0	0	9	5	1	0	

1973 - 1974

PRODUCTION	11.964	0.596	0.495	1.320	1.478	1.200	1.604	1.491	1.142	0.580	0.489	0.717	0.853
SURPLUS	10.117	0.517	0.356	1.113	1.222	0.902	1.394	1.349	0.994	0.470	0.425	0.631	0.744
UTILIZED	1.847	0.078	0.139	0.207	0.256	0.298	0.210	0.142	0.148	0.110	0.063	0.086	0.110
BACKUP	0.122	0.036	0.022	0.0	0.0	0.001	0.0	0.0	0.0	0.011	0.033	0.0	0.020
LOAD	1.969	0.114	0.161	0.207	0.256	0.299	0.210	0.142	0.148	0.121	0.096	0.086	0.129
BACKUP DEMAND (KW)		760.8	861.9	0.0	0.0	401.8	0.0	0.0	0.0	671.4	509.5	0.0	819.2
DAYS BKUP REQ	62	12	18	0	0	4	0	0	0	7	14	0	7

1974 - 1975

PRODUCTION	12.191	0.713	0.856	1.135	1.359	0.936	1.494	1.348	1.076	0.822	0.770	0.703	0.980
SURPLUS	10.257	0.599	0.698	0.924	1.103	0.639	1.284	1.206	0.931	0.702	0.701	0.622	0.848
UTILIZED	1.934	0.114	0.158	0.211	0.256	0.297	0.210	0.142	0.145	0.120	0.068	0.081	0.132
BACKUP	0.037	0.0	0.000	0.000	0.000	0.002	0.0	0.0	0.000	0.003	0.027	0.003	0.0
LOAD	1.971	0.114	0.158	0.211	0.256	0.299	0.210	0.142	0.145	0.123	0.096	0.085	0.132
BACKUP DEMAND (KW)		0.0	21.7	122.5	241.4	302.2	0.0	0.0	190.9	188.7	509.5	345.6	0.0
DAYS BKUP REQ	44	0	2	5	1	14	0	0	4	6	11	1	0

1975 - 1976

PRODUCTION	13.893	1.578	1.509	1.380	1.243	1.591	1.651	1.071	1.387	0.509	0.412	0.862	0.700
SURPLUS	11.967	1.464	1.355	1.164	0.994	1.286	1.432	0.928	1.245	0.391	0.359	0.776	0.573
UTILIZED	1.926	0.114	0.154	0.215	0.250	0.306	0.219	0.142	0.143	0.118	0.053	0.086	0.127
BACKUP	0.056	0.0	0.0	0.001	0.001	0.0	0.0	0.000	0.0	0.007	0.042	0.0	0.005
LOAD	1.981	0.114	0.154	0.216	0.251	0.306	0.219	0.142	0.143	0.125	0.094	0.086	0.132
BACKUP DEMAND (KW)		0.0	0.0	318.2	310.5	0.0	0.0	33.4	0.0	461.1	509.5	0.0	819.2
DAYS BKUP REQ	39	0	0	3	5	0	0	4	0	11	15	0	1

1976 - 1977

PRODUCTION	8.597	0.707	0.405	0.338	0.106	0.174	1.470	1.471	1.307	0.335	0.479	0.911	0.895
SURPLUS	7.266	0.598	0.297	0.179	0.060	0.100	1.252	1.332	1.167	0.245	0.418	0.824	0.794
UTILIZED	1.331	0.109	0.108	0.160	0.045	0.074	0.218	0.139	0.139	0.089	0.061	0.087	0.101
BACKUP	0.640	0.001	0.053	0.056	0.200	0.225	0.001	0.000	0.006	0.036	0.031	0.0	0.031
LOAD	1.971	0.110	0.161	0.216	0.246	0.299	0.219	0.139	0.145	0.125	0.093	0.087	0.132
BACKUP DEMAND (KW)		246.2	861.9	614.7	1152.6	1240.3	224.3	11.4	546.7	671.4	509.5	0.0	819.2
DAYS BKUP REQ	153	8	18	24	25	25	6	2	3	20	14	0	8

12 YEAR AVERAGES

PRODUCTION	10.329	0.578	0.726	1.006	0.783	0.847	1.319	1.391	1.205	0.744	0.609	0.561	0.559
SURPLUS	8.643	0.503	0.597	0.808	0.578	0.580	1.108	1.251	1.060	0.637	0.544	0.501	0.475
UTILIZED	1.686	0.075	0.129	0.198	0.204	0.267	0.212	0.140	0.145	0.107	0.065	0.060	0.085
BACKUP	0.287	0.037	0.030	0.015	0.047	0.034	0.003	0.000	0.001	0.017	0.029	0.026	0.046
LOAD	1.973	0.112	0.159	0.213	0.251	0.302	0.215	0.141	0.146	0.124	0.094	0.086	0.130
BACKUP DEMAND (KW)	484.2	446.6	326.9	662.9	598.8	295.2	36.1	115.3	381.8	467.0	214.5	607.7	
DAYS BKUP REQ	108	13	11	8	12	12	4	1	1	9	11	10	12

VARIANCE IN ENERGY PRODUCTION = 3.090

ND?



APPENDIX J  
ECONOMIC STUDIES  
COMPUTER PRINTOUT

PART 1

ALL CASE S - BASIC STUDIES

CANTON HYDRO PROJECT ALTERNATIVE - U<sub>1</sub>L<sub>1</sub>

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1659.6	1659.6	1775.8
0	2489.3	2638.7	2638.7
TOTALS	4148.9	4298.3	4414.4

COMPLETED COST = \$ 4414.4  
 FULLY AMORTIZED OVER 40 YEARS = \$ 331.1 PER YEAR AT 7.0 % INTEREST

## PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	10.330	2.95	304.6	0.0	0.0	304.6
2	10.330	3.17	327.8	0.0	0.0	327.8
3	10.330	3.41	352.7	0.0	0.0	352.7
4	10.330	3.67	379.5	0.0	0.0	379.5
5	10.330	3.95	408.3	0.0	0.0	408.3
6	10.330	4.25	439.4	0.0	0.0	439.4
7	10.330	4.58	472.8	0.0	0.0	472.8
8	10.330	4.92	508.7	0.0	0.0	508.7
9	10.330	5.30	547.3	0.0	0.0	547.3
10	10.330	5.70	588.9	0.0	0.0	588.9
11	10.330	6.13	633.7	0.0	0.0	633.7
12	10.330	6.60	681.9	0.0	0.0	681.9
13	10.330	7.10	733.7	0.0	0.0	733.7
14	10.330	7.64	789.4	0.0	0.0	789.4
15	10.330	8.22	849.4	0.0	0.0	849.4
16	10.330	8.85	914.0	0.0	0.0	914.0
17	10.330	9.52	983.5	0.0	0.0	983.5
18	10.330	10.24	1058.2	0.0	0.0	1058.2
19	10.330	11.02	1138.6	0.0	0.0	1138.6
20	10.330	11.86	1225.2	0.0	0.0	1225.2
21	10.330	12.76	1318.3	0.0	0.0	1318.3
22	10.330	13.73	1418.5	0.0	0.0	1418.5
23	10.330	14.78	1526.3	0.0	0.0	1526.3
24	10.330	15.90	1642.3	0.0	0.0	1642.3
25	10.330	17.11	1767.1	0.0	0.0	1767.1
26	10.330	18.41	1901.4	0.0	0.0	1901.4
27	10.330	19.81	2045.9	0.0	0.0	2045.9
28	10.330	21.31	2201.4	0.0	0.0	2201.4
29	10.330	22.93	2368.7	0.0	0.0	2368.7
30	10.330	24.67	2548.7	0.0	0.0	2548.7
31	10.330	26.55	2742.4	0.0	0.0	2742.4
32	10.330	28.57	2950.8	0.0	0.0	2950.8
33	10.330	30.74	3175.0	0.0	0.0	3175.0
34	10.330	33.07	3416.3	0.0	0.0	3416.3
35	10.330	35.59	3676.0	0.0	0.0	3676.0
36	10.330	38.29	3955.3	0.0	0.0	3955.3
37	10.330	41.20	4255.9	0.0	0.0	4255.9
38	10.330	44.33	4579.4	0.0	0.0	4579.4
39	10.330	47.70	4927.4	0.0	0.0	4927.4
40	10.330	51.33	5301.9	0.0	0.0	5301.9

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOT
1	0.0	0.0	61.9	12.4	9.3	2.8	0.0	0.0	86.
2	0.0	0.0	65.6	13.1	9.9	2.9	0.0	0.0	91.
3	0.0	0.0	69.5	13.9	10.5	3.1	0.0	0.0	97.
4	0.0	0.0	73.7	14.7	11.1	3.3	0.0	0.0	102.
5	0.0	0.0	78.1	15.6	11.8	3.5	0.0	0.0	109.
6	0.0	0.0	82.8	16.6	12.5	3.7	0.0	0.0	115.
7	0.0	0.0	87.8	17.6	13.3	3.9	0.0	0.0	122.
8	0.0	0.0	93.0	18.6	14.0	4.2	0.0	0.0	129.
9	0.0	0.0	98.6	19.7	14.9	4.4	0.0	0.0	137.
10	0.0	0.0	104.5	20.9	15.8	4.7	0.0	0.0	145.
11	0.0	0.0	110.8	22.2	16.7	5.0	0.0	0.0	154.
12	0.0	0.0	117.4	23.5	17.7	5.3	0.0	0.0	163.
13	0.0	0.0	124.5	24.9	18.8	5.6	0.0	0.0	173.
14	0.0	0.0	131.9	26.4	19.9	5.9	0.0	0.0	184.
15	0.0	0.0	139.9	28.0	21.1	6.3	0.0	0.0	195.
16	0.0	0.0	148.3	29.7	22.4	6.7	0.0	0.0	206.
17	0.0	0.0	157.1	31.4	23.7	7.1	0.0	0.0	219.
18	0.0	0.0	166.6	33.3	25.2	7.5	0.0	0.0	232.
19	0.0	0.0	176.6	35.3	26.7	7.9	0.0	0.0	246.
20	0.0	0.0	187.2	37.4	28.3	8.4	0.0	0.0	261.
21	0.0	0.0	198.4	39.7	30.0	8.9	0.0	0.0	276.
22	0.0	0.0	210.3	42.1	31.8	9.4	0.0	0.0	293.
23	0.0	0.0	222.9	44.6	33.7	10.0	0.0	0.0	311.
24	0.0	0.0	236.3	47.3	35.7	10.6	0.0	0.0	329.
25	0.0	0.0	250.5	50.1	37.8	11.2	0.0	0.0	349.
26	0.0	0.0	265.5	53.1	40.1	11.9	0.0	0.0	370.
27	0.0	0.0	281.4	56.3	42.5	12.6	0.0	0.0	392.
28	0.0	0.0	298.3	59.7	45.1	13.4	0.0	0.0	416.
29	0.0	0.0	316.2	63.2	47.8	14.2	0.0	0.0	441.
30	0.0	0.0	335.2	67.0	50.6	15.0	0.0	0.0	467.
31	0.0	0.0	355.3	71.1	53.7	16.0	0.0	0.0	496.
32	0.0	0.0	376.6	75.3	56.9	16.9	0.0	0.0	525.
33	0.0	0.0	399.2	79.8	60.3	17.9	0.0	0.0	557.
34	0.0	0.0	423.2	84.6	63.9	19.0	0.0	0.0	590.
35	0.0	0.0	448.5	89.7	67.7	20.1	0.0	0.0	626.
36	0.0	0.0	475.5	95.1	71.8	21.3	0.0	0.0	663.
37	0.0	0.0	504.0	100.8	76.1	22.6	0.0	0.0	703.
38	0.0	0.0	534.2	106.8	80.7	24.0	0.0	0.0	745.
39	0.0	0.0	566.3	113.3	85.5	25.4	0.0	0.0	790.
40	0.0	0.0	600.2	120.0	90.6	26.9	0.0	0.0	837.

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	304.6	86.4	331.1	26.1	-139.0	4.29
2	327.8	91.5	331.1	26.1	-121.0	4.34
3	352.7	97.0	331.1	26.1	-101.6	4.40
4	379.5	102.8	331.1	26.1	-80.6	4.45
5	408.3	109.0	331.1	26.1	-57.9	4.51
6	439.4	115.6	331.1	26.1	-33.4	4.58
7	472.8	122.5	331.1	26.1	-7.0	4.64
8	508.7	129.8	331.1	26.1	21.6	4.72
9	547.3	137.6	331.1	26.1	52.5	4.79
10	588.9	145.9	331.1	26.1	85.8	4.87
11	633.7	154.6	331.1	26.1	121.8	4.96
12	681.9	163.9	331.1	26.1	160.7	5.05
13	733.7	173.8	331.1	26.1	202.7	5.14
14	789.4	184.2	331.1	26.1	248.0	5.24
15	849.4	195.2	331.1	26.1	297.0	5.35
16	914.0	206.9	331.1	26.1	349.8	5.46
17	983.5	219.4	331.1	26.1	406.9	5.58
18	1058.2	232.5	331.1	26.1	468.5	5.71
19	1138.6	246.5	331.1	26.1	534.9	5.84
20	1225.2	261.3	331.1	26.1	606.7	5.99
21	1318.3	276.9	331.1	26.1	684.1	6.14
22	1418.5	293.6	331.1	26.1	767.7	6.30
23	1526.3	311.2	331.1	26.1	857.9	6.47
24	1642.3	329.8	331.1	26.1	955.2	6.65
25	1767.1	349.6	331.1	26.1	1060.2	6.84
26	1901.4	370.6	331.1	26.1	1173.5	7.05
27	2045.9	392.8	331.1	26.1	1295.8	7.26
28	2201.4	416.4	331.1	26.1	1427.7	7.49
29	2368.7	441.4	331.1	26.1	1570.0	7.73
30	2548.7	467.9	331.1	26.1	1723.6	7.99
31	2742.4	496.0	331.1	0.0	1915.3	8.01
32	2950.8	525.7	331.1	0.0	2093.9	8.29
33	3175.0	557.3	331.1	0.0	2286.7	8.60
34	3416.3	590.7	331.1	0.0	2494.5	8.92
35	3676.0	626.1	331.1	0.0	2718.7	9.27
36	3955.3	663.7	331.1	0.0	2960.5	9.63
37	4255.9	703.5	331.1	0.0	3221.3	10.02
38	4579.4	745.7	331.1	0.0	3502.5	10.42
39	4927.4	790.5	331.1	0.0	3805.8	10.86
40	5301.9	837.9	331.1	0.0	4132.9	11.32

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE INITIAL ENERGY VALUE IRR

30	2.00	0.083
30	2.10	0.087
30	2.20	0.091
30	2.30	0.095
30	2.40	0.098
30	2.50	0.102
30	2.60	0.105
30	2.70	0.108
30	2.80	0.111
30	2.90	0.114
30	3.00	0.117
30	3.10	0.120
30	3.20	0.123
30	3.30	0.126
30	3.40	0.129

PROJECT LIFE INITIAL ENERGY VALUE IRR

35	2.00	0.091
35	2.10	0.095
35	2.20	0.098
35	2.30	0.102
35	2.40	0.105
35	2.50	0.108
35	2.60	0.111
35	2.70	0.114
35	2.80	0.117
35	2.90	0.120
35	3.00	0.123
35	3.10	0.126
35	3.20	0.128
35	3.30	0.131
35	3.40	0.133

PROJECT LIFE INITIAL ENERGY VALUE IRR

40	2.00	0.097
40	2.10	0.100
40	2.20	0.104
40	2.30	0.107
40	2.40	0.110
40	2.50	0.113
40	2.60	0.116
40	2.70	0.119
40	2.80	0.121
40	2.90	0.124
40	3.00	0.127
40	3.10	0.129

CANTON HYDRO PROJECT - ALTERNATIVE - U<sub>2</sub>L<sub>2</sub>

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1357.0	1357.0	1452.0
0	2035.0	2157.1	2157.1
TOTALS	3392.0	3514.1	3609.1

COMPLETED COST = \$ 3609.1  
 FULLY AMORTIZED OVER 40 YEARS = \$ 270.7 PER YEAR AT 7.0 % INTEREST



PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	8.810	2.95	259.8	0.0	0.0	259.8
2	8.810	3.17	279.5	0.0	0.0	279.5
3	8.810	3.41	300.8	0.0	0.0	300.8
4	8.810	3.67	323.7	0.0	0.0	323.7
5	8.810	3.95	348.3	0.0	0.0	348.3
6	8.810	4.25	374.7	0.0	0.0	374.7
7	8.810	4.58	403.2	0.0	0.0	403.2
8	8.810	4.92	433.8	0.0	0.0	433.8
9	8.810	5.30	466.8	0.0	0.0	466.8
10	8.810	5.70	502.3	0.0	0.0	502.3
11	8.810	6.13	540.5	0.0	0.0	540.5
12	8.810	6.60	581.5	0.0	0.0	581.5
13	8.810	7.10	625.7	0.0	0.0	625.7
14	8.810	7.64	673.3	0.0	0.0	673.3
15	8.810	8.22	724.5	0.0	0.0	724.5
16	8.810	8.85	779.5	0.0	0.0	779.5
17	8.810	9.52	838.8	0.0	0.0	838.8
18	8.810	10.24	902.5	0.0	0.0	902.5
19	8.810	11.02	971.1	0.0	0.0	971.1
20	8.810	11.86	1044.9	0.0	0.0	1044.9
21	8.810	12.76	1124.3	0.0	0.0	1124.3
22	8.810	13.73	1209.7	0.0	0.0	1209.7
23	8.810	14.78	1301.7	0.0	0.0	1301.7
24	8.810	15.90	1400.6	0.0	0.0	1400.6
25	8.810	17.11	1507.1	0.0	0.0	1507.1
26	8.810	18.41	1621.6	0.0	0.0	1621.6
27	8.810	19.81	1744.8	0.0	0.0	1744.8
28	8.810	21.31	1877.4	0.0	0.0	1877.4
29	8.810	22.93	2020.1	0.0	0.0	2020.1
30	8.810	24.67	2173.6	0.0	0.0	2173.6
31	8.810	26.55	2338.8	0.0	0.0	2338.8
32	8.810	28.57	2516.6	0.0	0.0	2516.6
33	8.810	30.74	2707.8	0.0	0.0	2707.8
34	8.810	33.07	2913.6	0.0	0.0	2913.6
35	8.810	35.59	3135.1	0.0	0.0	3135.1
36	8.810	38.29	3373.3	0.0	0.0	3373.3
37	8.810	41.20	3629.7	0.0	0.0	3629.7
38	8.810	44.33	3905.6	0.0	0.0	3905.6
39	8.810	47.70	4202.4	0.0	0.0	4202.4
40	8.810	51.33	4521.7	0.0	0.0	4521.7

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	48.0	9.6	7.6	2.8	0.0	0.0	67.9
2	0.0	0.0	50.9	10.2	8.0	2.9	0.0	0.0	72.0
3	0.0	0.0	53.9	10.8	8.5	3.1	0.0	0.0	76.3
4	0.0	0.0	57.1	11.4	9.0	3.3	0.0	0.0	80.9
5	0.0	0.0	60.6	12.1	9.6	3.5	0.0	0.0	85.7
6	0.0	0.0	64.2	12.8	10.1	3.7	0.0	0.0	90.9
7	0.0	0.0	68.1	13.6	10.7	3.9	0.0	0.0	96.3
8	0.0	0.0	72.1	14.4	11.4	4.2	0.0	0.0	102.1
9	0.0	0.0	76.5	15.3	12.1	4.4	0.0	0.0	108.3
10	0.0	0.0	81.1	16.2	12.8	4.7	0.0	0.0	114.8
11	0.0	0.0	85.9	17.2	13.6	5.0	0.0	0.0	121.6
12	0.0	0.0	91.1	18.2	14.4	5.3	0.0	0.0	128.9
13	0.0	0.0	96.5	19.3	15.2	5.6	0.0	0.0	136.7
14	0.0	0.0	102.3	20.5	16.2	5.9	0.0	0.0	144.9
15	0.0	0.0	108.5	21.7	17.1	6.3	0.0	0.0	153.6
16	0.0	0.0	115.0	23.0	18.2	6.7	0.0	0.0	162.8
17	0.0	0.0	121.9	24.4	19.2	7.1	0.0	0.0	172.5
18	0.0	0.0	129.2	25.8	20.4	7.5	0.0	0.0	182.9
19	0.0	0.0	136.9	27.4	21.6	7.9	0.0	0.0	193.9
20	0.0	0.0	145.1	29.0	22.9	8.4	0.0	0.0	205.5
21	0.0	0.0	153.9	30.8	24.3	8.9	0.0	0.0	217.8
22	0.0	0.0	163.1	32.6	25.8	9.4	0.0	0.0	230.9
23	0.0	0.0	172.9	34.6	27.3	10.0	0.0	0.0	244.8
24	0.0	0.0	183.2	36.6	28.9	10.6	0.0	0.0	259.4
25	0.0	0.0	194.2	38.8	30.7	11.2	0.0	0.0	275.0
26	0.0	0.0	205.9	41.2	32.5	11.9	0.0	0.0	291.5
27	0.0	0.0	218.2	43.6	34.5	12.6	0.0	0.0	309.0
28	0.0	0.0	231.3	46.3	36.5	13.4	0.0	0.0	327.5
29	0.0	0.0	245.2	49.0	38.7	14.2	0.0	0.0	347.2
30	0.0	0.0	259.9	52.0	41.0	15.0	0.0	0.0	368.0
31	0.0	0.0	275.5	55.1	43.5	16.0	0.0	0.0	390.1
32	0.0	0.0	292.1	58.4	46.1	16.9	0.0	0.0	413.5
33	0.0	0.0	309.6	61.9	48.9	17.9	0.0	0.0	436.3
34	0.0	0.0	328.2	65.6	51.8	19.0	0.0	0.0	464.6
35	0.0	0.0	347.8	69.6	54.9	20.1	0.0	0.0	492.5
36	0.0	0.0	368.7	73.7	58.2	21.3	0.0	0.0	522.0
37	0.0	0.0	390.8	78.2	61.7	22.6	0.0	0.0	553.3
38	0.0	0.0	414.3	82.9	65.4	24.0	0.0	0.0	586.5
39	0.0	0.0	439.1	87.8	69.3	25.4	0.0	0.0	621.7

40 0.0 0.0 465.5 93.1 73.5 26.9 0.0 0.0 659.0

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	259.8	67.9	270.7	22.8	-101.6	4.10
2	279.5	72.0	270.7	22.8	-86.0	4.15
3	300.8	76.3	270.7	22.8	-69.0	4.20
4	323.7	80.9	270.7	22.8	-50.8	4.25
5	348.3	85.7	270.7	22.8	-31.0	4.30
6	374.7	90.9	270.7	22.8	-9.7	4.36
7	403.2	96.3	270.7	22.8	13.3	4.43
8	433.8	102.1	270.7	22.8	38.2	4.49
9	466.8	108.3	270.7	22.8	65.0	4.56
10	502.3	114.8	270.7	22.8	94.0	4.63
11	540.5	121.6	270.7	22.8	125.3	4.71
12	581.5	128.9	270.7	22.8	159.1	4.80
13	625.7	136.7	270.7	22.8	195.5	4.88
14	673.3	144.9	270.7	22.8	234.9	4.98
15	724.5	153.6	270.7	22.8	277.4	5.07
16	779.5	162.8	270.7	22.8	323.2	5.18
17	838.8	172.5	270.7	22.8	372.7	5.29
18	902.5	182.9	270.7	22.8	426.1	5.41
19	971.1	193.9	270.7	22.8	483.7	5.53
20	1044.9	205.5	270.7	22.8	545.9	5.66
21	1124.3	217.8	270.7	22.8	613.0	5.80
22	1209.7	230.9	270.7	22.8	685.3	5.95
23	1301.7	244.8	270.7	22.8	763.4	6.11
24	1400.6	259.4	270.7	22.8	847.7	6.28
25	1507.1	275.0	270.7	22.8	938.5	6.45
26	1621.6	291.5	270.7	22.8	1036.6	6.64
27	1744.8	309.0	270.7	22.8	1142.3	6.84
28	1877.4	327.5	270.7	22.8	1256.4	7.05
29	2020.1	347.2	270.7	22.8	1379.4	7.27
30	2173.6	368.0	270.7	22.8	1512.1	7.51
31	2338.8	390.1	270.7	0.0	1678.0	7.50
32	2516.6	413.5	270.7	0.0	1832.4	7.77
33	2707.8	438.3	270.7	0.0	1998.8	8.05
34	2913.0	464.6	270.7	0.0	2178.3	8.35
35	3135.1	492.5	270.7	0.0	2371.9	8.66
36	3373.3	522.0	270.7	0.0	2580.6	9.00
37	3629.7	553.3	270.7	0.0	2805.6	9.35
38	3905.0	586.5	270.7	0.0	3048.3	9.73
39	4202.4	621.7	270.7	0.0	3309.9	10.13
40	4521.7	659.0	270.7	0.0	3592.0	10.55

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.087
30	2.10	0.091
30	2.20	0.095

30	2.30	0.099
30	2.40	0.102
30	2.50	0.106
30	2.60	0.109
30	2.70	0.112
30	2.80	0.116
30	2.90	0.119
30	3.00	0.122
30	3.10	0.125
30	3.20	0.127
30	3.30	0.130
30	3.40	0.133
30	3.50	0.136

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.095
35	2.10	0.099
35	2.20	0.102
35	2.30	0.106
35	2.40	0.109
35	2.50	0.112
35	2.60	0.115
35	2.70	0.118
35	2.80	0.121
35	2.90	0.124
35	3.00	0.127
35	3.10	0.130
35	3.20	0.132
35	3.30	0.135
35	3.40	0.138
35	3.50	0.140

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.100
40	2.10	0.104
40	2.20	0.107
40	2.30	0.110
40	2.40	0.113
40	2.50	0.116
40	2.60	0.119
40	2.70	0.122
40	2.80	0.125
40	2.90	0.128
40	3.00	0.130
40	3.10	0.133
40	3.20	0.136
40	3.30	0.138
40	3.40	0.141
40	3.50	0.143

CANTON HYDRO PROJECT ALTERNATIVE - U3L2

PRICE ESCALATION RATES

	% PER YEAR
ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1056.0	1056.0	1129.9
0	1584.0	1679.0	1679.0
TOTALS	2640.0	2735.0	2809.0

COMPLETED COST = \$ 2809.0  
 FULLY AMORTIZED OVER 40 YEARS = \$ 210.7 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

## PROJECT REVENUES IN THOUSANDS

YFAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	7.100	2.95	209.4	0.0	0.0	209.4
2	7.100	3.17	225.3	0.0	0.0	225.3
3	7.100	3.41	242.4	0.0	0.0	242.4
4	7.100	3.67	260.8	0.0	0.0	260.8
5	7.100	3.95	280.7	0.0	0.0	280.7
6	7.100	4.25	302.0	0.0	0.0	302.0
7	7.100	4.58	324.9	0.0	0.0	324.9
8	7.100	4.92	349.6	0.0	0.0	349.6
9	7.100	5.30	376.2	0.0	0.0	376.2
10	7.100	5.70	404.8	0.0	0.0	404.8
11	7.100	6.13	435.6	0.0	0.0	435.6
12	7.100	6.60	468.7	0.0	0.0	468.7
13	7.100	7.10	504.3	0.0	0.0	504.3
14	7.100	7.64	542.6	0.0	0.0	542.6
15	7.100	8.22	583.8	0.0	0.0	583.8
16	7.100	8.85	628.2	0.0	0.0	628.2
17	7.100	9.52	676.0	0.0	0.0	676.0
18	7.100	10.24	727.3	0.0	0.0	727.3
19	7.100	11.02	782.6	0.0	0.0	782.6
20	7.100	11.86	842.1	0.0	0.0	842.1
21	7.100	12.76	906.1	0.0	0.0	906.1
22	7.100	13.73	974.9	0.0	0.0	974.9
23	7.100	14.78	1049.0	0.0	0.0	1049.0
24	7.100	15.90	1128.8	0.0	0.0	1128.8
25	7.100	17.11	1214.5	0.0	0.0	1214.5
26	7.100	18.41	1306.8	0.0	0.0	1306.8
27	7.100	19.81	1406.2	0.0	0.0	1406.2
28	7.100	21.31	1513.0	0.0	0.0	1513.0
29	7.100	22.93	1628.0	0.0	0.0	1628.0
30	7.100	24.67	1751.7	0.0	0.0	1751.7
31	7.100	26.55	1884.9	0.0	0.0	1884.9
32	7.100	28.57	2028.1	0.0	0.0	2028.1
33	7.100	30.74	2182.3	0.0	0.0	2182.3
34	7.100	33.07	2348.1	0.0	0.0	2348.1
35	7.100	35.59	2526.6	0.0	0.0	2526.6
36	7.100	38.29	2718.6	0.0	0.0	2718.6
37	7.100	41.20	2925.2	0.0	0.0	2925.2
38	7.100	44.33	3147.5	0.0	0.0	3147.5
39	7.100	47.70	3386.7	0.0	0.0	3386.7
40	7.100	51.33	3644.1	0.0	0.0	3644.1

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	36.6	7.3	5.9	2.8	0.0	0.0	52.6
2	0.0	0.0	38.8	7.8	6.3	2.9	0.0	0.0	55.8
3	0.0	0.0	41.1	8.2	6.7	3.1	0.0	0.0	59.2
4	0.0	0.0	43.6	8.7	7.1	3.3	0.0	0.0	62.7
5	0.0	0.0	46.2	9.2	7.5	3.5	0.0	0.0	66.5
6	0.0	0.0	49.0	9.8	7.9	3.7	0.0	0.0	70.5
7	0.0	0.0	51.9	10.4	8.4	3.9	0.0	0.0	74.7
8	0.0	0.0	55.1	11.0	8.9	4.2	0.0	0.0	79.2
9	0.0	0.0	58.4	11.7	9.5	4.4	0.0	0.0	83.9
10	0.0	0.0	61.9	12.4	10.0	4.7	0.0	0.0	88.9
11	0.0	0.0	65.6	13.1	10.6	5.0	0.0	0.0	94.3
12	0.0	0.0	69.5	13.9	11.3	5.3	0.0	0.0	99.9
13	0.0	0.0	73.7	14.7	11.9	5.6	0.0	0.0	105.9
14	0.0	0.0	78.1	15.6	12.7	5.9	0.0	0.0	112.3
15	0.0	0.0	82.8	16.6	13.4	6.3	0.0	0.0	119.0
16	0.0	0.0	87.7	17.5	14.2	6.7	0.0	0.0	126.2
17	0.0	0.0	93.0	18.6	15.1	7.1	0.0	0.0	133.7
18	0.0	0.0	98.6	19.7	16.0	7.5	0.0	0.0	141.8
19	0.0	0.0	104.5	20.9	16.9	7.9	0.0	0.0	150.3
20	0.0	0.0	110.8	22.2	18.0	8.4	0.0	0.0	159.3
21	0.0	0.0	117.4	23.5	19.0	8.9	0.0	0.0	168.8
22	0.0	0.0	124.5	24.9	20.2	9.4	0.0	0.0	179.0
23	0.0	0.0	131.9	26.4	21.4	10.0	0.0	0.0	189.7
24	0.0	0.0	139.8	28.0	22.7	10.6	0.0	0.0	201.1
25	0.0	0.0	148.2	29.6	24.0	11.2	0.0	0.0	213.2
26	0.0	0.0	157.1	31.4	25.5	11.9	0.0	0.0	225.9
27	0.0	0.0	166.6	33.3	27.0	12.6	0.0	0.0	239.5
28	0.0	0.0	176.5	35.3	28.6	13.4	0.0	0.0	253.9
29	0.0	0.0	187.1	37.4	30.3	14.2	0.0	0.0	269.1
30	0.0	0.0	198.4	39.7	32.1	15.0	0.0	0.0	285.2
31	0.0	0.0	210.3	42.1	34.1	16.0	0.0	0.0	302.4
32	0.0	0.0	222.9	44.6	36.1	16.9	0.0	0.0	320.5
33	0.0	0.0	236.3	47.3	38.3	17.9	0.0	0.0	339.7
34	0.0	0.0	250.4	50.1	40.6	19.0	0.0	0.0	360.1
35	0.0	0.0	265.5	53.1	43.0	20.1	0.0	0.0	381.7
36	0.0	0.0	281.4	56.3	45.6	21.3	0.0	0.0	404.6
37	0.0	0.0	298.3	59.7	48.3	22.6	0.0	0.0	428.9
38	0.0	0.0	316.2	63.2	51.2	24.0	0.0	0.0	454.6
39	0.0	0.0	335.1	67.0	54.3	25.4	0.0	0.0	481.9
40	0.0	0.0	355.2	71.0	57.6	26.9	0.0	0.0	510.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR P AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	209.4	52.6	210.7	17.8	-71.8	3.96
2	225.3	55.8	210.7	17.8	-59.0	4.00
3	242.4	59.2	210.7	17.8	-45.2	4.05
4	260.8	62.7	210.7	17.8	-30.4	4.10
5	280.7	66.5	210.7	17.8	-14.3	4.15
6	302.0	70.5	210.7	17.8	3.0	4.21
7	324.9	74.7	210.7	17.8	21.8	4.27
8	349.6	79.2	210.7	17.8	42.0	4.33
9	376.2	83.9	210.7	17.8	63.8	4.40
10	404.8	88.9	210.7	17.8	87.3	4.47
11	435.6	94.3	210.7	17.8	112.8	4.55
12	468.7	99.9	210.7	17.8	140.2	4.63
13	504.3	105.9	210.7	17.8	169.8	4.71
14	542.6	112.3	210.7	17.8	201.8	4.80
15	583.8	119.0	210.7	17.8	236.3	4.89
16	628.2	126.2	210.7	17.8	273.5	5.00
17	676.0	133.7	210.7	17.8	313.7	5.10
18	727.3	141.8	210.7	17.8	357.1	5.22
19	782.6	150.3	210.7	17.8	403.8	5.33
20	842.1	159.3	210.7	17.8	454.3	5.46
21	906.1	168.8	210.7	17.8	508.7	5.60
22	974.9	179.0	210.7	17.8	567.5	5.74
23	1049.0	189.7	210.7	17.8	630.8	5.89
24	1128.8	201.1	210.7	17.8	699.2	6.05
25	1214.5	213.2	210.7	17.8	772.9	6.22
26	1306.8	225.9	210.7	17.8	852.4	6.40
27	1406.2	239.5	210.7	17.8	938.2	6.59
28	1513.0	253.9	210.7	17.8	1030.7	6.79
29	1628.0	269.1	210.7	17.8	1130.4	7.01
30	1751.7	285.2	210.7	17.8	1238.0	7.24
31	1884.9	302.4	210.7	0.0	1371.8	7.23
32	2028.1	320.5	210.7	0.0	1496.9	7.48
33	2182.3	339.7	210.7	0.0	1631.8	7.75
34	2348.1	360.1	210.7	0.0	1777.3	8.04
35	2526.6	381.7	210.7	0.0	1934.1	8.34
36	2718.6	404.6	210.7	0.0	2103.3	8.67
37	2925.2	428.9	210.7	0.0	2285.6	9.01
38	3147.5	454.6	210.7	0.0	2482.2	9.37
39	3386.7	481.9	210.7	0.0	2694.1	9.76
40	3644.1	510.8	210.7	0.0	2922.6	10.16



INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.090
30	2.10	0.094
30	2.20	0.098

30	2.30	0.102
30	2.40	0.105
30	2.50	0.109
30	2.60	0.112
30	2.70	0.116
30	2.80	0.119
30	2.90	0.122
30	3.00	0.125
30	3.10	0.128
30	3.20	0.131
30	3.30	0.134
30	3.40	0.136
30	3.50	0.139

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.098
35	2.10	0.101
35	2.20	0.105
35	2.30	0.108
35	2.40	0.112
35	2.50	0.115
35	2.60	0.118
35	2.70	0.121
35	2.80	0.124
35	2.90	0.127
35	3.00	0.130
35	3.10	0.133
35	3.20	0.135
35	3.30	0.138
35	3.40	0.141
35	3.50	0.143

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.103
40	2.10	0.106
40	2.20	0.110
40	2.30	0.113
40	2.40	0.116
40	2.50	0.119
40	2.60	0.122
40	2.70	0.125
40	2.80	0.128
40	2.90	0.131
40	3.00	0.133
40	3.10	0.136
40	3.20	0.138
40	3.30	0.141
40	3.40	0.143
40	3.50	0.146

CANTON HYDRO PROJECT ALTERNATIVE - U<sub>4</sub>L<sub>3</sub>

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1128.0	1128.0	1207.0
0	1693.0	1794.6	1794.6
TOTALS	2821.0	2922.6	3001.5

COMPLETED COST = \$ 3001.5  
 FULLY AMORTIZED OVER 40 YEARS = \$ 225.1 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	6.720	2.95	198.2	0.0	0.0	198.2
2	6.720	3.17	213.2	0.0	0.0	213.2
3	6.720	3.41	229.4	0.0	0.0	229.4
4	6.720	3.67	246.9	0.0	0.0	246.9
5	6.720	3.95	265.6	0.0	0.0	265.6
6	6.720	4.25	285.8	0.0	0.0	285.8
7	6.720	4.58	307.5	0.0	0.0	307.5
8	6.720	4.92	330.9	0.0	0.0	330.9
9	6.720	5.30	356.1	0.0	0.0	356.1
10	6.720	5.70	383.1	0.0	0.0	383.1
11	6.720	6.13	412.2	0.0	0.0	412.2
12	6.720	6.60	443.6	0.0	0.0	443.6
13	6.720	7.10	477.3	0.0	0.0	477.3
14	6.720	7.64	513.6	0.0	0.0	513.6
15	6.720	8.22	552.6	0.0	0.0	552.6
16	6.720	8.85	594.6	0.0	0.0	594.6
17	6.720	9.52	639.8	0.0	0.0	639.8
18	6.720	10.24	688.4	0.0	0.0	688.4
19	6.720	11.02	740.7	0.0	0.0	740.7
20	6.720	11.86	797.0	0.0	0.0	797.0
21	6.720	12.76	857.6	0.0	0.0	857.6
22	6.720	13.73	922.8	0.0	0.0	922.8
23	6.720	14.78	992.9	0.0	0.0	992.9
24	6.720	15.90	1068.3	0.0	0.0	1068.3
25	6.720	17.11	1149.5	0.0	0.0	1149.5
26	6.720	18.41	1236.9	0.0	0.0	1236.9
27	6.720	19.81	1330.9	0.0	0.0	1330.9
28	6.720	21.31	1432.1	0.0	0.0	1432.1
29	6.720	22.93	1540.9	0.0	0.0	1540.9
30	6.720	24.67	1658.0	0.0	0.0	1658.0
31	6.720	26.55	1784.0	0.0	0.0	1784.0
32	6.720	28.57	1919.6	0.0	0.0	1919.6
33	6.720	30.74	2065.5	0.0	0.0	2065.5
34	6.720	33.07	2222.4	0.0	0.0	2222.4
35	6.720	35.59	2391.3	0.0	0.0	2391.3
36	6.720	38.29	2573.1	0.0	0.0	2573.1
37	6.720	41.20	2768.6	0.0	0.0	2768.6
38	6.720	44.33	2979.0	0.0	0.0	2979.0
39	6.720	47.70	3205.4	0.0	0.0	3205.4
40	6.720	51.33	3449.1	0.0	0.0	3449.1

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	31.6	6.3	6.4	2.8	0.0	0.0	47.1
2	0.0	0.0	33.5	6.7	6.8	2.9	0.0	0.0	49.9
3	0.0	0.0	35.5	7.1	7.2	3.1	0.0	0.0	52.9
4	0.0	0.0	37.6	7.5	7.7	3.3	0.0	0.0	56.1
5	0.0	0.0	39.8	8.0	8.1	3.5	0.0	0.0	59.5
6	0.0	0.0	42.2	8.4	8.6	3.7	0.0	0.0	63.0
7	0.0	0.0	44.8	9.0	9.1	3.9	0.0	0.0	66.8
8	0.0	0.0	47.5	9.5	9.7	4.2	0.0	0.0	70.8
9	0.0	0.0	50.3	10.1	10.3	4.4	0.0	0.0	75.1
10	0.0	0.0	53.3	10.7	10.9	4.7	0.0	0.0	79.6
11	0.0	0.0	56.5	11.3	11.5	5.0	0.0	0.0	84.3
12	0.0	0.0	59.9	12.0	12.2	5.3	0.0	0.0	89.4
13	0.0	0.0	63.5	12.7	13.0	5.6	0.0	0.0	94.8
14	0.0	0.0	67.3	13.5	13.7	5.9	0.0	0.0	100.4
15	0.0	0.0	71.4	14.3	14.6	6.3	0.0	0.0	106.5
16	0.0	0.0	75.6	15.1	15.4	6.7	0.0	0.0	112.9
17	0.0	0.0	80.2	16.0	16.4	7.1	0.0	0.0	119.6
18	0.0	0.0	85.0	17.0	17.3	7.5	0.0	0.0	126.8
19	0.0	0.0	90.1	18.0	18.4	7.9	0.0	0.0	134.4
20	0.0	0.0	95.5	19.1	19.5	8.4	0.0	0.0	142.5
21	0.0	0.0	101.2	20.2	20.6	8.9	0.0	0.0	151.0
22	0.0	0.0	107.3	21.5	21.9	9.4	0.0	0.0	160.1
23	0.0	0.0	113.7	22.7	23.2	10.0	0.0	0.0	169.7
24	0.0	0.0	120.6	24.1	24.6	10.6	0.0	0.0	179.9
25	0.0	0.0	127.8	25.6	26.1	11.2	0.0	0.0	190.7
26	0.0	0.0	135.5	27.1	27.6	11.9	0.0	0.0	202.1
27	0.0	0.0	143.6	28.7	29.3	12.6	0.0	0.0	214.2
28	0.0	0.0	152.2	30.4	31.0	13.4	0.0	0.0	227.1
29	0.0	0.0	161.3	32.3	32.9	14.2	0.0	0.0	240.7
30	0.0	0.0	171.0	34.2	34.9	15.0	0.0	0.0	255.1
31	0.0	0.0	181.3	36.3	37.0	16.0	0.0	0.0	270.5
32	0.0	0.0	192.1	38.4	39.2	16.9	0.0	0.0	286.7
33	0.0	0.0	203.7	40.7	41.5	17.9	0.0	0.0	303.9
34	0.0	0.0	215.9	43.2	44.0	19.0	0.0	0.0	322.1
35	0.0	0.0	228.8	45.8	46.7	20.1	0.0	0.0	341.4
36	0.0	0.0	242.6	48.5	49.5	21.3	0.0	0.0	361.9
37	0.0	0.0	257.1	51.4	52.5	22.6	0.0	0.0	383.6
38	0.0	0.0	272.6	54.5	55.6	24.0	0.0	0.0	406.7
39	0.0	0.0	288.9	57.8	58.9	25.4	0.0	0.0	431.1

40 0.0 0.0 306.2 61.2 62.5 26.9 0.0 0.0 456.9

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	198.2	47.1	225.1	18.8	-92.8	4.33
2	213.2	49.9	225.1	18.8	-80.6	4.37
3	229.4	52.9	225.1	18.8	-67.4	4.42
4	246.9	56.1	225.1	18.8	-53.1	4.46
5	265.6	59.5	225.1	18.8	-37.7	4.51
6	285.8	63.0	225.1	18.8	-21.1	4.57
7	307.5	66.8	225.1	18.8	-3.2	4.62
8	330.9	70.8	225.1	18.8	16.2	4.68
9	356.1	75.1	225.1	18.8	37.1	4.75
10	383.1	79.6	225.1	18.8	59.7	4.81
11	412.2	84.3	225.1	18.8	84.0	4.88
12	443.6	89.4	225.1	18.8	110.3	4.96
13	477.3	94.8	225.1	18.8	138.6	5.04
14	513.6	100.4	225.1	18.8	169.2	5.12
15	552.6	106.5	225.1	18.8	202.2	5.21
16	594.6	112.9	225.1	18.8	237.8	5.31
17	639.8	119.6	225.1	18.8	276.2	5.41
18	688.4	126.8	225.1	18.8	317.7	5.52
19	740.7	134.4	225.1	18.8	362.4	5.63
20	797.0	142.5	225.1	18.8	410.6	5.75
21	857.6	151.0	225.1	18.8	462.6	5.88
22	922.8	160.1	225.1	18.8	518.8	6.01
23	992.9	169.7	225.1	18.8	579.3	6.15
24	1068.3	179.9	225.1	18.8	644.6	6.31
25	1149.5	190.7	225.1	18.8	715.0	6.47
26	1236.9	202.1	225.1	18.8	790.9	6.64
27	1330.9	214.2	225.1	18.8	872.8	6.82
28	1432.1	227.1	225.1	18.8	961.1	7.01
29	1540.9	240.7	225.1	18.8	1056.3	7.21
30	1658.0	255.1	225.1	18.8	1158.9	7.43
31	1784.0	270.5	225.1	0.0	1288.4	7.37
32	1919.6	286.7	225.1	0.0	1407.8	7.62
33	2065.5	303.9	225.1	0.0	1536.4	7.87
34	2222.4	322.1	225.1	0.0	1675.2	8.14
35	2391.3	341.4	225.1	0.0	1824.8	8.43
36	2573.1	361.9	225.1	0.0	1986.0	8.74
37	2768.6	383.6	225.1	0.0	2159.8	9.06
38	2979.0	406.7	225.1	0.0	2347.2	9.40
39	3205.4	431.1	225.1	0.0	2549.2	9.76
40	3449.1	456.9	225.1	0.0	2767.0	10.15

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.084
30	2.10	0.088
30	2.20	0.091

30	2.30	0.095
30	2.40	0.098
30	2.50	0.101
30	2.60	0.105
30	2.70	0.108
30	2.80	0.111
30	2.90	0.114
30	3.00	0.117
30	3.10	0.119
30	3.20	0.122
30	3.30	0.125
30	3.40	0.127
30	3.50	0.130

PROJECT LIFE INITIAL ENERGY VALUE IRR

35	2.00	0.092
35	2.10	0.095
35	2.20	0.099
35	2.30	0.102
35	2.40	0.105
35	2.50	0.108
35	2.60	0.111
35	2.70	0.114
35	2.80	0.117
35	2.90	0.119
35	3.00	0.122
35	3.10	0.125
35	3.20	0.127
35	3.30	0.130
35	3.40	0.132
35	3.50	0.135

PROJECT LIFE INITIAL ENERGY VALUE IRR

40	2.00	0.097
40	2.10	0.101
40	2.20	0.104
40	2.30	0.107
40	2.40	0.110
40	2.50	0.113
40	2.60	0.115
40	2.70	0.118
40	2.80	0.121
40	2.90	0.123
40	3.00	0.126
40	3.10	0.128
40	3.20	0.131
40	3.30	0.133
40	3.40	0.136
40	3.50	0.138

CANTON HYDRO PROJECT ALTERNATIVE - U<sub>5</sub>L<sub>3</sub>

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1411.0	1411.0	1509.8
0	2116.0	2243.0	2243.0
TOTALS	3527.0	3654.0	3752.7

COMPLETED COST = \$ 3752.7  
 FULLY AMOYPTIZED OVER 40 YEARS = \$ 281.5 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	8.450	2.95	249.2	0.0	0.0	249.2
2	8.450	3.17	268.1	0.0	0.0	268.1
3	8.450	3.41	288.5	0.0	0.0	288.5
4	8.450	3.67	310.4	0.0	0.0	310.4
5	8.450	3.95	334.0	0.0	0.0	334.0
6	8.450	4.25	359.4	0.0	0.0	359.4
7	8.450	4.58	386.7	0.0	0.0	386.7
8	8.450	4.92	416.1	0.0	0.0	416.1
9	8.450	5.30	447.7	0.0	0.0	447.7
10	8.450	5.70	481.8	0.0	0.0	481.8
11	8.450	6.13	518.4	0.0	0.0	518.4
12	8.450	6.60	557.8	0.0	0.0	557.8
13	8.450	7.10	600.2	0.0	0.0	600.2
14	8.450	7.64	645.8	0.0	0.0	645.8
15	8.450	8.22	694.9	0.0	0.0	694.9
16	8.450	8.85	747.7	0.0	0.0	747.7
17	8.450	9.52	804.5	0.0	0.0	804.5
18	8.450	10.24	865.6	0.0	0.0	865.6
19	8.450	11.02	931.4	0.0	0.0	931.4
20	8.450	11.86	1002.2	0.0	0.0	1002.2
21	8.450	12.76	1078.4	0.0	0.0	1078.4
22	8.450	13.73	1160.3	0.0	0.0	1160.3
23	8.450	14.78	1248.5	0.0	0.0	1248.5
24	8.450	15.90	1343.4	0.0	0.0	1343.4
25	8.450	17.11	1445.5	0.0	0.0	1445.5
26	8.450	18.41	1555.3	0.0	0.0	1555.3
27	8.450	19.81	1673.5	0.0	0.0	1673.5
28	8.450	21.31	1800.7	0.0	0.0	1800.7
29	8.450	22.93	1937.6	0.0	0.0	1937.6
30	8.450	24.67	2084.8	0.0	0.0	2084.8
31	8.450	26.55	2243.3	0.0	0.0	2243.3
32	8.450	28.57	2413.8	0.0	0.0	2413.8
33	8.450	30.74	2597.2	0.0	0.0	2597.2
34	8.450	33.07	2794.6	0.0	0.0	2794.6
35	8.450	35.59	3007.0	0.0	0.0	3007.0
36	8.450	38.29	3235.5	0.0	0.0	3235.5
37	8.450	41.20	3481.4	0.0	0.0	3481.4
38	8.450	44.33	3746.0	0.0	0.0	3746.0
39	8.450	47.70	4030.7	0.0	0.0	4030.7
40	8.450	51.33	4337.0	0.0	0.0	4337.0



CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	41.7	8.3	7.8	2.8	0.0	0.0	60.6
2	0.0	0.0	44.2	8.8	8.3	2.9	0.0	0.0	64.2
3	0.0	0.0	46.8	9.4	8.8	3.1	0.0	0.0	68.1
4	0.0	0.0	49.5	9.9	9.3	3.3	0.0	0.0	72.2
5	0.0	0.0	52.6	10.5	9.9	3.5	0.0	0.0	76.5
6	0.0	0.0	55.8	11.2	10.5	3.7	0.0	0.0	81.1
7	0.0	0.0	59.1	11.8	11.1	3.9	0.0	0.0	86.0
8	0.0	0.0	62.6	12.5	11.8	4.2	0.0	0.0	91.1
9	0.0	0.0	66.4	13.3	12.5	4.4	0.0	0.0	96.6
10	0.0	0.0	70.4	14.1	13.2	4.7	0.0	0.0	102.4
11	0.0	0.0	74.6	14.9	14.0	5.0	0.0	0.0	108.5
12	0.0	0.0	79.1	15.8	14.9	5.3	0.0	0.0	115.0
13	0.0	0.0	83.8	16.8	15.7	5.6	0.0	0.0	121.9
14	0.0	0.0	88.9	17.8	16.7	5.9	0.0	0.0	129.3
15	0.0	0.0	94.2	18.8	17.7	6.3	0.0	0.0	137.0
16	0.0	0.0	99.8	20.0	18.8	6.7	0.0	0.0	145.2
17	0.0	0.0	105.8	21.2	19.9	7.1	0.0	0.0	153.9
18	0.0	0.0	112.2	22.4	21.1	7.5	0.0	0.0	163.2
19	0.0	0.0	118.9	23.8	22.3	7.9	0.0	0.0	173.0
20	0.0	0.0	126.0	25.2	23.7	8.4	0.0	0.0	183.3
21	0.0	0.0	133.6	26.7	25.1	8.9	0.0	0.0	194.3
22	0.0	0.0	141.6	28.3	26.6	9.4	0.0	0.0	206.0
23	0.0	0.0	150.1	30.0	28.2	10.0	0.0	0.0	218.4
24	0.0	0.0	159.1	31.8	29.9	10.6	0.0	0.0	231.5
25	0.0	0.0	168.7	33.7	31.7	11.2	0.0	0.0	245.4
26	0.0	0.0	178.8	35.8	33.6	11.9	0.0	0.0	260.1
27	0.0	0.0	189.5	37.9	35.6	12.6	0.0	0.0	275.7
28	0.0	0.0	200.9	40.2	37.7	13.4	0.0	0.0	292.2
29	0.0	0.0	213.0	42.6	40.0	14.2	0.0	0.0	309.8
30	0.0	0.0	225.7	45.1	42.4	15.0	0.0	0.0	328.3
31	0.0	0.0	239.3	47.9	45.0	16.0	0.0	0.0	348.0
32	0.0	0.0	253.6	50.7	47.7	16.9	0.0	0.0	368.9
33	0.0	0.0	268.8	53.8	50.5	17.9	0.0	0.0	391.1
34	0.0	0.0	285.0	57.0	53.5	19.0	0.0	0.0	414.5
35	0.0	0.0	302.1	60.4	56.8	20.1	0.0	0.0	439.4
36	0.0	0.0	320.2	64.0	60.2	21.3	0.0	0.0	465.8
37	0.0	0.0	339.4	67.9	63.8	22.6	0.0	0.0	493.7
38	0.0	0.0	359.8	72.0	67.6	24.0	0.0	0.0	523.3
39	0.0	0.0	381.4	76.3	71.7	25.4	0.0	0.0	554.7
40	0.0	0.0	404.2	80.8	75.9	26.9	0.0	0.0	588.0

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	249.2	60.6	281.5	22.6	-115.5	4.32
2	268.1	64.2	281.5	22.6	-100.2	4.36
3	288.5	68.1	281.5	22.6	-83.7	4.40
4	310.4	72.2	281.5	22.6	-65.9	4.45
5	334.0	76.5	281.5	22.6	-46.6	4.50
6	359.4	81.1	281.5	22.6	-25.8	4.56
7	386.7	86.0	281.5	22.6	-3.4	4.62
8	416.1	91.1	281.5	22.6	20.9	4.68
9	447.7	96.6	281.5	22.6	47.0	4.74
10	481.8	102.4	281.5	22.6	75.2	4.81
11	518.4	108.5	281.5	22.6	105.7	4.88
12	557.8	115.0	281.5	22.6	138.6	4.96
13	600.2	121.9	281.5	22.6	174.1	5.04
14	645.8	129.3	281.5	22.6	212.4	5.13
15	694.9	137.0	281.5	22.6	253.7	5.22
16	747.7	145.2	281.5	22.6	298.3	5.32
17	804.5	153.9	281.5	22.6	346.4	5.42
18	865.6	163.2	281.5	22.6	398.3	5.53
19	931.4	173.0	281.5	22.6	454.3	5.65
20	1002.2	183.3	281.5	22.6	514.7	5.77
21	1076.4	194.3	281.5	22.6	579.9	5.90
22	1150.3	206.0	281.5	22.6	650.2	6.04
23	1248.5	218.4	281.5	22.6	726.0	6.18
24	1343.4	231.5	281.5	22.6	807.8	6.34
25	1445.5	245.4	281.5	22.6	896.0	6.50
26	1555.3	260.1	281.5	22.6	991.1	6.68
27	1673.5	275.7	281.5	22.6	1093.7	6.86
28	1800.7	292.2	281.5	22.6	1204.4	7.06
29	1937.0	309.8	281.5	22.6	1323.7	7.26
30	2084.8	328.3	281.5	22.6	1452.4	7.48
31	2243.3	348.0	281.5	0.0	1613.7	7.45
32	2413.8	368.9	281.5	0.0	1763.3	7.70
33	2597.2	391.1	281.5	0.0	1924.7	7.96
34	2794.0	414.5	281.5	0.0	2098.6	8.24
35	3007.0	439.4	281.5	0.0	2286.1	8.53
36	3235.5	465.8	281.5	0.0	2488.3	8.84
37	3481.4	493.7	281.5	0.0	2706.2	9.17
38	3746.0	523.3	281.5	0.0	2941.2	9.52
39	4030.7	554.7	281.5	0.0	3194.5	9.90
40	4337.0	588.0	281.5	0.0	3467.5	10.29

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.084
30	2.10	0.087
30	2.20	0.091
30	2.30	0.095
30	2.40	0.098
30	2.50	0.101
30	2.60	0.105
30	2.70	0.108
30	2.80	0.111
30	2.90	0.114
30	3.00	0.117
30	3.10	0.120
30	3.20	0.122
30	3.30	0.125
30	3.40	0.128
30	3.50	0.130
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.092
35	2.10	0.095
35	2.20	0.099
35	2.30	0.102
35	2.40	0.105
35	2.50	0.108
35	2.60	0.111
35	2.70	0.114
35	2.80	0.117
35	2.90	0.120
35	3.00	0.122
35	3.10	0.125
35	3.20	0.128
35	3.30	0.130
35	3.40	0.132
35	3.50	0.135
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.097
40	2.10	0.101
40	2.20	0.104
40	2.30	0.107
40	2.40	0.110
40	2.50	0.113
40	2.60	0.115
40	2.70	0.118
40	2.80	0.121
40	2.90	0.123
40	3.00	0.126
40	3.10	0.128
40	3.20	0.131
40	3.30	0.133
40	3.40	0.136
40	3.50	0.138

CANTON HYDRO PROJECT ALTERNATIVE - U<sub>6</sub>L<sub>4</sub>

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES 7.60  
 OTHER QUANTITIES 6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1977.0	1977.0	2115.4
0	2956.0	3144.0	3144.0
TOTALS	4943.0	5121.0	5259.3

COMPLETED COST = \$ 5259.3  
 FULLY AMORTIZED OVER 40 YEARS = \$ 394.5 PER YEAR AT 7.0 % INTEREST

## PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	10.020	2.95	295.5	0.0	0.0	295.5
2	10.020	3.17	317.9	0.0	0.0	317.9
3	10.020	3.41	342.1	0.0	0.0	342.1
4	10.020	3.67	368.1	0.0	0.0	368.1
5	10.020	3.95	396.1	0.0	0.0	396.1
6	10.020	4.25	426.2	0.0	0.0	426.2
7	10.020	4.58	458.6	0.0	0.0	458.6
8	10.020	4.92	493.4	0.0	0.0	493.4
9	10.020	5.30	530.9	0.0	0.0	530.9
10	10.020	5.70	571.3	0.0	0.0	571.3
11	10.020	6.13	614.7	0.0	0.0	614.7
12	10.020	6.60	661.4	0.0	0.0	661.4
13	10.020	7.10	711.7	0.0	0.0	711.7
14	10.020	7.64	765.8	0.0	0.0	765.8
15	10.020	8.22	824.0	0.0	0.0	824.0
16	10.020	8.85	886.6	0.0	0.0	886.6
17	10.020	9.52	954.0	0.0	0.0	954.0
18	10.020	10.24	1026.5	0.0	0.0	1026.5
19	10.020	11.02	1104.5	0.0	0.0	1104.5
20	10.020	11.86	1188.4	0.0	0.0	1188.4
21	10.020	12.76	1278.7	0.0	0.0	1278.7
22	10.020	13.73	1375.9	0.0	0.0	1375.9
23	10.020	14.78	1480.5	0.0	0.0	1480.5
24	10.020	15.90	1593.0	0.0	0.0	1593.0
25	10.020	17.11	1714.0	0.0	0.0	1714.0
26	10.020	18.41	1844.3	0.0	0.0	1844.3
27	10.020	19.81	1984.5	0.0	0.0	1984.5
28	10.020	21.31	2135.3	0.0	0.0	2135.3
29	10.020	22.93	2297.6	0.0	0.0	2297.6
30	10.020	24.67	2472.2	0.0	0.0	2472.2
31	10.020	26.55	2660.1	0.0	0.0	2660.1
32	10.020	28.57	2862.2	0.0	0.0	2862.2
33	10.020	30.74	3079.8	0.0	0.0	3079.8
34	10.020	33.07	3313.8	0.0	0.0	3313.8
35	10.020	35.59	3565.7	0.0	0.0	3565.7
36	10.020	38.29	3836.6	0.0	0.0	3836.6
37	10.020	41.20	4128.2	0.0	0.0	4128.2
38	10.020	44.33	4442.0	0.0	0.0	4442.0
39	10.020	47.70	4779.5	0.0	0.0	4779.5
40	10.020	51.33	5142.8	0.0	0.0	5142.8

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	51.8	10.4	11.1	2.8	0.0	0.0	76.0
2	0.0	0.0	54.9	11.0	11.8	2.9	0.0	0.0	80.6
3	0.0	0.0	58.2	11.6	12.5	3.1	0.0	0.0	85.4
4	0.0	0.0	61.6	12.3	13.2	3.3	0.0	0.0	90.5
5	0.0	0.0	65.3	13.1	14.0	3.5	0.0	0.0	95.9
6	0.0	0.0	69.3	13.9	14.9	3.7	0.0	0.0	101.7
7	0.0	0.0	73.4	14.7	15.8	3.9	0.0	0.0	107.8
8	0.0	0.0	77.8	15.6	16.7	4.2	0.0	0.0	114.3
9	0.0	0.0	82.5	16.5	17.7	4.4	0.0	0.0	121.1
10	0.0	0.0	87.4	17.5	18.8	4.7	0.0	0.0	128.4
11	0.0	0.0	92.7	18.5	19.9	5.0	0.0	0.0	136.1
12	0.0	0.0	98.3	19.7	21.1	5.3	0.0	0.0	144.3
13	0.0	0.0	104.2	20.8	22.4	5.6	0.0	0.0	152.9
14	0.0	0.0	110.4	22.1	23.7	5.9	0.0	0.0	162.1
15	0.0	0.0	117.0	23.4	25.1	6.3	0.0	0.0	171.8
16	0.0	0.0	124.0	24.8	26.6	6.7	0.0	0.0	182.1
17	0.0	0.0	131.5	26.3	28.2	7.1	0.0	0.0	193.1
18	0.0	0.0	139.4	27.9	29.9	7.5	0.0	0.0	204.6
19	0.0	0.0	147.7	29.5	31.7	7.9	0.0	0.0	216.9
20	0.0	0.0	156.6	31.3	33.6	8.4	0.0	0.0	229.9
21	0.0	0.0	166.0	33.2	35.6	8.9	0.0	0.0	243.7
22	0.0	0.0	176.0	35.2	37.8	9.4	0.0	0.0	258.4
23	0.0	0.0	186.5	37.3	40.0	10.0	0.0	0.0	273.9
24	0.0	0.0	197.7	39.5	42.4	10.6	0.0	0.0	290.3
25	0.0	0.0	209.6	41.9	45.0	11.2	0.0	0.0	307.7
26	0.0	0.0	222.1	44.4	47.7	11.9	0.0	0.0	326.2
27	0.0	0.0	235.5	47.1	50.5	12.6	0.0	0.0	345.7
28	0.0	0.0	249.6	49.9	53.6	13.4	0.0	0.0	366.5
29	0.0	0.0	264.6	52.9	56.8	14.2	0.0	0.0	388.5
30	0.0	0.0	280.5	56.1	60.2	15.0	0.0	0.0	411.8
31	0.0	0.0	297.3	59.5	63.8	16.0	0.0	0.0	436.5
32	0.0	0.0	315.1	63.0	67.6	16.9	0.0	0.0	462.7
33	0.0	0.0	334.0	66.8	71.7	17.9	0.0	0.0	490.4
34	0.0	0.0	354.1	70.8	76.0	19.0	0.0	0.0	519.9
35	0.0	0.0	375.3	75.1	80.5	20.1	0.0	0.0	551.1
36	0.0	0.0	397.8	79.6	85.4	21.3	0.0	0.0	584.1
37	0.0	0.0	421.7	84.3	90.5	22.6	0.0	0.0	619.2
38	0.0	0.0	447.0	89.4	95.9	24.0	0.0	0.0	656.3
39	0.0	0.0	473.8	94.8	101.7	25.4	0.0	0.0	695.7
40	0.0	0.0	502.2	100.4	107.8	26.9	0.0	0.0	737.4

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	295.5	76.0	394.5	31.0	-206.0	5.01
2	317.9	80.6	394.5	31.0	-188.1	5.05
3	342.1	85.4	394.5	31.0	-168.8	5.10
4	368.1	90.5	394.5	31.0	-147.9	5.15
5	396.1	95.9	394.5	31.0	-125.4	5.20
6	426.2	101.7	394.5	31.0	-101.0	5.26
7	458.6	107.8	394.5	31.0	-74.8	5.32
8	493.4	114.3	394.5	31.0	-46.4	5.39
9	530.9	121.1	394.5	31.0	-15.7	5.46
10	571.3	128.4	394.5	31.0	17.3	5.53
11	614.7	136.1	394.5	31.0	53.1	5.61
12	661.4	144.3	394.5	31.0	91.6	5.69
13	711.7	152.9	394.5	31.0	133.2	5.77
14	765.8	162.1	394.5	31.0	178.1	5.86
15	824.0	171.8	394.5	31.0	226.6	5.96
16	886.6	182.1	394.5	31.0	278.9	6.06
17	954.0	193.1	394.5	31.0	335.4	6.17
18	1026.5	204.6	394.5	31.0	396.3	6.29
19	1104.5	216.9	394.5	31.0	462.0	6.41
20	1188.4	229.9	394.5	31.0	532.9	6.54
21	1278.7	243.7	394.5	31.0	609.5	6.68
22	1375.9	258.4	394.5	31.0	692.0	6.83
23	1480.5	273.9	394.5	31.0	781.1	6.98
24	1593.0	290.3	394.5	31.0	877.2	7.14
25	1714.0	307.7	394.5	31.0	980.8	7.32
26	1844.3	326.2	394.5	31.0	1092.6	7.50
27	1984.5	345.7	394.5	31.0	1213.2	7.70
28	2135.3	366.5	394.5	31.0	1343.3	7.90
29	2297.6	388.5	394.5	31.0	1483.6	8.12
30	2472.2	411.8	394.5	31.0	1634.9	8.36
31	2660.1	436.5	394.5	0.0	1829.1	8.29
32	2862.2	462.7	394.5	0.0	2005.0	8.55
33	3079.8	490.4	394.5	0.0	2194.8	8.83
34	3313.8	519.9	394.5	0.0	2399.4	9.13
35	3565.7	551.1	394.5	0.0	2620.1	9.44
36	3836.6	584.1	394.5	0.0	2858.0	9.77
37	4128.2	619.2	394.5	0.0	3114.5	10.12
38	4442.0	656.3	394.5	0.0	3391.1	10.49
39	4779.5	695.7	394.5	0.0	3689.3	10.88
40	5142.8	737.4	394.5	0.0	4010.8	11.30

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.073
30	2.10	0.076
30	2.20	0.080

30	2.30	0.083
30	2.40	0.087
30	2.50	0.090
30	2.60	0.093
30	2.70	0.096
30	2.80	0.099
30	2.90	0.102
30	3.00	0.104
30	3.10	0.107
30	3.20	0.110
30	3.30	0.112
30	3.40	0.115
30	3.50	0.117

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.082
35	2.10	0.085
35	2.20	0.088
35	2.30	0.091
35	2.40	0.094
35	2.50	0.097
35	2.60	0.100
35	2.70	0.103
35	2.80	0.106
35	2.90	0.109
35	3.00	0.111
35	3.10	0.113
35	3.20	0.116
35	3.30	0.118
35	3.40	0.120
35	3.50	0.123

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.088
40	2.10	0.091
40	2.20	0.094
40	2.30	0.097
40	2.40	0.100
40	2.50	0.102
40	2.60	0.105
40	2.70	0.108
40	2.80	0.110
40	2.90	0.113
40	3.00	0.115
40	3.10	0.117
40	3.20	0.120
40	3.30	0.122
40	3.40	0.124
40	3.50	0.126



CANTON HYDRO PROJECT ALTERNATIVE - U7L4

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1478.0	1478.0	1581.5
0	2216.9	2349.9	2349.9
TOTALS	3694.9	3827.9	3931.4

COMPLETED COST = \$ 3931.4  
 FULLY AMORTIZED OVER 40 YEARS = \$ 294.9 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	6.770	2.95	199.6	0.0	0.0	199.6
2	6.770	3.17	214.8	0.0	0.0	214.8
3	6.770	3.41	231.1	0.0	0.0	231.1
4	6.770	3.67	248.7	0.0	0.0	248.7
5	6.770	3.95	267.6	0.0	0.0	267.6
6	6.770	4.25	288.0	0.0	0.0	288.0
7	6.770	4.58	309.8	0.0	0.0	309.8
8	6.770	4.92	333.4	0.0	0.0	333.4
9	6.770	5.30	358.7	0.0	0.0	358.7
10	6.770	5.70	386.0	0.0	0.0	386.0
11	6.770	6.13	415.3	0.0	0.0	415.3
12	6.770	6.60	446.9	0.0	0.0	446.9
13	6.770	7.10	480.8	0.0	0.0	480.8
14	6.770	7.64	517.4	0.0	0.0	517.4
15	6.770	8.22	556.7	0.0	0.0	556.7
16	6.770	8.85	599.0	0.0	0.0	599.0
17	6.770	9.52	644.5	0.0	0.0	644.5
18	6.770	10.24	693.5	0.0	0.0	693.5
19	6.770	11.02	746.2	0.0	0.0	746.2
20	6.770	11.86	802.9	0.0	0.0	802.9
21	6.770	12.76	864.0	0.0	0.0	864.0
22	6.770	13.73	929.6	0.0	0.0	929.6
23	6.770	14.78	1000.3	0.0	0.0	1000.3
24	6.770	15.90	1076.3	0.0	0.0	1076.3
25	6.770	17.11	1158.1	0.0	0.0	1158.1
26	6.770	18.41	1246.1	0.0	0.0	1246.1
27	6.770	19.81	1340.8	0.0	0.0	1340.8
28	6.770	21.31	1442.7	0.0	0.0	1442.7
29	6.770	22.93	1552.3	0.0	0.0	1552.3
30	6.770	24.67	1670.3	0.0	0.0	1670.3
31	6.770	26.55	1797.3	0.0	0.0	1797.3
32	6.770	28.57	1933.9	0.0	0.0	1933.9
33	6.770	30.74	2080.8	0.0	0.0	2080.8
34	6.770	33.07	2239.0	0.0	0.0	2239.0
35	6.770	35.59	2409.1	0.0	0.0	2409.1
36	6.770	38.29	2592.2	0.0	0.0	2592.2
37	6.770	41.20	2789.2	0.0	0.0	2789.2
38	6.770	44.33	3001.2	0.0	0.0	3001.2
39	6.770	47.70	3229.3	0.0	0.0	3229.3
40	6.770	51.33	3474.7	0.0	0.0	3474.7

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	36.6	7.3	8.3	2.8	0.0	0.0	55.0
2	0.0	0.0	38.8	7.8	8.8	2.9	0.0	0.0	58.3
3	0.0	0.0	41.1	8.2	9.4	3.1	0.0	0.0	61.8
4	0.0	0.0	43.6	8.7	9.9	3.3	0.0	0.0	65.6
5	0.0	0.0	46.2	9.2	10.5	3.5	0.0	0.0	69.5
6	0.0	0.0	49.0	9.8	11.2	3.7	0.0	0.0	73.7
7	0.0	0.0	51.9	10.4	11.8	3.9	0.0	0.0	78.1
8	0.0	0.0	55.1	11.0	12.5	4.2	0.0	0.0	82.8
9	0.0	0.0	58.4	11.7	13.3	4.4	0.0	0.0	87.7
10	0.0	0.0	61.9	12.4	14.1	4.7	0.0	0.0	93.0
11	0.0	0.0	65.6	13.1	14.9	5.0	0.0	0.0	98.6
12	0.0	0.0	69.5	13.9	15.8	5.3	0.0	0.0	104.5
13	0.0	0.0	73.7	14.7	16.8	5.6	0.0	0.0	110.8
14	0.0	0.0	78.1	15.6	17.8	5.9	0.0	0.0	117.4
15	0.0	0.0	82.8	16.6	18.8	6.3	0.0	0.0	124.4
16	0.0	0.0	87.7	17.5	20.0	6.7	0.0	0.0	131.9
17	0.0	0.0	93.0	18.6	21.2	7.1	0.0	0.0	139.8
18	0.0	0.0	98.6	19.7	22.4	7.5	0.0	0.0	148.2
19	0.0	0.0	104.5	20.9	23.8	7.9	0.0	0.0	157.1
20	0.0	0.0	110.8	22.2	25.2	8.4	0.0	0.0	166.5
21	0.0	0.0	117.4	23.5	26.7	8.9	0.0	0.0	176.5
22	0.0	0.0	124.5	24.9	28.3	9.4	0.0	0.0	187.1
23	0.0	0.0	131.9	26.4	30.0	10.0	0.0	0.0	198.3
24	0.0	0.0	139.8	28.0	31.8	10.6	0.0	0.0	210.2
25	0.0	0.0	148.2	29.6	33.7	11.2	0.0	0.0	222.9
26	0.0	0.0	157.1	31.4	35.8	11.9	0.0	0.0	236.2
27	0.0	0.0	166.6	33.3	37.9	12.6	0.0	0.0	250.4
28	0.0	0.0	176.5	35.3	40.2	13.4	0.0	0.0	265.4
29	0.0	0.0	187.1	37.4	42.6	14.2	0.0	0.0	281.4
30	0.0	0.0	198.4	39.7	45.1	15.0	0.0	0.0	298.2
31	0.0	0.0	210.3	42.1	47.9	16.0	0.0	0.0	316.1
32	0.0	0.0	222.9	44.6	50.7	16.9	0.0	0.0	335.1
33	0.0	0.0	236.3	47.3	53.8	17.9	0.0	0.0	355.2
34	0.0	0.0	250.4	50.1	57.0	19.0	0.0	0.0	376.5
35	0.0	0.0	265.5	53.1	60.4	20.1	0.0	0.0	399.1
36	0.0	0.0	281.4	56.3	64.0	21.3	0.0	0.0	423.1
37	0.0	0.0	298.3	59.7	67.9	22.6	0.0	0.0	448.4
38	0.0	0.0	316.2	63.2	72.0	24.0	0.0	0.0	475.3
39	0.0	0.0	335.1	67.0	76.3	25.4	0.0	0.0	503.9
40	0.0	0.0	355.2	71.0	80.8	26.9	0.0	0.0	534.1

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	199.6	55.0	294.9	23.6	-173.9	5.52
2	214.8	58.3	294.9	23.6	-162.0	5.57
3	231.1	61.8	294.9	23.6	-149.2	5.62
4	248.7	65.6	294.9	23.6	-135.3	5.67
5	267.6	69.5	294.9	23.6	-120.4	5.73
6	288.0	73.7	294.9	23.6	-104.2	5.79
7	309.8	78.1	294.9	23.6	-86.7	5.86
8	333.4	82.8	294.9	23.6	-67.9	5.93
9	358.7	87.7	294.9	23.6	-47.5	6.00
10	386.0	93.0	294.9	23.6	-25.5	6.08
11	415.3	98.6	294.9	23.6	-1.8	6.16
12	446.9	104.5	294.9	23.6	23.9	6.25
13	480.8	110.8	294.9	23.6	51.6	6.34
14	517.4	117.4	294.9	23.6	81.5	6.44
15	556.7	124.4	294.9	23.6	113.8	6.54
16	599.0	131.9	294.9	23.6	148.6	6.65
17	644.5	139.8	294.9	23.6	186.2	6.77
18	693.5	148.2	294.9	23.6	226.8	6.89
19	746.2	157.1	294.9	23.6	270.6	7.03
20	802.9	166.5	294.9	23.6	317.9	7.16
21	864.0	176.5	294.9	23.6	368.9	7.31
22	929.6	187.1	294.9	23.6	424.0	7.47
23	1000.3	198.3	294.9	23.6	483.4	7.63
24	1076.3	210.2	294.9	23.6	547.5	7.81
25	1158.1	222.9	294.9	23.6	616.7	8.00
26	1246.1	236.2	294.9	23.6	691.4	8.19
27	1340.8	250.4	294.9	23.6	771.9	8.40
28	1442.7	265.4	294.9	23.6	858.8	8.63
29	1552.3	281.4	294.9	23.6	952.5	8.86
30	1670.3	298.2	294.9	23.6	1053.6	9.11
31	1797.3	316.1	294.9	0.0	1186.2	9.03
32	1933.9	335.1	294.9	0.0	1303.9	9.31
33	2080.8	355.2	294.9	0.0	1430.7	9.60
34	2239.0	376.5	294.9	0.0	1567.6	9.92
35	2409.1	399.1	294.9	0.0	1715.1	10.25
36	2592.2	423.1	294.9	0.0	1874.3	10.60
37	2789.2	448.4	294.9	0.0	2045.9	10.98
38	3001.2	475.3	294.9	0.0	2231.0	11.38
39	3229.3	503.9	294.9	0.0	2430.5	11.80
40	3474.7	534.1	294.9	0.0	2645.7	12.24

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.066
30	2.10	0.069
30	2.20	0.073

30	2.30	0.076
30	2.40	0.079
30	2.50	0.082
30	2.60	0.085
30	2.70	0.088
30	2.80	0.091
30	2.90	0.094
30	3.00	0.097
30	3.10	0.099
30	3.20	0.102
30	3.30	0.104
30	3.40	0.107
30	3.50	0.109

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.075
35	2.10	0.079
35	2.20	0.082
35	2.30	0.085
35	2.40	0.088
35	2.50	0.091
35	2.60	0.093
35	2.70	0.096
35	2.80	0.099
35	2.90	0.101
35	3.00	0.104
35	3.10	0.106
35	3.20	0.108
35	3.30	0.111
35	3.40	0.113
35	3.50	0.115

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.082
40	2.10	0.085
40	2.20	0.088
40	2.30	0.091
40	2.40	0.094
40	2.50	0.096
40	2.60	0.099
40	2.70	0.101
40	2.80	0.104
40	2.90	0.106
40	3.00	0.108
40	3.10	0.111
40	3.20	0.113
40	3.30	0.115
40	3.40	0.117
40	3.50	0.119

CANTON HYDRO PROJECT ALTERNATIVE - U1

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES 7.60  
 OTHER QUANTITIES 6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	858.4	858.4	918.5
0	1287.7	1365.0	1365.0
TOTALS	2146.1	2223.4	2283.4

COMPLETED COST = \$ 2283.4  
 FULLY AMORTIZED OVER 40 YEARS = \$ 171.3 PER YEAR AT 7.0 % INTEREST

## PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	5.880	2.95	173.4	0.0	0.0	173.4
2	5.880	3.17	186.6	0.0	0.0	186.6
3	5.880	3.41	200.8	0.0	0.0	200.8
4	5.880	3.67	216.0	0.0	0.0	216.0
5	5.880	3.95	232.4	0.0	0.0	232.4
6	5.880	4.25	250.1	0.0	0.0	250.1
7	5.880	4.58	269.1	0.0	0.0	269.1
8	5.880	4.92	289.6	0.0	0.0	289.6
9	5.880	5.30	311.6	0.0	0.0	311.6
10	5.880	5.70	335.2	0.0	0.0	335.2
11	5.880	6.13	360.7	0.0	0.0	360.7
12	5.880	6.60	388.1	0.0	0.0	388.1
13	5.880	7.10	417.6	0.0	0.0	417.6
14	5.880	7.64	449.4	0.0	0.0	449.4
15	5.880	8.22	483.5	0.0	0.0	483.5
16	5.880	8.85	520.3	0.0	0.0	520.3
17	5.880	9.52	559.8	0.0	0.0	559.8
18	5.880	10.24	602.3	0.0	0.0	602.3
19	5.880	11.02	648.1	0.0	0.0	648.1
20	5.880	11.86	697.4	0.0	0.0	697.4
21	5.880	12.76	750.4	0.0	0.0	750.4
22	5.880	13.73	807.4	0.0	0.0	807.4
23	5.880	14.78	868.8	0.0	0.0	868.8
24	5.880	15.90	934.8	0.0	0.0	934.8
25	5.880	17.11	1005.8	0.0	0.0	1005.8
26	5.880	18.41	1082.3	0.0	0.0	1082.3
27	5.880	19.81	1164.5	0.0	0.0	1164.5
28	5.880	21.31	1253.0	0.0	0.0	1253.0
29	5.880	22.93	1348.3	0.0	0.0	1348.3
30	5.880	24.67	1450.7	0.0	0.0	1450.7
31	5.880	26.55	1561.0	0.0	0.0	1561.0
32	5.880	28.57	1679.6	0.0	0.0	1679.6
33	5.880	30.74	1807.3	0.0	0.0	1807.3
34	5.880	33.07	1944.6	0.0	0.0	1944.6
35	5.880	35.59	2092.4	0.0	0.0	2092.4
36	5.880	38.29	2251.4	0.0	0.0	2251.4
37	5.880	41.20	2422.5	0.0	0.0	2422.5
38	5.880	44.33	2606.7	0.0	0.0	2606.7
39	5.880	47.70	2804.8	0.0	0.0	2804.8
40	5.880	51.33	3017.9	0.0	0.0	3017.9

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	41.7	8.3	4.8	2.8	0.0	0.0	57.6
2	0.0	0.0	44.2	8.8	5.1	2.9	0.0	0.0	61.0
3	0.0	0.0	46.8	9.4	5.4	3.1	0.0	0.0	64.7
4	0.0	0.0	49.6	9.9	5.7	3.3	0.0	0.0	68.6
5	0.0	0.0	52.6	10.5	6.1	3.5	0.0	0.0	72.7
6	0.0	0.0	55.8	11.2	6.4	3.7	0.0	0.0	77.0
7	0.0	0.0	59.1	11.8	6.8	3.9	0.0	0.0	81.7
8	0.0	0.0	62.6	12.5	7.2	4.2	0.0	0.0	86.6
9	0.0	0.0	66.4	13.3	7.6	4.4	0.0	0.0	91.8
10	0.0	0.0	70.4	14.1	8.1	4.7	0.0	0.0	97.3
11	0.0	0.0	74.6	14.9	8.6	5.0	0.0	0.0	103.1
12	0.0	0.0	79.1	15.8	9.1	5.3	0.0	0.0	109.3
13	0.0	0.0	83.8	16.8	9.7	5.6	0.0	0.0	115.8
14	0.0	0.0	88.9	17.8	10.2	5.9	0.0	0.0	122.8
15	0.0	0.0	94.2	18.8	10.8	6.3	0.0	0.0	130.2
16	0.0	0.0	99.8	20.0	11.5	6.7	0.0	0.0	138.0
17	0.0	0.0	105.8	21.2	12.2	7.1	0.0	0.0	146.2
18	0.0	0.0	112.2	22.4	12.9	7.5	0.0	0.0	155.0
19	0.0	0.0	118.9	23.8	13.7	7.9	0.0	0.0	164.3
20	0.0	0.0	126.0	25.2	14.5	8.4	0.0	0.0	174.2
21	0.0	0.0	133.6	26.7	15.4	8.9	0.0	0.0	184.6
22	0.0	0.0	141.6	28.3	16.3	9.4	0.0	0.0	195.7
23	0.0	0.0	150.1	30.0	17.3	10.0	0.0	0.0	207.4
24	0.0	0.0	159.1	31.8	18.3	10.6	0.0	0.0	219.9
25	0.0	0.0	168.7	33.7	19.4	11.2	0.0	0.0	233.1
26	0.0	0.0	178.8	35.8	20.6	11.9	0.0	0.0	247.1
27	0.0	0.0	189.5	37.9	21.8	12.6	0.0	0.0	261.9
28	0.0	0.0	200.9	40.2	23.1	13.4	0.0	0.0	277.6
29	0.0	0.0	213.0	42.6	24.5	14.2	0.0	0.0	294.3
30	0.0	0.0	225.7	45.1	26.0	15.0	0.0	0.0	311.9
31	0.0	0.0	239.3	47.9	27.6	16.0	0.0	0.0	330.6
32	0.0	0.0	253.6	50.7	29.2	16.9	0.0	0.0	350.5
33	0.0	0.0	268.8	53.8	31.0	17.9	0.0	0.0	371.5
34	0.0	0.0	285.0	57.0	32.8	19.0	0.0	0.0	393.8
35	0.0	0.0	302.1	60.4	34.8	20.1	0.0	0.0	417.4
36	0.0	0.0	320.2	64.0	36.9	21.3	0.0	0.0	442.5
37	0.0	0.0	339.4	67.9	39.1	22.6	0.0	0.0	469.0
38	0.0	0.0	359.8	72.0	41.4	24.0	0.0	0.0	497.1
39	0.0	0.0	381.4	76.3	43.9	25.4	0.0	0.0	527.0
40	0.0	0.0	404.2	80.8	46.5	26.9	0.0	0.0	558.6



RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	MFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	173.4	57.6	171.3	13.9	4 -49.4 1,26,551	4.13
2	186.6	61.0	171.3	13.9	5 -59.7 1,34	4.19
3	200.8	64.7	171.3	13.9	6 -49.1 1,92,250	4.25
4	216.0	68.6	171.3	13.9	7 -37.8	4.32
5	232.4	72.7	171.3	13.9	8 -25.5 1,59	4.39
6	250.1	77.0	171.3	13.9	9 -12.2	4.46
7	269.1	81.7	171.3	13.9	10 2.2 1,79, 1.2	4.54
8	289.6	86.6	171.3	13.9	11 17.8	4.62
9	311.6	91.8	171.3	13.9	12 34.6	4.71
10	335.2	97.3	171.3	13.9	13 52.8 -2.13, 24.8	4.80
11	360.7	103.1	171.3	13.9	14 72.4	4.90
12	388.1	109.3	171.3	13.9	15 93.6	5.01
13	417.6	115.8	171.3	13.9	16 116.6	5.12
14	449.4	122.8	171.3	13.9	17 141.4	5.24
15	483.5	130.2	171.3	13.9	18 168.1 -2.85	5.36
16	520.3	138.0	171.3	13.9	19 197.1	5.50
17	559.8	146.2	171.3	13.4	20 228.3	5.64
18	602.3	155.0	171.3	13.9	21 262.1	5.79
19	648.1	164.3	171.3	13.9	22 298.6	5.94
20	697.4	174.2	171.3	13.9	23 338.0 -3.82 88.5	6.11
21	750.4	184.6	171.3	13.9	24 380.5	6.29
22	807.4	195.7	171.3	13.9	25 426.5	6.48
23	868.8	207.4	171.3	13.9	26 476.1	6.68
24	934.8	219.9	171.3	13.9	27 529.7	6.89
25	1005.8	233.1	171.3	13.9	28 587.5 -5.11 115	7.11
26	1082.3	247.1	171.3	13.9	29 650.0	7.35
27	1164.5	261.9	171.3	13.9	30 717.4	7.60
28	1253.0	277.6	171.3	13.9	31 790.2	7.87
29	1348.3	294.3	171.3	13.9	32 868.8	8.15
30	1450.7	311.9	171.3	13.9	33 953.6 -6.89 139.4	8.45
31	1561.0	330.6	171.3	0.0	34 1059.1	8.54
32	1679.6	350.5	171.3	0.0	35 1157.9	8.87
33	1807.3	371.5	171.3	0.0	36 1264.5	9.23
34	1944.6	393.8	171.3	0.0	37 1379.6	9.61
35	2092.4	417.4	171.3	0.0	38 1503.7 -164	10.01
36	2251.4	442.5	171.3	0.0	39 1637.7	10.44
37	2422.5	469.0	171.3	0.0	40 1782.3	10.89
38	2606.7	497.1	171.3	0.0	41 1934.2	11.37
39	2804.8	527.0	171.3	0.0	42 2106.5	11.88
40	3017.9	558.6	171.3	0.0	43 2288.0 12.25 186.8	12.41

## INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.085
30	2.10	0.090
30	2.20	0.094

30	2.30	0.098
30	2.40	0.101
30	2.50	0.105
30	2.60	0.109
30	2.70	0.112
30	2.80	0.115
30	2.90	0.118
30	3.00	0.122
30	3.10	0.125
30	3.20	0.128
30	3.30	0.131
30	3.40	0.133
30	3.50	0.136

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.093
35	2.10	0.097
35	2.20	0.101
35	2.30	0.105
35	2.40	0.108
35	2.50	0.111
35	2.60	0.115
35	2.70	0.118
35	2.80	0.121
35	2.90	0.124
35	3.00	0.127
35	3.10	0.130
35	3.20	0.133
35	3.30	0.135
35	3.40	0.138
35	3.50	0.141

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.099
40	2.10	0.103
40	2.20	0.106
40	2.30	0.109
40	2.40	0.113
40	2.50	0.116
40	2.60	0.119
40	2.70	0.122
40	2.80	0.125
40	2.90	0.128
40	3.00	0.130
40	3.10	0.133
40	3.20	0.136
40	3.30	0.138
40	3.40	0.141
40	3.50	0.144

CANTON HYDRO PROJECT ALTERNATIVE - U2

PRICE ESCALATION RATES

	% PER YEAR
ENERGY VALUES	7.60
BACKUP ENERGY	0.0
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	588.4	588.4	736.6
0	1032.5	1094.4	1094.4
TOTALS	1720.9	1782.8	1831.0

COMPLETED COST = \$ 1831.0  
 FULLY AMORTIZED OVER 40 YEARS = \$ 137.3 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	5.030	2.95	148.3	0.0	0.0	148.3
2	5.030	3.17	159.6	0.0	0.0	159.6
3	5.030	3.41	171.7	0.0	0.0	171.7
4	5.030	3.67	184.8	0.0	0.0	184.8
5	5.030	3.95	198.8	0.0	0.0	198.8
6	5.030	4.25	213.9	0.0	0.0	213.9
7	5.030	4.58	230.2	0.0	0.0	230.2
8	5.030	4.92	247.7	0.0	0.0	247.7
9	5.030	5.30	266.5	0.0	0.0	266.5
10	5.030	5.70	286.8	0.0	0.0	286.8
11	5.030	6.13	308.6	0.0	0.0	308.6
12	5.030	6.60	332.0	0.0	0.0	332.0
13	5.030	7.10	357.3	0.0	0.0	357.3
14	5.030	7.64	384.4	0.0	0.0	384.4
15	5.030	8.22	413.6	0.0	0.0	413.6
16	5.030	8.85	445.1	0.0	0.0	445.1
17	5.030	9.52	478.9	0.0	0.0	478.9
18	5.030	10.24	515.3	0.0	0.0	515.3
19	5.030	11.02	554.4	0.0	0.0	554.4
20	5.030	11.86	596.6	0.0	0.0	596.6
21	5.030	12.76	641.9	0.0	0.0	641.9
22	5.030	13.73	690.7	0.0	0.0	690.7
23	5.030	14.78	743.2	0.0	0.0	743.2
24	5.030	15.90	799.7	0.0	0.0	799.7
25	5.030	17.11	860.4	0.0	0.0	860.4
26	5.030	18.41	925.8	0.0	0.0	925.8
27	5.030	19.81	996.2	0.0	0.0	996.2
28	5.030	21.31	1071.9	0.0	0.0	1071.9
29	5.030	22.93	1153.4	0.0	0.0	1153.4
30	5.030	24.67	1241.0	0.0	0.0	1241.0
31	5.030	25.55	1335.3	0.0	0.0	1335.3
32	5.030	24.57	1436.8	0.0	0.0	1436.8
33	5.030	30.74	1546.0	0.0	0.0	1546.0
34	5.030	33.07	1663.5	0.0	0.0	1663.5
35	5.030	35.59	1789.9	0.0	0.0	1789.9
36	5.030	38.29	1926.0	0.0	0.0	1926.0
37	5.030	41.20	2072.3	0.0	0.0	2072.3
38	5.030	44.33	2229.8	0.0	0.0	2229.8
39	5.030	47.70	2399.3	0.0	0.0	2399.3
40	5.030	51.33	2581.7	0.0	0.0	2581.7

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	34.1	6.8	3.9	2.8	0.0	0.0	47.6
2	0.0	0.0	36.1	7.2	4.1	2.9	0.0	0.0	50.5
3	0.0	0.0	38.3	7.7	4.4	3.1	0.0	0.0	53.5
4	0.0	0.0	40.6	8.1	4.7	3.3	0.0	0.0	56.7
5	0.0	0.0	43.0	8.6	4.9	3.5	0.0	0.0	60.1
6	0.0	0.0	45.6	9.1	5.2	3.7	0.0	0.0	63.7
7	0.0	0.0	48.4	9.7	5.6	3.9	0.0	0.0	67.5
8	0.0	0.0	51.3	10.3	5.9	4.2	0.0	0.0	71.6
9	0.0	0.0	54.3	10.9	6.2	4.4	0.0	0.0	75.9
10	0.0	0.0	57.6	11.5	6.6	4.7	0.0	0.0	80.4
11	0.0	0.0	61.0	12.2	7.0	5.0	0.0	0.0	85.2
12	0.0	0.0	64.7	12.9	7.4	5.3	0.0	0.0	90.3
13	0.0	0.0	68.6	13.7	7.9	5.6	0.0	0.0	95.8
14	0.0	0.0	72.7	14.5	8.3	5.9	0.0	0.0	101.5
15	0.0	0.0	77.1	15.4	8.8	6.3	0.0	0.0	107.6
16	0.0	0.0	81.7	16.3	9.4	6.7	0.0	0.0	114.1
17	0.0	0.0	86.6	17.3	9.9	7.1	0.0	0.0	120.9
18	0.0	0.0	91.8	18.4	10.5	7.5	0.0	0.0	128.2
19	0.0	0.0	97.3	19.5	11.2	7.9	0.0	0.0	135.9
20	0.0	0.0	103.1	20.6	11.8	8.4	0.0	0.0	144.0
21	0.0	0.0	109.3	21.9	12.6	8.9	0.0	0.0	152.6
22	0.0	0.0	115.9	23.2	13.3	9.4	0.0	0.0	161.8
23	0.0	0.0	122.8	24.6	14.1	10.0	0.0	0.0	171.5
24	0.0	0.0	130.2	26.0	14.9	10.6	0.0	0.0	181.8
25	0.0	0.0	138.0	27.6	15.8	11.2	0.0	0.0	192.7
26	0.0	0.0	146.3	29.3	16.8	11.9	0.0	0.0	204.3
27	0.0	0.0	155.1	31.0	17.8	12.6	0.0	0.0	216.5
28	0.0	0.0	164.4	32.9	18.9	13.4	0.0	0.0	229.5
29	0.0	0.0	174.2	34.8	20.0	14.2	0.0	0.0	243.3
30	0.0	0.0	184.7	36.9	21.2	15.0	0.0	0.0	257.9
31	0.0	0.0	195.8	39.2	22.5	16.0	0.0	0.0	273.4
32	0.0	0.0	207.5	41.5	23.8	16.9	0.0	0.0	289.8
33	0.0	0.0	220.0	44.0	25.3	17.9	0.0	0.0	307.1
34	0.0	0.0	233.2	46.6	26.8	19.0	0.0	0.0	325.6
35	0.0	0.0	247.2	49.4	28.4	20.1	0.0	0.0	345.1
36	0.0	0.0	262.0	52.4	30.1	21.3	0.0	0.0	365.8
37	0.0	0.0	277.7	55.5	31.9	22.6	0.0	0.0	387.8
38	0.0	0.0	294.4	58.9	33.8	24.0	0.0	0.0	411.0
39	0.0	0.0	312.0	62.4	35.9	25.4	0.0	0.0	435.7
40	0.0	0.0	330.7	66.1	38.0	26.9	0.0	0.0	461.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	148.3	47.6	137.3	11.5	-48.1	3.91
2	159.6	50.5	137.3	11.5	-39.7	3.96
3	171.7	53.5	137.3	11.5	-30.6	4.02
4	184.8	56.7	137.3	11.5	-20.8	4.09
5	198.8	60.1	137.3	11.5	-10.1	4.15
6	213.9	63.7	137.3	11.5	1.4	4.23
7	230.2	67.5	137.3	11.5	13.8	4.30
8	247.7	71.6	137.3	11.5	27.3	4.38
9	266.5	75.9	137.3	11.5	41.8	4.47
10	286.8	80.4	137.3	11.5	57.5	4.56
11	308.6	85.2	137.3	11.5	74.5	4.65
12	332.0	90.3	137.3	11.5	92.8	4.76
13	357.3	95.8	137.3	11.5	112.6	4.86
14	384.4	101.5	137.3	11.5	134.0	4.98
15	413.6	107.6	137.3	11.5	157.1	5.10
16	445.1	114.1	137.3	11.5	182.1	5.23
17	478.9	120.9	137.3	11.5	209.1	5.36
18	515.3	128.2	137.3	11.5	238.2	5.51
19	554.4	135.9	137.3	11.5	269.7	5.66
20	596.6	144.0	137.3	11.5	303.7	5.82
21	641.9	152.6	137.3	11.5	340.4	5.99
22	690.7	161.8	137.3	11.5	380.0	6.18
23	743.2	171.5	137.3	11.5	422.8	6.37
24	799.7	181.8	137.3	11.5	469.0	6.57
25	860.4	192.7	137.3	11.5	518.9	6.79
26	925.8	204.3	137.3	11.5	572.7	7.02
27	996.2	216.5	137.3	11.5	630.8	7.26
28	1071.9	229.5	137.3	11.5	693.5	7.52
29	1153.4	243.3	137.3	11.5	761.2	7.80
30	1241.0	257.9	137.3	11.5	834.3	8.09
31	1335.3	273.4	137.3	0.0	924.6	8.16
32	1436.8	289.8	137.3	0.0	1009.7	8.49
33	1546.0	307.1	137.3	0.0	1101.5	8.84
34	1663.5	325.6	137.3	0.0	1200.6	9.20
35	1789.9	345.1	137.3	0.0	1307.5	9.59
36	1926.0	365.8	137.3	0.0	1422.8	10.00
37	2072.3	387.8	137.3	0.0	1547.2	10.44
38	2229.8	411.0	137.3	0.0	1681.5	10.90
39	2399.3	435.7	137.3	0.0	1826.3	11.39
40	2581.7	461.8	137.3	0.0	1982.5	11.91

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
30	2.00	0.087
30	2.10	0.091
30	2.20	0.095
30	2.30	0.099
30	2.40	0.103

30	2.50	0.107
30	2.60	0.111
30	2.70	0.114
30	2.80	0.118
30	2.90	0.121
30	3.00	0.124
30	3.10	0.128
30	3.20	0.131
30	3.30	0.134
30	3.40	0.137
30	3.50	0.139

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
35	2.00	0.095
35	2.10	0.099
35	2.20	0.103
35	2.30	0.107
35	2.40	0.110
35	2.50	0.114
35	2.60	0.117
35	2.70	0.120
35	2.80	0.123
35	2.90	0.127
35	3.00	0.130
35	3.10	0.133
35	3.20	0.135
35	3.30	0.138
35	3.40	0.141
35	3.50	0.144

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
40	2.00	0.101
40	2.10	0.104
40	2.20	0.108
40	2.30	0.111
40	2.40	0.115
40	2.50	0.118
40	2.60	0.121
40	2.70	0.124
40	2.80	0.127
40	2.90	0.130
40	3.00	0.133
40	3.10	0.136
40	3.20	0.139
40	3.30	0.141
40	3.40	0.144
40	3.50	0.147

CANTON HYDRO PROJECT ALTERNATIVE - U3

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	7.60
BACKUP ENERGY	0.0
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	387.4	387.4	414.5
0	511.1	616.0	616.0
TOTALS	968.5	1003.4	1030.5

COMPLETED COST = \$ 1030.5  
 FULLY AMORTIZED OVER 40 YEARS = \$ 77.3 PER YEAR AT 7.0 % INTEREST



## PROJECT REVENUES IN THOUSANDS

YFAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	EMERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	3.330	2.95	98.2	0.0	0.0	98.2
2	3.330	3.17	105.7	0.0	0.0	105.7
3	3.330	3.41	113.7	0.0	0.0	113.7
4	3.330	3.67	122.3	0.0	0.0	122.3
5	3.330	3.95	131.6	0.0	0.0	131.6
6	3.330	4.25	141.6	0.0	0.0	141.6
7	3.330	4.58	152.4	0.0	0.0	152.4
8	3.330	4.92	164.0	0.0	0.0	164.0
9	3.330	5.30	176.4	0.0	0.0	176.4
10	3.330	5.70	189.9	0.0	0.0	189.9
11	3.330	6.13	204.3	0.0	0.0	204.3
12	3.330	6.60	219.8	0.0	0.0	219.8
13	3.330	7.10	236.5	0.0	0.0	236.5
14	3.330	7.64	254.5	0.0	0.0	254.5
15	3.330	8.22	273.8	0.0	0.0	273.8
16	3.330	8.85	294.6	0.0	0.0	294.6
17	3.330	9.52	317.0	0.0	0.0	317.0
18	3.330	10.24	341.1	0.0	0.0	341.1
19	3.330	11.02	367.1	0.0	0.0	367.1
20	3.330	11.86	394.9	0.0	0.0	394.9
21	3.330	12.76	425.0	0.0	0.0	425.0
22	3.330	13.73	457.3	0.0	0.0	457.3
23	3.330	14.78	492.0	0.0	0.0	492.0
24	3.330	15.90	529.4	0.0	0.0	529.4
25	3.330	17.11	569.6	0.0	0.0	569.6
26	3.330	18.41	612.9	0.0	0.0	612.9
27	3.330	19.81	659.5	0.0	0.0	659.5
28	3.330	21.31	709.6	0.0	0.0	709.6
29	3.330	22.93	763.6	0.0	0.0	763.6
30	3.330	24.67	821.6	0.0	0.0	821.6
31	3.330	26.55	884.0	0.0	0.0	884.0
32	3.330	28.57	951.2	0.0	0.0	951.2
33	3.330	30.74	1023.5	0.0	0.0	1023.5
34	3.330	33.07	1101.3	0.0	0.0	1101.3
35	3.330	35.59	1185.0	0.0	0.0	1185.0
36	3.330	38.29	1275.1	0.0	0.0	1275.1
37	3.330	41.20	1372.0	0.0	0.0	1372.0
38	3.330	44.33	1476.2	0.0	0.0	1476.2
39	3.330	47.70	1588.4	0.0	0.0	1588.4
40	3.330	51.33	1709.1	0.0	0.0	1709.1

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	22.7	4.8	2.1	2.8	0.0	0.0	32.4
2	0.0	0.0	24.1	5.1	2.3	2.9	0.0	0.0	34.4
3	0.0	0.0	25.5	5.4	2.4	3.1	0.0	0.0	36.5
4	0.0	0.0	27.1	5.7	2.5	3.3	0.0	0.0	38.6
5	0.0	0.0	28.7	6.1	2.7	3.5	0.0	0.0	41.0
6	0.0	0.0	30.4	6.4	2.9	3.7	0.0	0.0	43.4
7	0.0	0.0	32.2	6.8	3.0	3.9	0.0	0.0	46.0
8	0.0	0.0	34.2	7.2	3.2	4.2	0.0	0.0	48.8
9	0.0	0.0	36.2	7.6	3.4	4.4	0.0	0.0	51.7
10	0.0	0.0	38.4	8.1	3.6	4.7	0.0	0.0	54.8
11	0.0	0.0	40.7	8.6	3.8	5.0	0.0	0.0	58.1
12	0.0	0.0	43.1	9.1	4.1	5.3	0.0	0.0	61.6
13	0.0	0.0	45.7	9.7	4.3	5.6	0.0	0.0	65.3
14	0.0	0.0	48.5	10.2	4.6	5.9	0.0	0.0	69.2
15	0.0	0.0	51.4	10.8	4.9	6.3	0.0	0.0	73.4
16	0.0	0.0	54.5	11.5	5.1	6.7	0.0	0.0	77.8
17	0.0	0.0	57.7	12.2	5.5	7.1	0.0	0.0	82.4
18	0.0	0.0	61.2	12.9	5.8	7.5	0.0	0.0	87.4
19	0.0	0.0	64.9	13.7	6.1	7.9	0.0	0.0	92.6
20	0.0	0.0	68.8	14.5	6.5	8.4	0.0	0.0	98.2
21	0.0	0.0	72.9	15.4	6.9	8.9	0.0	0.0	104.1
22	0.0	0.0	77.3	16.3	7.3	9.4	0.0	0.0	110.3
23	0.0	0.0	81.9	17.3	7.7	10.0	0.0	0.0	116.9
24	0.0	0.0	86.8	18.3	8.2	10.6	0.0	0.0	123.9
25	0.0	0.0	92.0	19.4	8.7	11.2	0.0	0.0	131.4
26	0.0	0.0	97.5	20.6	9.2	11.9	0.0	0.0	139.2
27	0.0	0.0	103.4	21.8	9.8	12.6	0.0	0.0	147.6
28	0.0	0.0	109.6	23.1	10.3	13.4	0.0	0.0	156.5
29	0.0	0.0	116.2	24.5	11.0	14.2	0.0	0.0	165.8
30	0.0	0.0	123.1	26.0	11.6	15.0	0.0	0.0	175.8
31	0.0	0.0	130.5	27.6	12.3	16.0	0.0	0.0	186.3
32	0.0	0.0	138.3	29.2	13.1	16.9	0.0	0.0	197.5
33	0.0	0.0	146.6	31.0	13.8	17.9	0.0	0.0	209.4
34	0.0	0.0	155.4	32.8	14.7	19.0	0.0	0.0	221.9
35	0.0	0.0	164.8	34.8	15.6	20.1	0.0	0.0	235.3
36	0.0	0.0	174.7	36.9	16.5	21.3	0.0	0.0	249.4
37	0.0	0.0	185.1	39.1	17.5	22.6	0.0	0.0	264.3
38	0.0	0.0	196.2	41.4	18.5	24.0	0.0	0.0	280.2
39	0.0	0.0	208.0	43.9	19.6	25.4	0.0	0.0	297.0
40	0.0	0.0	220.5	46.5	20.8	26.9	0.0	0.0	314.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	98.2	32.4	77.3	6.6	-18.1	3.49
2	105.7	34.4	77.3	6.6	-12.6	3.55
3	113.7	36.5	77.3	6.6	-6.7	3.61
4	122.3	39.6	77.3	6.6	-0.2	3.68
5	131.6	41.0	77.3	6.6	6.8	3.75
6	141.6	43.4	77.3	6.6	14.3	3.82
7	152.4	46.0	77.3	6.6	22.5	3.90
8	164.0	48.8	77.3	6.6	31.3	3.98
9	176.4	51.7	77.3	6.6	40.8	4.07
10	189.9	54.8	77.3	6.6	51.1	4.17
11	204.3	58.1	77.3	6.6	62.3	4.26
12	219.8	61.6	77.3	6.6	74.3	4.37
13	236.5	65.3	77.3	6.6	87.3	4.48
14	254.5	69.2	77.3	6.6	101.4	4.60
15	273.8	73.4	77.3	6.6	116.6	4.72
16	294.6	77.8	77.3	6.6	133.0	4.85
17	317.0	82.4	77.3	6.6	150.7	4.99
18	341.1	87.4	77.3	6.6	169.9	5.14
19	367.1	92.6	77.3	6.6	190.5	5.30
20	394.9	98.2	77.3	6.6	212.9	5.47
21	425.0	104.1	77.3	6.6	237.0	5.64
22	457.3	110.3	77.3	6.6	263.1	5.83
23	492.0	116.9	77.3	6.6	291.2	6.03
24	529.4	123.9	77.3	6.6	321.6	6.24
25	569.6	131.4	77.3	6.6	354.4	6.46
26	612.9	139.2	77.3	6.6	389.8	6.70
27	659.5	147.6	77.3	6.6	428.0	6.95
28	709.6	156.5	77.3	6.6	469.3	7.22
29	763.6	165.8	77.3	6.6	513.8	7.50
30	821.6	175.8	77.3	6.6	561.9	7.80
31	884.0	186.3	77.3	0.0	620.4	7.92
32	951.2	197.5	77.3	0.0	676.4	8.25
33	1023.5	209.4	77.3	0.0	736.8	8.61
34	1101.3	221.9	77.3	0.0	802.1	8.99
35	1185.0	235.3	77.3	0.0	872.4	9.39
36	1275.1	249.4	77.3	0.0	948.4	9.81
37	1372.0	264.3	77.3	0.0	1030.3	10.26
38	1476.2	280.2	77.3	0.0	1118.7	10.74
39	1588.4	297.0	77.3	0.0	1214.1	11.24
40	1709.1	314.8	77.3	0.0	1317.0	11.78

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

30	2.00	0.097
30	2.10	0.101
30	2.20	0.106
30	2.30	0.110
30	2.40	0.114

30	2.50	0.118
30	2.60	0.122
30	2.70	0.126
30	2.80	0.130
30	2.90	0.133
30	3.00	0.137
30	3.10	0.140
30	3.20	0.143
30	3.30	0.147
30	3.40	0.150
30	3.50	0.153

PROJECT LIFE INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

35	2.00	0.104
35	2.10	0.108
35	2.20	0.112
35	2.30	0.116
35	2.40	0.120
35	2.50	0.124
35	2.60	0.128
35	2.70	0.131
35	2.80	0.134
35	2.90	0.138
35	3.00	0.141
35	3.10	0.144
35	3.20	0.147
35	3.30	0.151
35	3.40	0.154
35	3.50	0.157

PROJECT LIFE INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

40	2.00	0.109
40	2.10	0.113
40	2.20	0.117
40	2.30	0.121
40	2.40	0.124
40	2.50	0.128
40	2.60	0.131
40	2.70	0.134
40	2.80	0.138
40	2.90	0.141
40	3.00	0.144
40	3.10	0.147
40	3.20	0.150
40	3.30	0.153
40	3.40	0.156
40	3.50	0.159

PART 2

CASES U1L1, U3.L2, U3 : INCREASED ENERGY ESCALATION

CANTON HYDRO PROJECT ALTERNATIVE U<sub>11</sub> INCREASED ESCALATION

PRICE ESCALATION RATES

	% PER YEAR
ENERGY VALUES	9.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1659.6	1659.6	1775.8
0	2489.3	2638.7	2638.7
TOTALS	4148.9	4298.3	4414.4

COMPLETED COST = \$ 4414.4  
 FULLY AMORTIZED OVER 40 YEARS = \$ 331.1 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	10.330	3.17	327.9	0.0	0.0	327.9
2	10.330	3.48	359.4	0.0	0.0	359.4
3	10.330	3.81	393.9	0.0	0.0	393.9
4	10.330	4.18	431.7	0.0	0.0	431.7
5	10.330	4.58	473.2	0.0	0.0	473.2
6	10.330	5.02	518.6	0.0	0.0	518.6
7	10.330	5.50	568.4	0.0	0.0	568.4
8	10.330	6.03	622.9	0.0	0.0	622.9
9	10.330	6.61	682.7	0.0	0.0	682.7
10	10.330	7.24	748.3	0.0	0.0	748.3
11	10.330	7.94	820.1	0.0	0.0	820.1
12	10.330	8.70	898.8	0.0	0.0	898.8
13	10.330	9.54	985.1	0.0	0.0	985.1
14	10.330	10.45	1079.7	0.0	0.0	1079.7
15	10.330	11.46	1183.3	0.0	0.0	1183.3
16	10.330	12.56	1296.9	0.0	0.0	1296.9
17	10.330	13.75	1421.4	0.0	0.0	1421.4
18	10.330	15.08	1557.9	0.0	0.0	1557.9
19	10.330	16.53	1707.5	0.0	0.0	1707.5
20	10.330	18.12	1871.4	0.0	0.0	1871.4
21	10.330	19.85	2051.0	0.0	0.0	2051.0
22	10.330	21.76	2247.9	0.0	0.0	2247.9
23	10.330	23.85	2463.7	0.0	0.0	2463.7
24	10.330	26.14	2700.2	0.0	0.0	2700.2
25	10.330	28.65	2959.5	0.0	0.0	2959.5
26	10.330	31.40	3243.6	0.0	0.0	3243.6
27	10.330	34.41	3554.9	0.0	0.0	3554.9
28	10.330	37.72	3896.2	0.0	0.0	3896.2
29	10.330	41.34	4270.2	0.0	0.0	4270.2
30	10.330	45.31	4680.2	0.0	0.0	4680.2
31	10.330	49.66	5129.5	0.0	0.0	5129.5
32	10.330	54.42	5621.9	0.0	0.0	5621.9
33	10.330	59.65	6161.6	0.0	0.0	6161.6
34	10.330	65.37	6753.1	0.0	0.0	6753.1
35	10.330	71.65	7401.4	0.0	0.0	7401.4
36	10.330	78.53	8111.9	0.0	0.0	8111.9
37	10.330	86.07	8890.7	0.0	0.0	8890.7
38	10.330	94.33	9744.2	0.0	0.0	9744.2
39	10.330	****	10679.6	0.0	0.0	10679.6
40	10.330	****	11704.8	0.0	0.0	11704.8

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	61.9	12.4	9.3	2.8	0.0	0.0	86.4
2	0.0	0.0	65.6	13.1	9.9	2.9	0.0	0.0	91.5
3	0.0	0.0	69.5	13.9	10.5	3.1	0.0	0.0	97.0
4	0.0	0.0	73.7	14.7	11.1	3.3	0.0	0.0	102.8
5	0.0	0.0	78.1	15.6	11.8	3.5	0.0	0.0	109.0
6	0.0	0.0	82.8	16.6	12.5	3.7	0.0	0.0	115.6
7	0.0	0.0	87.8	17.6	13.3	3.9	0.0	0.0	122.5
8	0.0	0.0	93.0	18.6	14.0	4.2	0.0	0.0	129.8
9	0.0	0.0	98.6	19.7	14.9	4.4	0.0	0.0	137.6
10	0.0	0.0	104.5	20.9	15.8	4.7	0.0	0.0	145.9
11	0.0	0.0	110.8	22.2	16.7	5.0	0.0	0.0	154.0
12	0.0	0.0	117.4	23.5	17.7	5.3	0.0	0.0	163.9
13	0.0	0.0	124.5	24.9	18.8	5.6	0.0	0.0	173.8
14	0.0	0.0	131.9	26.4	19.9	5.9	0.0	0.0	184.2
15	0.0	0.0	139.9	28.0	21.1	6.3	0.0	0.0	195.2
16	0.0	0.0	148.3	29.7	22.4	6.7	0.0	0.0	206.9
17	0.0	0.0	157.1	31.4	23.7	7.1	0.0	0.0	219.4
18	0.0	0.0	166.6	33.3	25.2	7.5	0.0	0.0	232.5
19	0.0	0.0	176.6	35.3	26.7	7.9	0.0	0.0	246.5
20	0.0	0.0	187.2	37.4	28.3	8.4	0.0	0.0	261.3
21	0.0	0.0	198.4	39.7	30.0	8.9	0.0	0.0	276.9
22	0.0	0.0	210.3	42.1	31.8	9.4	0.0	0.0	293.6
23	0.0	0.0	222.9	44.6	33.7	10.0	0.0	0.0	311.2
24	0.0	0.0	236.3	47.3	35.7	10.6	0.0	0.0	329.8
25	0.0	0.0	250.5	50.1	37.8	11.2	0.0	0.0	349.0
26	0.0	0.0	265.5	53.1	40.1	11.9	0.0	0.0	370.6
27	0.0	0.0	281.4	56.3	42.5	12.6	0.0	0.0	392.8
28	0.0	0.0	298.3	59.7	45.1	13.4	0.0	0.0	416.4
29	0.0	0.0	316.2	63.2	47.8	14.2	0.0	0.0	441.4
30	0.0	0.0	335.2	67.0	50.6	15.0	0.0	0.0	467.9
31	0.0	0.0	355.3	71.1	53.7	16.0	0.0	0.0	496.0
32	0.0	0.0	376.6	75.3	56.9	16.9	0.0	0.0	525.7
33	0.0	0.0	399.2	79.8	60.3	17.9	0.0	0.0	557.3
34	0.0	0.0	423.2	84.6	63.9	19.0	0.0	0.0	590.7
35	0.0	0.0	448.5	89.7	67.7	20.1	0.0	0.0	626.1
36	0.0	0.0	475.5	95.1	71.8	21.3	0.0	0.0	663.7
37	0.0	0.0	504.0	100.8	76.1	22.6	0.0	0.0	703.5
38	0.0	0.0	534.2	106.8	80.7	24.0	0.0	0.0	745.7
39	0.0	0.0	566.3	113.3	85.5	25.4	0.0	0.0	790.5
40	0.0	0.0	600.2	120.0	90.6	26.9	0.0	0.0	837.9



RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	327.9	86.4	331.1	26.1	-115.7	4.29
2	359.4	91.5	331.1	26.1	-89.4	4.34
3	393.9	97.0	331.1	26.1	-60.4	4.40
4	431.7	102.6	331.1	26.1	-28.4	4.45
5	473.2	109.0	331.1	26.1	6.9	4.51
6	518.6	115.6	331.1	26.1	45.8	4.58
7	568.4	122.5	331.1	26.1	88.6	4.64
8	622.9	129.8	331.1	26.1	135.9	4.72
9	682.7	137.6	331.1	26.1	187.9	4.79
10	748.3	145.9	331.1	26.1	245.1	4.87
11	820.1	154.6	331.1	26.1	308.2	4.96
12	898.8	163.9	331.1	26.1	377.7	5.05
13	985.1	173.8	331.1	26.1	454.1	5.14
14	1079.7	184.2	331.1	26.1	538.3	5.24
15	1183.3	195.2	331.1	26.1	630.9	5.35
16	1296.9	206.9	331.1	26.1	732.8	5.46
17	1421.4	219.4	331.1	26.1	844.8	5.58
18	1557.9	232.5	331.1	26.1	968.1	5.71
19	1707.5	246.5	331.1	26.1	1103.7	5.84
20	1871.4	261.3	331.1	26.1	1252.9	5.99
21	2051.0	276.9	331.1	26.1	1416.8	6.14
22	2247.9	293.6	331.1	26.1	1597.1	6.30
23	2463.7	311.2	331.1	26.1	1795.3	6.47
24	2700.2	329.8	331.1	26.1	2013.2	6.65
25	2959.5	349.6	331.1	26.1	2252.6	6.84
26	3243.6	370.6	331.1	26.1	2515.7	7.05
27	3554.9	392.8	331.1	26.1	2804.9	7.26
28	3896.2	416.4	331.1	26.1	3122.6	7.49
29	4270.2	441.4	331.1	26.1	3471.6	7.73
30	4680.2	467.9	331.1	26.1	3855.1	7.99
31	5129.5	496.0	331.1	0.0	4302.4	8.01
32	5621.9	525.7	331.1	0.0	4765.1	8.29
33	6161.6	557.3	331.1	0.0	5273.2	8.60
34	6753.1	590.7	331.1	0.0	5831.3	8.92
35	7401.4	626.1	331.1	0.0	6444.2	9.27
36	8111.9	663.7	331.1	0.0	7117.1	9.63
37	8890.7	703.5	331.1	0.0	7856.0	10.02
38	9744.2	745.7	331.1	0.0	8667.3	10.42
39	10579.6	790.5	331.1	0.0	9558.0	10.86
40	11704.8	837.9	331.1	0.0	10535.8	11.32

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.109
30	2.10	0.113
30	2.20	0.117
30	2.30	0.120
30	2.40	0.124
30	2.50	0.127
30	2.60	0.130
30	2.70	0.133
30	2.80	0.137
30	2.90	0.140
30	3.00	0.142
30	3.10	0.145
30	3.20	0.148
30	3.30	0.151
30	3.40	0.154
30	3.50	0.156
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.117
35	2.10	0.121
35	2.20	0.124
35	2.30	0.127
35	2.40	0.130
35	2.50	0.134
35	2.60	0.137
35	2.70	0.140
35	2.80	0.142
35	2.90	0.145
35	3.00	0.148
35	3.10	0.151
35	3.20	0.153
35	3.30	0.156
35	3.40	0.158
35	3.50	0.161
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.123
40	2.10	0.126
40	2.20	0.129
40	2.30	0.132
40	2.40	0.135
40	2.50	0.138
40	2.60	0.141
40	2.70	0.144
40	2.80	0.146
40	2.90	0.149
40	3.00	0.151
40	3.10	0.154
40	3.20	0.157
40	3.30	0.159
40	3.40	0.161
40	3.50	0.164

CANTON HYDRO PROJECT ALTERNATIVE U<sub>3</sub>L<sub>2</sub> INCREASED ESCALATION

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	9.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1056.0	1056.0	1129.9
0	1584.0	1679.0	1679.0
TOTALS	2640.0	2735.0	2809.0

COMPLETED COST = \$ 2809.0  
 FULLY AMORTIZED OVER 40 YEARS = \$ 210.7 PER YEAR AT 7.0 % INTEREST

## PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	7.100	3.17	225.4	0.0	0.0	225.4
2	7.100	3.48	247.0	0.0	0.0	247.0
3	7.100	3.81	270.7	0.0	0.0	270.7
4	7.100	4.18	296.7	0.0	0.0	296.7
5	7.100	4.58	325.2	0.0	0.0	325.2
6	7.100	5.02	356.4	0.0	0.0	356.4
7	7.100	5.50	390.6	0.0	0.0	390.6
8	7.100	6.03	428.1	0.0	0.0	428.1
9	7.100	6.61	469.3	0.0	0.0	469.3
10	7.100	7.24	514.3	0.0	0.0	514.3
11	7.100	7.94	563.7	0.0	0.0	563.7
12	7.100	8.70	617.8	0.0	0.0	617.8
13	7.100	9.54	677.1	0.0	0.0	677.1
14	7.100	10.45	742.1	0.0	0.0	742.1
15	7.100	11.46	813.3	0.0	0.0	813.3
16	7.100	12.56	891.4	0.0	0.0	891.4
17	7.100	13.76	977.0	0.0	0.0	977.0
18	7.100	15.08	1070.8	0.0	0.0	1070.8
19	7.100	16.53	1173.6	0.0	0.0	1173.6
20	7.100	18.12	1286.2	0.0	0.0	1286.2
21	7.100	19.85	1409.7	0.0	0.0	1409.7
22	7.100	21.76	1545.0	0.0	0.0	1545.0
23	7.100	23.85	1693.4	0.0	0.0	1693.4
24	7.100	26.14	1855.9	0.0	0.0	1855.9
25	7.100	28.65	2034.1	0.0	0.0	2034.1
26	7.100	31.40	2229.4	0.0	0.0	2229.4
27	7.100	34.41	2443.4	0.0	0.0	2443.4
28	7.100	37.72	2677.9	0.0	0.0	2677.9
29	7.100	41.34	2935.0	0.0	0.0	2935.0
30	7.100	45.31	3216.8	0.0	0.0	3216.8
31	7.100	49.66	3525.6	0.0	0.0	3525.6
32	7.100	54.42	3864.0	0.0	0.0	3864.0
33	7.100	59.65	4235.0	0.0	0.0	4235.0
34	7.100	65.37	4641.5	0.0	0.0	4641.5
35	7.100	71.65	5087.1	0.0	0.0	5087.1
36	7.100	78.53	5575.5	0.0	0.0	5575.5
37	7.100	86.07	6110.7	0.0	0.0	6110.7
38	7.100	94.33	6697.4	0.0	0.0	6697.4
39	7.100	****	7340.3	0.0	0.0	7340.3
40	7.100	****	8045.0	0.0	0.0	8045.0

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	36.6	7.3	5.9	2.8	0.0	0.0	52.6
2	0.0	0.0	38.8	7.8	6.3	2.9	0.0	0.0	55.8
3	0.0	0.0	41.1	8.2	6.7	3.1	0.0	0.0	59.2
4	0.0	0.0	43.6	8.7	7.1	3.3	0.0	0.0	62.7
5	0.0	0.0	46.2	9.2	7.5	3.5	0.0	0.0	66.5
6	0.0	0.0	49.0	9.8	7.9	3.7	0.0	0.0	70.5
7	0.0	0.0	51.9	10.4	8.4	3.9	0.0	0.0	74.7
8	0.0	0.0	55.1	11.0	8.9	4.2	0.0	0.0	79.2
9	0.0	0.0	58.4	11.7	9.5	4.4	0.0	0.0	83.9
10	0.0	0.0	61.9	12.4	10.0	4.7	0.0	0.0	88.9
11	0.0	0.0	65.6	13.1	10.6	5.0	0.0	0.0	94.3
12	0.0	0.0	69.5	13.9	11.3	5.3	0.0	0.0	99.9
13	0.0	0.0	73.7	14.7	11.9	5.6	0.0	0.0	105.9
14	0.0	0.0	78.1	15.6	12.7	5.9	0.0	0.0	112.3
15	0.0	0.0	82.8	16.6	13.4	6.3	0.0	0.0	119.0
16	0.0	0.0	87.7	17.5	14.2	6.7	0.0	0.0	126.2
17	0.0	0.0	93.0	18.6	15.1	7.1	0.0	0.0	133.7
18	0.0	0.0	98.6	19.7	16.0	7.5	0.0	0.0	141.8
19	0.0	0.0	104.5	20.9	16.9	7.9	0.0	0.0	150.3
20	0.0	0.0	110.8	22.2	18.0	8.4	0.0	0.0	159.3
21	0.0	0.0	117.4	23.5	19.0	8.9	0.0	0.0	168.8
22	0.0	0.0	124.5	24.9	20.2	9.4	0.0	0.0	179.0
23	0.0	0.0	131.9	26.4	21.4	10.0	0.0	0.0	189.7
24	0.0	0.0	139.8	28.0	22.7	10.6	0.0	0.0	201.1
25	0.0	0.0	148.2	29.6	24.0	11.2	0.0	0.0	213.2
26	0.0	0.0	157.1	31.4	25.5	11.9	0.0	0.0	225.9
27	0.0	0.0	166.6	33.3	27.0	12.6	0.0	0.0	239.5
28	0.0	0.0	176.5	35.3	28.6	13.4	0.0	0.0	253.9
29	0.0	0.0	187.1	37.4	30.3	14.2	0.0	0.0	269.1
30	0.0	0.0	198.4	39.7	32.1	15.0	0.0	0.0	285.2
31	0.0	0.0	210.3	42.1	34.1	16.0	0.0	0.0	302.4
32	0.0	0.0	222.9	44.6	36.1	16.9	0.0	0.0	320.5
33	0.0	0.0	236.3	47.3	38.3	17.9	0.0	0.0	339.7
34	0.0	0.0	250.4	50.1	40.6	19.0	0.0	0.0	360.1
35	0.0	0.0	265.5	53.1	43.0	20.1	0.0	0.0	381.7
36	0.0	0.0	281.4	56.3	45.6	21.3	0.0	0.0	404.6
37	0.0	0.0	298.3	59.7	48.3	22.6	0.0	0.0	428.9
38	0.0	0.0	316.2	63.2	51.2	24.0	0.0	0.0	454.6
39	0.0	0.0	335.1	67.0	54.3	25.4	0.0	0.0	481.9

40 0.0 0.0 355.2 71.0 57.6 26.9 0.0 0.0 510.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR P AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	225.4	52.6	210.7	17.8	-55.8	3.96
2	247.0	55.8	210.7	17.8	-37.3	4.00
3	270.7	59.2	210.7	17.8	-16.9	4.05
4	296.7	62.7	210.7	17.8	5.5	4.10
5	325.2	66.5	210.7	17.8	30.2	4.15
6	356.4	70.5	210.7	17.8	57.5	4.21
7	390.6	74.7	210.7	17.8	87.5	4.27
8	428.1	79.2	210.7	17.8	120.5	4.33
9	469.3	83.9	210.7	17.8	156.8	4.40
10	514.3	88.9	210.7	17.8	196.8	4.47
11	563.7	94.3	210.7	17.8	240.9	4.55
12	517.8	99.9	210.7	17.8	289.3	4.63
13	577.1	105.9	210.7	17.8	342.7	4.71
14	742.1	112.3	210.7	17.8	401.3	4.80
15	813.3	119.0	210.7	17.8	465.8	4.89
16	891.4	126.2	210.7	17.8	536.7	5.00
17	977.0	133.7	210.7	17.8	614.7	5.10
18	1070.8	141.8	210.7	17.8	700.5	5.22
19	1173.6	150.3	210.7	17.8	794.8	5.33
20	1286.2	159.3	210.7	17.8	898.4	5.46
21	1409.7	168.8	210.7	17.8	1012.4	5.60
22	1545.0	179.0	210.7	17.8	1137.6	5.74
23	1693.4	189.7	210.7	17.8	1275.1	5.89
24	1855.9	201.1	210.7	17.8	1426.3	6.05
25	2034.1	213.2	210.7	17.8	1592.4	6.22
26	2229.4	225.9	210.7	17.8	1774.9	6.40
27	2443.4	239.5	210.7	17.8	1975.4	6.59
28	2677.9	253.9	210.7	17.8	2195.6	6.79
29	2935.0	269.1	210.7	17.8	2437.4	7.01
30	3215.8	285.2	210.7	17.8	2703.0	7.24
31	3525.6	302.4	210.7	0.0	3012.5	7.23
32	3864.0	320.5	210.7	0.0	3332.8	7.48
33	4235.0	339.7	210.7	0.0	3684.6	7.75
34	4641.5	360.1	210.7	0.0	4070.7	8.04
35	5087.1	381.7	210.7	0.0	4494.7	8.34
36	5575.5	404.6	210.7	0.0	4960.2	8.67
37	6110.7	428.9	210.7	0.0	5471.1	9.01
38	6697.4	454.6	210.7	0.0	6032.0	9.37
39	7340.3	481.9	210.7	0.0	6647.7	9.76
40	8045.0	510.8	210.7	0.0	7323.4	10.16

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.116
30	2.10	0.120
30	2.20	0.123
30	2.30	0.127
30	2.40	0.131
30	2.50	0.134
30	2.60	0.137
30	2.70	0.141
30	2.80	0.144
30	2.90	0.147
30	3.00	0.150
30	3.10	0.153
30	3.20	0.156
30	3.30	0.158
30	3.40	0.161
30	3.50	0.164
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.123
35	2.10	0.127
35	2.20	0.130
35	2.30	0.134
35	2.40	0.137
35	2.50	0.140
35	2.60	0.143
35	2.70	0.146
35	2.80	0.149
35	2.90	0.152
35	3.00	0.155
35	3.10	0.157
35	3.20	0.160
35	3.30	0.163
35	3.40	0.165
35	3.50	0.168
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.128
40	2.10	0.132
40	2.20	0.135
40	2.30	0.138
40	2.40	0.141
40	2.50	0.144
40	2.60	0.147
40	2.70	0.150
40	2.80	0.153
40	2.90	0.155
40	3.00	0.158
40	3.10	0.161
40	3.20	0.163
40	3.30	0.166
40	3.40	0.168
40	3.50	0.171

CANTON HYDRO PROJECT ALTERNATIVE - U3 - INCREASED ESCALATION

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	9.60
BACKUP ENERGY	0.0
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	387.4	387.4	414.5
0	581.1	616.0	616.0
TOTALS	968.5	1003.4	1030.5

COMPLETED COST = \$ 1030.5  
 FULLY AMORTIZED OVER 40 YEARS = \$ 77.3 PER YEAR AT 7.0 % INTEREST



PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	3.330	3.17	105.7	0.0	0.0	105.7
2	3.330	3.48	115.9	0.0	0.0	115.9
3	3.330	3.81	127.0	0.0	0.0	127.0
4	3.330	4.18	139.2	0.0	0.0	139.2
5	3.330	4.58	152.5	0.0	0.0	152.5
6	3.330	5.02	167.2	0.0	0.0	167.2
7	3.330	5.50	183.2	0.0	0.0	183.2
8	3.330	6.03	200.8	0.0	0.0	200.8
9	3.330	6.61	220.1	0.0	0.0	220.1
10	3.330	7.24	241.2	0.0	0.0	241.2
11	3.330	7.94	264.4	0.0	0.0	264.4
12	3.330	8.70	289.7	0.0	0.0	289.7
13	3.330	9.54	317.6	0.0	0.0	317.6
14	3.330	10.45	348.1	0.0	0.0	348.1
15	3.330	11.46	381.5	0.0	0.0	381.5
16	3.330	12.56	418.1	0.0	0.0	418.1
17	3.330	13.76	458.2	0.0	0.0	458.2
18	3.330	15.08	502.2	0.0	0.0	502.2
19	3.330	16.53	550.4	0.0	0.0	550.4
20	3.330	18.12	603.3	0.0	0.0	603.3
21	3.330	19.85	661.2	0.0	0.0	661.2
22	3.330	21.76	724.6	0.0	0.0	724.6
23	3.330	23.85	794.2	0.0	0.0	794.2
24	3.330	26.14	870.5	0.0	0.0	870.5
25	3.330	28.65	954.0	0.0	0.0	954.0
26	3.330	31.40	1045.6	0.0	0.0	1045.6
27	3.330	34.41	1146.0	0.0	0.0	1146.0
28	3.330	37.72	1256.0	0.0	0.0	1256.0
29	3.330	41.34	1376.6	0.0	0.0	1376.6
30	3.330	45.31	1508.7	0.0	0.0	1508.7
31	3.330	49.66	1653.5	0.0	0.0	1653.5
32	3.330	54.42	1812.3	0.0	0.0	1812.3
33	3.330	59.65	1986.3	0.0	0.0	1986.3
34	3.330	65.37	2176.9	0.0	0.0	2176.9
35	3.330	71.65	2385.9	0.0	0.0	2385.9
36	3.330	78.53	2615.0	0.0	0.0	2615.0
37	3.330	86.07	2866.0	0.0	0.0	2866.0
38	3.330	94.33	3141.2	0.0	0.0	3141.2
39	3.330	****	3442.7	0.0	0.0	3442.7
40	3.330	****	3773.2	0.0	0.0	3773.2

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	22.7	4.8	2.1	2.8	0.0	0.0	32.4
2	0.0	0.0	24.1	5.1	2.3	2.9	0.0	0.0	34.4
3	0.0	0.0	25.5	5.4	2.4	3.1	0.0	0.0	36.5
4	0.0	0.0	27.1	5.7	2.6	3.3	0.0	0.0	38.6
5	0.0	0.0	28.7	6.1	2.7	3.5	0.0	0.0	41.0
6	0.0	0.0	30.4	6.4	2.9	3.7	0.0	0.0	43.4
7	0.0	0.0	32.2	6.8	3.0	3.9	0.0	0.0	46.0
8	0.0	0.0	34.2	7.2	3.2	4.2	0.0	0.0	48.8
9	0.0	0.0	36.2	7.6	3.4	4.4	0.0	0.0	51.7
10	0.0	0.0	38.4	8.1	3.6	4.7	0.0	0.0	54.8
11	0.0	0.0	40.7	8.6	3.8	5.0	0.0	0.0	58.1
12	0.0	0.0	43.1	9.1	4.1	5.3	0.0	0.0	61.6
13	0.0	0.0	45.7	9.7	4.3	5.6	0.0	0.0	65.3
14	0.0	0.0	48.5	10.2	4.6	5.9	0.0	0.0	69.2
15	0.0	0.0	51.4	10.8	4.9	6.3	0.0	0.0	73.4
16	0.0	0.0	54.5	11.5	5.1	6.7	0.0	0.0	77.8
17	0.0	0.0	57.7	12.2	5.5	7.1	0.0	0.0	82.4
18	0.0	0.0	61.2	12.9	5.8	7.5	0.0	0.0	87.4
19	0.0	0.0	64.9	13.7	6.1	7.9	0.0	0.0	92.6
20	0.0	0.0	68.8	14.5	6.5	8.4	0.0	0.0	98.2
21	0.0	0.0	72.9	15.4	6.9	8.9	0.0	0.0	104.1
22	0.0	0.0	77.3	16.3	7.3	9.4	0.0	0.0	110.3
23	0.0	0.0	81.9	17.3	7.7	10.0	0.0	0.0	116.9
24	0.0	0.0	86.8	18.3	8.2	10.6	0.0	0.0	123.9
25	0.0	0.0	92.0	19.4	8.7	11.2	0.0	0.0	131.4
26	0.0	0.0	97.5	20.6	9.2	11.9	0.0	0.0	139.2
27	0.0	0.0	103.4	21.8	9.9	12.6	0.0	0.0	147.6
28	0.0	0.0	109.6	23.1	10.3	13.4	0.0	0.0	156.5
29	0.0	0.0	116.2	24.5	11.0	14.2	0.0	0.0	165.8
30	0.0	0.0	123.1	26.0	11.6	15.0	0.0	0.0	175.8
31	0.0	0.0	130.5	27.6	12.3	16.0	0.0	0.0	186.3
32	0.0	0.0	138.3	29.2	13.1	16.9	0.0	0.0	197.5
33	0.0	0.0	146.6	31.0	13.8	17.9	0.0	0.0	209.4
34	0.0	0.0	155.4	32.8	14.7	19.0	0.0	0.0	221.9
35	0.0	0.0	164.8	34.8	15.6	20.1	0.0	0.0	235.3
36	0.0	0.0	174.7	36.9	16.5	21.3	0.0	0.0	249.4
37	0.0	0.0	185.1	39.1	17.5	22.6	0.0	0.0	264.3
38	0.0	0.0	196.2	41.4	18.5	24.0	0.0	0.0	280.2
39	0.0	0.0	208.0	43.9	19.6	25.4	0.0	0.0	297.0
40	0.0	0.0	220.5	46.5	20.8	26.9	0.0	0.0	314.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	105.7	32.4	77.3	6.6	-10.6	3.49
2	115.9	34.4	77.3	6.6	-2.4	3.55
3	127.0	36.5	77.3	6.6	6.6	3.61
4	139.2	38.6	77.3	6.6	16.6	3.68
5	152.5	41.0	77.3	6.6	27.7	3.75
6	167.2	43.4	77.3	6.6	39.8	3.82
7	183.2	46.0	77.3	6.6	53.3	3.90
8	200.8	48.8	77.3	6.6	68.1	3.98
9	220.1	51.7	77.3	6.6	84.5	4.07
10	241.2	54.8	77.3	6.6	102.5	4.17
11	264.4	58.1	77.3	6.6	122.4	4.26
12	289.7	61.6	77.3	6.6	144.3	4.37
13	317.6	65.3	77.3	6.6	168.4	4.48
14	348.1	69.2	77.3	6.6	194.9	4.60
15	381.5	73.4	77.3	6.6	224.2	4.72
16	418.1	77.8	77.3	6.6	256.4	4.85
17	458.2	82.4	77.3	6.6	291.9	4.99
18	502.2	87.4	77.3	6.6	330.9	5.14
19	550.4	92.6	77.3	6.6	373.9	5.30
20	603.3	98.2	77.3	6.6	421.2	5.47
21	661.2	104.1	77.3	6.6	473.2	5.64
22	724.6	110.3	77.3	6.6	530.4	5.83
23	794.2	116.9	77.3	6.6	593.4	6.03
24	870.5	123.9	77.3	6.6	662.6	6.24
25	954.0	131.4	77.3	6.6	738.7	6.46
26	1045.6	139.2	77.3	6.6	822.4	6.70
27	1146.0	147.6	77.3	6.6	914.5	6.95
28	1256.0	156.5	77.3	6.6	1015.6	7.22
29	1376.6	165.8	77.3	6.6	1126.8	7.50
30	1508.7	175.8	77.3	6.6	1249.0	7.80
31	1653.5	186.3	77.3	0.0	1389.9	7.92
32	1812.3	197.5	77.3	0.0	1537.5	8.25
33	1986.3	209.4	77.3	0.0	1699.6	8.61
34	2176.9	221.9	77.3	0.0	1877.7	8.99
35	2385.9	235.3	77.3	0.0	2073.4	9.39
36	2615.0	249.4	77.3	0.0	2288.3	9.81
37	2866.0	264.3	77.3	0.0	2524.4	10.26
38	3141.2	280.2	77.3	0.0	2783.7	10.74
39	3442.7	297.0	77.3	0.0	3068.4	11.24
40	3773.2	314.8	77.3	0.0	3381.1	11.78

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
30	2.00	0.125
30	2.10	0.130
30	2.20	0.134
30	2.30	0.138
30	2.40	0.142
30	2.50	0.146
30	2.60	0.149
30	2.70	0.153
30	2.80	0.157
30	2.90	0.160
30	3.00	0.164
30	3.10	0.167
30	3.20	0.170
30	3.30	0.173
30	3.40	0.176
30	3.50	0.180
PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
35	2.00	0.132
35	2.10	0.136
35	2.20	0.140
35	2.30	0.144
35	2.40	0.148
35	2.50	0.151
35	2.60	0.155
35	2.70	0.158
35	2.80	0.161
35	2.90	0.165
35	3.00	0.168
35	3.10	0.171
35	3.20	0.174
35	3.30	0.177
35	3.40	0.180
35	3.50	0.183
PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
40	2.00	0.137
40	2.10	0.141
40	2.20	0.144
40	2.30	0.148
40	2.40	0.151
40	2.50	0.155
40	2.60	0.158
40	2.70	0.161
40	2.80	0.164
40	2.90	0.168
40	3.00	0.171
40	3.10	0.174
40	3.20	0.177
40	3.30	0.180
40	3.40	0.182
40	3.50	0.185

PART 3

CASES U1L1, U3L2, U3: DECREASED ENERGY ESCALATION

CANTON HYDRO PROJECT ALTERNATIVE U<sub>1L1</sub> DECREASED ESCALATION

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	5.60
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1659.6	1659.6	1775.8
0	2489.3	2638.7	2638.7
TOTALS	4148.9	4298.3	4414.4

COMPLETED COST = \$ 4414.4  
 FULLY AMORTIZED OVER 40 YEARS = \$ 331.1 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	10.330	2.74	282.6	0.0	0.0	282.6
2	10.330	2.89	298.4	0.0	0.0	298.4
3	10.330	3.05	315.1	0.0	0.0	315.1
4	10.330	3.22	332.8	0.0	0.0	332.8
5	10.330	3.40	351.4	0.0	0.0	351.4
6	10.330	3.59	371.1	0.0	0.0	371.1
7	10.330	3.79	391.9	0.0	0.0	391.9
8	10.330	4.01	413.8	0.0	0.0	413.8
9	10.330	4.23	437.0	0.0	0.0	437.0
10	10.330	4.47	461.5	0.0	0.0	461.5
11	10.330	4.72	487.3	0.0	0.0	487.3
12	10.330	4.98	514.6	0.0	0.0	514.6
13	10.330	5.26	543.4	0.0	0.0	543.4
14	10.330	5.56	573.9	0.0	0.0	573.9
15	10.330	5.87	606.0	0.0	0.0	606.0
16	10.330	6.19	639.9	0.0	0.0	639.9
17	10.330	6.54	675.8	0.0	0.0	675.8
18	10.330	6.91	713.6	0.0	0.0	713.6
19	10.330	7.29	753.6	0.0	0.0	753.6
20	10.330	7.70	795.8	0.0	0.0	795.8
21	10.330	8.13	840.3	0.0	0.0	840.3
22	10.330	8.59	887.4	0.0	0.0	887.4
23	10.330	9.07	937.1	0.0	0.0	937.1
24	10.330	9.58	989.6	0.0	0.0	989.6
25	10.330	10.12	1045.0	0.0	0.0	1045.0
26	10.330	10.68	1103.5	0.0	0.0	1103.5
27	10.330	11.28	1165.3	0.0	0.0	1165.3
28	10.330	11.91	1230.5	0.0	0.0	1230.5
29	10.330	12.58	1299.5	0.0	0.0	1299.5
30	10.330	13.28	1372.2	0.0	0.0	1372.2
31	10.330	14.03	1449.1	0.0	0.0	1449.1
32	10.330	14.81	1530.2	0.0	0.0	1530.2
33	10.330	15.64	1615.9	0.0	0.0	1615.9
34	10.330	16.52	1706.4	0.0	0.0	1706.4
35	10.330	17.44	1802.0	0.0	0.0	1802.0
36	10.330	18.42	1902.9	0.0	0.0	1902.9
37	10.330	19.45	2009.4	0.0	0.0	2009.4
38	10.330	20.54	2122.0	0.0	0.0	2122.0
39	10.330	21.69	2240.8	0.0	0.0	2240.8
40	10.330	22.91	2366.3	0.0	0.0	2366.3

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	61.9	12.4	9.3	2.8	0.0	0.0	86.4
2	0.0	0.0	65.6	13.1	9.9	2.9	0.0	0.0	91.5
3	0.0	0.0	69.5	13.9	10.5	3.1	0.0	0.0	97.0
4	0.0	0.0	73.7	14.7	11.1	3.3	0.0	0.0	102.8
5	0.0	0.0	78.1	15.6	11.9	3.5	0.0	0.0	109.0
6	0.0	0.0	82.8	16.6	12.5	3.7	0.0	0.0	115.6
7	0.0	0.0	87.8	17.6	13.3	3.9	0.0	0.0	122.5
8	0.0	0.0	93.0	18.6	14.0	4.2	0.0	0.0	129.8
9	0.0	0.0	98.6	19.7	14.9	4.4	0.0	0.0	137.6
10	0.0	0.0	104.5	20.9	15.8	4.7	0.0	0.0	145.9
11	0.0	0.0	110.8	22.2	16.7	5.0	0.0	0.0	154.6
12	0.0	0.0	117.4	23.5	17.7	5.3	0.0	0.0	163.9
13	0.0	0.0	124.5	24.9	18.8	5.6	0.0	0.0	173.8
14	0.0	0.0	131.9	26.4	19.9	5.9	0.0	0.0	184.2
15	0.0	0.0	139.9	28.0	21.1	6.3	0.0	0.0	195.2
16	0.0	0.0	148.3	29.7	22.4	6.7	0.0	0.0	206.9
17	0.0	0.0	157.1	31.4	23.7	7.1	0.0	0.0	219.4
18	0.0	0.0	166.6	33.3	25.2	7.5	0.0	0.0	232.5
19	0.0	0.0	176.6	35.3	26.7	7.9	0.0	0.0	246.5
20	0.0	0.0	187.2	37.4	28.3	8.4	0.0	0.0	261.3
21	0.0	0.0	198.4	39.7	30.0	8.9	0.0	0.0	276.9
22	0.0	0.0	210.3	42.1	31.8	9.4	0.0	0.0	293.6
23	0.0	0.0	222.9	44.6	33.7	10.0	0.0	0.0	311.2
24	0.0	0.0	236.3	47.3	35.7	10.6	0.0	0.0	329.8
25	0.0	0.0	250.5	50.1	37.8	11.2	0.0	0.0	349.6
26	0.0	0.0	265.5	53.1	40.1	11.9	0.0	0.0	370.6
27	0.0	0.0	281.4	56.3	42.5	12.6	0.0	0.0	392.8
28	0.0	0.0	298.3	59.7	45.1	13.4	0.0	0.0	416.4
29	0.0	0.0	316.2	63.2	47.8	14.2	0.0	0.0	441.4
30	0.0	0.0	335.2	67.0	50.6	15.0	0.0	0.0	467.9
31	0.0	0.0	355.3	71.1	53.7	16.0	0.0	0.0	496.0
32	0.0	0.0	376.6	75.3	56.9	16.9	0.0	0.0	525.7
33	0.0	0.0	399.2	79.8	60.3	17.9	0.0	0.0	557.3
34	0.0	0.0	423.2	84.6	63.9	19.0	0.0	0.0	590.7
35	0.0	0.0	448.5	89.7	67.7	20.1	0.0	0.0	626.1
36	0.0	0.0	475.5	95.1	71.8	21.3	0.0	0.0	663.7
37	0.0	0.0	504.0	100.8	76.1	22.6	0.0	0.0	703.5
38	0.0	0.0	534.2	106.8	80.7	24.0	0.0	0.0	745.7
39	0.0	0.0	566.3	113.3	85.5	25.4	0.0	0.0	790.5
40	0.0	0.0	600.2	120.0	90.6	26.9	0.0	0.0	837.9



RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR P AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	282.5	86.4	331.1	26.1	-161.0	4.29
2	298.4	91.5	331.1	26.1	-150.3	4.34
3	315.1	97.0	331.1	26.1	-139.1	4.40
4	332.8	102.8	331.1	26.1	-127.3	4.45
5	351.4	109.0	331.1	26.1	-114.8	4.51
6	371.1	115.6	331.1	26.1	-101.7	4.58
7	391.9	122.5	331.1	26.1	-87.8	4.64
8	413.8	129.8	331.1	26.1	-73.2	4.72
9	437.0	137.6	331.1	26.1	-57.9	4.79
10	461.5	145.9	331.1	26.1	-41.6	4.87
11	487.3	154.6	331.1	26.1	-24.6	4.96
12	514.6	163.9	331.1	26.1	-6.5	5.05
13	543.4	173.8	331.1	26.1	12.4	5.14
14	573.9	184.2	331.1	26.1	32.4	5.24
15	606.0	195.2	331.1	26.1	53.5	5.35
16	639.9	206.9	331.1	26.1	75.8	5.46
17	675.8	219.4	331.1	26.1	99.2	5.58
18	713.6	232.5	331.1	26.1	123.9	5.71
19	753.6	246.5	331.1	26.1	149.9	5.84
20	795.8	261.3	331.1	26.1	177.3	5.99
21	840.3	276.9	331.1	26.1	206.2	6.14
22	887.4	293.6	331.1	26.1	236.6	6.30
23	937.1	311.2	331.1	26.1	268.7	6.47
24	989.6	329.8	331.1	26.1	302.5	6.65
25	1045.0	349.6	331.1	26.1	338.1	6.84
26	1103.5	370.6	331.1	26.1	375.7	7.05
27	1165.3	392.8	331.1	26.1	415.2	7.26
28	1230.5	416.4	331.1	26.1	456.9	7.49
29	1299.5	441.4	331.1	26.1	500.8	7.73
30	1372.2	467.9	331.1	26.1	547.1	7.99
31	1449.1	496.0	331.1	0.0	622.0	8.01
32	1530.2	525.7	331.1	0.0	673.4	8.29
33	1615.9	557.3	331.1	0.0	727.5	8.60
34	1706.4	590.7	331.1	0.0	784.6	8.92
35	1802.0	626.1	331.1	0.0	844.7	9.27
36	1902.9	663.7	331.1	0.0	908.0	9.63
37	2009.4	703.5	331.1	0.0	974.8	10.02
38	2122.0	745.7	331.1	0.0	1045.1	10.42
39	2240.8	790.5	331.1	0.0	1119.2	10.86
40	2366.3	837.9	331.1	0.0	1197.2	11.32

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.054
30	2.10	0.058
30	2.20	0.062
30	2.30	0.066
30	2.40	0.070
30	2.50	0.074
30	2.60	0.077
30	2.70	0.081
30	2.80	0.084
30	2.90	0.087
30	3.00	0.090
30	3.10	0.094
30	3.20	0.096
30	3.30	0.099
30	3.40	0.102
30	3.50	0.105
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.062
35	2.10	0.066
35	2.20	0.070
35	2.30	0.074
35	2.40	0.077
35	2.50	0.081
35	2.60	0.084
35	2.70	0.087
35	2.80	0.090
35	2.90	0.093
35	3.00	0.096
35	3.10	0.099
35	3.20	0.102
35	3.30	0.104
35	3.40	0.107
35	3.50	0.110
PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.068
40	2.10	0.071
40	2.20	0.075
40	2.30	0.078
40	2.40	0.082
40	2.50	0.085
40	2.60	0.088
40	2.70	0.091
40	2.80	0.094
40	2.90	0.097
40	3.00	0.100
40	3.10	0.102
40	3.20	0.105
40	3.30	0.108
40	3.40	0.110
40	3.50	0.113



CANTON HYDRO PROJECT ALTERNATIVE U<sub>3</sub>L<sub>2</sub> DECREASED ESCALATION

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES 5.60  
 OTHER QUANTITIES 6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1056.0	1056.0	1129.9
0	1584.0	1679.0	1679.0
TOTALS	2640.0	2735.0	2809.0

COMPLETED COST = \$ 2809.0  
 FULLY AMORTIZED OVER 40 YEARS = \$ 210.7 PER YEAR AT 7.0 % INTEREST

## PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	7.100	2.74	194.2	0.0	0.0	194.2
2	7.100	2.89	205.1	0.0	0.0	205.1
3	7.100	3.05	216.6	0.0	0.0	216.6
4	7.100	3.22	228.7	0.0	0.0	228.7
5	7.100	3.40	241.5	0.0	0.0	241.5
6	7.100	3.59	255.1	0.0	0.0	255.1
7	7.100	3.79	269.4	0.0	0.0	269.4
8	7.100	4.01	284.4	0.0	0.0	284.4
9	7.100	4.23	300.4	0.0	0.0	300.4
10	7.100	4.47	317.2	0.0	0.0	317.2
11	7.100	4.72	334.9	0.0	0.0	334.9
12	7.100	4.98	353.7	0.0	0.0	353.7
13	7.100	5.26	373.5	0.0	0.0	373.5
14	7.100	5.56	394.4	0.0	0.0	394.4
15	7.100	5.87	416.5	0.0	0.0	416.5
16	7.100	6.19	439.8	0.0	0.0	439.8
17	7.100	6.54	464.5	0.0	0.0	464.5
18	7.100	6.91	490.5	0.0	0.0	490.5
19	7.100	7.29	517.9	0.0	0.0	517.9
20	7.100	7.70	546.9	0.0	0.0	546.9
21	7.100	8.13	577.6	0.0	0.0	577.6
22	7.100	8.59	609.9	0.0	0.0	609.9
23	7.100	9.07	644.1	0.0	0.0	644.1
24	7.100	9.58	680.1	0.0	0.0	680.1
25	7.100	10.12	718.2	0.0	0.0	718.2
26	7.100	10.68	758.5	0.0	0.0	758.5
27	7.100	11.28	800.9	0.0	0.0	800.9
28	7.100	11.91	845.8	0.0	0.0	845.8
29	7.100	12.58	893.1	0.0	0.0	893.1
30	7.100	13.28	943.2	0.0	0.0	943.2
31	7.100	14.03	996.0	0.0	0.0	996.0
32	7.100	14.81	1051.7	0.0	0.0	1051.7
33	7.100	15.64	1110.6	0.0	0.0	1110.6
34	7.100	16.52	1172.8	0.0	0.0	1172.8
35	7.100	17.44	1238.5	0.0	0.0	1238.5
36	7.100	18.42	1307.9	0.0	0.0	1307.9
37	7.100	19.45	1381.1	0.0	0.0	1381.1
38	7.100	20.54	1458.5	0.0	0.0	1458.5
39	7.100	21.69	1540.1	0.0	0.0	1540.1
40	7.100	22.91	1626.4	0.0	0.0	1626.4

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	OTHER	ROYALTIES	TOTAL
1	0.0	0.0	36.5	7.3	5.9	2.8	0.0	0.0	52.6
2	0.0	0.0	38.8	7.8	6.3	2.9	0.0	0.0	55.8
3	0.0	0.0	41.1	8.2	6.7	3.1	0.0	0.0	59.2
4	0.0	0.0	43.6	8.7	7.1	3.3	0.0	0.0	62.7
5	0.0	0.0	46.2	9.2	7.5	3.5	0.0	0.0	66.5
6	0.0	0.0	49.0	9.8	7.9	3.7	0.0	0.0	70.5
7	0.0	0.0	51.9	10.4	8.4	3.9	0.0	0.0	74.7
8	0.0	0.0	55.1	11.0	8.9	4.2	0.0	0.0	79.2
9	0.0	0.0	58.4	11.7	9.5	4.4	0.0	0.0	83.9
10	0.0	0.0	61.9	12.4	10.0	4.7	0.0	0.0	88.9
11	0.0	0.0	65.6	13.1	10.6	5.0	0.0	0.0	94.3
12	0.0	0.0	69.5	13.9	11.3	5.3	0.0	0.0	99.9
13	0.0	0.0	73.7	14.7	11.9	5.6	0.0	0.0	105.9
14	0.0	0.0	78.1	15.6	12.7	5.9	0.0	0.0	112.3
15	0.0	0.0	82.8	16.6	13.4	6.3	0.0	0.0	119.0
16	0.0	0.0	87.7	17.5	14.2	6.7	0.0	0.0	126.2
17	0.0	0.0	93.0	18.6	15.1	7.1	0.0	0.0	133.7
18	0.0	0.0	98.6	19.7	16.0	7.5	0.0	0.0	141.8
19	0.0	0.0	104.5	20.9	16.9	7.9	0.0	0.0	150.3
20	0.0	0.0	110.8	22.2	18.0	8.4	0.0	0.0	159.3
21	0.0	0.0	117.4	23.5	19.0	8.9	0.0	0.0	168.8
22	0.0	0.0	124.5	24.9	20.2	9.4	0.0	0.0	179.0
23	0.0	0.0	131.9	26.4	21.4	10.0	0.0	0.0	189.7
24	0.0	0.0	139.8	28.0	22.7	10.6	0.0	0.0	201.1
25	0.0	0.0	148.2	29.6	24.0	11.2	0.0	0.0	213.2
26	0.0	0.0	157.1	31.4	25.5	11.9	0.0	0.0	225.9
27	0.0	0.0	166.6	33.3	27.0	12.6	0.0	0.0	239.5
28	0.0	0.0	176.5	35.3	28.6	13.4	0.0	0.0	253.9
29	0.0	0.0	187.1	37.4	30.3	14.2	0.0	0.0	269.1
30	0.0	0.0	198.4	39.7	32.1	15.0	0.0	0.0	285.2
31	0.0	0.0	210.3	42.1	34.1	16.0	0.0	0.0	302.4
32	0.0	0.0	222.9	44.6	36.1	16.9	0.0	0.0	320.5
33	0.0	0.0	236.3	47.3	38.3	17.9	0.0	0.0	339.7
34	0.0	0.0	250.4	50.1	40.6	19.0	0.0	0.0	360.1
35	0.0	0.0	265.5	53.1	43.0	20.1	0.0	0.0	381.7
36	0.0	0.0	281.4	56.3	45.6	21.3	0.0	0.0	404.6
37	0.0	0.0	298.3	59.7	48.3	22.6	0.0	0.0	428.9
38	0.0	0.0	316.2	63.2	51.2	24.0	0.0	0.0	454.6
39	0.0	0.0	335.1	67.0	54.3	25.4	0.0	0.0	481.9

40

0.0

0.0

355.2

71.0

57.6

26.9

0.0

0.0

510.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR P AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	194.2	52.6	210.7	17.8	-86.9	3.96
2	205.1	55.8	210.7	17.8	-79.2	4.00
3	216.6	59.2	210.7	17.8	-71.1	4.05
4	228.7	62.7	210.7	17.8	-62.5	4.10
5	241.5	66.5	210.7	17.8	-53.4	4.15
6	255.1	70.5	210.7	17.8	-43.9	4.21
7	269.4	74.7	210.7	17.8	-33.8	4.27
8	284.4	79.2	210.7	17.8	-23.2	4.33
9	300.4	83.9	210.7	17.8	-12.1	4.40
10	317.2	88.9	210.7	17.8	-0.3	4.47
11	334.9	94.3	210.7	17.8	12.2	4.55
12	353.7	99.9	210.7	17.8	25.3	4.63
13	373.5	105.9	210.7	17.8	39.1	4.71
14	394.4	112.3	210.7	17.8	53.6	4.80
15	416.5	119.0	210.7	17.8	69.0	4.89
16	439.8	126.2	210.7	17.8	85.2	5.00
17	464.5	133.7	210.7	17.8	102.2	5.10
18	490.5	141.8	210.7	17.8	120.2	5.22
19	517.9	150.3	210.7	17.8	139.2	5.33
20	546.9	159.3	210.7	17.8	159.2	5.46
21	577.6	168.8	210.7	17.8	180.2	5.60
22	609.9	179.0	210.7	17.8	202.4	5.74
23	644.1	189.7	210.7	17.8	225.9	5.89
24	680.1	201.1	210.7	17.8	250.6	6.05
25	718.2	213.2	210.7	17.8	276.6	6.22
26	758.5	225.9	210.7	17.8	304.0	6.40
27	800.9	239.5	210.7	17.8	332.9	6.59
28	845.6	253.9	210.7	17.8	363.4	6.79
29	893.1	269.1	210.7	17.8	395.5	7.01
30	943.2	285.2	210.7	17.8	429.4	7.24
31	996.0	302.4	210.7	0.0	482.9	7.23
32	1051.7	320.5	210.7	0.0	520.6	7.48
33	1110.6	339.7	210.7	0.0	560.2	7.75
34	1172.8	360.1	210.7	0.0	602.0	8.04
35	1238.5	381.7	210.7	0.0	646.1	8.34
36	1307.9	404.6	210.7	0.0	692.6	8.67
37	1381.1	428.9	210.7	0.0	741.5	9.01
38	1458.5	454.6	210.7	0.0	793.1	9.37
39	1540.1	481.9	210.7	0.0	847.5	9.76
40	1626.4	510.8	210.7	0.0	904.9	10.16

## INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
30	2.00	0.062
30	2.10	0.066
30	2.20	0.070

30	2.30	0.074
30	2.40	0.078
30	2.50	0.082
30	2.60	0.085
30	2.70	0.089
30	2.80	0.092
30	2.90	0.095
30	3.00	0.099
30	3.10	0.102
30	3.20	0.105
30	3.30	0.107
30	3.40	0.110
30	3.50	0.113

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
35	2.00	0.069
35	2.10	0.073
35	2.20	0.077
35	2.30	0.081
35	2.40	0.085
35	2.50	0.088
35	2.60	0.091
35	2.70	0.094
35	2.80	0.098
35	2.90	0.101
35	3.00	0.104
35	3.10	0.106
35	3.20	0.109
35	3.30	0.112
35	3.40	0.115
35	3.50	0.117

PROJECT LIFE	INITIAL ENERGY VALUE	IRR
40	2.00	0.075
40	2.10	0.078
40	2.20	0.082
40	2.30	0.086
40	2.40	0.089
40	2.50	0.092
40	2.60	0.095
40	2.70	0.098
40	2.80	0.101
40	2.90	0.104
40	3.00	0.107
40	3.10	0.110
40	3.20	0.112
40	3.30	0.115
40	3.40	0.117
40	3.50	0.120

CANTON HYDRO PROJECT ALTERNATIVE - U3 - DECREASED ESCALATION

PRICE ESCALATION RATES

% PER YEAR

ENERGY VALUES	5.60
BACKUP ENERGY	0.0
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	387.4	387.4	414.5
0	581.1	616.0	616.0
TOTALS	968.5	1003.4	1030.5

COMPLETED COST = \$ 1030.5  
 FULLY AMORTIZED OVER 40 YEARS = \$ 77.3 PER YEAR AT 7.0 % INTEREST



PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	OTHER REVENUES	TOTAL REVENUES
1	3.330	2.74	91.1	0.0	0.0	91.1
2	3.330	2.89	96.2	0.0	0.0	96.2
3	3.330	3.05	101.6	0.0	0.0	101.6
4	3.330	3.22	107.3	0.0	0.0	107.3
5	3.330	3.40	113.3	0.0	0.0	113.3
6	3.330	3.59	119.6	0.0	0.0	119.6
7	3.330	3.79	126.3	0.0	0.0	126.3
8	3.330	4.01	133.4	0.0	0.0	133.4
9	3.330	4.23	140.9	0.0	0.0	140.9
10	3.330	4.47	148.8	0.0	0.0	148.8
11	3.330	4.72	157.1	0.0	0.0	157.1
12	3.330	4.98	165.9	0.0	0.0	165.9
13	3.330	5.26	175.2	0.0	0.0	175.2
14	3.330	5.56	185.0	0.0	0.0	185.0
15	3.330	5.87	195.4	0.0	0.0	195.4
16	3.330	6.19	206.3	0.0	0.0	206.3
17	3.330	6.54	217.8	0.0	0.0	217.8
18	3.330	6.91	230.0	0.0	0.0	230.0
19	3.330	7.29	242.9	0.0	0.0	242.9
20	3.330	7.70	256.5	0.0	0.0	256.5
21	3.330	8.13	270.9	0.0	0.0	270.9
22	3.330	8.59	286.1	0.0	0.0	286.1
23	3.330	9.07	302.1	0.0	0.0	302.1
24	3.330	9.58	319.0	0.0	0.0	319.0
25	3.330	10.12	336.9	0.0	0.0	336.9
26	3.330	10.68	355.7	0.0	0.0	355.7
27	3.330	11.28	375.6	0.0	0.0	375.6
28	3.330	11.91	396.7	0.0	0.0	396.7
29	3.330	12.58	418.9	0.0	0.0	418.9
30	3.330	13.28	442.4	0.0	0.0	442.4
31	3.330	14.03	467.1	0.0	0.0	467.1
32	3.330	14.81	493.3	0.0	0.0	493.3
33	3.330	15.64	520.9	0.0	0.0	520.9
34	3.330	16.52	550.1	0.0	0.0	550.1
35	3.330	17.44	580.9	0.0	0.0	580.9
36	3.330	18.42	613.4	0.0	0.0	613.4
37	3.330	19.45	647.8	0.0	0.0	647.8
38	3.330	20.54	684.0	0.0	0.0	684.0
39	3.330	21.69	722.3	0.0	0.0	722.3
40	3.330	22.91	762.8	0.0	0.0	762.8

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	22.7	4.8	2.1	2.8	0.0	0.0	32.4
2	0.0	0.0	24.1	5.1	2.3	2.9	0.0	0.0	34.4
3	0.0	0.0	25.5	5.4	2.4	3.1	0.0	0.0	36.5
4	0.0	0.0	27.1	5.7	2.6	3.3	0.0	0.0	38.6
5	0.0	0.0	28.7	6.1	2.7	3.5	0.0	0.0	41.0
6	0.0	0.0	30.4	6.4	2.9	3.7	0.0	0.0	43.4
7	0.0	0.0	32.2	6.8	3.0	3.9	0.0	0.0	46.0
8	0.0	0.0	34.2	7.2	3.2	4.2	0.0	0.0	48.8
9	0.0	0.0	36.2	7.6	3.4	4.4	0.0	0.0	51.7
10	0.0	0.0	38.4	8.1	3.6	4.7	0.0	0.0	54.8
11	0.0	0.0	40.7	8.6	3.8	5.0	0.0	0.0	58.1
12	0.0	0.0	43.1	9.1	4.1	5.3	0.0	0.0	61.6
13	0.0	0.0	45.7	9.7	4.3	5.6	0.0	0.0	65.3
14	0.0	0.0	48.5	10.2	4.6	5.9	0.0	0.0	69.2
15	0.0	0.0	51.4	10.8	4.9	6.3	0.0	0.0	73.4
16	0.0	0.0	54.5	11.5	5.1	6.7	0.0	0.0	77.8
17	0.0	0.0	57.7	12.2	5.5	7.1	0.0	0.0	82.4
18	0.0	0.0	61.2	12.9	5.8	7.5	0.0	0.0	87.4
19	0.0	0.0	64.9	13.7	6.1	7.9	0.0	0.0	92.6
20	0.0	0.0	68.8	14.5	6.5	8.4	0.0	0.0	98.2
21	0.0	0.0	72.9	15.4	6.9	8.9	0.0	0.0	104.1
22	0.0	0.0	77.3	16.3	7.3	9.4	0.0	0.0	110.3
23	0.0	0.0	81.9	17.3	7.7	10.0	0.0	0.0	116.9
24	0.0	0.0	86.8	18.3	8.2	10.6	0.0	0.0	123.9
25	0.0	0.0	92.0	19.4	8.7	11.2	0.0	0.0	131.4
26	0.0	0.0	97.5	20.6	9.2	11.9	0.0	0.0	139.2
27	0.0	0.0	103.4	21.8	9.8	12.6	0.0	0.0	147.6
28	0.0	0.0	109.6	23.1	10.3	13.4	0.0	0.0	156.5
29	0.0	0.0	116.2	24.5	11.0	14.2	0.0	0.0	165.8
30	0.0	0.0	123.1	26.0	11.6	15.0	0.0	0.0	175.8
31	0.0	0.0	130.5	27.6	12.3	16.0	0.0	0.0	186.3
32	0.0	0.0	138.3	29.2	13.1	16.9	0.0	0.0	197.5
33	0.0	0.0	146.6	31.0	13.8	17.9	0.0	0.0	209.4
34	0.0	0.0	155.4	32.8	14.7	19.0	0.0	0.0	221.9
35	0.0	0.0	164.8	34.8	15.6	20.1	0.0	0.0	235.3
36	0.0	0.0	174.7	36.9	16.5	21.3	0.0	0.0	249.4
37	0.0	0.0	185.1	39.1	17.5	22.6	0.0	0.0	264.3
38	0.0	0.0	196.2	41.4	18.5	24.0	0.0	0.0	280.2
39	0.0	0.0	208.0	43.9	19.6	25.4	0.0	0.0	297.0
40	0.0	0.0	220.5	46.5	20.8	26.9	0.0	0.0	314.8

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NFT FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	91.1	32.4	77.3	6.6	-25.2	3.49
2	96.2	34.4	77.3	6.6	-22.1	3.55
3	101.6	36.5	77.3	6.6	-18.8	3.61
4	107.3	38.6	77.3	6.6	-15.3	3.68
5	113.3	41.0	77.3	6.6	-11.6	3.75
6	119.6	43.4	77.3	6.6	-7.7	3.82
7	126.3	46.0	77.3	6.6	-3.6	3.90
8	133.4	48.8	77.3	6.6	0.7	3.98
9	140.9	51.7	77.3	6.6	5.3	4.07
10	148.8	54.8	77.3	6.6	10.0	4.17
11	157.1	58.1	77.3	6.6	15.1	4.26
12	165.9	61.6	77.3	6.6	20.4	4.37
13	175.2	65.3	77.3	6.6	26.0	4.48
14	185.0	69.2	77.3	6.6	31.9	4.60
15	195.4	73.4	77.3	6.6	38.1	4.72
16	206.3	77.8	77.3	6.6	44.6	4.85
17	217.8	82.4	77.3	6.6	51.5	4.99
18	230.0	87.4	77.3	6.6	58.8	5.14
19	242.9	92.5	77.3	6.6	66.4	5.30
20	256.5	94.2	77.3	6.6	74.5	5.47
21	270.9	104.1	77.3	6.6	82.9	5.64
22	286.1	110.3	77.3	6.6	91.9	5.83
23	302.1	116.9	77.3	6.6	101.3	6.03
24	319.0	123.9	77.3	6.6	111.2	6.24
25	336.9	131.4	77.3	6.6	121.6	6.46
26	355.7	139.2	77.3	6.6	132.6	6.70
27	375.6	147.5	77.3	6.6	144.1	6.95
28	396.7	156.5	77.3	6.6	156.3	7.22
29	418.9	165.8	77.3	6.6	169.1	7.50
30	442.4	175.8	77.3	6.6	182.7	7.80
31	467.1	186.3	77.3	0.0	203.5	7.92
32	493.3	197.5	77.3	0.0	218.5	8.25
33	520.9	209.4	77.3	0.0	234.2	8.61
34	550.1	221.9	77.3	0.0	250.8	8.99
35	580.9	235.3	77.3	0.0	268.3	9.39
36	613.4	249.4	77.3	0.0	286.7	9.81
37	647.8	264.3	77.3	0.0	306.1	10.26
38	684.0	280.2	77.3	0.0	326.5	10.74
39	722.3	297.0	77.3	0.0	348.0	11.24
40	762.8	314.8	77.3	0.0	370.7	11.78

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
30	2.00	0.063
30	2.10	0.068
30	2.20	0.073
30	2.30	0.078
30	2.40	0.083

30	2.50	0.087
30	2.60	0.092
30	2.70	0.096
30	2.80	0.100
30	2.90	0.103
30	3.00	0.107
30	3.10	0.111
30	3.20	0.114
30	3.30	0.118
30	3.40	0.121
30	3.50	0.124

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
35	2.00	0.071
35	2.10	0.076
35	2.20	0.080
35	2.30	0.085
35	2.40	0.089
35	2.50	0.093
35	2.60	0.097
35	2.70	0.101
35	2.80	0.105
35	2.90	0.108
35	3.00	0.112
35	3.10	0.115
35	3.20	0.119
35	3.30	0.122
35	3.40	0.125

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
35	3.50	0.128
40	2.00	0.076
40	2.10	0.081
40	2.20	0.085
40	2.30	0.089
40	2.40	0.093
40	2.50	0.097
40	2.60	0.101
40	2.70	0.105
40	2.80	0.108
40	2.90	0.111
40	3.00	0.115
40	3.10	0.118
40	3.20	0.121
40	3.30	0.124
40	3.40	0.127
40	3.50	0.130

PART 4

CASE U111 : UTILITY BACKUP AND DIESEL BACKUP STUDIES

CANTON HYDRO PROJECT ALTERNATIVE U<sub>1L1</sub> UTILITY BACKUP

PRICE ESCALATION RATES

% PER YEAR

UTILITY ENERGY	8.00
HYDRO ENERGY	7.60
BACKUP ENERGY	8.30
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1772.7	1772.7	1896.8
0	2659.0	2818.5	2818.5
TOTALS	4431.7	4591.2	4715.3

COMPLETED COST = 4715.3

FULLY AMORTIZED OVER 40 YEARS = \$ 353.7 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	TAX REVENUES	TOTAL REVENUES
1	8.640	2.64	231.6	0.0	138.8	370.4
2	8.640	2.88	249.2	0.0	149.9	399.1
3	8.640	3.10	268.2	0.0	161.9	430.0
4	8.640	3.34	288.6	0.0	174.8	463.4
5	8.640	3.59	310.5	0.0	188.8	499.3
6	8.640	3.87	334.1	0.0	203.9	538.0
7	8.640	4.16	359.5	0.0	220.2	579.7
8	8.640	4.48	386.8	0.0	237.8	624.6
9	8.640	4.82	416.2	0.0	256.9	673.0
10	8.640	5.18	447.8	0.0	277.4	725.2
11	8.640	5.58	481.8	0.0	299.6	781.4
12	8.640	6.00	518.5	0.0	323.6	842.0
13	8.640	6.46	557.9	0.0	349.4	907.3
14	8.640	6.95	600.3	0.0	377.4	977.7
15	8.640	7.48	645.9	0.0	407.6	1053.5
16	8.640	8.04	695.0	0.0	440.2	1135.2
17	8.640	8.65	747.8	0.0	475.4	1223.2
18	8.640	9.31	804.6	0.0	513.4	1318.1
19	8.640	10.02	865.8	0.0	554.5	1420.3
20	8.640	10.78	931.6	0.0	598.9	1530.5
21	8.640	11.60	1002.4	0.0	646.8	1649.2
22	8.640	12.48	1078.5	0.0	698.5	1777.1
23	8.640	13.43	1160.5	0.0	754.4	1914.9
24	8.640	14.45	1248.7	0.0	814.8	2063.5
25	8.640	15.55	1343.6	0.0	879.9	2223.6
26	8.640	16.73	1445.7	0.0	950.3	2396.1
27	8.640	18.00	1555.6	0.0	1026.4	2582.0
28	8.640	19.37	1673.8	0.0	1108.5	2782.3
29	8.640	20.85	1801.0	0.0	1197.2	2998.2
30	8.640	22.43	1937.9	0.0	1292.9	3230.8
31	8.640	24.13	2085.2	0.0	1396.4	3481.6
32	8.640	25.97	2243.7	0.0	1508.1	3751.7
33	8.640	27.94	2414.2	0.0	1628.7	4042.9
34	8.640	30.07	2597.7	0.0	1759.0	4356.7
35	8.640	32.35	2795.1	0.0	1899.7	4694.8
36	8.640	34.81	3007.5	0.0	2051.7	5059.2
37	8.640	37.45	3236.1	0.0	2215.8	5451.9
38	8.640	40.30	3482.0	0.0	2393.1	5875.1
39	8.640	43.36	3746.6	0.0	2584.6	6331.2
40	8.640	46.66	4031.4	0.0	2791.3	6822.7

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	63.1	12.6	10.0	2.8	55.3	0.0	143.8
2	0.0	0.0	66.9	13.4	10.6	2.9	59.0	0.0	152.8
3	0.0	0.0	70.9	14.2	11.2	3.1	63.0	0.0	162.4
4	0.0	0.0	75.2	15.0	11.9	3.3	67.3	0.0	172.7
5	0.0	0.0	79.7	15.9	12.6	3.5	71.8	0.0	183.5
6	0.0	0.0	84.5	16.9	13.3	3.7	76.7	0.0	195.1
7	0.0	0.0	89.5	17.9	14.1	3.9	81.9	0.0	207.4
8	0.0	0.0	94.9	19.0	15.0	4.2	87.4	0.0	220.5
9	0.0	0.0	100.6	20.1	15.9	4.4	93.4	0.0	234.4
10	0.0	0.0	106.6	21.3	16.8	4.7	99.7	0.0	249.2
11	0.0	0.0	113.0	22.6	17.9	5.0	106.5	0.0	265.0
12	0.0	0.0	119.8	24.0	18.9	5.3	113.8	0.0	281.8
13	0.0	0.0	127.0	25.4	20.1	5.6	121.6	0.0	299.7
14	0.0	0.0	134.6	26.9	21.3	5.9	129.9	0.0	318.7
15	0.0	0.0	142.7	28.5	22.5	6.3	138.9	0.0	338.9
16	0.0	0.0	151.3	30.3	23.9	6.7	148.4	0.0	360.5
17	0.0	0.0	160.4	32.1	25.3	7.1	158.6	0.0	383.5
18	0.0	0.0	170.0	34.0	26.9	7.5	169.6	0.0	407.9
19	0.0	0.0	180.2	36.0	28.5	7.9	181.3	0.0	433.9
20	0.0	0.0	191.0	38.2	30.2	8.4	193.9	0.0	461.7
21	0.0	0.0	202.4	40.5	32.0	8.9	207.4	0.0	491.2
22	0.0	0.0	214.6	42.9	33.9	9.4	221.8	0.0	522.6
23	0.0	0.0	227.5	45.5	35.9	10.0	237.2	0.0	556.1
24	0.0	0.0	241.1	48.2	38.1	10.6	253.8	0.0	591.8
25	0.0	0.0	255.6	51.1	40.4	11.2	271.5	0.0	629.8
26	0.0	0.0	270.9	54.2	42.8	11.9	290.5	0.0	670.3
27	0.0	0.0	287.2	57.4	45.4	12.6	310.9	0.0	713.5
28	0.0	0.0	304.4	60.9	48.1	13.4	332.7	0.0	759.5
29	0.0	0.0	322.7	64.5	51.0	14.2	356.1	0.0	808.5
30	0.0	0.0	342.0	68.4	54.0	15.0	381.2	0.0	860.8
31	0.0	0.0	362.5	72.5	57.3	16.0	408.2	0.0	916.5
32	0.0	0.0	384.3	76.9	60.7	16.9	437.0	0.0	975.8
33	0.0	0.0	407.3	81.5	64.4	17.9	468.0	0.0	1039.1
34	0.0	0.0	431.8	86.4	68.2	19.0	501.2	0.0	1106.6
35	0.0	0.0	457.7	91.5	72.3	20.1	536.9	0.0	1178.6
36	0.0	0.0	485.2	97.0	76.7	21.3	575.1	0.0	1255.3
37	0.0	0.0	514.3	102.9	81.3	22.6	616.2	0.0	1337.2
38	0.0	0.0	545.1	109.0	86.1	24.0	660.2	0.0	1424.5
39	0.0	0.0	577.8	115.6	91.3	25.4	707.5	0.0	1517.6

40                    0.0                    0.0                    612.5                    122.5                    96.8                    26.9                    758.2                    0.0                    1617.0



RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	370.4	143.8	353.7	34.9	-162.0	4.56
2	399.1	152.8	353.7	34.9	-142.3	4.53
3	430.0	162.4	353.7	34.9	-121.0	4.50
4	463.4	172.7	353.7	34.9	-97.9	4.47
5	499.3	183.5	353.7	34.9	-72.8	4.44
6	538.0	195.1	353.7	34.9	-45.7	4.40
7	579.7	207.4	353.7	34.9	-16.3	4.35
8	624.6	220.5	353.7	34.9	15.5	4.30
9	673.0	234.4	353.7	34.9	50.0	4.24
10	725.2	249.2	353.7	34.9	87.4	4.17
11	781.4	265.0	353.7	34.9	127.8	4.10
12	842.0	281.8	353.7	34.9	171.6	4.01
13	907.3	299.7	353.7	34.9	219.1	3.92
14	977.7	318.7	353.7	34.9	270.4	3.82
15	1053.5	338.9	353.7	34.9	325.9	3.70
16	1135.2	360.5	353.7	34.9	386.1	3.58
17	1223.2	383.5	353.7	34.9	451.2	3.43
18	1318.1	407.9	353.7	34.9	521.6	3.28
19	1420.3	433.9	353.7	34.9	597.8	3.10
20	1530.5	461.7	353.7	34.9	680.2	2.91
21	1549.2	491.2	353.7	34.9	769.4	2.70
22	1777.1	522.6	353.7	34.9	865.9	2.46
23	1914.9	556.1	353.7	34.9	970.2	2.20
24	2063.5	591.8	353.7	34.9	1083.1	1.92
25	2223.6	629.8	353.7	34.9	1205.2	1.60
26	2396.1	670.3	353.7	34.9	1337.2	1.26
27	2582.0	713.5	353.7	34.9	1479.9	0.88
28	2782.3	759.5	353.7	34.9	1634.2	0.46
29	2998.2	808.5	353.7	34.9	1801.1	-0.00
30	3230.8	860.8	353.7	34.9	1981.5	-0.50
31	3481.6	916.5	353.7	0.0	2211.4	-1.46
32	3751.7	975.8	353.7	0.0	2422.2	-2.07
33	4042.9	1039.1	353.7	0.0	2650.1	-2.73
34	4356.7	1106.6	353.7	0.0	2896.4	-3.46
35	4694.8	1178.6	353.7	0.0	3162.5	-4.25
36	5059.2	1255.3	353.7	0.0	3450.2	-5.12
37	5451.9	1337.2	353.7	0.0	3761.0	-6.08
38	5875.1	1424.5	353.7	0.0	4096.9	-7.12
39	6331.2	1517.6	353.7	0.0	4459.9	-8.26
40	6822.7	1617.0	353.7	0.0	4852.0	-9.50

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
30	1.50	0.072
30	1.60	0.076
30	1.70	0.079
30	1.80	0.082

30	1.90	0.085
30	2.00	0.088
30	2.10	0.091
30	2.20	0.094
30	2.30	0.097
30	2.40	0.099

PROJECT LIFE      INITIAL ENERGY VALUE  
4 YEARS PRIOR TO YEAR 1      IRR

35	1.50	0.082
35	1.60	0.085
35	1.70	0.088
35	1.80	0.091
35	1.90	0.094
35	2.00	0.097
35	2.10	0.099
35	2.20	0.102
35	2.30	0.104
35	2.40	0.107

PROJECT LIFE      INITIAL ENERGY VALUE  
4 YEARS PRIOR TO YEAR 1      IRR

40	1.50	0.089
40	1.60	0.092
40	1.70	0.095
40	1.80	0.097
40	1.90	0.100
40	2.00	0.102
40	2.10	0.105
40	2.20	0.107
40	2.30	0.109
40	2.40	0.112

ANTON HYDRO PROJECT ALTERNATIVE U<sub>1</sub>L<sub>1</sub> DIESEL BACKUP

PRICE ESCALATION RATES

% PER YEAR

UTILITY ENERGY	8.00
HYDRO ENERGY	7.60
BACKUP ENERGY	8.30
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1851.2	1851.2	1980.8
0	2776.9	2943.5	2943.5
TOTALS	4628.1	4794.7	4924.3

COMPLETED COST = \$ 4924.3

FULLY AMORTIZED OVER 40 YEARS = \$ 369.4 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	TAX REVENUES	TOTAL REVENUES
1	8.640	2.68	231.6	0.0	138.8	370.4
2	8.640	2.88	249.2	0.0	149.9	399.1
3	8.640	3.10	268.2	0.0	161.9	430.0
4	8.640	3.34	288.6	0.0	174.8	463.4
5	8.640	3.59	310.5	0.0	188.8	499.3
6	8.640	3.87	334.1	0.0	203.9	538.0
7	8.640	4.16	359.5	0.0	220.2	579.7
8	8.640	4.48	386.8	0.0	237.8	624.6
9	8.640	4.82	416.2	0.0	256.9	673.0
10	8.640	5.18	447.8	0.0	277.4	725.2
11	8.640	5.58	481.8	0.0	299.6	781.4
12	8.640	6.00	518.5	0.0	323.6	842.0
13	8.640	6.46	557.9	0.0	349.4	907.3
14	8.640	6.95	600.3	0.0	377.4	977.7
15	8.640	7.48	645.9	0.0	407.6	1053.5
16	8.640	8.04	695.0	0.0	440.2	1135.2
17	8.640	8.65	747.8	0.0	475.4	1223.2
18	8.640	9.31	804.6	0.0	513.4	1318.1
19	8.640	10.02	865.8	0.0	554.5	1420.3
20	8.640	10.78	931.6	0.0	598.9	1530.5
21	8.640	11.60	1002.4	0.0	646.8	1649.2
22	8.640	12.48	1078.5	0.0	698.5	1777.1
23	8.640	13.43	1160.5	0.0	754.4	1914.9
24	8.640	14.45	1248.7	0.0	814.8	2063.5
25	8.640	15.55	1343.6	0.0	879.9	2223.6
26	8.640	16.73	1445.7	0.0	950.3	2396.1
27	8.640	18.00	1555.6	0.0	1026.4	2582.0
28	8.640	19.37	1673.8	0.0	1108.5	2782.3
29	8.640	20.85	1801.0	0.0	1197.2	2998.2
30	8.640	22.43	1937.9	0.0	1292.9	3230.8
31	8.640	24.13	2085.2	0.0	1396.4	3481.6
32	8.640	25.97	2243.7	0.0	1508.1	3751.7
33	8.640	27.94	2414.2	0.0	1628.7	4042.9
34	8.640	30.07	2597.7	0.0	1759.0	4356.7
35	8.640	32.35	2795.1	0.0	1899.7	4694.8
36	8.640	34.81	3007.5	0.0	2051.7	5059.2
37	8.640	37.45	3236.1	0.0	2215.8	5451.9
38	8.640	40.30	3482.0	0.0	2393.1	5875.1
39	8.640	43.36	3746.6	0.0	2584.6	6331.2
40	8.640	46.66	4031.4	0.0	2791.3	6822.7

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	65.6	13.1	10.5	2.8	22.6	0.0	114.6
2	0.0	0.0	69.6	13.9	11.1	2.9	24.5	0.0	122.0
3	0.0	0.0	73.8	14.8	11.8	3.1	26.5	0.0	129.9
4	0.0	0.0	78.2	15.6	12.5	3.3	28.7	0.0	138.3
5	0.0	0.0	82.9	16.6	13.2	3.5	31.1	0.0	147.3
6	0.0	0.0	87.9	17.6	14.0	3.7	33.6	0.0	156.8
7	0.0	0.0	93.1	18.6	14.9	3.9	36.4	0.0	167.0
8	0.0	0.0	98.7	19.7	15.8	4.2	39.5	0.0	177.8
9	0.0	0.0	104.6	20.9	16.7	4.4	42.7	0.0	189.4
10	0.0	0.0	110.9	22.2	17.7	4.7	46.3	0.0	201.8
11	0.0	0.0	117.6	23.5	18.8	5.0	50.1	0.0	214.9
12	0.0	0.0	124.6	24.9	19.9	5.3	54.3	0.0	229.0
13	0.0	0.0	132.1	26.4	21.1	5.6	58.8	0.0	244.0
14	0.0	0.0	140.0	28.0	22.3	5.9	63.7	0.0	260.0
15	0.0	0.0	148.4	29.7	23.7	6.3	68.9	0.0	277.0
16	0.0	0.0	157.3	31.5	25.1	6.7	74.7	0.0	295.2
17	0.0	0.0	166.8	33.4	26.6	7.1	80.9	0.0	314.7
18	0.0	0.0	176.8	35.4	28.2	7.5	87.6	0.0	335.4
19	0.0	0.0	187.4	37.5	29.9	7.9	94.8	0.0	357.5
20	0.0	0.0	198.6	39.7	31.7	8.4	102.7	0.0	381.2
21	0.0	0.0	210.5	42.1	33.6	8.9	111.2	0.0	406.4
22	0.0	0.0	223.2	44.6	35.6	9.4	120.5	0.0	433.3
23	0.0	0.0	236.6	47.3	37.8	10.0	130.5	0.0	462.1
24	0.0	0.0	250.8	50.2	40.0	10.6	141.3	0.0	492.8
25	0.0	0.0	265.8	53.2	42.4	11.2	153.0	0.0	525.7
26	0.0	0.0	281.7	56.3	45.0	11.9	165.7	0.0	560.7
27	0.0	0.0	298.7	59.7	47.7	12.6	179.5	0.0	598.2
28	0.0	0.0	316.6	63.3	50.5	13.4	194.4	0.0	638.2
29	0.0	0.0	335.6	67.1	53.6	14.2	210.5	0.0	681.0
30	0.0	0.0	355.7	71.1	56.9	15.0	228.0	0.0	726.7
31	0.0	0.0	377.0	75.4	60.2	16.0	246.9	0.0	775.5
32	0.0	0.0	399.7	79.9	63.8	16.9	267.4	0.0	827.7
33	0.0	0.0	423.6	84.7	67.6	17.9	289.6	0.0	883.5
34	0.0	0.0	449.1	89.8	71.7	19.0	313.7	0.0	943.2
35	0.0	0.0	476.0	95.2	76.0	20.1	339.7	0.0	1007.0
36	0.0	0.0	504.6	100.9	80.5	21.3	367.9	0.0	1075.2
37	0.0	0.0	534.8	107.0	85.4	22.6	398.4	0.0	1148.2
38	0.0	0.0	566.9	113.4	90.5	24.0	431.5	0.0	1226.3
39	0.0	0.0	600.9	120.2	95.9	25.4	467.3	0.0	1309.8

40                    0.0                    0.0                    637.0                    127.4                    101.7                    26.9                    506.1                    0.0                    1399.1

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	370.4	114.6	369.4	34.9	-148.5	4.40
2	399.1	122.0	369.4	34.9	-127.2	4.36
3	430.0	129.9	369.4	34.9	-104.1	4.31
4	463.4	138.3	369.4	34.9	-79.2	4.26
5	499.3	147.3	369.4	34.9	-52.2	4.20
6	538.0	156.8	369.4	34.9	-23.1	4.13
7	579.7	167.0	369.4	34.9	8.4	4.06
8	624.6	177.8	369.4	34.9	42.5	3.98
9	673.0	189.4	369.4	34.9	79.4	3.90
10	725.2	201.8	369.4	34.9	119.2	3.80
11	781.4	214.9	369.4	34.9	162.2	3.70
12	842.0	229.0	369.4	34.9	208.8	3.58
13	907.3	244.0	369.4	34.9	259.1	3.46
14	977.7	260.0	369.4	34.9	313.4	3.32
15	1053.5	277.0	369.4	34.9	372.2	3.17
16	1135.2	295.2	369.4	34.9	435.7	3.00
17	1223.2	314.7	369.4	34.9	504.3	2.82
18	1318.1	335.4	369.4	34.9	578.4	2.62
19	1420.3	357.5	369.4	34.9	658.5	2.40
20	1530.5	381.2	369.4	34.9	745.0	2.16
21	1649.2	406.4	369.4	34.9	838.5	1.90
22	1777.1	433.3	369.4	34.9	939.5	1.61
23	1914.9	462.1	369.4	34.9	1048.6	1.30
24	2063.5	492.8	369.4	34.9	1166.4	0.95
25	2223.6	525.7	369.4	34.9	1293.6	0.58
26	2396.1	560.7	369.4	34.9	1431.1	0.17
27	2582.0	598.2	369.4	34.9	1579.5	-0.28
28	2782.3	638.2	369.4	34.9	1739.8	-0.76
29	2998.2	681.0	369.4	34.9	1913.0	-1.30
30	3230.8	726.7	369.4	34.9	2099.9	-1.88
31	3481.6	775.5	369.4	0.0	2336.7	-2.91
32	3751.7	827.7	369.4	0.0	2554.7	-3.60
33	4042.9	883.5	369.4	0.0	2790.0	-4.35
34	4356.7	943.2	369.4	0.0	3044.1	-5.17
35	4699.8	1007.0	369.4	0.0	3318.4	-6.06
36	5059.2	1075.2	369.4	0.0	3614.6	-7.03
37	5451.9	1148.2	369.4	0.0	3934.3	-8.08
38	5875.1	1226.3	369.4	0.0	4279.5	-9.23
39	6331.2	1309.8	369.4	0.0	4652.1	*****
40	6822.7	1399.1	369.4	0.0	5054.2	*****

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE: INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

30	1.50	0.076
30	1.60	0.079
30	1.70	0.083
30	1.80	0.085

30	1.90	0.088
30	2.00	0.091
30	2.10	0.094
30	2.20	0.097
30	2.30	0.099
30	2.40	0.102

PROJECT LIFE: INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

35	1.50	0.086
35	1.60	0.088
35	1.70	0.091
35	1.80	0.094
35	1.90	0.096
35	2.00	0.099
35	2.10	0.101
35	2.20	0.104
35	2.30	0.106
35	2.40	0.109

PROJECT LIFE: INITIAL ENERGY VALUE IRR  
4 YEARS PRIOR TO YEAR 1

40	1.50	0.092
40	1.60	0.095
40	1.70	0.097
40	1.80	0.100
40	1.90	0.102
40	2.00	0.104
40	2.10	0.107
40	2.20	0.109
40	2.30	0.111
40	2.40	0.113

PART 5

CASE U1 : UTILITY BACKUP AND DIESEL BACKUP STUDIES



CANTON HYDRO PROJECT ALTERNATIVE - U1 - UTILITY BACKUP

PRICE ESCALATION RATES

% PER YEAR

UTILITY ENERGY	8.00
HYDRO ENERGY	7.60
BACKUP ENERGY	8.30
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	956.7	956.7	1023.7
0	1435.1	1521.2	1521.2
TOTALS	2391.8	2477.9	2544.9

COMPLETED COST = \$ 2544.9

FULLY AMORTIZED OVER 40 YEARS = \$ 190.9 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	TAX REVENUES	TOTAL REVENUES
1	4.310	2.68	115.5	0.0	138.8	254.3
2	4.310	2.88	124.3	0.0	149.9	274.2
3	4.310	3.10	133.8	0.0	161.9	295.6
4	4.310	3.34	143.9	0.0	174.8	318.8
5	4.310	3.59	154.9	0.0	188.8	343.7
6	4.310	3.87	166.7	0.0	203.9	370.6
7	4.310	4.16	179.3	0.0	220.2	399.5
8	4.310	4.48	192.9	0.0	237.8	430.8
9	4.310	4.82	207.6	0.0	256.9	464.5
10	4.310	5.18	223.4	0.0	277.4	500.8
11	4.310	5.58	240.4	0.0	299.6	540.0
12	4.310	6.00	258.6	0.0	323.6	582.2
13	4.310	6.46	278.3	0.0	349.4	627.7
14	4.310	6.95	299.4	0.0	377.4	676.8
15	4.310	7.48	322.2	0.0	407.6	729.8
16	4.310	8.04	346.7	0.0	440.2	786.9
17	4.310	8.65	373.0	0.0	475.4	848.4
18	4.310	9.31	401.4	0.0	513.4	914.8
19	4.310	10.02	431.9	0.0	554.5	986.4
20	4.310	10.78	464.7	0.0	598.9	1063.6
21	4.310	11.60	500.0	0.0	646.8	1146.8
22	4.310	12.48	538.0	0.0	698.5	1236.6
23	4.310	13.43	578.9	0.0	754.4	1333.3
24	4.310	14.45	622.9	0.0	814.8	1437.7
25	4.310	15.55	670.3	0.0	879.9	1550.2
26	4.310	16.73	721.2	0.0	950.3	1671.5
27	4.310	18.00	776.0	0.0	1026.4	1802.4
28	4.310	19.37	835.0	0.0	1108.5	1943.5
29	4.310	20.85	898.4	0.0	1197.2	2095.6
30	4.310	22.43	966.7	0.0	1292.9	2259.6
31	4.310	24.13	1040.2	0.0	1396.4	2436.5
32	4.310	25.97	1119.2	0.0	1508.1	2627.3
33	4.310	27.94	1204.3	0.0	1628.7	2833.0
34	4.310	30.07	1295.8	0.0	1759.0	3054.8
35	4.310	32.35	1394.3	0.0	1899.7	3294.0
36	4.310	34.81	1500.3	0.0	2051.7	3552.0
37	4.310	37.45	1614.3	0.0	2215.8	3830.1
38	4.310	40.30	1737.0	0.0	2393.1	4130.1
39	4.310	43.36	1869.0	0.0	2584.6	4453.5
40	4.310	46.66	2011.0	0.0	2791.3	4802.3

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	42.9	8.6	5.4	2.8	74.2	0.0	134.0
2	0.0	0.0	45.5	9.1	5.8	2.9	79.2	0.0	142.5
3	0.0	0.0	48.2	9.6	6.1	3.1	84.6	0.0	151.7
4	0.0	0.0	51.1	10.2	6.5	3.3	90.3	0.0	161.4
5	0.0	0.0	54.2	10.8	6.9	3.5	96.4	0.0	171.8
6	0.0	0.0	57.4	11.5	7.3	3.7	103.0	0.0	182.9
7	0.0	0.0	60.9	12.2	7.7	3.9	109.9	0.0	194.7
8	0.0	0.0	64.5	12.9	8.2	4.2	117.4	0.0	207.2
9	0.0	0.0	68.4	13.7	8.7	4.4	125.4	0.0	220.6
10	0.0	0.0	72.5	14.5	9.2	4.7	134.0	0.0	234.9
11	0.0	0.0	76.9	15.4	9.7	5.0	143.1	0.0	250.1
12	0.0	0.0	81.5	16.3	10.3	5.3	152.9	0.0	266.3
13	0.0	0.0	86.4	17.3	10.9	5.6	163.4	0.0	283.6
14	0.0	0.0	91.6	18.3	11.6	5.9	174.7	0.0	302.0
15	0.0	0.0	97.0	19.4	12.3	6.3	186.7	0.0	321.7
16	0.0	0.0	102.9	20.6	13.0	6.7	199.5	0.0	342.7
17	0.0	0.0	109.0	21.8	13.8	7.1	213.3	0.0	365.0
18	0.0	0.0	115.6	23.1	14.6	7.5	228.1	0.0	388.9
19	0.0	0.0	122.5	24.5	15.5	7.9	243.9	0.0	414.3
20	0.0	0.0	129.9	26.0	16.4	8.4	260.8	0.0	441.5
21	0.0	0.0	137.7	27.5	17.4	8.9	278.9	0.0	470.5
22	0.0	0.0	145.9	29.2	18.5	9.4	298.4	0.0	501.4
23	0.0	0.0	154.7	30.9	19.6	10.0	319.2	0.0	534.4
24	0.0	0.0	164.0	32.8	20.7	10.6	341.5	0.0	569.6
25	0.0	0.0	173.8	34.8	22.0	11.2	365.4	0.0	607.2
26	0.0	0.0	184.2	36.8	23.3	11.9	391.0	0.0	647.3
27	0.0	0.0	195.3	39.1	24.7	12.6	418.5	0.0	690.2
28	0.0	0.0	207.0	41.4	26.2	13.4	447.9	0.0	735.9
29	0.0	0.0	219.4	43.9	27.7	14.2	479.5	0.0	784.8
30	0.0	0.0	232.6	46.5	29.4	15.0	513.4	0.0	836.9
31	0.0	0.0	246.5	49.3	31.2	16.0	549.7	0.0	892.7
32	0.0	0.0	261.3	52.3	33.0	16.9	588.7	0.0	952.2
33	0.0	0.0	277.0	55.4	35.0	17.9	630.4	0.0	1015.8
34	0.0	0.0	293.6	58.7	37.1	19.0	675.3	0.0	1083.7
35	0.0	0.0	311.2	62.2	39.4	20.1	723.4	0.0	1156.4
36	0.0	0.0	329.9	66.0	41.7	21.3	775.0	0.0	1234.0
37	0.0	0.0	349.7	69.9	44.2	22.6	830.4	0.0	1316.9
38	0.0	0.0	370.7	74.1	46.9	24.0	889.9	0.0	1405.5
39	0.0	0.0	392.9	78.6	49.7	25.4	953.7	0.0	1500.3

40                    0.0                    0.0                    416.5                    83.3                    52.7                    26.9                    1022.2                    0.0                    1601.6

RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	254.3	134.0	190.9	21.6	-92.2	4.32
2	274.2	142.5	190.9	21.6	-80.9	4.76
3	295.6	151.7	190.9	21.6	-68.6	4.69
4	318.8	161.4	190.9	21.6	-55.2	4.62
5	343.7	171.8	190.9	21.6	-40.7	4.54
6	376.6	182.9	190.9	21.6	-24.8	4.44
7	399.5	194.7	190.9	21.6	-7.7	4.34
8	430.8	207.2	190.9	21.6	11.0	4.22
9	464.5	220.6	190.9	21.6	31.3	4.09
10	500.8	234.9	190.9	21.6	53.4	3.94
11	540.0	250.1	190.9	21.6	77.3	3.78
12	582.2	265.3	190.9	21.6	103.4	3.60
13	627.7	283.6	190.9	21.6	131.6	3.40
14	676.8	302.0	190.9	21.6	162.3	3.18
15	729.8	321.7	190.9	21.6	195.6	2.94
16	786.9	342.7	190.9	21.6	231.7	2.67
17	848.4	365.0	190.9	21.6	270.9	2.37
18	914.8	388.9	190.9	21.6	313.4	2.04
19	986.4	414.3	190.9	21.6	359.6	1.68
20	1063.6	441.5	190.9	21.6	409.6	1.28
21	1146.8	470.5	190.9	21.6	463.8	0.84
22	1236.6	501.4	190.9	21.6	522.7	0.36
23	1333.3	534.4	190.9	21.6	586.4	-0.17
24	1437.7	569.6	190.9	21.6	655.6	-0.76
25	1550.2	607.2	190.9	21.6	730.5	-1.40
26	1671.5	647.3	190.9	21.6	811.7	-2.10
27	1802.4	690.2	190.9	21.6	899.7	-2.87
28	1943.5	735.9	190.9	21.6	995.0	-3.71
29	2095.6	784.8	190.9	21.6	1098.3	-4.64
30	2259.6	836.9	190.9	21.6	1210.2	-5.65
31	2436.5	892.7	190.9	0.0	1353.0	-7.26
32	2627.3	952.2	190.9	0.0	1484.2	-8.47
33	2833.0	1015.8	190.9	0.0	1626.3	-9.79
34	3054.8	1083.7	190.9	0.0	1780.2	*****
35	3294.0	1156.4	190.9	0.0	1946.8	*****
36	3552.0	1234.0	190.9	0.0	2127.1	*****
37	3830.1	1316.9	190.9	0.0	2322.4	*****
38	4130.1	1405.5	190.9	0.0	2533.7	*****
39	4453.5	1500.3	190.9	0.0	2762.3	*****
40	4802.3	1601.6	190.9	0.0	3009.8	*****

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
30	1.50	0.077
30	1.60	0.080
30	1.70	0.083
30	1.80	0.086

30	1.90	0.089
30	2.00	0.091
30	2.10	0.094
30	2.20	0.096
30	2.30	0.099
30	2.40	0.101

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
35	1.50	0.087
35	1.60	0.090
35	1.70	0.092
35	1.80	0.095
35	1.90	0.097
35	2.00	0.099
35	2.10	0.102
35	2.20	0.104
35	2.30	0.106
35	2.40	0.108

PROJECT LIFE	INITIAL ENERGY VALUE 4 YEARS PRIOR TO YEAR 1	IRR
40	1.50	0.094
40	1.60	0.096
40	1.70	0.099
40	1.80	0.101
40	1.90	0.103
40	2.00	0.105
40	2.10	0.107
40	2.20	0.109
40	2.30	0.111
40	2.40	0.113

CANTON HYDRO PROJECT ALTERNATIVE - U1 - DIESEL BACKUP

PRICE ESCALATION RATES

% PER YEAR

UTILITY ENERGY	8.00
HYDRO ENERGY	7.60
BACKUP ENERGY	8.30
OTHER QUANTITIES	6.00

CAPITAL COST BY YEAR IN THOUSANDS

YEAR	UNESCALATED COST ESTIMATE	ESCALATED TO YEAR OF PAYMENT	CONTRIBUTION TO COMPLETED COST INCLUDING INTEREST DURING CONSTRUCTION
-1	1033.4	1033.4	1105.7
0	1550.0	1643.0	1643.0
TOTALS	2583.4	2676.4	2748.7

COMPLETED COST = \$ 2748.7

FULLY AMORTIZED OVER 40 YEARS = \$ 206.2 PER YEAR AT 7.0 % INTEREST

PROJECT REVENUES IN THOUSANDS

YEAR	ELECTRICITY MILLIONS OF KWH	VALUE CENTS/KWH	ENERGY SALES	CAPACITY REVENUES	TAX REVENUES	TOTAL REVENUES
1	4.310	2.68	115.5	0.0	138.8	254.3
2	4.310	2.88	124.3	0.0	149.9	274.2
3	4.310	3.10	133.8	0.0	161.9	295.6
4	4.310	3.34	143.9	0.0	174.8	318.8
5	4.310	3.59	154.4	0.0	188.8	343.7
6	4.310	3.87	166.7	0.0	203.9	370.6
7	4.310	4.16	179.3	0.0	220.2	399.5
8	4.310	4.48	192.9	0.0	237.8	430.8
9	4.310	4.82	207.6	0.0	256.9	464.5
10	4.310	5.18	223.4	0.0	277.4	500.8
11	4.310	5.58	240.4	0.0	299.6	540.0
12	4.310	6.00	258.6	0.0	323.6	582.2
13	4.310	6.46	278.3	0.0	349.4	627.7
14	4.310	6.95	299.4	0.0	377.4	676.8
15	4.310	7.48	322.2	0.0	407.6	729.8
16	4.310	8.04	346.7	0.0	440.2	786.9
17	4.310	8.65	373.0	0.0	475.4	848.4
18	4.310	9.31	401.4	0.0	513.4	914.8
19	4.310	10.02	431.9	0.0	554.5	986.4
20	4.310	10.75	464.7	0.0	598.9	1063.6
21	4.310	11.60	500.0	0.0	646.8	1146.8
22	4.310	12.48	538.0	0.0	698.5	1236.6
23	4.310	13.43	578.9	0.0	754.4	1333.3
24	4.310	14.45	622.9	0.0	814.8	1437.7
25	4.310	15.55	670.3	0.0	879.9	1550.2
26	4.310	16.73	721.2	0.0	950.3	1671.5
27	4.310	18.00	776.0	0.0	1026.4	1802.4
28	4.310	19.37	835.0	0.0	1108.5	1943.5
29	4.310	20.85	898.4	0.0	1197.2	2095.6
30	4.310	22.43	966.7	0.0	1292.9	2259.6
31	4.310	24.13	1040.2	0.0	1396.4	2436.5
32	4.310	25.97	1119.2	0.0	1508.1	2627.3
33	4.310	27.94	1204.3	0.0	1628.7	2833.0
34	4.310	30.07	1295.8	0.0	1759.0	3054.8
35	4.310	32.35	1394.3	0.0	1899.7	3294.0
36	4.310	34.81	1500.3	0.0	2051.7	3552.0
37	4.310	37.45	1614.3	0.0	2215.8	3830.1
38	4.310	40.30	1737.0	0.0	2393.1	4130.1
39	4.310	43.36	1869.0	0.0	2584.6	4453.5
40	4.310	46.66	2011.0	0.0	2791.3	4802.3

CASH OUTFLOWS NOT INCLUDING BOND AMORTIZATION IN THOUSANDS

YEAR	INCREASES IN WC	REPAIRS OR REPLACEMENT	OPERATION & MAINTENANCE	ADMIN. OVERHEAD	INSURANCE	LICENSE FEE	BACKUP ENERGY	ROYALTIES	TOTAL
1	0.0	0.0	44.2	8.8	5.7	2.8	30.8	0.0	92.2
2	0.0	0.0	46.8	9.4	6.0	2.9	33.3	0.0	98.5
3	0.0	0.0	49.6	9.9	6.4	3.1	36.1	0.0	105.2
4	0.0	0.0	52.6	10.5	6.8	3.3	39.1	0.0	112.3
5	0.0	0.0	55.8	11.2	7.2	3.5	42.3	0.0	119.9
6	0.0	0.0	59.1	11.8	7.6	3.7	45.8	0.0	128.1
7	0.0	0.0	62.7	12.5	8.1	3.9	49.6	0.0	136.8
8	0.0	0.0	66.4	13.3	8.5	4.2	53.7	0.0	146.2
9	0.0	0.0	70.4	14.1	9.1	4.4	58.2	0.0	156.2
10	0.0	0.0	74.7	14.9	9.6	4.7	63.0	0.0	166.9
11	0.0	0.0	79.1	15.8	10.2	5.0	68.3	0.0	178.4
12	0.0	0.0	83.9	16.8	10.8	5.3	73.9	0.0	190.6
13	0.0	0.0	88.9	17.8	11.4	5.6	80.1	0.0	203.8
14	0.0	0.0	94.2	18.8	12.1	5.9	86.7	0.0	217.8
15	0.0	0.0	99.9	20.0	12.8	6.3	93.9	0.0	232.9
16	0.0	0.0	105.9	21.2	13.6	6.7	101.7	0.0	249.0
17	0.0	0.0	112.2	22.4	14.4	7.1	110.1	0.0	266.3
18	0.0	0.0	119.0	23.8	15.3	7.5	119.3	0.0	284.8
19	0.0	0.0	126.7	25.2	16.2	7.9	129.2	0.0	304.7
20	0.0	0.0	133.7	26.7	17.2	8.4	139.9	0.0	325.9
21	0.0	0.0	141.7	28.3	18.2	8.9	151.5	0.0	348.7
22	0.0	0.0	150.2	30.0	19.3	9.4	164.1	0.0	373.1
23	0.0	0.0	159.2	31.8	20.5	10.0	177.7	0.0	399.3
24	0.0	0.0	168.8	33.8	21.7	10.6	192.5	0.0	427.3
25	0.0	0.0	178.9	35.8	23.0	11.2	208.4	0.0	457.4
26	0.0	0.0	189.6	37.9	24.4	11.9	225.7	0.0	489.6
27	0.0	0.0	201.0	40.2	25.8	12.6	244.5	0.0	524.2
28	0.0	0.0	213.1	42.6	27.4	13.4	264.8	0.0	561.3
29	0.0	0.0	225.4	45.2	29.0	14.2	286.8	0.0	601.0
30	0.0	0.0	239.4	47.9	30.8	15.0	310.6	0.0	643.7
31	0.0	0.0	253.8	50.8	32.6	16.0	336.3	0.0	689.4
32	0.0	0.0	269.0	53.8	34.6	16.9	364.2	0.0	738.5
33	0.0	0.0	285.1	57.0	36.7	17.9	394.5	0.0	791.2
34	0.0	0.0	302.3	60.5	38.9	19.0	427.2	0.0	847.8
35	0.0	0.0	320.4	64.1	41.2	20.1	462.7	0.0	908.5
36	0.0	0.0	339.6	67.9	43.7	21.3	501.1	0.0	973.6
37	0.0	0.0	360.0	72.0	46.3	22.6	542.7	0.0	1043.6
38	0.0	0.0	381.6	76.3	49.1	24.0	587.7	0.0	1118.7
39	0.0	0.0	404.5	80.9	52.0	25.4	636.5	0.0	1199.3
40	0.0	0.0	428.7	85.7	55.1	26.9	689.3	0.0	1285.9



RECEIPTS AND DISBURSEMENTS IN THOUSANDS

YEAR	REVENUES	OUTFLOWS	BOND AMORTIZATION	SINKING FUND FOR R AND R	NET FUNDS FOR YEAR	ENERGY VALUE TO SUPPLY REQUIRED FUNDS (CENTS/KWH)
1	254.3	92.2	206.2	29.1	-73.2	4.38
2	274.2	98.5	206.2	29.1	-59.5	4.27
3	295.6	105.2	206.2	29.1	-44.7	4.14
4	318.8	112.3	206.2	29.1	-28.8	4.01
5	343.7	119.9	206.2	29.1	-11.5	3.86
6	370.6	128.1	206.2	29.1	7.2	3.70
7	399.5	136.8	206.2	29.1	27.5	3.52
8	430.8	146.2	206.2	29.1	49.4	3.33
9	464.5	156.2	206.2	29.1	73.0	3.12
10	500.8	166.9	206.2	29.1	98.6	2.89
11	540.0	178.4	206.2	29.1	126.4	2.65
12	582.2	190.6	206.2	29.1	156.3	2.37
13	627.7	203.8	206.2	29.1	188.7	2.08
14	676.8	217.8	206.2	29.1	223.8	1.76
15	729.8	232.9	206.2	29.1	261.6	1.41
16	786.9	249.0	206.2	29.1	302.6	1.02
17	848.4	266.3	206.2	29.1	346.9	0.61
18	914.8	284.8	206.2	29.1	394.7	0.15
19	986.4	304.7	206.2	29.1	446.5	-0.34
20	1063.6	325.9	206.2	29.1	502.4	-0.88
21	1146.8	348.7	206.2	29.1	562.9	-1.46
22	1236.6	373.1	206.2	29.1	628.2	-2.09
23	1333.3	399.3	206.2	29.1	698.8	-2.78
24	1437.7	427.3	206.2	29.1	775.1	-3.53
25	1550.2	457.4	206.2	29.1	857.6	-4.35
26	1571.5	489.5	206.2	29.1	946.7	-5.23
27	1502.4	524.2	206.2	29.1	1043.0	-6.19
28	1443.5	561.3	206.2	29.1	1147.0	-7.24
29	2095.6	601.0	206.2	29.1	1259.3	-8.37
30	2259.6	643.7	206.2	29.1	1380.7	-9.61
31	2436.5	689.4	206.2	0.0	1540.9	*****
32	2527.3	738.5	206.2	0.0	1682.6	*****
33	2833.0	791.2	206.2	0.0	1835.6	*****
34	3054.8	847.8	206.2	0.0	2000.9	*****
35	3294.0	908.5	206.2	0.0	2179.4	*****
36	3552.0	973.6	206.2	0.0	2372.2	*****
37	3830.1	1043.6	206.2	0.0	2580.4	*****
38	4130.1	1118.7	206.2	0.0	2805.2	*****
39	4453.5	1199.3	206.2	0.0	3048.1	*****
40	4802.3	1285.9	206.2	0.0	3310.3	*****

INTERNAL RATE OF RETURN SENSITIVITY ANALYSIS

PROJECT LIFE      INITIAL ENERGY VALUE  
4 YEARS PRIOR TO YEAR 1      IRR

30	1.50	0.087
30	1.60	0.089
30	1.70	0.092
30	1.80	0.094

30	1.90	0.096
30	2.00	0.099
30	2.10	0.101
30	2.20	0.103
30	2.30	0.105
30	2.40	0.107

PROJECT LIFE      INITIAL ENERGY VALUE  
4 YEARS PRIOR TO YEAR 1      IRR

35	1.50	0.095
35	1.60	0.097
35	1.70	0.100
35	1.80	0.102
35	1.90	0.104
35	2.00	0.106
35	2.10	0.108
35	2.20	0.110
35	2.30	0.112
35	2.40	0.114

PROJECT LIFE      INITIAL ENERGY VALUE  
4 YEARS PRIOR TO YEAR 1      IRR

40	1.50	0.101
40	1.60	0.103
40	1.70	0.105
40	1.80	0.107
40	1.90	0.109
40	2.00	0.111
40	2.10	0.113
40	2.20	0.115
40	2.30	0.117
40	2.40	0.118