AGREEMENT

FOR

PROFESSIONAL SERVICES FOR

CITY OF PORTLAND

PORTLAND, OREGON

THIS AGREEMENT AND CONTRACT, made and entered into at Portland, Oregon, this _______ day of _________, 1981, by and between the CITY OF PORTLAND of Multnomah County, State of Oregon, hereinafter called the "Client," and STRAAM Engineers, a Division of CRS Group Engineers, Inc., a firm of consulting engineers duly authorized to perform professional services in the State of Oregon, hereinafter called the "Engineers":

WITNESSETH THAT:

WHEREAS, the Client desires to retain a consulting engineer to provide professional services as follows:

(1) for preliminary design and final design of a groundwater pumping station and related auxiliary facilities to be located on property owned by the Client in S.19, R.3E, T.1N, W.M.; and

(2) for a feasibility study for hydroelectric power generation at the pump station site, and preliminary and final design of such facilities if found to be feasible as an integrated portion of the pump station; and

(3) for other engineering services during the construction phase of the work to be designed; and

(4) for other services that may be required in connection with the groundwater pumping station project; and

WHEREAS, the Engineers do offer to provide such professional services, in accordance with their Proposal dated October 27, 1980, attached hereto as Exhibit A and made a part hereof, NOW THEREFORE,

IT IS AGREED BETWEEN THE PARTIES HERETO AS FOLLOWS:

ARTICLE I - DEFINITIONS

Whenever the term "Client" is used herein, it is understood to mean City of Portland of Multnomah County, Oregon, or its authorized officers and the term "Engineer" or "Engineers" means an authorized representative of STRAAM Engineers Division.

ARTICLE II - OBLIGATION OF THE ENGINEERS

The services to be performed by the Engineers under this Contract are: (1) professional services required to conduct studies and investigations, make and present reports, and provide general and miscellaneous services, all as directed by the Client; (2) professional services required for the preparation of detailed plans, specifications, and other contract documents for projects as the Client may specifically authorize; (3) professional services during construction as specifically authorized by the Client; and (4) special services as authorized by the Client.

The services to be performed by the Engineer are described as follows and in Exhibit A:

1. Studies, Investigations, Reports, General, and Miscellaneous. The Engineer shall perform such work as required to design and obtain the necessary permits and licenses for the pump station and electrical generating facility outlined in Exhibit A; and as may be specifically mutually agreed upon and directed by the Client. He shall furnish survey personnel and equipment required to obtain design information for preparation of preliminary plans and specifications. He shall arrange for personnel and equipment required to perform subsurface explorations pertaining to foundation and/or construction conditions and such other studies as necessary to complete the work.

   Reports for studies performed for this project shall be forwarded to the Client for review and comment prior to issuance. These reports or studies shall include, but are not limited to: (1) Report on water availability from Bull Run and the supply system hydraulic analysis; (2) Report on the hydromachinery/hydraulic transient/surge control evaluations; (3) Report on hydroelectric/ feasibility analysis; (4) Report on the licensing and permit requirements; (5) Site corrosion survey and Geotecnnical Investigation Report; and (6) The Preliminary Design Report. After receipt of Client's comments from the initial review, the Engineer shall provide the Client a minimum of ten copies of each report for formal review. If feasibility (3) above, is not indicated then all hydroelectric power work shall be stopped and only work for a pumping station shall continue. The Engineer will endeavor to determine feasibility as a priority item of Phase I of the Proposal's work schedule.

The Preliminary Design Report shall include, in addition to other necessary items, the following items, if the feasibility study determines that hydroelectric power generation is feasible as an integral portion of the pump station:

a. SITE DESCRIPTION - The Engineer shall describe the site in detail including the pump station, water or surge tanks, 60-inch pipeline (Groundwater Transmission Main) from the site to Powell Butte, etc. Also, the Engineer shall provide site location by reference to other buildings at the site, and provide a site plan.

b. ESTABLISH SITE PERFORMANCE CHARACTERISTICS - The Engineer shall estimate the head on the wells and the flow rate to effect recharge and shall determine if the water reservoir will develop enough head to provide for such recharge conditions. The Engineer will identify any surge problems in the Groundwater Transmission Main, Conduit Interties, and Bull Run Conduits. The flow, head, and duration shall be determined by the Engineer.

c. ENGINEERING SITE ASSESSMENT - The Engineer shall analyze the surge problems that could possibly be produced by the hydroelectric facility and determine if they can be suppressed. The control of pressure for recharging the wells shall also be determined. The powerhouse layout shall be developed and plan and profile drawings made. The configuration of piping shall be sketched. The Engineer shall determine foundation conditions and quantity estimates shall be developed for any required excavation or fill.

d. SAFETY ASSESSMENT - The Engineer shall examine the condition of the Groundwater Transmission Main and all related piping to determine if they can safely handle the surge that is anticipated. The examination shall include: review of available plans and specifications, interviews of operations, maintenance, and inspection personnel of the Client, and evaluation of the information so gathered. The Engineer shall recommend that field inspections and material tests be made by the

Client if these are needed to complete the examination. On request of the Client, the Engineer will assist with examinations and tests as a special service. Alternative emergency discharge areas shall be developed if necessary.

e. AVAILABILITY OF TURBINE AND GENERATOR - The Engineer shall receive quotes from at least four manufacturers including cost, size, delivery time, and performance.

f. POWER TRANSMISSION - The Engineer shall include and evaluate the alternative of using the same transformers for both the pump station and the powerhouse. The Engineer shall insure compatibility of the transformers and distribution feeder circuit.

g. ESTIMATE OF ANNUAL O&M - The Engineer shall use existing similar-sized plants as a basis to establish O&M costs.

h. ESTABLISH ANTICIPATED PROJECT LIFE - The economic life of the project shall be established by the Engineer using the engineering site assessment, preliminary turbine selection, and establishment of annual O&M costs.

i. LICENSING AND APPROVAL PLAN - The Engineer shall evaluate the latest FERC regulations and determine if the site is exempt from the formal licensing process. Also, an evaluation of all remaining Federal, State, and local requirements shall be made and a plan for compliance developed.

j. PROJECT COST ESTIMATE - The Engineer shall develop cost estimates based on the quantity take-offs determined during another portion of this study.

k. PROJECT SCHEDULE - The project schedule shall be determined by the Engineer taking into account the licensing period with FERC (if applicable), the delivery time of equipment, the City's schedule for marketing the power and selling bonds. All factors affecting schedule shall be determined based on the prior experience of the Engineer.

2. <u>Detailed Plans</u>. The Engineer shall prepare detailed construction drawings for all units of authorized projects. He shall furnish survey personnel and equipment required to obtain design information for preparation of final plans and specifications.

3. Specifications. After the plans have been made, the Engineer shall prepare specifications, contract forms, and other documents as may be appropriate for soliciting and receiving bids for the construction work and the performance of contract obligations. The specifications shall incorporate the latest revision of the Standard Construction Specifications of the City of Portland and shall cover materials and workmanship and serve as a guide to the building of the project.

   It is recognized that some items of material may require long lead-times to manufacture. The Engineer shall provide separate specifications, contract forms, and other documents as may be required for procurement of these items.

4. Quantity and Cost Estimates. The Engineer shall prepare estimates of the quantities of the materials to be furnished and work to be done. Estimates of cost shall be provided based upon prices which appear to be appropriate at the time the plans upon which the estimate is based are complete. Statements of estimated construction cost and detailed cost estimates prepared by the Engineer represent his best judgment as a design professional. It is recognized, however, that neither the Engineer nor the Client has any control over the cost of labor, materials, or equipment, over the Contractor's methods of determining bid prices, or over competitive bidding or market conditions. Accordingly, the Engineer cannot and does not guarantee that bids will not vary from any statement of estimated construction cost or other cost estimates prepared by him.

5. Amendment of Plans and Specifications. When plans, specifications, and other documents have been prepared they shall be submitted to the Client for review and approval. An engineer familiar with the project will be available on request of the Client for the purpose of explaining the plans and other documents. The Engineers shall make such modifications as directed by the Client before the final documents are issued.

6. Approval of Regulatory Agencies. The Engineers will submit permit applications, contract documents, and other information as may be reasonably required to appropriate agencies to secure the necessary approvals for the facilities planned.

7. Copies of Plans, Specifications, and Contract Documents. The Engineer shall furnish as a part of this Contract the following copies of the plans, specifications, contract documents, and any required addenda thereto.

   a. A maximum of twenty (20) sets with reduced plans to the Client for record purposes.

   b. As many copies as may be required by the governmental regulatory agencies involved.

c. As many copies as may be required by Contractors desiring to submit bids on the work.

d. After award, a maximum of ten (10) sets of the complete plans, specifications, and contract documents.

e. Three (3) complete sets of full sized drawings of the work, as it is finally constructed, shall be given to the Client for record purposes, one of which shall be a set of transparencies. If the Engineer does not provide on-site, daily inspection, the record drawings shall be prepared from data provided by the City and its Construction Contractors as well as from data gathered by the Engineer in his performance of Article II, Section 9.

8. Contract Awards. The Engineer shall review the qualifications of prospective bidders and recommend those firms suitable as prequalified to bid on the work. The Engineers shall also review the bids received and recommend award of the contracts for construction work.

9. General Engineering Services During Costruction and Field Staking. The Engineers shall periodically visit the site of the project to observe the progress of the work. On the basis of these visits, the Engineers shall keep the Client informed of the progress of the work and shall determine if the intent of the contract documents is being followed by the Contractor(s). If he determines that this intent is not being followed, he shall so advise the Client and shall make recommendations for corrective action. Such visits to the construction site and observations made by the Engineers shall not relieve the Contractor of this obligation to conduct comprehensive inspections of the work sufficient to ensure conformance with the intent of the contract documents, and shall not relieve the Contractor of his full responsibility for all construction means, methods, techniques, sequences, and procedures necessary for coordinating and completing all portions of the work under the Construction Contract and for all safety precautions incidental thereto, nor render the Engineer responsible for such matters. Upon request, the Engineers shall review and explain any matter which may not be clearly shown on the plans or in the specifications, including the modifications of documents if this should be required. The Engineers shall prepare and recommend approval of change orders when applicable. The Engineers shall review claims submitted by Contractors and make recommendations for disposition of the claims. The Engineers shall review the Contractor's shop drawings and material samples for the sole purpose of determining if the items submitted conform with the contract documents. Such review shall not relieve the Contractor of responsibility for conforming with the Contract documents.

The Engineer shall perform all necessary construction staking with their personnel and equipment.

10. Final Inspections. The Engineers shall make a final inspection of the completed construction work and report thereon to the Client with recommendations concerning its acceptance.

11. Resident Inspection of Construction. If specifically authorized by the Client, the Engineers shall furnish the services of a qualified resident inspector to provide on-site inspection of the work of the Contractor to determine if the construction is proceeding according to the contract documents during the period of construction. The qualifications of the resident inspector shall be submitted to and approved by the Client prior to his assignment to the work. The resident inspector shall be experienced in the type of work to be done and shall keep all records, maps, and plans necessary for the preparation of final record drawings. The resident inspector shall make out monthly reports of construction progress and monthly estimates as the basis for payments to the Contractor as construction proceeds. The resident inspector shall attend the official meetings of the Client when requested.

It is anticipated that the resident inspector may be assisted by inspectors provided by the Client from his own forces. The number of assistants shall be recommended by the Engineer to the Client. However, additional engineers, inspectors, or assistants may also be provided by the Engineers with the approval of the Client.

The resident inspector shall see that the Construction Contractor's work is performed according to the construction contract documents and shall report any significant deviations from the requirements of the contract documents that may be observed. It is recognized, however, that such inspection services cannot cover all of the work all of the time and, therefore, it is agreed that such inspection will not cause the Engineer to be responsible for those duties and responsibilities of the Contractor as set forth in Section 9, above, or other responsibilities of the Contractor which include, but are not limited to, full responsibility for the techniques and sequences of construction and the safety precautions incidental thereto, and for performing the construction work in accordance with the contract documents.

12. Operation and Maintenance Manual. The Engineers shall prepare an operation and maintenance manual for the installation to be constructed. This manual includes written instructions by the Engineer and manufacturers' data and catalogs covering the equipment installed in the project. Ten copies of the Operation and Maintenance Manual shall be provided to the Client. The Engineers shall provide assistance and supervision to train the Clients' personnel for operation and maintenance of the new facilities, such assistance shall include at least one formal

instructional presentation on the operation of the facility to the Client's personnel prior to startup of the facility and assistance in operating the facility for two eight-hour shifts, if hydroelectric generation facilities are installed.

13. Special Services. There may be certain special services requested by the Client beyond the services listed above. The type and extent of such special services, if any, cannot be determined at this time. However, the Engineers agree to assist the Client and perform such special services as the Client may request all in order to accomplish the objective of providing the facilities desired. Such services may include the following:

   a. Perform power sales negotiations and prepare FERC permit applications according to Tasks 26 and 17 of the Proposal. The permit application work will be that related to securing FERC forms and processing and expediting them. Engineering data necessary for permitting is included in the work to be done under Sections 1, 2, and 3 of this Article II and will be remunerated under Section 4.a.(2) of Article III. The upper limit of these services are based on payroll costs plus expenses as defined in Section 4.a.(2) of Article III with a provisional cost limit of $60,500. When 50 percent and again when 75 percent of the $60,500 provisional cost limit are incurred, the Engineer will notify the Client and advise him of the estimated cost to complete this Special Service. The Client and the Engineer will agree on the amount of remaining services to be performed and a mutually agreeable cost limit will be set for the balance of these Special Services.

   b. Furnish survey personnel and equipment required to obtain field information for preparation of easements and property descriptions.

   c. Furnish legal descriptions and provide personnel to assist the Client or those designated by the Client to obtain easements, rights-of-way, and property.

   d. Arrange for bacteriological, chemical, mechanical, geotechnical tests for construction control, or other tests.

   e. Witness machinery tests for compliance to specifications where such tests are conducted off-site or away from the Portland area and are not a part of the final inspection.

   f. Provide expert testimony as may be required in connection with the project.

14. Compliance with Civil Rights Act. The Engineers shall comply with all applicable provisions of the regulations issued pursuant to the Civil Rights Act of 1964, in regard to nondiscrimination in employment because of sex, race, creed, color or national origin.

15. Insurance. The Engineer shall maintain in its name insurance coverage, subject to limitations and exclusions, for claims against it under Workmen's Compensation Act and claims for bodily injury, death or property damage which might arise from the performance of their services under this agreement. Certificates evidencing such insurance and the amounts thereof will be furnished. The Client shall be named as additional insured for a minimum of $100,000 - $300,000 B.I., $300,000 P.D. or single limit $300.000.

16. Time Schedule. The Engineer shall begin work within a mutually agreeable time after authorization and shall diligently prosecute the work to meet the time schedule(s) agreed upon by the Client and the Engineers as set forth in Exhibit A and such that:

   a. The Preliminary Engineering Report is produced within 32 weeks after authorization to proceed is given by the Client, and;

   b. The pump station is operational on January 1, 1984, if hydroelectric generation is not found to be feasible as an integral part of the pump station; and

   c. The pump station is operational on June 1, 1984, if hydroelectric generation is found to be feasible as an integral part of the pump station.

ARTICLE III - OBLIGATION OF THE CLIENT

1. Authorization. The work required under this Contract shall not begin, nor shall the Client assume any obligation for the work involved until the Engineers are given authorization. Such authorization may be in the form of a letter or supplement to this agreement and, when executed, becomes a part of this agreement. Authorization will be given for: (1) Preliminary Design, (2) Final Design, (3) Services During Construction, (4) Resident Inspection, (5) Operation and Maintenance Manual and Training, and (6) Special Services by particular type.

2. Furnishing Data; Operation and Maintenance. In order to facilitate the work as outlined above, the Client will furnish to the Engineer all information in the Client's possession mutually agreed to be necessary for the design of the project.

Should it be necessary prior to design and construction to locate underground structures and/or utilities, the Client will cause such excavation and incidental work connected therewith to be done at no extra cost to the Engineer.

The Engineer will not be required to personally verify that the data provided to him is correct, but he will review the data to determine its reasonability.

3. Permits and Bids. The Client will assist in obtaining and will pay fees required for permits and licenses that may be required by local, state, or federal authorities, will obtain the necessary land, easements, and rights-of-way, and will pay the cost of publishing Advertisement for Bids.

4. Remuneration. The Client will pay the sums as outlined below in accordance with the services rendered:

   a. For the professional services as outlined in Article II, the Client shall pay the Engineer fees mutually agreed upon. Such sums will be in the form of: (1) lump sum, (2) cost-plus-fixed-fee, or (3) cost times a factor.

      (1) Lump Sum. Fees for Phases I and II, as defined in the Exhibit A and this Agreement, shall be based on lump sums. The lump sum fees shall be equitably adjusted in the event of changes in the scope of work or delays beyond the control of the Engineers.

      The lump sum fees for Phases I and II are given after subparagraph (2), next, below in two columns. One column, "Pumping Station" names fees for a pumping station and related auxiliary facilities including a permanent roadway to N.E. 158th from the site. The other column, "Pumping and Generating Station" names fees for the foregoing installation with hydroelectric generating capability included.

      (2) Cost Plus Fixed Fee. The fees for Phase III services (engineering services during construction and field staking, operation and maintenance manual and training, and for on-site resident inspection) and field staking will be based on cost-plus-fixed-fee. "Cost" is defined as Engineers project payroll cost, plus 33 per- cent for direct payroll overhead, plus 107 percent for indirect overhead cost (total multiplier, 2.40), plus expenses directly related to the project, including subconsultant's charges, mileage at 20 cents per mile, transportation costs, long distance telephone, printing and reproduction work, etc.

The estimated Phase III costs, the fixed fees, and the total of costs plus fixed fees are given below in two columns. One column, "Pumping Station" names costs and fees for a pumping station and related auxiliary facilities including a permanent roadway to N.E. 158tn from the site. The other column, "Pumping and Generating Station" names costs and fees for the foregoing installation with hydroelectric generating capability included. The "Maximum Cost-Plus-Fixed-Fee" will not exceed the stated amounts unless there is an authorized change in the scope of services.

Item	Pumping Station	Pumping and Generating Station
Phase I, Preliminary Studies, Analysis and Reports, Lump Sum Fees		
(a) Financial Feasibility	$ 38,200	$ 38,200
(b) Hydropower Engieering	57,000	57,000
(c) Pumping Station Engineering	84,800	84,800
Total	$180,000	$180,000
Phase II, Design and Construction Lump Sum Fees	$205,000	$270,000
Phase III, Construction		
(a) General Engineering Services and Field Staking		
Estimated Cost	$ 79,600	$105,700
Fixed Fee	11,500	15,400
Maximum Cost Plus-Fixed-Fee	91,100	121,100
(b) Operation & Maintenance Manual and Training		
Estimated Cost	$ 26,200	$ 37,400
Fixed Fee	4,500	6,400
Maximum Cost-Plus-Fixed-Fee	30,700	43,800
(c) Resident Inspection*		
Estimated Cost	$94,100	$94,100
Fixed Fee	13,900	13,900
Maximum Cost-Plus-Fixed-Fee	108,000	108,000

Should the Engineers' actual total cost excluding direct salary increases vary more than 20 percent from that estimated due to changes or delays beyond the control of the Engineers, the fixed fee may be equitably adjusted.

*This estimate is based on 60 man-weeks of on-site construction inspection.

(3) Cost Times a Factor. The fee for special services, as defined under Article II, Section 13, will be based on payroll cost times a factor plus other expenses at cost. The factor to be used as a multiplier is 2.80. Other expenses directly related to the project will be charged at cost, including subconsultant's charges, mileage at 20 cents per mile, transportation costs, living allowances for personnel away from home, long distance telephone, printing and reproduction work, etc.

b. Payments to the Engineer shall be on a monthly basis and monthly statements for services performed during the previous month will be submitted to the Client and will be due and payable within 30 days thereof. Interest will be payable on the unpaid balance after 60 days from date of billing at the rate of eight percent per annum.

c. If the Client directs that competitive bids be taken for construction on alternate designs of the selected alternative, such direction shall be deemed a change in scope if it involves the preparation of additional designs, plans, and specifications for such alternate designs. If the Engineer considers a design as an alternate, he will notify the Client in advance and in writing.

d. If time of a specific project is extended because of circumstances beyond the control of the Engineers, payments for Article II, Section 9, General Engineering Services During Construction, shall apply only through the period ending 60 calendar days after the applicable completion date specified in the Construction Contract of the project. Payment for this service beyond 60 days after said specified completion date shall be paid for under Article III, Section 4.a.(2).

ARTICLE IV - ENGINEERS' PERSONNEL

The Engineers' personnel assigned to provide the services listed in Article II shall be the individuals listed in Exhibit A as performing specific tasks of the project. Persons of equal or greater qualifications, as determined by the Client, may be substituted for those persons listed in Exhibit A upon written request to and approval of the Client. Personnel of the Engineer determined by the Client to be unsatisfactory, shall be replaced with personnel of similar or greater qualifications to the satisfaction of the Client upon written notification to the Engineers by the Client.

The Client will name an engineer from the Bureau of Water Works as its official representative in matters relating to this agreement, and the Client will notify the Engineer of the name of this representative and any substitutes who may take his place as the work proceeds.

ARTICLE V - GENERAL

1. Termination. The Client may terminate this agreement by giving the Engineers written notice of the abandonment or indefinite postponement of the project. If any portion of the authorized work covered by this agreement and begun by the Engineers shall be abandoned, unreasonably delayed or indefinitely postponed the Engineers may terminate this agreement. Whether or not terminated, the Client shall pay the Engineers for the services rendered in connection therewith prior to written notice of such abandonment, delay, postponement, payment to be based insofar as possible on the amounts specifically established in this agreement, or, where the agreement cannot be applied, on the basis of the amounts prescribed in Article III, Section 4.a.(2). In the event of termination, the Engineer will provide the Client with copies of all notes, computations, reproducible drawings, and other similar work products.

2. Legal

   a. This Agreement is entered into and shall be governed under the laws of the State of Oregon.

   b. All statutory, charter, and ordinance provisions that are applicable to public contracts in general, in the City of Portland and the State of Oregon, are hereby incorporated by reference and shall be followed with respect to this contract.

   c. No official or employee of the City, who is authorized in any official capacity to negotiate, accept, approve, or take part in such decisions on this contract and project, shall have any finanacial or personal interest in this contract or a subcontract thereof.

d. Engineer agrees to hold harmless, defend and indemnify the City of Portland, its officers and employees against any and all claims for damage to property or injury to person(s) which are legally caused by Consultant in the performance of this agreement.

3. Expenses and Fees. In the event of any arbitration or legal suit or action, including any appeals therefrom, brought by either party against the other to enforce any of the obligations hereunder or arising out of any dispute concerning the terms and conditions hereby created, the losing party shall pay the prevailing party such reasonable amount for investigation costs, attorneys' fees, and expert witness fees, as may be set by the panel or court.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed in duplicate by their respectively authorized officers or representatives.

CITY OF PORTLAND, OREGON

Date ____________________ By ____________________
Mayor

STRAAM Engineers, a Division of
CRS Group Engineers, Inc.

Date March 23, 1981 By Gilbert R. Meigs
Gilbert R. Meigs
Senior Vice President

151351

STRAAM ENGINEERS

Proposal

Groundwater Pump Station for Columbia River Wells

City of Portland, Oregon

October 1980

A Division of CRS GROUP ENGINEERS, INC.

5505 S.E. Milwaukie Avenue
PO Box 02201
Portland, Oregon 97202
Tel 503 234-0721 TWX 910-464-8042

October 27, 1980

Mr. Bob Willis
Bureau of Water Works
City of Portland
1800 Southwest Sixth Avenue
Portland, Oregon 97201

Dear Bob:

On behalf of our firm, I am pleased to submit this proposal to undertake the preliminary and final design of the Groundwater Pump Station for the Columbia River wells.

Because of complexity of this project and the need to understand the hydraulic functioning of the City's supply and storage system, we feel it essential to assign key senior staff to this project who have prior working experience with this system. Accordingly, we have also decided that I should be project manager for this project. I am able to and I will arrange my practice so I can devote the required amount of time to it. Throughout my career I have been associated with the Water Bureau, and this has been a most professionally rewarding relationship.

Briefly, the more significant projects in which I have been directly involved for the Water Bureau are:

- Design of Bull Run Dam No. 2 and associated power studies.
- Design of the Roslyn Lake diversion structure.
- Participation in the Water Bureau's "Water Supply Development Program" which introduced the concept of using groundwater as a supplement to Bull Run and as a backup to Bull Run for purposes of overall regional water supply reliability.
- Preparation of preliminary plans for Conduit No. 5 which further defined the hydraulic requirements for storage of Powell Butte.
- The Conduit Intertie project on Southeast 162nd Avenue.

All of the foregoing experience provides our proposed project staff with what I think is a thorough understanding of your supply system strategy, operations, and long-range planning. Our two senior designers have performed engineering analysis and design for the Water Bureau.

We have been associated with groundwater projects involving well drilling and pump station design and control. I believe this gives us a good understanding of your operations planning for the well field now under construction.

Insofar as pumping stations are concerned, I want to mention some of the projects that I have worked on, which are either of large magnitude or which had hydraulic control situations requiring extraordinary care and analysis.

- Ankeny Street Sewage Pumping Station: The problem was to install 120 mgd pumping capacity, over a total head range from 15 to 35 feet, with an uncomplicated control system.

- Hillsboro, Oregon, Transmission Line Booster Stations: The problem was to apply in two stations a total of 800 horsepower to 7 mgd on a 20-mile-long, 18-inch line in a downhill pumping situation on the only line serving the City under conditions where improper control of hydraulic transients could cause failure of a system with little terminal storage.

- City of LaGrande Well Pumping Station: The total head was 500 feet on a long transmission line where improper control of transients could cause failure of the pipeline or damage to the pumping station.

- Fairbanks Pumping Stations: The City is served by a water treatment plant and the discharge from it to the entire City passes through a single header; the City has not seen fit to go to a redundant header and consequently the pumping equipment we have designed has required extra care so that transients do not cause failure of the header.

As we indicated in our Statement of Qualifications, we are supplementing our expertise with the firms of Shannon & Wilson for geotechnical investigation and Engineering & Design Associates (EDA) for design of electrical controls for the pump station and hydroelectric generation facilities. I would like to stress that we have ongoing working relationships with both firms. We consider these to be the most highly qualified local firms in their respective areas of expertise. Because of our long standing, working relationships with the personnel of these firms, I believe you will share the great confidence which I have in the engineering team which we have committed to your project.

I am very enthusiastic, as are the other members of our project team, in undertaking this assignment, particularly because of the unique multi-use potential of the facility. We are confident that we bring the highest quality expertise to all aspects of your project, and we look forward to detailed discussions during the interview concerning some of the more unique and interesting aspects of the assignment.

Respectfully submitted,

STRAAM Engineers

Gilbert R. Meigs

Gilbert R. Meigs, P.E.
Senior Vice President

GRM:kpw

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GROUNDWATER PUMP STATION
CITY OF PORTLAND

151251

Executive Summary

EXECUTIVE SUMMARY

PROPOSAL FOR
GROUNDWATER PUMP STATION
CITY OF PORTLAND

After discussions with the Water Bureau staff, STRAAM Engineers has come to the conclusion that the project staff should be knowledgeable about the Portland water supply system besides being capable of undertaking the necessary specialized tasks. As a result, our proposal includes a multidisciplined team composed of key senior staff having experience in areas of civil and hydraulic engineering and structural, electrical, and architectural design. They are also experienced in cost estimating and in the agency requirements which will be necessary to complete the project.

Gilbert Meigs, P.E., will be assigned as project manager. Mr. Meigs has had over 20 years of experience working on various hydraulic projects for the City of Portland. Assisting Mr. Meigs will be David Jochim, P.E., and Steve Simonson, P.E. Both of these key staff members have experience in designing water works facilities, in particular large conduits, pump stations, and reservoirs. Mr. Jochim was project engineer for the Bull Run Conduit Intertie project, and Mr. Simonson was project engineer for the Bull Run Conduit No. 5 feasibility analysis.

Because of the potential for design of electrical generating facilities, we have supplemented our expertise with the firm of Engineering & Design Associates (EDA). EDA is a consulting electrical engineering firm which specializes in the feasibility, planning and design of generation, transmission, and distribution faciliies. EDA is noted for its experience in design of small hydrogeneration plants in the Northwest, particularly on the Clackamas, Bull Run, and Deschutes Rivers. They are, for example, currently involved in design for Portland General Electric Company at the Bull Run plant and at Pelton Dam.

Ray Johnson, P.E., and Luther Kurtz, P.E. of EDA will be the key electrical facility designers. Mr. Johnson has been responsible for designing major electrical projects, including facilties at hydroelectric installations. Mr. Kurtz has experience in designing electrical facilities for hydro projects and has also designed facilities for PGE.

The firm of Shannon & Wilson will provide all necessary soils and geotechnical investigations. Their efforts will be directed by Frank Fujitani, P.E.

In summary, the proposed project team contains key individuals experienced in:

- Hydraulic analysis
- Pump station design
- Pipeline and reservoir design
- Electrical control design
- Hydroelectrical facilities design
- Power sales negotiations
- Geotechnical engineering

In addition, the members of this team have experience dealing with local, state, and federal regulatory and review agencies. STRAAM provides services primarily to the public sector; and therefore, we have on-going experience in working with the City, Multnomah County, Metro, DEQ, EPA, the Corps of Engineers, etc. Likewise, EDA is experienced in dealing with state and federal regulatory agencies involved with electric power.

The members of the project team have also previously collaborated on other projects and, therefore, have already established an effective working relationship. Furthermore, these staff members are all currently assigned to Portland area offices and are available to undertake this project upon successful contract negotiations.

We strongly believe that STRAAM Engineers in association with EDA and Shannon & Wilson provides the City with the best local expertise to undertake and successfully complete all technical aspects of this project. We have complete understanding of the complexity of the project and the efforts which will be required to complete the work. We also have the resources and staff available to undertake the project immediately, and we can complete the project within the time-frame outlined by the city. Specifically we offer:

- Experience in the design and construction of pump stations and related facilities

- Experienced personnel who are familiar with the Portland water supply system

- Knowledge of the federal licensing procedures

- Extensive design experience with hydroelectric facilities and with electrical control systems

- Experience in electrical sales contract negotiations

- Proven performance with the City of Portland

In the following, we describe our approach to this challenging project, both in terms of an overall project philosophy and, more tangibly, by presenting an outline of major project tasks which we feel must be completed. We illustrate how these tasks will interface to obtain an efficient and timely project completion. In addition, we also discuss in more detail the project team, indicating each team member's involvement and commitment to the project. Finally, we will present our experience, a schedule for completion of project tasks, and the estimated range of cost.

Project Approach

Foremost in our approach, we view this project as one involving the design and construction of a pump station, the purpose of which is to pump water from the Columbia River well fields into the Portland storage and water transmission system. In accomplishing this end, a number of factors must be considered:

- The pump station design must provide for the safety of the water supply system at all times. This requirement encompasses the need for ongoing consideration of hydraulic transient control and a number of other related hydraulic problems.

- The pump station must be reliable as well as electrically and hydraulically efficient. This indicates the need for careful evaluation of hydromachinery and electrical equipment items and control components.

- It must be operationally flexible. It must be possible to provide flows under a number of operational scenarios.

- The pump station must be on-line by January 1984.

An additional aspect of the project involves investigations into, and possible design and construction of on-site power generation facilities. The power generation issue is an important element of the project, however, it will not overshadow or compromise the primary objective, which is the design and construction of the pump station.

The project has been divided into three engineering phases; preliminary design, final design, and construction services. We have broken the first two phases into four work elements, and have further divided the work elements into specific work tasks. The accompanying flow diagram represents the interrelations and sequencing of the various tasks which must be accomplished for each of the work elements shown. The specific efforts to be undertaken under each of the work tasks are discussed in the next section.

Several aspects of the work program presented herein warrant special explanation. First, although we recognize the importance of the final design and construction phases, we feel it is especially important to develop a sound work program which will ensure that proper design decisions and criteria have been thoroughly researched and evaluated in the preliminary design phase. We have therefore placed significant emphasis on discussions of preliminary design tasks and their interrelationships.

Of the four major work efforts indicated under the preliminary and final design phases, the Hydraulic Analyses and Hydromachinery Evaluation is considered to be most crucial, because of the need to interface all subsequent analyses and design criteria with sound hydraulic data in order to assure the continued reliability and safety of the water supply system. Analysis of the water supply system for unacceptable hydraulic transients caused by alternative hydromachinery selections and various operational scenarios will be an extremely critical task which will occur continuously through both the preliminary and final design tasks.

Likewise, the power generation feasibility analysis is an important element of the preliminary design project work program. Not only must a cost/revenue evaluation of capital and operating costs versus projected power sales revenues be undertaken, but it will also be necessary to weight the cost-effectiveness of constructing generation facilities at the pump station versus continuing to sell water to PGE at Roslyn Lake. If power generation appears to be cost-effective, the subsequent power sales negotiations will also be an important element of the work program.

The section which immediately follows delineates in more detail the specific efforts encompassed by the various project work tasks. The text, used in conjunction with the accompanying flow diagram, explains how each work task interfaces with other ongoing tasks to result in final product outputs.

PHASE I - PRELIMINARY DESIGN

The tasks which compose the preliminary design phase generally fall into four major efforts: (1) hydraulic analyses and hydromachinery evaluation, (2) facilities design, (3) electrical systems/controls, and (4) institutional arrangements.

Because it is essential that all aspects of the city's water supply and transmission system, including Bureau of Water Works operating procedures and philosophies, be thoroughly understood by the consultant, our work program for completion of hydraulic analyses and the hydromachinery evaluation will be conducted to take maximum advantage of our understanding of and familiarity with the Portland water supply system. Our experience obtained as a result of our involvement in the design of the dam and headworks facilities at Bull Run Dam No. 2, design of the diversion structure at Roslyn Lake, preparation of the Portland Water Supply Development Program, preliminary design studies for proposed Bull Run Conduit No. 5, and most recently, preliminary and final design of the Conduit Intertie Project on 162nd Avenue will be a significant advantage in developing the basic hydraulic data which will, in turn, serve as the building block upon which all subsequent analyses and design decisions will be predicated.

Several items will affect the pump station design and the feasibility of integrating power generation facilities at the proposed pump station (or stand alone power generation facilities). Two aspects which must be established at an early stage are the availability of water and the hydraulic capacity of the water supply system. Development of this basic data is essential before hydromachinery can be sized and evaluated, and before the feasibility of power generation facilities can be addressed.

The facilities design effort will center on preliminary site investigations and alternative layouts and configurations of equipment.

The preliminary engineering of electrical systems/controls will center on two distinct functions. The first will be a cursory evaluation of the feasibility of hydroelectric generation based on specific hydraulic inputs, anticipated capital costs, and potential revenues. The second effort will focus on the preliminary layout of electrical systems and controls for the pump station both with and without integrated generating facilities.

Institutional arrangements center primarily on establishing what licensing and permits will be required, if any, and the necessary procedures to be followed. In addition, preliminary reviews and discussions will be held with local regulatory agencies in order to determine specific requirements and identify any environmental impacts.

As a result of these investigations and analyses, several products will be developed during the course of completing the preliminary design phase. Following the water availability and supply system hydraulic analysis tasks, a working paper will be produced which will document and summarize the results of the investigations. Besides documenting basic data upon which subsequent work will be based, the working paper will also provide a document for Bureau review and comment prior to initiation of successive tasks.

It is contemplated that a second working paper will be prepared following completion of the hydromachinery/hydraulic transient/surge control evaluation tasks. Again, the working paper will document results of previous investigations and provide the Bureau an opportunity for review and comment prior to initiating the preliminary facilities layout task. It is also anticipated that two working papers will be issued which summarize the findings of the hydroelectric feasibility analysis and the licensing and permit requirements for those facilities.

Task 1: Water Availability

The rate at which the groundwater development program is implemented will set the staging and flow criteria for the pumping facilities. However, the present and future availability of surplus Bull Run water will directly affect the feasibility of power generation. The existing and future water supply/demand situation must be analyzed in light of seasonal fluctuations, present and projected water sales (within Portland and to outlying areas), as well as other contractual obligations.

Task 2: Supply System Hydraulics

The flow capacities of the Bull Run conduits and intertie conduits have been calculated and/or measured directly. However, the inclusion of the intertie valves to the water supply system has greatly enhanced system flexibility in terms of controlling flows between the city's terminal storage facilities on Powell Butte and Mt. Tabor. These facilities, together with the headworks at Bull Run Dam No. 2 and the standpipes on Lusted Hill, provide the major hydraulic control points for the city's water supply system. The construction of the groundwater pump station (and possible power generation facilities) will result in yet another hydraulic control point. All possible operating modes involving these control points and the intertie valves must be examined in terms of water supply system hydraulics. This information is required for the power generation feasibility analyses, for subsequent evaluation of hydromachinery, and for hydraulic transient analyses.

Analysis of operating modes must take into consideration the necessity of maintaining adequate turnover in the Powell Butte Reservoir for water quality purposes. This is especially important when considering power generation options, as the reservoir level should not "float" for extended periods of time.

Task 3: Discharge Options

Finding an acceptable use for water discharged from power generation equipment will be an important task because of the potential magnitude of flows involved. Options which must be investigated include discharge of the water to the Columbia Slough or Columbia River. Both of these options entail potential environmental considerations as well as involvement of appropriate governmental agencies, i.e., the Corps of Engineers, Oregon Department of Enviromental Quality, Multnomah County Flood Control District, and others.

Reuse options must also be explored. One possiblity which should be investigated involves using discharged water to recharge the groundwater aquifer in the vicinity of the wellfields. This could be a viable alternative since the well pump header system could be utilized, thereby eliminating the need to construct a separate large diameter line to the Columbia River or other receiving waters.

Task 4: Hydromachinery Evaluation/Selection

Evaluation of all hydromachinery will be interfaced with the transient analyses, surge control evaluations, electrical system conceptual design, and storage tank sizing elements. Data developed from the water availability and supply system hydraulics tasks, as previously discussed, will provide the data base for this element.

The hydromachinery which must be investigated falls into two obvious categories; pumping equipment and power generation equipment. (It is quite possible that the same facilities could be used for both purposes, however.) An important item in the evaluation of pump equipment will be the proper selection of prime movers. Types of electric motors to be used, rotative speed, operating efficiency, voltage, and other factors must be addressed. The use of diesel engine or natural gas turbine driven pumps, in whole or in part, must also be considered. Engines would make for a highly reliable pumping facility, and because of their high inertial characteristics, would also tend to lessen hydraulic transient problems. Engines would also have inherent environmental drawbacks, and would be more costly to operate and maintain, thus the pros and cons must be weighed.

Evaluation of hydromachinery for power generation will require close interfacing with the power generation feasibility analysis. It is in this latter element that the feasibility of stand-alone turbines versus integrated facilities (i.e. reversible pump turbines) will become better defined. Power generating machinery will be evaluated from the view point of providing the most efficient facility possible without compromising the safety, reliability, or operation of the pumping facilities or water transmission conduits.

Task 5: Transient Analyses and Surge Control Evaluation

Analysis of the water supply system for hydraulic pressure transients resulting from situations which may occur as a result of operating proposed hydromachinery and/or appurtenant valving is a critical element of the work program. Situations involving pump station start-up and shut-down (including power fail), valve operation (accidental or planned), and turbine load changes are of special interest.

Extensive computer modeling of the water supply system from the Bull Run headworks to Mt. Tabor, and the groundwater pump station to Powell Butte will occur. The computer model will include the existing Bull Run and intertie conduits, reservoirs and intertie valves, as well as proposed piping, hydraulic control devices (automatic pump control, surge and air valves, surge tanks, hydropneumatic tanks, etc.), and physical characteristics of specific hydromachinery selections (inertial characteristics, specific speed, performance characteristics, etc.) Combinations of intertie valve positions will be investigated to determine interactions with supply system hydraulics in terms of surge control under pumping and power generation operating modes. Using the computer model as a computation aid, locations and magnitudes of objectionable upsurge and water column separation resulting from hydraulic transient waves will be identified, and practical solutions will be found to mitigate their effects.

Task 6: Storage Tank Sizing

Investigations will be made to determine the optimal size and use of on-site storage facilities. The storage facilities will be sized to effect proper hydraulic control of the well station pumps as well as the well field pumps. Hydraulic requirements of automatic surge control valves and downstream hydraulic control requirements of power generation faciltiies will also affect sizing of the storage tank.

Buried versus above ground, and concrete versus steel tank alternatives will be investigated.

Task 7: Conceptual Design

The electrical conceptual design task will include development of a power one-line diagram and conceptual facilities, layouts, and arrangements including cost estimates for a facility with and without generation. The generation option will consider combination generator-pump generation and a facility using stand-alone generation. A variation in types and sizes of equipment and in discharge options will be considered for both of the generations facility operations.

Task 8: Power Generation Feasibility Analysis

The revenue requirements pertaining to the incremental costs associated with each of the generation options considered in the conceptual study will be developed. The revenue requirements will be compared with the anticipated selling price of the energy and capacity available from each of the generation options considered in the conceptual design. It is anticipated that a significant input to development of probable selling price will be the "avoided cost" data now in development by the utilities in preparation for submittal to the State Public Utility Commissions as required by the Public Utility Regulatory Practices Act ("PURPA") regulations. It is anticipated that the power generation feasibility analysis will be reviewed subsequent to development of preliminary facilities layouts and preliminary cost estimates. The latter review will be made to compare and revise as necessary the earlier feasibility analysis, subsequent to develoment of more detailed cost data available in the preliminary cost estimate.

Task 9: Define Licensing and Permit Requirements

This task pertains to licensing and permit requirements associated with power generation facilities and will be completed assuming the feasibility analysis indicates such facilities are economically feasible. This task will include the following data pertaining to licensing and permit requirements applicable to the project: the name of the agency's authority for requiring such permits or licensing, a description of the permit or licensing requirements, and approximate time schedule for obtaining such permits and licenses.

Task 10: Preliminary Site Surveys/Geotechnical Investigations

Early in the work program, preliminary site surveys and data acquisition tasks will get underway. Work which must be done includes gathering of horizontal and vertical survey data at the proposed site, reconnaissance for existing utilities (water, sewer, natural gas, power, telephone, etc.), and the acquisition of other site-specific data. Preliminary geotechnical investigations will also get underway to determine subsurface conditions such as groundwater depth, soil type, allowable bearing capacity, and related data.

Data gathered under this task will be used in the preliminary facilities layout task.

Task 11: Preliminary Facilities Layouts

The various civil, mechanical, and electrical work elements will be integrated to arrive at preliminary facility layouts which will be further developed and presented in the preliminary design report. Preliminary location of major facilities such as the pump station structure, water storage tank, electrical transformers, access road, yard piping, etc., will be determined, as will preliminary site grading. If stand-alone power generation appears feasible, provisions for location of the generation related facilities will also be made.

A preliminary plan and sections of the pump house will be developed, indicating number and location of proposed and future pump units and other mechanical equipment, piping, electrical switchgear, and other components. An on-grade versus partially buried structure will be evaluated, and an architectural rendering of the pump station will be presented.

The electrical layouts will include a one-line diagram illustrating power circuits and apparatus, instrument transformers, and relay control and metering for all city facilities on the load side of the utility interface. The electrical layouts will include electrical arrangements and physical layouts for the electrical facilities.

Task 12: Agency Coordination and Review

As they are developed, and as appropriate, the preliminary site layouts will be discussed with appropriate governmental agencies to streamline the agency review and regulatory process during design and construction.

Task 13: Environmental Considerations

The environmental effects of several project aspects must be considered. The discharge of water from generation faclities to the Columbia River will have environmental implcations which will have to be looked at. Likewise, if engines are selected as the prime movers for the pumps, there will be air pollution, noise, and other effects which will have to be assessed.

Task 14: Preliminary Cost Estimates

Preliminary construction cost estimates of recommended and alternative facilities will be prepared. If power generation appears feasible, preliminary revenue projections from the sale of power will also be presented. All cost estimates will be referenced to an assumed construction schedule, for possible future adjustment.

At the time that more definitive cost estimtes become available, the results of the preliminary power feasibility analysis will be reviewed in an effort to "fine tune" the cost and revenue projections made earlier.

Task 15: Preliminary Engineering Report

The final product of the preliminary design analyses will be the preliminary engineering report. The report will summarize the results of the hydraulic, geotechnical, and other engineering analyses previously described. It will identify the alternatives developed during the course of the preliminary design and will contain the output discussed in the Preliminary Facilities Layout task. Preliminary construction costs and power revenue projections will be included, as will a schedule showing time to complete successive phases of the project, i.e., final design and construction.

The report will also contain a discussion of the various institutional arrangements which will be required, as well as environmental considerations, permits which must be obtained, and other pertinent information. Finally, it will contain a recommended facilities development plan and site layout, and include a recommended operating plan to achieve maximum efficiency and system-wide reliability from those facilities.

Task 16: City Review and Alternative Selection

This task is essentially a Water Bureau function. The project team will be available to provide consultation as necessary.

PHASE II - FINAL DESIGN

Following review of the preliminary engineering report by the Bureau of Water Works and selection by the Bureau of an alternative for final development, STRAAM will proceed into the final design phase of the project. As the outset, this process will again center on the same four general efforts: (1) hydraulic, (2) facilities design, (3) electrical, and (4) institutional arrangements. The hydraulic and electrical efforts are initially to reaffirm, or verify, the results of the preliminary design, should the Bureau require modifications or additions to the selected alternative. Once verification is completed, the primary effort will focus on facilities design, culminating in the preparation of construction drawings and specifications.

The institution arrangements will again center on two aspects: power generation and agency review of proposed facilities. The power generation will require the initiation of the licensing and permit process as well as the development and negotiation of sales contracts. Agency review will include final regulatory approval, and in turn, the securing of required permits for construction and operation.

Task 17: Power Sales Contract Negotiations

Contingent upon receiving a decision from the Water Bureau to proceed with power generation, sales contract negotiations will be initiated. The first stage of this task will be the development of a power sales contract which will involve counseling with the city attorney's office and the city's bond counsel. Subsequent to development of the first draft power sales contract, discussions with prospective power purchasers will be initiated. Subsequent contract drafts will be developed and power purchaser negotiations pursued as required to realize a contract which satisfies the City's needs, is of optimum benefit to the city, and is acceptable to a power purchaser or purchasers. It is anticipated that the "avoided cost" data now being prepared by utilities for submission to the State Public Utility Commission in response to the "PURPA" regulations will be a significant factor in determining the final selling price of the capacity and energy from the project.

Tasks 18 and 19: Verify Final Hydrualic Design Criteria and Electrical One-line Diagrams

It is anticipated that the Bureau's review of the preliminary engineering report will result in some modifications to the recommended facilities layout presented in the report. Accordingly, time has been budgeted in the final design phase for verification of final hydraulic design criteria, including possible modificatons to hydromachinery layouts and selections, piping arrangements, and "fine tuning" of the water supply system computer model to reflect the final configuration of pumping, surge control, and other water supply elements. A similar task has been budgeted for verification of electrical one-line diagrams.

The initial stage of final design pertaining to electrical systems/controls will be the development of a conventional electrical one-line diagram. It will include a power one-line diagram as well as all instrument transformers, relaying, metering, and control circuits. The one-line diagram will incorporate the alternate selection decisions resulting from review by the city and will be the basis for final electrical design.

Tasks 20 and 21: Design Surveys, Final Geotechnical Work, and Site Plan Finalization

Following verification of final hydraulic design criteria, the site plan can be finalized. Work tasks will include final design surveys and geotechnical investigations, final siting of major structures, storage tank, yard piping, access road and transformer station, site grading, landscaping, and related activities.

Task 22: Final Systems Design Concepts and Schematics

Upon verification of final hydraulic design criteria and electrical one-line diagrams, the various civil, mechanical, and electrical design elements will be combined to summarize the final system design concepts and develop final system schematics prior to beginnning the actual construction plans and specifications.

The final design concepts will illustrate with electrical arrangements and other physical layouts the electrical facilities illustrated in the electrical one-line diagram.

Task 23: Agency Reviews

During the final systems design task, input will be provided to and received from appropriate regulatory agencies, so their comments and requirements can be integrated into the final system design. This will allow time to include any special permit requirements in the project specifications.

Task 24: Equipment Bid/Evaluation

Because of anticipated long delivery times on certain hydromachinery and electrical equipment items, specifications and other contract documents will be prepared for separate advertisement and purchase of these items by the city. This approach has several advantages; it will minimize construction delays because of long delivery of key equipment items, it will allow the final design to be based on specific equipment items and known electrical and other loadings, and it may result in a cost savings to the city, since by purchasing the equipment directly, the city will avoid paying the contractor's mark-up for profit on those items. The city may also avoid the contractor's mark-up for potential delays caused by late equipment delivery.

Tasks 25 and 27: Final Facilities Design, Plans and Specifications

The work elements in the above tasks are self-explanatory. They include final civil, mechanical, electrical, and architectural design of facilities, and preparation of plans and specifications necessary for advertising and taking bids. Interfacing of this task with Task 24 (Equipment Bid and Evaluation) has been alluded to.

At the time that final project design features are known, applications for necessary permits will be initiated (Task 26). In fact, it may be necessary to apply for some permits, such as a Corps of Engineers construction permit, earlier than is shown in the work program because of the length of time needed to process the permits.

Task 26: Agency Permit Applications

Should the generation option be selected, and further assuming that a permit is required from the Federal Energy Regulatory Commission (FERC) an application for licensing will be submitted to FERC as soon as final design concepts and schematics are available to complete such a submittal.

Task 28: City Review

This task is a Water Bureau function. The project team will be available to provide consultation as necessary during the review of the plans and specifications.

Task 29: Advertise and Take Bids

Upon Water Bureau approval of plans specifications, the project will be advertised and bids will be opened.

Task 30: Public Meetings

STRAAM will attend any public meetings or hearings which may be required in the course of the project. We recognize that public meetings may be needed at different points in the project and the project team will be available as needed to assist the Water Bureau.

PHASE III - CONSTRUCTION

The construction phase will begin following receipt of bids for construction of the facilities. Specific work tasks which will be covered in the construction phase but are classified as advisory supervision functions of final design include:

- Evaluation of Bids
- Attendence at Preconstrucion Conference and Other Meetings
- Review of Shop Drawings
- Preparation of Change Orders and Monthly Pay Estimates
- Resolution of Construction Problems
- Periodic Visits to the Project Site
- Provide Assistance to Water Bureau Construction Staff
- Preparation of Record Drawings

If requested by the Bureau of Water Works, STRAAM can also provide inspection services for monitoring and controlling the work. Should a resident engineer be required, we would propose utilizing one of the project engineers, namely David Jochim or Steve Simonson. We can also provide Dick Brucken and/or Harry Rehm for service as inspectors.

Project Staff

KEY PERSONNEL

The project team will be composed of three key senior staff members from STRAAM's Portland office. Each team member has been selected because of proven technical expertise on past projects of similar magnitude and experience as project engineer on previous projects for the Bureau of Water Works. Through this experience on Bureau projects, each team member has gained a thorough understanding of the Portland water supply system.

The project team will be led by Gilbert Meigs. Mr. Meigs has been professionally associated with the Bureau of Water Works for over 20 years, and he has been directly involved in a number of significant projects for the Water Bureau including:

- Design of Bull Run Dam No. 2 and associated power studies.
- Design of the Roslyn Lake diversion structure.
- Participation in the Water Bureau's "Water Supply Development Program" which introduced the concept of using groundwater as a supplement to Bull Run and as a backup to Bull Run for purposes of overall regional water supply reliability.
- Preparation of preliminary plans for Conduit No. 5 which further defined the hydraulic requirements for storage on Powell Butte.
- The Conduit Intertie Project on Southeast 162nd Avenue.

He has also been directly involved in the design of numerous other major hydraulic projects involving selection of hydromachinery and analysis and control of hydraulic transients.

Mr. Meigs will serve on the project team in two capacities. As project manager, he will have responsibility for the overall coordination and timely completion of all project activities and for assuring the technical quality of all work which is produced.

Because of his understanding of the Portland water supply system and his expertise as a hydraulic engineer, Mr. Meigs will also participate as a project engineer on the team. His primary responsibilities in this regard will be in evaluation of the supply system hydraulics, hydromachinery evaluation and selection, hydraulic transient analyses, and surge control evaluations during the preliminary design phase. In the final design phase he will be responsible for verification of final hydraulic design criteria, and formulation of final hydraulic system design concepts and schematics. Mr. Meigs is committed to devoting 30 to 40 percent of his time on project tasks during the preliminary design phase, and 20 to 30 percent during the final design.

The other key project engineers who will assist Mr. Meigs are Steve Simonson and David Jochim. Mr. Simonson has been with the firm since 1972. He has extensive hydraulic design experience and was a project engineer on the Preliminary Design Study for Bull Run Conduit No. 5. Mr. Simonson's major role during the preliminary and final design phases will be in the pump station facilities design and site layout elements. He will devote 60 to 70 percent of his time to the preliminary design phase and 70 to 80 percent during the final design.

David Jochim joined STRAAM in 1973. He too has an impressive hydraulic design background. Mr. Jochim participated in the Portland Water Development Program, and was project engineer for the preliminary and final design of the Conduit Intertie Project on Southeast 162nd Avenue.

During the preliminary design, Mr. Jochim will assist Mr. Meigs in several hydraulic analysis tasks, particularly during computer modeling of hydraulic transients. He will also be responsible for several other work tasks, including researching discharge options and sizing of the storage tank for the proper control of the well field and pump station pumps. During final design he will share responsibility with Steve Simonson for final facilities design and site layout tasks, and preparation of final plans and specifications. He will commit 60 to 70 percent of his time during the preliminary design phase, and 70 to 80 percent during the final design.

STRAAM will supplement its project team with the firm of Engineering and Design Associates (EDA) for electrical engineering and power generation feasibility analyses. EDA is a Tigard, Oregon, firm and is noted for its expertise in hydroelectric facilities, particularly on the Clackamas, Bull Run, and Deschutes Rivers. The firm is currently involved in design of facilities for Portland General Electric Company at the Bull Run Plant and at Pelton Dam.

Ray Johnson of EDA will lead the electrical engineering and generation analysis team. He will be supported by Luther Kurtz. Mr. Johnson is an electrical engineer who has been responsible for designing major electrical projects, including facilities at hydroelectric installations. Mr. Kurtz has experience in designing electrical facilities for hydro projects and has also designed facilities for PGE. Both of these individuals will commit 50 to 60 percent of their time to the preliminary design phase. During final design, Mr. Johnson will devote approximately 70 to 80 percent of his time to the final design phase, and Luther Kurtz about 50 to 60 percent.

Support Personnel

Additional personnel who will support the project team include Alan Peterson and Lloyd Pajunen, who will be responsible for structural engineering, and Ray Smith who will provide architecture and landscaping expertise. All of these individuals are located in the Portland office of STRAAM Engineers.

Edward Dibble will supplement the EDA team with his areas of expertise in power sales negotiations and in dealing with the federal agencies involved in the Federal licensing process. He is currently involved in providing both types of services to the Confederated Tribes of the Warm Springs Indian Reservation and to the Colville Confederated Tribes. His special expertise will expedite the governmental review process and power sales negotiations, should power generation prove to be a feasible element to include in the pump station design.

Bill Thompson will also provide project support in the electrical engineering effort. Prior to joining EDA, Mr. Thompson was involved in design review and coordination for PGE of the City's new 36 megawatt hydro generation plant, and is, therefore, extremely knowledgeable with PGE requirements for control systems when interfacing these types of generating facilities with PGE installations.

Geotechnical investigations and reports will be performed by the firm of Shannon & Wilson, Inc. All investigations will be supervised by Frank Fujitani.

Detailed resumes of all project staff are included in the following.

GILBERT R. MEIGS, P.E.

As senior vice president, Mr. Meigs is responsible for feasibility studies and design of hydraulic engineering projects, including structures, pumping, and conveyance systems. He has served as project engineer for studies and design of municipal and industrial water supply, storage, and distribution systems.

Some of his major projects include the Trask River Dam and pipeline, Hillsboro, Oregon; Bull Run Dam No. 2, Portland, Oregon; preliminary design of Youngs River Dam for Astoria, Oregon; and preliminary design of McKay Dam for the Soil Conservation Service and McKay Water Conservation District, Oregon. During the design of Bull Run Dam No. 2, preliminary planning was undertaken for inclusion of a 24 megawatt hydroelectric facility and for adding a 12 megawatt hydroelectric facility to Bull Run Dam No. 1. Mr. Meigs was also involved in the preliminary design of Conduit No. 5 for the City of Portland.

Mr. Meigs was project engineer for planning the reclamation of Vancouver Lake, Washington; was involved in site location studies for nuclear power plants; and was responsible for planning and hydraulic design of water tunnels and appurtenances in Washington, D.C. and Montgomery County, Maryland. He was also involved in water supply master plans for Portland and Washington County, and has been responsible for several flood insurance studies, all in Oregon.

Mr. Meigs was responsible for hydraulic and civil engineering, Willamette Falls Fishway; surface water supply systems for Hillsboro and Seaside, Oregon; and water distribution systems for Fairbanks, Alaska; Vancouver, Washington; LaGrande and Milwaukie, Oregon; and Washington State University.

Mr. Meigs also worked on groundwater supplies for Woodland and Vancouver, Washington; LaGrande, Oregon; Electronic Specialty Company; and Washington State University. Other experience included distribution storage for LaGrande, Salem, and Hillsboro, Oregon; Vancouver, Washington; and Garden Home Water District, Oregon.

EDUCATION:

BSCE, 1952, Stanford University; MSCE, 1956, Stanford University.

REGISTRATION:

Civil Engineer: Oregon, Washington, Idaho, Alaska, California, Colorado.

AFFILIATIONS:

American Geophysical Union; American Society of Civil Engineers; Consulting Engineers Council of Oregon (Past President); National Society of Professional Engineers; American Water Works Association; Pacific Northwest Pollution Control Association; American Society for Testing and Materials; Society of American Military Engineers.

DAVID A. JOCHIM, P.E.

As a senior civil engineer, Mr. Jochim has been responsible for the design and project management of a number of projects for the firm, including water transmission, distribution, and pumping facilities as well as various other studies, designs, and feasibility analyses.

Major projects include preliminary engineering and final design of the 84-inch and 90-inch water conduits and valving system for the Portland Bureau of Water Works conduit intertie project. The project involved the intertie of Portland's three water supply conduits to allow diversion of flows to storage facilities located on Powell Butte. He was also project engineer for design of an 8-mile 45-inch water transmission line for the City of Hillsboro, Oregon. Design features included a river crossing, pressure control facilities, and valving for surge protection. Mr. Jochim designed a major water pump station to maintain winter circulation for a large residential/commercial area in Fairbanks, Alaska. The pump station includes primary and standby circulation pumps as well as two 4000 gpm diesel fire pumps. He was also responsible for design of the water transmission and distribution facilities which serve the same area.

He also provided process design for a 0.45 mgd reverse osmosis sea water desalination plant to serve the Maritime Academy now under construction near Jeddah, Saudi Arabia; he has completed a feasibility analysis of a 138-acre industrial site for the Intel Corporation, which included preliminary site layout and utility investigations; and was a project engineer on the Vancouver, Washington, water system master plan which involved computer simulation of the supply, storage, and distribution system, and development of a long-range capital improvements program. Mr. Jochim has also performed computer modeling of water distribution systems, including those for Fairbanks, Alaska; Salem, Hillsboro, and Milwaukie, Oregon; Vandenberg AFB, California; and Coeur d'Alene, Idaho.

Other projects which Mr. Jochim has been involved include design of a deep well water supply system for the Boeing of Portland Company, HUD Flood Insurance studies for Jackson County, Oregon, and participation in the Portland, Oregon, water supply development program.

EDUCATION:

BSCE, 1972, Montana State University; MSCE in Hydraulic Engineering, 1973, Montana State University; "Cold Regions Engineering" University of Washington, 1979.

REGISTRATION:

Civil Engineer: Washington, Oregon, and Alaska; Professional Land Surveyor: Oregon.

AFFILIATIONS:

American Society of Civil Engineers, American Water Works Association, Chi Epsilon Civil Engineering Honorary Society.

STEVEN E. SIMONSON, P.E.

Mr. Simonson is an assistant vice president responsible for project management of water system studies and designs including supply, storage, and distribution facilities. He also has expertise in hydraulics, pump station designs, and in the design and construction of mechanical systems.

A recent project includes the preliminary design of a Columbia River raw water intake, a pumping station, and supply pipeline for the City of The Dalles, Oregon. The facilities have a capacity of 10 mgd and discharge pressure of 250 psi. Work included equipment selection, preliminary design, pipeline route location, and cost estimating for all facilities.

Mr. Simonson was also involved in the design of water treatment plant modifications at the Hayden Bridge Water Treatment Plant for the Eugene Water and Electric Board, Oregon. The project included modifications to flocculation and sedimentation basins, addition of filters, and addition of 50 mgd finished water pumping station.

He has also been responsible for design and construction coordination of water system improvements for the City of Gresham, including two custom built booster pumping stations, metering facilities and telemetry. Design involved connections to Portland Supply Conduits nos. 2 and 3. In addition, he provided preliminary design with respect to alternate route evaluation and selection for the proposed Conduit No. 5 for Portland Water Bureau; he was involved in the design of a 30-inch raw water supply pipeline for the City of Lewiston, Idaho, which also included crossing the Clearwater River.

Mr. Simonson has additional pump station design experience having been responsible for preliminary design of pumping facilities for the Milwaukee CSO pollution abatement project. Facilities sizes ranged from 20 to 60 mgd at 150 psi, and work included review and selection of available equipment, and preliminary design and cost estimates for underground pumping facilities.

He has previous mechanical system design and construction experience as project engineer for sewage treatment plants at Woodland and LaConner, Washington, and Government Camp, Oregon. In addition, he has just concluded construction coordination of the Upper Tualatin Interceptor project, including a 10 mgd pumping station, for the Unified Sewerage Agency of Washington County.

Mr. Simonson's current assignment is project manager for design and construction of sewage collection and treatment facilities for the Hoodland Service District of Clackamas County, Oregon.

EDUCATION:

BSCE, 1968, Oregon State University; June 1979, attended "Institute on Transient Flow and Hydromachinery" at Colorado State University.

REGISTRATION:

Civil Engineer: Oregon, Washington.

AFFILIATIONS:

American Society of Civil Engineers, American Water Works Association, Water Pollution Control Federation.

RAY J. JOHNSON
Electrical Engineer
Principal

EDUCATION

1946-1950, University of Washington, Electrical Engineering, Bachelor of Science Degree.

PROFESSIONAL REGISTRATION

Electrical Engineer: Oregon, Washington.

PROFESSIONAL AFFILIATION

Consulting Engineers Council of Oregon (CECO), Corporate Member; Institute of Electrical and Electronic Engineers, Member.

TECHNICAL PAPERS, PUBLICATIONS, AND PRESENTATIONS

"A New Low Profile Substation Design" presented 1967 NELPA, Engineering and Operations Meeting, Sun Valley, Idaho. Published in Electrical World Magazine.

WORK EXPERIENCE

1974-Present - Principal, EDA: Design and supervise the design and drafting of engineering drawings covering electrical substation distribution systems for electric utility and industrial clients. Also prepare and issue equipment and construction specifications in connection with engineering projects including an indoor 69 kv substation for Central Lincoln Public Utility District.

Performed electrical and operational tests on equipment and circuits and supervised the energization and phasing tests at eight substations designed by Engineering & Design Associates.

Responsible for a study for the Puget Sound Naval Shipyard to devise a system for automatic underfrequency/under voltage load shedding and restoration.

Responsible for design of electrical power distribution system for serving the nuclear submarine acoustic test range at Fox Island, Washington.

Responsible for work order approval and design review for additions and replacements to the distribution system of PUD No. 1 of Douglas County, East Wenatchee, Washington.

1967-1974 - Allis Chalmers Co.: Promoted and sold high voltage electrical equipment such as transformers, power circuit breakers, and switches to major utilities in the State of Washington.

1965-1967 - Puget Sound Power & Light Company: Performed substation design engineering and eventually directed the substation design effort.

Developed standard low profile distribution substation design.

Designed the installation of a bus differential relaying system for the main 6600 volt bus at the White River Generating Station of Puget Sound Power and Light Co.

As electrical equipment and controls engineer, prepared and supervised the preparation of electrical equipment specifications and performed bid evaluations to select suppliers of the equipment.

1953-1956 - Portland General Electric Co.: Performed distribution engineering work including the design of distribution facilities to serve residential tract developments and commercial loads, including line extension over public and/or private right-of-way.

1950-1953 - Bonneville Power Administration: As a test engineer in the test and energization section, performed and/or supervised the performance of electrical tests upon equipment and control circuits comprising either a new installation or a revision to an existing installation.

LUTHER W. KURTZ, P.E.
Electrical Engineer
Senior Principal

EDUCATION

1946-1948, Oregon State University, BSEE.

PROFESSIONAL REGISTRATION

Electrical Engineer: Oregon.

PROFESSIONAL AFFILIATIONS

Institute of Electrical & Electronic Engineers (IEEE), Senior Member; Consulting Engineers Council of Oregon (CECO), Corporate Member.

WORK EXPERIENCE

1972-Present, Senior Principal, EDA: Responsible for the electrical control design for the Pacific Power & Light Company, Lone Pine Substation project. Responsible for the design of the interface at PGE's Bethel Substation between the new gas-turbine generators and the existing substation. In 1974-76, responsible for the Portland General Electric Company SCADA projects, which consisted initially of developing the necessary criteria and design guides for SCADA installations in PGE substations, and preparing necessary equipment specifications for telemetering transducers and other auxiliary equipment required. The detailed design of the SCADA installations of 19 substations and six gas-turbine generator units were completed during this period.

Responsible for the electrical design for several BPA substation projects, including the design of 500 kv additions at C.W. Paul Substation for both BPA and Puget Sound Power & Light Company. Responsible for the electrical control design of recent BPA projects, specifically Trentwood and Shelton Substations, involving BPA's miniaturized control concept.

Responsible for electrical design of 20 mw bulb turbine generator and associated step-up and utility interface substations. This is a small hydro project involving unique river control problems.

1967-1972, Associate Partner, Downing & Ries Engineers: Experience included working on design for rebuilding of BPA's Big Eddy Substation as the ac terminal station for the northwest-southwest HVDC line. Primarily responsible for the technical design of several major new BPA 500 kv substations, including Little Goose, Lower Monumental, and Dworshak substations, other BPA 230 kv and 115 kv substation additions, some of the initial SCADA installations at BPA substations for operation from the Dittmer Control Center, and some minor substation and distribution line design work for industrial customers.

1958-1967, Assistant Chief of Electrical Design Branch, Portland General Electric Company: Assisted in supervision of electrical design branch personnel, review of technical designs prepared in the branch, and coordination of design and construction with other departments. Responsible for the preparation of equipment specifications for all substation equipment, including power transformers, circuit breakers, regulators, capacitator banks, disconnects, buses, protective and control relays and instruments and meters; and for all other equipment required for electrical design projects.

Responsible for special projects involving technical design and major coordination problems. In 1963, prepared specifications for PGE's first digital KWH telemetering system, which was installed in 1965. Assisted in the coordination and review of technical details and design by consultants for the Pelton, North Fork, and Round Butte hydroelectric projects.

1948-1957, Engineer, Electrical Design Branch, Portland General Electric Company: Electrical draftsman, assisted in design of assigned projects, 1948-1950; Assistant engineer, electrical control, responsible for electrical control design of assigned projects, 1950-1952; Engineer, electrical control, responsible for electrical control design of assigned project, 1952-1955; Electrics control design supervisor, responsible for electrical control design of all projects, 1955-1957.

ALAN A. PETERSON, P.E.

Mr. Peterson is responsible for the structural design and plan preparation for sewage and water treatment plants, reservoirs, and highway structures. Some of the projects in which he has been involved include pump station, clarifiers, and aeration basins for Unified Sewerage Agency, Washington County, Oregon; sewage treatment plant and pump stations for Cowlitz County, Washington; Lewiston, Idaho; and Winston-Green, Glide, and Hermiston, Oregon; reservoirs, clearwells, and water intakes for Lincoln City, Hillsboro, South Fork Water Board, and Oregon City, Oregon; Longview, Kalama, and Auburn, Washington; and Lewiston, Idaho; and highway bridges at Soda Springs, Idaho, and Kenosha County, Wisconsin.

Mr. Peterson's previous experience includes programming and structural analysis of high-rise buildings; project engineer for general engineering, including structural design; computer analysis, and engineering investigations; and civil engineer for the Pennsylvania Department of Highways.

Major projects included investigation of the cause of the John Day Bridge collapse during the floods of December 1964, for the State of Oregon; and investigation of the meanderings of the Willamette River near Corvallis to determine riverbed boundaries and adjacent land ownership.

Experience with the Pennsylvania Department of Highways includes an 18-month training course in all phases of road construction from initial surveying and design through construction and maintenance. Subsequent assignments included construction inspection and bridge and highway design functions.

EDUCATION:

BSCE, 1958, Carnegie Institute of Technology (now Carnegie-Mellon University).

REGISTRATION:

Civil Engineer: Oregon.
Professional Engineer: Pennsylvania.

AFFILIATIONS:

Structural Engineers Association of Oregon, Amercian Society of Civil Engineers.

LLOYD A. PAJUNEN, P.E.

Mr. Pajunen is responsible for the structural design and plan preparation for water treatment plants and reservoirs. Some of the projects in which he has been involved include water treatment plant for the Confederated Tribes of the Warm Springs Indian Reservation, Warm Springs; reinforced concrete roof for the City of Forest Grove's reservoir; 20 mg post-tensioned concrete Spring Hill reservoir for the Hillsboro-Forest Grove-Beaverton Joint Water Commission; and the Waluga reservoir for the City of Lake Oswego, all in Oregon.

He has 30 years structural experience in projects involving design, production of components, and expediting and maintaining schedules for their erection. These projects involved private, state, and federal structures in Oregon, Washington, Montana, Alaska, and Wisconsin.

He is experienced in design, production and supervision of precast prestress concrete involving bridge girders, piling, deck slabs, single tees, double tees, wall panels and many various types of components. These components were used in bridges, office buildings, banks, parking structures, docks, dry docks, manufacturing buildings, nuclear plants, and sewage treatment plants.

EDUCATION:

BSCE, 1948, Oregon State University; correspondence course in Strength of Materials; night school in Prestress Concrete and Critical Path Scheduling.

REGISTRATION:

Structural Engineer: Oregon.
Civil Engineer: Alaska, Washington.

AFFILIATIONS:

American Society of Civil Engineers, Consulting Engineers Council of Oregon, National Society of Professional Engineers, Structural Engineers Association of Oregon, American Concrete Institute, Prestress Concrete Institute, Oregon Building Congress.

RAYMOND S. SMITH, AIA

Mr. Smith is responsible for architectural projects and the architectural aspects of the firm's other projects. He has extensive experience in design for structures and buildings.

He designed water pumping stations for Gresham and Oregon City; sewerage pumping stations for the Unified Sewerage Agency of Washington County, Winston-Green, and Lincoln City, all in Oregon; and a fire station for Grangeville, Idaho. He was involved in team design of an indoor swimming pool for Tualatin Hills Park and Recreation District, Oregon; and maintenance buildings for Getty Oil Company, Shirley Basin, Wyoming.

Mr. Smith provided advisory supervision and coordination for wastewater treatment plants for the Unified Sewerage Agency of Washington County, Oregon, and Cowlitz County, Washington; a water treatment plant for Washington County, Oregon; and maintenance shops for Getty Oil Company, Shirley Basin, Wyoming. He also was responsible for value engineering for Stewart State Park, Oregon, for the Portland District, Corps of Engineers.

From 1970-1974, Mr. Smith was an associate architect with Rudd Associates, Architects, Portland, Oregon. He worked as a technical administrator and as project architect on residential, commercial, and industrial projects. He was an associate architect with Bear, McNeil, Bloodworth, Hawes, Peterson & Smith, Architects, where he was involved in design, drafting, and supervision of construction on hospital facilities, dormitories, and commercial and industrial buildings. He also has been employed by Robert B. Martin, Architect, where he performed design and drafting work on schools and industrial projects.

EDUCATION:

BA in Architecture, 1951, University of Oregon.

REGISTRATION:

Architect: Oregon.

AFFILIATIONS:

Corporate member, American Institute of Architects; International Council of Building Officials.

EDWARD F. DIBBLE
Special Consultant

EDUCATION

Graduated from Cornell University, Ithaca, New York, 1938, with M.E. degree.

REGISTRATION

Electrical Engineer: Oregon, California.
Mechanical Engineer: California.
Civil Engineer: California.

AFFILIATIONS

American Geophysical Union, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, American Society of Civil Engineers, American Society of Agricultural Engineers, American Water Works Association, Air Pollution Control Association, American Association for Advancement of Science, California Water Pollution Control Association, Aircraft Owners and Pilots Association, Rotary Club of Redlands, California Farm Bureau Federation, California Water Resources Association, Los Angeles World Affairs Council, Commonwealth Club.

Mr. Dibble, for the past seven years has been a consulting engineer in the field of water and power. He has performed studies of hydroelectric power sites, feasibility studies for power development, engineering economic studies of alternative power developments; given testimony as an expert witness before the Federal Energy Regulatory Commission; negotiated electrical power contracts; investigated and advised on the move of a steam-fired power plant from Fairbanks, Alaska, to Warm Springs, Oregon; and is currently project manager for Pelton Reregulating Dam Hydroelectric Project for the Confederated Tribes of the Warm Springs Indian Reservation.

RECENT PACIFIC NORTHWEST PROJECTS

Colville Confederated Tribes

Studies and reports relating to economic value of power rights and power generation for Tribes at Grand Coulee and Chief Joseph projects, and similar reports relating to Wells Hydroelectric Project of Douglas County P.U.D., followed by negotiations with U.S. Bureau of Reclamation, Corps of Engineers, Bonneville Power Administration, and Office of Solicitor and Secretary of Interior.

Confederated Tribes of the Warm Springs Indian Reservation, Oregon

- feasibility study of Pelton Reregulating Dam Hydroelectric Project.
- application to Federal Energy Regulatory Commission for federal license for project (license issued in nine months).
- project manager for construction of Pelton project.
- prepared feasibility studies of irrigation projects on Warm Springs Reservation.
- prepared studies of electric service distribution on Warm Springs Reservation, and extension of telephone service.
- extensive negotiations with PGE and PP&L relating to sale of electric power and electric service, from steam power plant at Warm Springs Forest Product Industries, and from hydroelectric project.
- negotiations with Bonneville Power Administration for location of extra-high voltage transmission lines across reservation.
- testified as expert witness before hearings of Federal Energy Regulatory Commission; also before Board of Arbitrators on annual rental for Pelton Dam and Round Butte Dam.

PREVIOUS PROFESSIONAL EXPERIENCE

Member of Water Resources Control Board of State of California for six years, which exercises the adjudicatory and regulatory functions of the State of California in the field of water resources. The Board issues, denies, or revokes permits and licenses for appropriation of waters of the state. It also has primary responsiblity for policy, and control of water pollution and water quality within the state.

Eight years as manager and secretary of San Gorgonio Pass Water Agency. Engineer and secretary for San Bernardino Valley Water Conservation District from 1946 to 1972.

Consulting engineer in primary field of water and power, including water supply, pumping, power, irrigation, basin hydrology, water rights investigations, contract negotiations, engineering economics, studies and reports for regulatory agencies, appraisals and valuations of water facilities and water rights for 26 years.

Chief operator for generation and distribution of power at Pensacola project of Grand River Dam Authority on Grand River in Oklahoma. Was in responsible charge of operation of new hydroelectric power plant and dam, and also testing of equipment, training of personnel, and preparing specifications for additional equipment.

Inspector and assistant engineer in firm of Holway and Neuffer, Consulting Engineers, on planning and construction of Pensacola Hydroelectric Project for Grand River Dam Authority in Oklahoma.

WILLIAM R. THOMPSON
Electrical Engineer

EDUCATION

1966-1969, Cal State, Los Angeles, B.S. Electrical Engineering;
1972-1977, University of Portland, M.S. Electrical Engineering.

PROFESSIONAL REGISTRATION

Electrical Engineer: Oregon.

PROFESSIONAL AFFILIATIONS

Institute of Electrical and Electronic Engineers; Instrument Society of America; City of Portland Electrical Code Board of Examiners.

WORK EXPERIENCE

April 1980-Present, Engineering & Design Associates: Electrical Engineer. Currently working on a project to provide the electrical design for the relocation of the plant control room and the replacement of the governors and the exciters on the hydroelectric generators at the PGE Bull Run plant.

1969-1980, Portland General Electric Company: Supervising electrical engineer. Engineering supervisor of an electrical design group providing the engineering and design to relocate the company's load dispatching operations, including the installation of new telemetry and generation control systems; and project responsibility for the procurement of equipment and engineering design to install fifty SCADA remote terminal units in company plants and substations. Group was also involved in design review and coordination of the operating interface for 36MW of hydro generation to be operated and maintained for the City of Portland and providing the design and engineering of electrical arrangements and control systems of generating technical and personal supervision of an electrical engineer, an engineering technician, and two draftsmen.

Electrical engineer, resident engineer's staff. Project level responsiblity for installation of electrical systems at a nuclear power plant.

Electrical engineer. Design and engineering of electrical arrangements and control systems of substation and generating plants or other special construction projects. Responsible for the technical and personal supervision of two draftsmen.

K. FRANK FUJITANI, P.E.

Mr. Fujitani, a soil mechanics engineer, joined Shannon & Wilson, Inc., in the summer of 1960, prior to entering graduate school at Harvard University. After receiving his master's degree in 1961, he rejoined the firm and was assigned to the Portland office.

During his years with the firm, Mr. Fujitani has participated in a wide variety of studies and investigations in connection with industrial, commercial, municipal and residential projects; railroad and highway construction; dams and retaining structures; landslides; and waterfront facilities.

He has conducted most of the firm's investigations on the Oregon State University campus and at the Health Sciences complex in Portland. Other significant building foundations include the Farmers Insurance Group building in Tigard, Oregon; the Bay Area District Hospital in Coos Bay, Oregon; and the American Plaza condominium in Portland.

Mr. Fujitani also participated in the foundation investigation and design of the Trask Dam for the City of Hillsboro, Oregon; studies for the expansion of the Publishers Paper Company in Newberg, Oregon; investigation of the West Interceptor Sewer for the Greater Anchorage Area Borough in Alaska; and the Fern Hill slide investigation near Astoria, Oregon.

His most recent projects include site investigations for power plants where he has been project engineer.

EDUCATION:

BSCE, 1960, University of Washington; MS in Engineering, 1961, Harvard University.

RICHARD R. BRUCKEN

As senior construction representative, Mr. Brucken performs detailed inspection and coordinates and directs inspectors and survey parties on projects for which he is responsible.

He served as resident engineer on modification and expansion of the Hayden Bridge water treatment plant for the Eugene Water & Electric Board, Oregon. The plant was expanded from 25 mgd to 105 mgd. He also was resident engineer for expansion of the water treatment plant in Oregon City, Oregon, from 8 mgd to 20 mgd for the South Fork Water Board.

Mr. Brucken's previous experience includes employment with an engineering firm as a quality assurance inspector on a wastewater reclamation plant in Orange County, California. He also has been responsible for structural engineering inspection of a dam, spillway, powerhouse, power tunnels, intake structure, and control gates; water reclamation treatment, desalinization, and pipeline; and reinforced concrete, structural steel, and mechanical work.

Mr. Brucken has been in charge of architectural inspection, coordinating the work of subcontractors and suppliers for commercial buildings; and was field engineer for a high-rise building for a private contractor. He also was in charge of field engineering on road and bridge construction, where he inspected concrete, structural steel, and paving.

EDUCATION:

BS in Architecture and Construction, 1951, Oregon State University; MBA, 1975, University of Portland; courses in Construction Management and Supervision, and Building Codes; corporate management seminars.

REGISTRATION:

Licensed Inspector: Orange County, California.

Related Experience

RELATED EXPERIENCE

STRAAM Engineers

PROPOSAL FOR
GROUNDWATER PUMP STATION
CITY OF PORTLAND

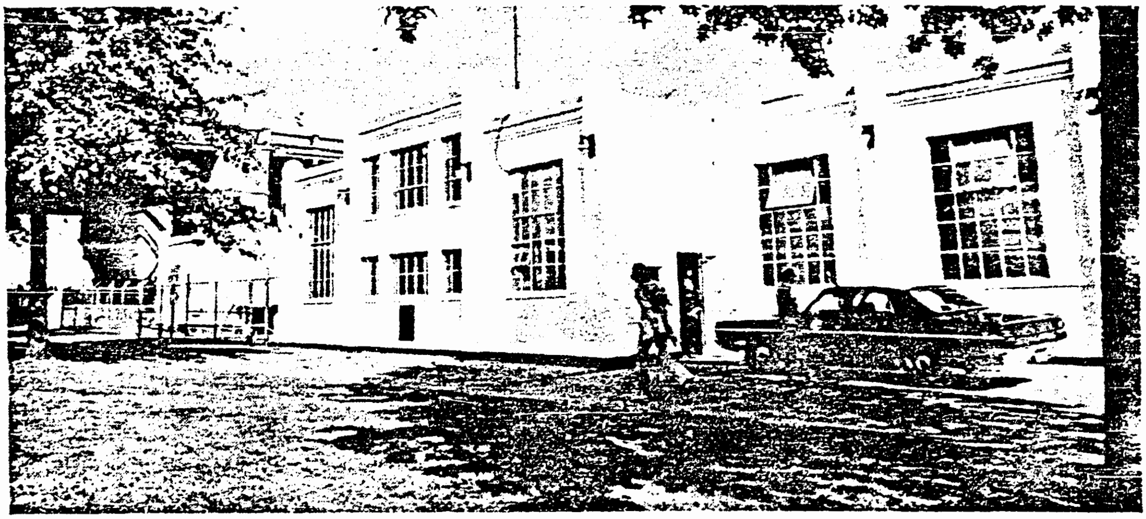
STRAAM Engineers, a division of CRS Group Engineers, Inc., provides comprehensive engineering services in planning, design, construction, and consulting.

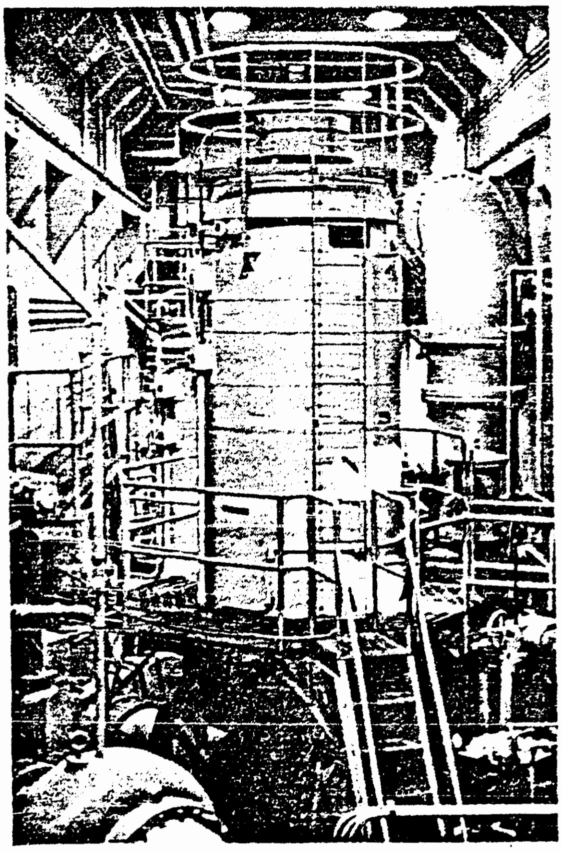
Within the Portland office, STRAAM offers a wide range of technical disciplines including civil, mechanical, structural, electrical, and sanitary engineering as well as architectural and planning services.

The fact sheets which follow indicate several recent STRAAM projects which are related, or have aspects similar to the project under consideration.

Ankeny Street Pump Station

Client City of Portland, Oregon





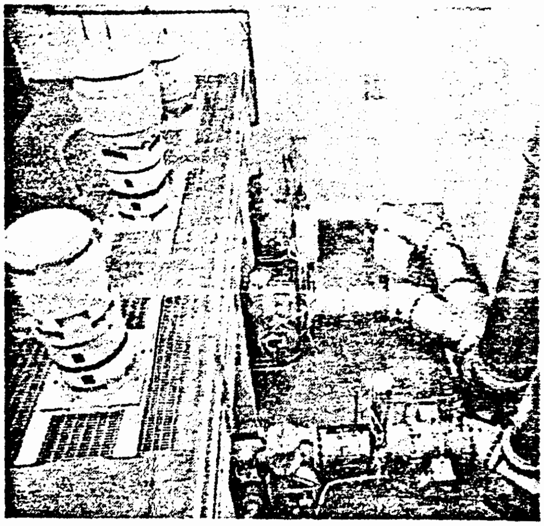
Above: vertical turbine pump. Above right: horizontal split case centrifugal pumps

The Ankeny Pump Station has a total installed capacity of 180 million gallons per day. This pump station serves a large area of predominantly combined sewers, and 60 million gallons per day is pumped to the sanitary sewerage tunnel and 120 million gallons per day goes directly to the receiving stream.

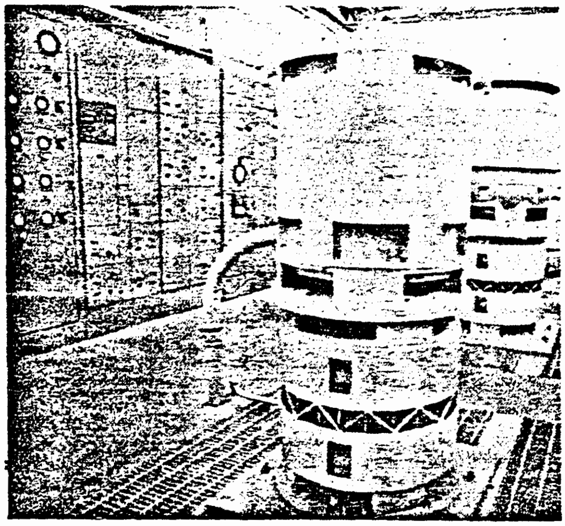
The sanitary pumps are two-speed, and the storm pumps are fixed speed. The latter are provided with automatic control valves to maintain constant head on the pumps as the river stage varies a total of 30 feet.

Guilds Lake Pump Station

Client City of Portland, Oregon



Above: two variable speed and one constant speed vertical turbine pumps. Right: motor control center and variable speed pump

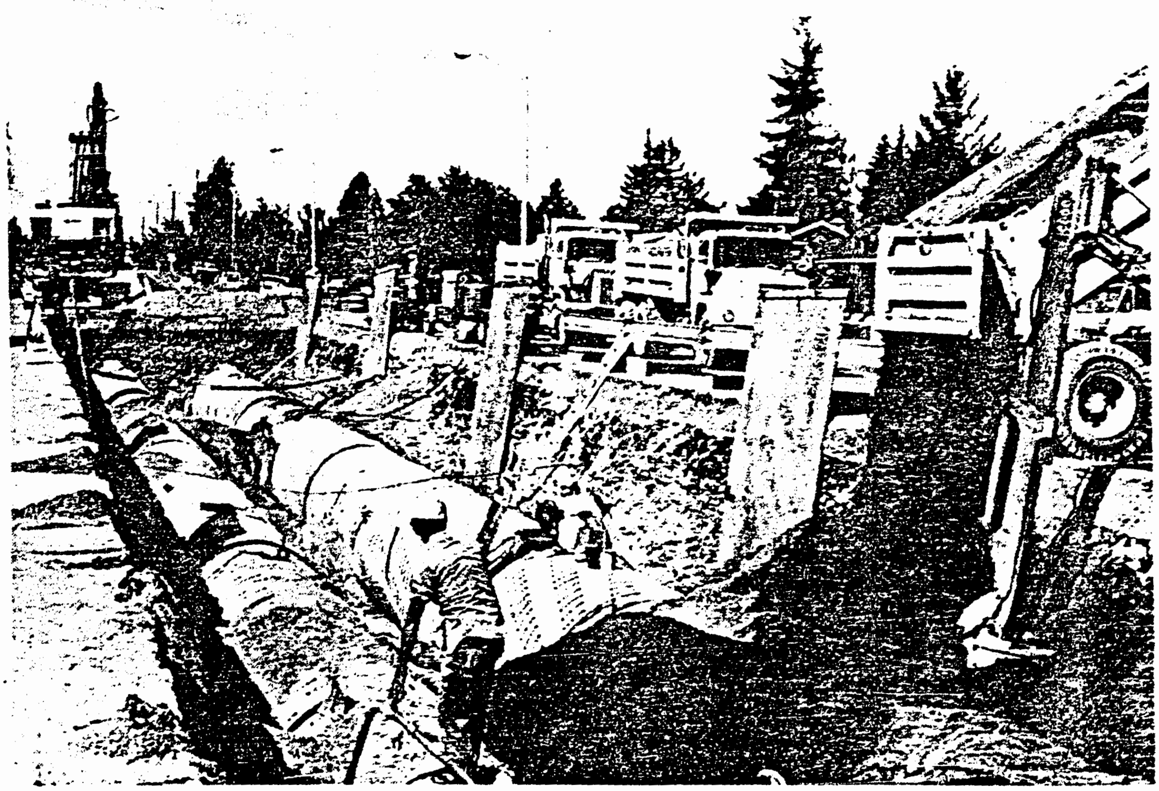


The Guilds Lake Pump Station has a design capacity of 80 mgd and an installed capacity of 30 mgd. This facility discharges to a river undercrossing and then to a six-foot diameter tunnel. The industrial area served by the Guilds Lake Pump Station primarily produces sanitary wastes, although some storm connections still exist.

Three pumps are installed, two variable speed and one constant speed. Discharge ball-valve controls maintain a constant pressure across the pumps. The station also contains a mechanically cleaned bar rack for protection of the pumps.

Conduit Intertie Project

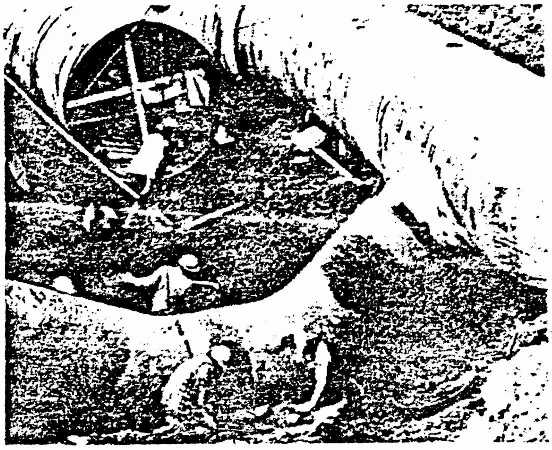
Client Bureau of Water Works, City of Portland, Oregon

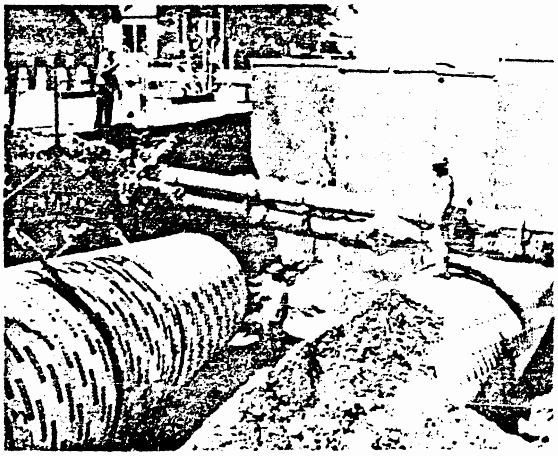


Water settling of sand backfill around 72 inch and 90 inch conduit.

The firm performed the preliminary engineering, including route and capacity studies, followed by final engineering and design of the conduit interties which connect Portland's Bull Run supply conduits with storage facilities on Powell Butte. The project consisted of approximately 11,000 feet of twin conduits ranging in diameter from 56-inch through 90-inch.

Because of the need to protect the Bull Run conduits from hydraulic transients, a unique valving arrangement was incorporated into the design of the conduits. Dual butterfly valves connecting each Bull Run conduit with the intertie conduits are mechanically interlocked to assure unimpeded flow through the Bull Run conduits at all times; either to Powell Butte or to storage facilities on Mt. Tabor.

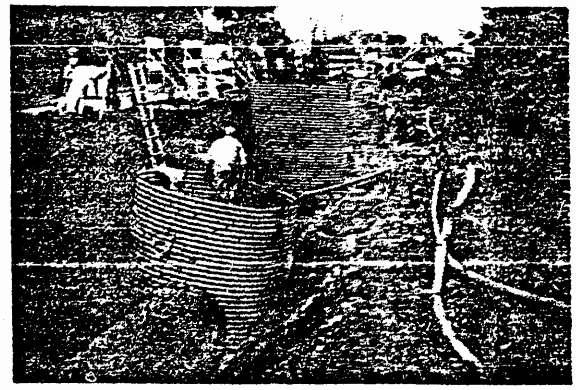


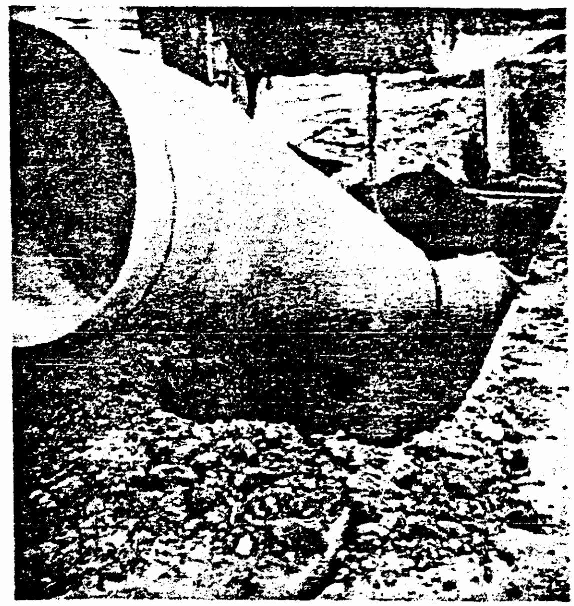


Upper left: connection to valve vault near Bull Run Conduit No. 3. Lower left: crossing Powell Boulevard. Upper right: crossing under Bull Run Conduit No. 4.

Water Transmission Line

Client City of Beaverton, Oregon



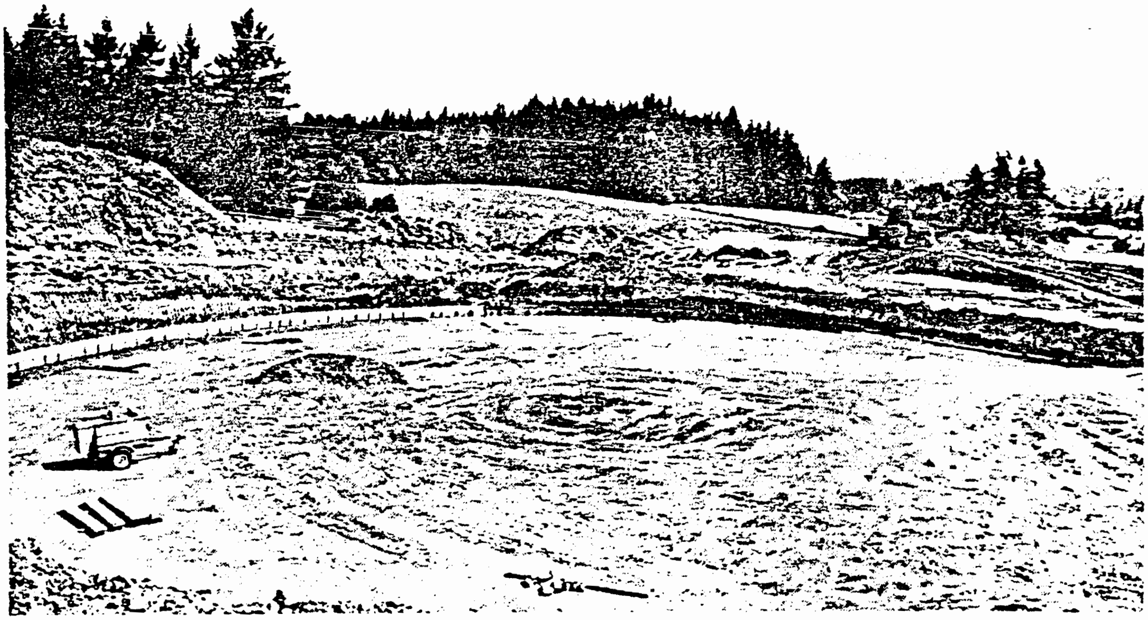


Above—upper and lower: laying and positioning pipe. Upper right: welder's cage for welding joints. Lower right: installation of special fabricated fitting.

As part of a water supply system for the City of Beaverton, Oregon, the firm designed approximately 12 miles of water transmission pipeline of various diameters from 24 to 42 inches, together with all valves, connections to existing piping, blow-offs, air valves, pressure regulating stations, a meter station, and a 5 million gallon reservoir. The concrete cylinder pipeline conveys water from the existing Hillsboro water system to Beaverton.

Sexton Mountain Reservoirs

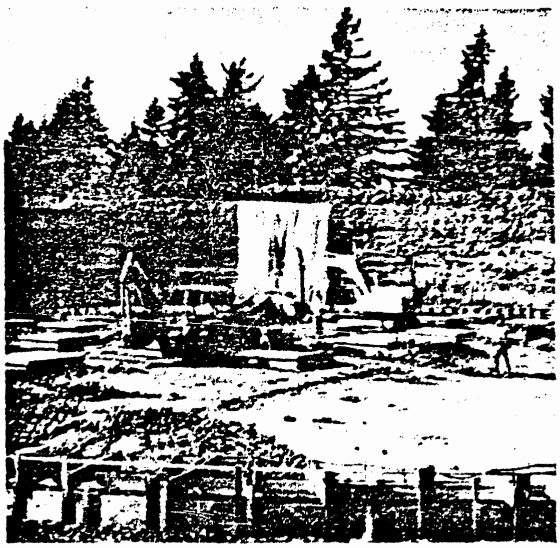
Client City of Beaverton, Oregon



This project is a part of an overall water system improvements program for the City of Beaverton. Preliminary engineering performed by the firm included a distribution analysis to determine capacities and types of tanks required to serve the City's present and future needs. The project consists of a partially buried, post-tensioned concrete tank with 5 million gallon capacity, and a steel standpipe 110 feet high with a capacity of 1.75 million gallons.

Extensive study was devoted to selecting a site for the standpipe due to the foundation required for this type of structure. Prior to final site selection, several sites were evaluated on the basis of engineering, economic, and aesthetic considerations. The firm also participated in public hearings to determine neighborhood impacts and concerns.

During construction, special care was taken to protect existing facilities, including an existing reservoir and piping, to avoid disruption of municipal service. Overall improvements for the City's system also included a 12-mile water transmission line which provides water supply for these reservoirs.



Current construction centers on site preparation and forming foundations for the post-tensioned concrete tank.

WATER INTAKE AND PUMPING PLANT DESIGN

STRAAM Engineers has extensive experience in water resource engineering for the design of water intake structures and pumping plants for irrigation water, municipal raw water supplies, flood control, urban storm drainage, and combined sewage overflow. Hydrologic, hydraulic, structural, mechanical, and electrical specialties required for all sizes of projects are available to provide surveys, design evaluation, and cost-effective final design plans and specifications.

WARM SPRINGS RESERVATION WATER PUMPING STATION

STRAAM Engineers is currently completing design of a high-pressure finished water pump station for the Confederated Tribes of the Warm Springs Indian Reservation, Warm Springs, Oregon. The pumps in the station will pump treated Deschutes River water to the Tee Wees Butte Reservoir serving the town of Warm Springs and to the Kah-Nee-Ta Reservoir serving the Kah-Nee-Ta Lodge complex. Three pumps are provided initially with provisions for the addition of a fourth pump. The pumps are 400 horsepower, vertical turbine, high-pressure pumps, each rated at 1,400 gpm at 878 feet of head. The installation of electric stop-and-check valves, surge anticipator valves, and surge relief valves will protect the pump station and the four-mile transmission main from excessive pressures.

RIVER INTAKE STRUCTURE, CITY OF ANACORTES, WASHINGTON

A municipal water supply project constructed for the city included a diversion structure, pump house, pumps, sluice gates, screening equipment, piping, and bank protection. The facility has a design pumping capacity of 30,000 gpm and features two 8-foot wide automatic traveling screens, motor operated gate lifts, motor control center and variable speed controls, and screen wash system. The diversion structure was constructed of timber piling and logs.

RIVER INTAKE AND PUMPING STATION, OREGON CITY, OREGON

Retained by the South Fork Water Board, STRAAM designed the systems which include two stations; one 12,000 gpm at 240 feet TH and one 14,000 gpm at 300 feet TH. Both are equipped with supervisory control from the water treatment plant. The smaller station consists of three turbine pumps and the larger of four horizontal split-case units.

RAW WATER SUPPLY PUMPING PLANT, LEWISTON, IDAHO

This station, with a concrete intake structure, has an installed capacity of 12,000 gpm at 280 feet TH and serves the high distribution zone from the intermediate zone. The station originally served as an on-line booster utilizing three pumps of different capacities with a pressure maintaining control system. Current operation is into a high level reservoir. Supervisory control is provided from the water treatment plant.

PUMP HOUSE/WELL NO. 4, CAPITAL SECURITIES WATER CORPORATION

This project involved planning and design of pumping facilities required for Well No. 4 of the Capital Securities System. It included review of well test data to determine the most efficient pumping rate for integration into the existing distribution system. STRAAM specified sizes, types, and construction of the equipment best suited for this purpose, and selected a variable speed control system for the pumping equipment. Plans and specifications were prepared for all electrical details of the pump and complete design of the pumping station. The discharge capacity of the completed station was 2,400 gallons per minute.

WATER PUMPING STATIONS, CITY OF HILLSBORO, OREGON

This system, designed for the City of Hillsboro, includes several pumping stations ranging in capacity from 1,500 gpm variable speed to 4,500 gpm at 350 feet. Supervisory control is included.

The pumping station at the treatment plant consists of four pumps each rated 4,000 gpm at 325 feet of head. The 400 horsepower units are automatically controlled from reservoir level or may be manually operated. Provision is made to increase the pumping station capacity to 50 mgd.

BOOSTER PUMPING STATION, EUGENE, OREGON

This booster station, designed by STRAAM for the Eugene Water & Electric Board, has the capacity of 35,000 gpm at 150 feet TH. It is located at the water treatment plant and supplies water to the high service zones of the distribution system.

SEWAGE PUMP STATIONS

STRAAM has been responsible for the design of many sewage pump stations in conjunction with sewage treatment plant and interceptor sewer design.

CAMPBELL CREEK PUMP STATION, GREATER ANCHORAGE AREA BOROUGH, ALASKA

The Campbell Creek Pump Station is designed to handle a peak flow of 18.2 mgd.

The pumping station is designed to operate in an automatic manner at all times to minimize on-site operator attendance except for preventative maintenance functions. Three 4,800 gpm centrifugal pumps are driven by variable-speed wound rotor motors installed to provide noninterrupted pumping capacity for the station. The station design allows for the future installation of a fourth variable-speed pump along with a second pump discharge header. Two stationary diesel-powered turbo generators are installed to provide an emergency power supply, which ensures continuity of normal operation in the event of power failure. A telemetering system transmits information on station operation to a central control center.

CHESTER CREEK PUMP STATION, GREATER ANCHORAGE AREA BOROUGH, ALASKA

The Chester Creek Pump Station is located near the mouth of Chester Creek and serves the major portion of sewers from the core area of Anchorage, Elmendorff Air Force Base, and the Spenard area. The station has a design peak flow rate of 26.6 mgd with any one pump out of service. The pumping system consists of one 9,000 gpm (350 hp) constant-speed pump and two 12,000 gpm (400 hp) pumps driven by variable-speed wound rotor motors.

The pumping operation is designed for complete reliability through standby or dual units in all vital systems. A stationary diesel-powered turbo-generator is installed to provide an emergency power supply which assures continuity of normal operation in the event of a power failure. A status and alarm system is installed with alarm activation if there is a station malfunction. All vital information is telemetered to a central control center.

SCREW LIFT STATIONS, CITY OF ASTORIA, OREGON

For economy, simplicity, and minimum maintenance, and to meet the design requirements of a low lift and high flow rate, three of the five pump stations designed by STRAAM incorporate screw lift pumps based on the Archimedes screw principle. The application of screw pumps to the task of lifting sewage is uncommon in the Northwest and is the first such application by STRAAM.

Each station features two screw pumps operating in concrete troughs set at an angle of 38 degrees from the horizontal and covered with grating for safety. The vertical lift of one station is 9.5 feet at a design capacity of 4,800 gpm. The other two pump stations have a vertical lift of about 14 feet and pump 8,100 gpm and 3,600 gpm respectively. The pumps are self-regulating, requiring no variable speed controls, are surge-free and nonclogging, feature economical installation, and require no complicated controls for operation.

Unusual architectural design of the pump stations blends with the existing surroundings and conforms to future planned development of the area.

OTHER PUMP STATIONS DESIGNED BY STRAAM INCLUDE:

180 mgd pump station, Unified Sewerage Agency, Washington County

2,500 gpm pump station, Lincoln City, Oregon

20 mgd pump station, Vancouver, Washington

19 mgd pump station, Astoria, Oregon

11 mgd, 30 mgd, and 18 mgd pump stations, Cowlitz County, Washington

South Shore Pump Station (5,100 gpm/6,400 gpm), Lewiston, Idaho

10,300 gpm effluent pump station, Lewiston, Idaho

3,800 gpm, 2,700 gpm, 2,600 gpm irrigation system pump stations, Walla Walla, Washington

OTHER RELEVANT PROJECTS

BULL RUN RIVER HYDROELECTRIC POWER FACILITIES STUDY, CITY OF PORTLAND, OREGON

The City of Portland, Bureau of Water Works, retained STRAAM to study the feasibility of installation of hydroelectric power facilities in its existing Bull Run Dams, as well as in construction of other smaller dams.

PUMP STORAGE FEASIBILITY REPORT, UNION FLAT CREEK, WASHINGTON

Because the accumulative amount of power available from both existing and scheduled future power facilities is insufficient to meet projected power demands, STRAAM was retained by the Army Corps of Engineers to do a reconnaissance level feasibility study of a potential multipurpose pumped storage project above the Lower Granite Dam Pool.

In the study, STRAAM evaluated four potential reservoir sites--two each in the Union Flat Creek and Almota Creek drainages. The study indicated that each of these sites feasibly could support a pumped storage project, provided the plant production was at least 1,000 megawatts. As a multipurpose facility, the pumped storage project would feasibly provide municipal and industrial water in the Pullman-Moscow area, provide irrigation water to 5,000 acres of potentially irrigable land in the lower reaches of Union Flat Creek, support limited water-oriented recreational use at the Union Flat Creek site, and support the development and operation of a warm water fishery.

CORPS OF ENGINEERS, NORTH PACIFIC DIVISION, HYDRO DESIGN BRANCH

STRAAM has completed work on an open-end contract with this government agency. Included was design, checking, and estimating work on the New Melones Powerhouse, Chief Joseph Powerhouse, and Lost Creek Lake Powerhouse.

WATER TREATMENT PLANT, CITY OF BELLINGHAM, WASHINGTON

As part of a \$2.8 million water improvement program for the city, STRAAM designed a 24 mgd modern water treatment plant which produces a high quality potable water for the city's citizens.

Fine screening is the first step in the water treatment process. Water for industrial uses which does not require further treatment, is diverted, and the remainder of the screened water is transmitted by gravity through a 66-inch steel pipeline to the treatment plant.

Due to the clarity of the water, conventional flocculation and clarification are not incorporated in the treatment process at this plant.

The treated water flows by gravity to the City of Bellingham. A complete supervisory telemetering control panel allows plant personnel to monitor and control the distribution system reservoirs and booster pump stations.

WATER TREATMENT PLANT, CITY OF ANACORTES, WASHINGTON

STRAAM provided an initial water supply study and the design of water treatment facilities for the City of Anacortes, Washington, including two parallel, 17-mile long high-pressure transmission pipelines. A high service pump station at the treatment plant contains eight 400 hp pumps which deliver water to Anacortes. Each pump rating is 4,000 gpm at 320 feet of head. The pumps are programmed from flow and pressure or may be controlled manually. Stop and check valves together with surge control valves protect the installation from excessive pressures. STRAAM and the city received an award from the Washington Aggregate and Concrete Association for "Excellence in the Use of Concrete" in the design of the plant. The firm also received an award for electrical design on the project.

WATER WELL, BOEING OF PORTLAND

STRAAM designed a well for Boeing of Portland at N.E. Sandy Boulevard and 185th. The well is about 297 feet deep, and is screened and gravel-packed. Upon completion of construction and testing of the well, STRAAM designed the required pump installation and piping arrangement.

WATER WELL, CITY OF LA GRANDE, OREGON

This well and the associated pumping station and transmission pipeline were designed to supplement the City of La Grande's surface water supply. The well is approximately 500 feet deep and ranges in size from 24 to 16 inches in diameter. It produces approximately 2,000 gpm, which is pumped directly into the city distribution system from a transmission line approximately three miles long.

WATER TREATMENT AND DISTRIBUTION SYSTEM, MUNICIPAL UTILITIES SYSTEM, FAIRBANKS, ALASKA

In a joint venture with Alaska Architectural & Engineering Company, Fairbanks, STRAAM completed a metropolitan water supply study and design of a major water system expansion. The study phase included hydraulic network analyses, booster pumping, thermal analysis of heat loss from buried pipes, cost estimates, and project feasibility.

Modifications to the MUS water treatment plant included expansion to 3 mgd and remodeling of the building to cope with interior freezing problems. Unusual cold weather factors affecting the water system were a major consideration in the project. Special design features to handle the highly mineralized and extremely cold water of the area were incorporated into treatment plant design. Extreme weather conditions necessitated housing the entire plant. Special attention was also given to seismic design of the plant structures. The distribution system, consisting of 19 miles of 4-inch to 18-inch pipe, utilizes a recircu-
lating concept to eliminate freezing in the lines.

WATER SYSTEM, WASHINGTON STATE UNIVERSITY, PULLMAN, WASHINGTON

Washington State University provides its own water from a series of wells drilled into the basalt formations containing several aquifers. One well is approximately 250 deep and produces approximately 1,500 gpm. Another well more recently completed is approximately 690 feet deep and produces 1,500 gpm. In each case, STRAAM also designed the associated water pumping stations, which include chlorination, telemetering and supervisory control, flow metering, control valving, etc. The pump station buildings are compatible with nearby campus architecture.

CONDUIT NO. 5 PRELIMINARY DESIGN, PORTLAND, OREGON

STRAAM completed route and capacity studies, preliminary design, cost estimates, and construction packaging and scheduling for a new conduit between Powell Butte and the Bull Run headworks for the Portland Water Bureau. Alternatives were examined to set controlling elevations for system planning and to determine the preferred route so that right-of-way acquisition could begin.

WATER RESERVOIRS, WARM SPRINGS, OREGON

The Confederated Tribes of the Warm Springs Indian Reservation retained the firm to design a water system to supply the Warm Springs area as well as the Kah-Nee-Ta resort development. Three reservoirs totaling 4.2 mg of storage were designed for this system. Each is a ground line facility constructed of welded steel. The average diameter is approximately 80 feet. The reservoirs are located at Kah-Nee-Ta, Tee Wees Butte, and Warm Springs.

TELEMETERING, SUPERVISORY CONTROL, AND INSTRUMENTATION

Telemetering, supervisory control, and instrumentation systems have been designed by STRAAM for many government agencies, utilities, and private industries. Complex government projects have included large tertiary sewage treatment plants and a recirculating water system for a major city. STRAAM's full-time staff of electrical power, instrumentation, and control engineers is thoroughly experienced in telemetering, supervisory control, and instrumentation system design.

Principal clients in the last five years for whom STRAAM has designed telemetering, supervisory control and instrumentation systems are as follows:

	Telemetering	Supervisory Control	Instrumentation
City of Vancouver, Washington	x	x	x
Cities of Longview and Kelso, Washington	x	x	x
City of Burlington, Washington	x	x	x
City of Portland, Oregon	x	x	x
City of Gresham, Oregon	x	x	x
City of Hillsboro, Oregon	x	x	x
Unified Sewerage Agency, Washington County, Oregon		x	x
City of Astoria, Oregon	x	x	x
City of Anchorage, Alaska	x	x	x
City of Fairbanks, Alaska	x	x	x
City of Lewiston, Idaho	x	x	x
City of Moscow, Idaho	x	x	x
Bonneville Power Administration		x	x
Portland General Electric Company		x	x
Western Grain Exchange, Portland, Oregon	x	x	x
Getty Oil Company, Los Angeles, California	x	x	
City of Auburn, Washington	x		

General characteristics of the telemetering, supervisory control, and instrumentation systems designed for the above clients are as follows:

	Frequency of use in System Designs		
Characteristic	Most	Some	Few
Leased telephone line link	x		
Cable link		x	
Microwave link			x
Tone equipment	x		
Multiplexing, other than tone equip.			x
Status annunciation	x		
Alarm annunciation	x		
Operating commands	x		
Multipoint scanners		x	
Programmable controls			x
A&D quantities for:			
Indicators	x		
Recorders	x		
Counters	x		
Addition		x	
Subtraction		x	
Extraction		x	
Data logging		x	
O&M scheduling			x
Graphic panels		x	
Graphic displays			x
Control panels	x		
Control consoles		x	

An example of a typical municipal water system design by STRAAM is as follows:

City of Gresham, Oregon. STRAAM designed a system to provide central control, annunciation, and data receiving for the city's water distribution system. It consists of four remote pump stations, three reservoirs, and five pressure points, and a central control with a master control panel, recorders, indicators, pump control and alarm modules, plus a graphic display consisting of a map of the district complete with alarm lights indicating points of trouble. Flows, levels and pressures, alarms, and status are received and commands sent to the pump stations for operation of pumps. The pumps may be operated either automatically from the received data or manually. "AM" and "FSK" tone transmitters and receivers sending signals via leased telephone lines are used to link the remote stations to the central console.

Some of the "FSK" units were modified from three-state to five-state transmission to provide better economy. The system was designed for future expansion.

EDA is a consulting electrical engineering firm located in Tigard, Oregon, which specializes in planning, protection, system design and project feasibility studies, and design of generation transmission and distribution facilities.

The following EDA projects illustrate the variety of the firm's experience in the field of electrical power consulting.

Trojan Nuclear Plant - EDA designed the substation and switchyard for Trojan Nuclear Plant which Plant includes the largest operational commercial power nuclear reactor in the United States. Under terms of an open ended contract with Portland General Electric Company (the plant operator) EDA is currently working on a series of design modifications at the plant.

Utah Power & Light Company - Standard Substation Design - EDA was selected for and has completed a standard design substation arrangement being used by Utah Power & Light Company in the Company's 345-230-138 kV substations.

Skaggit Nuclear Plant Switchyard - EDA was selected for and completed preliminary layouts for the 230 and 500 kV yards associated with the Skaggit Nuclear Plant proposed for construction in Northwestern Washington.

Portland Core Area Planning Study - EDA was selected and has completed a 20 year load flow and planning study of the Portland core area for Portland General Electric Company. The system involved includes essentially all of the commercial undergound systems in Portland, Oregon, with a load projected in excess of 1000 megawatts.

University of Oregon Distribution System - EDA was selected and has completed planning studies for and subsequent design of the distribution system serving the University of Oregon campus in Eugene, Oregon.

Hatwai Substation - EDA was selected and has completed design for the first SICS (Substation Intergrated Control System) substation completed in the Northwest. Hatwai is a major substation in Idaho and is owned and operated by the Bonneville Power Administration.

GENERAL - The following general outline of EDA's work experience is presented as an overview of the firm's experience.

Substation & Switching Stations - In the past ten years EDA has designed approximately 105 substations and switching stations or additions thereto in voltages ranging through 500 kV. These substations have varied in size from distribution substations (10-80 MVA) to transmission substations (150-1600 MVA) which projects have included work on more than a dozen 500 kV stations.

System Planning Studies - Load Flows - In the past ten years EDA has completed approximately 22 major system planning studies. The later studies generally include load projection and associated load flows, system addition and replacement recommendations and cost estimates for a 20 year period.

System Protection Studies - In the past ten years EDA has completed approximately 16 system protection studies. The later studies including fault calculations and recommendations pertaining to protective apparatus types and settings as well as related cost estimates.

Oregon State University Distribution System - EDA was selected and has completed planning studies for and subsequent design of the distribution system serving the Oregon State University campus in Corvallis, Oregon.

Systems Planning and Protection Studies - EDA authored the POWER$ program currently available internationally on the General Electric Information Services Co. Time Share system. These programs were originally developed by EDA for in house use during system planning studies and were subsequently made available to other users through a contract between EDA and General Electric Information Services Co. The POWER$ program is to our knowledge the only software available for studying unbalanced loading and fault levels on non-symmetrical distribution systems.

EDA Conducted System Seminars - EDA is retained by the American Public Power Association which is headquartered in Washington. D.C., to instruct seminars in power system planning, design, protection, and voltage control including a simplified approach to symmetrical components and transformer connection phases which seminars are conducted for engineering personnel of member companies of the Association. These seminars are of 4 day duration the next of which is scheduled for September in Jacksonville, Florida. EDA is also retained by the Northwest Public Power Association conducting similar seminars.

Supervisory Control & Data Aquisition - EDA has completed in excess of 50 substation SCADA design projects in the past ten years. These projects have been completed for Bonneville Power Administration as well as for public and investor owned utilities in the Northwest and include a major portion of the SCADA control systems on the Portland General Electric Company system which services a 3,000 megawatt load in the Northern Willamette Valley of Oregon.

EDA Is Consultant to several Northwest publicly owned utilities for electrical distribution system design, protection and planning.

MX Missle Deployment - EDA is developing conceptual designs of the electric power supply system for MX missle deployment in Utah and Nevada under a contract with Boeing Aerospace Co. of Seattle, Washington.

SPECIFIC WORK EXPERIENCE PERTAINING TO PROJECT AS REFERENCED.

The following is a partial list of projects for which key personnel, available for the project as referenced, had design responsibility.

CURRENT PROJECTS

PORTLAND GENERAL ELECTRIC COMPANY - BULL RUN PLANT - EDA is currently designing the control scheme for implementing semi-automatic operation of the plant.

BEAVER GENERATION - EDA is currently involved in design of several plant modifications including controls.

PELTON REREGULATING DAM GENERATION - EDA is currently designing the electrical portion of this 20 mw project on the Dechutes River which design includes generation and river control, electrical facilities within the powerhouse, step-up substation, transmission line, interface switching station, and all control and communication lines to implement semi-automatic operation with control from the Pelton Project.

HOODLAND SEWAGE TREATMENT PLANT - Electrical Design - Subcontract with STRAAM Engineers.

COMPLETED PROJECTS BY EDA AND EDA STAFF

RIVER MALL PLANT, CLACKAMAS RIVER - Design of fifth generating unit addition and control scheme for entire plant to implement semi-automatic operation.

FARADAY PLANT, CLACKAMAS RIVER - Design of control scheme to implement semi-automatic operation, all five generators.

OAK GROVE PLANT - CLACKAMAS RIVER - Design of control scheme to implement semi-automatic operation of 2 units.

SULLIVAN PLANT - WILLAMETTE RIVER - Electrical design of installation of 12 induction generators and development of control scheme to implement semi-automatic operation.

COLORADO SPRINGS - WASTE WATER RECLAMATION ADDITION, Electrical Design - Subcontract with STRAAM Engineers.

WARM SPRINGS WATER TREATMENT PLANT, Electrical Design - Subcontract with STRAAM Engineers.

TYPICAL COLUMBIA RIVER FLOOD PLAIN PROJECTS

Project	Client
Settlement Study ADC Ammo Storage Area Portland Air Base	Northwest Division Bureau of Yards & Docks Dept. of Navy
Foundation Investigation Portland International Airport Terminal Building	Burns Bear McNeil & Schneider
Foundation Investigation Air Cargo Facilities Portland International Airport	James Kunkle
Foundation Investigation UAL Freight Terminal Portland International Airport	Skidmore Owings & Merrill
Foundation Investigation Sheraton Airport	Travers/Johnston
Foundation Investigation Weapons Calibration Shelter OANG Portland Air Base	Edmondson, Kochendoerfer & Kennedy
Foundation Investigation UAL Food Service Center Portland International Airport	Bear, McNeil, Schneider, Bloodworth & Hawes

151351

Schedule

SCHEDULE

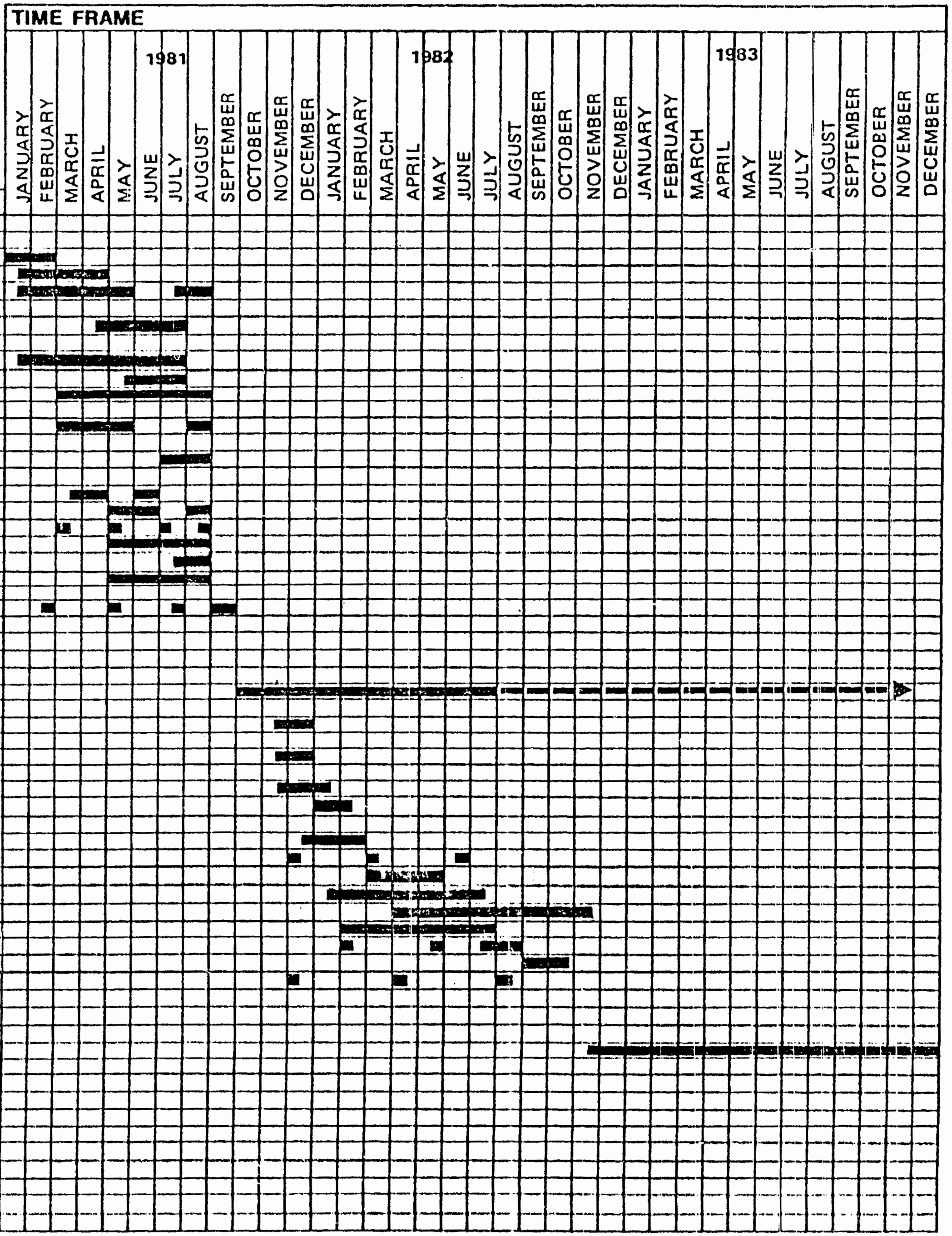
PROPOSAL FOR
GROUNDWATER PUMP STATION
CITY OF PORTLAND

Project scheduling is predicated on the Bureau of Water Works' requirement to have the pump station facilities on-line no later than January 1984. For scheduling purposes, we have assumed that the consultant selection process and contract negotiation stage will be complete, and that notice to proceed will be issued by January 1, 1981. We envision a 6 to 8 month effort required for completion of the preliminary design phase, and another 8 to 10 months for final design. The above time-frame will allow construction to begin in late 1982, thereby allowing slightly over one year for actual construction of the facilities.

The accompanying chart indicates the time-frame for the above schedule and shows the time relation between work tasks. The time-frame indicates points where Bureau review will take place. The intent is not to show rigidly scheduled review points, but merely to indicate that reviews will occur at logical periods timed to coincide with significant project outputs or decision points on the part of the Bureau of Water Works.

Project Work Plan

TASKS	STRAAM	EDA	Shannon & Wilson	Bureau of Water Wks
PHASE I - PRELIMINARY DESIGN				
Task 1: Water Availability	●			
Task 2: Supply System Hydraulics	●			
Task 3: Discharge Options	●			
Task 4: Hydromachinery Evaluation/ Selection	●	●		
Task 5: Transient Analyses and Surge Control Evaluation	●			
Task 6: Storage Tank Sizing	●			
Task 7: Conceptual Design	●	●		
Task 8: Power Generation Feasibility Analysis		●		
Task 9: Define Licensing and Permit Requirements		●		
Task 10: Preliminary Site Surveys/ Geotechnical Investigations	●		●	
Task 11: Preliminary Facilities Layouts	●	●		
Task 12: Agency Coordination & Review	●	●		
Task 13: Environmental Considerations	●	●		
Task 14: Preliminary Cost Estimates	●	●		
Task 15: Preliminary Engineering Report	●	●	●	
Task 16: City Review and Alternative Selection	●	●		●
PHASE II - FINAL DESIGN				
Task 17: Power Sales Contract Negotiations		●		
Task 18: Verify Final Hydraulic Design Criteria	●			
Task 19: Verify Electrical One-line Diagrams		●		
Task 20: Design Surveys and Final Geotechnical Work	●		●	
Task 21: Site Plan Finalization	●			
Task 22: Final Systems Design Concepts and Schematics	●	●		
Task 23: Agency Reviews	●	●		
Task 24: Equipment Bid/Evaluation	●	●		
Task 25: Final Facilities Design	●	●		
Task 26: Agency Permit Applications	●	●		●
Task 27: Plans and Specifications	●	●		
Task 28: City Review	●	●		●
Task 29: Advertise and Take Bids				●
Task 30: Public Meetings	●	●		●
PHASE III - CONSTRUCTION				
Notice to Proceed - - Construction				



Project Cost Estimate

PROJECT COST ESTIMATE

PROPOSAL FOR
GROUNDWATER PUMP STATION
CITY OF PORTLAND

Based on the scope of work outlined in your letter of October 7, 1980, our project approach as previously described, and time frame required to perform the engineering services, we estimate that the total cost will range from $375,000 to $550,000. This range takes into account the uncertainty of the work scope which is dependent on the decision relating to power generation. The estimated design cost would be near the low end of the range with pumping facilities only and would approach the higher figure with power generation included. As you requested, this cost range is exclusive of the cost of resident engineering and inspection services and exclusive of final design of any stand-alone power generation facilities.

In regard to the fee, we believe the most equitable method of compensation for the professional services proposed herein is the cost-plus-fixed-fee. Cost is our direct payroll plus a percentage for direct payroll overhead, plus a percentage for indirect overhead cost, plus expenses. The fixed-fee portion is a percentage of cost and is negotiated.

This method of compensation is also advantageous to the city, since they pay only for the services rendered. Therefore, should the project be completed at less than the maximum limit, the city will realize the cost savings.

We are also agreeable to negotiate an upper limit for the engineering cost-plus-fixed-fee which we would not exceed in our billings, or if preferred by the city, other methods of compensation can be negotiated.

References

Persons on the following list of references may be contacted to ascertain the quality of work which STRAAM produces. Feel free to contact any or all of the list below. The references are:

1. City of Beaverton, Oregon
   Mr. Chris Bowles, City Engineer
   644-2062

2. City of Hillsboro, Oregon
   Mr. Eldon Mills
   648-4811

3. City of Seaside, Oregon
   Mr. Burton Lowe, City Manager
   738-5511

4. City of Oregon City, Oregon
   Mr. Al Simonson, City Manager
   655-8481

5. City of Astoria, Oregon
   Mr. Dale Curry, City Manager
   324-5821

6. City of Milwaukie, Oregon
   Mr. Steven M. Hall, Director of Public Works
   659-5171

7. Eugene Water & Electric Board, Eugene, Oregon
   Mr. James Brown
   484-2411

Affirmative Action

STRAAM Engineers is an equal opportunity employer. Following is the City of Portland's Notice of Certification dated February 26, 1979.

9/1/// 151251

RECEIVED
FEB 27 1979
STRAAM

CITY OF PORTLAND

Bureau of Financial Affairs
Contract Compliance Division

CONTRACTOR EQUAL EMPLOYMENT OPPORTUNITY PROGRAM

NOTICE OF CERTIFICATION

TO STRAAM Engineers, Inc.

STREET P.O. Box 02201 - 5505 S.E. Milwaukie Avenue

CITY Portland, Oregon 97202

You are hereby notified of certification as an

EQUAL EMPLOYMENT OPPORTUNITY
AFFIRMATIVE ACTION EMPLOYER

as specified by Chapter 3.100 of the Code of the City of Portland, Oregon.

Unless found in violation of Chapter 3.100 of the City Code, or of the Rules and regulations thereof, certification shall be continuous, PROVIDING you meet the requirements for annual and/or other periodic data as applicable.

WARNING TO CONTRACTING OFFICES

This notification does not constitute evidence of certification and shall not be accepted as such by the Bureau of Buildings or any contracting office of the City of Portland. Current certification status may be determined by reference to the current Combined Vendor/Contractor List, or by communication with the Contract Compliance Division.

DATE 2-26-79 SIGNED Patricia A. Ba[illegible]
(Contract Compliance Division)

Brochure

151354

STRAAM ENGINEERS

A Division of CRS GROUP ENGINEERS, INC.

STRAAM Engineers

STRAAM Engineers, a division of CRS Group Engineers, Inc., provides comprehensive engineering services in planning, design, construction, and consulting.

Our engineers work effectively with public and private sector clients throughout the United States.

Our clients have the benefit of thirty-five years of engineering experience in a wide range of technical disciplines including sanitary, civil, mechanical, electrical, and structural engineering. To this engineering capacity we have the additional technical depth of specialists in transportation, chemical engineering, ecology, economics, costing, geology, hydrology, mining and soils, surveying, and estimating.

In the public sector, we provide services beginning with planning and grant application through design, bidding, resident engineering inspection, operations, and maintenance. Our engineers are experienced in meeting regulatory agency requirements for municipal and industrial water and wastewater systems.

For both private and public clients, we combine this technical depth with quick response to meet cost critical schedules and to provide solutions which take into account time and cost as well as required performance criteria.

Our extensive experience in tunneling techniques and equipment and the design of underground structures of all types saves our clients' time and cost and provides an efficient and safe construction operation.

In transportation and related projects, our engineers can provide long-range planning and cost feasibility, as well as complete engineering design, whether the project involves highways or streets, railroad expansion and rehabilitation, bridges or tunnels, surveying, lighting, automated signalization, airport facilities, or port and harbor structures.

CRS Group Engineers is part of The CRS Group, Inc., a company providing services in architecture, engineering, and construction management worldwide.

151351

ORDINANCE NO. 151351

An Ordinance authorizing an agreement with STRAAM Engineers, a Division of CRS Group Engineers, Inc., for professional services, in the amount of $614,800.00 in connection with the Groundwater Development Program of the Water Bureau, authorizing the drawing and delivery of warrants, and declaring an emergency.

The City of Portland ordains:

Section 1. The Council finds:

1. The construction of a pump station is required for the Groundwater Development Program of the Water Bureau and the best way to expedite the construction of this facility is to employ the services of a Consulting Engineer.

2. The firm of STRAAM Engineers, a Division of CRS Group Engineers, Inc., 5505 S.E. Milwaukie Avenue, Portland, Oregon 97202, was selected to perform the necessary professional services to design and construct the project in accordance with Chapter 5.68 of the City Code, Consultant Service Contracts, and that the selection was approved by the Water Bureau Administrator.

3. Generation of electric power using excess water from the Bull Run River may be feasible at the pump station facility and considerable savings could be realized in the cost of the hydroelectric facility by incorporating the necessary power generation equipment into the pump station facility.

4. Revenue received from power generation at the pump station, if such generation is found feasible, will be assigned to the Small Hydroelectric Fund, when this fund is established.

5. The cost of the consulting engineering services necessary to design and construct the pump station and to perform a feasibility study and the preliminary design for a hydroelectric power generation unit at the pump station site is $614,800.00.

NOW, THEREFORE, the Council directs:

a. The Auditor and Mayor are hereby authorized to enter into an agreement with the firm of STRAAM Engineers, a Division of CRS Group Engineers, Inc., to provide the above stated professional services substantially in accordance with the agreement attached to the original only of this Ordinance, marked Exhibit "I" and by this reference made a part hereof.

ORDINANCE No.

b. The Water Fund shall be reimbursed for the cost of the feasibility study and preliminary engineering for hydroelectric power generation at the pump station from the Small Hydroelectric Fund, when such a fund is established.

c. The work herein shall be charged to the Water Fund, Bureau of Water Works, BUC No. 18600374, Project No. 3700, Object Code 210.

d. The Mayor and Auditor hereby are authorized to draw and deliver warrants payable to STRAAM Engineers, a Division of CRS Group Engineers, Inc., for professional services rendered in accordance with the agreement attached hereto, when demand is presented, approved by the proper authorities.

Section 2. The Council declares that an emergency exists because a delay in proceeding with the project will result in increased project cost to the City; therefore, this Ordinance shall be in force and effect from and after its passage by the Council.

Passed by the Council, APR 1 1981

Mayor Ivancie
March 24, 1981
R.F. Willis:ct
BUC No. 18600374

Attest:

[signature]
Auditor of the City of Portland

THE COMMISSIONERS VOTED AS FOLLOWS:		
	Yeas	Nays
Jordan	✓	
Lindberg	✓	
Schwab	✓	
Ivancie	✓	

FOUR-FIFTHS CALENDAR	
Ivancie	
Jordan	
Lindberg	
Schwab	
McCready	

Calendar No. 1047

ORDINANCE No. 151351

Title

An Ordinance authorizing an agreement with STRAAM Engineers, a Division of CRS Group Engineers, Inc., for professional services, in the amount of $614,800.00 in connection with Groundwater Development Program of the Water Bureau, authorizing the drawing and delivery of warrants, and declaring an emergency.

Filed MAR 27 1981

GEORGE YERKOVICH
Auditor of the CITY OF PORTLAND

By Gordon Ruell
Deputy

INTRODUCED BY
MAYOR FRANCIS J. IVANCIE

NOTED BY THE COMMISSIONER	
Affairs	
Finance and Administration	FJI/MK
Safety	
Utilities	
Works	

BUREAU APPROVAL	
Bureau: WATER WORKS	
Prepared By: RFW R.F.Willis:ct	Date: 3/24/81
Budget Impact Review: ☐ Completed ☐ Not required	
Bureau Head: CARL GOEBEL, ADMINISTRATOR	

CALENDAR	
Consent	Regular X

NOTED BY
City Attorney
City Auditor
City Engineer