

Monday, October 20, 2014

Thomas Assimes
Chief Financial Officer, Site C Clean Energy Project
Suite 600, Four Bentall Centre
1055 Dunsmuir Street
P.O. Box 49260
Vancouver, B.C., V7X 1V5

RE: Site C Clean Energy Project Capital Cost Estimate
Independent Review of Direct Construction Cost Estimate (September 2014)
Consolidated Commentary Letter from Panel Members

Dear Mr. Assimes,

As part of its due diligence process and to support its final investment decision, BC Hydro asked me to engage a panel of industry experts (**the Panel**), to undertake an independent review of the direct cost estimate, and provide an opinion regarding its completeness, sufficiency and accuracy.

The Panel assembled for the review included experts with 35 to 50 years' experience in the construction of earthfill dams, RCC structures, hydraulic tunnelling, generating stations, spillways, and other heavy civil works. Their qualifications are summarized in Appendix A.

Scope of Review

During the review, the Panel was provided access to key direct cost estimate documentation including:

- General arrangement drawings
- Procurement Approach
- Construction sequencing diagrams
- Site and climatic information
- Construction Schedule
- Bill of quantities
- HeavyBid Activity Lists (including crew complement, productivity, and costs)
- Labour, Material, and EquipmentWatch pricing information
- Estimated mark-ups and contractor indirect costs
- Material flows where applicable
- Detail Construction drawings where required
- Estimator calculation sheets as required
- Work package contingency calculations

The Panel also met with key personnel involved in the development of the direct cost estimate including:

- Site C's Finance, Project Management, Estimating, and Integrated Engineering Teams
- SNC-Lavalin Estimators
- BC Hydro's Generation Engineering Estimators
- BC Hydro's Principal Engineer

In this context, the Panel was asked to

- Conduct a bottom-up review of the key construction quantities and assumptions incorporated into the estimate and identify areas that were not consistent with the Panel's experience.
- Assess the feasibility of the direct cost estimate in the context of the anticipated construction schedule, means & methods, and sequencing of work.
- Provide feedback on key assumptions with respect to pricing of materials, equipment and labour, productivity factors, and the overall completeness of the estimate.
- Conduct sample audits of quantity takeoffs.
- Provide an overall opinion regarding the completeness, sufficiency and accuracy of the direct cost estimate and associated contingency.

Approach

The Site C Capital Cost estimate is subdivided into the several contract packages to align with the procurement approach approved by the BC Hydro Board of Directors. The major contract packages are:

- Worker Accommodation (WA)
- Site Preparation Work
- Main Civil Works (MCW)
- Generating Station and Spillways (GSS)
- Turbine Generator (TG)
- Realignment of Highway 29
- Transmission & Substation

The Panel reviewed the direct cost estimate refreshed to June 2014. Each Panel member was asked to review components only within their area of expertise and experience.

The Panel gave priority to the two largest contract packages (Main Civil Works and Generating Station and Spillways) since they represent approximately 60% of the direct costs. Four days were allocated to reviewing materials and included:

- a line-item review of direct construction cost details (specifically Heavy Bid output reports)
- an assessment of key cost drivers such as crew complements and man-hour requirements, equipment rates and productivities, material supply costs, contractor indirect costs, mark-ups, profit margins and risk premiums
- a comparison of unit costs to other current and past projects.
- select audits of key quantity take-offs

The other remaining packages were reviewed by me as the lead Panel member.

Conclusions

Based on the activities described above the Panel has reached conclusions regarding the sufficiency and accuracy of the direct construction cost estimate. The following are the key conclusions of the Panel resulting from their review:

- The direct cost estimate has been prepared to higher level of detail than typical owner's estimates and at a similar level of detail as a Contractor in the Private Sector.
- The direct cost estimate appears to be sufficiently complete and adequate to cover all anticipated costs associated with constructing the works in the planned time schedule.

- The approach used by BC Hydro on the larger contract packages where two independent estimates were consolidated into a single final estimate is consistent with the experience of the Panel. This methodology reduces the likelihood of error and improves the quality of the final estimate.
- The estimate has sufficient allowances/contingency to cover any reasonable increase in cost resulting from design development or cost estimate uncertainty.

Overall, it is the Panel's conclusion that the estimate is sufficient for the proposed scope and schedule of Site C. The estimate has an appropriate level of accuracy for making a final investment decision. Further, there are some opportunities for cost reduction available.

Sincerely,

Lead Panel Member

(Signed) Frank Margitan

Frank Margitan

Main Civil Works:

(Signed) David Imper

David Imper

(Signed) Carl Jonasson

Carl Jonasson

Diversion Tunnel and Generating Station and Spillway

(Signed) Bev Trautman

Bev Trautman

Appendix A Credentials of Reviewers

The Panel has a range of expertise and reviewed components of the direct construction cost estimate appropriate to their experience. Generally, Panel members reviewed one or more of three components of the direct cost estimate:

- The Main Civil Works contract package (**MCW**)
- The Generating Station and Spillway contract package (**GSS**)
- The balance of the major components of the project not included in either of the above (**BALANCE**)

The members of the Panel, as well as the portion of the direct cost estimate they reviewed and key elements of their credentials, are listed below.

Frank Margitan	<p>All Packages</p> <ul style="list-style-type: none"> • 40 years of experience in management and construction of heavy civil and mining projects in Canada and the United States. • Experience in construction and management of a range of heavy civil projects, labour relations, contract management, First Nations, and cost estimating. • Previous roles include: <ul style="list-style-type: none"> • Vice President, Peter Kiewit Sons and Kiewit Infrastructure Co. • Chair & Director, BC Roadbuilders & Heavy Construction Association • Previous project experience includes: <ul style="list-style-type: none"> • Port Mann Highway 1 Project • Sea to Sky Highway • Keenleyside Power Plant • Run-of-river projects for Plutonic Power, Cloudworks, Rutherford, McNair and Mamquam (11 plants total)
David Imper	<p>Main Civil Works Package (Dam, RCC Buttress, Approach Channel, excluding diversion works)</p> <ul style="list-style-type: none"> • 30+ years of experience in the heavy construction industry in roles related to engineering and project management. • Experience in engineering and project management for heavy civil projects, claims management and dispute resolution. • Previous roles include: <ul style="list-style-type: none"> • Project Manager with Peter Kiewit and Sons • Principal with KDE Investments (claims management and dispute review board member) • Previous project experience includes: <ul style="list-style-type: none"> • Project Manager on the Eastside Reservoir east and west dams for the Metropolitan Water District of Southern California. • Deputy Project Manager on San Joaquin Toll Road project • Project Manager on new navigation lock at Bonneville lock and dam

<p>Carl Jonasson</p>	<p>Main Civil Works Package (Dam, RCC Buttress, Approach Channel, excluding diversion works)</p> <ul style="list-style-type: none"> • 40+ years of experience in the heavy construction industry in western North America • Expertise in heavy civil estimating and constructability, dam construction and deconstruction, road and bridge construction, value engineering, estimating, claims preparation and dispute resolution. • Previous roles include: <ul style="list-style-type: none"> • Senior Project Manager with Puget Sound Contractors • Civil Construction Manager with Wilder Construction Co. • Expert witness in large civil cases in California and Alaska • Previous project experience includes: <ul style="list-style-type: none"> • Scoggins dam reconstruction • Alaskan Way viaduct removal/replacement • Portion of Highway 9 improvement in Clearview WA
<p>Bev Trautman</p>	<p>Generating Station and Spillway and Diversion Works</p> <ul style="list-style-type: none"> • 45+ years' experience in major civil engineering and construction throughout North America. • Substantial experience in construction and project management including cost estimating, including civil, tunnel, pipeline and mechanical and electrical construction. • Previous roles include: <ul style="list-style-type: none"> • Division manager with Balfour Beatty • VP Operations with Torno-America • VP and Manager of Civil Group, Harrison Western Corporation • Operations Manager, S.J. Groves • Previous project experience includes: <ul style="list-style-type: none"> • Original construction of the Mica Creek Dam and Generating station • Project Construction Manager for JV on Chief Joseph powerhouse extension • Project Construction Manager for JV on Bonneville Dam and Generating Station



Jonasson Consultants LLC

Carl F. Jonasson

Carl.Jonasson@comcast.net

Profile

Heavy construction management with over 40 years of experience in the western U.S. Duties included job inspection, engineering, field superintendence, job superintendence, project management, general superintendence, estimating, bidding, value engineering, claims preparation and negotiation, project sponsorship and division management. Expertise lies in heavy highway estimating and constructability issues, residential and commercial site grading, utility installation, dam construction and deconstruction, light rail grading, substation grading and ductbank installation, jetty construction, road and bridge construction, highway safety improvements, microtunneling, value engineering, and dispute resolution.

Work History

September 2007
to present

Jonasson Consultants LLC- Construction Consultant, Federal Way, Washington.

Estimating, bidding, claim and change order preparation, constructability advisement, and project troubleshooting for clients. Estimated and bid on many projects in the Puget Sound area since 1973. A sampling of recent projects estimated follows:

- Estimated a portion of the Highway 9 improvement project in Clearview, WA.
- Participated in the Delridge CSO VE study.
- Advised on constructability and cost issues and estimated portions of an alternate for the Alaskan Way Viaduct removal and replacement.
- Estimated Scoggins dam reconstruction cost, involving three options, totaling over \$2,000,000,000 including options.
- Estimated a portion of the SR 520 east approach currently under construction,
- Estimated a portion of one of the Nalley Valley project phases.
- Scheduled and advised on the cost estimate for the Mercer West project.

Clients include WSDOT, King County, City of Seattle, KPFF Consulting Engineers, Kleinfelder, Jacobs Associates, HDR, GEI Consultants, PacificCorp, Barnard Construction, PCL Construction, Parametrix, Granite Construction, Martin Brothers Construction, KLB Construction, Power Engineers, RSRI and others.

February 2001
to April 2008

Puget Sound Contractors - Senior Project Manager.

Estimated, bid and managed public and private heavy civil projects in the Puget Sound area, ranging in size from \$1,000,000 to \$1,000,000,000. As an employee of Balfour Beatty, I participated in the construction of multi-model project SR519, Phase 1, the

4346 Southwest 307th Street

Federal Way, WA 98023

Tel: (206) 963-1718 Fax: (253) 874-0202



Jonasson Consultants LLC

October 1994
To February 2001

Edgar Martinez Drive access to I-5 by Safeco Field. In addition, I estimated a portion of Sound Transit's Pine Street Stubtunnel adjacent to the Paramount Theater in Seattle.
Wilder Construction Co. - Civil Construction Manager, Everett, Washington.

Managed all heavy civil and structural activities in the Northwest, and the opening of a new sand, gravel and asphalt operation in Tumwater. Sponsored the \$20 million NE 40th project on SR 520 in Bellevue, the \$32 million Swamp Creek project on I-405 near Lynnwood that included widening modifications to 4 bridges, the \$8 million Stillaguamish River Bridge project in Arlington, the \$14 million Lakemont Boulevard project in Bellevue that included a bridge, and the \$8 million Novelty Bridge project near Duvall, Washington. Directly estimated or estimate reviewed numerous road, bridge and site grading projects in Whatcom, Skagit, Snohomish, King and Pierce counties, and in counties east of the mountains. Other projects include:

- Estimate - Barclay Boulevard in Bellingham,
- Estimate, sponsor - Highway 101 improvements near Port Angeles and Sequim,
- Estimate - Highway 9 improvements near Nugents Corner,
- Estimate - Port Angeles ferry terminal parking lot expansion,
- Estimate, sponsor - Pilchuck River bridge #86404 on Snohomish Monroe Road,
- Estimate, sponsor - Bear Creek habitat restoration, Redmond, WA.
- Estimate - Housing development on 30th St. off College Way, Mt. Vernon.
- Estimate -Housing development site grading projects near Tumwater,
- Estimate - Cathcart Landfill expansion,
- Estimate - Dosewallips Bridge replacement,
- Estimate - Highway 101 slide repair near Lilliwaup,
- Estimate, sponsor - street improvement projects for the City of Tacoma,
- Estimate, sponsor - Highway 97 improvements near Blewett Pass,
- Estimate, sponsor - Tank firing range at the Yakima Training Center,
- Estimate, sponsor - Cold Springs Dam improvements, Umatilla, Oregon.

July 1973
to October 1994

Puget Sound Contractors and Engineers - General Superintendent, Project Engineer, Chief Engineer, Contract Administrator, Estimating Consultant.

Estimated, bid and sponsored grading projects throughout Washington for several contractors. Helped institute computerization of, job cost, equipment management and estimating functions. Administered a contract for KPFF Consulting Engineers for the initial groundwork for the Cascade Mall in Burlington, WA.

Education

*4346 Southwest 307th Street
Federal Way, WA 98023
Tel: (206) 963-1718 Fax: (253) 874-0202*



Jonasson Consultants LLC

Bachelor of Science in Civil Engineering Technology (Construction Engineering Management), Oregon State University, 1973.

Bachelor of Science in Business Administration, Oregon State University, 1973.

*4346 Southwest 307th Street
Federal Way, WA 98023
Tel: (206) 963-1718 Fax: (253) 874-0202*

DAVID V. “Dave” IMPER

Education:

**Oregon State University
Bachelor of Science, Civil Engineering Technology –Conferred 1971**

Experience:

- 1965-1973** **Sergeant, United States Marine Corps Reserve,
5th Engineer Battalion, Portland, Oregon. Honorable Discharge**
- 1968-1997** **Peter Kiewit Sons’ Inc.
Twenty-nine year veteran in the heavy construction industry. Commencing
with working as a Summer Engineer on various road projects in northern
California and culminating with serving as the Project Manager on the \$300-
million Eastside Dam for the Metropolitan Water District of Southern
California. A description of the various projects and duties is attached.**
- 1998-current.** **KDE Investments, LLC
Principal performing among other responsibilities, construction-
related services and consultation. Served as expert witness and in claims
avoidance capacity for various matters. Disputes Review Board Member on
various contracts.**
- 1999-2000** **Representing Marshall Associated Contractors/Central Utah Project
crushing claim with the Bureau of Reclamation.**
- 2003** **Member of the Disputes Resolution Board (DRB) for State of
California Department of Transportation
Contract: 11-199344. 4 Lane Express Way in Imperial County.**
- 2003-2005** **Member of the Disputes Resolution Board (DRB) for State of
Alaska Department of Transportation
Contract: #DP-0005(394)/55136 Glenn-Parks Interchange, Design Build
Contract.**

- 2003-2004** Representing the Ministry of Transportation for British Columbia, Canada, for highway grading and crushing claims in Graehold Construction Corp. v. Her Majesty the Queen et al. (Oyster River to Miller Creek Project).
- 2003-2006** Member of the Disputes Resolution Board (DRB) for State of California Department of Transportation
Contract: 08-483764. Fenner Overhead Bridge Replacement in San Bernardino County.
- 2003-2007** Member of the Disputes Resolution Board (DRB) for the State of California Department of Transportation
Contract: 08-4567V4. Paving project from East Main Street in Barstow to South Razor Road in San Bernardino County.
- 2005** Representing Shimmick Construction Co., Inc./ Obayashi Corporation, a Joint Venture
Contract: Los Angeles County Metropolitan Authority, San Fernando Valley East-West Bus Rapid Transit Design Build Project.
Consultant for prime contractor on subcontractor claims.
- 2006** Expert witness for Richardson & Wilhelmy, Walnut Creek, CA
Contract: Shames Construction for new Home Depot Development.
Representing Shames in subcontractor dispute.
- 1997-2014** Half owner in I & P Investments, a Washington State LLC. Involved with Quarry development and landfill operations in the state of Washington, Idaho and Utah.
- 2014** Doing consultant work for Flatiron/Kiewit JV. Assisting in pre reviews for DRB presentations between the JV partners and Cal Trans.

Other Interests:

Active in community service as long-time member and Past President of the Local Chapter of the Los Rancheros Kiwanis Club engaged in providing work and education opportunities to youths leaving the Romanian orphanages. Working with the United States Marine Corps Foundation raising funds for scholarship for children of retired and active duty Marines. Past Secretary for Kiwanis Club Division 100 Miracle Mile of Quarters San Diego representing Children's Hospital. The club raises monies exclusively for the Pediatric Trauma Care Unit of Children's Hospital of San Diego California. Enjoy reading and traveling to study Native American history and art as well as fishing and spending time with grandchildren.

Relevant Construction Experience

1968-1971

Worked as a summer engineer on state highway projects in northern California on I-5 and SR 101

1971

Job Engineer on the Denny Creek project I-90 for the State of Washington DOT over Snoqualmie Pass in Washington. Moved into the Seattle office to estimate new work and help with claims on existing projects.

1972

Project Engineer on the Chelan job for the relocation of existing highway and railroad north of Wenatchee, Washington.

1972

Project Engineer on a Railroad relocations for the Army Corps of Engineers behind Lower Granite Lock and Dam on the Snake River located down stream of Lewiston, Idaho.

1973 - 1975

Project Engineer on the Lewiston Levees at Lewiston, Idaho for the Army Corps of Engineers. \$20 million dollar project to build 8 miles of slurry cutoff wall and Levee, including all excavation, embankments, material zone processing including Rip Rap.

1975

Field Superintendent on \$10 million dollar I-5 project at Castle Rock, Washington in charge of field operations.

1975

Superintendent in charge of grout plant operations on the Trans- Alaska Pipeline. A joint venture project working the northern 200-mile portion of the pipe line, from the Brooks mountain range to Prudhoe Bay.

1976 – 1977

Crusher Superintendent on the Boardman coal fire generating plant site for Portland General Electric at Boardman, Oregon.

Relevant Construction Experience Continued

1977

Superintendent on I-90 highway work at Mullan Idaho for IDOT.

1977 –1978

Crusher Superintendent on several crushing projects in the State of Washington, located in Yakima, Humptulips, Kennwick, and Richland.

1978

Superintendent on I-84 highway project near Prosser, Washington.

1979

Estimating and Oversight (Project Sponsor) for all Portable Asphalt Operations in the Pacific Northwest working out of the Vancouver, Washington Office.

1980

Project Superintendent on the Army Corps of Engineers emergency project at Lexington, Washington north of Kelso to build Levees along the Cowlitz River to protect the town from flooding after the Mt. St. Helens volcanic eruption. Project ran 7 days a week around the clock from Labor Day to New Years day.

1981

Estimating for new Grading and Crushing work from the Vancouver Office through out the Pacific Northwest and Western Canada.

1982 – 1983

Project Manager on a \$50 million dollar project for a Deep Draft Harbor and Boat Basin at Barbers Point, Hawaii for the Army Corps of Engineers.

1983 –1984

Estimating and Oversight for new work out of the Vancouver Office. Ie: Cow Creek project, aggregate production for Cow Creek RCC Dam and relocate the new county Road for Douglas County in Oregon. Access road to Sprit Lake along with the Tunneling project to drain the lake for flood control after the Mt. St. Helens volcanic eruption.

Relevant Construction Experience Continued

1984 – 1987

Vice President and Area Manager of Gilbert Pacific Corp. subsidiary of Peter Kiewit Sons. Office located in Camas, Washington. Estimating and Oversight of merit-shop construction projects. Manager of Quarry operations at the Camas Quarry and English Gravel Pit operations.

1987 –1989

Area Manager in the San Diego area office responsible to estimate and sponsor new work in the Southern California i.e.: \$46 million dollar I-8 and 125 Cal Trans interchange. Subdivision grading work in Rancho Santa Fe, New state highway relocation 86 at Salton Sea, California.

1989 –1990

Project Manager on the \$140 million dollar Corps of Engineers project to construct a new Navigation Lock at Bonneville Lock and Dam on the Columbia River near Cascade Locks, Oregon.

1990 –1992

Project Manager on an \$80 million dollar, 11 mile long, 108 inch Diameter steel welded pipeline through San Marcos, California for the San Diego County Water Authority.

1993 – 1994

Segment Manager on the Crown Valley Section (one of four sections) of the \$800 million dollar San Joaquin Toll road in Orange County, CA. The Project was for the Transportation Corridor Agencies (TCA) to design and build 17 miles of six-lane freeway, with 78 box girder bridges, on State Route 73 between Newport Beach and San Juan Capistrano, CA.

1995

Project Manager on the Eastside Reservoir (West Dam) project for the Metropolitan Water District of Southern California. Excavate 12 million cubic yards in 120 days for phase one of the West Dam project near Hemet, CA.

Relevant Construction Experience Continued

1996

Deputy Project Manager for the \$800 million dollar San Joaquin Toll road Project with over all Field Construction Responsibility.

1997

Project Manager on the Eastside Reservoir (East Dam) \$300 million dollar project near Hemet, California. Excavate 25 million cy, embank 60 million cy, crush and process 11 million cy of filter materials.

California Address:

15805 Lime Grove Road

Poway, CA 92064

H 858-486-9216

e-mail: davidvi@msn.com

Washington Address:

3300 NE 164th st. #CC-2

Ridgefield, WA 98642

H 360-574-6993

C 369-921-5794

e-mail: davidvi@msn.com

FRANK MARGITAN

In a career spanning over 37 years with Kiewit, Frank has been responsible for the management and construction of numerous heavy civil and mining projects in Canada and the United States. Most recently as the Vice President of Kiewit Canada, he had management responsibilities in Western Canada, the Yukon and Northwest Territories. He was instrumental in estimating, negotiating and successfully delivering over \$5 Billion worth of projects during his career.

Frank played a significant role in several high profile projects in British Columbia, including the \$2.5 Billion Port Mann Highway 1 project, the largest project in Kiewit's history; the \$600 Million Sea to Sky Highway project and the \$500 Million Plutonic Run of River hydro project. He is widely recognized for his depth and variety of experience, his talent for developing people and his ability to win projects and deliver them on time and on budget.

With an aptitude for developing excellent relationships with owners and partners, Frank is an industry leader whose advice is sought by his peers, colleagues and competitors. He has generously offered his time and insights to education institutions and philanthropic organizations, including the United Way.

Positions: Past Vice President, Peter Kiewit Sons and Kiewit Infrastructure Co.
Past Vice President, Kiewit Flatiron General Partnership
Past Assistant District Manager, Kiewit Western Canada
Past Director, VK Mason
Past Chair & Director, BC Roadbuilders & Heavy Construction Association
Board Member, Crofton House School
Past Campaign Chair, United Way
Judge, Awards for Engineering Excellence, ACECBC

Roles: Construction and Engineering Specialist:
Highways, Bridges, Hydroelectric, Transmission Lines,
Mining, Industrial, Marine
Labour Relations, General and Personnel Management
Contract Negotiations and Management
Marketing and Project Estimating
First Nations Advisor

Education: B. Sc. Civil Engineering, University of British Columbia, 1976
Professional Engineer – BC

Affiliations: Canadian Society of Civil Engineers
BC Roadbuilders and Heavy Construction Association
Alberta Roadbuilders and Heavy Construction Association
Western Canada Roadbuilders and Heavy Construction Association
Independent Contractors and Business Association of British Columbia
Canadian Construction Association
Canadian Council for Public Private Partnerships

B. J. (Bev) Trautman

20213 SE 245th St.
Maple Valley, WA 98038
(250) 358-2336
(425) 413-1604

SUMMARY

Mr. Trautman has over 45 years of experience in major heavy/civil engineering and construction throughout the United States, with a strong emphasis on operations, planning, and the directing of projects to successful completion. Responsibilities included oversight of all aspects of construction from the estimating and bidding phases, management of projects during construction, and final turnover of the project to the owner. Upon entering semi-retirement several years ago, Mr. Trautman has participated in constructability review of projects prior to advertisement, active contract administration, and dispute review board assignments.

On occasion, Mr. Trautman has been retained by Balfour Beatty Infrastructure, Inc. to oversee joint venture tunnel projects at several locations in the United States. His duties included the review of project estimates for fixed price contracts prior to bid, followed by an operational overview of contracts upon award. To date, 8 tunnel projects exceeding \$750,000,000 in volume have been overseen by Mr. Trautman in conjunction with ML Shank CO the managing partner.

EXPERIENCE

Balfour Beatty Construction, Inc. Division Manager, Western Region.

Duties included full management responsibility to select projects to bid, to assist and review estimate preparation, and direct operational control of all field efforts on work under contract. Completed a number of projects such as replacement of foundations under north approach of the Golden Gate Bridge, seismic upgrade to foundations of the north approach to the Oakland Bay Bridge, 29 cell cofferdam on the Ohio River for new Olmsted Lock & Dam,

Torno-America, Inc. Vice President, Operations.

Responsibilities included oversight on the selection of projects to bid, cost estimating new work, operational management of ongoing projects, procurement of major equipment, selection and hiring of field management personnel, monitoring of cost and schedule performance of projects, and contract negotiation with the owner's representatives on major contractual issues.

Harrison Western Corporation. Vice President and Manager of Civil Group.

Duties included managing the efforts of four operating divisions and a central estimating staff created to prepare cost estimates for various corporate units, including civil, tunnel, pipeline and mechanical electrical entities.

S. J. Groves – Hydroelectric Division. Operations Manager.

Provided supervision for all aspects of construction on up to six projects running concurrently throughout the United States.

Groves-Kiewit-Granite Joint Venture. Project Construction Manager for S. J. Groves. Sponsoring joint venture partner for the construction of a \$306 million hydroelectric project at Bonneville Dam, North Bonneville, Washington. Assisted in bidding the contract and managed all facets of construction from award in 1978 to completion in 1982.

Groves-Granite Joint Venture. Project Construction Manager for S. J. Groves. Assisted in the preparation of the cost estimate and managed the construction of \$55 million in an eleven unit addition to Chief Joseph Powerhouse, situated downstream from the Grand Coulee Dam on the Columbia River.

EDUCATION

BS: Civil Engineering, Gonzaga University, 1961

ACHIEVEMENT

Mr. Trautman was nationally recognized by the construction industry in 1983 when he received the Beavers Heavy Construction Industry Award for Supervision for his oversight of the Bonneville Second Powerhouse project.

HYRDO PROJECTS

The following projects were either managed directly by Mr Trautman or overseen as part of operations management duties.

Loon Lake Powerhouse. An 80 megawatt underground unit with 1200ft vertical penstock, single Pelton turbine, 4 mile tailrace tunnel.

Tyee Lake. A 2 unit 20 megawatt surface plant fed thru a 2500ft tunnel and 1250 vertical shaft connected to lake intake by live lake tap.

Swan Lake. A 2 unit 30 megawatt surface plant fed by 3500 ft inclined tunnel from 150ft high double curvature arch dam.

Green Lake. A 2 unit 25 megawatt surface plant fed by 3000ft tunnel from 160ft high arch dam.

Idaho Falls Project. Three each single unit low head run of the river plants on the Snake river.

Senora Power House. A 25 megawatt surface plant fed thru 5000 ft tunnel utilizing the fall of the south fork of the Stanislaus River.

Cowlitz Falls. A 40 megawatt 2 unit run of the river dam and powerhouse.
Roosevelt Dam Intake works. Work included drilling a 20ft diameter shaft under water, 1500 ft of tunnel to reconnect to an existing powerhouse. This was a historical site with very stringent water quality and environmental controls
Beldon Penstock. A 1500ft 10ft diameter 300ft head steel pipe penstock on concrete support and anchors to feed a new powerhouse on the Feather River.