

44th ANNUAL MEETING WESTERN SNOW CONFERENCE

APRIL 20-22, 1976

The Palliser
Calgary, Alberta, Canada



PROCEEDINGS
of the
WESTERN SNOW CONFERENCE

Calgary, Alberta

April 20 - 22, 1976

FORTY-FOURTH ANNUAL MEETING

Archie M. Kahan (General Chairman)
Bureau of Reclamation
Code 1200, P. O. Box 25007
Denver Federal Center
Denver, Colorado 80225

Robert T. Davis (Secretary)
Soil Conservation Service
Room 360 U. S. Courthouse
Spokane, Washington 99201

Program Committee

Jack A. Wilson, Chairman
Lloyd Cox

Editorial Committee

Jack N. Washichek, Editor
Jack A. Wilson
Robert T. Davis

Printed by

Colorado State University
Fort Collins, Colorado

PROCEEDINGS OF THE WESTERN SNOW CONFERENCE

TABLE OF CONTENTS

	Page
NUCLEAR TECHNIQUES APPLIED TO HYDROLOGY	
By R. G. Morrison	1
A PORTABLE PROFILING SNOW GAUGE - RESULTS OF FIELD TESTS ON GLACIERS	
By G. J. Young	7
THE APPLICATION OF ISOTOPIC PROFILING SNOW GAUGE DATA TO AVALANCHE RESEARCH	
By R. L. Armstrong	12
WATER IN FRESHLY-FALLEN SNOW	
By E. V. Stashko	20
A METHOD FOR DETERMINING SENSIBLE HEAT TRANSFER TO LATE-LYING SNOWDRIFTS	
By L. M. Cox and J. F. Zuzel	23
SNOW CREEP INVESTIGATIONS NEAR THE SNETTISHAM TRANSMISSION LINE IN SOUTHEAST ALASKA NEAR JUNEAU, By R. L. Meyer	29
METRICATION OF BRITISH COLUMBIA SNOW SURVEY OPERATIONS	
By D. B. Letvak	36
SNOW PILLOW EXPERIENCES IN A PRAIRIE (ALBERTA) ENVIRONMENT	
By W. E. Kerr	39
SYNOPTIC PATTERNS ASSOCIATED WITH HEAVY SPRING SNOWFALLS IN SOUTHWESTERN ALBERTA, By B. Janz	48
SNOWMELT RECHARGE ON A SHORTGRASS PRAIRIE SITE	
By B. P. Vanhaveren and W. D. Striffler	56
AREAL WATER EQUIVALENTS FOR PRAIRIE SNOWCOVERS BY CENTRALIZED SAMPLING	
By H. Steppuhn	63
AN ESTIMATE OF WATERSHED EFFICIENCY FOR A COLORADO ALPINE BASIN	
By T. Carroll	69
COMPARISON OF PRECIPITATION-GAUGE AND SNOWPILLOW DATA FROM A SEVERE APRIL SNOWSTORM IN A MOUNTAIN WATERSHED, By D. Storr and D. L. Golding	78
THE SIMPAK PROGRAM, APPLICATION TO SIMPLIFIED STREAMFLOW FORECASTING	
By R. O. Lyons	87
GRID SQUARE RUNOFF MODEL	
By W. Obedkoff	94
FLOOD FORECASTING - OLDMAN RIVER BASIN	
By A. M. Mustapha, G. W. Samide and W. K. Kuhnke	101

	Page
Minutes of the Executive Committee	i
Minutes of the Business Meeting	vii
Attendance Roster	xii

MINUTES OF THE EXECUTIVE COMMITTEE

WESTERN SNOW CONFERENCE
Calgary, Alberta

The meeting was called to order by General Chairman A. Kahan at 11:30 A.M. The Chairman thanked J. Washichek for his contribution to the table decoration. The Chairman asked the Secretary to read the minutes of the Del Coronado meeting. R. Davis stated that the minutes were published in the 43rd Proceedings and moved that the minutes be approved as published. D. Kuehl seconded. Motion carried.

The General Chairman asked that the Secretary present the financial statement of the conference. R. Davis explained the financial statement, as audited by R. Benker and D. Felgenhauer, showed that the conference had a net loss of \$25.20. After the presentation of the financial statement the Secretary moved the acceptance of the financial report. Seconded by J. Smith. Motion carried.

The General Chairman asked for the report of the Publication Committee from the Chairman, J. Washichek. J. Washichek stated that he had no report.

The General Chairman asked for a report from the Archives Committee. R. Moreland stated that there was no report.

The General Chairman then asked for the Dr. Church Committee report. R. Moreland stated that John Stoughton was the designated recipient of the Dr. Church Award and stated his qualifications. He will be entering the University of Nevada Medical School in the fall.

The General Chairman stated that generally there is no report from the Awards Committee at this time, but that each member is to cooperate with the Awards Chairman regarding the festivities this evening. R. Brown stated that he had no report but requested that the Area Chairman supply him with a firm candidate for the El Farsante and also supply him with names of proposed Life Members. He also stated that he understood that candidates for Life Membership are to be voted on by the Executive Committee. There was considerable discussion on the qualifications for life membership by J. Wilson, D. Kuehl, R. Davis, R. Brown, and A. Kahan. A constitutional amendment was proposed by D. Kuehl and seconded by R. Moreland to strike the age "60" from subsection A, Article III, Chapter 4 and substitute "55". This proposal will be put to the membership at the general meeting on Thursday as all constitutional amendments must be approved by two thirds of the members at the general meeting or by a simple majority on a mail ballot. F. Limpert suggested that any proposed life memberships approved at this meeting be approved retroactively if the constitutional amendment is passed at the general meeting. A. Kahan said that there was a motion to bring before the general membership the constitutional amendment. The motion carried.

F. Limpert moved that contingent upon the acceptance of the previous motion that any members eligible be awarded life memberships this year, seconded by J. Wilson. Motion carried.

The General Chairman recessed the meeting for lunch.

The Snowflake Tie Committee report was given by J. Washichek. He had for display two examples of pewter ties which were handed around. He proposed that a single tie shape be authorized with a stone inset in the center to designate the appropriate area. The bolo would be a neutral color and the same for all ties. Discussion followed by F. Limpert, A. Kahan, J. Washichek, D. Kuehl and J. Wilson. J. Smith moved that J. Washichek be authorized to proceed with the casting of silver snowflake ties with appropriate inset stones for use as presentation only. D. Kuehl seconded. Motion carried.

J. Wilson moved that all active past general chairman be so honored. Seconded by J. Smith. D. Kuehl moved it be amended to strike "active". The amendment was acceptable to the original mover and seconder. Motion carried.

The General Chairman asked the committee to listen to a discussion on a text for snow hydrology. Since this is not executive business it will not be reported here.

The General Chairman asked for the current status of the Forum. There was considerable discussion by J. Wilson, D. Kuehl, P. Farnes, J. Smith, A. Kahan and R. Davis. It was read from the 1973 minutes that it was the responsibility of the Publications Committee to select an editor for the Forum. H. Hunter made a plea for material from the Executive Committee. R. Brown suggested that the nominations for El Farsente be written up for the Forum.

The General Chairman asked if there were any further proposed constitutional amendments that should be brought before the general meeting. D. Kuehl suggested that the dues might be increased. Discussion followed by R. Brown, J. Smith, A. Kahan, F. Limpert, R. Moreland and J. Wilson. J. Wilson moved that the dues be raised from three to five dollars. F. Limpert seconded. Motion carried.

C. McCullough moved that the corporate dues be increased from "not to exceed \$50.00" to from "\$20.00 to \$100.00". The motion was amended to also specify that "the Corporate member would receive one copy of the Proceedings and Forum for each \$6.00 contributed". J. Smith seconded. Discussion followed by D. Kuehl, J. Smith, R. Davis, A. Kahan, K. Reed, R. Brown, F. Limpert and H. Hunter. The motion was withdrawn.

The General Chairman suggested that the Secretary be instructed to contact the corporate members to explore ways of recognizing the increased cost without decreasing the net to the Western Snow Conference. The alternative of decreasing the number of copies to the corporate member or increasing the amount of the corporate contribution.

The General Chairman asked if the South Pacific Area had a candidate to propose for the new General Chairman. R. Brown reported that the South Pacific Area has unanimously elected, with one abstention, to propose the name of Dr. James L. Smith as the new General Chairman of the Western Snow Conference. The General Chairman then announced that R. T. Brown will succeed J. Smith as Area Chairman and R. Moreland will be appointed as the fifth representative of the South Pacific Area. There being no further nominations for the position of General Chairman, F. Limpert moved that nominations be closed, seconded by J. Wilson. The General Chairman then stated that J. Smith is elected by acclamation.

The General Chairman then stated that Albuquerque is the location for the next Western Snow Conference meeting, and asked that J. Washichek convey the thanks of the conference to those that supplied the greetings. As for the 1978 meeting, the General Chairman stated it is the responsibility of the North Pacific Area and asked if the North Pacific Area had any report. F. Limpert reported that the area committee had selected the Oregon coast as the site of the 1978 Western Snow Conference meeting, specifically that area around Lincoln City which is due west of Portland. The exact site (hotel/motel) has not been selected as yet. It was moved by B. Berling that the executive committee accept the report of the North Pacific Area which recommends the Lincoln City, Oregon area for the 1978 conference. Seconded by R. Brown. Motion carried.

The General Chairman then named D. Kuehl and F. Limpert as the resolution committee with D. Kuehl as Chairman.

The General Chairman then asked R. Leake to give the Wilderness Committee report. (See report at end of these minutes)

It was moved by C. McCullough and seconded by A. Crook that the Wilderness report and recommendations be accepted. Further comments were made by P. Farnes, A. Kahan, J. Smith and K. Reed. The motion carried.

The General Chairman discussed the desirability of setting up a metrification committee. F. Limpert discussed the existing metrification committee set up in the Office of Water Data Coordination that will probably be contacting both the Eastern and Western Snow Conferences for input. H. Coulson reported that the Eastern Snow Conference Research Committee is working on this plus a whole concept of recording as well as reporting the data and data cited. Further discussion was made by F. Limpert, J. Smith, D. Kuehl and H. Hunter. The difference between SI units and WMO units was brought out. H. Coulson commented that B. C. is using cm for snow depth and mm for water equivalents. This is not according to the SI units but is being used by WMO. The General Chairman then appointed H. Coulson to chair this committee, and asked F. Limpert to participate. C. McCullough volunteered

J. Brown as a member of this committee. A. Crook also volunteered to be a member. R. Berling also volunteered to participate as a user. J. Wilson moved that the above named members be appointed as a Metrification Committee. J. Washichek seconded. Motion carried.

J. Wilson discussed the idea that papers not being presented during the technical sessions might be published in the Proceedings. A. Kahan commented that presentation by title only is sometimes used to get by this matter. P. Farnes and D. Kuehl commented further. J. Smith commented that there is the possibility of having a paper presented in brief or abstract form and then printed in its entirety. A. Kahan brought out the idea of concurrent sessions as a way around this. The General Chairman suggested that this be left in the hands of the Publication Committee.

The General Chairman then brought up the idea that attendance at workshops is sometimes easier to obtain than attendance at scientific meetings and there would be merit in the Western Snow Conference holding "Hydrology Workshops" instead of conferences. F. Limpert stated that BPA considers the Western Snow Conference a working session that is part of employee development and therefore does not require the approval as for the ASCE or ASME. J. Smith suggested that the General Chairman appoint a committee to canvass the membership to find out the situation with regards to the Canadian and U. S. entities. This is to determine their thinking about what type of educational program is necessary to improve attendance at the Western Snow Conference. The General Chairman agreed and appointed L. Warner Chairman, B. Berling, A. Crook and P. Farnes. There was discussion by A. Crook, H. Hunter, F. Limpert, J. Wilson, L. Warner, A. Kahan, C. McCullough and J. Smith.

R. Brown brought forward the thought that Life Membership awards must be voted on by the Executive Committee. At the request of the General Chairman he proposed the names of 1) S. E. Rantz, 2) G. Pearson, 3) D. Storr, 4) R. Lindgren. It was moved by R. Brown that the above named members be awarded Life Membership, seconded by R. Berling. Motion carried.

R. Brown asked for the names of any Life Members that had passed away during the year. The names of Roe Heller and P. R. Lockie in the North Pacific Area were all that was mentioned.

There being no further business the meeting was adjourned.

Respectfully submitted,

Robert T. Davis, Secretary

MINUTES OF THE BUSINESS MEETING

WESTERN SNOW CONFERENCE

Calgary, Alberta

The meeting was called to order by General Chairman A. Kahan at 10:45 A.M.

The General Chairman asked for the secretary's report of the minutes of the 43rd annual business meeting. R. Davis stated that the minutes of the meeting were published in the Proceedings and submitted them as published. B. Thomas moved that the minutes be accepted as published and L. Ambrose seconded. Motion carried.

The General Chairman requested the treasurer to present the financial report of the conference. R. Davis reviewed the annual income and disbursements for the year announcing that there was a loss for the year of \$25.20. The books of the conference were audited by R. Benker and D. Felgenhauer and found satisfactory. R. Davis submitted the financial statement to the membership of the conference for their consideration. It was moved by L. Ambrose that the financial report be accepted, seconded by B. Clorety. Motion carried.

The General Chairman asked that R. Moreland give the Dr. Church Award report (See minutes of Executive Committee).

The General Chairman asked R. Leake to give the Wilderness Committee report (See report following Executive Committee minutes). Additional comment was made by L. Ambrose. R. Leake moved the adoption of the recommendations stated, C. McCullough seconded. Motion carried.

The General Chairman commented on the status of the Forum. If it is the wish of the membership to continue the Forum, positive action must be taken. Material should be sent to J. Washichek, Chairman of the Publications Committee, who has the authority to name an editor and can send the material received to the new editor for inclusion.

The General Chairman asked D. Kuehl to present the recommended Constitutional amendments. D. Kuehl moved that the Constitution and By-laws of the Western Snow Conference be amended to increase the dues, and cost of the Proceedings be increased from \$3.00 to \$5.00. J. Wilson seconded. Motion carried.

The General Chairman commented and stated that a committee had been appointed to look into the problem of attendance at the Conference.

The General Chairman stated that Albuquerque has been selected as the meeting location for the 1977 annual meeting of the Western Snow Conference, and that the Oregon coast in the area of Lincoln City had been proposed for the 1978 meeting location. The General Chairman asked for a motion approving the Oregon coast - Lincoln City area for the 1978 meeting location. F. Limpert so moved. B. Berling seconded. Comments and questions were made by F. Limpert, A. Kahan, J. Smith, L. Ambrose and B. Thomas. Motion carried with one negative vote.

The General Chairman commented on the question of possibly increasing the number of papers presented or published by the Western Snow Conference, and asked for comments from the floor. J. Wilson commented further with the suggestion of adding 6-8 papers by using the partial split session. J. Smith commented he is against the split session and stated why. F. Limpert commented further as did D. Kuehl, A. Crook, and R. Davis. The General Chairman stated that since it is a part of the Publications Policy to adjust the number of papers, etc., to fit the current needs, that the matter will be left with the Publications Committee working with the Program Committee to set the policy for each meeting.

The General Chairman stated that a Metrification Committee had been appointed (see minutes of Executive Committee).

The General Chairman asked for the report of the Resolutions Committee. D. Kuehl gave the report, (see resolutions following), and moved that they be sent to the recipients, seconded by L. Ambrose. Motion carried.

The General Chairman asked for the report of the Awards Committee. (These were made at the banquet and are presented here for the record). Life Members: R. Lindgren, D. Storr, S. Rantz, and G. Pearson. Honorary Life: J. Davis. El Farsante: A. Carpenter. R. Brown moved the acceptance of these awards, R. Moreland seconded. Motion carried.

D. Felgenhauer suggested the use of Microfiche for all past and current publications. The General Chairman stated that he will instruct the Secretary to contact the Chairman of the Publication Committee for a report at the next meeting. D. Kuehl commented, as did F. Limpert and A. Kahan. J. Smith asked about the policy of committee memberships, and the General Chairman responded that it was the authority of the General Chairman to reconstitute any standing or ongoing committee.

B. Goodison asked that the Metrification Committee of the Western Snow Conference be instructed to keep in touch with the Research Committee of the Eastern Snow Conference in order to benefit both.

The General Chairman then turned the gavel over to the new General Chairman, but before doing so, thanked the committees that put on the conference here in Calgary.

J. Smith accepted the gavel as the new General Chairman and asked if there was any further business. There being none, he declared the meeting adjourned.

Respectfully submitted,

Robert T. Davis, Secretary

Awards presented at the Annual Banquet, Wednesday, April 21, 1976.

Honorary Life Membership: Jackie R. Davis

Life Membership: Richard Lindgren
 Don Storr
 S. E. Rantz
 Gregory Pearson

El Farsante: A. "Dib" Carpenter

ATTENDANCE ROSTER
 WESTERN SNOW CONFERENCE
 CALGARY, ALBERTA
 April 20 - 22, 1976

Ambrose, Lewis R.	Seattle, Washington
Angelakos, D. J.	Berkeley, California
Armstrong, Richard L.	Silverton, Colorado
Assmus, Neil	Sherwood Park, Alberta
Atkins, Roy R.	Aledo, Texas
Barnaby, Ian E.	Edmonton, Alberta
Bauer, Don J.	Saskatoon, Saskatchewan
Bombardier, B. B.	Tacoma, Washington
Berling, Mr. & Mrs. Bob	Loveland, Colorado
Brooks, Kenneth N.	St. Paul, Minnesota
Brown, Bob	Rosemead, California
Brown, Robert J.	Irvine, California
Bryant, George S.	Warminster, Pennsylvania
Carpenter, Dib	Concord, California
Carroll, Tom	Boulder, Colorado
Chapman, Edward F.	Calgary, Alberta
Christianson, Wm.	Tulsa, Oklahoma
Clorety, Barney	Sacramento, California
Coles, G. A.	Edmonton, Alberta
Coulson, Mr. & Mrs. Hal	Victoria, British Columbia
Cox, Lloyd M.	Boise, Idaho
Crook, Mr. & Mrs. Art	Beaverton, Oregon
Dahl, Mr. & Mrs. Bob	Oakdale, California
Daly, Ken. W.	Edmonton, Alberta
Davis, Mr. & Mrs. Robert T.	Spokane, Washington
Dunlap, Donald V.	New Brunswick, New Jersey
Dyer, Fred	Seattle, Washington
Eaken, Mr. & Mrs. Glen	Tacoma, Washington
Eaken, David	Tacoma, Washington
Eakin, Ralph D.	Oakland, California
Elliott, Robert D.	Goleta, California
Ewald, George E., Jr.	City of Industry, California
Farnes, Phil	Bozeman, Montana
Felgenhauer, Don	Spokane, Washington
Fetty, Carl W.	Hillsboro, Oregon
Ffolliott, Peter	Tucson, Arizona
Fox, W. B.	McLean, Virginia
Golding, Douglas L.	Edmonton, Alberta
Goodison, Barry	Downsview, Ontario
Guenther, Mr. & Mrs. Glenn	Edmonton, Alberta
Hedberg, Dennis	Bozeman, Montana
Holecek, George	Edmonton, Alberta
Hunter, Mr. & Mrs. Harry	Victoria, British Columbia
Janz, Ben	Edmonton, Alberta
Kahan, Mr. & Mrs. Archie	Lakewood, Colorado
Kerr, W. Elliot	Edmonton, Alberta
Konizecki, Dick	Missoula, Montana
Kuehl, Don	Portland, Oregon
Kuhnke, Bill	Edmonton, Alberta
Ladine, D. A.	Burbank, California
Leaf, Chuck	Fort Collins, Colorado
Leake, Robert E., Jr.	Fresno, California
Letvak, Bruce	Victoria, British Columbia
Limpert, Mr. & Mrs. F. A.	Portland, Oregon
Lyons, R. O. (Neill)	Vancouver, British Columbia
MacIntyre, Don I.	Edmonton, Alberta
McCall, Mr. & Mrs. Warren	Tacoma, Washington
McCullough, Charles A.	Sacramento, California
McFalls, Mr. & Mrs. Jim	Calgary, Alberta

Mann, Mr. & Mrs. A. S.	Edmonton, Alberta
Manz, David H.	Lethbridge, Alberta
Meadows, Neil C.	Calgary, Alberta
Mei, Kenneth K.	Berkeley, California
Meyer, Robert L.	Anchorage, Alaska
Molnau, Myron	Moscow, Idaho
Moreland, Mr. & Mrs. Ronald	Reno, Nevada
Morrison, Rod	Boise, Idaho
Mustapha, A. Majeed	Edmonton, Alberta
Nemanishen, Walter	Calgary, Alberta
Newman, Howard C.	Missoula, Montana
Nguyen, Thai	Edmonton, Alberta
Norseth, Donald	Salt Lake City, Utah
Obedkoff, William	Victoria, British Columbia
Omness, Lorraine	Edmonton, Alberta
Pipes, Anthony	Vancouver, British Columbia
Poliquin, W. H.	Surrey, British Columbia
Potter, B. L.	Red Deer, Alberta
Purcell, Mr. & Mrs. Ralph	Vancouver, British Columbia
Reed, Kenneth R.	Portland, Oregon
Bothwell, Richard L.	Edmonton, Alberta
Ryckborst, Hans	Edmonton, Alberta
Schaefer, D. Garry	Vancouver, British Columbia
Shillinglaw, Mr. & Mrs. Robert	Seattle, Washington
Smith, James L.	Berkeley, California
Stashko, Edward	Edmonton, Alberta
Steed, Glen L.	Lethbridge, Alberta
Steppuhn, Harold	Saskatoon, Saskatchewan
Strauss, Fred A.	Porterville, California
Sundberg, Eric	Bozeman, Montana
Swanson, Robert H.	Edmonton, Alberta
Tabler, Ronald D.	Laramie, Wyoming
Tanner, Willa	Edmonton, Alberta
Taylor, Jeff L.	Fresno, California
Thomas, Billy J.	Portland, Oregon
Tibbs, James H.	Bozeman, Montana
Van Haveren, Bruce P.	Denver, Colorado
Wallace, Mr. & Mrs. J. M.	Vancouver, British Columbia
Warner, Mr. & Mrs. Lyman A.	Calgary, Alberta
Washichek, Mr. & Mrs. Jack	Denver, Colorado
Wilson, Mr. & Mrs. Jack	Boise, Idaho
Young, Gordon J.	Ottawa, Ontario