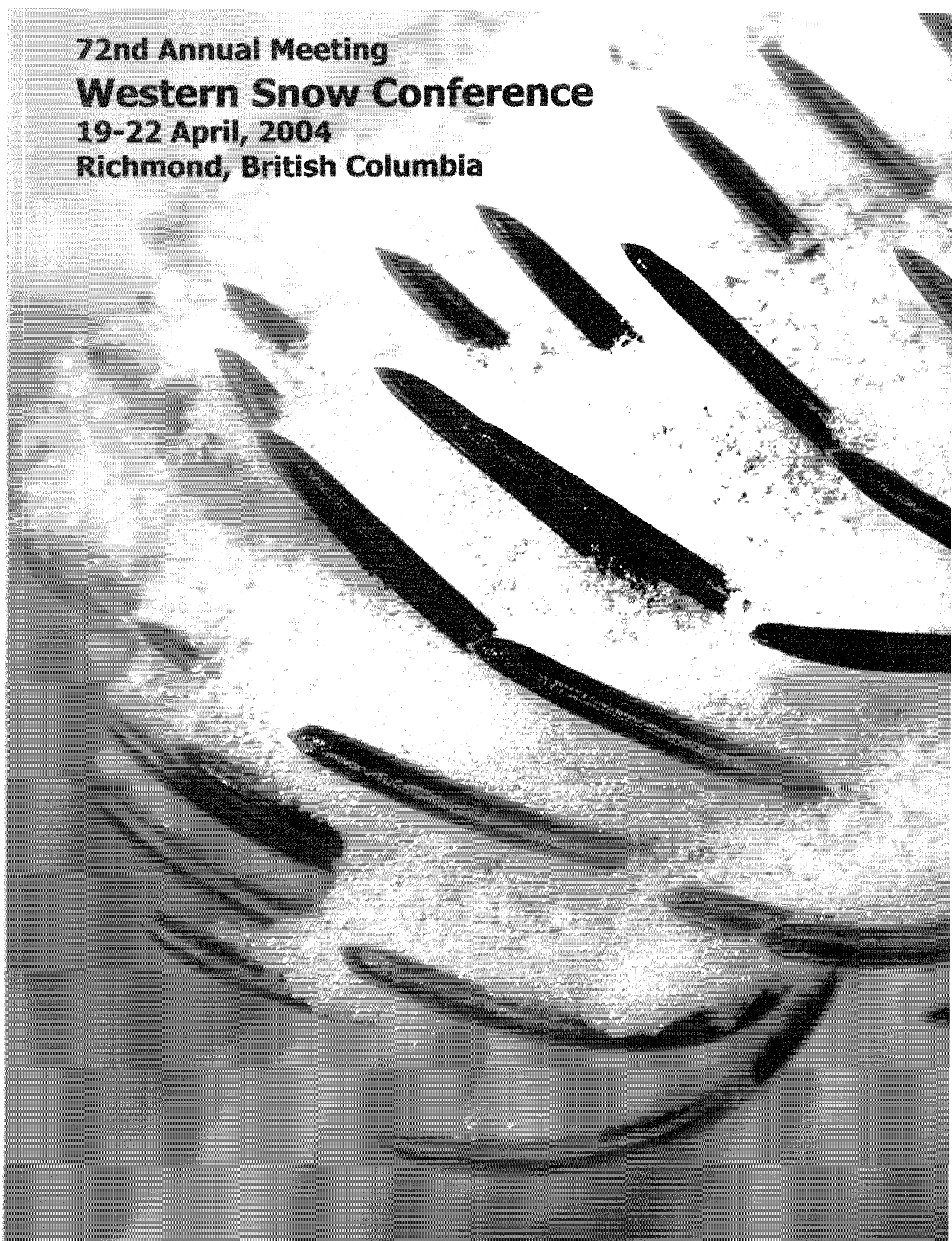


72nd Annual Meeting
Western Snow Conference
19-22 April, 2004
Richmond, British Columbia



**PROCEEDINGS
OF THE
WESTERN SNOW CONFERENCE**

**RICHMOND, BRITISH COLUMBIA
APRIL 19-22, 2004**

SEVENTY SECOND ANNUAL MEETING

Don Huffman (General Chair)
USDA – NRCS
Portland, OR 80526

Randal Osterhuber (Secretary/Treasurer)
Soda Springs, CA 95728

Editorial Committee:
Kelly Elder, Editor
Bruce McGurk, Assistant Editor
Jon Lea, Program Chair

Printed by

omnipress.

1-800-828-0305 www.omnipress.com

For sale by the Western Snow Conference - \$35.00

Order From:
Randall Osterhuber
P.O. Box 810
Soda Springs, CA 95728
Phone: (530) 426-0318
randall@sierra.net

Cover Photo:
Snowfall interception by *Abies lasiocarpa*
Kelly Elder

**PROCEEDINGS OF THE
2004 WESTERN SNOW CONFERENCE**

TABLE OF CONTENTS

PAPERS

The effect of basin scale on diurnal streamflow timing by Jessica Lundquist and Michael Dettinger	3
Variability and trends in mountain snowpacks in western North America by Philip Mote, Alan Hamlet, and Dennis Lettenmaier	15
The relationship between synoptic weather patterns and snowpack stability in a high-latitude maritime snow climate by Kent Scheler, Peter Carter, and Eran Hood	23
Snowmelt in a forest and clearcut by David Spittlehouse, and Rita Winkler	33
Effects of small logged openings on snow ablation during a high snow year by Patrick Teti	45
Identifying snow indices for forest planning in southern British Columbia by Rita Winkler, David Gluns, and Doug Golding	53
Effect of alternative silvicultural treatments on snow accumulation in lodgepole pine stands, Montana by Scott Woods, Ward McCaughey, Robert Ahl, and Jason Sappington	65
Computer assisted avalanche forecasting: skier-triggered avalanches by Antonia Zeidler and Bruce Jamieson	75

POSTERS

Evaluating the stuffblock and tilt board snowpack tests as snow avalanche forecasting tools by Peter Carter, Matt Heavner, and Eran Hood	87
A history of the Skagit River Basin snow surveys and hydroelectric project by Scott Pattee	95
The complete WRENS hydrologic model by Robert Swanson	99

SNOW NOTES

Trip report of Lightning Creek Trail snow survey accident, Skagit River, February 3, 1947 by Scott Pattee	105
WESTERN SNOW CONFERENCE: MINUTES OF EXECUTIVE MEETING	113
WESTERN SNOW CONFERENCE: MINUTES OF GENERAL BUSINESS MEETING	115
WESTERN SNOW CONFERENCE: LIST OF ATTENDEES	117

Minutes of the Western Snow Conference Executive Committee Meeting

Richmond, British Columbia, Canada April 19, 2004

In attendance:

Abramovich, Ron
Allerman, Rob
Beard, Jerry
Brunengo, Matt
Gilbert, Ted
Hannaford, Jack
Huffman, Don

Julander, Randy
Kattelmann, Rick
Lea, Jolyne
Lea, Jon
McGurk, Bruce
Osterhuber, Randall
Pattee, Scott

Rango, Al
Schaefer, Garry
Smith, Stephanie
Tolsdorf, Tony
Whaley, Bob

Huffman called the meeting to order at 1430.

Minutes of the 2003 Executive Committee Meeting

- Changes to the minutes of the Executive Committee meeting as printed in the 2003 Proceedings (not yet printed) will wait until the WSC 2005 Executive Committee meeting.

Executive Committee Membership

- Changes to Executive Committee members discussed. McGurk reported that Rey Encarnacion of East Bay MUD will be a new member for the South Pacific area. WSC bylaws state no Executive Committee member shall serve for more than four (4) consecutive two-year terms. Due to difficulty in recruiting new Exec Committee members, some members have exceeded the four term limit. No action on this at this time, but was agreed that interest in serving on the Exec Committee will follow interest in the WSC in general. As more people become involved with the WSC, area chairs will pursue potential new Exec Committee members.

Treasurer's Report

- Osterhuber reported a current WSC bank account of \$22,224.58. Account balance one year ago was \$15,450.04. Major annual expenses not yet incurred are the printing of the WSC 2003 Proceedings and expenses of the current (2004) meeting. The WSC books are open and can be audited by anyone, anytime.

2003 WSC, Scottsdale, Arizona

- McGurk reported that the WSC 2003 in Scottsdale, Arizona, though a little poster-paper shy, was very successful. The presentation and technical level of all the papers was very good. 60 people attended the conference. Total meeting costs were \$6,374.28. A \$5000.00 donation from the NRCS helped tremendously. Hannaford reported that Noah Molotch, Kent Scheler, and Thomas Pagano were the award recipients (for Best Paper, Best Poster, Best Student Paper/IE Church Award, respectively) from the 2003 meeting. For a broad number of miscalculations (too many to list here), Don Huffman was granted the 2003 El Farsante Award.
- Printing of the WSC 2003 Proceedings has been late due to several factors. The July 1 deadline (for the final, camera-ready version of authors' papers) that was adopted by the WSC last year will be enforced from here on. Final versions of papers not submitted by July 1 will be omitted from the printed proceedings and not be eligible to receive any award from the WSC. Even though specific guidelines are supplied to all authors, McGurk reported that roughly 20 percent of the papers received for publication are not formatted to the specifications set forth by the WSC. Much time and effort (by the current area chair) is required to format papers properly. Hiring a technical editor to relieve the area chair from these duties is a possibility, but would probably be costly. Kattelmann suggested a web-based technical paper example/template. McGurk will follow up on this idea.

2004 WSC, Richmond, British Columbia

- Jon Lea reported that organization of the current conference (2004) was going well. A couple authors had cancelled their presentations at the last minute. The staff at the Delta Airport Richmond Hotel has been easy and pleasant to work with. BC Hydro is funding one of the (coffee) breaks. It was decided (on McGurk's recommendation) to use a single laptop computer for the presentations, and have each presenter load his or her presentation onto the one machine. This avoids the problems and time associated with booting up new machines.

2005, 2006, 2007 WSC

- Beard handed out proposals for the 2005 WSC. It will be held in Great Falls, Montana, April 11-14. A motion to move the traditional third-week-in-April meeting date to April 11 was proposed by McGurk, seconded by Allerman, and passed. Beard suggested a historical theme for the conference, coinciding with the 200 year anniversary of the Lewis and Clark Expedition. A proposal to hold the 2005 meeting in conjunction with the Eastern Snow Conference in Canada was graciously declined by General Chair Huffman. The timing was not good for the WSC, but future joint meetings with the ESC or others will always be considered.
- Rango handed out proposals for the 2006 WSC to be held at the Hilton Hotel in Las Cruces, New Mexico, April 17-20. Rango also proposed that the 2007 WSC—the Snow Conference's 75th anniversary—ought to be held someplace special. Say, Hawaii. Hawaii is part of the South Pacific area, so is in the proper area rotation for the 2007 meeting. Pattee, while vacationing in Hawaii this upcoming summer, will investigate possible conference sites. Huffman will query general membership as to their interest in holding the 2007 WSC in Hawaii.

Wilderness Committee Report

- No report on wilderness-based hydro-meteorological instrumentation or telemetry was presented. The WSC will take no official action at this time.

WSC Documents

- Osterhuber has anywhere from 0 to 10 copies of past WSC Proceedings stored at the Snow Lab in Soda Springs, California. He will follow up getting a list of available Proceedings for sale on the WSC website. Osterhuber reported that OmniPress, the current printer of the WSC Proceedings, offers a searchable, web browser-driven CD version of printed journals. The quoted cost for 100 CDs was \$19 each. Osterhuber will pursue (potentially lower) cost/CD of producing a greater number.

Awards

- Huffman will follow up on money that may be available for the Art Crook Award, from a trust set forth by that late WSC member's family. Osterhuber will work on getting a list of past El Farsante awardees to Hannaford.

WSC Website

- Much discussion on the WSC website concerning: links to WSC vendors, other meetings, and supporters; having a place for people to sign on to an email information list; new photographs; and just a lot more updating and updated material. Huffman will talk with webmaster Tom Painter to see if he needs help with keeping the website updated.

Communication Strategy for WSC

- Smith inquired if the WSC had a long-term goal or mission statement for the immediate future. This may aid in directing the WSC toward increasing membership and participation. McGurk wants to build and maintain an email list with which to more frequently contact the WSC membership, possibly up to six times per year. This may make a difference in increasing participation in the WSC. Julander suggested that it may also be time to develop a logo for the WSC. Huffman will query the general membership for logo ideas.
- Osterhuber reported that Roger Bales, the head of the snow hydrology department at the (new) University of California Merced, is looking for a venue at which to hold a workshop for the (snow) remote sensing research and application communities. Would the WSC be an appropriate venue for this? Beard will contact Bales about next year's WSC.

Next General Chair

- Bob Whaley will be the next General Chair of the WSC following the 2004 meeting. Randy Julander is the new General Chair Elect.

Meeting adjourned at 1630.

Minutes of the Annual Business Meeting of the Western Snow Conference

Richmond, British Columbia, Canada April 21, 2004

50 WSC members in attendance.

General Chair Don Huffman called the meeting to order at 1100.

Executive Committee Report

- Huffman briefly discussed topics from the Executive Committee meeting. Jerry Beard reported on the 2005 meeting preparations in Great Falls, Montana. A show-of-hands from the general membership demonstrated wide support of pursuing Hawaii as a 2007 meeting location. Randall Osterhuber gave a financial report as per the Exec Committee meeting and announced that there are 74 participants at this year's meeting. The following discussions ensued:

WSC Logo

- Huffman asked the general membership to submit logo ideas for the WSC. Follow up on this will be at the 2005 meeting in Great Falls, MT.

WSC Website

- It was universally agreed upon by the general membership that the WSC website is currently underused and should be a first vehicle for advertising, promoting, informing, and representing the WSC and its membership.

Technical Papers

- It was requested that when submitting the final versions of technical papers, authors also submit key words as part of the abstract. This will help in locating the research paper when using Bob Swanson's WSC Proceedings search software. Key words will be included in the Proceedings starting this year. It was suggested that the research presented at the WSC be posted on the WSC website in PowerPoint format. This was generally agreed upon as a good idea unless specific authors and/or agencies have some publishing or copyright conflict.

Communication Strategy for WSC

- In order to increase membership and participation in the WSC, it was suggested that the conference diversify beyond only snow science. This could be advantageous for networking among scientists of different disciplines, and may produce other products not currently spawned at the WSC. No specific action on this was decided
- It was suggested that researchers working on especially important or relevant snow science be invited to present their work at future WSCs. Huffman reported that this has been done in the past and recommended that area chairs organizing future WSCs pursue this.

Meeting adjourned at 1200.

Respectfully submitted,
Randall Osterhuber
Secretary/Treasurer, Western Snow Conference
May 18, 2004

Award Recipients of the 2004 Western Snow Conference

Best Paper Presentation

Scott Woods

Evaluating the Effect of Fuel Reduction Treatments on Snow Accumulation and Melt in Lodgepole Pine Stands
(co-authors W. McCaughey, R. Ahl, J. Sappington)

Best Student Paper Presentation/ JE Church Award

Jessica Lundquist

The Effect of Basin Scale on Diurnal Timing
(co-author M. Dettinger)

El Farsante Award

Randall Osterhuber

For accepting the WSC Secretary/Treasurer's position in the first place!

1. Abramovich, Ron	USDA-NRCS	ron.abramovich@id.usda.gov
2. Ahl, Robert	Univ of Montana	rob.ahl@umontana.edu
3. Allerman, Rob	PacifiCorp	robert.allerman@pacificorp.com
4. Anderson, Craig	CU-Boulder	cranders@colorado.edu
5. Baumann, Frank		fwbaumann@shaw.ca
6. Beard, Jerry	USDA-NRCS Snow Survey	jerry.beard@mt.usda.gov
7. Biduk, Steve	Geo Scientific, Ltd.	info@geoscientific.com
8. Blandford, Troy	Univ of Idaho	blan9320@uidaho.edu
9. Bowerman, Nicole	Western Washington University	bowermn@cc.wvu.edu
10. Brunengo, Matt	Portland State University	mbrunengo@aol.com
11. Carcoana, Radu	North Dakota State Univ	radu.carcoana@ndsu.nodak.edu
12. Carter, Peter	University of Alaska Southeast	peter.carter@uas.alaska.edu
13. Corner, Steve	BC Min of Water/Land/Air Protection	steve.corner@gems6.gov.bc.ca
14. Cryer, Randy	Ute Ltd	snow@uteltd.com
15. Doyle, Chris	Meteorological Service of Canada	chris.doyle@ec.gc.ca
16. Encarnacion, Rey	East Bay MUD	rey@ebmud.com
17. Erickson, Jessica	Nevada Irrigation District	(530) 273-8571
18. Ester, Charlie	Salt River Project	ceester@srpnet.com
19. Ford, Glenn	Gov of Yukon Water Resources	glenn.ford@gov.yk.ca
20. Giesbrecht, Bill	BC Hydro	bill.giesbrecht@bchydro.bc.ca
21. Gilbert, Ted	USDA-Retired	troopersted@aol.com
22. Gillespie, Alison	Western Washington University	gillesa@cc.wvu.edu
23. Hannaford, Jack	Sierra Hydrotech (retired)	jmhanna@innercite.com
24. Harshburger, Brian	Univ of Idaho	hars7458@uidaho.edu
25. Heinonen, John	Fisheries & Oceans Canada	heinonenj@pac.dfo-mpo.gc.ca
26. Howe, Hubert	Alberta Environment	hubert.howe@gov.ab.ca
27. Huffman, Don	USDA-NRCS (retired)	dhuffman@wcc.nrcs.usda.gov
28. Hussey, Morna	Alberta Environment	morna.hussey@gov.ab.ca
29. Jensen, Randy	SMUD	rjensen@smud.org
30. Julander, Randy	NRCS	randy.julander@ut.usda.gov
31. Jurosek, Marla	City/County of San Francisco	mjurosek@sfgwater.org
32. Kattelmann, Rick	Mammoth Lakes	rickk@qnet.com
33. Landry, Chris	Center for Snow/Avalanche Studies	clandry@snowstudies.org
34. Lea, Jolyne	USDA-NRCS	jlea@wcc.nrcs.usda.gov
35. Lea, Jon	USDA-NRCS	jon.lea@or.usda.gov
36. Lundquist, Jessica	UCSD	jlundquist@ucsd.edu
37. Luo, Wuben	BC Hydro	wuben.luo@bchydro.com
38. Mann, Bill	Stevens Water Monitoring Systems	bmanna@stevenswater.com
39. McGurk, Bruce	Pacific Gas & Electric	bjmo@pge.com
40. Moore, Brandon	Univ of Idaho	moor4743@uidaho.edu
41. Moore, Dan	University of BC	rdmoore@geog.ubc.ca
42. Mote, Philip	Univ of Washington	Philip@atmos.washington.edu
43. Neff, Doug	Campbell Scientific	dneff@campbellsci.com
44. Newton, Bruce	NRCS	bruce.newton@usda.gov
45. Osterhuber, Randall	University of California	randall@sierra.net
46. Pattee, Scott	USDA-NRCS	scott.pattee@wa.usda.gov
47. Potter, Tom	Univ of Utah	tdpotter@met.utah.edu
48. Protsch, Bernie	Whistler Ski Patrol	
49. Rango, Albert	ARS Jornada Exp Range	alrango@nmsu.edu
50. Richards, Bob	BC Snow Survey Program (retired)	valrobr@shaw.ca
51. Romanick, Danielle	Campbell Scientific	www.campbellsci.ca
52. Roos, Maurice	CA DWR (retired)	mroos@water.ca.gov
53. Runions, Karl	Alberta Environment	karl.runions@gov.ab.ca
54. Samii, Camron	City/County of San Francisco	csamii@sfgwater.org
55. Schaefer, Garry	USDA-NRCS-NWCC	gschaefer@wcc.nrcs.usda.gov
56. Scheler, Kent	Univ of Alaska SE	kentscheler@hotmail.com

57. Shillinglaw, Michael R.	Carpenter Machine Works	(206) 632-2755
58. Skarupa, Tim	Salt River Project	teskarup@srpnet.com
59. Smiley, Bruce	BC Hydro	bruce.smiley@bchydro.com
60. Smith, Stephanie	BC Hydro	stephanie.smith@bchydro.bc.ca
61. Spittlehouse, Dave	BC Ministry of Forests	dave.spittlehouse@gems4.gov.bc.ca
62. Swanson, Robert	Forest Hydrology Consultant	rhswan@telusplanet.net
63. Teti, Pat	BC Ministry of Forests	pat.teti@gems7.gov.bc.ca
64. Tolsdorf, Tony	NRCS	tony.tolsdorf@co.usda.gov
65. Tsang, Michael	Hetch Hetchy Water & Power	mtsang@sfgwater.org
66. Van der Have, Frank	Hoskin Scientific Ltd	salesv@hoskin.ca
67. Vatcher, Scott	Alberta Environment	scott.vatcher@gov.ab.ca
68. Weber, Frank	BC Hydro	frank.weber@bchydro.bc.ca
69. Whaley, Bob	SCS (retired)	bvwale@earthlink.net
70. Whitin, Brett	US Army Corp of Engineers	brett.j.whitin@usace.army.mil
71. Winkler, Rita	BC Ministry of Forests	rita.winkler@gems7.gov.bc.ca
72. Woods, Scott	Univ of Montana	swoods@forestry.umt.edu
73. Wright, Janis	BC Min of Water/Land/Air Protection	Janis.wright@gems9.gov.bc.ca
74. Zeidler, Antonia	Univ of Calgary	azeidler@ucalgary.ca