

Marie Callaway Kellner, ISB No. 8470
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Attorney for Protestant *Idaho Conservation League*

BEFORE THE IDAHO DEPARTMENT OF WATER RESOURCES

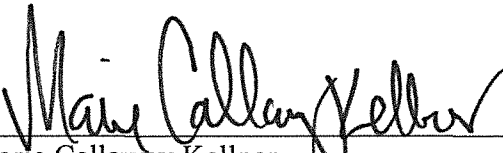
CASE NOS. 37-22682 & 37-22852

IN THE MATTER OF)
APPLICATIONS FOR PERMIT)
NO. 37-22682 & 37-22852, IN THE)
NAME OF INNOVATIVE)
MITIGATION SOLUTIONS LLC)

**PROTESTANT IDAHO
CONSERVATION LEAGUE'S
NOTICE AND SUBMITTAL OF
EXPERT REPORT**

Protestant Idaho Conservation League (“ICL”), through its attorney of record Marie Callaway Kellner, and pursuant to the March 13, 2015 *Scheduling Order and Notice of Hearing* in the above captioned matter, submits this Expert Report (“report”) by Wendy Pabich, Ph.D. The report is intended to assist IDWR in its evaluation of the applications at issue and is to be included in the administrative record for this matter. The report is also intended to address some, though not all, of the issues and concerns raised by ICL in this matter. ICL reserves the right to amend, modify or supplement the report in keeping with the parameters of the *Scheduling Order and Notice of Hearing*.

DATED: April 30, 2015


Marie Callaway Kellner
Attorney for *Idaho Conservation League*

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on April 30, 2015, I served a true copy of the foregoing document **via email** to the parties listed below:

Idaho Dep't of Water Resources
Water Management Division
322 East Front Street
PO Box 83720
Boise, ID 83720-0098

Idaho Dep't of Water Resources
Southern Regional Office
1341 Fillmore Street, Suite 200
Twin Falls, ID 83301-3380

Innovative Mitigation Solutions, LLC
2918 N. El Rancho Place
Boise, ID 83704

Idaho Water Resource Board
Harriett Hensley, Office of the Attorney General
PO Box 83720
Boise, Idaho 83720-0010

Idaho Dep't of Fish & Game
Dallas Burkhalter, Office of the Attorney General
PO Box 25
Boise, ID 83707

Trout Unlimited Inc.
Attn: Peter Anderson
910 W. Main St, Suite 342
Boise, ID 83702

Blaine County Commissioners
206 1st Ave South, Suite 300
Hailey, ID 83333

Redstone Partners LLP
c/o Steve Beevers
1188 Eagle Vista Court
Reno, NV 89511

Idaho Rivers United
Attn: Kevin Lewis
PO Box 633
Boise, ID 83701

Peter Sturdivant
PO Box 968
Hailey, ID 83333

Eccles Flying Hat Ranch LLC
Eccles Window Rock Ranch
PO Box 3028
Salt Lake City, UT 84110

Frank Erwin
711 East Ave N
Hagerman, ID 83332

Western Watersheds Project
Attn: Jon Marvel
PO Box 1770
Hailey, ID 83333

Lane Ranch HOA
c/o Sun Country Mgmt
PO Box 1675
Sun Valley, ID 83353

Heart Rock Ranch LLC
PO Box 3724
Hailey, ID 83333

Peter Trust LP
PO Box 642
Sun Valley, ID 83353

Big Wood Canal Company
c/o Craig Hobdey
PO Box 176
Gooding, ID 83330

Harry S. Rinker
PO Box 7250
Newport Beach, CA 92658

Walker Sand & Gravel Ltd. Co.
Attn: Brad Walker
PO Box 400
Bellevue, ID 83313

The City of Hailey, and the Valley Club, Inc.
c/o Givens Pursley LLP
Attn: Michael Creamer
PO Box 2720
Boise, ID 83701


Thomas M. O'Gara Family Trust, Dry Lot LLC,
Valley Club Owner's Association and LSRARD
c/o Barker Rosholt & Simpson
Attn: Paul Arrington & Travis Thompson
195 River Vista Pl, Suite 204
Twin Falls, ID 83301

Idaho Power Company
c/o Barker Rosholt & Simpson
Attn: John K Simpson
PO Box 2139
Boise, ID 83701-2139

Brockway Engineering
2016 N. Washington St, Ste 4
Twin Falls, ID 83301

Wood River Land Trust
c/o Patti Lousen
119 E. Bullion Street
Hailey, ID 83333

DATED: April 30, 2015


Marie Callaway Kellner
Attorney for *Idaho Conservation League*



Marie Callaway Kellner
Water Associate
Idaho Conservation League
PO Box 844
Boise, ID 83701

April 29, 2015

Dear Marie,

Attached please find a memo entitled *Review of Applications for Permit Nos. 37-22682 and 37-22852 by Innovative Mitigation Solutions, LLC*. I am submitting this report in response to Idaho Conservation League's request that I evaluate whether applications for permit to appropriate water 37-22852 and 37-22682 in the name of Innovative Mitigation Solutions, LLC (IMS), are consumptive or have the potential to be consumptive. This report constitutes my expert opinion.

Sincerely,

A handwritten signature in black ink, appearing to read "Wendy Pabich".

Wendy Pabich, Ph.D.,
President, Water Futures



**REVIEW OF APPLICATIONS FOR PERMIT NOS. 37-22682 AND 37-22852 IN
THE NAME OF INNOVATIVE MITIGATION SOLUTIONS, LLC**

April 29, 2015

Proposed permit 37-22852 is to divert 10.0 cfs from the Big Wood River to the Comstock Canal for groundwater recharge year round. Recharge will occur through the canal and at sites near the canal. IMS will seek to use this recharge as part of mitigation plans under current Idaho Water Law. Proposed permit 37-22682 seeks to divert 154 cfs from the Big Wood River to the Hiawatha and new diversions downstream from the Glendale Bridge year round. Recharge will occur through the canal and at sites within the Walker Sand and Gravel operation. IMS will seek to use this recharge as part of mitigation plans under current Idaho Water Law. Documents supporting the applications, including lease arrangements with the Hiawatha Canal Water Users Association and Walker Sand and Gravel, refer to mitigation credits that will be generated from the project, and in the case of the leases, in part transferred to the Landlord as rent. In my opinion, these proposed uses are likely to be, in some part, consumptive in nature.

It is my opinion that a hydrologic model, which has not been included in the application, is necessary to evaluate the details associated with this application and to assess the degree to which proposed uses are consumptive. Outstanding questions include:

- the extent to which water will recharge the aquifer during transit in canals and in recharge pits,
- the direction of flow of recharge water in the aquifer (i.e., whether it goes east or west of the groundwater divide, whether it all remains in the unconfined aquifer or some portion migrates into the confined aquifer), and,
- the residence time in the aquifer and timing of discharge to surface water bodies.

Also unknown are the exact location, volume, and timing of water delivery, and exact location and configuration of the proposed recharge sites. Notwithstanding this lack of information, the following issues contribute to the consumptive nature of these water uses.



Evaporative Loss

Diverting water from the Big Wood River into the Comstock, Hiawatha, or any other canal system in the Wood River Valley will have the effect of increasing evaporative losses for a given volume of water. This constitutes a consumptive use. There are several factors at work here.

Diverting water from the larger, deeper watercourse of the Big Wood River to smaller, shallower canals necessarily increases the ratio of surface area (SA) to volume (V). For example, compare a semi-circle river cross-section with a radius (R) of 10 units (and diameter (D) of 20 units) and 1 unit thick (W) to a similar, smaller, cross-section with a radius (R) of 1 unit (and diameter (D) of 2 units), also 1 unit thick (W).

Assume:

Surface Area (SA) = $D \times W$

Cross-Sectional Area = $\pi R^2/2$

Volume (V) = Cross-Sectional Area \times W

In the first case, the ratio of the surface area ($D \times W = 20 \times 1 = 20$) to the volume ($\pi R^2/2 \times W = \pi(10)^2/2 \times 1 = 157.08$) is 0.127; in the second, the ratio is 1.27, representing a ten-fold increase in the ratio. Evaporation is proportional to surface area. Therefore, water in the smaller channel is subjected to ten times greater evaporative loss per unit area than water remaining in the river. This effect is well known, and is evaluated by McJannet et al. (2008) as a potential means to reduce evaporative losses in reservoirs by reducing surface area to volume ratios.

Increasing the ratio of surface area to volume also has the effect of increasing solar heat absorption and water temperatures to drive higher rates of evaporation. Together, these factors will likely increase evaporative losses for any water moved from the Big Wood River to the Comstock, Hiawatha, or other canal system in the Wood River Valley.

Evaporative losses are considered consumptive by the Idaho Department of Water Resources and such losses are routinely evaluated in applications for wildlife, recreational, and aesthetic water rights. Idaho Department of Water Resources, Application Processing Memo No. 67, Permitting Requirements for Ponds, calls for determination of annual evaporative losses in ponds and for plans to replace water lost via evaporation. This approach was employed in Transfer No. 75849, approved August 6, 2013, which added wildlife, recreation, and aesthetic uses as beneficial uses to a dozen irrigation rights (see back files



for 37-60), and dried up irrigated area to mitigate for additional open water evaporation attributed to water use for wildlife, recreational, and aesthetics uses on the property. Evaporative losses should be considered in these applications as well.

Increased Consumptive Water Use by Downstream Users

The Big Wood system displays a high degree of connectivity between the river and the aquifer, relatively short residence times in the aquifer, and a number of gaining stretches in the river (Connelly et al. (2003), Bartolino, JR (2009), and Bartolino and Adkins (2012)). Water recharged under this proposal is likely to migrate back to the river in relatively short periods of time, and may act to extend the tail of the irrigation season. In an over-allocated system, any groundwater returning to the river will be diverted by downstream water users and used consumptively.

In a memo dated January 29, 2015, Brockway Engineering provided similar analysis.

Consumptive to the Source

In Application Processing Memo No. 72, Evaluation of Mitigation Plans for Water Right Permits, IDWR lays out its policy for mitigation requirements for permits to appropriate water in areas of the state closed to new consumptive appropriations (such as the Big Wood Basin). The policy states that a depletion analysis must consider the consumptive nature of the proposed use. Further,

“a proposed use normally considered to be non-consumptive may require mitigation in cases where the water is not returned to the original source or is returned to the original source in a different location. For example, diversion and use of water may be considered *consumptive to the source* when the water is impounded (e.g., pond fill), when return flow is discharged to a separate source, or when the timing or location of return flow is such that other right holders will be injured.”

In the case of the proposed appropriations, it seems any portion of the proposed allocation deemed consumptive would necessarily require a mitigation proposal (i.e., this proposal to allocate water for mitigation, in and of itself, requires mitigation).

In the case that the Department finds some or all of this application to constitute



a non-consumptive water use, it appears the use constitutes one that is *consumptive to the source*, and thus subject to a potential requirement for mitigation. The proposal meets the Department's criteria for a water use that is *consumptive to the source*: The water will be impounded for some time period in the aquifer, and the water is either not returned to the original source or returned in a different location. A groundwater model will be required to determine what portion of recharged rights will cross the groundwater divide and discharge to Silver Creek, thereby constituting water not returned to the source; and to determine the timing and location of returns flows to the Big Wood River, which will necessarily be downgradient—and different—from the point of diversion. Any portion of recharge flows that ultimately discharge to Silver Creek are permanently lost to the Big Wood River system and would require an additional water rights injury analysis.

In all cases, it appears that a proper groundwater model will be required to evaluate the particular flow details, and the Department, by its own guidance, is asked to assess the degree to which mitigation will be required for this application itself.

Additional Considerations

If the list of outstanding questions about the hydrology of these proposals are not sufficiently evaluated and answered, it is conceivable that credits will be generated and applied to mitigate for consumptive uses that exceed the real benefits provided by the proposed project, thereby increasing total consumptive use in the system. In addition, proper injury analyses will not be possible. Lastly, it seems unlikely that a new priority water right can provide much in the way of a real offset for extended consumptive use by senior water rights, and that more likely it will result in an expansion of consumptive use in the basin.



Documents Reviewed

Amended Application for Permit No. 37-22682

Application for Permit No. 37-22852

IDWR letter to Applicant Wood River Mitigation Solutions, LLC (February 8, 2012)

Applicant Wood River Mitigation Solutions, LLC letter to IDWR (February 8, 2012)

District 37 Watermaster Comments on Application for Permit No. 37-22682 (April 17, 2012 email exchange)

District 37 Watermaster Comments on Application for Permit No. 37-22852 (March 7, 2014)

IDWR Letter to Applicant Innovative Mitigation Solutions, LLC (January 8, 2014)

Brockway Engineering Letter to IDWR (January 17, 2014)

IDWR Letter to Applicant Innovative Mitigation Solutions, LLC (February 12, 2014)

IDWR Notice of Consolidated Pre-Hearing Conference and Order Authorizing Discovery (April 15, 2014)

Idaho Department of Fish & Game Rationale for Protest of Permit Applications 37-22682 and 37-22852 (Preliminary Draft, December 11, 2014)

Brockway Engineering Memo Re: Preliminary Technical Comments Pertaining to Use of Groundwater Model for Applications for Permit 37-22682 and 37-22852 (January 29, 2015)

Applicant Innovative Mitigation Solutions, LLC's Responses to Protestant Dry Lot LLC, Valley Club Owners Assn Inc., Thomas O'Gara Family Trust, and Lower Snake River Aquifer Recharge District's First Discovery Requests, including attachments (January 30, 2015)



Applicant Innovative Mitigation Solutions, LLC's Responses to Intervenor City of Hailey's First Set of Interrogatories and Requests for Production, including attachments (April 9, 2015)

References

Bartolino, JR (2009) Ground-water budgets for the Wood River Valley aquifer system, south-central Idaho, 1995-2004: U.S. Geological Survey Scientific Investigations Report 2009-5016, 36 p.

Bartolino, JR, and Adkins, CB (2012), Hydrogeologic framework of the Wood River Valley aquifer system, south-central Idaho: U.S. Geological Survey Scientific Investigations Report 2012-5053, 46 p.

Connolly et al. (2003) *Blaine County Evaluation and Assessment of Nitrogen Sources, Project Report*. Department of Civil and Environmental Engineering, Massachusetts Institute of Technology.

Idaho Department of Water Resources, Application Processing Memo No. 67 (2003), *Permitting Requirements for Ponds*.

Idaho Department of Water Resources, Application Processing Memo No. 72 (2010), *Evaluation of Mitigation Plans for Water Right Permits*.

McJannet, D, Cook, F, and Burn, S. (2008) *Evaporation reduction by manipulation of surface area to volume ratios: overview, analysis and effectiveness*. Technical Report 8 for the Urban Water Security Research Alliance, Brisbane.

Wendy J. Pabich

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Hailey, ID 83333
(781) 962-1583
www.waterdeva.com
www.waterfuturesinc.com
wendy@waterfuturesinc.com

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA
Ph.D., Environmental Engineering (biogeochemistry and hydrology), Parsons Water Resource Laboratory, 2001
M.S., Urban Studies & Planning, 1995
Duke University, Durham, NC
M.S., Geology (coastal), 1995
Dartmouth College, Hanover, NH
B.A., Geography (*cum laude*), 1988

CERTIFICATIONS

Dispute Mediation (40 hr), Harvard Law School (2013)
Wilderness First Responder (80 hr), Wilderness Medicine Institute
Level 1 Avalanche Training, American Avalanche Association
Open Water Diver, PADI

CONSULTING AND APPLIED EXPERIENCE

Water Futures, Hailey, ID and Salem, MA (2005-present)

President

- Providing strategic technical and policy consulting services related to corporate water risk and security, land and water conservation, sustainable water use, wastewater planning, water rights, and waste-to-energy issues.
- Developed and lead scientific strategy, built and managed research team, worked closely with legal counsel, fundraised, and built coalition in four-year effort to conduct robust due diligence and challenge \$500 million worth of water rights in Idaho's Snake River Basin Adjudication for coalition of ranchers and conservation groups looking to protect agricultural and in-stream water rights.
- Client list includes county governments, municipalities, land trusts, ranching associations, canal companies, non-profits, technology companies, private equity firms, private investors, and Fortune 500 companies.
- Business development and administration, building/managing contract teams, high-level analysis, study design, project management and public presentations.

Tetra Tech EM, Cambridge, MA (2003-2005)

Scientist and Project Manager

- Managed ecosystem restoration projects in New England, including NOAA salt marsh restoration and dam removal efforts, and state beach bacterial studies; developed nutrient management practice.
- Study design, fieldwork, analysis and project engineering.
- Client interface, budgeting, staff and subcontractor oversight, and overall project direction.

Independent Consultant, Marblehead, MA (1993-2005)

- Reviewed states' experiences with effluent trading in watersheds and synthesized requirements for successful program development.
- Analyzed state nitrogen loading policy, modeling and permitting.
- Provided technical review and testimony related to nitrogen load modeling and riverine response, environmental impact assessment, and permit conditions, including groundwater monitoring plans, for a proposed 1,800-home subdivision and wastewater treatment facility.
- Developed methodology to assess natural resource damages (NRD) to groundwater.
- Designed educational materials related to drinking water protection, groundwater/surface water interactions, and contaminate fate and transport.

Environmental Defense, Boston, MA (2001-2003)

Post-Doctoral Scientist, Oceans Program (Advisor: Robert W. Howarth, Ph.D.)

- Developed strategies to address anthropogenic nutrient loading to coastal system, evaluated nitrogen export from agricultural best management practices (BMPs), provided scientific input to national policy process including EPA's proposed Nutrient Criteria program, and evaluated nitrogen reduction opportunities under the U.S. Farm Bill.
- Acted as technical lead for a large, multi-institutional project to develop a pilot nutrient trading program for the Conestoga watershed in Pennsylvania.
- Assessed anthropogenic perturbations to the nitrogen cycle in the US.

Temple, Barker & Sloane (now Oliver Wyman), Lexington, MA (1989-1991; -93, part-time)

Research Associate/Consultant, Public Policy and Management Group

- Analyzed environmental regulatory issues including biological monitoring, risk communication, wastewater treatment facility financing, recycling markets, packaging, groundwater contamination, and SRF, RCRA and Superfund.
- Formal training in financial analysis, accounting, writing, analytical techniques, and public speaking.

RESEARCH EXPERIENCE

Massachusetts Institute of Technology, Cambridge and Woods Hole, MA (1995-2001)

Research Assistant, Parsons Water Resources Laboratory (Harold F. Hemond)

Denitrification of anthropogenic nitrogen in groundwater: Measurement and Modeling using stable isotopic and mass balance approaches.

Committee: Harold F. Hemond (chair), Ivan Valiela (Marine Biological Laboratory), Sally Chisholm

- Designed and implemented field-based research project to evaluate rate of denitrification of anthropogenically-derived nitrogen in groundwater from fertilizer, atmospheric deposition, and septic waste, and to assess the role of nitrate and dissolved organic carbon (DOC) as controls on reaction rate using stoichiometry and stable isotopes.
- Investigated the relationship between vadose thickness and DOC to predictively model groundwater DOC concentrations. Developed kinetics model to predict groundwater denitrification rates.
- Designed, constructed, installed and sampled several fields of multi-level groundwater sampling wells, optimized methods for measurement of low level nitrate and ammonium, and developed methods for analysis of N₂/Ar by gas chromatography in aqueous samples.

Massachusetts Institute of Technology, Cambridge, MA (1994)

Research Assistant, Energy Laboratory (Jefferson Tester)

Hydrothermally-Generated Electricity in the United States: An Industry Analysis.

- Analyzed extraction technology, market opportunities, and regulatory framework of domestic hydrothermal industry for U.S. Department of Energy, Geothermal Division.

MIT-Harvard Program on Negotiation, Cambridge, MA (Fall 1993)

Research Assistant (Lawrence Suskind)

- Developed and published role-playing case study to illustrate negotiation strategies in environmental regulation and compliance.

Duke University, Department of Geology, Durham, NC (1991-1993)

Research Assistant (Orrin Pilkey)

A Sedimentological Study of a Replenished Beach: Revere Beach, Massachusetts.

- Designed and implemented field-based research project to evaluate sediment transport mechanics of a beach replenishment project.
- Collected nearshore and beach samples and analyzed sedimentology to estimate transport pathways.
- Evaluated beach profiles to estimate erosion and deposition rates.
- Correlated transport pathways with theoretical model of transport on a log-spiral beach.

TEACHING EXPERIENCE

Massachusetts Institute of Technology, Civil and Environmental Engineering (2008-2009)

Lecturer and Project Supervisor, Evaluation of Dam Projects in Patagonia

- Responsible for curriculum, logistics, budget and teaching for year-long project course, including month-long expedition to Chilean Patagonia.
- Supervised five Masters of Engineering theses assessing impacts of five proposed hydro-electric dams on Rios Baker and Pasqua and 1,400 miles of transmission lines.
- Assessed carbon implications of proposal; modeled options for operational optimization of reservoirs at existing hydro-power facilities closer to Santiago; evaluated risks associated with Glacial Lake Outburst Floods (GLOFs) and flooding in the Rio Baker watershed; and analyzed potential water quality changes.
- Trekged up remote Rio Colonia valley to the Northern Patagonian Ice Field and ran the Rio Baker from ice to sea.

Massachusetts Institute of Technology, Civil and Environmental Engineering (2002-2003)

Lecturer and Project Supervisor, Big and Little Wood River Watershed Nitrogen Loading Assessment, Blaine County, Idaho

- Responsible for curriculum, logistics, budget and teaching for year-long project course; including month expedition to Idaho.
- Supervised three Masters of Engineering theses.
- Assessed nitrogen loading to two watersheds, developed land use-based mass balance GIS model of nitrogen loads and transport, evaluated appropriate management strategies, including nutrient trading and agricultural best management practices (BMPs), and conducted public outreach and education

Massachusetts Institute of Technology, Civil and Environmental Engineering (1996)

Teaching Assistant, Aquatic Chemistry Laboratory

Massachusetts Institute of Technology, Urban Studies and Planning (Fall 1994)

Teaching Assistant, Environmental Policy and Regulation

Duke University Marine Laboratory, Beaufort, NC (Summers 1992 and 1993)

Teaching Assistant, Biological Oceanography

Teaching Assistant, Marine Biology

Sierra Institute

Co-Instructor, Himalayan Field Studies Program, Ladakh, India (Fall 2005)

- Co-instructed semester-long undergraduate field courses in natural history, sustainable development, wilderness skills and environmental education.
- Extended backpacking through remote Himalayan terrain.

The Wild Gift, Sun Valley, Idaho (2003-present)

Advisor

- Advising on curriculum, mentoring students, participating in governance for organization helping to foster leaders focused on sustainable communities and preservation of wilds.
- Participated on three-week educational backpacking and river rafting adventure in the Wrangell St. Elias National Park in Alaska (summer 2003), and in the Boulder/White Clouds (summers 2006 and 2009).
- Mentored student working on sustainable design in urban housing projects.

ART AND FILMMAKING EXPERIENCE

Artist and Scientist-in-Residence, *Land and Water*, Colorado Art Ranch, Carpenter Ranch, Hayden, CO (September 2012).

- Selected to participate in a one-month artist residency program to explore issues related to water and land, and the intersection between art and science.

Collaborative Art, Water Footprinting, *The Ripple Effect*, Peabody Essex Museum, Salem, MA (April 2012)

- Lead a collaborative art project with museum visitors to create an impressive wave sculpture representing the water footprint of one pair of blue jeans (over 2,000 gallons) as a means to reveal the hidden demands on water.

Artist and Scientist-in-Residence, *Wade in the Water*, Colorado Art Ranch, Salida, CO (May 2010).

- Selected to participate in a one-month residency program to explore issues related to water, land use and the intersection between art and science.
- Joined in an Artposium to celebrate the mysteries of water through music, dance, art-making and writing.

Science Advisor, *Patagonia Rising* (2009)

- Developed initial film concept and provided scientific input to documentary film tracing the hydrologic cycle of the Baker River from ice to ocean, providing voice to the frontier people caught in the crossfire of Chile's energy demands, and juxtaposing the pro-dam business sector with renewable energy experts, bringing awareness and solutions to this global conflict over water and power.

Exhibiting Painter (www.wendypabich.com), Hailey, ID (ongoing)

- Exhibiting member of Green Antelope Gallery (www.greenantelope.net), with ongoing exhibitions and individual showing (October 2009), Ketchum Arts Festival, Hailey Artists' Market, St. Luke's Hospital.

Geography Intern, National Geographic Society, Washington, D.C. (Fall 1988)

- Chosen for nationally-competitive geography intern program.
- Created artwork and maps published in Traveler Magazine.

BOARD AND VOLUNTEER POSITIONS

Vice President, Idaho Chapter, International Women's Forum

Board of Directors, High Country News, Paonia, CO (2012-present)

- Charged with broad responsibility for promoting the mission, programs and public image of High Country News, an award-winning print and online magazine dedicated to coverage of natural resource, public lands, ranching, wildlife and communities of the West. Board holds legal, financial and governance responsibilities.

Blaine County Land, Water and Wildlife Levy Advisory Board (2009-present)

Inaugural Board Member

- From inception, envisioning, designing and managing program to properly invest \$3.2 million in levy proceeds to conserve land, water, wildlife and working farms via a standardized and transparent process for consideration of eligible expenditures.
- Evaluating proposed conservation projects relative to levy goals, conservation merits, financial leverage, suitability of conservation partners, and strength of conservation instruments, and making funding recommendations to Board of Commissioners.
- Acting as technical lead and providing counsel on water issues.

Wood River Valley Watershed Project, Hailey, Idaho (2005-present)

- Co-initiator, organizer and fundraiser for \$750,000 study of four-phase, multi-year effort by the U.S. Geological Survey to better understand the groundwater system of the Wood River Valley and provide information for scientifically informed decisions.
- The study assessed groundwater budgets, the hydrologic framework of the aquifer, groundwater and surface water quality, and water table elevation pre- and post-development. A groundwater flow model for resource management was developed using the results.
- Work results are now informing the development of a integrated ground and surface water model that will be used for conjunctive management.

Massachusetts Executive Office of Environmental Affairs, Lakeville, MA. (1999-2000)

Task Force Member, Eel River Watershed Nutrient Technical Advisory Committee

Town of Marblehead Conservation Commission, Marblehead, MA (1995-2000)

Board Member and Vice Chair

- Charged with enforcing Massachusetts Wetlands Protection laws and evaluating and deciding on wetland permit applications.

Environmental Policy Intern, Office of Senator John Kerry, Boston, MA (Spring 1993)

PUBLICATIONS

Pabich, Wendy J. (September 2012) *TAKING ON WATER: How One Water Expert Challenged Her Inner Hypocrite, Reduced Her Water Footprint (without Sacrificing a Toasty Shower), and Found Nirvana*, Sasquatch Books, Seattle, WA.

Pabich, Wendy J. (2008) *Idaho: An Explorer's Guide*. Countryman Press. Woodstock, VT, 384 p.

Bowan JL, Kroeger KD, Tomasky G, Pabich WJ, Cole ML, Carmichael RH and I Valiela. (2007) A review of land-sea coupling by groundwater discharge to New England estuaries: Mechanisms and effects. *Applied Geochemistry* 22:175-191

Colman JA, Masterson, Pabich WJ & Walter DA (2004) Effects of aquifer travel time on nitrogen transport to a coastal embayment. *Ground Water* 42(7):1069-1078.

Howarth RW, Boyer EW & Pabich WJ. (2002) Nitrogen Use in the United States from 1961 – (2000) and Potential Future Trends. *Ambio* 31:88-96.

Pabich WJ, Valiela I & Hemond HF (2001). Relationship between DOC concentration and vadose zone thickness and depth below water table in groundwater of Cape Cod, U.S.A. *Biogeochemistry*. 55: 247-268.

Valiela I, Bowen JD, Cole ML, Kroeger KD, Lawrence D, Pabich WJ, Tomasky G & Mazzilli S. (2001). Following up on a Margalevian concept: Interactions and exchanges among adjacent parcels of coastal landscapes. In: J.M. Gill, J.L. Pretus and T.T. Packard (eds.), *A Marine Science Odyssey into the 21st Century*. Scientia Marina 65 (Suppl. 2): 217-231.

Westgate EJ, Kroeger KD, Pabich WJ & Valiela I. (2000). Fate of anthropogenic nitrogen in a nearshore Cape Cod aquifer. *Biological Bulletin* 199:221-223.

Pabich WJ and Susskind L. (1999). *Chemco, Inc.: Negotiating Compliance Before the Fact*. In *Negotiating Environmental Agreements: How to Avoid Escalating Confrontation, Needless Costs, and Unnecessary Litigation* by L. Susskind and P.F. Levy

Pabich WJ, Hemond HF & Valiela I (accepted). Denitrification rates in groundwater, Cape Cod, USA: Control by nitrate and DOC concentrations. *Biogeochemistry*.

PRESENTATIONS

Taking on Water, keynote, Finlandia University, Servant Leadership Program, Hancock, MI, January 21, 2015.

Conjunctive Management and Water Conservation, Panel Discussion, Wood River Land Trust, The Nature Conservancy, and UIdaho, Hailey, Idaho, March 7, 2014.

Beyond GDP: Investing for Quality of Place, Panel: Sustainable Energy and Water, 2013 Sustain Blaine Economic Summit, Sun Valley, Idaho, October 8, 2013.

Taking on Water: How One Water Expert Confronted Her Inner Hypocrite, Reduced Her Water Footprint (without Sacrificing a Toasty Shower), and Found Nirvana, book tour:

High Country Speaker Series, Walking Mountains Science Center, Vail, Co, January 21, 2014

Idaho Rivers United Boise Community Lecture, Boise, ID, September 24, 2013

Water for a Viable Future, keynote address, Ruidoso, NM, April 26, 2013

Charles River Watershed Annual Meeting, keynote address, Cambridge, MA, April 4, 2013

Bear Yuba Land Trust, Armchair Trek Series, Nevada City, CA, March 25, 2013

Idaho Conservation League, Boise, ID, November 15, 2012

Phillips Academy Andover, Andover, MA, November 9, 2102
Charles River Watershed Association, Boston, MA, November 8, 2012
Presidio Graduate School of Management, San Francisco, CA, November 6, 2012
Third Place Books/Puget Soundkeepers, Seattle, WA, November 2, 2012
Broadway Books, Portland, OR, October 25, 2012
Oregon State University, Institute for Water and Watersheds, Corvallis, OR, October 24, 2012
Freshwater Trust, Portland, OR, October 23, 2012
Water: The Ripple Effect, Chicago Ideas Week, Chicago, IL, October 10, 2012
Idaho Conservation League/The Community Library, Ketchum, ID, October 4, 2012
Colorado Art Ranch Artposita, Bud Warner Memorial Library, September 27, 2012
Woody Creek Community Center, Woody Creek, CO, September 24, 2012
The Tattered Cover, Land and Water Series, Denver, CO, September 22, 2012
Bud Warner Memorial Library, Steamboat Springs, CO, September 20, 2012
Sustainable Living Fair, Ft. Collins, CO, September 16, 2012

Taking on Water, Peabody Essex Museum, Salem, MA, April 15, 2012

Patagonia: Ice to Ocean. Chaffee Citizens for Sustainability. Salida, CO, May 19, 2010.

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PANEL DISCUSSIONS

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