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*ATTORNEYS FOR THE IDAHO GROUND WATER APPROPRIATORS*

**BEFORE DEPARTMENT OF WATER RESOURCES**

**STATE OF IDAHO**

**IDAHO GROUND WATER  
APPROPRIATORS, INC.,  
Petitioners**

Docket No.: CM-MP-2009-06

**BRENDECKE AFFIDAVIT IN  
SUPPORT OF IGWA'S REQUEST  
FOR MITIGATION CREDIT FOR  
SURFACE WATER COALITION  
DELIVERY CALL**

STATE OF COLORADO    )  
                                  ss:  
County of                    )

The undersigned, Charles M. Brendecke, having been first duly sworn upon oath does hereby depose and state as follows:

1. I am employed by AMEC, 1002 Walnut, Suite 200, Boulder, Colorado 80302. I am a Licensed Professional Engineer in Idaho, Colorado, Wyoming, Texas and Washington. I have a Bachelor of Science degree in Civil Engineering from the University of Colorado, and Master of Science and Doctor of Philosophy Degrees in Civil Engineering from Stanford

University. My education and professional experience are set forth in greater detail in my resume, which is attached hereto as Exhibit A. I have been for the past several years and continue to be the lead engineer and technical consultant to IGWA and its Ground Water District Members.

2. The information contained in the table on page 3 the *IGWA's Request for 2012 Mitigation Credit* is identical to that attached hereto as Exhibit B. Exhibit B contains my best estimate and opinion of the amount of reach gains for the near-Blackfoot to Minidoka reach ("reach") of the Snake River from mitigation activities performed by IGWA and other parties. The reach gains in Exhibit B are expressed in acre-feet.

3. The estimates in Exhibit B were prepared by me using information from previous groundwater modeling by the Department and from information obtained from the Department and others concerning ongoing mitigation and aquifer management activities. This information was used with version 1.1 of the ESPAM to estimate 2012 irrigation season (April through October) gains to the reach of the Snake River. The procedures used to develop each entry in Exhibit B are described more fully below.

4. In 2010, the Department performed groundwater modeling to quantify the 2010 mitigation credit allowed IGWA for its past and ongoing mitigation activities. The findings of this modeling effort were contained in the Director's Final Order Approving Mitigation Credits Regarding SWC Delivery Call, dated July 19, 2010 ("July 19<sup>th</sup> Order"). I obtained from the Department the model input files and results from this 2010 modeling effort ("2010 modeling") to use as the basis for my estimate of the 2012 gains shown in Exhibit B.

5. The 2010 modeling was used verbatim with one exception. The model input file representing IGWA CREP activities for 2010 appeared to contain an error that prevented the model from reading all the cell stresses for CREP lands in 2010. Correcting this error changes the estimate of 2010 CREP credit from the 5390 acre-feet approved in the July 19<sup>th</sup> Order to 5734 acre-feet. This correction was carried forward in my additional modeling to derive 2012 credits.

6. The estimate of 2012 credit from IGWA's CREP program was derived by adjusting the corrected stress file from the 2010 modeling to account for changes in CREP enrollment that occurred between 2009 and 2011 (the 2010 modeling assumed 2010 enrollment to be the same as 2009). Enrollment adjustments were derived from annual CREP reports obtained from the Department and were applied on a county basis. I assumed CREP enrollment in 2012 to be the same as 2011. The ESPAM v1.1 was then run in transient mode (SuperTran) to estimate the 2012 irrigation season reach gains accruing from IGWA's ongoing and previous CREP activity within the Surface Water Coalition (SWC) trimline.

7. The estimate of 2012 credit from IGWA's conversion activities in Water District 130 were derived by assuming these activities remained ongoing at 2010 levels. The ESPAM v1.1 was then run in transient mode to estimate the 2012 irrigation season reach gains accruing to the reach from IGWA's ongoing and previous conversions activity within the SWC trimline.

8. The estimate of 2012 credit from IGWA's recharge activities was derived in two steps. In the first step, the 2010 modeling of recharge was extended through 2012 to estimate the residual reach gains from IGWA's 2007 and 2009 recharge activities. In the second step, the 2012 reach gains attributable to IGWA's portion of Eastern Snake Plain Recharge Alliance

(ESPRA) recharge activities in the fall of 2011 was added to the residual reach gains. ESPRA recharge results for activities within the SWC trimline were obtained from ESPRA. IGWA's portion of these reach gains was calculated as 12.8% of those reach gains, reflecting the agreed-upon allocation of credits among ESPRA participants.

9. Exhibit B also contains estimates of 2012 irrigation season reach gains attributable to ongoing CREP and conversion activities in the Southwest Irrigation District and Goose Creek Irrigation District. These estimates were derived using similar approaches to those described above for IGWA CREP and conversion activities.

10. Exhibit B contains estimates of winter period and 2012 irrigation season reach gains that will occur as a result of recharge projects undertaken by the Idaho Water Resource Board. Records of amounts, locations and timing of IWRB recharge activities since 2007 were obtained from the Department. This information was used to create input files for ESPAM v1.1 reflecting those historical IWRB recharge activities that occurred within the SWC trimline. The ESPAM v1.1 was run in transient mode to estimate the monthly reach gains that will occur beginning November 2011 through October 2012 to the near-Blackfoot to Minidoka reach as a result of the preceding 5 years' recharge by the IWRB.

11. Some refinement of the estimates in Exhibit B is possible as additional information is gathered, but it is my belief that such refinements will not materially change the estimates.

Further, your Affiant saith not.

Dated: March 22, 2012.



CHARLES M. BRENDENCKE

Subscribed to and sworn to before me, a Notary Public, this 22<sup>nd</sup> day of March, 2012.



Charles M. Brendencke  
Notary Public for Colorado  
Residing at 7988 Marshall St., Arvada  
My commission expires 12/2/2012 CO  
80003

**CERTIFICATE OF SERVICE**

I HEREBY CERTIFY that on the 23rd day of March, 2012, the above and foregoing document was served in the following manner.

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WATER RESOURCES  
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CANDICE M. McHUGH

Charles M. Brendecke, PhD, PE

**Principal**

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**Professional summary**

Dr. Brendecke has more than 40 years of diverse experience in hydrology, water rights, water resources engineering, and water resources planning and management. He has directed a wide variety of projects addressing local and regional water supply planning; management of complex water supply systems; simulation modeling of surface and groundwater systems (including water right administration); municipal and agricultural water demand forecasting and conservation; and water rights development and transfer. His work as lead expert in a variety of water rights proceedings includes historical consumptive use analysis, evaluation of surface/groundwater interactions, conjunctive administration of surface and groundwater rights, development of protective terms and conditions, settlement negotiations, and expert witness testimony. He has been qualified as an expert witness in numerous venues, including the U.S. Supreme Court.

Summary of Core Skills: Hydrology; Water rights; Water supply planning /management; Surface/ground water interaction; Reservoir system operations; computer modeling of surface and groundwater systems; Statistical hydrology; Negotiation/litigation support; Expert witness testimony.

**Professional qualifications/registration(s)**

Professional Engineer (PE), CO #17578, 1980  
Professional Engineer (PE), WY #6960  
Professional Engineer (PE), ID #11896  
Professional Engineer (PE), TX #105482  
Professional Engineer (PE), WA# 47461

**Education**

Ph.D., Civil Engineering, Stanford University, Stanford, California/USA, 1979.  
M.S., Civil Engineering, Stanford University, Stanford, California/USA, 1976.  
B.S., Civil Engineering, University of Colorado, Boulder, Colorado/USA, 1971.  
Public Policy Mediation Training – CDR Associates, Boulder, Colorado/USA, 2004.

**Memberships/Affiliations**

American Society of Civil Engineers  
American Water Resources Association  
American Geophysical Union

**Languages**

English

**Employment history**

AMEC Environment & Infrastructure, Principal, Boulder, Colorado, 2007 – Present  
Hydrosphere Resource Consultants, Inc., Principal and President, Boulder, Colorado, 1990 to 2007  
Wright Water Engineers Inc., Senior Project Engineer, Denver, Colorado, 1985 – 1986.  
University of Colorado, Assistant Professor of Civil Engineering, Boulder, Colorado, 1979 – 1985  
Institute for Arctic and Alpine Research, Faculty Research Associate, Boulder, Colorado, 1979 – 1985  
Independent Water Consultant (various clients), Boulder, Colorado, 1979-1985  
Stanford University, Research Assistant and Lecturer, Stanford, California, 1975 – 1979  
Wright-McLaughlin Engineers, Inc., Design Engineer, Denver, Colorado, 1973 – 1975

## Representative projects

*Horse Creek Groundwater Investigations, Wyoming State Engineer Office, Cheyenne*  
Project Manager. Work involved development of groundwater model to evaluate relationships between groundwater pumping and surface water supplies in an alluvial basin, Wyoming.

*City of Boulder Water Rights, Boulder, CO*

Expert witness. Work involved preparation of expert reports and technical assistance in settlement of water rights claims on the South Platte River, Colorado.

*Long Range Water Demand Projections, Colorado Springs Utilities, Colorado Springs*

Project Manager. Work involved preparation of long range water demand forecasts and submittal of expert report in support of water rights claims. Colorado

*Land Application (Spray Field) Plan for Wastewater Disposal, Tessenderlo-Kerley, Inc.*

Project Manager. Work involved development of land treatment plan for agricultural products facility near Kennewick, Washington.

*Long Range Water Demand Forecast, Idaho Water Resource Board, Boise*

Project Manager. Work involved development of long-range water demand forecasts for Rathdrum Prairie Aquifer, Idaho.

*Golf Resort Water Management, The Valley Club, Sun Valley, Idaho*

Project manager. Work involved water supply planning and water rights transfers for golf resort.

*Interstate Water Litigation, North Carolina Department of Justice, Raleigh, North Carolina*

Project Manager. Work involved hydrology, water supply and reservoir operations studies.

*Municipal Water Storage Planning, Colorado Springs Utilities, Colorado Springs, Colorado*

Project manager. Lead a reconnaissance-level evaluation of potential water storage projects for major municipal water utility in southern Colorado.

*Spear T Ranch v. Knaub, et.al., Hageman and Brighton, Attorneys, Morrill County, Nebraska*

Project manager. Performed groundwater modeling analysis regarding effects of pumping on surface flows at points of diversion on Pumpkin Creek in Morrill County, Nebraska.

*Conjunctive Administration of Ground Water Rights, Idaho Ground Water Appropriators, Inc., Boise, Idaho*

Project manager and testifying expert. Testified in proceedings related to administration of surface and groundwater rights. Work has involved oversight of regional ground water model development of the Eastern Snake Plain Aquifer, groundwater modeling in support of management and mitigation plans, and analysis of historical water use data.

*Rio Grande Basin Groundwater Management, Conejos Water Conservancy District, Manassa, Colorado*

Testifying expert. Testified regarding proposed methods for replacement of injurious depletions caused by groundwater pumping in Special Improvement District No. 1 of the Rio Grande Water Conservation District and regarding the use of the RGDSS groundwater model in developing rules governing new withdrawals from the confined aquifer system of the San Luis Valley.

*Columbia River Basin Reservoir Operations, Busch Agricultural Resources, Inc., Kootenai Valley, Idaho*

Project manager. Performed studies of the impact of modified reservoir operations on agricultural interests in the Kootenai River basin.

*New Mexico Surface Water Studies*

Project manager. Performed a program of surface and ground water studies on the Pecos River in support of State initiatives.

*Interstate Compact Litigation, Colorado Division of Water Resources, Denver, Colorado*  
Expert witness. Testified in litigation between Kansas and Colorado regarding Arkansas River water uses.

*Interstate Compact Litigation, Wyoming Attorney General, Cheyenne, Wyoming*  
Project manager and expert witness. Testified in litigation between Nebraska and Wyoming regarding storage project operations and water deliveries to agricultural users on the North Platte River.

*Rio Grande Decision Support System, Colorado Division of Water Resources, Denver, Colorado*  
Quality assurance officer. Developed a comprehensive surface water model of the Rio Grande River basin in Colorado.

*Agricultural Water Conservation, U.S. Bureau of Reclamation, Denver, Colorado*  
Project manager. Developed a water conservation guidebook for use by irrigation districts. The guidebook describes planning approaches and methods for evaluating specific conservation measures.

*Colorado City Metropolitan District*  
Project manager. Performed water supply planning studies and water rights litigation support for municipal water provider.

*Gunnison Basin Planning Model*  
Project manager. Developed an interactive PC-based computer model of hydrology and water rights administration in the Gunnison River basin. The model uses a network solution algorithm and incorporates a Windows™-based interface.

*Boulder Creek Water Rights, City of Boulder, Boulder, Colorado*  
Lead expert. Testified in a variety of water rights proceedings related to applications, changes, and transfers of agricultural rights in the Boulder Creek basin.

*Yampa River Basin Planning Studies, Colorado River Water Conservation District, Glenwood Springs, Colorado*  
Project manager. Performed a comprehensive water supply planning study that included demand forecasting, development of a basin computer model, and evaluation of potential water storage project operations.

*Snake River Basin Water Supply Study*  
Project manager. Performed a comprehensive review of water use in the Snake River basin and computer model evaluation of potential water management strategies, including agricultural water conservation, to enhance anadromous fisheries.

*Upper Colorado River Water Rights, Colorado River Water Conservation District, Glenwood Springs, Colorado*  
Performed engineering analysis of the historical use of irrigation rights located on the Blue River, determining the portion of consumptive use made possible by Green Mountain Reservoir releases. Analyzed the historical consumptive use of the irrigation water rights associated with the Gary Hill Ranch on Muddy Creek, in support of water rights acquisition associated with the construction of Muddy Creek Reservoir.

*Summit County Small Reservoir Study, Colorado Water Conservation Board, Denver, Colorado*  
Project manager. Performed a water management study for the Blue River basin involving development of a hydrologic model and evaluation of new storage facilities for instream flow maintenance.

*Gunnison Basin Planning Study, Colorado River Water Conservation District, Glenwood Springs, Colorado*

Project manager. Developed a detailed hydrology and water rights model of the 8000 square mile Gunnison River basin as part of a comprehensive river basin planning study.

*Windy Gap Delivery Study, City of Boulder, Boulder, Colorado*

Project manager. Developed detailed computer models of Colorado-Big Thompson Project operations to support analysis of the yields of the Windy Gap Project, which shares common facilities.

*Superconducting Super Collider Water Supply, State of Colorado*

Project manager. Determined industrial water needs and developed the water supply strategy for a proposed Department of Energy physics research facility.

*Boulder Raw Water Master Plan, City of Boulder, Boulder, Colorado*

Project manager. Prepared a comprehensive report concerning water rights holdings and water supply system operating policies for a Front Range municipality of 100,000 persons.

*Standley Lake Pollutant Loading*

Project manager. Developed hydrologic and pollutant loading model of Standley Lake to assess relative effects of non-point sources and a proposed effluent exchange by a major industrial water user.

*Pecos River Compact*

Consultant to the Special Master of the U.S. Supreme Court. Advised on technical issues in a lawsuit between Texas and New Mexico concerning river depletions and water deliveries.

*Rocky Ford Ditch Transfer*

Project manager. Performed engineering analyses of historic irrigation practices and Arkansas River depletions associated with a 4100-acre tract in southeastern Colorado.

*Buena Vista Water Rights*

Project manager. Analysis of the historic use of irrigation water rights and development of engineering data supporting their transfer to municipal use.

*Dillon Clean Lakes Study*

Project manager. Development of a comprehensive hydrologic monitoring network to determine lake inflow patterns and non-point source pollutant loadings from various land uses.

*Restoration of West Tenmile Creek*

Project manager. Performed hydrologic and hydraulic analysis and design of comprehensive stream habitat improvements at Copper Mountain ski area.

**Publications and presentations**

"Climate Change and Water Supply Planning in Colorado," Rozaklis, L., B. Harding and C.

Brendecke, presentation at Annual Water Resources Conference, American Water Resources Association, Nov 6-10, 2011. Albuquerque, New Mexico.

"Toward Conjunctive Management of the Eastern Snake Plain Aquifer," poster presentation, by Charles Brendecke at Natural Resources Law Center 25th Summer Conference Groundwater in the West, Boulder, Colorado, June 16-18, 2004.

"Interstate Water Conflict: Compacts, Adjudications and Decrees," Charles Brendecke, Water Policy Seminar: Freshwater Conflicts in the United States, Stanford, California, May 19, 2004.

"Water Rights, Compact Entitlements and Endangered Fishes of the Yampa River Basin," Brendecke, C., and R.D.Tenney, Proceedings of the Annual Water Resources Conference, American Water Resources Association, November 12-15, 2001. Albuquerque, New Mexico.

- "Conjunctive Management: Science or Fiction?" Brendecke, Charles M., presentation to Idaho Water Users Association 18th Annual Water Law and Resource Issues Seminar, November 8-9, 2001. Boise, Idaho.
- "Planning for Water Development and Endangered Species Recovery in the Yampa River Basin." Tenney, Ray D., and C.M. Brendecke, Proceedings of the Wetlands Engineering & River Restoration Conference, American Society of Civil Engineers, March 26, 1998, Denver, Colorado.
- "Agricultural Water Conservation Planning & Pricing-Tools & Technologies." Payton, E., C. Brendecke, B. Harding, E. Armbruster, T. McGuckin and C. Huntley. Proceedings of the Irrigation Association's 18th International Conference, November 2, 1997, Nashville, Tennessee.
- "Achieving Efficient Water Management: Hydrosphere Resource Consultants, Inc., Agricultural Water Conservation Planning," workshop for U.S. Bureau of Reclamation staff, December 16 - 18, 1996. Las Vegas, Nevada.
- "PC-Based Decision Support Tools: Lessons from a Dozen Applications," Brendecke, C., B. Harding and E. Payton, Proceedings of the Fifth Water Resources Operations Management Workshop, Water Resources Planning and Management Division (ASCE). March 4, 1996. Arlington, Virginia.
- "The Value of Water Supply Reliability in Urban Water Systems," Howe, C.W., M. Smith, L. Bennett, C. Brendecke, J. Flack, R. Hamm, R. Mann, L. Rozaklis, and K. Wunderlich, Journal of Environmental Economics and Management, 1994. v. 26, pg. 19-30.
- "Managing Snake River Operations for Juvenile Salmon Migration," Brendecke, C. Proceedings of the ASCE Water Resource Planning and Management Conference Division 20th Anniversary Conference, Seattle, Washington, May, 1993.
- "The Hydrosphere Snake River Operations Model", Brendecke, C., 9th Annual Water Law and Resource Issues Seminar, Idaho Water Users Association, Boise, Idaho. 1992.
- "Logical Intransitivities and Other Administrative Nightmares: Can Models Help?," Brendecke, C., and B. Harding. Proceedings of the 26th Annual AWRA Conference and Symposium, November 4-9, 1990. Denver, Colorado.
- "Legal and Economic Disincentives in the Transfer of Models to Users," Harding, B., C. Brendecke, and R. Kerr. Proceedings of the 26th Annual AWRA Conference and Symposium, November 4-9, 1990. Denver, Colorado.
- "Network Models of Water Rights and System Operations," Brendecke, C., W. DeOreo, E. Payton, and L. Rozaklis. Journal of the Water Resources Planning and Management Division (ASCE). 1989.
- "Modeling Water Allocation Problems Under Complex Hydrologic and Institutional Settings," Rozaklis, L., E. Payton, C. Brendecke, and B. Harding, paper presented at the 24th Annual AWRA Conference and Symposium, November 8, 1988. Milwaukee, Wisconsin.
- "Water Rights Analysis and System Operation Using Network Optimization Models," Brendecke, C., W. DeOreo, and L. Rozaklis, paper presented at the 14th Annual ASCE Water Resources Planning and Management Division Conference, March 16-18, 1987. Kansas City.
- "Network Optimization Models for Water Rights Analysis and System Operating Studies for the City of Boulder," Brendecke, C., E. Payton, and R. Wheeler, Proceedings of the Colorado Water Engineering and Management Conference, February 17-18, 1987. Ft. Collins, Colorado.
- "Rainfall and Snowmelt Frequency in an Alpine Watershed," Payton, E., and C. Brendecke, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp. 25-36.
- "A Simulation Model of Boulder's Alpine Water Supply," Brendecke, C., and J. Sweeten, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp. 63-71.

- "The Redistribution and Sublimation Loss of Snowpack in an Alpine Watershed," James, E., and C. Bredecke, Proceedings of the 53rd Western Snow Conference, April 16-18, 1985. Boulder, Colorado, pp.148-151.
- "Comparison of Two Daily Streamflow Simulation Models of an Alpine Watershed," Bredecke, C., D. Laiho, and D. Holden, Journal of Hydrology, 1985, v. 77, pp. 171-186.
- "Management of a Municipally Owned Alpine Watershed Using Continuous Simulation," Bredecke, C., D. Laiho, and J. Sweeten, Proceedings of the 11th International Symposium on Urban Hydrology, Hydraulics, and Sediment Control, July 23-26, 1984. Lexington, Kentucky, pp. 79-87.
- Eutrophication and Land Use, Lewis, W., D. Crumpacker, J. Saunders, and C. Bredecke, Ecological Studies Vol. 46, Springer-Verlag, 1984. New York, 202 pp.
- "A Comparative Evaluation of Streamflow Simulation Models in a Colorado Alpine and Subalpine Environment," Bredecke, C., D. Laiho, and D. Holden, Proceedings of the American Geophysical Union Front Range Branch Hydrology Days, April 24-26, 1984. Ft. Collins, Colorado, pp. 40-55.
- "Seepage from Oilfield Brine Disposal Ponds in Utah," Baker, F., and C. Bredecke, Groundwater, 1983. 21(3), pp. 317-324.
- "Environmental Considerations in Corps Planning," Bredecke, C., and L. Ortolano, Water Resources Bulletin, 1981. 17(2), pp. 248-254.

#### **Expert Testimony 2007-2011**

##### **Water Delivery Call by Blue Lakes Trout Co. and Clear Springs Foods, Inc., before Idaho Department of Water Resources**

Deposition: November 12-13, 2007  
Testimony: December 11-12, 2007

##### **Water Delivery Call by the Surface Water Coalition, before Idaho Department of Water Resources**

Deposition: October 24, 2007  
Testimony: February 1, 2008

##### **Water Delivery Call by the A&B Irrigation District, before Idaho Department of Water Resources**

Deposition: September 15, 2008

##### **07CW52 Colorado Water Division 3 "Sub-district 1 Plan of Water Management"**

Testimony: October 6, 2009

##### **Water Delivery Call by Clear Springs Foods, Inc., (Mitigation Plan), before Idaho Department of Water Resources**

Deposition: October 13, 2009  
Testimony: December 7-8, 2009

##### **Water Delivery Call by the Surface Water Coalition, (Mitigation Plan), before Idaho Department of Water Resources**

Testimony: May 24-25, 2010

**EXHIBIT B**

Modeled Gains (acre-feet) Accruing to  
nr Blackfoot-Minidoka reach

	<u>Winter*</u>	<u>Irrigation Season**</u>
IGWA		
CREP	3,760	6,773
Conversions	230	329
Recharge	139	185
	<u>4,129</u>	<u>7,287</u>
SWID/GC		
CREP	248	347
Hard Conversions	0	0
Soft Conversions	1	3
	<u>249</u>	<u>350</u>
Other		
IWRB recharge	2,305	2,185
Grand Total	6,683	9,822

\* November 2011 through March 2012

\*\* April 2012 through October 2012