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*Attorneys for Idaho Ground Water Appropriators, Inc. (IGWA)*

RECEIVED

Jan 31, 2024

DEPARTMENT OF  
WATER RESOURCES

**STATE OF IDAHO**

**DEPARTMENT OF WATER RESOURCES**

IN THE MATTER OF DISTRIBUTION OF  
WATER TO VARIOUS WATER RIGHTS  
HELD BY OR FOR THE BENEFIT OF  
A&B IRRIGATION DISTRICT,  
AMERICAN FALLS RESERVOIR  
DISTRICT #2, BURLEY IRRIGATION  
DISTRICT, MILNER IRRIGATION  
DISTRICT, MINIDOKA IRRIGATION  
DISTRICT, NORTH SIDE CANAL  
COMPANY, AND TWIN FALLS CANAL  
COMPANY

IN THE MATTER OF IGWA'S  
SETTLEMENT AGREEMENT  
MITIGATION PLAN

MP  
Docket No. CM-~~DC~~-2016-001

**IGWA'S WITNESS DISCLOSURE**

Idaho Ground Water Appropriators, Inc. ("IGWA"), by and through its counsel of record, submits the following expert and lay witness list, in accordance with the Hearing Officer's *Order Authorizing Discovery, Scheduling Order, Order Suspending IDAPA 37.01.01.354, and Notice of Prehearing Conference and Hearing* issued December 29, 2023.

**EXPERT WITNESSES**

1. **Sophia Sigstedt**. Lynker Technologies, 5445 Conestoga Ct., Boulder, Colorado 80301; (855) 596-5371. A copy of Ms. Sigstedt's updated curriculum vitae is attached hereto as Exhibit A.

2. **Jim McCord.** Lynker Technologies, 5445 Conestoga Ct., Boulder, Colorado 80301; (855) 596-5371. A copy of Mr. McCord's updated curricula vitae is attached hereto as Exhibit B.
3. **Jaxon Higgs.** Water Well Consultants, 355 West 500 South, Burley, Idaho 83318; (208) 650-6605. A copy of Mr. Higgs' updated curricula vitae is attached hereto as Exhibit C.

#### **LAY WITNESSES**

1. **Kirk Jacobs.** Kirk Jacobs is the chairman of Jefferson-Clark Ground Water District ("Jefferson-Clark") and is expected to testify regarding Jefferson-Clark's understanding and implementation of the *Surface Water Coalition's and IGWA's Stipulated Mitigation Plan and Request for Order* filed March 9, 2016, the *Final Order Approving Stipulated Mitigation Plan* issued May 2, 2016, *Surface Water Coalition's and IGWA's Stipulated Amended Mitigation Plan and Request for Order* filed February 7, 2017, and the *Final Order Approving Amendment to Stipulated Mitigation Plan* issued May 9, 2017, in IDWR Docket No. CM-MP-2016-001 (collectively, "2016 Mitigation Plan"); and *IGWA's Mitigation Plan for the Surface Water Coalition Delivery Call* filed November 9, 2009 and *Order Approving Mitigation Plan* issued June 3, 2010, in IDWR Docket No. CM-MP-2009-007 ("2009 Mitigation Plan"); and how Jefferson-Clark intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman's ruling that averaging may not be used. Mr. Jacobs may be contacted at the Jefferson-Clark office: P.O. Box 118, Terreton, Idaho 83450-0118; (208) 520-5904.
2. **Bill Stoddart.** Bill Stoddart is secretary for Jefferson-Clark and is expected to testify regarding Jefferson-Clark's understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how Jefferson-Clark intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman's ruling that averaging may not be used. Mr. Stoddart may be contacted at the Jefferson-Clark office: P.O. Box 118, Terreton, Idaho 83450-0118; (208) 520-5904.
3. **Lynn Carlquist.** Lynn Carlquist is the chairman of North Snake Ground Water District ("North Snake") and is expected to testify regarding North Snake's understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how North Snake intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman's ruling that averaging may not be used. Mr. Carlquist may be contacted at the North Snake office: 152 E Main St., Jerome, Idaho 83338; (208) 324-8995.
4. **Aaron Dalling.** Aaron Dalling is the manager of Henry's Fork Ground Water District ("Henry's Fork") and is expected to testify regarding Henry's Fork's understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how Henry's Fork intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman's ruling that averaging may not be used. Mr. Dalling may be contacted at 350 N 6th W, St Anthony, ID 83445; (208) 624-3381.

5. **Jeffrey Raybould.** Jeffrey Raybould is the chairman of Henry’s Fork and is expected to testify regarding Henry’s Fork’s understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how Henry’s Fork intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman’s ruling that averaging may not be used. Mr. Raybould may be contacted at may be contacted at 350 N 6th W, St Anthony, ID 83445; (208) 624-3381.
6. **Bevan Jeppsen.** Bevan Jeppsen is chairman of Madison Ground Water District (“Madison”) and is expected to testify regarding Madison’s understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how Madison intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman’s ruling that averaging may not be used. Mr. Jeppsen may be contacted at 1282 S. 2nd E., Rexburg, ID 83440; (208) 390-8240.
7. **Dean Stevenson.** Dean Stevenson is chairman of Magic Valley Ground Water District (“Magic Valley”) and is expected to testify regarding Magic Valley’s understanding and implementation of the 2016 Mitigation Plan and the 2009 Mitigation Plan; and how Madison intends to measure compliance with the 2016 Mitigation Plan in light of former Director Spackman’s ruling that averaging may not be used. Mr. Stevenson may be contacted at the Magic Valley office: P.O. Box 430, Paul, Idaho; (208) 532-4175.
8. **Tim Deeg.** Tim Deeg is a director of American Falls-Aberdeen Ground Water District (“American Falls-Aberdeen”) and the former president of IGWA. Mr. Deeg is expected to testify regarding IGWA’s implementation of the 2016 Mitigation Plan. Mr. Deeg may be contacted at the American Falls-Aberdeen offices: P.O. Box 70, American Falls, Idaho 83211; (208) 226-5914.

IGWA reserves the right to call any witness disclosed by any other party, any witness necessary to authenticate an exhibit(s), and any witness necessary for rebuttal purposes.

RESPECTFULLY SUBMITTED this 31st day of January, 2024.

RACINE OLSON, PLLP

By:   
Thomas J. Budge  
Attorneys for IGWA

**CERTIFICATE OF SERVICE**

I hereby certify that on this 31st day of January, 2024, I served the foregoing document on the persons below via email at the address shown:

  
Thomas J. Budge

Hon. Roger S. Burdick, Hearing Officer Sarah Tschohl, Paralegal Idaho Department of Water Resources 322 E. Front St. Boise, ID 83720-0098	<a href="mailto:roburd47@gmail.com">roburd47@gmail.com</a> <a href="mailto:sarah.tschohl@idwr.idaho.gov">sarah.tschohl@idwr.idaho.gov</a> <a href="mailto:file@idwr.idaho.gov">file@idwr.idaho.gov</a>
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John K. Simpson Travis L. Thompson Abigail R. Bitzenburg MARTEN LAW P. O. Box 63 Twin Falls, ID 83303-0063	<a href="mailto:tthompson@martenlaw.com">tthompson@martenlaw.com</a> <a href="mailto:jsimpson@martenlaw.com">jsimpson@martenlaw.com</a> <a href="mailto:abitzenburg@martenlaw.com">abitzenburg@martenlaw.com</a> <a href="mailto:jnielsen@martenlaw.com">jnielsen@martenlaw.com</a>
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<p>Sarah A Klahn  Maximilian C. Bricker  SOMACH SIMMONS &amp; DUNN  2033 11th Street, Ste 5  Boulder, Co 80302</p>	<p><a href="mailto:sklahn@somachlaw.com">sklahn@somachlaw.com</a>  <a href="mailto:mbricker@somachlaw.com">mbricker@somachlaw.com</a>  <a href="mailto:vfrancisco@somachlaw.com">vfrancisco@somachlaw.com</a></p>
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*Courtesy Copies to:*

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<p>Robert L. Harris  HOLDEN, KIDWELL, HAHN &amp; CRAPO, PLLC  P.O. Box 50130  Idaho Falls, ID 83405</p>	<p><a href="mailto:rharris@holdenlegal.com">rharris@holdenlegal.com</a></p>
<p>Michael A. Kirkham  City Attorney, City of Idaho Falls  P.O. Box 50220  Idaho Falls, ID 83402</p>	<p><a href="mailto:mirkham@idahofallsidaho.gov">mirkham@idahofallsidaho.gov</a></p>
<p>Rich Diehl  City of Pocatello  P.O. Box 4169  Pocatello, ID 83205</p>	<p><a href="mailto:rdiehl@pocatello.us">rdiehl@pocatello.us</a></p>
<p>David W. Gehlert  Natural Resources Section  Environment and Natural Resources Division  U.S. Department of Justice  999 18th St., South Terrace, Suite 370  Denver, CO 80202</p>	<p><a href="mailto:david.gehlert@usdoj.gov">david.gehlert@usdoj.gov</a></p>
<p>Matt Howard  US Bureau of Reclamation  1150 N Curtis Road  Boise, ID 83706-1234</p>	<p><a href="mailto:mhoward@usbr.gov">mhoward@usbr.gov</a></p>

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Corey Skinner IDWR-Southern Region 1341 Fillmore St., Ste. 200 Twin Falls, ID 83301-3033	<a href="mailto:corey.skinner@idwr.idaho.gov">corey.skinner@idwr.idaho.gov</a>
William A. Parsons PARSONS, LOVELAND, SHIRLEY & LINDSTROM, LLP P.O. Box 910 Burley, ID 83318	<a href="mailto:wparsons@pmt.org">wparsons@pmt.org</a> <a href="mailto:wparsons@magicvalley.law">wparsons@magicvalley.law</a>

# Sophia C. Sigstedt

## Professional Hydrogeologist (PH-GW)



### Education

M.S., Hydrology, New Mexico Institute of Mining and Technology, 2010

B.S., Environmental Science with Biology, New Mexico Institute of Mining and Technology, 2008

### Years of Experience

15+

### Employment History

Lynker, LLC, Hydrogeologist, 2015-Present

AMEC Environment & Infrastructure, Hydrogeologist, 2010-2015

NM Institute of Mining and Technology, Research Assistant, 2008-2010

NM Institute of Mining and Technology, Teaching Assistant, 2009

Laboratory of Biochemical and Biomedical Research, Research Assistant, 2007-2008

### Summary

Sophia Sigstedt is a certified professional hydrogeologist by the American Institute of Hydrology. She has a M.S. in Hydrology and a B.S. in Environmental Science and Biology. She has over 15 years of experience. Professional experience includes hydrogeochemical evolution and water quality analysis, geochemical modeling, applications of stable isotopes to groundwater and water resource studies, radiocarbon dating of groundwater, numerical groundwater modeling, basin-scale water resource management, and conjunctive use management.

She has diverse experience in hydrology, water rights, water resources engineering, and water resources planning and management. She has been integral in several basin-scale water management studies involving development of hydrologic data, forecast of future water demands, and creation of planning models to investigate effects of changes in water management. Her work includes litigation support in a variety of water rights proceedings including historical consumptive use analysis, evaluation of surface/groundwater interactions, groundwater modeling, conjunctive administration of surface water and groundwater rights, stream depletion analysis, development of protective terms and conditions, settlement negotiations, and expert witness testimony.

Her hydrology graduate degree experience includes surface-water, vadose zone and groundwater hydrology with an emphasis in hydrogeology and hydrogeochemistry. Undergraduate background includes microbiology, environmental geology, toxicology, ecology and waste water treatment.

She has run stable isotopic analysis using mass spectrometry for the New Mexico Tech Stable Isotope Lab. She has taught laboratory and field techniques in hydrology at New Mexico Institute of Mining and Technology. Techniques included surveying, employing tensiometers and infiltrometers to quantify unsaturated flow, solute transport experiments, well hydraulic tests, and stream gauging.

### Core Skills

Hydrogeologic and hydrogeochemical analysis performed using Modflow2K, Modflow-Surfact, Modflow-USG, MODPATH, PEST, IDSCU-AWAS, SAC-SMA, Lag/K, Snow-17, StateCU, RefET, Hydrus, Leapfrog, Netpath, Phreeqc, SaltNorm, Aquachem, ArcGIS, and RockWare.

### Selected Project Experience Water Resources

#### Snake River Conjunctive Administration of Water Rights

*Idaho Ground Water Appropriators, ID, 2012-2024*

Ms. Sigstedt provides expert support in the evaluation of conjunctive administration of ground water rights with modeling of aquifer management and mitigation plans, consumptive use analysis, and analysis of historical water use. Ms. Sigstedt provides project support on the Eastern Snake Plain Aquifer Model and its development under the Eastern Snake Hydrologic Modeling

Committee, as well as, its application for conjunctive use management of water rights.

### **City of Boulder Water Supply Planning and Water Resources Engineering**

*City of Boulder, CO, 2020-2024*

Ms. Sigstedt is project manager under contract with City of Boulder for water resources engineering and water supply planning services. Ms. Sigstedt provides evaluation of the city's water system and ability to meeting policy and planning goals, computer modeling of the city's water supply and water rights portfolio and water system operations, evaluation of climate change impacts, drought planning, water efficiency planning, evaluation and forecasting of water demands and technical analysis around water rights administration.

### **South Platte River & Boulder Creek Conjunctive Administration of Water Rights**

*City of Boulder, CO, 2010-2020*

Ms. Sigstedt provides expert support in the evaluation of applications to the state focused on assessing the quantity and timing of depletions to streamflow. Ms. Sigstedt provides review and independent analysis of numerical modeling, consumptive use and historical use for technical support in the evaluation of conjunctive use management of water rights. This work includes analysis of certain water court cases and State Engineer proceedings to which the City of Boulder is a party.

### **Laramie County Control Area Hydrogeologic Model**

*Wyoming State Engineer's Office, WY, 2013-2014*

Ms. Sigstedt developed a hydrogeologic model for management of the Laramie County Groundwater Control Area. Ms. Sigstedt was tasked with data review for model inputs and development of a hydrogeologic model of the High Plains Aquifer System using MODFLOW-SURFACT. Modeling included developing DCMI, consumptive use for irrigation withdrawals, recharge estimates, and modeling stream flows (STR). The model was calibrated using PEST. The groundwater modeling analysis was used to determine the status of appropriable water in the county.

### **Determination of Appropriable Water for Salt Basin Groundwater System**

*New Mexico State Engineer's Office Interstate Stream Commission (ISC), NM, 2007-2010*

Ms. Sigstedt acted as a hydrogeochemist for the analysis of the Salt Basin groundwater system to determine water resources available for appropriation by the State. For this project Ms. Sigstedt's primary tasks included developing a hydrogeochemical model based on environmental tracers collected from groundwater, surface water and precipitation sources within the basin. Ms. Sigstedt collected samples for carbon-14, tritium, oxygen and deuterium stable isotopes, and general ion chemistry analysis. Ms. Sigstedt analyzed the environmental tracers and general ion chemistry data to delineate recharge zones, identify groundwater flow paths and characterize fracture flow, estimate groundwater flow rates and permeability and elucidate the controls on the evolution of groundwater chemistry and the water quality distribution of the basin. The geochemical modeling was used to calibrate a basin-scale MODFLOW-SURFACT model.

### **Navajo Nation Zuni Basin Water Rights Adjudication**

*Navajo Nation, NM, 2011-2012*

Ms. Sigstedt provided water resource management consulting for the Zuni basin. Ms. Sigstedt was tasked with DCMI estimates as well as the development of a hydrogeologic model. Three-dimensional geologic model built using Leapfrog Hydro. Groundwater model was run using MODFLOW-SURFACT and used to develop scenarios and determine impacts of claims on appropriable water in the basin.

### **Middle Rio Grande Conservancy District (MRGCD) Ad Valorem Tax Assessment**

*Bureau of Indian Affairs (BIA), NM, 2011*

Ms. Sigstedt provided a detailed Ad Valorem tax assessment for properties with acreage benefitted by the Middle Rio Grande Conservancy District (MRGCD) water services. Ms. Sigstedt's analysis included identifying non-pueblo, irrigable acres evaluating the ad valorem and water services collections and providing a summary for both the residential and non-residential property for each county within the conservation District. Ms. Sigstedt's data compilation and mapping were performed with the use of Microsoft Access and ArcGIS.

### **National Weather Service Hydrologic Modeling and Support**

*National Oceanic Atmospheric Administration (NOAA), Federal, 2014-2017*

Lynker under contract with NOAA calibrated and implemented models for use in NWS river, flood, and drought forecast processes. Ms. Sigstedt's work includes developing and modifying hydrologic inputs, understanding groundwater-surface



water interactions, consumptive use analysis and hydrologic model calibration. Ms. Sigstedt is currently involved in the Northwest River Forecast Center (NWRFC), Missouri Basin River Forecast Center (MBRFC), and the West Gulf River Forecast Center (WGRFC) calibration tasks, which involve calibration of the SAC-SMA, SNOW-17, and LAG/K hydrologic models. The task was completed using a variety of tools including the CHPS environment, GIS, and Python scripting.

## Selected Project Experience Mineral Resources and Impact Analysis

### Ollachea Mine Hydrology and Hydrogeology for Feasibility Study

*Compania Minera Kuri Kullu, Peru, 2012*

Ms. Sigstedt provided hydrology and hydrogeological characterization for the Ollachea underground gold mine site for operational planning. Ms. Sigstedt was tasked with the development of the hydrogeological modeling with MODFLOW-USG to determine impacts on local streamflow and estimate mine tunnel inflows used in the assessment of sizing the on-site waste water treatment plant.

### Carmen de Andacollo Hydrogeologic Analysis of Tailings Expansion

*Compania Minera TECK, Chile, 2012*

Ms. Sigstedt provided hydrogeological characterization and analyses in support of expansion of the mine tailing facilities. As part of this effort Ms. Sigstedt provided consulting to the team in Santiago on water quality and geochemical evolution, stable isotope analysis and development of the hydrogeological modeling with MODFLOW-SURFACT.

### Corani Mine Water Resources Environmental Impact Analysis

*Bear Creek Mining Company, Peru, 2011*

Ms. Sigstedt was tasked with the surface water and groundwater quality analysis. Analysis included water quality comparisons to environmental standards, temporal and spatial distributions of contaminants of concern using ArcGIS mapping, analysis of geochemical evolution through the use of Piper and Stiff diagrams, stable isotope analysis, and identifying and analyzing impacts from existing environmental liabilities. Ms. Sigstedt assisted in the groundwater model development of a MODFLOW-SURFACT model to determine wetland impacts at the mine site.

### Antamina Mine Regional Hydrogeologic Integration and Geodatabase

*Antamina, Peru, 2011*

Ms. Sigstedt served as a hydrologist on a team charged with integrating all hydrogeologic data collected since site inception into an ArcGIS geodatabase, and compiling a hydrogeologic integration report. The hydrogeologic integration report involved summarizing all past work, identifying important data gaps, and developing a site-wide integrated hydrogeologic conceptual model that could be used to provide a framework for interpreting existing and newly acquired site data. Ms. Sigstedt's work focused primarily on hydrogeology and groundwater movement, water quality, geochemical evolution and developing the ArcGIS geodatabase.

### Expert Testimony

Before the Department of Water Resources of the State of Idaho In the Matter of Distribution of Water to Various Water Rights Held by or for the Benefit of the *Surface Water Coalition*, June 6, 2023.

Before the Michigan Department of Environment, Great Lakes and Energy in the Matter of *Wetland Permit issued to Aquila Resources docket #18-013058* June 10, 2019.

Before the Department of Water Resources of the State of Idaho In the Matter of *Application for Transfer no. 79560 in the Name of North Snake Ground Water Dist., Magic Valley Ground Water Dist., and Southwest Irrigation Dist.* December 18<sup>th</sup>, 2014.

### Appointed as an Expert to:

Big Lost Modeling Technical Advisory Committee (2022) **Idaho**

Surface Water Coalition Technical Working Group (2015) **Idaho**

Eastern Snake Hydrologic Modeling Committee (2014) **Idaho**

Case no. 10CW306 Technical Working Group (2014) **Colorado**

Swan Falls Technical Working Group (2013) **Idaho**

## Expert Reports & Publications

- "Expert Report Hydrology, Water Rights, and Groundwater Modeling Evaluation of the Fifth Amended Final Order Regarding Methodology for Determining Material Injury to Reasonable In-Season Demand and Reasonable Carryover and the Final Order Regarding April 2023 Forecast Supply issued April 21, 2023, in the Matter of Distribution of Water to Various Water Rights Held by or for the Benefit of the Surface Water Coalition" Prepared for IGWA May 30, 2023.
- "Expert Report of the Idaho Ground Water Appropriators, Inc (IGWA) Concerning Applications for Permit Nos. 36-17121 and 36-17122" Prepared for IGWA February 7<sup>th</sup>, 2020.
- "Opinions to Date of Louis Rozaklis and Sophia Sigstedt Regarding Case No. 16CW3200 Application for Change of Water Rights and Appropriation of Return by Arapahoe County Water and Wastewater Authority, East Cherry Creek Valley Water and Sanitation District and United Water and Sanitation District" Prepared for City of Boulder, 2018.
- "Engineering Report in the Evaluation of Consolidated Case Nos. 13CW3144 and 14CW3134: Application for Groundwater Rights and Augmentation Plan by Timbro Ranch and Cattle Company, LLC" Prepared for City of Boulder by Sophia C. Sigstedt, Lee T. Rozaklis, and Shaden A. Musleh, 2018.
- "Opinions to Date of Louis T. Rozaklis and Sophia Sigstedt Regarding Case No. 14CW3068 Application for Change of Water Rights and Addition of Sources of Augmentation and Substitute Supply by the Town of Wiggins" Prepared for City of Boulder, 2017.
- "Groundwater flow in an 'underfit' carbonate aquifer in a semiarid climate: application of environmental tracers to the Salt Basin, New Mexico (USA)", S.C. Sigstedt, F.M. Phillips, and A.B.O Ritchie, Hydrogeology Journal DOI 10.1007/s10040-016-1402-2, 2016.
- "Evaluation of Hydrogeology and Groundwater Modeling of Case no. 13CW3144 Applications for Water Rights of Timbro Ranch & Cattle Company, LLC" prepared for City of Boulder by S.C. Sigstedt, Lynker Technologies, 2015.
- "Water Right, Water Measurement, and Groundwater Modeling Evaluation of Rangen 2014 Delivery Call" Prepared for Idaho Ground Water Association by C.M. Brendecke & S.C. Sigstedt, Lynker Technologies, 2015.
- "Hydrogeologic Study of the Laramie County Control Area" Prepared for the Wyoming State Engineer's Office by AMEC Environment & Infrastructure, Hinckley Consulting & HDR Engineering, Inc, 2014.
- "Opinions to Date of Louis Rozaklis and Sophia Sigstedt Regarding Case No. 13-SE-18 Applications by 70 Ranch Resource Development, L.L.C.", Prepared for the City of Boulder, CO by AMEC Environment & Infrastructure, 2014.
- "Nontributary Determination Huerfano County, Colorado Raton Basin", prepared for SWEPI LLP, by R. McGregor, D.S. Kaback, J. Clark & S. Sigstedt at AMEC Environment & Infrastructure, 2013.
- "Opinions to Date of Louis Rozaklis, Shaden Musleh, Sophia Sigstedt, and Courtney Black Regarding Case No. 10CW306 Applications by the Arapahoe County Water and Wastewater Authority, United Water and Sanitation District, and East Cherry Creek Valley Water and Sanitation District", Prepared for the City of Boulder, CO by AMEC Environment & Infrastructure, 2013.
- "Freeman 3-24 Well Nontributary Determination Huerfano County, Colorado Raton Basin, by R. McGregor, D.S. Kaback, J. Clark & S. Sigstedt at AMEC Environment & Infrastructure, 2013.
- "Ollachea Gold Project PERU NI 43-101 Technical Report on Feasibility Study: Chapter 16.4 Hydrogeology", Prepared for Minera Kuri Kulla S.A. by AMEC Environment & Infrastructure, 2012.
- "Environmental tracers in groundwater of the Salt Basin, NM, and implications for water resources" Sophia Sigstedt. New Mexico Institute of Mining and Technology, Socorro, NM. 2010.

## Jim McCord, Ph.D., P.E.

Principal Hydrogeologist / Water Resources Engineer



### Education

Ph.D., Geoscience, Dissertation in Hydrogeology, New Mexico Institute of Mining and Technology, 1989

M.S., Hydrology, New Mexico Institute of Mining and Technology, 1986

B.S., Civil Engineering, Virginia Polytechnic Institute and State University, 1981

### Memberships/Affiliations

Professional Engineer (New Mexico #15568, in process for California, Arizona, Colorado)

Member, California Groundwater Resources Assoc.

Member, New Mexico Geological Society

### Languages

English, Mother Tongue

Spanish, DELE (Diploma in Spanish as Foreign Tongue) Level 2, Fluent spoken and written

### Consulting Employment History

Lynker Technologies, LLC, Principal Hydrogeologist - Water Resources Engineer / Groundwater Lead, July 2021 – Present

IRP Water Resources Consulting  
Principal Consultant, 2020 – 2021

Geosystems Analysis, Inc.  
Principal Hydrogeologist, 2018 – 2020

Amec Foster Wheeler  
Principal Water Resources Engineer 2007-2018

Hydrosphere Resource Consultants, Principal Hydrologist, 1999 – 2007 (acquired by Amec)

Daniel B. Stephens & Associates, Hydrology Group Leader, 1997 - 1999

### Summary

Dr. McCord has more than 35 years of professional experience in hydrology, hydrogeology, and water resource investigations, with emphasis on characterization of groundwater and surface water systems, numerical modeling of hydrologic systems, river basin planning and management, water supply and availability analysis, vadose zone hydrology, contaminant hydrology, surface water and groundwater interaction, water rights, and stochastic hydrology and geostatistics. Prior to embarking on his water resources consulting career, Dr. McCord was employed as Assistant Professor of Civil Engineering and Geology at Washington State University (1988 – 1990) and as Senior Member of the Technical Staff at Sandia National Laboratories (1990 – 1997), where he worked on radioactive waste management issues.

Over his nearly 20 years with Hydrosphere and Amec Foster Wheeler (who acquired Hydrosphere in 2007), Dr. McCord served as New Mexico manager (1999 – 2007), Water Resources Technical Director for Texas – New Mexico (2007-2011), and Water Resources Technical Director for South America (2011 – 2016). He is a recognized expert in Vadose Zone Hydrology, has authored numerous consulting reports and technical peer-reviewed papers, and co-authored the textbook, *Vadose Zone Processes* (CRC Press, 1999). Following a summary of core skills is a listing of representative projects in which Dr. McCord played an important role.

### Core Skills

- Mine water management
- Seepage in mine waste rock dumps and tailings storage facilities
- Heap leach optimization studies
- Hydrogeology and Vadose Zone Hydrology
- Groundwater flow and transport modeling, from site- to basin-scale
- Unsaturated flow and contaminant transport
- Groundwater recharge processes
- Surface water/groundwater interactions
- Hydrologic analyses in Water Rights
- Crop Water Use / Irrigation Hydrology

### Project Experience

#### Sustainable Groundwater Management and Water Rights

##### GSP Groundwater Model Development and Application, Santa Ynez River Basin Eastern Management Area

*Santa Ynez Groundwater Basin Eastern Management Area Groundwater Sustainability Agency, Santa Ynez, California, 2020 - 2022*

Working under subcontract to GSI Water Solutions (GSI), Dr. McCord led development of a monthly-stress period three-dimensional numerical model in MODFLOW-USG, utilizing best available historical data and California Department of Water Resources (DWR) requirements related to

Groundwater Sustainability Plan (GSP) development. Important hydrologic model inputs were treated as time and spatially variable, utilizing gridded hydrologic data (recharge, ETo, ETa, and runoff) from the USGS Basin Characterization Model (BCM). The data was downscaled to 417-ft model grid cells and adjusted to honor monthly precipitation measured at local weather stations in the model domain. The gridded data was further utilized to develop future climate series that met SGMA requirements and incorporated climate change factors per DWR.

### **Hydrology and Hydrogeology Expert Consultant, Casitas Municipal Water District**

*Casitas Municipal Water District, Ventura County, California, 2020 - current*

For Casitas Municipal Water District (Ventura County, California), Dr. McCord is serving as a hydrogeology and hydrologic modeling expert in support of the District's TAC (Technical Advisory Committee) involvement and review of the integrated hydrologic – hydrogeologic – water quality model being developed by the State Water Boards for evaluation of fish flows for the Ventura River, review of models developed to support to GSPs in the Ojai and Upper Ventura River Subbasins, and for potential use of model in the ongoing groundwater adjudication for the basin.

### **Development of Spatially Distributed Recharge Estimates and Surface Water-Groundwater Interactions for Aquifers in Central and West Texas**

*Texas Water Development Board, 2020 - 2021*

Teamed with WSP, LRE Water Consultants, and Dr. Raghavan Srinivasan (Texas A&M University), Dr. McCord is supporting Development of Recharge Estimates and Surface Water-Groundwater Interactions for Aquifers in Central and West Texas. A variety of modeling approaches are being employed to develop the estimates, and Dr. McCord is leading the effort to evaluate the use of satellite-based tools such as GRACE and MODIS to compare to and in some cases help constrain the estimates.

### **Hydrology Expert, Navajo Nation, Zuni River Basin and Little Colorado River Adjudications**

*Navajo Nation Department of Justice, Arizona and New Mexico, 2007 - 2019*

For the Navajo Nation DOJ, Dr. McCord served as the hydrology expert on two water rights adjudications (Little Colorado River Basin, Arizona, and Zuni River Basin, New Mexico). Tasks include evaluating water claims and demands (including agricultural, M&I, and domestic) by other water users in the basin, developing Navajo claims, evaluating surface water and groundwater supplies and availability in the basins, development of a three-dimensional groundwater flow model for the Zuni River Basin, evaluation and application of a unique surface water model (based on PRMS) to estimate surface water diversions - depletions associated with Hopi agricultural systems, development of expert reports, and expert testimony.

### **Water Supply and Water Rights Due Diligence for Vineyard Acquisition, Aconcagua River Valley, Chile**

*Confidential Client, California, 2018*

For a confidential client, Dr. McCord led a due diligence assessment of the irrigation water supply reliability and sustainability for a 540-hectare vineyard property in the Aconcagua River Valley of Chile; currently only 105 hectares are being cultivated (1 hectare = 2.47 acres). The assessment included an evaluation of existing water rights (both surface water and groundwater) held by the farm, the historical yield of the surface rights, hydrogeologic analyses to identify preferred areas to install wells and thus perfect existing groundwater rights, and evaluation of various approaches (including groundwater banking) to increase the sustainability of the farm water supply.

### **GSP Water Budget Model Development, San Antonio Creek Groundwater Basin**

*San Antonio Creek Basin Groundwater Sustainability Agency, Los Alamos, California, 2020 - 2022*

Working under subcontract to GSI Water Solutions (GSI), Dr. McCord supported development of an annual and monthly timestep water budget tool, utilizing available historical data and DWR requirements related to GSP development. He led the effort in bringing in gridded hydrologic data (recharge, ETo, ETa, and runoff) from the USGS Basin Characterization Model (BCM), adjusting the gridded data to honor local weather station monthly precipitation, and filtering and processing the data to develop future climate series that met SGMA requirements and incorporated climate change factors per DWR.

### **Groundwater Sustainability Plan Groundwater Model Development, Tulare Lake Subbasin, San Joaquin Valley**

*Upper Kings River GSA, San Joaquin Valley, California, 2016 - 2020*

Supported the development of the 3D groundwater flow model that will be used as the quantitative basis for development of a Groundwater Sustainability Plan (GSP) for the Tulare Lake subbasin in Kings County, California. The GSP for the Tulare Lake subbasin must be completed and delivered to DWR by 2020 per the requirements of the SGMA. The preliminary model was delivered in March 2018, and the updated GSP model was delivered in December 2019.

### **Groundwater Hydrology Expert, Surface Water – Groundwater Interactions Along South Platte River**

*City of Boulder, South Platte Basin, Colorado, 2005-2011*

Retained by the City of Boulder, CO as groundwater hydrology expert, Dr. McCord evaluated and critiqued numerous water supply augmentation plans submitted by alluvial aquifer water users / irrigators in the Lower South Platte River, Colorado. The evaluations focused on assessing the quantity and timing of depletions to South Platte flows caused by groundwater pumping. Most of the cases involved development and application of site-specific 3D numerical models of groundwater flow, and preparation of expert reports, as well as depositions and testimony in Colorado Water Court.

### **Hydrologic Impacts of Water Rights Acquisitions and Transfers, Middle Rio Grande Basin, New Mexico**

*Middle Rio Grande ESA Collaborative Program, NM ISC, 2004 - 2005*

The Water Acquisition and Management Subcommittee (WAMS) of the Middle Rio Grande Endangered Species Act Collaborative Program made preliminary estimates of the volume of water required to meet the flow targets of the 2003 Biological Opinion regarding the silvery minnow. This study addresses how a water rights acquisition program in the Middle Rio Grande Basin might work, how water rights transfers might be affected, recommended terms and conditions for to be placed on transfers to avoid increased depletions in the basin, and the likely magnitude of the acquisitions.

### **Hydrogeology, Hydrochemistry, and Groundwater Transport Studies, Wadi Ibrahim, Saudi Arabia**

*Saudi Geological Survey, Mecca Valley, Saudi Arabia 2010 - 2012*

On contract to the Saudi Geological Survey, Dr. McCord served as project manager and principal hydrogeologist for a study of Wadi Ibrahim hydrogeochemistry and isotope hydrology Study. Specific tasks included evaluation of aquifer hydrochemistry and geochemistry include isotope chemistry, recharge sources and rates, hydraulic properties, flow path characterization, and design and execution of single- and multi-well tracer tests for aquifer transport characteristics.

### **Hydrology and Water Resources of Lower Pecos River Basin, New Mexico**

*New Mexico Interstate Stream Commission, 2000- 2008*

Served as Project Manager and lead hydrologist for several New Mexico Interstate Stream Commission (ISC) studies related to water management issues on the lower Pecos River. Tasks included: Representing ISC on the NEPA team Hydrology Work Group for developing an EIS for re-operations of Pecos River projects; develop and apply linked surface water – groundwater hydrologic model to support adjudication settlement discussions for the lower Pecos River; analysis of seepage losses from Carlsbad Irrigation District main canal; disaggregated unidentified losses from Brantley Reservoir into three components: seepage/bank storage, submerged spring inflow, and ungaged tributary inflows.

### **Impacts of Coalbed Methane Development on Connected Groundwater Systems, Southern Colorado**

*Public Counsel of the Rockies, Huerfano and Archuleta Counties, Colorado, 2008-2011*

Assessed impairment to existing water rights due to Coal-bed Methane (CBM) development in northern San Juan Basin, La Plata and Archuleta counties, and northern Raton Basin, Huerfano County, Colorado. Performed hydrogeologic evaluations and submitted expert witness documents (including affidavits in Colorado District Court, Water Division 7 and Colorado Supreme Court, Vance vs Wolfe, SEO). Included in project tasks was development of a groundwater flow model for the northern Raton Basin in Colorado and critical evaluation of groundwater models developed by energy production companies in San Juan Basin in southwest Colorado. Provided testimony in hearing before Colorado State Engineer on potential impacts of CBM development on connected surface water rights.

### **Isleta Pueblo Water Resources and Hydrology Expert, New Mexico**

*Isleta Pueblo, New Mexico, 2007 - 2011*

Dr. McCord served as hydrology expert for the Pueblo of Isleta (New Mexico) addressed a variety of technical tasks including surface water and groundwater interactions in support of Rio Grande riverine habitat restoration, and evaluation of injury to Pueblo water rights due to ag to municipal transfers.

## **Stream – Aquifer Interactions along San Acacia – San Marcial Reach of the Middle Rio Grande**

*US Bureau of Reclamation, Socorro County, New Mexico, 2000-2001*

Project Manager for study funded by US Bureau of Reclamation looking at surface water – groundwater interaction along the San Acacia to San Marcial Reach of Rio Grande, New Mexico. Utilizing a variety of historical data collected as early as the 1960s, Dr. McCord's analysis supported refinement of the hydrogeologic conceptual model for the reach, identified losing and gaining sub-reaches, and quantified the gains and losses (and their variability). This understanding is critical for evaluating management alternatives for this reach of the Rio Grande.

## **Watershed Hydrology and Habitat Restoration**

### **Recharge Characterization and Enhancement in Semiarid Rangeland, Valencia County, New Mexico**

*Valencia County, New Mexico, 2003-2004*

Project manager and technical leader for the planned long-term preservation of Comanche Springs, NM and the enlargement and management of surrounding. A hydrological and ecological investigation was performed to evaluate baseline conditions and develop BMPs for stormwater and land-use management with objectives to increase aquifer recharge, decrease erosion, improve water quality, and provide habitat for "Species of Concern" and "Priority Species." Groundwater recharge under natural conditions was evaluated using environmental tracers present in waters sampled from the vadose and saturated groundwater zones.

### **Santa Fe Municipal Watershed Management EIS**

*Santa Fe National Forest, New Mexico, 2000-2001*

Under contract to the US Forest Service, Dr. McCord served as lead hydrologist in support of an EIS that evaluated various management alternatives for the Santa Fe Municipal Watershed. As part of a multidisciplinary team of physical, chemical, and social scientists, Dr. McCord provided quantitative estimates of hydrologic impacts of catastrophic fire and the various treatment alternatives. Hydrologic parameters considered included peak flows in the Santa Fe River, annual watershed water yield, erosion, and reservoir sedimentation.

### **Hydrology and Hydrogeology Associated with Invertebrate Species Listing, Bitter Lake NWR, New Mexico**

*Chaves County, New Mexico, 2004*

Retained by NM Interstate Stream Commission for groundwater hydrology review to accompany ISC comments to proposed ESA Listing of Invertebrates at Bitter Lakes National Wildlife Refuge, New Mexico. Report focused on the historical & future hydrology of the Roswell Basin in the vicinity of BLNWR, specifically the springs which comprise the critical habitat of the proposed species.

### **Surface Water – Groundwater Interactions, San Acacia to San Marcial Reach of Rio Grande, New Mexico**

*Socorro County, New Mexico, 1999-2000*

Project Manager for study funded by US Bureau of Reclamation looking at surface water – groundwater interaction along the San Acacia to San Marcial Reach of Rio Grande, New Mexico. Utilizing a variety of historical data collected as early as the 1960s, Dr. McCord's analysis supported refinement of the hydrogeologic conceptual model for the reach, identified losing and gaining sub-reaches, and quantified the gains and losses (and their variability). This understanding is to support evaluating management alternatives for this reach of the Rio Grande.

## **Contaminant Fate and Transport / Remediation Studies**

### **Stage 2 Investigation and Remediation of Mine Waste Rock Dump Leachate Plume, New Mexico, 2014-2020**

Supported a Stage 2 investigation to remediate perched groundwater contamination at the Tyrone Mine, NM. The site investigations are in support of design and construction of a keyed-in, low-permeability barrier and perched groundwater collection system to collect impacted water. Data from the site investigation was used to design the Stage 2 abatement measures. Re-designed abatement measure installed in 2018, and operating since then

### **Remediation of LNAPL-Contaminated Soil and Groundwater, Southwest Alluvial Basin, Arizona , 2012-2015**

Senior reviewer and consultant for development of models to estimate the natural and enhanced bioremediation depletion of a jet fuel and aviation gas release at Williams Air Force Base, AZ. The water table at this site has risen some 90 feet creating an uncharacteristically deep LNAPL residual in the site aquifers. MODFLOW-SURFACT was used to predict the fate of residual LNAPL and dissolved phase contamination following aggressive, steam-flushing recovery operations at the site.

### **Radionuclide Transport Modeling, Uranium Milling Facility, Western US, 2001-2002**

Groundwater expert responsible for the development and application of flow and transport models to evaluate historical radionuclide concentrations in groundwater. The results of our analysis were used for exposure assessments for off-site individuals via the drinking water and food chain pathways as part of a toxic tort suit.

### **Tuba City Plume Contaminant Characterization and Site Closure, Arizona, 2010 -2012**

Under contract to the US Bureau of Indian Affairs, Dr. McCord served as senior reviewer and consultant for the Tuba City Landfill Remediation Feasibility Study, AZ to develop groundwater flow and transport models to evaluate sources of uranium contamination and potential remediation alternatives.

### **Evaluation of Contaminant Plume Remediation and Monitored Natural Attenuation, Louisville, Kentucky, 2012-2014**

Senior reviewer and consultant for development of models to estimate the total, mobile, and recoverable volumes and natural source zone depletion of a 20+ acre LNAPL plume in Louisville, KY. MODFLOW-SURFACT was employed to simulate reactive transport in an active water phase (both saturated and unsaturated flow) with interaction and interphase transfer with a static separate LNAPL phase. Developed remedial strategies to pinpoint locations of the project site amenable to recovery; as well as to define the areas of the site where recovery is technically impractical with use of more innovative enhanced bioremediation approaches to effective management of the LNAPL plume.

### **Transport of Contaminants through the Vadose Zone, Redlands, California, 2005-2006**

Redlands Toxic Tort Litigation, California, Served as methodology expert in evaluation of contaminant transport through the vadose zone. Contaminants included organic solvents disposed of from industrial and manufacturing facilities.

### **Natural Resources Damage Claim, Rocky Mountain Arsenal, Denver, Colorado, 2007-2009**

As the groundwater expert to the Colorado Office of Attorney General, Dr. McCord worked with interdisciplinary team of scientists and engineers to assess and quantify injury to groundwater resources and water supply impairment due to historical site operations at the Rocky Mountain Arsenal, CO, as part of a Natural Resources Damage Claim by the state. Tasks involved review and analysis of historical site data, as well as development and application of a regional groundwater flow model.

### **LNAPL Contaminant Plume Characterization and Remediation, Artesia, New Mexico, 1997-1999**

Evaluation of transport of petroleum contamination plume emanating from a refinery and migrating in an alluvial aquifer toward the Pecos River, NM. Tasks included acquisition and compilation of site data, interpretation of plume migration data, evaluation of site observations to groundwater quality standards at various locations, development and application of groundwater contaminant transport model.

### **Soil and Groundwater Contamination by DNAPL, Characterization and Remediation, New Mexico, 1997-1999**

Under contract to US Department of Justice, Dr. McCord served as Project Manager and groundwater expert on a case which involved subsurface contamination by DNAPL at an industrial site on Albuquerque's west mesa, NM. Evaluated observed contaminant plumes (water and gas phases) for current and historical conditions in both the vadose and saturated zones. Considered impacts of municipal well pumping and a nearby irrigation ditch system on the dynamics of the fate and transport processes. Prepared expert report and was involved in technical aspects of the settlement negotiations.

### **Regional Hydrogeologic Characterization, Sandia National Laboratories, Albuquerque, New Mexico, 1994-1997**

Project Manager for Sandia National Laboratory (SNL) Site Wide Hydrogeologic Characterization Project. Development and testing of surface and subsurface hydrologic conceptual models for environmental restoration sites at the 200 square mile SNL region. Annual reports, regional groundwater characterization and monitoring wells, definition and

characterization of representative vadose zone settings across the region, and characterization and monitoring of the site-wide surface water system.

### **Vadose Zone Greater Confinement Disposal Site, Nevada Test Site, Nevada, 1990-1992**

Development and application of vadose zone hydrologic models to project radionuclide migration rates associated with disposal of low-level and "orphan waste" to be disposed of in the Greater Confinement Disposal Test located on the Nevada Test Site in southern Nevada.

### **Soil and Groundwater Contamination by Wood Treating Chemicals, California, Washington, Texas, Louisiana, 1997 - 1999**

Project Manager and groundwater expert in major insurance recovery case involving five separate wood treating plant facilities across the country (LA, TX, MO, CA and WA). Development of contaminant histories based on plant records (going back to the early 20th century), site specific data and contaminant fate and transport modeling.

### **Performance Assessment Models of Regional Groundwater Flow and Transport, WIPP, New Mexico, 1994-1995**

Supported the development of a regional MODFLOW model used to define groundwater flow patterns and rates in the vicinity of the Waste Isolation Pilot Plant (WIPP), NM site, and application of the SECO performance assessment model to evaluate potential radionuclide releases over a 10,000-year performance period. Provided written and oral rationales for groundwater transport parameters to EPA and National Academy of Science technical review panels and developed QA records for the WIPP license application.

### **Contaminant Transport Characteristics in Fractured Dolomite, WIPP Site, New Mexico, 1995-1997**

Member on a team of scientists from Sandia National Labs, Lawrence Berkeley National Lab, Oregon State University, and private consultants responsible for analysis of single- and multi-well tracer test results. Tracer tests were undertaken to infer flow and transport properties of geologic media along the major release pathway from the proposed WIPP, NM. Provided written and oral rationales for groundwater transport parameters to EPA and National Academy of Science technical review panels and developed QA records for the rationales and values for the parameters as part of the WIPP license application.

## **Mine Water Management**

### **Analysis of Hydrogeology Related to Mine Development and Production Risks, Global Sulfate of Potash Projects, 2021 - current**

Working as external consultant to Appian Capital Advisors, Dr. McCord has led a Lynker team in performing a due-diligence analysis for several potential sulfate of potash, including in-situ dissolution projects in Saskatchewan Canada and brine recovery projects in Western Australia.

### **Analysis of Groundwater Flow, Mine Dewatering Plan, and Karst Risk, Pine Point Mine, NW Territories, Canada, 2022 - current**

Working as external consultant to Appian Capital Advisors, Dr. McCord is leading Lynker team in performing a due-diligence analysis to evaluate the historical and ongoing groundwater system characterization, and utilization of that information in development and application of a variety of models to project future mine dewater rates. The modeled mine dewater results are being used to develop the CAPEX and OPEX for the mine dewater programs, and the feed into the overall Preliminary Engineering Analysis report for the projected 12-year mine life. The geologic terrain of the mining region, and the high-grade deposits themselves, are associated with karstified carbonate deposits, which leads to a complex hydrogeologic environment and challenges to model development.

### **Analysis of Seepage, Las Bambas Mine Waste Rock Facilities, Apurimac, Peru, 2020-2021**

Working with DHI under contract to Mining & Minerals Group (MMG), Dr. McCord is leading the effort in detailed seepage analysis. Tasks undertaken in this effort include review and compilation of waste rock materials properties, climate data analysis, and development and application of a numerical model of long-term seepage (including matrix and macropore flow) for the waste rock facility. Dr. McCord's waste rock facility seepage analyses modeling results will be used as input for the regional groundwater flow model developed in FEFLOW

### **Peer Review of Hydrogeologic Flow Model, Vega Sapunta, Pampa Puno Mine, Chile, 2021**



Under contract to CODELCO and working with Ausenco hydrogeologists, Dr. McCord served as senior consultant and reviewer of detailed 3D regional hydrogeologic flow model (developed in MODFLOW-USG) of the Cerro Leon and Quebrada Yocas basins that converge and feed the Vega Sapunta wetlands, a protected ecological zone. The model had been developed specifically to evaluate impacts of well fields located upgradient of the wetlands that supply water for the Pampa Puno mine.

### **Analysis of Seepage, Zafranal Waste Rock and Tailings Facilities, Arequipa, Peru , 2018-2020**

Under contract to Teck, Dr. McCord led the effort in detailed seepage analysis from the mine waste rock and tailings storage facilities. Tasks undertaken in this effort included development of a TMF conceptual model for seepage development, and development and application of a numerical model of draindown seepage from the TMF and another for long-term seepage (including matrix and macropore flow) for the waste rock facility. Dr. McCord's TMF and Waste Rock Dump modeling results were used as input for the regional model developed in FEFLOW.

### **Analysis of Waste Rock Seepage, Antapaccay – Tintaya Mines, Cusco, Peru , 2019-2021**

Under contract to DHI, Dr. McCord led the effort in detailed seepage analysis. Tasks undertaken in this effort included development and application of a hybrid analytical - numerical model for long-term seepage (including matrix and macropore flow) for the waste rock facility and working closely with regional modeling team (FEFLOW) to ensure consistency between the two modeling efforts.

### **Analysis of Seepage, Antamina Waste Rock Dump, Ancash, Peru, 2018-2020**

Working with GeoSystems Analysis scientists under contract to Antamina, Dr. McCord led the effort in detailed seepage analysis for the East Waste Rock Dump. The effort included compilation and integration of more than a decade's worth of monitoring and experimental data generated by the client since 2009 and synthesized the data to support development and application of a transient water balance model for the waste rock facility. The results of this model will be used to support mine closure engineering and water management.

### **Analysis of Seepage from Tailings Storage Facility and Waste Rock Dumps, Candelaria Mine, Chile, 2018-2019**

For an EIA in support of expansion of the Candelaria project, Dr. McCord performed detailed seepage analysis, which included development and application of a numerical model for long-term seepage for the waste rock facility. For the tailings management facility, Dr. McCord supported the FEFLOW team in the development and application of post-operations draindown modeling embedded within the regional model.

### **Analysis of Seepage, Drystack Tailings Facility, Rosemont Mine, Arizona, 2016-2017**

In support of mine planning for the planned Hudbay drystack tailings facility (DTF) at the Rosemont Mine in Arizona, Dr. McCord played a senior consultant role in the development of a hydrologic conceptual model for seepage development in the DTF, design and execution of a laboratory characterization program for the drystack tailing materials, analysis of geotechnical and soil-physical properties from the laboratory test results, and development and application of a numerical model of seepage and subsurface flow, with the objective to project long-term seepage rates from the facility.

### **Analysis of Seepage and Karst Risk, Antamina Nequip Valley Waste Rock Dump, Ancash, Peru, 2014**

Working with Amec team of engineers in the final design of the Nequip Valley waste rock storage facility, Dr. McCord led the effort in seepage analysis, under drainage, and seepage collection systems. Evaluated and support refined designs of seepage collection systems and geomembrane locations and installation utilizing data and information from drilling programs and previous Nequip Valley karst studies.

### **Lagunas Norte Project (Barrick Gold), Water Resources Lead for Modification to EIA, Peru, 2016**

Under contract to Barrick Gold, Dr. McCord led the water resources effort for the EIA study for the Lagunas Norte project expansion and supported the mine operations team by evaluating the ability of the pit dewatering activity to provide the supply required for the mine expansion. For the water resource activity, particular tasks performed by AMEC included: compilation of historical hydrology and hydrogeology data, and development of a GoldSim water balance and water quality model, and a three-dimensional numerical model of groundwater flow for the mine area.

### **Fruta del Norte Project, Water Resources Coordinator for Feasibility Study, Ecuador, 2016-2018**

Under contract to Lundin Gold, Dr. McCord supported the feasibility study for this gold mine, in the "ceja de selva" (edge of the jungle) in southeast Ecuador. For this project, he led the water resource studies for the project, coordinating

activities among AMEC staff and subcontractors who performed the hydrogeologic and surface hydrology characterization and modeling efforts, and played a key role in development of mine water management strategies.

### **Pampa de Pongo Project Water Resources Lead for EIA, Arequipa, Peru, 2013-2016**

Under contract to Jinzhao Mining Company, AMEC performed the EIA study for the Pampa de Pongo Project, located near the coast in the Department of Arequipa in southern Peru. For this project, Dr. McCord led the water resource studies for the project and supported the geotechnical analysis of the of pit wall stability for the feasibility study. For the water resource activity, particular tasks performed by AMEC included hydrology and hydrogeology field characterization, core drilling, and borehole hydraulic testing; site surface hydrology, meteorology, and project area water balance; and estimation of open pit water inflows using analytical and numerical models.

### **Analysis of Seepage, San Nicolas Waste Rock and Tailings Management Facilities, Zacatecas, Mexico , 2018-2020**

Under contract to Teck, Dr. McCord led the effort in detailed seepage analysis, which included development and application of a numerical model of draindown seepage from the TMF and another for long-term seepage (including matrix and macropore flow) for the waste rock facility. The results of these models were used as part of the upper boundary condition for the regional flow model developed in FEFLOW.

### **Studies and Engineering, Sustainable Management of Tailings, Minera Doña Inés de Collahuasi, Chile, 2017**

Provided services in disciplines of hydrogeology and acid drainage. Preparation Analysis of Relevance and PAS 135, 137 and 155. Oversight Activities of soil sampling, QA/QC control of soil analysis, and acid mine drainage determination, updated hydrogeologic conceptual and numerical model of seepage and contaminant transport.

### **Analysis of Seepage and Acid Drainage, Quillayes –El Chinche Tailings Facility, Los Pelambres Mine, 2013-2015**

In support of closure planning for this tailings facility, AMEC is performing a detailed hydrogeological study, tasks have included sampling activities of tailings and water, QA/QC control of analysis of tailings and water samples, water quality assessment and geochemical modeling of water quality, installation of piezometers, development of a hydrogeological conceptual model, and development and application of a numerical model of seepage, subsurface flow, and contaminant transport.

### **Antamina Mine Project Regional Hydrogeologic Integration and Hydrogeologic Geodatabase, 2011-2012**

Under contract to Antamina, Dr. McCord served as project manager for AMEC team charged with integrating all hydrogeologic data collected since site inception into an ArcGIS geodatabase, and compiling a hydrogeologic integration report, as well as developing three- and four-dimensional data visualizations. The hydrogeologic integration report involved summarizing all past work, with a particular focus on site studies undertaken since 2008, identifying important data gaps, and developing a site-wide integrated hydrogeologic conceptual model that could be used to provide a framework for interpreting existing and newly acquired site data.

### **La Granja Project Water Resources Lead for Prefeasibility Study, Peru, 2011-2013**

Under contract to Rio Tinto Mining Company, AMEC performed the prefeasibility study for the “starter case” for the La Granja Mine Project, located in the Department of Cajamarca in northern Peru. For this project, Dr. McCord led the water resource studies for the project and supported the analysis of the heap leach planning task. For the water resource task, Dr. McCord coordinated activities among AMEC staff and subcontractors who performed the hydrogeologic and surface hydrology characterization and modeling efforts and played a key role in development of mine water management strategies.

### **Carmen de Andacollo Project – Hydrogeologic Analyses in Support of Tailings Facility Expansion, Chile , 2012-2014**

On contract to Compania Minera TECK, AMEC is providing hydrogeological characterization and analyses in support of expansion of the mine tailing facilities. As part of this effort Dr. McCord is providing senior review and consulting to the AMEC E&I team in Santiago involved in data analysis, field characterization, and hydrogeological modeling.

### **Mina Huaron and Mina Morococha, Water Resources Management and Compliance with LMP and ECA Water Quality Standards, 2012-2013**

Under contract to Pan American Silver Corporation, AMEC led efforts to characterize mining project water management and discharges to evaluate current conditions and develop water management and treatment plans to ensure compliance with the new Peruvian LMP (Limitacion Maximum Permissible, basically end-of-pipe discharge) and ECA (Estandar de Calidad Ambiental, basically river standards at locations downstream from end-of-pipe discharges) for the Huaron and Morococha mines in the Peruvian Andes. Dr. McCord led the water management team involved in analysis of existing data and development of water management models for evaluation of alternatives to ensure compliance with new standards. Treatment alternatives considered included standard mine water treatment plants, innovative water recycling and management schemes, and constructed wetlands and permeable reactive barriers.

### **Ollachea Mine Project Hydrology and Hydrogeology for Prefeasibility and Feasibility Studies, Peru, 2012-2014**

Under contract to IRL / Compania Minera Kuri Kullu, Dr. McCord performed project management, model development, and senior review tasks for the hydrology and hydrogeology activities for the project pre-feasibility study. Particular tasks performed by AMEC hydrology and hydrogeology team included: field characterization, core drilling, and borehole hydraulic testing; site surface hydrology, meteorology, and project area water balance; and estimation of underground mine tunnel inflows using analytical and numerical models (MODFLOW-USG).

### **Hydrogeological Modeling of the Limestone Quarries, Toromocho Project, Peru, 2010**

As part of mine development studies for Minera Chinalco Perú S.A., AMEC constructed a groundwater flow model to evaluate likely timing that seepage from the tailings facility would begin flowing into the limestone quarry. Dr McCord served a project manager of this effort which involved staff from US and Peru office. The project was performed on a very accelerated schedule to address concerns that arose during the facility permitting process and utilized the limited available data from the quarry area to generate a numerical model suitable for addressing questions raised by government regulators.

### **Quechua Mine Water Balance, Peru, 2010**

For Compañía Minera Quechua performed senior review for the development of a comprehensive water balance of the Proyecto Minero Quechua mine during the operating phase. Water balances for the construction and closure phases are currently under development.

### **Bongará Mine Hydrogeologic Studies, Amazonas, Perú, 2011-2013**

Under contract to Votorantim, Amec developed an EIA for an expanded resource exploration program, and Dr. McCord served as senior reviewer on the water resources / hydrogeologic study for the EIA. The hydrogeology study included mapping in the steeply eroded karstic terrain, over 1,000 of hydrogeologic characterization boreholes, hydraulic testing of boreholes, and tracer testing in discrete karstic features. From that data and information, a hydrogeologic conceptual model was developed, as well as a scope and referential budget for follow-on hydrogeologic studies.

### **Tyrone Mine Pit Lake Model for Closure Plan, New Mexico, 1997-1999**

Senior reviewer for hydrogeology team in development of pit lake model to address a variety of issues, including estimating the post-closure recovery period of water levels in the mine pits and surrounding aquifers, and project the post-closure steady-state pit lake(s) surface elevation(s), examining the potential for pit lake outflows, and evaluating the potential interactions of pit lake(s) with other mine facilities, hydrologic features, and geologic structures.

### **Corani Mine, Water Resources Lead for EIA, Peru, 2011-2013**

Under contract to Bear Creek Mining Company, Dr. McCord performed project management, oversaw model development, and senior review tasks for the hydrology and hydrogeology, and water resource management tasks for the project EIA study. Utilizing existing data supplemented by AMEC-collected data on site hydrology, hydrogeologic measurements and mapping, and water quality sampling team, developed linked surface water and regional groundwater models, and project area water balance to provide EIA impact analysis for water resources.

### **Unsaturated Flow and Transport Analysis of Heap Leach Operations, 1998**

Developed a conceptual model for heterogeneous distribution of hydraulic properties within a heap leach pad for the Tyrone Mine in southwest New Mexico. Based on the conceptual model, constructed and applied a variability saturated

flow and transport model to evaluate the potential for channeling and flow bypass at various surface application rates, and leaching efficiency as a function of irrigation rates and patterns.

## Expert Witness

- 2022, Adjudication of Water Rights in the Ventura River Watershed, California; Civil Case No. 19STCP01176, Superior Court of the State of California, County of Los Angeles. *Deposition testimony* on behalf of the Casitas Municipal Water District, water provided to more than 200,000 persons in the basin. As expert in trial Phase I, Dr. McCord's analysis and testimony focused on critique of the integrated groundwater-surface water model of the basin developed by the State of California experts, and connectivity between the surface water and groundwater systems in the watershed.
- 2019, General Adjudication of All Rights to Use Water in the Little Colorado River System, Civil Case No. 6417-203, Apache County Superior Court, The State Of Arizona. *Trial testimony* on behalf of the Navajo Nation, as expert in trial Phase II, Hopi Water Claims, focus on historical water resource availability, surface water modeling, and water use and depletion for agricultural and irrigation purposes. Phase II court ruling in 2019 favorable to Navajo
- 2018, General Adjudication of All Rights to Use Water in the Little Colorado River System, Civil Case No. 6417-203, Apache County Superior Court, The State Of Arizona. Filing of expert report and subsequent *deposition testimony* on contract to the Navajo Nation Department of Justice. Court-accepted expert in historical water resource availability, surface water model and water depletion analysis, and water use for agricultural irrigation purposes.
- 2009, Colorado State Engineer, CBM Produced Water Nontributary Rulemaking Hearing, Groundwater expert for Public Counsel of the Rockies, *testified at SEO rule-making hearing* on technical review of northern San Juan Basin groundwater model produced by CBM industry consultants (Client: Public Counsel of the Rockies).
- 2009, Isleta Pueblo vs Santa Fe Water Resource Alliance, NEW MEXICO Office of the State Engineer File No. SD-04729 & RG-74141 into SP-4842, Hearing No. 07-059. Expert reports filed and hearing testimony related to hydrologic impact of surface water transfers that moved point of diversion (and depletion) along the Rio Grande from south of Isleta Pueblo to north of Isleta Pueblo, cases settle (Client: Pueblo of Isleta).
- 2007, Vance et al vs Wolfe (Colorado State Engineer) et al. Colorado Water Court Division 7, Case No. 05CW63. Plaintiffs' hydrology expert in case to determine jurisdiction of Colorado State Engineer to adopt permitting requirements for coalbed methane wells that may be impacting plaintiffs' decreed water rights. Plaintiffs prevailed in Water Court, and case was appealed to the Colorado Supreme Court, which in 2009 affirmed the lower court ruling (see [http://www.westernwaterlaw.com/articles/Vance\\_v\\_Wolfe.html](http://www.westernwaterlaw.com/articles/Vance_v_Wolfe.html)).
- 2007, Sierra Club and Mineral Policy Center vs. El Paso Gold Mine, Civil Action 01-PC-2163, Federal District Court of Colorado. *Trial testimony* as groundwater flow and transport methodology expert. (Client: John Barth, Attorney-at-Law)
- 2006, Low Line Ditch Well Users, An Application For Water Rights And Approval Of Plan For Augmentation, Colorado District Court, Water Division No. 1 Case NO. 2003CW094. *Deposition testimony* in October 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)
- 2006, Dinsdale Brothers, Inc Well Users, An Application For Water Rights And Approval Of Plan For Augmentation, Colorado District Court Case Nos. 2001CW061 and 2003CW194.; Water Division No. 1. *Deposition testimony* in September 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)
- 2006, Allen et al. vs. Aerojet General et al., Superior Court of the State of California, County of Sacramento, Consolidated Case No. RCV 31496. *Jury trial testimony* in March 2006 regarding the evaluation of historical groundwater contamination at Aerojet Rancho Cordova Plant. Case Phase I (defendant negligence) ruled in client favor, Phase 2 (damages) settled for undisclosed sum (client: Engstrom, Lipscomb & Lack)
- 2006, Well Augmentation Subdistrict of Central Colorado Water Conservancy District, Water Rights Application and Augmentation Plan, Colorado District Court, Water Division No. 1. *Deposition testimony* in March 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)

## Reports & Publications

### Textbooks

- Selker, J.S., C.K. Keller, and J.T. McCord, 1999. *Vadose Zone Processes*, Lewis / CRC Press, Boca Raton, FLA, 339 pp.
- McCord, J.T., and J.S. Selker, 2003. Transport Phenomena and Vulnerability of the Unsaturated Zone, in *Encyclopedia of Life Support Systems*, UNESCO, [www.eolss.net](http://www.eolss.net).

### Refereed Journal Articles

- Guerra, P.A., A. Bauer, R.A. Reiss, and J.T. McCord, 2021. In Situ Bioremediation of a Chlorinated Hydrocarbon Plume: A Superfund Site Field Pilot Test, *Appl. Sci.* 2021, 11(21), 10005; <https://doi.org/10.3390/app112110005>.
- McCord, J.T., C.A. Gotway, and S.H. Conrad. 1997. Impact of geological heterogeneities on recharge estimation using environmental tracers. *Water Resources Research*, 33(6):1229-1240.
- Goodrich, M.T. and J.T. McCord. 1995. Quantification of uncertainty in exposure assessments of hazardous waste sites. *Ground Water*, 33(5):727-732.
- Eaton, R.R. and J.T. McCord. 1995. Monte Carlo stochastic analysis of effective conductivities for unsaturated flow. *Transport in Porous Media*, 18(3).
- McCord, J.T. 1991. On the application of second-type boundaries in modeling unsaturated flow. *Water Resources Research*, 27(12):3257-3260.
- McCord, J.T., J.L. Wilson, and D.B. Stephens. 1991. The importance of hysteresis and state-dependent anisotropy in modeling flow through variably saturated soils. *Water Resources Research*, 27(7):1501-1518.
- McCord, J.T., D.B. Stephens, and J.L. Wilson. 1991. Toward validating macroscopic state-dependent anisotropy in unsaturated soils: Field experiments and modeling considerations. *Journal of Contaminant Hydrology*, 7:145-175.
- McCord, J.T. and D.B. Stephens. 1988. Comment on 'Effective and relative permeabilities of anisotropic porous media' by Jacob Bear, Carol Braester, and Pascal Menier. *Transport in Porous Media*, 3:207-210.
- McCord, J.T. and D.B. Stephens. 1987. Comment on 'Effect of ground-water recharge on configuration of the water table beneath sand dunes and on seepage in lakes in the Sandhills of Nebraska, USA' by Thomas C. Winter. *Journal of Hydrology*, 95:365-367.
- McCord, J.T. and D.B. Stephens. 1987. Lateral moisture flow beneath a sandy hillslope without an apparent impeding layer. *Hydrological Processes*, 1(3):225-238.

### Conference and Symposia Proceedings

- McCord, J.T., and W.A. Miliband, 2022. Kicking the Can Up the Hill: How SGMA Can Help Resolve the Disconnect in California's Treatment of Surface Water and Groundwater Interconnectivity, 2022 Western Groundwater Summit, Groundwater Resources Association of California.
- McCord, J.T., S. Sigstedt, S. Gangopadhyay, and R. Uribe, 2018. Stream Depletion Factors, Unit Response Functions, and streambed properties for modeling lagged river depletions due to well pumping, 2018 Western Groundwater Summit, Groundwater Resources Association of California.
- McCord, J.T., and S. Gangopadhyay, 2016. Stochastic numerical analysis of up-scaled aquifer and streambed properties for modeling lagged river depletions due to well pumping, Geological Society of America Annual Meeting, 25-28 Sept 2016, Denver, CO.
- McCord, J.T., D.B. Stephens, and T.C. Jim Yeh, 2016. Moisture dependent anisotropy in unsaturated flow: theory and application, Geological Society of America Annual Meeting, 25-28 Sept 2016, Denver, CO.
- McCord, J.T., J.A. Clark, N. Starr, R. McGregor, and N. Mandic, 2010. Applied Telescopic Mesh Refinement in Groundwater Modeling: Three Case Studies, NGWA National Groundwater Modeling Summit, Denver, CO, April 11-15.
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- McCord, J.T., and J.L. Smith, J.C. Carron, L.T. Rozaklis, A. Elhassan, , and V. Sperling, 2005. Hydrological Modeling to Support Conjunctive Use and Management: Case Studies from Two Western River Basins, New Mexico Water Resources Research Institute, Annual Hydrology Conference, August 2005 Las Cruces, NM.
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- Carron, J.C., and J.T. McCord, J.L. Longworth, and B. Liu, 2004. Hydrological Model Analysis Of Alternatives For Pecos River NEPA Studies, New Mexico Water Resources Research Institute, Annual Hydrology Conference August 2004, Las Cruces, NM.
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- Naff, R.L., E.R. Banta, and J.T. McCord, 2003. Obtaining a steady-state initial solution with elliptic and parabolic equations under dewater conditions: experiences with a basin model, IGWMC MODFLOW Modeling Conference, Colorado School of Mines, Golden, Colorado.
- McCord, J.T., and J.W. Longworth, 2003. Application of a Linear Groundwater Reservoir Model to Simulate Losses on the Dunlap to Acme Reach of the Pecos River, New Mexico Hydrological Modeling Symposium, Socorro, NM, 8/12/03; New Mexico Water Resources Research Institute, NMSU.
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- Clark, J.A., J.T. McCord, J.W. Longworth, and B. Liu, 2003. Development and Application of Unit Response Functions for Groundwater Pumping in the Roswell Basin, New Mexico Hydrological Modeling Symposium, Socorro, NM, 8/12/03; New Mexico Water Resources Research Institute, NMSU.
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- Winchester, J.N., and J.T. McCord, 2001. Soil & Water Effects Analysis of Management Alternatives for the Santa Fe Municipal Watershed, Rocky Mtn Section, Geologic Society of America Annual Meeting, Albuquerque, NM.
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- Crowson, D. and J.T. McCord. 1993. Detailed mapping and geostatistical analysis of alluvial fan deposits exposed in six miles of trench. AGU Spring Meeting, EOS, Transactions of the AGU, 74(16):143.
- Stephens, D.B., R.G. Knowlton, Jr., J.T. McCord, and W. Cox. 1985. Physical considerations in ground-water recharge. In Proceedings, Symposium on Water and Science, February 15, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, pp. 92-108.

*Dr. McCord contributed to an additional 30 conference papers between the 1985 and 1993 papers shown above; those have been deleted to save a couple pages here, but a list of those papers can be provided upon request.*

# Exhibit C

Jaxon Higgs, Professional Geologist (PGL - 1672)  
Water Well Consultants, Inc.  
355 West 500 South  
Burley, Idaho 83318

## Education:

- B.S., Geology, Brigham Young University Idaho, 2010
- M.S., Hydrogeology, University of Idaho, 2012

## Employment History:

- Water Well Consultants, Inc.
  - Field Tech (2000-2012)
  - Staff Hydrogeologist & GIS Analyst (2012-Present)

## Summary:

Jaxon Higgs is the principal owner and operator of Water Well Consultants, Inc. (“WWC”). WWC provides a variety of hydrogeologic services in southern Idaho related to aquifer management and water conservation. Contracted duties include, but are not limited to, monitoring of aquifer health, usage measurement and reporting, and management of aquifer recharge programs.

WWC is a consultant for Idaho Ground Water Appropriators, Inc. (“IGWA”). In that capacity Higgs provides technical assistance on a variety of matters, including groundwater modelling and other issues related to the Surface Water Coalition (“SWC”) delivery call. Higgs also attends IGWA board meetings, including those involving the settlement agreement entered into between IGWA and the SWC in 2015 (the “2016 Settlement Agreement”). Among other things, Higgs prepares the spreadsheets showing groundwater diversion and recharge data that IGWA submits to the SWC and IDWR under section 2.a of the Second Addendum to the 2016 Settlement Agreement.

Higgs is also a consultant for five of IGWA’s member ground water districts: North Snake Ground Water District, Magic Valley Ground Water District, Southwest Irrigation District, American Falls-Aberdeen Ground Water District, and Bonneville-Jefferson Ground Water District. He provides input on the development of, and is familiar with, each of these districts’ programs for conserving groundwater under the 2016 Settlement Agreement (Southwest Irrigation District conserves water under a separate settlement agreement with the SWC).