Photocatalytic Decontamination of Wastewater with Porous Material HNb_3O_8

Maryam Zarei Chaleshtori, University of Texas at El Paso, Center for Environmental Research Management, Environmental Science and Engineering Ph.D. Program
500 University Ave., El Paso, TX 79968, mzarei@miners.utep.edu, 915-845-5677
S. M. Sarif Masud, University of Texas at El Paso, Materials Science and Engineering Ph.D. Program, 500 University Ave., El Paso, TX 79968, ssmasud@miners.utep.edu, 915-747-5861
Mahsa Hosseini, University of Texas at El Paso, 500 West University Ave., Department of Chemistry, El Paso, TX, 79968, mhosseini@utep.edu, 915-747-5861
Geoffrey B. Saupe, University of Texas at El Paso, 500 West University Ave., Department of Chemistry, El Paso, TX, 79968, gsaupe@utep.edu, 915-747-7559

Poster Abstract 1

This study describes how a niobium oxide nanocomposite heterogeneous photocatalyst has been synthesized to accelerate the photolytic destruction of organic contaminants in water. We studied the structural characteristics of a newly synthesized catalyst and its photocatalytic ability under UV light irradiation. The surface area, pore size, crystal structure, and morphology of the synthesized catalyst were characterized by BET, XRD, UV-Vis, SEM and TEM. Porous photocatalytic materials can have the combined qualities of high surface area and relatively large particle sizes, as compared with nanoparticulate catalyst powders. The larger particle sizes of the porous materials facilitate catalyst removal from a solution, after purification has taken place. The new material can be used to purify contaminated water by accelerating the photodegradation of any kind of organic pollutant. The new materials have very large open pore structures that facilitate the diffusion, the surface contact of contaminants, and solvent flow through the catalyst. These qualities enhance surface reactions important to the process. The new catalysts have shown robust physical and chemical properties that make them candidates for real applications in polluted water decontamination. They exhibited excellent catalytic activity, but with a strong pH dependence on the photo efficiency. These results suggest that elimination of the ion exchange character of the catalyst may improve its performance at various pHs. To address this issue, this research studied the effects of a topotactic dehydration reaction on this new porous material catalyst and compared the photocatalytic activity with other synthesis methods and that of the parent material.

Contact: Maryam Zarei-Chaleshtori, UTEP, mzarei@miners.utep.edu, 6071 Via Hermosa Ct., El Paso, TX 79912, 915-845-5677, 915-747-5748

The Effects of Watershed Characteristics and Ungulate Grazing on Nutrient Cycling in Montane Grassland Streams and Riparian Areas

David J. Van Horn, Department of Biology, University of New Mexico, MSC03 2020, 1 University of New Mexico, Albuquerque, NM 87131, vanhorn@unm.edu, 505-277-9164
Carleton S. White, Department of Biology, University of New Mexico, MSC03 2020, 1 University of New Mexico, Albuquerque, NM 87131, cswhite@sevilleta.unm.edu, 505-277-8689
Edward A. Martinez, Department of Natural Resources New Mexico Highlands University, PO Box 9000, Las Vegas, NM 87701, eamartinez@nmhu.edu, 505-454-3366
Christina Hernandez, Department of Natural Resources New Mexico Highlands University, PO Box 9000, Las Vegas, NM 87701, chernandez8@miners.utep.edu
Josh Merrill, Department of Natural Resources, New Mexico Highlands University, PO Box 9000, Las Vegas, NM 87701, merrjp61@oneonta.edu
Clifford N. Dahm, Department of Biology, UNM, MSC03 2020, 1 University of New Mexico, Albuquerque, NM 87131, cdahm@sevilleta.unm.edu, 505-277-2850

Poster Abstract 2

Catchment characteristics and disturbances control the conditions and processes found in stream ecosystems. We examined nutrient cycling linkages between riparian soils and adjacent streams and the impacts of ungulate grazing on these ecosystems and processes at six grazing exclosure sites in the Valles Caldera National Preserve, NM, USA. The exclusion of native and domestic ungulate grazers for three years significantly increased the riparian aboveground biomass of standing vegetation (273 ± 155 vs. 400 ± 178 g m-2) and litter (56 ± 75 vs. 107 ± 77 g m-2) (p = 0.005 and 0.013, respectively). Soil nutrient values were minimally affected by grazing after five growing seasons, with significant increases in soil total phosphorus at three of the six sites. No connection was found between 0 to 15-cm depth soil and stream nutrient availability or limitation. Stream geomorphology was not significantly altered by five years of grazing exclusion. The elimination of grazing suppressed instream nutrient processing with significantly longer NH4 uptake lengths (p = 0.02) and non-significant trends toward decreased NH4 uptake rates observed in exclosure reaches. These results suggest ungulate grazing impacts terrestrial characteristics that are linked to ecosystem services provided by adjacent aquatic ecosystems. Management plans should carefully balance the positive effect of grazing on stream nutrient processing and retention reported here with the documented grazing related loss of other ecosystem services.

Contact: Carl White, UNM Biology Department, cswhite@sevilleta.unm.edu, MSC03 2020, University of New Mexico, Albuquerque, NM 87131-0001, 505-277-8689, 505-277-6318

Morphological and Genetic Variation in Tadpole Shrimp of the Northern Chihuahuan Desert

Kenneth S. Macdonald III, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Molecular Biology Program, Las Cruces, NM 88003, tripp@nmsu.edu, 575-646-5022
Rossana Sallenave, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Department of Extension Animal Sciences and Natural Resources, Las Cruces, NM 88003, rsallena@nmsu.edu, 575-646-6093
David E. Cowley, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Molecular Biology Program, Las Cruces, NM 88003, dcowley@nmsu.edu

Poster Abstract 3

We report results of analyses comparing three forms of tadpole shrimp using meristic counts, morphological measurements, and portions of the mitochondrial COI and ND1 genes. The three forms were morphologically distinct for multiple characters and exhibited large molecular differences. Additionally, prior literature and our own observed sex ratios suggests the three forms exhibit different reproductive systems (gonochorism, hermaphroditism and androdioecy). These three forms likely are sufficiently distinct in morphology, mitochondrial DNA, and reproductive life history to warrant elevation to species level.

Contact: Kenneth S. Macdonald III, New Mexico State Univeristy, tripp@nmsu.edu,
2980 S. Espina St., Knox Hall, Room 132, Las Cruces, NM 88003, 575-646-5022

Reclamation of Salt from Brine Springs

Tejaswini Anand, University of Texas at El Paso, 500 West University Avenue, El Paso, TX 79968, tanand@miners.utep.edu, 646-280-6846
John C. Walton, University of Texas at El Paso, 500 West University Avenue, El Paso, TX 79968, walton@utep.edu, 915-747-8699
Arturo Woocay, Instituto Tecnológico de Ciudad Juárez, Ave. Tecnológico #1340, Ciudad Juárez, Chih. MX 32500, awoocay@hotmail.com, 915-747-5653
Huanmin Lu, University of Texas at El Paso, 500 West University Avenue, El Paso, TX 79968, lhuanmin@utep.edu, 915-747-6904

Poster Abstract 4

Brazos River is an important source of water in central Texas. Sodium-chloride brine underlies the shallow subsurface and discharges in springs and streams at numerous locations, reducing the quality of water in Brazos River. One potentially cost effective solution for the excess salt loading to the Brazos River by brine spring discharge is to intercept brine groundwater discharges and either treat or evaporate the water. Comparison of locally available solar versus wind energy for evaporation indicates that significantly more (>50X) potential exists from wind than solar energy. This is a function of the locally high winds and relatively dry ambient air. A design for an innovative wind energy based evaporation system to produce high quality marketable salt products has been developed and will be presented.

Contact: Tejaswini Anand, University of Texas at El Paso, tanand@miners.utep.edu, 200 W Schuster Ave, Apt 1, El Paso, TX 79902, 646-280-6846

Estimation of Mountain-Front Recharge for the Rincon-Mesilla Basin Groundwater Flow Model

Sevinc Yeliz Cevik, New Mexico State University, Department of Civil Engineering, Las Cruces, NM 88001
Phanindra Kambhammettu, New Mexico State University, Department of Civil Engineering, Las Cruces, NM 88001
John Hawley, New Mexico Water Resources Research Institute
J. Phillip King, New Mexico State University, Department of Civil Engineering, Las Cruces, NM 88001

Poster Abstract 5

Mountain front recharge (MFR) refers to aquifer recharge through infiltration of subsurface flow from streams that have headwaters in mountain areas (Anderholm 2001). Groundwater flow models developed for the Rincon-Mesilla Basins are based on empirical estimates of recharge fluxes derived for similar catchments. However, uncertainty in the estimated recharge is generally not quantified due to low magnitude of recharge compared to other fluxes and absence of calibration targets near the recharge zones. This research presents the comparison between three empirical methods (Maxey-Eakin, 1949; Hearne and Dewey, 1988; Waltemeyer, 1993) to estimate mountain-front recharge for the Rincon-Mesilla Basins and chooses the most suitable estimate from the re-calibrated OSE (2007) groundwater model based on calibration statistics. The recharge distribution in the basin fill aquifer along the mountain front is classified into five zones based on the spatial location: West Rincon; East Rincon; West Mesilla; East Mesilla; and Franklin. In order to choose the suitable empirical method for the study area, the model is calibrated for the static water levels in 95 monitoring wells located in the Mesilla Valley for the irrigation year 2002. During the calibrations, recharge estimates are varied and the residual statistics is evaluated in terms of mean error, sum of squared errors, and root mean square error. The Waltemeyer equation provided better estimation of recharge for the measured water levels that can be used in southern New Mexico region.

Contact: Sevinc Yeliz Cevik, Post Doctorate Researcher, NMSU Department of Civil Engineering, yeliz@nmsu.edu, Las Cruces, NM 88001, 575-635-0833, 575-646-6049

Salt Cedar (Tamarix spp.) Management and Native Vegetation Restoration along the Rio Grande: First Findings of Wildlife Habitat Conservation Project, Pueblito, Socorro County, New Mexico

Belle Rehder, Socorro Soil & Water Conservation District, 103 Francisco de Avondo Socorro, NM 87801, belle@qwestoffice.net, 575-838-0078
Nyleen Troxel Stowe, Socorro Soil & Water Conservation District, 103 Francisco de Avondo, Socorro, NM 87801, Nyleen@qwestoffice.net, 575-838-0078
Will Kolbenschlag, Socorro Soil & Water Conservation District, 103 Francisco de Avondo, Socorro, NM 87801, will@qwestoffice.net, 575-838-0078

Poster Abstract 6

Salt cedar eradication and native vegetation restoration on four quadrants of 21.9 acres in Pueblito, New Mexico presents a method for enhancing and restoring an associated riparian area along the middle Rio Grande corridor, north of Socorro. The acreage is held in a conservation easement by the Rio Grande Agricultural Trust. In the spring of 2008, using mechanical and chemical means, the exotic and invasive Salt cedar (Tamarix spp.) were extracted in three quadrants of the project boundaries using a John Deere 200 CLC, followed by a Magnum 500 for mulching. Three post spot herbicide treatments were performed in 2009 and spring of 2010 using Habitat® (Imazapyr). In areas along the Arroyo de Los Pinos, cut stump practices using Garlon® (Triclorpyr) were performed to prevent erosion and provide bank stability. Several trees were treated with herbicide Habitat® and left standing along the west side of the Escondida Drain to serve as raptor roosting habitat. Quadrant two was treated with Habitat® and left standing. In quadrant four in the spring of 2010, 109 locally harvested Rio Grande cottonwood poles (Populus fremontii var. wislizenii) were planted using a Bobcat E35 with a fully flighted eight foot auger. Placement of cottonwood poles was determined by soil survey data and groundwater test sites. As a result of these practices, native vegetation (shrubs, forbes, and grasses) is increasing in all areas that have been treated. Pole plantings show variable success. Management practices show reduction of Salt cedar viability and population decline.

Contact: Belle Rehder, Socorro Soil & Water Conservation District, belle@qwestoffice.net, 103 Francisco de Avondo, Socorro, NM 87801, 575-838-0078, 575-838-0978

Natural and Human Factors that Affect Groundwater Quality in Basin-Fill Aquifers in the Southwestern United States—Conceptual Models for Selected Contaminants

L.M. Bexfield, USGS, 5338 Montgomery Blvd. NE, Ste 400, Albuquerque, NM 87109
bexfield@usgs.gov, 505-830-7972
S.A. Thiros, USGS, 2329 W. Orton Circle, Salt Lake City, UT 84119, sthiros@usgs.gov, 801-908-5063
D.W. Anning, USGS, 2255 N. Gemini Dr., Flagstaff, AZ 86001, dwanning@usgs.gov, 928-556-7139
J.M. Huntington, USGS, 2730 N. Deer Run Rd, Carson City, NV 89701, jmhunt@usgs.gov, 775-887-7692
T.S. McKinney, USGS, 2329 W. Orton Circle, Salt Lake City, UT 84119
tmckinney@usgs.gov, 801-908-5060

Poster Abstract 7

As part of the USGS National Water-Quality Assessment Program, the Southwest Principal Aquifer (SWPA) study is building a better understanding of factors that affect water quality in basin-fill aquifers in the Southwestern United States. The SWPA study area includes four principal aquifers: the Basin and Range basin-fill aquifers in California, Nevada, Utah, and Arizona; the Rio Grande aquifer system in New Mexico and Colorado; and the Coastal Basin and Central Valley aquifer systems in California. Previously published information about the groundwater systems and water quality of 15 information-rich basin-fill aquifers has been synthesized into conceptual models of the primary natural and human-related factors commonly affecting groundwater quality with respect to selected contaminants, including dissolved solids, nitrate, arsenic, and volatile organic compounds (VOCs). These conceptual models contribute to understanding of major factors important to aquifer vulnerability in alluvial basins of the Southwest, and are aiding ongoing SWPA statistical modeling of contaminant occurrence.

Both natural and human-related sources are important to the occurrence of the studied contaminants in groundwater. The primary natural sources for dissolved solids and arsenic are rocks and (or) sediments within alluvial basins and in adjacent recharge areas, although geothermal water is also a common source. Flushing of natural soil-zone or subsoil accumulations is a relatively common source for nitrate. Excess irrigation water infiltrating through agricultural fields is a primary human-related source for dissolved solids and nitrate. Important urban sources of dissolved solids, nitrate, and VOCs include point sources, chlorinated municipal-supply water infiltrating through irrigated yards/turf areas or leaking from distribution pipes, seepage of water from sewer and septic systems, treated urban wastewater infiltrating through streams or irrigated fields, diffuse urban runoff, and (or) engineered recharge water.

Natural and human-related factors other than sources also can influence the vulnerability of Southwestern basin-fill aquifers to contamination. Important natural hydrogeologic factors include the presence/absence of protective confining units and direction of natural vertical hydraulic gradients; the concentrating effects of evapotranspiration; and geochemical conditions within the aquifer, such as redox and pH. Primary human-related factors influencing aquifer vulnerability include depth to water in areas of artificial recharge, contribution of artificial recharge to the basin budget, magnitude of pumping stresses, well depth, preferential groundwater flow along wellbores, and changes from agricultural to urban land use.

Contact: Laura Bexfield, U.S. Geological Survey, New Mexico Water Science Center, bexfield@usgs.gov, 5338 Montgomery Blvd. NE, Ste 400, Albuquerque, NM 87109, 505-830-7972, 505-830-7998

Algal Species Compatibility with EDR Concentrate.

Venkat Ravi Kiran Paruchuri, Dept of Chemical Engineering New Mexico State University, 855 E University Ave #1125, Las Cruces, NM 88001, pvrk@nmsu.edu, 575-915-2459
Abbas Ghassemi, Institute for Energy and the Environment, WERC Executive Director & Professor Chemical Engineering New Mexico State University, 1060 Frenger Mall, ECIII, Ste 300, PO Box 30001, MSC WERC, Las Cruces, NM 88003-8001, aghassem@nmsu.edu, 575-646-2357

Poster Abstract 8

Electrodialysis Reversal (EDR) is a water purification system used for purifying inland brackish water at Alamogordo, New Mexico. The TDS of the feed brackish water ranges from 1200ppm to 6000ppm and the concentrate coming out of EDR has TDS ranging from 3000ppm to 16000ppm. The water chemistry of the EDR includes calcium, magnesium, sodium, chloride, silica, carbonate, strontium, potassium, bicarbonate, sulfate and many other species in varying concentrations. For the concentrate to be disposed off there are many environmental and economic factors to be considered. One of the better ways to manage the concentrate is using it for some beneficial purpose so that all the salts, ions and other species present in it could be utilized. This can be done by growing species of algae like Nanno Chloropsis and Chlorella. The reason for selecting these two species is because of their high oil content. These species can be used for biodiesel production. This would be achieved if there are no growth inhibitors for these algal species in the EDR concentrate. This is done by comparing the growth media of the algal species with the water chemistry of the EDR. This would possibly give an idea about the outcome and the possibility for growth of these species.

Contact: Venkat Ravi Kiran Paruchuri, Dept of Chemical Engineering NMSU, pvrk@nmsu.edu, 855 E University Ave # 1125, Las Cruces, NM 88001, 575-915-2459

Rapid Radiochemical Sample Preparation for Alpha Spectrometry Using Polymer Ligand Films

Crystal L. Tulley, Los Alamos National Laboratory and University of New Mexico, PO Box 1663, MS K484, Los Alamos, NM 87545, ctulley@lanl.gov, 505-667-9945
Dominic S. Peterson
Edward R. Gonzales
Claudine E. Armenta
Jaclyn A. Herrer

Poster Abstract 9

The existing procedure for radiochemical analysis of environmental samples involves extensive laboratory preparation. There is a need for a method with a reduced turnaround time and increased throughput to examine radionuclides in samples. We will describe a method that is able to extract and prepare radionuclides from environmental samples in the field. A solution including an extractive ligand and polymer is placed on the planchet surface to create the thin film. In this technique, a tracer solution is stippled onto the thin film. The polymer ligand thin film is analyzed using alpha spectrometry. Using the polymer ligand thin film decreases sample preparation and analysis time. The thin film allows for monitoring of select actinides in surface and ground waters. Using polymer ligand films allows for expedient extraction of plutonium and uranium from environmental samples used in the field and analysis by alpha spectrometry once brought back to the lab. We will also demonstrate our capability for detection of uranium in natural environmental samples LA-UR 10-02983

Contact: Crystal L. Tulley, Los Alamos National Laboratory, ctulley@lanl.gov, University of New Mexico, PO Box 1663 MS K484, Los Alamos, NM 87545, 505-667-9945

Arsenate Sorption on Calcareous Soils

Sandra I. Campos-Díaz, NMSU, MSC 3Q, Box 30003, Las Cruces, NM 88003-8003, camposs@nmsu.edu
April Ulery, NMSU, MSC 3Q, Box 30003, Las Cruces, NM 88003-8003, aulery@nmsu.edu, 575-646-2219

Poster Abstract 10

The strong affinity of calcite for arsenic predicts its importance for arsenic sorption on calcareous soils, but depends on the calcite content. More sorption sites are provided as the calcite content increases. A mechanistic approach was applied to batch sorption experiments on sorbent mixtures composed of acid-washed silica sand and reagent grade calcite powder. Arsenate sorption was investigated as a function of calcite content, ranging from 2% to 8%, and of NaCl vs. wastewater effluent as background buffers. Sorption was analyzed according to EPA accuracy guidelines of +/- 10%. Possible sorption maxima of only 1 mg/Kg were observed on 2% and 3% calcite and significant concentrations of arsenate were observed on 4% and 8% calcite, but only in NaCl background buffer. A calcite content of 4% sorbed up to 20 mg/Kg, while an 8% calcite content showed a sorption capacity for over 70 mg/Kg. Arsenate sorption on calcite was inhibited when applied with wastewater effluent. Sorption from wastewater effluent appears to be independent of calcite content and arsenate is probably unable to compete for sorption sites until present at concentrations above 50 mg/L. Major species of potential competitive anions present in wastewater effluent were modeled with PHREEQC as HCO_3^-, SO_4^{2-}, Cl^-, F^-, HPO_4^{2-}, NO_3^-, $H_2VO_4^-$, and MoO_4^{2-}. Sodium interference with ICP-OES readings is also a possibility and might have affected sorption results. Solids and algae present in the wastewater effluent might have also affected sorption. Formation of calcium arsenates was investigated but not observed from XRD and SEM-EDS analysis.

Contact: Sandra I. Campos-Díaz, New Mexico State University, camposs@nmsu.edu, Box 30003 MSC 3Q, Las Cruces, NM 88003-8003, 575-646-3405, 575-646-6041

Investigating Pathogenic Water Quality Impairments in the Lower Rio Grande Basin

Randa I. Hatamleh, NMSU MSC 3CE, Box 30001, Las Cruces, NM 88003-8001
hatamleh@nmsu.edu, 575-621-9407
Hilary R. Brinegar, NMSU, New Mexico Department of Agriculture, 575-646-2642
J. Phillip King, NMSU MSC 3CE, Box 30001, Las Cruces, NM 88003-8001
jpking@nmsu.edu, 575-571-8166

Poster Abstract 11

Water resource demands are exceeding supplies all over the world, leading water managers to focus on the sustainability of watersheds to address the rapid increase in population and development. States are obliged by Section 303(d) of the Clean Water Act to report impaired water bodies and to develop total maximum daily loads (TMDL) for pollutants that are in exceedance of state water quality standards. The U.S. Environmental Protection Agency approved the 2006 New Mexico 303(d) report which designated the Lower Rio Grande as impaired due to exceedances of regulatory limits for Escherichia coli (E. coli) bacteria (126 cfu/100 mL for monthly geometrical mean and 410 cfu/100 mL for single sample). High concentrations of E. coli were detected in some portions of the river and were associated with significant rainfall events. This project is the initial effort to investigate the source, fate and transport of E. coli in the Lower Rio Grande watershed. This project's water quality sampling plan was designed to fill existing data gaps and fully depict rainfall events. The BASINS (Better Assessment Science Integrating point and Nonpoint Sources) model is used to simulate the source and transport of bacteria. It is expected that this model will allow for an estimate of the spatial and temporal relationship between the bacteria and differing land use categories within the watershed. Further, E. coli variability in the river will be predicted under different flow scenarios, providing valuable information for resource managers on the best balance of resource dependence. This water quality characterization will eventually lead to the identification of best management practices for pathogen remediation in the watershed.

Contact: Randa I. Hatamleh, NMSU, jrgastelum@ag.tamu.edu, MSC-3CE, PO Box 30001, Las Cruces, NM 88003-8001, 575-646-3801, 575-646-6049

Optimization of Electrodialysis Reversal Process and Influence of Operating Parameters on Separation Percentage and Current Efficiency

Lakshmi Pradeepa Vennam, IEE/WERC and Department of Chemical Engineering, 2450 Hagerty Rd, Apt #3, Las Cruces, NM 88001, pradeepa@nmsu.edu, 575-915-2543
Abbas Ghassemi, IE/WERC NMSU

Poster Abstract 12

In recent times, an increase in water crises and a gradual reduction of groundwater levels have given rise to the development of emerging water desalination techniques. The electrodialysis reversal (EDR) process is the most prominent water treatment process used today. EDR is based on the principles governing the behavior of ionic solutions when subjected to direct current potential. In EDR, the performance can be evaluated by two important factors: separation percentage (SP) defined as the amount of salts removed from the feed water to obtain a potable product, and current efficiency (CE) defined as the measure of how effectively ions are transported across the ion exchange membrane for a particular applied current.

This study demonstrates the influence of operating parameters like temperature, flow-rate, and voltage on SP and CE. The experimental design addresses two and three level factor design with experiments conducted at a flow-rate of 7, 9, 11 gpm; temperature of 15 and 30°C; and voltage of 15, 25, and 35 V. Graphs are plotted for both divalent and monovalent ions from which we can study the effect of parameters on SP and CE. Statistical analysis such as ANOVA (analysis of variance) is used to determine which parameters have a significant influence on the yield. The outcome of this study demonstrates the optimized operating parameters to achieve lower cost and higher performance.

Contact: Lakshmi Pradeepa Vennam, Graduate Student, IEE/WERC and Department of Chemical Engineering, pradeepa@nmsu.edu, 2450 Hagerty Rd, Apt #3, Las Cruces, NM 88001, 575-915-2543

Case Study for Hydraulic Relationships Associated with the Design and Operation of Artificial Recharge Wells

Jesús R. Gastélum, Texas AgriLife Research Center at El Paso, Texas A&M University System, El Paso, TX 79927-5020, jrgastelum@ag.tamu.edu, 915-859-1908
Gary G. Small, HydroSystems, Inc., Phoenix, AZ 85044
Zhuping Sheng, Texas AgriLife Research Center at El Paso, Texas A&M University System, El Paso, TX 79927-5020

Poster Abstract 13

Artificial recharge wells have become essential infrastructure to store water underground and manage aquifers. Aquifer storage and recovery (ASR) and vadose zone recharge (VZR) wells are the most common types of artificial recharge wells. Several publications have been providing guidelines for the design, construction, operation, and management of recharge facilities. However, ASR and VZR wells have not yet received enough attention in terms of performance evaluation, design, and predictive maintenance based on industry standards. This case study is to evaluate the drop pipe hydraulic equation based on the standard engineering orifice equation, and the specific capacity of the artificial recharge well using artificial recharge wells located in different recharge facilities in the Phoenix metropolitan area. The study findings provided guidelines for the calibration of contraction and discharge coefficients based on the specific characteristics of the artificial recharge well's injection drop pipe and orifice plate. In the study orifice plate-injection rates curves were generated as a useful tool for design and replacement of orifice plates used to regulate the well's injection rates. The creation of orifice plate-specific capacity curves provides an insight to the hydraulic relationship between artificial recharge well and the vadose zone.

Contact: Jesús R. Gastélum, Texas AgriLife Research Center at El Paso-Texas A&M System, jrgastelum@ag.tamu.edu, 1380 A&M Circle, El Paso, TX 79927, 915-859-1908 Ext 25, 915-859-1078

Geochemistry of Horace Springs, Pueblo of Acoma, New Mexico

Christopher Wolf, Daniel B. Stephens & Associates, Inc., 6020 Academy NE, Ste 100
Albuquerque, NM 87109, cwolf@dbstephens.com, 505-822-9400

Poster Abstract 14

Horace Springs is the most important hydrological feature at the Pueblo of Acoma. The combined spring discharges from Horace Springs and nearby Anzac Springs recharge the Rio San Jose, which has been relied upon by Acoma for irrigation, domestic, and cultural uses since time immemorial. Discharge from Horace Springs represents the beginning of a gaining reach within the Rio San Jose, where the shallow groundwater discharges into the river from the alluvial-basalt aquifer. Historically, springs like Horace Springs and Ojo del Gallo were major contributors to flow in the river. Ojo del Gallo is essentially dry now due to groundwater withdrawals.

To understand the geochemistry of Horace Springs, regional water quality data were examined for the San Andres Limestone and Glorieta Sandstone aquifer (SAGA), alluvial-basalt aquifer, Entrada Sandstone, Dakota Sandstone, Ojo del Gallo, Horace Springs, and the Rio San Jose. Geochemical analyses were performed using statistics, mixing models, and piper diagrams. Saturation indices were calculated with PHREEQC to determine mineral reactions.

Based on geochemical data analyses, the composition of Horace Springs is dominated by groundwater from the SAGA that probably recharged and mixed with the alluvial-basalt aquifer in the Ojo del Gallo area. The SAGA water quality is apparent in Horace Springs due to the $NaSO_4$ character of the water, which reflects cation-exchange and gypsum dissolution. The alluvial-basalt signature is evident from the elevated dissolved silica concentrations. Near Horace Springs, this water mixes with groundwater from the Entrada and Dakota Sandstones before discharging at Horace and Anzac Springs.

Contact: Christopher Wolf, Daniel B. Stephens & Associates, Inc., cwolf@dbstephens.com, 6020 Academy NE, Ste 100, Albuquerque, NM 87109, 505-822-9400, 505-822-8877

Modeling of Metal Interactions with Geologic Materials from the Mojave Desert: An Overview of the Surface Complexation Approach

Sijie Lin, Civil Engineering Department New Mexico State University, MSC 3CE, Las Cruces, NM 88003, linsj@nmsu.edu, 575-571-3082
Lambis Papelis, Civil Engineering Department New Mexico State University, MSC 3CE, Las Cruces, NM 88003, lpapelis@nmsu.edu, 575-646-3023

Poster Abstract 15

Anion and cation interactions with mineral surfaces frequently control the fate and transport of contaminants in the environment and the remediation of waters and wastewaters. Because of the complexity of natural systems, despite significant efforts, modeling of processes at the mineral-water interface remains a challenge. Mineral surfaces have either pH-dependent charge or a permanent charge, leading to processes such as adsorption, absorption, surface precipitation, and ion exchange. These processes have been incorporated in geochemical models, such as MINEQL+, MINTEQ, EQ3/6, PHREEQC, HYDRAQL, and the Geochemist's Workbench. The structure of the charged mineral-water interface has been represented by several surface complexation models, including the constant capacitance, diffuse layer, and triple layer models. Two distinct approaches have been used to model complex systems. In the mineral additivity approach, the overall interaction can be modeled as the sum of interactions with individual minerals. However, determining separate model parameters for every phase present is a formidable task. An alternative approach involves the determination of overall modeling parameters for a given complex system. Modeling can be further simplified by omitting the electrostatic contributions in surface complexation models. In this presentation, we demonstrate these concepts by providing an overview of the strategy used to model the sorption of cations and anions on complex geologic materials from the Mojave Desert. These materials include alluvium, tuffs, and zeolitized tuffs. The observed behavior is a function of the sorbent-sorbate pair and geochemical conditions, namely pH and solution composition. These studies have significant implications because the interactions described may control the transport of radionuclides and other contaminants from nuclear testing facilities and radioactive waste storage sites.

Contact: Lambis Papelis, Civil Engineering Department New Mexico State University, lpapelis@nmsu.edu, MSC 3CE, Las Cruces, NM 88003, 575-646-3023, 575-646-6049

Modeling of Metal Oxyanion Speciation in Produced Waters Used in Algal Cultivation for Biofuels

Cynthia A. Dean, Los Alamos National Laboratory, MS J966, PO Box 1663, Los Alamos, NM 87545, cdean@lanl.gov, 505-664-0060
Enid J. Sullivan, Los Alamos National Laboratory, MS J964, PO Box 1663, Los Alamos, NM 87545, ejs@lanl.gov, 505-667-2889
Mei Ding, Los Alamos National Laboratory, MS J966, PO Box 1663, Los Alamos, NM 87545, mding@lanl.gov, 505-667-7051

Poster Abstract 16

Waters from oil/gas production can potentially provide a sustainable alternative to fresh water sources for algae cultivation. The twofold benefit of using produced waters is an increase in the economic viability of algal biofuel production while providing the oil and gas industry a path forward for beneficial use of produced water. A potential concern in using challenged waters is the presence of metal oxyanion species (e.g., arsenate, selenate, chromate) and other metals (e.g., copper, lead, iron) that may reduce industrial sustainability by increasing treatment costs, affecting algal health, and increasing toxicity in coproducts. For example, contaminating oxyanion species are chemically similar to and may inhibit uptake of essential nutrients such as phosphate, nitrate and sulfate during cultivation. The speciation (and thus oxidation state) of these species determines its bioavailability and toxicity in the environment. By using geochemical models to predict metals speciation while adjusting nutrient concentrations (i.e., CO_2, oxygen and salt), pH and evaporation, affects on algae health, as well as biofuel/coproduct and waste streams, can be predicted. Knowing the speciation and thus potential bioavailability and toxicity of oxyanion species will help determine which produced waters are viable alternatives to fresh water in algae cultivation as well as required pretreatment methods. Chemical analyses and modeling results of oil/gas produced waters pre- and post-treatment, as well as potential effects of the resultant speciation on algal biofuel cultivation, will be presented.

Contact: Cynthia A. Dean, Los Alamos National Lab, cdean@lanl.gov, MS J 966, PO Box 1663, Los Alamos, NM 87545, 505-664-0060

Composite Membranes for Brackish Water Desalination Using Membrane Distillation Processes

Sai Reddy Pinappu, NMSU Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, saireddy@nmsu.edu, 505-818-8589
Dr. Lucy Camacho, NMSU Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, lcamacho@nmsu.edu, 575-649-3267
Dr. Veera Gnaneswar Gude, NMSU Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, john_us@nmsu.edu, 530-751-6061
Saketa Yarlagadda, NMSU Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, saketa@nmsu.edu, 575-520-1113
Dr. Shuguang Deng, NMSU Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, sdeng@nmsu.edu, 575-646-4346

Poster Abstract 17

Membrane distillation (MD) is an emerging membrane technology for pure water production from saline water, solution concentration, recovery of volatile compounds from aqueous solution, and other separation and purification processes. Membrane distillation differs from other membrane technologies in that the driving force for separation is the difference in vapor pressure of volatile compound across the membrane, rather than total pressure. The main difference between membrane distillation and conventional thermal distillation is that membrane distillation could occur at a much lower temperature than conventional thermal distillation. The membranes for membrane distillation are hydrophobic, which allows vapor (but not liquid solution) to pass. The vapor pressure gradient is created by heating the feed solution and cooling/purging the condensate in the permeate side. Therefore membrane distillation enables separation to occur below the normal boiling point of the feed solution and could utilize low-grade alternative energy. For all these to be possible the membrane should have following properties: 1) Low Thermal conductivity and high thermal stability, 2) Low Mass transfer resistance, 3) Chemically resistant towards different feed solutions and cleaning agents, 4) Membrane should have high porosity, and 5) Membrane should have high liquid entry pressure for water.

Conventional polymer membranes possesses all the properties but the problem with those membranes are 1) Thermally Unstable 2) High Heat losses within the membrane 3) Non uniform pore size distribution due to thermal expansion and contraction during the process.

Above mentioned drawbacks can be rectified by a relatively simple way i.e. by using a composite membrane (hydrophobic + hydrophilic polymers or hydrophobic polymer + hydrophobic in organics) to improve the thermal stability and to curtail the conduction. The top hydrophobic thin layer will be responsible for mass transport in MD process while the top hydrophobic and hydrophilic sub layer will prevent the conductive heat loss through the whole membrane matrix. These composite membranes have been prepared by phase inversion method. We have characterized the composite membranes by conventional membrane distillation process

Contact: Sai Reddy Pinappu, New Mexico State University (NMSU) Chemical Engineering, saireddy@nmsu.edu, Jett Hall, Room 259, New Mexico State University, PO Box 30001, MSC 3805, Las Cruces, NM 88003-8001, 505-818-8589, 575-646-7706

Climate Change Impact on Streamflow, Bosque Del Apache

Chi Bui, Department of Civil Engineering, MSC01 1070, University of New Mexico
Albuquerque, NM 87131, anhbao87123@yahoo.com, 505-974-1529
Julie Coonrod, Department of Civil Engineering, MSC01 1070, University of New Mexico,
Albuquerque, NM 87131, jcoonrod@unm.edu, 505-277-3233

Poster Abstract 18

Bosque Del Apache National Wildlife Refuge provides habitat for diverse wildlife along the Middle Rio Grande. Various migratory birds flock in every November and stay through the winter, making the area one of the national prime bird-watching locations. Bosque Del Apache in the summer is an oasis with extensive wetlands, farmlands, and riparian forests surrounded by desert landscapes. Altered temperature and precipitation associated with future climate change scenarios will impact the average annual flow through the refuge.

To estimate future streamflow through the refuge, previous results of estimated streamflow from eight Rio Grande tributary watersheds were used along with historic information for San Acacia and San Marcial. Two different statistical methods are used resulting in average monthly values of flow for different climate change scenarios.

Contact: Julie Coonrod, University of New Mexico, jcoonrod@unm.edu, Department of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, NM 87131, 505-277-3233

New Mexico Hydrologic Information System (NMHIS)

Stephen W. Brown, Dept of Civil Engineering, University of New Mexico, MSC01 1070, Albuquerque, NM 87131-0001, stephenb@unm.edu, 505-221-4377
Julia E. A. Coonrod, Dept of Civil Engineering, University of New Mexico, MSC01 3055, Albuquerque, NM 87131-0001, jcoonrod@unm.edu, 505-277-3233
Karl Benedict, Earth Data Analysis Center University of New Mexico, MSC01 1110, Albuquerque, NM 87131-0001, kbene@edac.unm.edu, 505-277-3622 x234
Renzo Sanchez-Silva, Earth Data Analysis Center, University of New Mexico, MSC01 1110, Albuquerque, NM 87131-0001, renzo@edac.unm.edu, 505-277-3622 x240
Hays Barrett, Earth Data Analysis Center, University of New Mexico, MSC01 1110, Albuquerque, NM 87131-0001, hays.barrett@gmail.com, 505-277-3622

Poster Abstract 19

Advances in monitoring technology have resulted in huge quantities of temporal hydrologic system data. Devices were previously limited to large corporation or government agencies are now affordable for educational research. The result is hundreds of universities, primary schools, and non-profit organizations collecting hundreds of thousands of hydrologic system measurements per year. Data management has reached a critical state. The rate and resolution of measurements recorded is rapidly exceeding the storage and processing capabilities of modern computers. Additional difficulties arise when retrieving information required for research analysis.

We are implementing the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) HIS server system in collaboration with New Mexico Resource Geographic Information System (NMRGIS) and EPSCoR. Initial steps involve setting up the HIS as specified by CUAHSI. A sample dataset is populated in the database for testing. When the HIS is debugged and stable, the database schema will be incorporated into the schema currently in use for NMRGIS. Currently, data stored in RGIS is spatial, the database is equipped to process temporal datasets but this functionality has not been fully tested.

Establishment of the New Mexico Hydrologic Information System provides one access point for statewide hydrologic data. Researchers currently collecting field data can store temporal data and post process and model within the HIS. Scientists who are currently researching water related subjects will have a single location to find a variety hydrologic datasets. Research in water quality, distribution, climatology, and dozens of other water related fields will benefit from the NMHIS.

Contact: Stephen W. Brown, University of New Mexico, stephenb@unm.edu, Dept of Civil Engineering, MSC01 1070, University of New Mexico, Albuquerque, NM 87131-0001, 505-221-4377, 505-277-1988

Investigating the Relationships between Groundwater History, Soil Structure, Root Architecture, and Phreatophytic Transpiration in Riparian Zones

Lijuan Jia, University of New Mexico, Department of Civil Engineering, MSC01 1070, Albuquerque, NM 87131, lijuan@unm.edu, 775-815-2542
Mark Stone, University of New Mexico, Department of Civil Engineering, MSC01 1070, Albuquerque, NM 87131, stone@unm.edu, 505-277-0115
Mitchell Nakai, Department of Civil Engineering, University of New Mexico

Poster Abstract 20

As western water supplies continue to tighten in the face of increasing demand and dwindling resources, efforts have intensified to describe and quantify all consumptive uses of water. Riparian evapotranspiration (ET) has long been acknowledged as a source of great uncertainty in compiling watershed water budgets. Traditional methods used for quantifying ET, which were generally developed for agricultural fields, are difficult to apply in riparian zones due to the spatial and temporal heterogeneity of this environment. This study was motivated by a federal mandate on the Truckee River in California and Nevada to quantify interactions between streamflow, groundwater stage, and riparian water use. Initial field observations were conducted on the Truckee River, near the city of Truckee, CA, using stage sensors, groundwater monitoring wells, and sap flow sensors capable of estimating tree transpiration. The results indicated a very sophisticated interaction between groundwater history, soil structure, root architecture, and transpiration. Further studies on the Rio Salado near Socorro have provided insights into the development of root architecture of salt cedars in response to soil texture and water holding capacity. This study is now focused on developing simulation tools capable of estimating root architecture as a function of hydrologic history and soil types, which will ultimately improve estimates of riparian water use.

Contact: Lijuan Jia, University of New Mexico, lijuan@unm.edu, 1-775-815-254

Desalination Tool: An Online Approach

Devikaa Rajaraman, New Mexico State University, Institute for Energy and the Environment, 1060 Frenger Mall, MSC WERC, New Mexico State University, PO Box 30001, Las Cruces, NM 88003-8001, devikaa8@nmsu.edu, 713-614-6725
Muang Thein Myint, Institute for Energy and the Environment, 1060 Frenger Mall, MSC WERC, New Mexico State University, PO Box 30001, Las Cruces, NM 88003-8001 mmyint@nmsu.edu, 949-439-1873

Poster Abstract 21

The desalination tool is developed for removal of specific kinds of ions from ground water using specific techniques which include different types of pre-treatment processes, desalination techniques, post-treatment methods and concentrate management. The immediate objective of this research is to develop a tool which enables the user to define the basic feed water chemistry. Once the feed water chemistry has been defined the decision tree created helps the user identify the kind(s) of ion(s) which needs to be removed and then proceed to select the pretreatment options available for that particular ion. Once the pre-treatment method has been selected the user will be required to select the available desalination technique for the removal of ion(s). The techniques that are dealt with in this tool are Reverse Osmosis, Nano-Filtration and Electro dialysis Reversal. The desalination tool also includes a performance model and a cost model based on the methods used. It is important to take concentrate management into consideration when applying a desalination technique. The cost model included in the tool also accounts for concentrate disposal. The goal of the project is to conduct research and develop innovative ideas for removal of specific kinds of ions with a focus on reducing energy costs and minimizing operating costs.

Contact: Devikaa Rajaraman, New Mexico State University, devikaa8@nmsu.edu, College of Engineering, Institute for Energy and the Environment, 1060 Frenger Mall, MSC WERC, New Mexico State University, PO Box 30001, Las Cruces, NM 88003-8001, 575-646-2073, 575-646-5474

Verification of a Hydro-Mechanic Bending Algorithm to Describe Riparian Vegetation Bending

Mark Stone, Department of Civil Engineering, University of New Mexico, MSC01 1070, Albuquerque, NM 87131, stone@unm.edu, 505-277-0115
Lauren Jaramillo, Department of Civil Engineering, University of New Mexico, MSC01 1070, Albuquerque, NM 87131, alwayslo@unm.edu
Kent Steinhaus, Department of Civil Engineering, University of New Mexico, MSC01 1070, Albuquerque, NM 87131, ksteinhaus@gmail.com
Li Chen, Division of Hydrologic Sciences, Desert Research Institute, 755 E Flamingo Road, Las Vegas, NV 89119, lchen@dri.edu, 702-862-5457

Poster Abstract 22

Riparian vegetation provides numerous ecological benefits including wildlife habitat, nutrient cycling, and improved water quality. However, vegetation also increases the risk of local flooding due to the obstruction of flow and increased hydraulic roughness. In order to balance these competing risks and benefits, our research team has developed techniques for describing the influence of riparian vegetation on channel hydraulics. One aspect of this work is a hydro-mechanical algorithm, capable of predicting the degree of vegetation bending when exposed to flowing water. Here we will describe efforts to verify the performance of this algorithm using experimental results in a flume carried out in the University of New Mexico's hydraulics laboratory. The experiments include testing of both natural and artificial vegetation exposed to five different flow conditions. The algorithm is evaluated with respect to predictions of total deflection and description of the deflected plant. This verified algorithm will next be incorporated into a two-dimensional hydrodynamic code in order to support a dynamic hydraulic roughness estimate.

Contact: Mark Stone, University of New Mexico, stone@unm.edu, MSC01 1070, Albuquerque, NM 87131, 505-277-0115

Physical Modeling of a Supercritical Culvert in Jemez Springs, New Mexico

Kyle Shour, UNM Department of Civil Engineering, University of New Mexico, MSC01 1070, Albuquerque, NM 87131-0001, kshour@unm.edu, 505-277-1823
Kent Steinhaus, UNM, ksteinhaus@gmail.com
Lauren Jaramillo, UNM, alwayslo@unm.edu
Julie Coonrod, UNM, jcoonrod@unm.edu
Mark Stone, UNM, stone@unm.edu

Poster Abstract 23

New Mexico Department of Transportation (NMDOT) contracted with the University of New Mexico (UNM) Hydraulics Laboratory to create a physical model of a supercritical culvert in Jemez Springs, New Mexico. NMDOT engineers designed a double barrel, box culvert to convey the 100-year peak flow of 2300 cfs. Because of the arroyo planform and constraints caused by existing infrastructure, the design includes several bends and multiple slopes. This design is expected to respond unpredictably to supercritical flow and result in an increase in downstream velocity. The physical model will be used to examine hydraulic function of the NMDOT design. The UNM hydraulics laboratory team will examine alternate designs to minimize adverse hydraulic effects and reduce design velocities to existing velocities. Modeling results will be presented.

Contact: Kyle Shour, University of New Mexico, kshour@unm.edu, 1704 Cornell SE, Albuquerque, NM 87106, 505-277-1823

Design and Prototype of a Low-Cost Water Sonde

Katrina Koski, New Mexico Tech, Socorro, NM 87801, 575-418-8531, kkoski@nmt.edu

Poster Abstract 24

Commercial sondes (multi-parameter probes) provide accurate, high-resolution temporal data collection of a variety of water quality parameters, but their cost (~$5,000) prohibits more than a few sampling locations. We present a design and prototype for a low cost (<$100) sonde. Although the accuracy of the sonde is lower than that of commercially available sondes, the cost is <5% of a commercial sonde. The low cost allows for data collection from up to 25 times more sampling points in a field location. The sonde is constructed from a single-board microcontroller (Arduino), a commercially available temperature sensor, and a fabricated conductivity sensor. Using a secure digital (SD) memory card, the sonde can record over a month of data at a user specified interval. Construction, calibration, and data retrieval can be accomplished by a skilled undergraduate. Initial deployment will take place as part of a chloride tracer test in the Valles Caldera National Preserve in northern New Mexico. Future work includes: addition of commercial ion selective electrodes (pH, bromide, nitrate, and others); construction of optically based sensors (chlorophyll, dissolved oxygen, rhodamine, and others); wireless networking between the sensors; and reduction of biofouling. The sonde will be at the poster for demonstrations.

Contact: Katrina Koski, New Mexico Tech, kkoski@nmt.edu, Earth & Environmental Science, 801 Leroy Place, Socorro, NM 87801, 575-418-8531

Integrating External Costs in Water Utility Asset Management: An Application of the Threshold Break Rate Model

Megan Marsee, University of New Mexico, Water Resources Program,
MSC05 3110, 1 University of New Mexico, Albuquerque, NM, 87131, mmarsee@unm.edu,
505-277-0646
Jennifer Thacher, University of New Mexico, Department of Economics, MSC05 3060,
1 University of New Mexico, Albuquerque, NM 87131, jthacher@unm.edu, 505-277-1965
Bruce Thomson, University of New Mexico, Water Resources Program,
MSC05 3110, 1 University of New Mexico, Albuquerque, NM 87131, bthomson@unm.edu,
505-277-4729
Janie Chermak, University of New Mexico, Department of Economics,
MSC05 3060, 1 University of New Mexico, Albuquerque, NM 87131, jchermak@unm.edu,
505-277-4906
Heather Himmelberger, New Mexico Environmental Finance Center,
2445 Alamo SE, Albuquerque, NM 87106, heatherh@efc.nmt.edu, 505-924-7028

Poster Abstract 25

The goal of asset management is to minimize the life-cycle cost of water utility assets, while continuing to meet the service levels expected by utility customers. The total cost of an asset includes both utility internal costs to maintain the asset and external costs borne by customers, the community, and the environment when the asset fails. This research estimates the external costs of water outages experienced by Albuquerque Bernalillo County Water Utility Authority residential customers through an economic-valuation survey. It applies those costs in the threshold break rate model, a pipe-replacement model that minimizes the cost of individual water pipes, in order to determine which six-inch-diameter steel pipes in the Water Utility Authority distribution system should be replaced. Model outputs with and without external costs are compared. The break rate at which it is economically optimal to replace a 1,000-foot-long six-inch-diameter steel pipe serving 30 customers is 1.25 breaks per year when external costs are taken into consideration, and 2 breaks per year when they are ignored. Accounting for external costs increases the number of pipes recommended for replacement at the current time by 17%.

Contact: Megan Marsee, University of New Mexico, mmarsee@unm.edu, Water Resources Program, MSC05 3110, 1 University of New Mexico, Albuquerque, NM 87131, 505-277-0646, 505-277-5226

Use of the Continuous-Slope-Area Method to Quantify Runoff and Transmission Losses in a Network of Ephemeral Stream Channels, Southeast Arizona

A.M. Stewart, USGS NM Water Science Center, Univ. of AZ Dept. of Hydrology and Water Resources, 5338 Montgomery Blvd. NE Ste 300/400, Albuquerque, NM 87109, astewart@usgs.gov, 505-830-7957
J.B. Callegary, USGS AZ Water Science Center, 520 N. Park Ave., Tucson, AZ 85719
C.F. Smith, USGS Water Science Center, 520 N. Park Ave., Tucson, AZ 85719
H.V. Gupta, Univ. of AZ, Dept. of Hydrology and Water Resources, 1133 E. James E. Rogers Way, Tucson, AZ 85721
J.M. Leenhouts, USGS Water Science Center, 520 N. Park Ave, Tucson, AZ 85719

Poster Abstract 26

Quantification of runoff during ephemeral-channel flow events in urban areas of the desert southwest is of increasing importance to water resource managers for flood-water management and for water-balance accounting. The continuous-slope-area (CSA) method, developed at the USGS Arizona Water Science Center, provides a method for recording the occurrence and calculating the volume of runoff in ephemeral stream channels. The CSA method combines the well-known slope-area method with a modified version of the USGS slope-area-computation (SAC) program to calculate complete-event discharge hydrographs.

During July 2007, a small watershed-scale implementation of the CSA method was initiated by installing eleven CSA gaging sites within three sand-bedded ephemeral channels near the City of Sierra Vista in southeast Arizona. The purpose of the work was to estimate changes in runoff, infiltration, and groundwater recharge attributable to urbanization. The total volume of runoff from the study area for Water Year 2008 was estimated. For cases when runoff from upstream gages was not observed downstream, channel transmission losses were calculated directly. For cases when flow was observed at both upstream and downstream gages, and for ungaged channel reaches in the study area, rainfall-runoff numerical modeling will be used to estimate channel transmission losses (as infiltration) by using CSA-generated discharge time series to identify optimal hydraulic conductivity and roughness parameters for the entire study area (rainfall-runoff numerical modeling is in progress). Results from rainfall-runoff modeling will also be used to estimate potential groundwater recharge with groundwater modeling.

Contact: Anne M. Stewart, USGS AZ Water Science Center (now at NM Water Science Center), Univ. AZ. Dept. of Hydrology and Water Resources, astewart@usgs.gov, 5338 Montgomery Blvd NE Ste 300/400, Albuquerque, NM 87109, 505-830-7957, 505-830-7998

Potential Impacts of Increases in Rainfall Intensity on the Lower Rio Grande of New Mexico

Susanna Glaze, NMWRRI, MSC 3167, PO Box 30001, Las Cruces, NM 88003-8001,
sglaze@wrri.nmsu.edu, 575-646-4337
Bobby Creel, NMWRRI
Christopher Brown, NMSU, MSC MAP, PO Box 30001, Las Cruces, NM 88003-8001,
brownchr@nmsu.edu, 575-646-1892

Poster Abstract 27

Communities in the American Southwest are experiencing the effects of global climate change. These effects are not limited to simply warmer temperatures and drier climates, but also have effects on rainfall intensity, which in turn impacts urban flooding. A study by Denault et al in 2006 explored the impacts of future increases in rainfall intensity on the urban flood infrastructure and natural ecosystems in a watershed near Vancouver in British Columbia, Canada. Using the framework constructed by the authors, the impacts of potential changes in rainfall intensity on urban flooding in the Lower Rio Grande of New Mexico will be examined. Increases in future rainfall intensity will be modeled using low, medium, and high scenarios. Future rainfall Intensity-Duration-Frequency (IDF) curves will be created for the Las Cruces area using these scenarios, from which synthetic design storms will be derived. The Storm Water Management Model (SWMM) will be used to create a framework that can model these synthetic design storms as well as the current flood infrastructure in place in Las Cruces. The results will be a framework that can be used in Las Cruces or other regions to identify the possible effects of increased storm intensity in the future, including flood control structures that may need upgrading to accommodate increasing flows.

Contact: Susanna Glaze, NMWRRI, sglaze@wrri.nmsu.edu, 575-646-4337, 575-646-6418

Characterizing Surface Water and Groundwater Flows in Traditionally-Irrigated Agriculture Systems

Carlos Ochoa, Animal and Range Sciences, New Mexico State University,
Las Cruces, NM 88003, carochoa@nmsu.edu, 575-646-5558

Poster Abstract 28

Ditch seepage and deep percolation from irrigation in agricultural valleys of semi-arid regions can have multiple hydrological benefits including aquifer recharge, temporary storage, and delayed return flow. This study aims to advance scientific understanding of surface water and groundwater interactions in semi-arid region valleys of the western USA. The study is being conducted in three different irrigated valleys of the Rio Grande basin in northern New Mexico. The first site is a floodplain valley along the main stem of the Rio Grande; the second site is an upper valley along the Rio Hondo, a tributary to the Rio Grande; and the third site is a floodplain valley along the Rio Chama, which also is a tributary to the Rio Grande. Beginning in 2002, we instrumented the first study site to measure climate variables, surface water flows, and groundwater fluctuations due to deep percolation from irrigation and ditch seepage. Currently, we are installing field equipment at the second study site, and we will start instrumentation at the third study site in the spring of 2010. A multi-modeling approach is being used to extrapolate field-based results to larger spatial scales. One and two dimensional models like the Root Zone Water Quality Model and Hydrus, respectively, are being used to simulate physical processes in the vadose zone at the field scale, and the model GSFlow will be used to integrate surface water and groundwater components at the valley scale. Results from an ongoing study aimed to quantify water budget components at the first study site showed that up to 92% of the water diverted for irrigation in this floodplain valley returns back to the river, either as surface return flow (59%) or as shallow groundwater return flow that originated as canal seepage (12%) and deep percolation from irrigation (21%). Also, simulations with a System Dynamics Model showed that the coupled surface water irrigation system and shallow aquifer act together to store water underground and then release it to the river. Surface water management has important effects on groundwater and streamflow responses in irrigated valleys.

Contact: Carlos Ochoa, NMSU, carochoa@nmsu.edu, 575-646-5558

Is a Crisis in Water Supply Coming to the El Paso/Juarez Transboundary Area in Response to Global Warming?

Yi Liu, Texas AgriLife Research and Extension Center at El Paso, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, yiliu@ag.tamu.edu, 915-859-9111, 915-859-1078
Zhuping Sheng, Texas AgriLife Research and Extension Center at El Paso, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, z-sheng@tamu.edu, 915-859-9111, 915-859-1078
Kaitlin Florey, Texas AgriLife Research and Extension Center at El Paso, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, 915-859-9111, 915-859-1078
Zhuming Ye, Texas AgriLife Research and Extension Center at El Paso, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, 915-859-9111, 915-859-1078
Ricardo Marmolejo, Texas AgriLife Research and Extension Center at El Paso, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, 915-859-9111, 915-859-1078

Poster Abstract 29

El Paso/Juarez Transboundary area crossing the international border between the United States at El Paso, Texas and Mexico at Cd. Juarez, Chihuahua is an arid to semiarid region, in which El Paso and Cd. Juarez comprise of the largest binational metropolitan area in the world with a combined population of 2.6 million. The regional water supply is from surface water and aquifers. The Rio Grande provides about 374,000 acre-ft of water supply in a normal year. This study was advanced by concerns of profound impacts of future climate changes on water resources and their management in this area. To find the correlation between the annual Rio Grande water availability at El Paso and the global warming trend, two correlations were integrated, namely a quadratic correlation of Rio Grande flow at El Paso with its source flow below Caballo, New Mexico and a slope-reversed from positive to negative correlation of the source flow with global surface temperature anomaly between 1954 and 2003. The results show that the trend Rio Grande water available at El Paso increased quadratically with global warming at a lower temperature anomaly between 0°C and 0.23 °C from 1975 to 1990, and decreased quadratically with global warming at a higher temperature anomaly of greater than 0.23 °C since 1990. Based on its current trend, more severe global warming drought is anticipated in the near future, which could lead to shortage of surface water supply for both municipal and agricultural uses.

Key words: Global warming; stream flow; water supply; drought

Contact: Yi Liu, Texas AgriLife Research and Extension Center at El Paso, yiliu@ag.tamu.edu, Texas A&M University System, 1380 A&M Circle, El Paso, TX 79927, 915-859-9111, 915-859-1078

Hydrogeologic Framework of the Salt Basin, New Mexico and Texas

André B. Ritchie, Department of Earth and Environmental Science, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM 87801, aritchie@nmt.edu

Poster Abstract 30

The Salt Basin is a closed drainage basin located in southeastern New Mexico (Otero, Chaves, and Eddy Counties), and northwestern Texas (Hudspeth, Culberson, Jeff Davis, and Presidio Counties), which can be divided into a northern and a southern system. Since the 1950s, extensive groundwater withdrawals have been associated with agricultural irrigation in the Dell City, Texas region, just south of the New Mexico-Texas border. The Salt Basin groundwater system was declared by the New Mexico State Engineer during 2002 in an attempt to regulate and control growing interest in the groundwater resources of the basin. In order to help guide long-term management strategies, a conceptual model of groundwater flow in the Salt Basin was developed by reconstructing the tectonic forcings that have affected the basin during its formation, and identifying the depositional environments that formed and the resultant distribution of facies.

The tectonic history of the Salt Basin can be divided into four main periods: a) Pennsylvanian-to-Early Permian, b) Mid-to-Late Permian, c) Late Cretaceous, and d) Tertiary-to-Quaternary. Pennsylvanian to Permian structural features affected deposition throughout the Permian, resulting in three distinct hydrogeologic facies: basin, shelf-margin, and shelf. Permian shelf-facies rocks form the primary aquifer within the northern Salt Basin, although minor aquifers occur in Cretaceous rocks and Tertiary-to-Quaternary alluvium. Subsequent tectonic activity during the Late Cretaceous resulted in the re-activation of many of the earlier structures. Tertiary-to-Quaternary Basin-and-Range extension produced the current physiographic form of the basin.

Contact: André B. Ritchie, Department of Earth and Environmental Science, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM 87801, aritchie@nmt.edu

Albuquerque West Levee: Analysis of Transient Seepage in Response to Realistic Extreme Event Floodwave Time Series

Peter Guerra, AMEC Earth & Environmental 8519 Jefferson NE, Albuquerque, NM 87113
505-821-1801, fax: 505-821-7371, peter.guerra@amec.com
Jim McCord, 115 West Abeyta Street Suite A, Socorro, NM 87801, 575-835-2569,
fax 575-835-2609; Jim.Mccord@amec.com
Daniel McDonald, Ralph Crockett, John Lommler, AMEC Earth & Environmental, AMEC Earth & Environmental 8519 Jefferson NE, Albuquerque, NM 87113

Poster Abstract 31

Transient through- and under-seepage analyses based on extreme event floodwater elevations and durations were performed to support the design of the reconstruction of 3.2 miles of an existing levee system in Albuquerque, New Mexico. Seventeen location-specific cross sections were analyzed using VS2DT, a public domain finite difference code that solves the Richards equation for transient flow of water under variably saturated conditions. At each of the locations to be analyzed using the model, three soil borings were advanced: one at the top of the existing levee, and one each at the landside and riverside toe of the proposed, replacement levee. Twelve soil types, six native sediments and six levee fills, were catalogued based on review of boring logs, as well as laboratory and in-situ test results. The measurement of soil water characteristic curves (SWCCs) that describe the relationship between water content and capillary pressure was also included in the laboratory testing campaign of soil samples from the site.

To establish a representative initial condition for the transient seepage analysis, relative-permeability curve fitting parameters of each soil type were determined at various residual water contents (Θr) corresponding to in-situ moisture contents observed in the subsurface characterization boreholes. The results from soil-water retention measurements and general physical property testing were used as input to RETC, a public-domain computer program for fitting laboratory measurements to mathematical functions for the SWCCs and the unsaturated hydraulic conductivity. Each of the logged soil types were further disaggregated into subclasses with varying Θr to accommodate accurate representation of the observed depth-dependence on the initial moisture content distribution

Levee seepage in response to three flooding scenarios were analyzed using each of the 17 cross sections: i) 200-year snow melt event (low flood height, long-duration floodwaters), ii) 200-year rainfall event (high flood height, short-duration floodwaters), and iii) steady state (high flood height, infinite term). Flood heights and durations were taken from stochastic hydraulic and hydrologic analyses performed to acquire the flood characteristics. Design of levee cross section geometry including setbacks, slope angles, crest width, and toe drain placement was refined using the VS2DT simulation results. Those results were also used to establish initial conditions for slope-stability analyses. As a result of the seepage analysis, the overall footprint of the levee was minimized and the alignment of the levee was optimized compared with what one would obtain employing traditional steady-state seepage analysis.

Contact: Jim McCord, Jim.Mccord@amec.com, AMEC Earth & Environmental, AMEC Earth & Environmental 8519 Jefferson NE, Albuquerque, New Mexico 87113

Applying GIS and Numerical Modeling to River Restoration

Kyle Shour, kshour@unm.edu, 505-277-1823; Julie Coonrod, jcoonrod@unm.edu, 505-277-3233; Mark Stone, stone@unm.edu, 505-277-0115

Poster Abstract 23B

Hydraulic function and sediment transport impact alluvial bed structure and should be accounted for in sustainable river restoration practices. However, establishing hydraulic and sediment movement characteristics conducive to project sustainability and function is a complex task. A numerical model can allow designers to create a project that is sustainable and supports habitat structure. A two-dimensional, numerical model was created using ArcMap 9.3, the CCHE (Center for Computational Hydroscience and Engineering) Mesh Generation and CCHE2D software. The model is being used to analyze hydraulic conditions and sedimentation problems in a high-flow, restoration channel in the Rio Grande Nature Center in Albuquerque, New Mexico. Model development and results will be presented.