M/N EXHIBIT 1

Principal Engineer
Hydrologist
Mediator

Christian R. Petrich, Ph.D., P.E., P.G.

Education

Ph.D., Geology
University of Idaho

M.S., Civil Engineering
Washington State University

B.S., Resource Conservation
University of Montana

Professional Certifications

Professional Engineer
Idaho No. 9011

Professional Geologist
Idaho No. 1088

Certified Water Rights Examiner
Idaho No. 7-132

Certified Professional Mediator
Idaho No. 251

Areas of Expertise

- Aquifer characterization
- Ground water monitoring
- Ground and surface water interaction
- Simulation of ground water flow
- Geothermal analysis and simulation
- Expert witness
- Solving water conflicts through mediation
- Teaching and instruction

Experience Summary

Dr. Petrich has over 26 years of progressive academic, professional, and managerial experience in hydrology and water resource engineering. He has particular expertise in characterizing regional ground water flow systems (including groundwater and surface water interaction), development and calibration of numerical groundwater flow models, analysis of geothermal systems, analysis of water rights, and solving water problems through facilitation and mediation.

SPF Water Engineering, LLC – 2004 to Present

Dr. Petrich is currently a Principal Engineer/Hydrologist with (and co-founder of) SPF Water Engineering, LLC (SPF). Representative project experience includes the following:

- Sun Valley Company – Representative on Big Wood River Modeling Committee (2013 to present).
- City of Hailey – Representative on Big Wood River Modeling Committee (2013 to present).
- Farm Development Corporation - Response to IDWR questions regarding water supply for multiple applications (2013).
- Ryals, Steve – water supply investigation for 120-acre irrigation application (2013).
- WDT Lake View LLC – water supply investigation for 120-acre irrigation application (2012 to present).
- SunRidge Dairy LLC - Water supply investigation for water right application in southern Canyon County, multiple transfers and applications (2012 to present).
- Nevid LLC and ARK Properties LLC – technical support related to water supply and water availability for consolidated water-right cases in western Ada County and eastern Elmore County (2012 to present).
- Boise Project Board of Control – review of USBR investigation into conditions leading to flooding in Minuteman Way area (2011 to present).
- Idaho Office of the Attorney General – technical support for matters related to Snake River flow measurement above and below Swan Falls Dam (2011-present).
- TerraGraphics Engineering/City of Moscow, Idaho – analysis of surface-water supply alternatives, including Aquifer Storage and Recovery (ASR) potential (2010 to present).

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- Moore & Elia, LLP/Idaho Counties Risk Management Program (ICRMP) – technical support on behalf of defendant (Boise Project Board of Control) in Robert and Meredith Allis vs. Boise Project Board of Control and DOES I-X, Ada County Case No. CV OC 102-1285 (2010-present).
- Pioneer Irrigation District (Moffatt Thomas Barrett Rock & Fields, Chtd.) – technical support for Pioneer Irrigation District vs. City of Caldwell, Canyon Co. Case No. CV 08-556-C (2009-present).
- Kirkwood Bank & Trust Company – water supply analysis in support of water-right application (2011- present).
- Jackson Law Office/Saetrum Law Office – technical support on behalf of defendant in Maybon vs. Aviles, Owyhee County Case No. CV-10-01477M (2011-2012).
- Crane Creek Country Club – technical support for miscellaneous water right and water supply matters (2011-2012).
- Idaho Office of the Attorney General – compilation and analysis of Eastern Snake River Plain "trust area" water rights related to Swan Falls Settlement litigation, ongoing technical support (2008-2012).
- Blaine County School District – water right permit applications (with mitigation strategies) for Woodside School and Carey High School, development of measurement plan (2007-2008, 2012).
- Murray, Smith, & Associates, Inc./United Water Idaho – review of Fisk Well water quality data (2011-2012).
- John Marshall Law PLLC – water supply assessment for Farm Development Corporation, Allen Noble Farms, and A-D Cattle Company lands in Canyon County, Idaho (2011).
- Dennis Rider – analysis of available water supply in support of water-right applications in western Elmore County (2011)
- Idaho Department of Fish and Game - analysis of hydrologic implications associated with a proposed point of diversion change under water right 72-4077 (2011).
- Portneuf Watershed Users Association (Moffatt Thomas Barrett Rock & Fields, Chtd.) – technical support in the matter of protest to Transfer 76779 (2011).
- US Department of Veteran Affairs – analysis of geothermal water availability for Fort Harrison facility (Helena, Montana); preparation of final report summarizing well construction and testing (2010-2011).
- Barker Rosholt & Simpson – analysis of Tenmile Creek hydrology for defendant in United States of America vs. Rodriguez, CR-09-279-S-BLW (2011).
- West Park Company - Response to IDWR questions regarding water supply and availability in support of Application for Permit 61-12256 (2011).
- Settlers Irrigation District – source analysis for the Black Cat Well, including analysis of surface-water impacts (2011).
- Tyson Fresh Meats, Inc. – analysis of existing water rights, historical water use, and water-level trends; provide technical support in the matter of Application for Permit 63-12546 (2010-2012).

- Nevid, LLC – design and testing of 1,000-foot test well; design and testing of 1,100-foot public water system production well (2010-2011).
- City of Hailey – analysis of potential mitigation options in anticipation of conjunctive administration (2010).
- Sands, LLC – technical support and expert testimony on behalf of plaintiff in Sands LLC vs. Timothy and Jennifer Swenson, Boise County Case No. CV 2008-255 (2010).
- ENERCON Services, Inc. – water availability analysis for the Idaho Energy Complex Payette County site (2010).
- Idaho Water Resource Board – 50-year water demand projections for the Rathdrum Prairie aquifer area (prepared as part of Comprehensive Aquifer Management Plan); included analysis of potential climate variability impacts and alternative conservation measures (2009-2010).
- Nevid, LLC – technical support and expert testimony in the matter of Application for Permit 61-12090 before the Department of Water Resources (2009).
- Double C Farms (Givens Pursley LLP) – technical support for federal sentencing hearing, which included evaluation of groundwater conditions in the Oakley Fan and Burley area, United States of America vs. Cory Ledeal King, CR No. 08-002-E-BLW (2009).
- City of Hailey – technical support related to water rights and annexation issues (2008-2011).
- Hepworth, Lezamiz, and Janis – technical support (including the analysis of local aquifer conditions in a portion of the Twin Falls area) on behalf of plaintiff in Bastians vs. Twin Falls Canal Company, Twin Falls Case No. CV-07-3632 (2008).
- Daniels Creek Land, LLC – groundwater supply evaluation for the Daniels Creek Ranch (2008).
- Elk Creek Canyon, LLC – groundwater supply evaluation for the Elk Creek Canyon Planned Community (2008).
- XRoads Development, Inc. - hydrogeologic investigation of the Northridge area at Terrace Lakes (2008).
- Stewart Land Group – storm water infiltration analysis for the Plano Lane Subdivision (2008).
- Idaho Ground Water Appropriators – litigation support and expert testimony in A&B Delivery Call; included analysis of aquifer conditions in the A&B service area of the Eastern Snake River Plain near Rupert, Idaho (2007-2009).
- MidAmerican Energy Company/ENERCON Services, Inc. – analysis of Snake and Payette river water availability for a proposed Pearl power facility in Payette County (2007-2008).
- Elmore-Ada Water Project – analysis of Snake River water availability, regional aquifer characteristics, and water availability in a bi-county area; development of Aquifer Storage and Recovery (ASR) strategy; and analysis of multiple water supply alternatives (2007-2008).
- City of Bellevue – technical support related to water rights, potential annexation, and conjunctive administration (2007-2011).
- Eaglefield, LLC – review of City of Eagle 9-day pumping test; technical support and testimony on behalf of Eaglefield, LLC and the City of Eagle in the matter of Applications

for Permit 63-32089 and 63-32090 before the Idaho Department of Water Resources (2007).

- Kuna-Cole 880, LLC – water supply assessment for the Vista Planned Community (2007).
- Secesh Engineering – groundwater resource evaluation of the Boulder Creek Ranch (2007).
- Secesh Engineering – groundwater resource evaluation for the Whisper Creek area (2007).
- Knorr Development – groundwater resource evaluation of the Orchard Ranch property (2007).
- Kuna Mora Properties, LLC – water supply assessment for the Kuna Mora Planned Community (2007).
- Idaho Ground Water Appropriators – technical support for "Surface Coalition" Delivery Call, including mapping and evaluation of urban irrigated areas (2006-2007).
- Micron Technology, Inc. – analysis and simulation (using MODFLOW) of diversion rates and groundwater levels in the Southeast Boise Ground Water Management Area to evaluate effects of water injection and pumping (2006-2007).
- Eagle Springs Ranch, LLC – preliminary water supply assessment for Southfork Landing, Garden Valley, Idaho (2006).
- US Geothermal, Inc./Raft River Energy LLC – simulation of groundwater flow and transport for the Raft River Geothermal Power Project (2006).
- City of Marsing, Idaho – groundwater supply assessment (2006).
- Carden Hiatt Bowdon – groundwater resource evaluation of the Hopson Ranch area (2006).
- U.S. Geothermal, Inc. – development of groundwater flow model (MODFLOW) to evaluate effects of land application (2006).
- JRG Partners (Givens Pursley LLP) – technical support in the matter of Application for Transfer 71076 in Teton County (2006).
- Intermountain Sewer and Water Corp. – water supply assessment for the Mayfield Springs Planned Community (2006).
- Sands, LLC – water supply assessment for the Webster Ranch (2006).
- Capital Investors – water supply assessment for the Osprey Ridge Planned Community (2006).
- Vision First, LLC – water supply assessment for the Bryans Run Planned Community (2006).
- United Water Idaho – detailed analysis of Floating Feather, Arctic, Clinton, and Fisk wells (2005).
- United Water Idaho – comprehensive water supply assessment for public water system with 87 high-capacity wells (2004-2005).
- SunCor Idaho, LLC – hydrogeologic characterization, well testing, technical support, and expert testimony in the matter of Application for Permit 63-32061 before the Idaho Department of Water Resources (2005-2006).
- McCain Foods USA – water supply assessment for a 4 MGD potato processing facility in

Eastern Snake River Plain area (2004-2005).

Idaho Water Resources Research Institute –1996 to 2004

- Idaho Department of Water Resources – Principal Investigator of the Treasure Valley Hydrologic Project, an 8-year regional groundwater study to characterize regional flow characteristics, develop a numerical flow model (MODFLOW), and evaluate the effects of regional groundwater pumping (1996-2004).
- Assessment and simulation of hydrologic conditions in the Boise Front geothermal aquifer – conducted a hydrogeologic investigation of the Boise Front geothermal aquifer and oversaw the development of a numerical model to simulate temperature and flow; study was used to resolve technical issues in water right litigation (2002-2004).

University of Idaho – 1989 to 1996

- Taught or co-taught the following graduate-level courses: Computer Geology (1989), Computer Applications (i.e., modeling) in Hydrology (1989, 1991), and Contaminant Hydrogeology (1990, 1992, 1995).
- Conducted doctoral research in the transport of conservative ions (e.g., bromide) and particle tracers (2-, 5-, and 15-μ polystyrene microspheres and agarose-encapsulated flavobacterium) in a shallow, unconsolidated aquifer.
- Subsurface transport research between 1995 and 1996 as a Postdoctoral Fellow with the Institute for Molecular and Agricultural Genetic Engineering.

Miscellaneous Experience, 1986 to 1995

- Pullman-Moscow Water Resources Committee, Executive Secretary – guided committee-funded research, organized and maintained a groundwater withdrawal and water level database, began development of a water conservation program (part-time, 1994-1996).
- TerraGraphics Environmental Engineering, Moscow Idaho – hydrogeologic evaluations, numerical model reviews, reviews of proposed Bunker Hill (Idaho) superfund site remedial designs, and development of present-value cost estimates for operations and maintenance tasks associated with remedial designs (part-time, 1993-1995).
- Independent consulting – well location and design consultations (various clients), well interference investigations (State of Idaho Risk Management Bureau), short course presentations on wellhead protection (Idaho Water Resources Institute, Idaho Department of Environmental Quality) numerical modeling (University of Idaho Irrigation Systems Management Program), numerical modeling (private clients) (part-time, 1989-1996).
- Engineering-Science, Inc., Cleveland, Ohio – site characterization, well design, sampling and analysis, environmental impact mitigation, and recovery system design and installation at bulk and retail petroleum storage facilities (9 months, 1986-1987).

Selected Public Domain Publications, Presentations, and Short Courses

Petrich, C. 2012. Agricultural and Residential Irrigation Water Needs: Fact and Fiction. Summer Water Law and Resource Issues Seminar, Idaho Water Users Association, Sun Valley, Idaho.

Petrich, C. (moderator), C. Meyer, G. Baxter, and J. Fereday, 2012. Water Planning for Cities – News You Can Use! Association of Idaho Cities Annual Conference, Boise, Idaho.

Petrich, C. 2011. Long-Range Water Demand Forecasting. University of Idaho Water Resource Seminar, Boise, Idaho.

Petrich, C. 2011. Projecting Long-Term Water Demand. Law Seminars International, Boise, Idaho.

Petrich C. (moderator), C. Meyer, T. Barry, M. Fuss, P. Klatt, F. Haemmerle, 2011. Conjunctive Management – Implications for Municipal Water Supplies. Association of Idaho Cities Annual Conference, Boise, Idaho.

Petrich, C. 2010. Treasure Valley Hydrology. Presentation to Treasure Valley Comprehensive Aquifer Management Plan (CAMP) Advisory Committee.

Petrich, C. 2010. Rathdrum Prairie Future Water Demand Projections. Spokane River Forum, March 22, 2010.

Petrich, C. 2010. Panel discussion on water supply issues. Urban Land Institute, Coeur d'Alene, Idaho, June 2010.

Petrich, C. 2010. Panel discussion on water supply issues. Urban Land Institute, Boise, Idaho, June 2010.

Petrich, C. 2010. Treasure Valley Water Supply Choices and Trade-offs. Idaho Environmental Forum, August 11, 2010.

Cooper, C. and C. Petrich. 2010. Water System Planning and Optimization. Association of Idaho Cities, Idaho Falls, Idaho.

McHugh, C. and C. Petrich. 2009. Can Water Delivery Calls Lead to Curtailment of Municipal Pumping? I Association of Idaho Cities, June 19, 2009.

Petrich, C. 2007. Ground Water Flow and Testing. Presentation for the Idaho Ground Water Association's 56th Annual Convention.

Petrich, C. and S. Urban. 2004. Characterization of Ground Water Flow in the Lower Boise River Basin. Idaho Water Resources Research Institute and the Idaho Department of Water Resources, Research Report IWRRI-2004-01.

Petrich, C.R. 2004. Simulation of Ground Water Flow in the Lower Boise River Basin. Idaho Water Resources Research Institute, Research Report IWRRI-2004-02.

Petrich, C.R. 2004. Simulation of Increased Ground Water Withdrawals in the Treasure Valley Associated with Unprocessed Well Applications. Idaho Water Resources Research Institute, Research Report IWRRI-2004-03.

Petrich, C. 2003. Hydrogeologic Conditions in the Boise Front Geothermal Aquifer. Idaho Water Resources Research Institute, Research Report IWRRI-2003-05.

Petrich, C. and J. Doherty. 2003. Simulation of increased ground water withdrawals associated with unprocessed well applications in the lower Boise River basin, Idaho. In Proceedings of MODFLOW 2003, Colorado School of Mines, Golden, CO.

Zyvoloski, G., Keating, E. and C. Petrich. 2003. Simulation Of Potential Increased Withdrawal and Re-Injection From the Boise Front Geothermal Aquifer. Idaho Water Resources Research Institute, Research Report IWRRI-2003-04.

Hutchings, J. and C. Petrich. 2002. Ground Water Recharge and Flow in the Regional Treasure Valley Aquifer System–Geochemistry and Isotope Study. Idaho Water Resources Research Institute, Research Report IWRRI-2002-08.

Hutchings, J. and C. Petrich. 2002. Influence of Canal Seepage on Aquifer Recharge near the New York Canal. Idaho Water Resources Research Institute, Research Report IWRRI-2002-09.

Dreher, K., C. Petrich, K. Neely, E. Bowles, and A. Byrne. 2000. Review of survival, flow, temperature, and migration data for hatchery-raised, subyearling fall Chinook Salmon above Lower Granite Dam, 1995–1998. Idaho Department of Water Resources.

Tuthill, D., C. Petrich, T. Morse, B. Kissinger, and J. Oakleaf. 2000. Migration from tabular to spatial data analysis techniques for water management in Idaho. Journal of Hydroinformatics. Vol. 2, No.3, pp. 183-195.

Petrich, C. 2002. Treasure Valley Hydrology–an Overview (presentation). Treasure Valley Water Summit, Boise, Idaho.

Petrich, C. 2001. An Introduction to Ground Water Flow Modeling (presentation). 18th Annual Water Law & Resources Issues Seminar, Idaho Water Users Association.

Petrich, C. 2001. Use of PEST for Model Calibration to Ground Water Levels and Residence Times (presentation). Connections 2001, Boise, Idaho.

Petrich, C., S. Urban, and J. Hutchings. 1999. Development and Calibration of a Regional-Scale Ground Water Flow Model in Southwestern Idaho, U.S.A (presentation). Geological Society of America Annual Meeting, Denver, Colorado.

Petrich, C., S. Urban, H. Anderson, and D. Tuthill, Jr. 1999. Development of a Hydrologic Data Platform for Conjunctive Management in Southwest Idaho (presentation). NGWA Pacific Northwest Focus Ground Water Conference, Portland, Oregon.

Petrich, C., K. Stormo, D. Ralston, and R. Crawford. 1998. Encapsulated cell bioremediation: evaluation on the basis of particle tracer tests. Ground Water, Vol. 36, No. 4., pg. 771.

Gregory, B. and C. Petrich. 1998. Water Rights Mediation Training (short course). Idaho Mediation Association.

Johnson, G., C. Petrich, and D. Cosgrove. 1998 (January and May). An Introduction to Ground Water Modeling (short course). Idaho Water Resources Research Institute short course, Boise, Idaho.

Petrich, C. and D. Ralston. 1998. Evaluation of Encapsulated Cell Movement in a Heterogeneous, Sedimentary Aquifer (presentation). International Conference on Future Ground Water Resources at Risk, Changchun, China.

Carlson, R.A. and C. Petrich. 1998. New York Canal Geologic Cross-Section, Seepage Gain/Loss Data, and Ground Water Hydrographs: Compilation and Findings. Idaho Water Resources Research Institute and Idaho Department of Water Resources.

Urban, S.M. and C. Petrich. 1998. 1996 Water Budget for the Treasure Valley Aquifer System. Idaho Department of Water Resources Research Report.

Petrich, C., K. Stormo, D. Knaebel, D. Ralston, and R. Crawford. 1995. A preliminary assessment of field transport experiments using encapsulated cells. In Proceedings of the Third International In Situ and On-Site Bioreclamation Symposium, R. E. Hinchee et al., eds.

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MEMO

State of Idaho
Department of Water Resources
322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098
Phone: (208) 287-4800 Fax: (208) 287-6700

Date: May 31, 2012

To: Gary Spackman, Hearing Officer

From: Craig Tesch, Hydrology Section, State Office

cc: Dennis Owsley
Rick Raymondi
Jennifer Sukow
Sean Vincent
John Westra

Subject: Sufficiency of Water Supply for Water Right Applications and Transfers along the I-84 Corridor

Overview

This memorandum has been prepared in response to the request for staff memorandum dated January 24, 2012 in the matter of applications for transfer/new water rights No. 73811, 73834, 63-32499, 61-12095, 61-12096, 63-32703, 61-12256, and 63-33344. The following information was requested:

1) Suggest and justify a study boundary.
2) Present data and information within the boundary.
3) Conclude the sufficiency of the water supply within the boundary for existing and new uses.

Introduction

There are six pending water right applications and two transfers for planned communities and irrigation projects along the I-84 corridor near the Ada County/Elmore County line (Figure 1). Groundwater is the water source. The anticipated depths of the production zones for the proposed wells are 800 to 1,200 feet below ground level (ft-bgl). The total combined maximum appropriation rate is 84.76 ft^3/sec (cfs), 67.84 cfs in applications and

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16.92 cfs in transfers. This is in addition to a combined maximum rate of 14.02 cfs for two permits already issued but not yet fully developed.

The area of proposed large-scale residential and irrigation development is bisected by the administrative boundary that separates Basins 61 and 63. In addition, many of the proposed developments lie along the northwest boundary of the Mountain Home Ground Water Management Area (GWMA) and are approximately five miles northwest of the Cinder Cone Critical Ground Water Area (CGWA). Significant water level declines resulted in the establishment of the CCCGWA on May 7, 1981 and the Mountain Home GWMA on November 9, 1982.

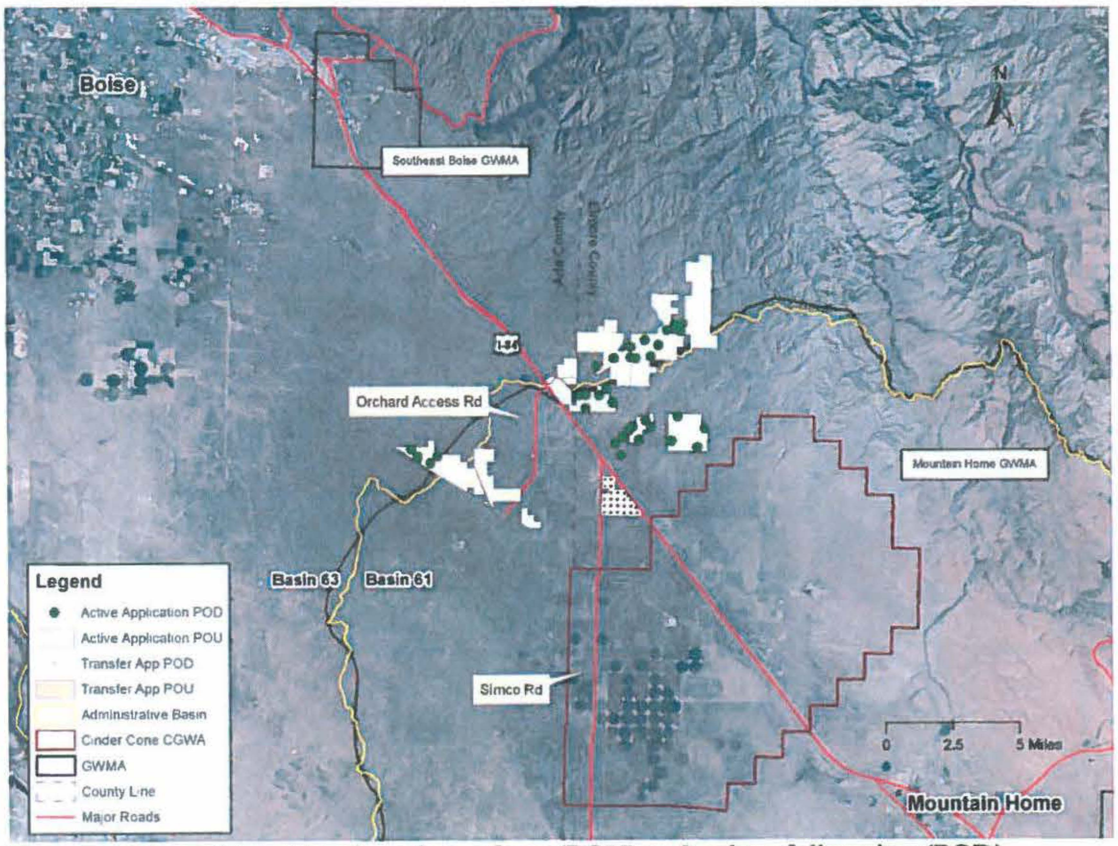

Figure 1. Consolidated hearing place of use (POU) and point of diversion (POD) locations.

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Technical Review

Responses to the request for analysis are presented below.

Item 1

- Suggest and justify a study boundary.

The suggested consolidated hearing study boundary is an 11-mile wide swath oriented parallel to the southwesterly direction of regional groundwater flow. The study boundary extends from the granitic uplands to the northeast, across the Mountain Home Plateau to the rim of the Snake River Canyon (Figure 2). For comparison, an adjacent swath of similar geometry and hydrogeologic setting was created which encompasses the Cinder Cone CGWA (Figure 3). Comparing information from the study area to information from a nearby area that has had significant groundwater development for several decades provides context for assessing the potential hydrologic impacts of the proposed applications.

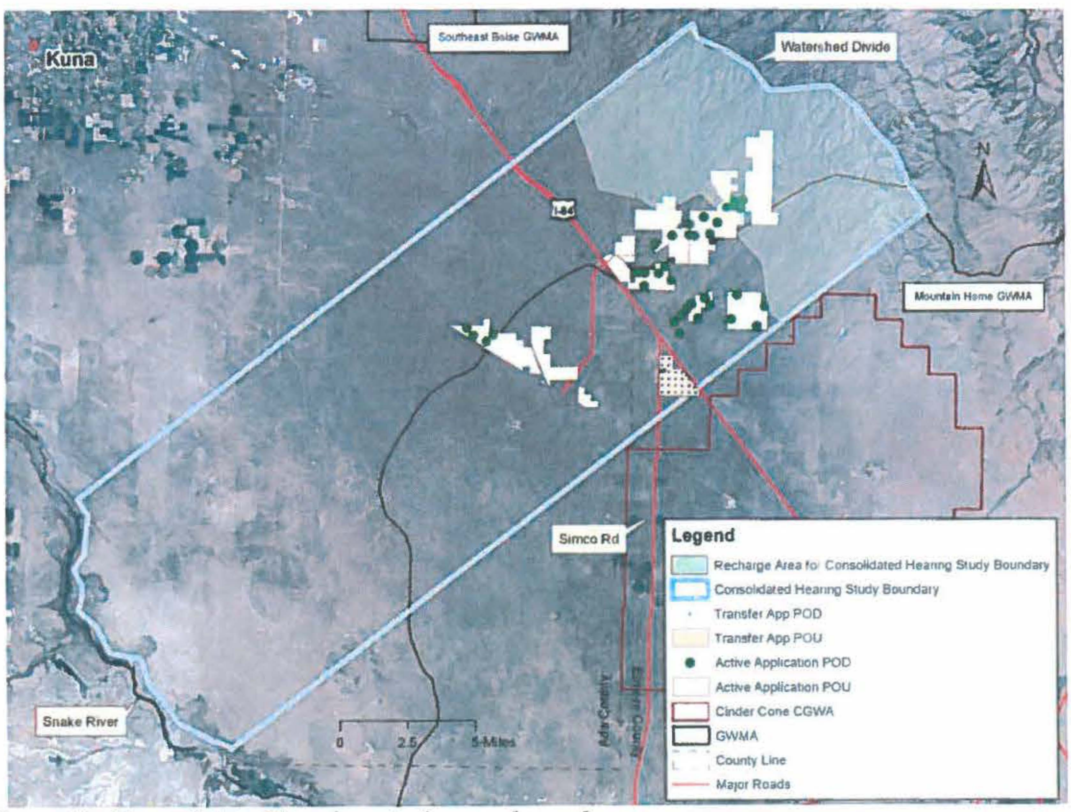

Figure 2. Consolidated hearing study area boundary.

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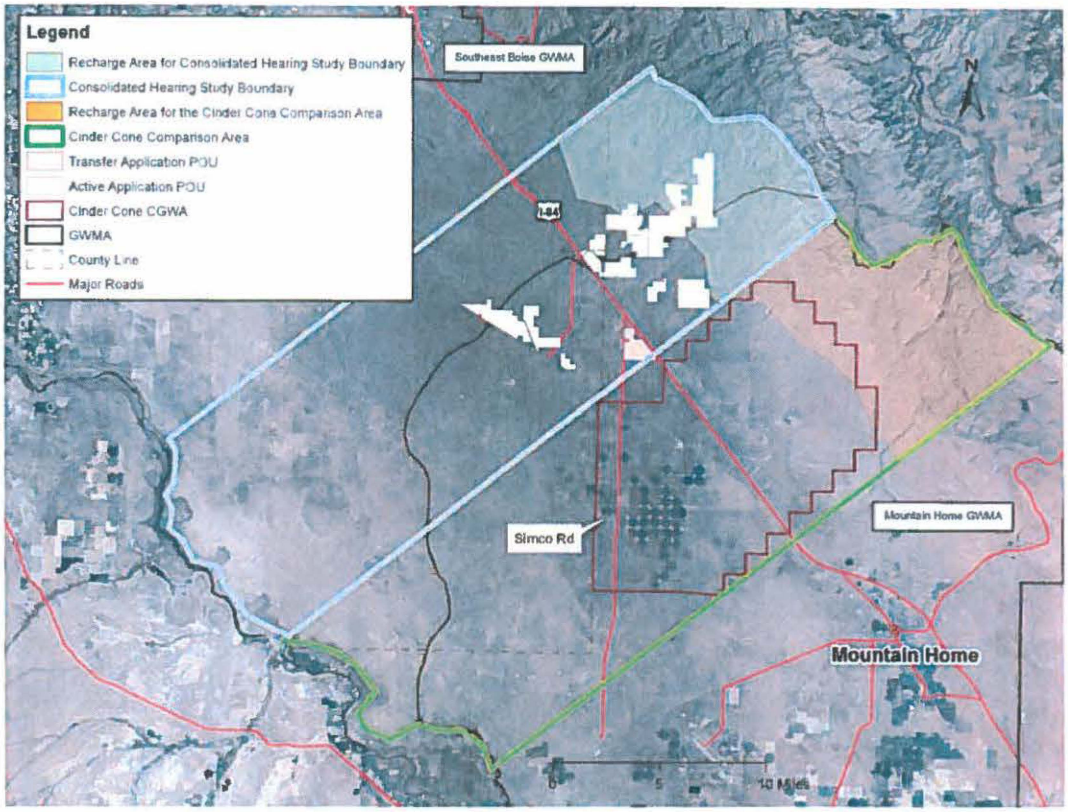

Figure 3. Consolidated hearing study area boundary (blue line) and adjacent Cinder Cone comparison area boundary (green line).

Study area boundaries are as follows:

- The southwestern boundary is the rim of the Snake River Canyon.
- The southeastern boundary is a NE-SW line that runs along the northwestern boundary of Cinder Cone CGWA study area.
- The northwestern boundary parallels the southeastern boundary and is generally perpendicular to groundwater flow contours (Figure 4).
- The northeastern boundary is the watershed divide between the South Fork of the Boise River and the western Snake River Plain.

The following are justifications for the study area:

- The boundary encompasses all proposed POUs and PODs.
- The study area includes the hydrogeologic system from the recharge area to the discharge area.
- The study area is large enough to encompass all of the applications, but does not include areas influenced by surface water diversions from the Boise River.
- The study area does not include the Cinder Cone CGWA; however, recharge areas and overall boundary dimensions were based on consideration of the Cinder

Cone CGWA study (IDWR, 1981) because it also involved an assessment of the impacts of groundwater development in a similar hydrogeologic setting.

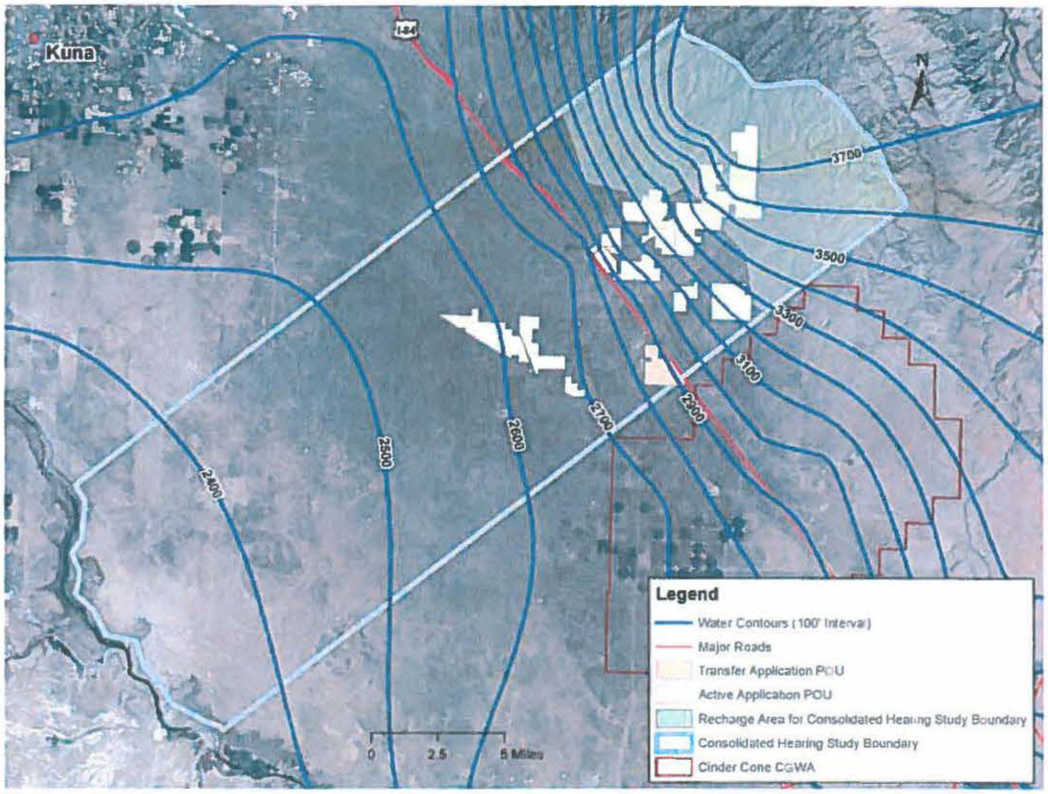

Figure 4. Water table contour map for October, 2011.

The northeastern portions of the Cinder Cone comparison area and the consolidated hearing study area comprise the primary recharge areas (Figure 3). For each, the recharge area includes all land above an elevation of 3,600 ft. The 3,600 ft contour roughly corresponds to the transition between the foothills and the plateau.

Assignment of the recharge areas based on elevation is the same approach that was taken in the development of a water budget for a previous study of the Cinder Cone Butte area (IDWR, 1981). The premise of the approach is that precipitation significantly exceeds the rate of evapotranspiration (ET) only at higher elevations. At lower elevations on the plateau, evapotranspiration on non-irrigated lands consumes almost all of the precipitation during most months of the year and there is, therefore, limited recharge from precipitation (Newton, 1991). It is recognized that some of the water that falls as precipitation in the highlands recharges the aquifer system outside the recharge areas via losing stream reaches on the plateau.

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Item 2

- Present data and information within the boundary.

Study Area Hydrogeology

Previous studies have provided information describing the hydrogeologic setting (Ralston and Chapman, 1968; Ralston and Chapman, 1970; Young, 1977; Newton, 1991; Harrington and Bendixsen, 1999; Phillips et al., 2012; Liberty, 2012; and Welhan, 2012). In summary, the western Snake River Plain is a deep structural depression that is filled with sedimentary and volcanic rocks of Tertiary and Quaternary age (Newton, 1991). Mountains composed of granitic and volcanic rocks surround the plain on the northeast and southwest.

The regional aquifer targeted by the applications is comprised primarily of basalt flows interbedded with fine-grained sediments of the Bruneau Formation, a unit in the Idaho Group (Ralston and Chapman, 1968). Minor or less extensive perched aquifers occur in alluvial sand and gravels on the flanks of the mountain front and drain into the basalt-dominated portion of the aquifer (Bendixsen, 1994). Faults have been identified in the study area based upon interpretation of geology and surface geophysical data (Bond, 1978 and Liberty, 2012). The hydrogeologic significance of the faults is unknown. Geologic cross-sections based on information compiled from well driller's reports are presented in Appendix A.

The general groundwater flow direction in the regional aquifer is to the southwest towards the Snake River (Figure 4). The horizontal hydraulic gradient decreases in the vicinity of Interstate 84. Various mechanisms, including faulting, an influx of aquifer recharge, and a reduction in aquifer transmissivity have been proposed to explain the decrease (Welhan, 2012).

The predominant source of recharge to the ground water system is precipitation in the upland areas. In addition, a small portion of the precipitation that falls on the plain may contribute to the recharge of the aquifer system. Lastly, upwelling of geothermal waters may also recharge the cold water system (Welhan, 2012).

Water Levels in Wells on the Mountain Home Plateau

IDWR has maintained a groundwater level monitoring network on the Mountain Home Plateau since 1960. The monitoring network includes wells within the Mountain Home GWMA and the Cinder Cone CGWA.

Water level data from wells in the Cinder Cone CGWA were analyzed to evaluate water level changes (Figure 5). Water levels in 8 of the 12 wells were lower in the fall of 2011 than in the fall of 1981. These eight wells show decreases ranging from

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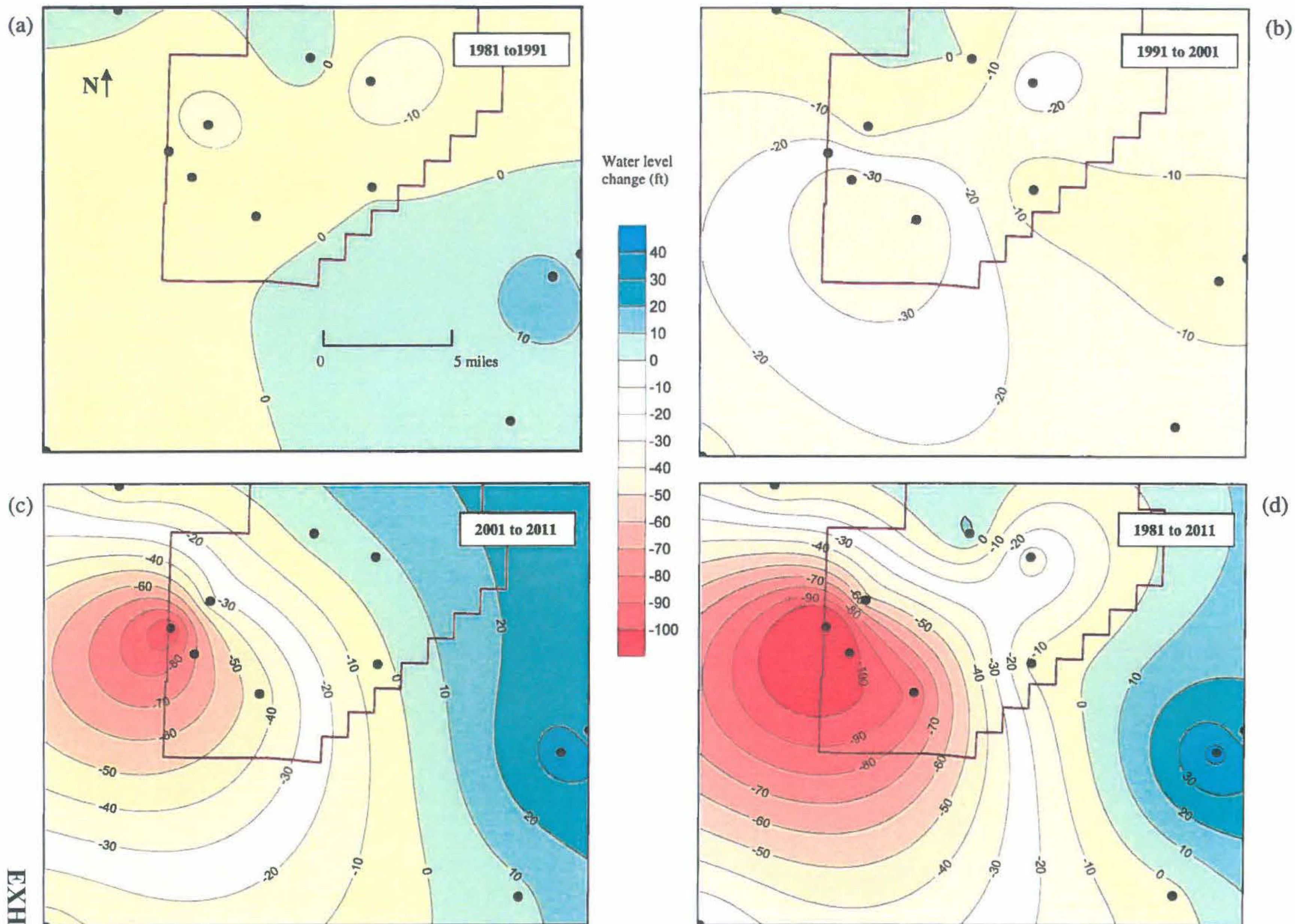

Figure 5. Groundwater level change maps for the Cinder Cone CGWA for the fall season between the years (a) 1981 and 1991, (b) 1991 and 2001, (c) 2001 and 2011, and (d) 1981 and 2011.

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3.5 to 130.7 feet; declines greater than 50 feet were observed in four wells located in the southwest portion of the Cinder Cone CGWA (Appendix B).

Four of the twelve wells, primarily located northeast of the interstate, show an increase in water levels that ranges from 0.3 to 44.7 feet. The water level in one well (#01S04E-30AAC1) increased during the period 1967 to 2000 but it has been decreasing since that time (Appendix C, Plate B). Although this trend reversal could be attributed to propagation of the cone of depression from the Cinder Cone CGWA, other explanations are equally plausible (e.g., water level drawdown from a nearby pumping well).

IDWR established a water level monitoring network in the consolidated hearing study area in 2009 (Appendix C, Plates A and B). However, there is currently not enough data to establish long-term trends, with the exception of two USGS monitoring wells in the southern portion of the study area: Well #01S04E-10DAD1, which is northeast of Interstate 84, and Well #01S04E-30AAC1, which is southwest of Interstate 84 (see Plate B). Over the last ten years, the water level in Well #01S04E-10DAD1 has increased at an average rate of 0.14 ft/yr, and the water level in Well #01S04E-30AAC1 has declined at an average rate of 0.20 ft/yr; both trends were found to be statistically significant based upon a Mann-Kendall analysis (Helsel, 2006). Northwest-trending faults mapped in the area (Bond, 1978) or other structural features may contribute to the difference in trends between wells northeast of I-84 and those southwest of I-84.

Surface Water Data

The headwaters for several ephemeral streams exist in the upland recharge areas for the two study areas (Figure 6). These streams are generally intermittent, and flow is derived from precipitation and runoff events. Due to the permeable soils in this area, the majority of the stream flow discharges into the subsurface near the range front and this is a significant recharge mechanism.

Relatively recent gage data are available for several of the streams in the area (Table 1 and Appendix D). The streams and gage locations are identified on Figure 6. Because of the longer period of record, flow data for Cottonwood Creek (USGS gage #13204640) are also presented in the Appendix. The Cottonwood Creek gage was chosen because it is approximately 18.5 miles west and at similar elevation (3,780 ft-msl) to the Indian Creek gage (USGS gage #13211100) near Mayfield (3,620 ft-msl). Inspection of the hydrograph for the Cottonwood Creek gage (Appendix D) reveals that 2006 and 2011 were anonymously high water years, with annual runoff volumes that are 214% and 193% percent of the average for the 11-year period of record.

Indian Creek Reservoir is the primary reservoir in the study area and the comparison area. Water that flows into the reservoir typically is derived from the local watershed of Sheep Creek, although some of the flow within Indian Creek reaches the reservoir during extreme run-off conditions. The USGS recently conducted a water balance study of the reservoir and will complete a report on this subject in November 2012.

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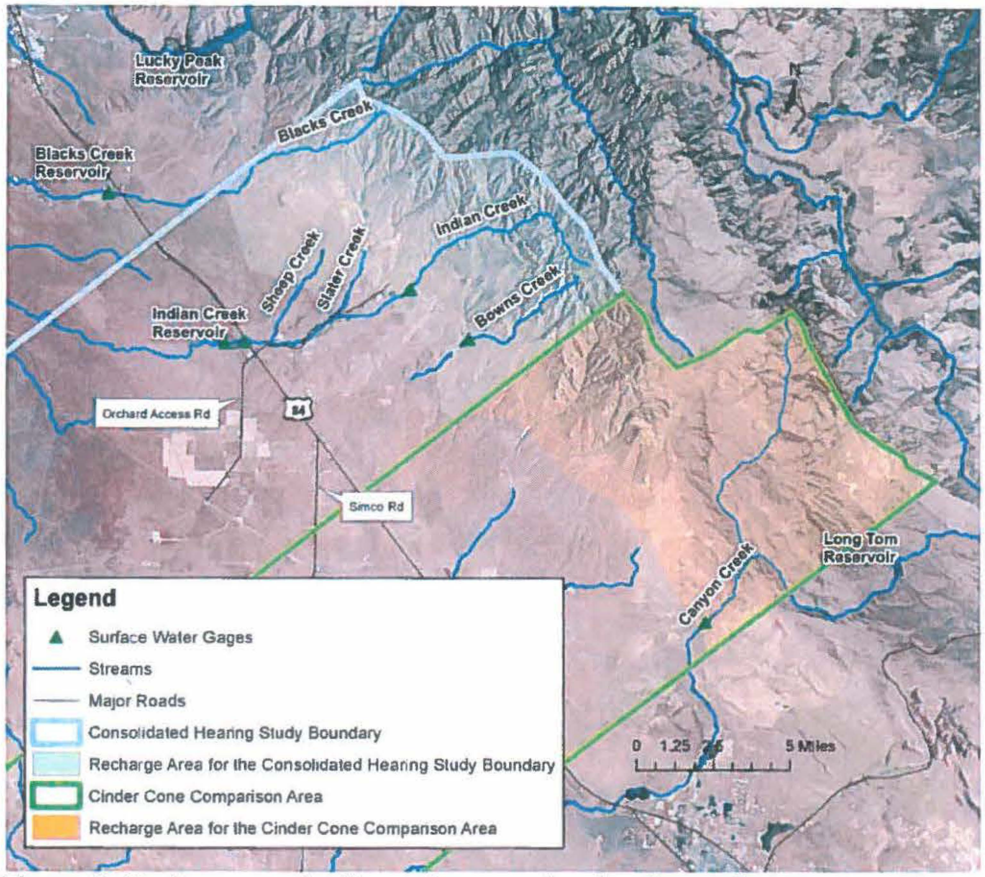

Figure 6. Surface water bodies and gages related to the study area.

Table 1. Runoff volumes for creeks in the area of the proposed residential and irrigation development.

Creek	Method	Date Range	Total Runoff [1] (acre-ft)
Blacks Creek	Transducer – Mean daily discharge	1/1/11 – 6/20/11	2,309
Bowns Creek	Transducer – Mean daily discharge	10/10/10 – 7/27/11	640
Canyon Creek	Staff Gage	1985-2012	24,658[2]
Cottonwood Creek (USGS #13204640)	Water Stage Recorder	2001 – 2011	1,183
Indian Creek (Mayfield)	Eight Flow Tracker measurements	3/12/08 – 6/13/08	2,065
Indian Creek near Mayfield (USGS # 13211100)	Transducer – Mean daily discharge	10/19/10 – 7/23/11	2,431
Indian Creek (Above Reservoir)	Transducer – Mean daily discharge	1/16/11 – 6/24/11	696
[1] Runoff volume for each creek was calculated by summing the daily mean discharge.			
[2] Annual average runoff volume, which includes imported water from the South Fork of the Boise River.			

EXHIBIT ___

Geochemical Data

The USGS collected groundwater samples from 14 wells in the study area. The samples were analyzed for a suite of inorganic constituents, carbon-14, and chlorofluorocarbons (CFCs). Age dating is being performed along a known groundwater flow path to help determine the relative timing of recharge to area aquifers. Future geochemical modeling by the USGS will help identify areas receiving recharge, interpret groundwater mixing, and provide corrected age dates. A final report will be completed by the USGS in early 2013.

Item 3

- Conclude the sufficiency of the water supply within the boundary for existing and new uses.

To address the sufficiency of the water supply issue, water budgets were developed for the consolidated hearing study area and for the adjacent Cinder Cone comparison area. Water budget development involved determining precipitation and evapotranspiration in the recharge areas and precipitation, crop irrigation requirements, and non-irrigation consumptive uses in the non-recharge areas. Details regarding each of the water budget components are presented in the following sections.

Precipitation in Recharge Areas

As previously mentioned, the primary recharge source for the study area is precipitation that falls on the uplands in the northeast portion of the study area. Precipitation in the recharge area may be consumed by evapotranspiration, leave the study area as surficial streamflow, evaporate from surface water bodies, or infiltrate either directly into the regional aquifer or through perched aquifers prior to entering the regional aquifer.

The average annual precipitation in the two recharge areas was quantified using PRISM precipitation data (PRISM, 2012). For the period 1971-2000, the average precipitation in the recharge area for the consolidated hearing study area was 1.66 ft, or 75,420 acre-feet per annum (AFA). In the Cinder Cone comparison area, the average precipitation was 1.70 feet, or 88,989 AFA over the recharge area (Table 3). Precipitation data are also available from the Arrowrock and Anderson Ranch Dam National Weather Service (NWS) stations (Allen and Robison, 2009). The annual precipitation at the two stations is 1.58 and 1.74 ft/yr, respectively. The weather station locations are identified on Figure 7.

Table 3. Water budgets for the consolidated hearing study area and the Cinder Cone comparison area.

Item	Component	Consolidated Hearing Study Area	Cinder Cone Comparison Area
1	Acres within Recharge Area	45,490	52,492
2	Precipitation (AFA) within Recharge Area	75,420	88,989
3	Actual Evapotranspiration (AFA) within Recharge Area	66,147	76,240
4	Acres within Non-recharge Area	177,447	181,307
5	Precipitation within Non-recharge Area (AFA)	175,662	162,111
6	Recharge from Precipitation in Non-recharge Area (AFA)	2,656	2,025
7	Irrigated Lands CIR (AFA) * Non-recharge Area	884	13,131
	Surface Discharge Out of Area (AFA)		
	8a) Blacks Creek	506	
	8b) Indian Creek Reservoir Evaporation	360	
	8c) Canyon Creek		9,877
8	Total Surface Discharge Out of Area (AFA)	866	9,877
	DCMI Consumptive Use Breakdown Recharge + Non-recharge Areas (AFA):		
	9a) GW Rights	317	797
	9b) Springs	6	136
	9c) Surface Water	170	99
	9d) Permit Volume	2,566	132
9	Total DCMI Consumptive Use (AFA)	3,059	1,165
10	**Recharge (AFA) [Item#2-#3+#6-#8]**	11,063	4,897
11	**Recharge (cfs)**	15.27	6.76
12	**Net Recharge (AFA) [Item#10-#7-#9]**	7,120	-9,399
13	**Net Recharge (cfs)**	9.83	-12.97

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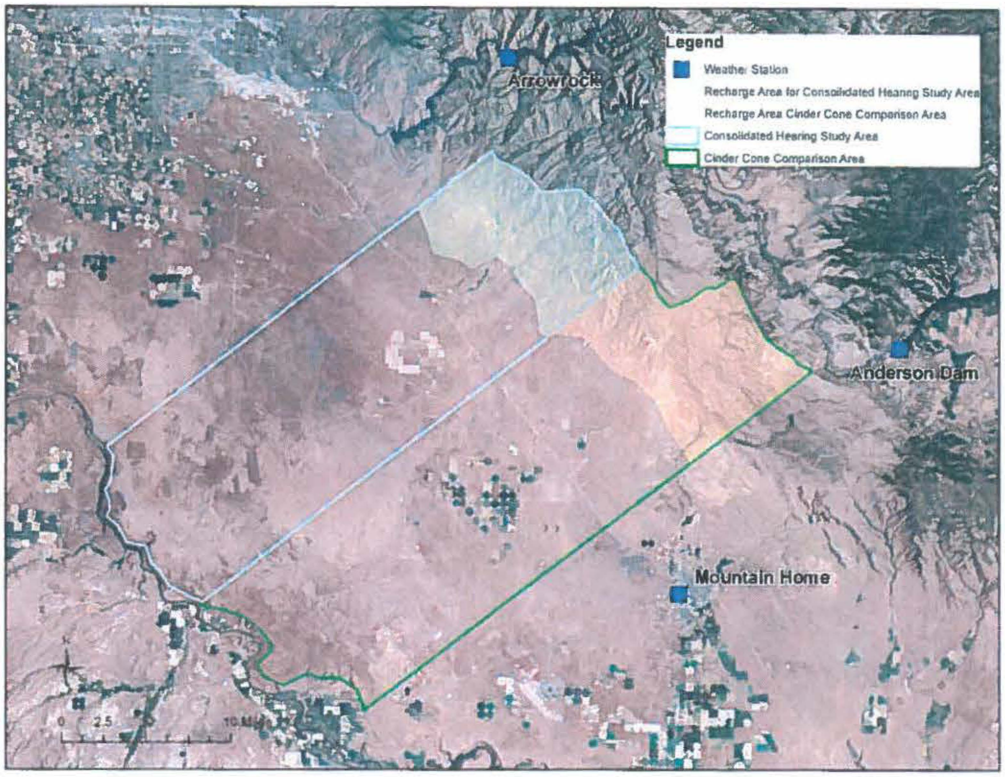

Figure 7. Weather stations in the vicinity of the study area.

Evapotranspiration in Recharge Areas

To determine the net potential recharge volume from precipitation, the evapotranspiration (ET) rates of vegetation in the recharge areas were quantified. The acreage of specific vegetation types was based on data from the 2011 National Agricultural Statistics Service Cropland Data Layer (USDA, 2012). ET estimates were based on average values for vegetation types obtained from ET Idaho from the Arrowrock and Anderson Dam stations. Since the average precipitation in each of the recharge areas (1.66-1.70 ft/yr) is between the annual precipitation at the Anderson Dam and Arrowrock Dam NWS stations (1.58-1.74 ft/yr), it is reasonable to use ET Idaho values from these stations to calculate ET for the recharge areas. Based on these two data sources, the average annual evapotranspiration in the recharge area for the consolidated hearing study area is 66,147 acre-feet and 76,240 acre-feet in the recharge area for the Cinder Cone comparison area.

Precipitation, ET, and Recharge in Non-Recharge Areas

PRISM data were also used to derive estimates of precipitation in the non-recharge areas to the southwest of the study area and the comparison area. The average precipitation for the period 1971-2000 is 175,662 AFA (0.99 ft/yr) in the study area and 162,111 AFA (0.89 ft/yr) in the Cinder Cone comparison area. The precipitation at Mountain Home is

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slightly less at 0.91 ft/yr from ET Idaho or 0.86 ft/yr from PRISM. Using ET Idaho values from the Mountain Home station for sagebrush and range grasses in the study area likely results in underestimation because actual ET is limited by the amount of precipitation. Due to a lack of site-specific ET monitoring, estimates of non-irrigated lands recharge for each of the non-recharge areas were developed based on previous estimates that were included in the water budget for a groundwater flow model of the western Snake River Plain (Newton, 1991). Note that non-irrigated lands recharge on the Mountain Home Plateau was assumed negligible for a previous assessment of groundwater resources in the Cinder Cone Butte area (IDWR, 1981).

For non-recharge areas of the study area and the Cinder Cone comparison area, Newton (1991) estimated that recharge ranges from 0.3% to 3.0% of annual precipitation. Using area-weighted recharge percentages from the model (Newton, 1991), recharge in the study area is 2,656 AFA (1.51% of the average annual precipitation), and 2,025 AFA (1.25%) in the Cinder Cone comparison area.

Adjustments for Surface Water Outflows

Two streams, Blacks Creek and Canyon Creek, have portions of their headwaters in the recharge areas and transmit water southwest and out of the study area and the Cinder Cone comparison area. The volume of water derived from precipitation within the recharge areas that flows out of the study area was deducted from the water budget. For Blacks Creek, data from the gage station indicates 2,309 acre-ft flowed out of the study area between January and June of 2011. Of that, approximately 977 acre-ft originated from precipitation in the recharge area. To account for the abnormally high runoff conditions in 2011, the quantity of water that leaves the study area on an average season was computed. Considering the 2011 runoff season flows were 193% of normal, the value was scaled back by a factor of 1.93, resulting in 506 acre-ft. For Canyon Creek, an annual average of 24,658 acre-ft was reported at the Canyon Creek gage between 1985 and 2012. Of that, approximately 9,877 acre-ft was derived from precipitation within the study area.

Indian Creek Reservoir is the primary reservoir in the area. Water that flows into the reservoir typically is derived from the Sheep Creek watershed, although some Indian Creek flow reaches the reservoir during extreme run-off conditions. A gage was set up to monitor the flow into Indian Creek Reservoir in January of 2011. The inflow during 2011 was approximately 696 acre-ft. Average inflow was also estimated by scaling back this value by a factor of 1.93, resulting in 360 acre-ft. It is assumed that the water that flows into Indian Creek Reservoir evaporates rather than infiltrating into the aquifer based on preliminary findings of a reservoir water balance study that is being conducted by the USGS. A report documenting the study findings is scheduled for publication by the USGS in November 2012.

Crop Irrigation Requirements

Crop irrigation requirement (CIR) values were taken from ET Idaho and multiplied by irrigated acres within the non-recharge areas for the study area and Cinder Cone comparison area. The acreage of specific vegetation types was based on data from the 2011 National Agricultural Statistics Service (USDA, 2012). CIR for the non-recharge areas are 884 AFA for the study area and 13,131 AFA for the Cinder Cone comparison area.

Other Consumptive Uses

Domestic and stockwater consumptive use was estimated based upon review of the IDWR water rights database files. Consumptive use for domestic households was assigned 0.8 AFA based on a family of four (Cook, et. al, 2001). In accordance with IDWR guidelines for water use (http://www.idwr.idaho.gov/WaterManagement/WaterRights/wateruse.htm), consumptive use for stockwater was determined by assigning 0.0022 AFA per sheep (2 gal/day), 0.0392 AFA per dairy cow (35 gal/day), and 0.0134 AFA per non-dairy cow (12 gal/day). Estimated total consumptive domestic and stockwater use in the study area is 493 AFA and 866 AFA in the Cinder Cone comparison area.

Diversion volume limits were used to provide conservative estimates of consumptive use for permitted, undeveloped, municipal and commercial uses. Consumptive use will likely be less than diversion volume limits by an unknown amount depending on water use and reuse practices. Permit volume limits amount to 2,566 AFA in the hearing study area and 132 AFA in the Cinder Cone comparison area.

Verification of IDWR recharge estimate

Welhan (2012) applied Darcy's law (see, for example, Freeze and Cherry, 1979) to develop recharge estimates for the regional aquifer system in the vicinity of the proposed water right POUs as part of a hydrogeologic assessment being conducted for the Comprehensive Aquifer Management Plan (CAMP) program. He prepared separate estimates for each of two hydrogeologic conceptual models that were developed to explain a steepening of the hydraulic gradient that occurs in the vicinity of Interstate 84. One conceptual model involved recharge from precipitation in the highlands with an additional influx of geothermal and/or perched water and the other involved a zone of decreased aquifer transmissivity near Interstate 84. Using available aquifer transmissivity values, he estimated that recharge to the regional aquifer along a 6.21-mile wide cross-section and oriented approximately perpendicular to the southwesterly groundwater flow direction (Figure 8) is 7,000 AFA for the conceptual model involving an additional influx of water and 12,600 AFA for the conceptual model involving decreased aquifer transmissivity. Proportionally scaling up the estimates from Welhan (2012) to the width of the study area (11 miles) results in a range of 12,400 AFA to 22,320 AFA.

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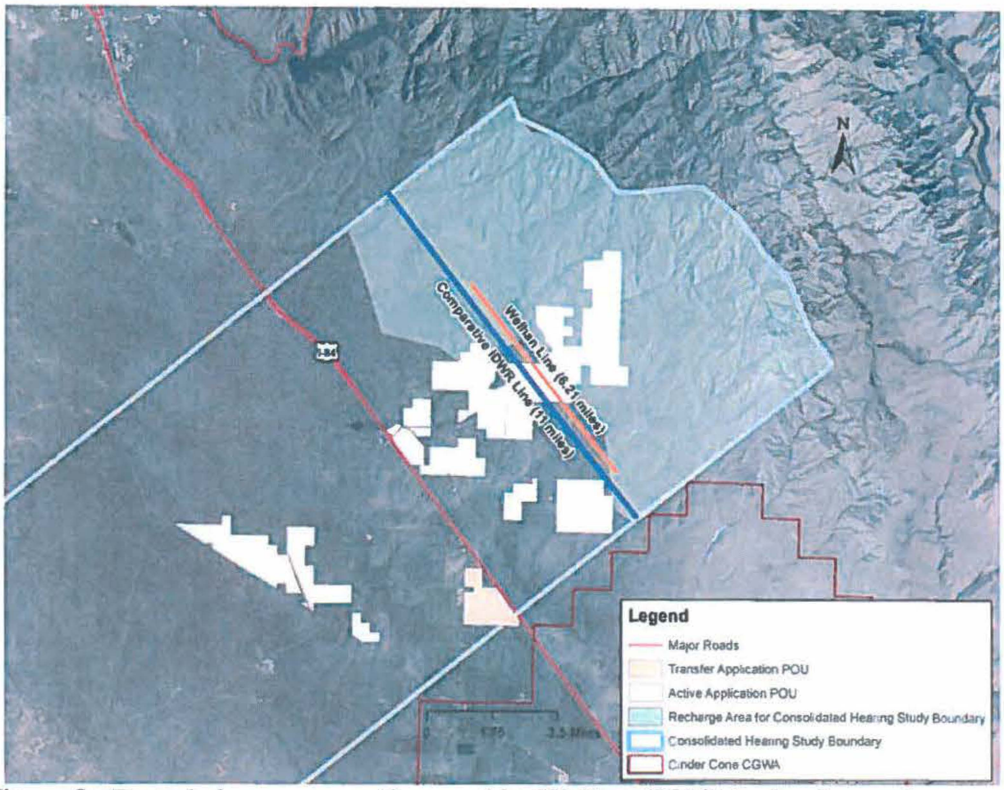

Figure 8. Darcy's law cross-section used by Welhan (2012) to develop recharge estimates.

Current consumptive uses reflected in the Welhan (2102) recharge estimate but not in the IDWR estimate (item 10 in Table 3) include CIR in the non-recharge area (item #7 in Table 3) and existing DCMI consumptive uses (items 9a, 9b, and 9c in Table 3). Adding the sum of these four components of the study area (1,377 AFA) to the width-adjusted estimates, results in estimates of 13,777 AFA and 23,697 AFA. The low end of this range is somewhat higher than the recharge estimate of 11,063 AFA in Table 3. The estimates compare well given the uncertainty inherent in the estimation of recharge, especially when using Darcy's law.

Sufficiency of the Water Supply

In this section, the water budget information developed in Table 3 is used to assess the sufficiency of the water supply. Comparisons are made between the computed net recharge rate for the consolidated hearing study area to the computed net recharge rate for the Cinder Cone comparison area and to the total appropriation amount for the study area. The validity of the former is enhanced by the fact that the method of calculation is the same for the two areas.

The net recharge rate for the study area (7,120 AFA) is positive, indicating that existing consumptive uses, including those for water rights that are not yet fully developed, are

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less than the rate of recharge. The net recharge rate is 16,519 AFA higher than the net recharge for the Cinder Cone comparison area (-9,399 AFA). Additional consumptive uses approaching the amount of the difference would be expected to result in water level declines similar to those observed in the Cinder Cone CGWA and, assuming hydrologic continuity, exacerbate conditions in the Cinder Cone CGWA.

Idaho Code stipulates that, with only a couple of exceptions, "*water in a well shall not be deemed available to fill a water right therein if withdrawal therefrom of the amount called for by such right would affect, contrary to the declared policy of this act, the present or future use of any surface or ground water right or result in the withdrawing of the groundwater supply at a rate beyond the reasonably anticipated rate of future natural recharge*" (Idaho Code §42-237a.g.). According to IDAPA 37.03.11, the "*reasonably anticipated rate of future natural recharge*" includes recharge from precipitation, underflow from tributary sources, stream losses, and incidental recharge of water used for irrigation and other purposes. Thus, based on the water budget presented herein, and assuming similar hydrologic conditions in future years, the reasonably anticipated rate of future natural recharge is 11,063 AFA and the maximum additional consumptive use that could be authorized within the study area is 7,120 AFA. On a continuous basis, this latter amount is equivalent to 9.8 cfs, which is considerably less than the maximum total appropriation amount of 84.76 cfs. Note, however, that the fraction of the maximum total appropriation that would be consumptively used depends, not on the rate limits, but rather on water use and reuse practices and the amounts withdrawn, information that is lacking for this analysis.

Inherent in the assumption that the future natural recharge rate would be roughly equivalent to the average based on precipitation data for the time period 1971-2000 is the assumption that the rate of inflow to the aquifer system would be unchanged by additional groundwater withdrawals that are the subject of the consolidated hearing. Induced underflow from tributary sources, for example, is assumed negligible because the recharge area extends all the way to the surface water divide and the granitic rocks that underlie the surface water divide are relatively impermeable. Similarly, induced inflow from the aquifer system adjacent the study area is assumed to be negligible and/or off limits for appropriation because of the existence of the Cinder Cone CGWA. In other words, lowering of the water table in the study area would not substantively increase the amount of water available for appropriation.

Additional groundwater extraction would, however, decreases aquifer storage, particularly in the short term, and, eventually, decreases aquifer discharge to the Snake River. An indication of the expected transient water level response is provided by hydrographs for wells in the Cinder Cone CGWA monitoring network (Appendix B). Despite the fact that there has been a moratorium on new irrigation appropriations for more than 30 years, water level monitoring indicates that aquifer storage continues to decline in the Cinder Cone CGWA.

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If, as assumed, inflow to the study area is unchanged, mass balance requires that increased withdrawals will decrease outflow to the Snake River by an equivalent amount at steady state. This applies to both the consolidated study area and the Cinder Cone comparison area.

The table in Figure 8 shows that the current cumulative volume limit for licensed water rights in the study area is less than five percent of the cumulative volume limit for licensed water rights in the Cinder Cone comparison area. In combination with the maximum rate for recently approved water right permits (14.02 cfs), the proposed additional maximum appropriation rate of 84.76 cfs represents a 1,102% increase in the permissible, instantaneous withdrawal rate in the study area.

Figure 9 relates the growth of the cumulative licensed water right volume limit for the Cinder Cone comparison area to water levels in two monitoring wells in the Cinder Cone CGWA. Since the study area and the Cinder Cone comparison area are within a similar hydrogeologic setting, the relationship between the growth of the cumulative volume limit and the water level trends provides an indication of the potential hydrologic impacts of rapid groundwater development in the study area. The data suggest an inverse relationship between the amount of groundwater development and the water levels in the regional aquifer.

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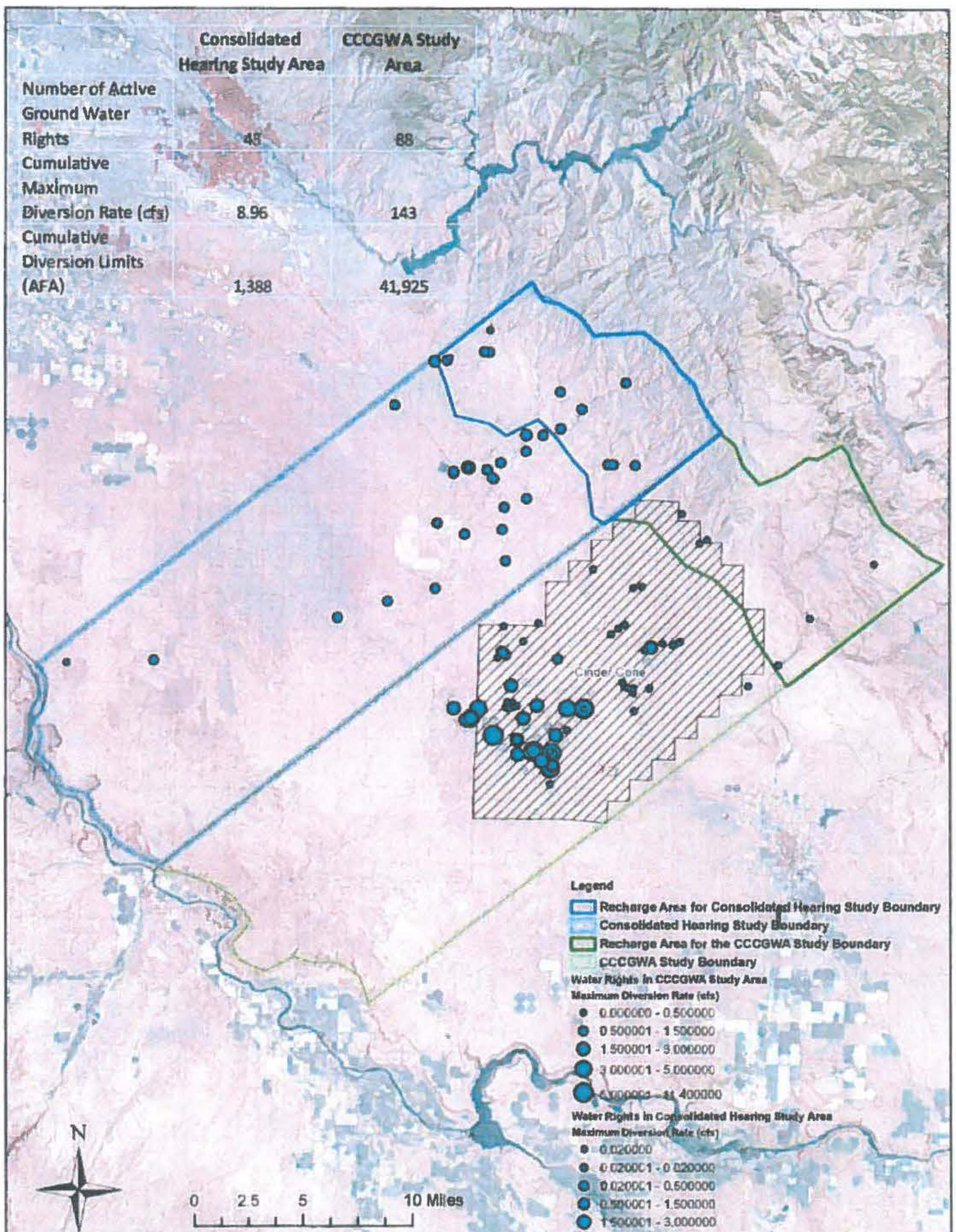

Figure 8. Licensed water rights and maximum diversion rates in the study area and in the Cinder Cone comparison area.

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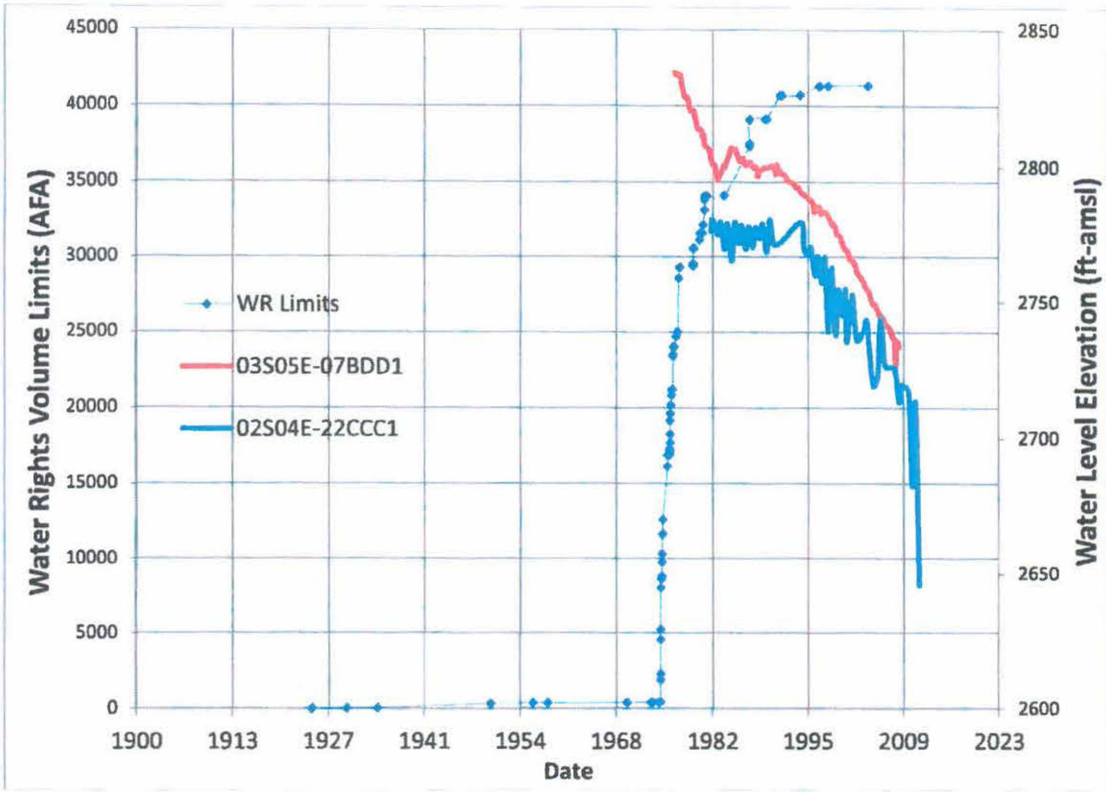

Figure 9. Cumulative water right volume limit in the Cinder Cone comparison area and water levels in wells 03S05E-07BDD1 and 02S04E-22CCC1.

Summary and Conclusions

The preceding analysis attempts to quantify the maximum amount of water that is available for appropriation in the study area. The validity of the analysis depends on the validity of the assumptions. While there is uncertainty in estimates of individual water budget components, use of the same assumptions and methodology for the Cinder Cone comparison area provides context for interpreting the results.

Specific conclusions are as follows:

1. Assuming future hydrologic conditions similar to those during the recent past, the reasonably anticipated rate of future natural recharge is 11,100 AFA.

2. The estimated net recharge rate for the study area is 7,100 AFA. The estimate is positive, indicating that existing consumptive uses, including those for water rights that are not yet fully developed, are less than the rate of recharge.

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3. The net recharge rate (7,100 AFA) is an estimate of the maximum additional consumptive use that could normally be authorized within the study area. On a continuous basis, this amount is equivalent to 9.8 cfs, which is approximately an order of magnitude less than the maximum total appropriation amount being sought as part of the consolidated hearing (85 cfs).

4. In combination with the combined maximum appropriation rate for recently approved but not yet developed water rights (14 cfs), the proposed additional maximum appropriation rate of 85 cfs represents a 1,100% increase in the permissible, instantaneous withdrawal rate in the study area.

5. The magnitude of the recharge estimate for the study area is generally confirmed by extrapolation of results from an analysis that involved the application of Darcy's law.

6. Given uncertainties in aquifer properties and hydrologic boundary conditions, no attempt has been made to quantify hydrologic impacts of the proposed groundwater development. Instead, data from the Cinder Cone CGWA provide an indication of potential impacts. The data suggest an inverse relationship between the amount of groundwater development and water levels in the regional aquifer.

7. Ongoing water level declines more than 30 years after establishment of the Cinder Cone CGWA indicate that the groundwater supply on the Mountain Home Plateau is limited and support the conclusion that consumptive use within the Cinder Cone comparison area exceeds the rate of recharge.

8. Unless inflow to the aquifer system in the study area is increased, mass balance requires that increased withdrawals will decrease outflow to the Snake River by an equivalent amount at steady state.

9. Assuming hydrologic continuity, groundwater development in the study area would eventually exacerbate conditions in the Cinder Cone CGWA.

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APPENDIX A
Geologic Cross Sections

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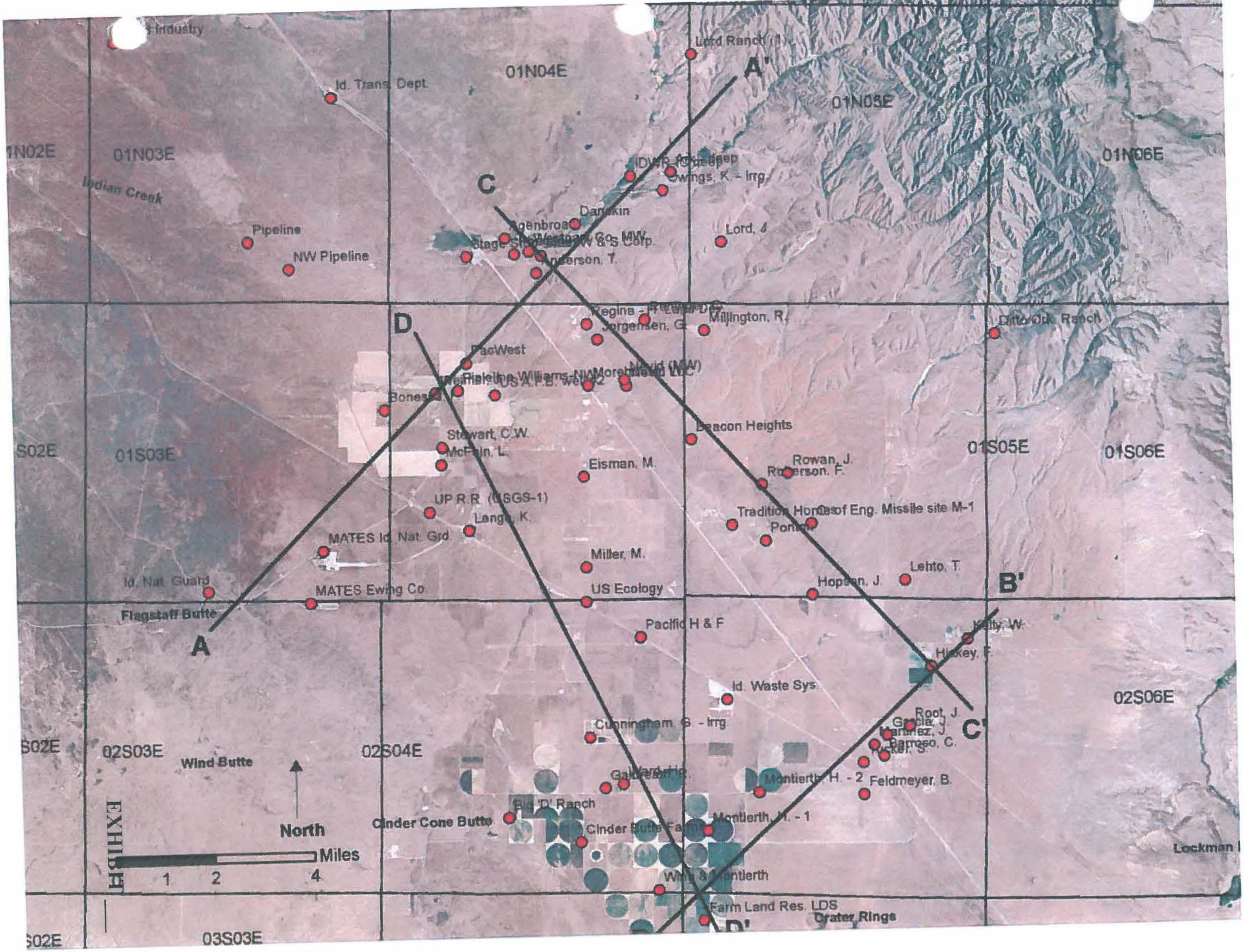
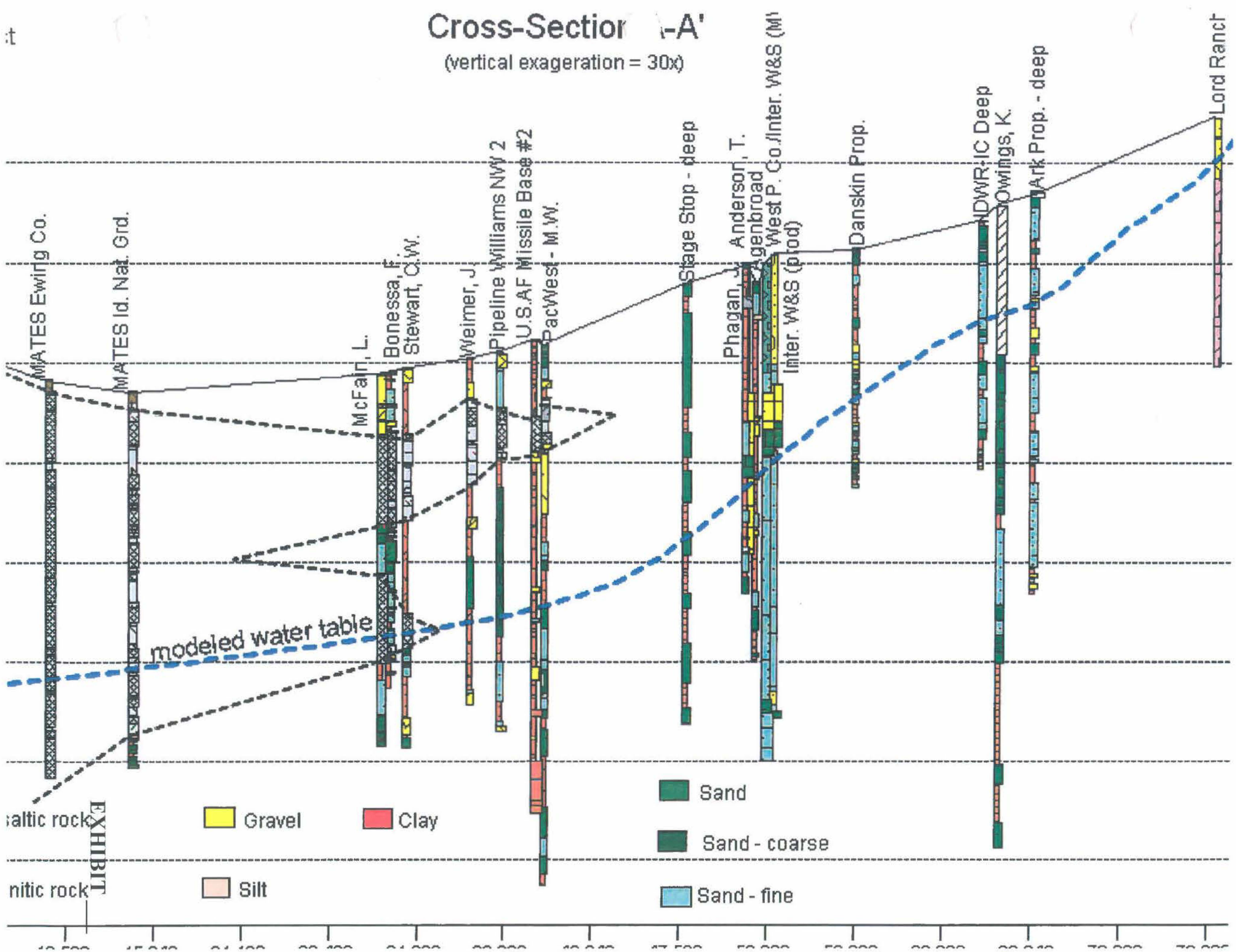


Industry
Id. Trans. Dept
01N04E
Lord Ranch (1)
A'
01N05E
1N02E
01N03E
Indian Creek
01N06E
C
Owings, K. - Irrg.
Lord, 4
Pipeline
NW Pipeline
D
Millington, R.
PacWest
Bones
Beacon Heights
Stewart, C.W.
S02E
01S03E
Eisman, M.
Rowan, J.
01S05E
01S06E
UP R.R. (USGS-1)
Lange, K.
MATES Id. Nat. Grd.
Miller, M.
Lehto, T.
Id. Nat. Guard
MATES Ewing Co.
US Ecology
Hopson, J.
B'
Flagstaff Butte
Pacific H & F
Kelly, W.
A
Id. Waste Sys.
02S06E
Cunningham, G. - Irrg.
Root, J.
C'
S02E
02S03E
02S04E
Wind Butte
Montierth, H. - 2
Feldmeyer, B.
Big 'D' Ranch
Cinder Cone Butte
North
Montierth, H. - 1
Miles
1
2
4
Lockman
Farm Land Res. LDS
Crater Rings
D'
S02E
03S03E



Cross-Sectior -A'
(vertical exageration = 30x)
MATES Ewing Co.
MATES Id. Nat. Grd.
McFain, L.
Bonessa, F.
Stewart, C.W.
Weimer, J.
Pipeline Williams NW 2
U.S.AF Missile Base #2
PacWest - M.W.
Stage Stop - deep
Phagan, J.
Anderson, T.
Agenbroad
West P. Co./Inter. W&S (M
Inter. W&S (prod)
Danskin Prop.
IDWR-IC Deep
Owings, K.
Ark Prop. - deep
Lord Ranch
modeled water table
saltic rock
nitic rock
Gravel
Clay
Silt
Sand
Sand - coarse
Sand - fine

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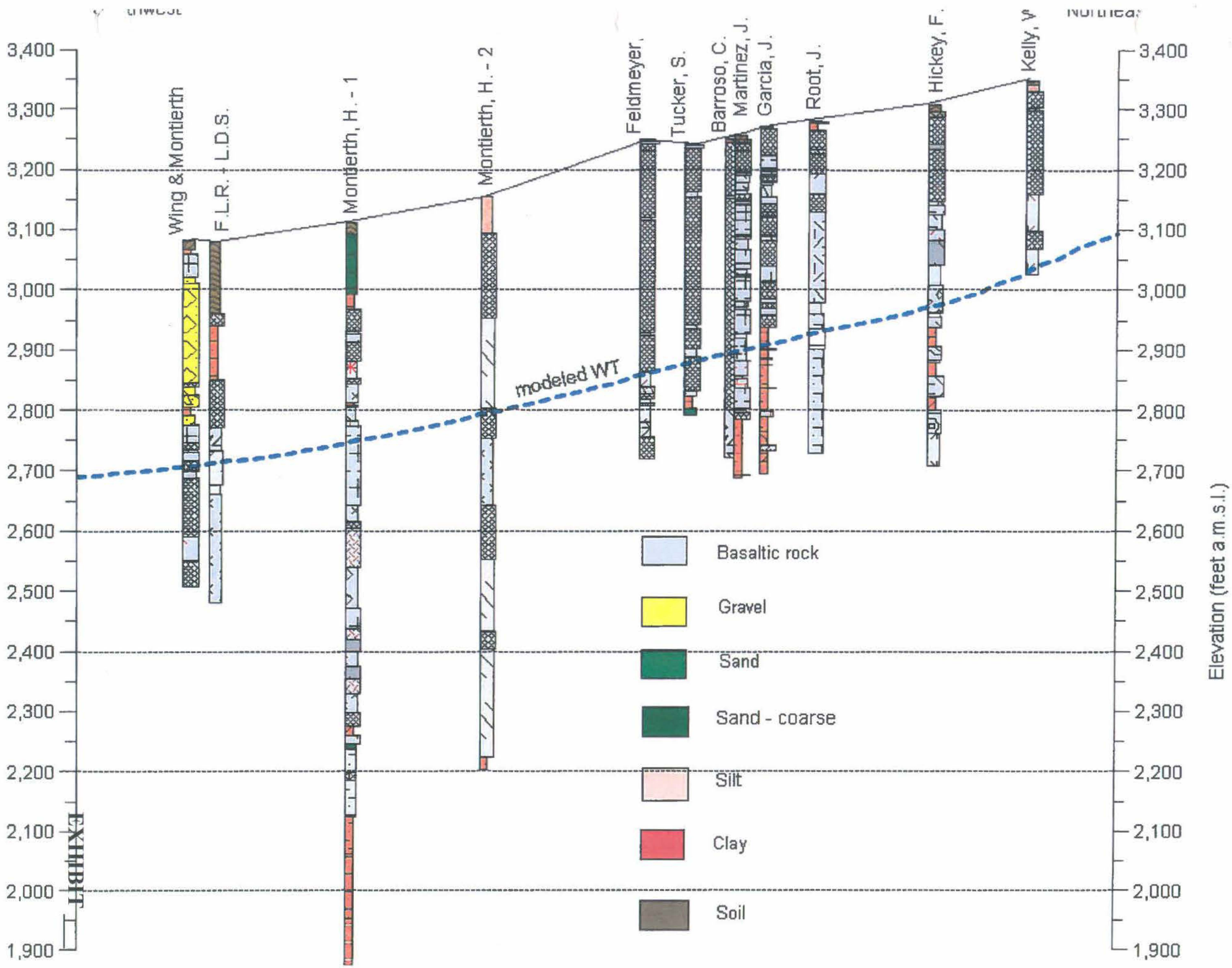
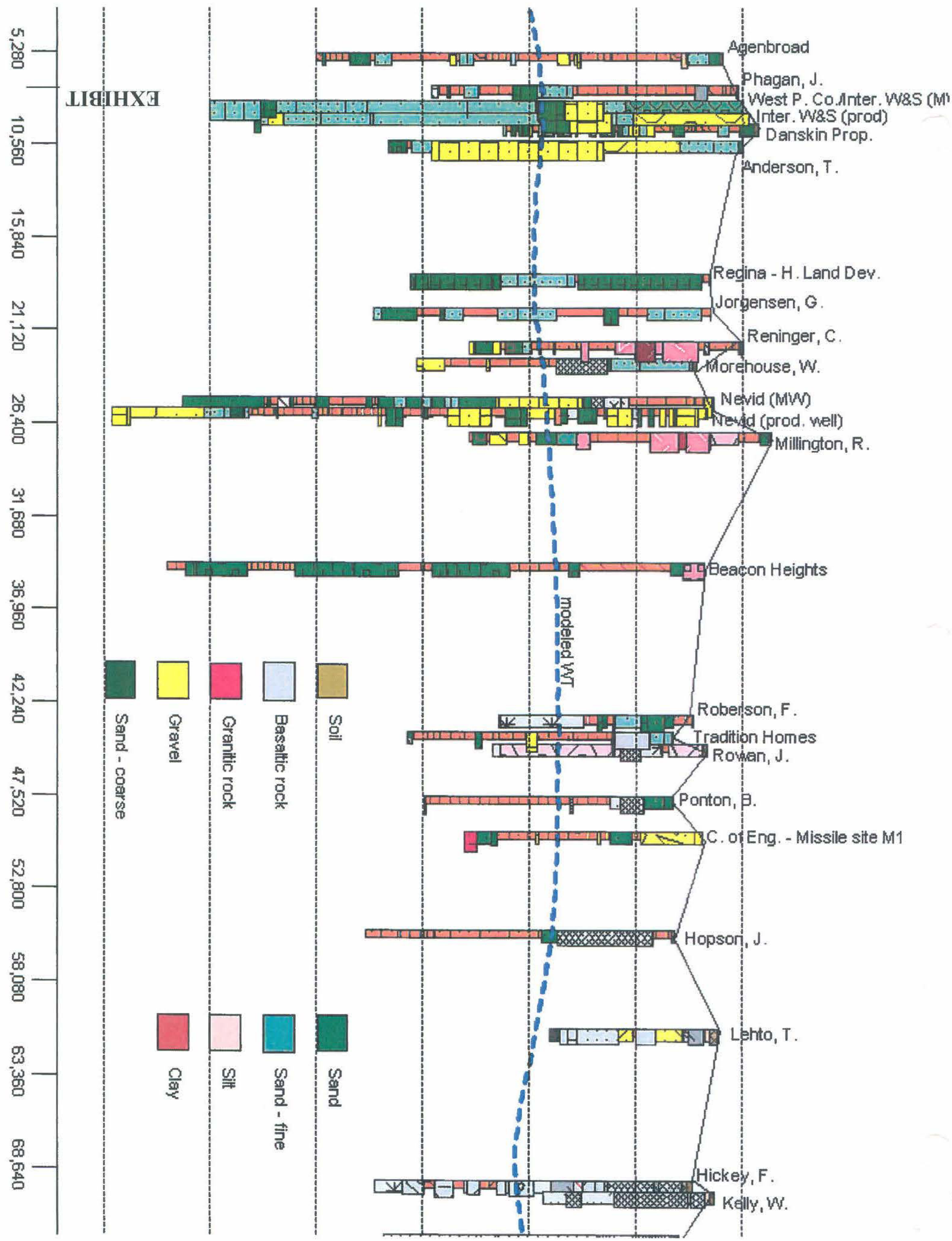


Southwest
Northeast
Wing & Montierth
F.L.R. - L.D.S.
Montierth, H. - 1
Montierth, H. - 2
Feldmeyer,
Tucker, S.
Barroso, C.
Martinez, J.
Garcia, J.
Root, J.
Hickey, F.
Kelly, V
modeled WT
3,400
3,300
3,200
3,100
3,000
2,900
2,800
2,700
2,600
2,500
2,400
2,300
2,200
2,100
2,000
1,900
Elevation (feet a.m.s.l.)
Basaltic rock
Gravel
Sand
Sand - coarse
Silt
Clay
Soil
EXHIBIT



5,280
10,560
15,840
21,120
26,400
31,680
36,960
42,240
47,520
52,800
58,080
63,360
68,640
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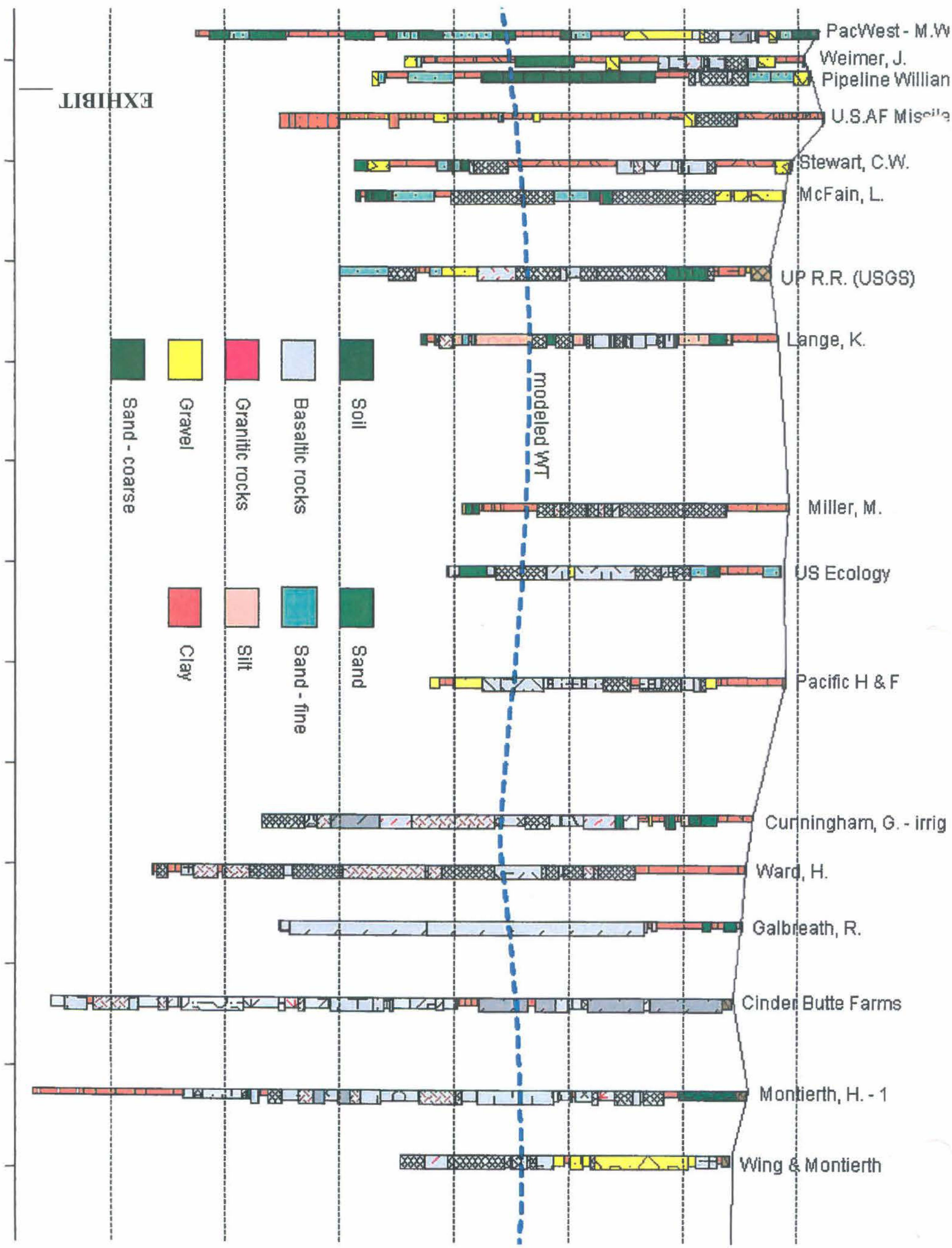
Agenbroad
Phagan, J.
West P. Co./Inter. W&S (M
Inter. W&S (prod)
Danskin Prop.
Anderson, T.
Regina - H. Land Dev.
Jorgensen, G.
Reninger, C.
Morehouse, W.
Nevid (MW)
Nevid (prod. well)
Millington, R.
Beacon Heights
modeled WT
Roberson, F.
Tradition Homes
Rowan, J.
Ponton, B.
C. of Eng. - Missile site M1
Hopson, J.
Lehto, T.
Hickey, F.
Kelly, W.
Sand - coarse
Gravel
Granitic rock
Basaltic rock
Soil
Clay
Silt
Sand - fine
Sand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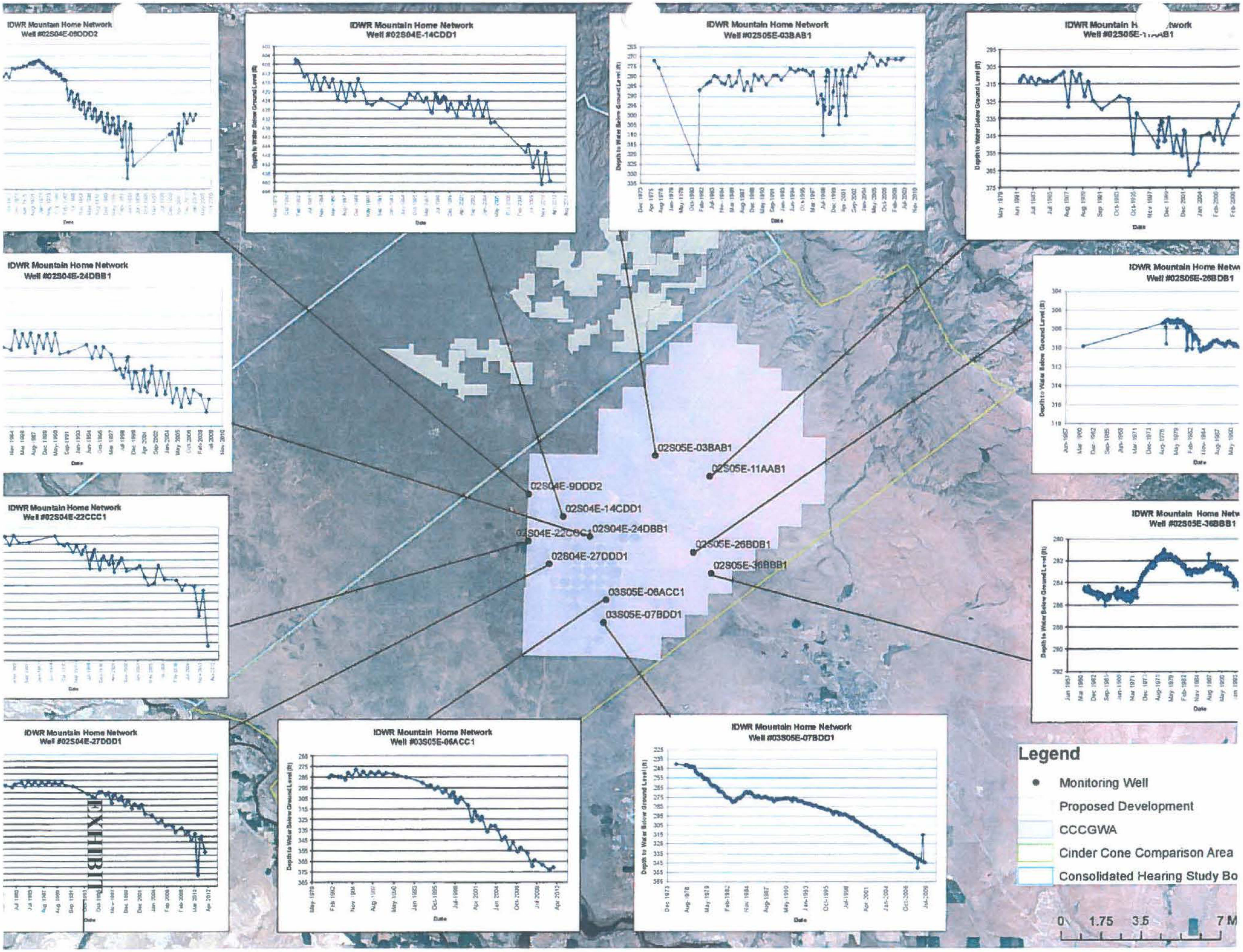
PacWest - M.W
Weimer, J.
Pipeline Willian
U.S.AF Mis
Stewart, C.W.
McFain, L.
UP R.R. (USGS)
Lange, K.
Miller, M.
US Ecology
Pacific H & F
Cunningham, G. - irrig
Ward, H.
Galbreath, R.
Cinder Butte Farms
Montierth, H. - 1
Wing & Montierth
modeled WT
Soil
Basaltic rocks
Granitic rocks
Gravel
Sand - coarse
Sand
Sand - fine
Silt
Clay

APPENDIX B
Cinder Cone CGWA Well Hydrographs

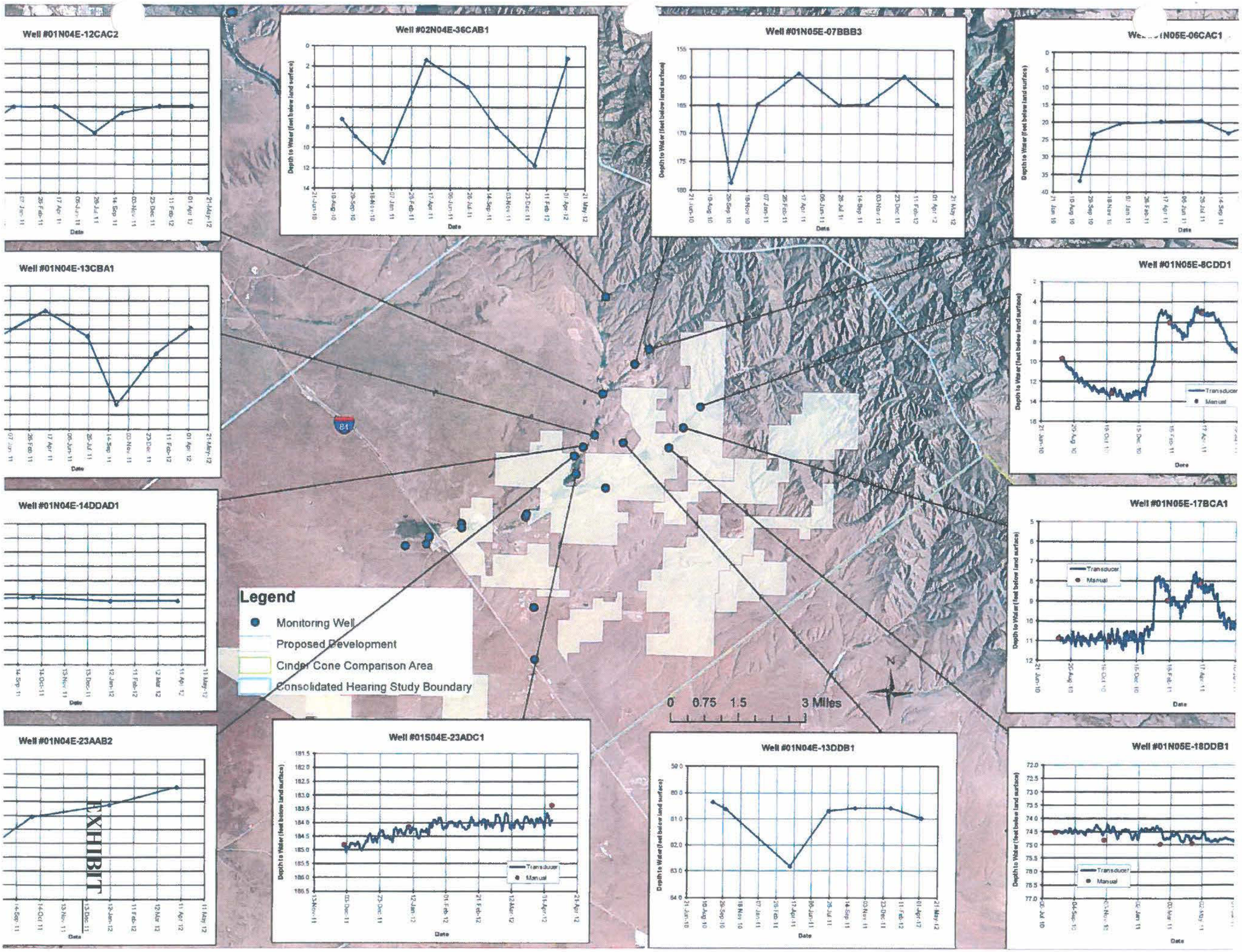
EXHIBIT ___



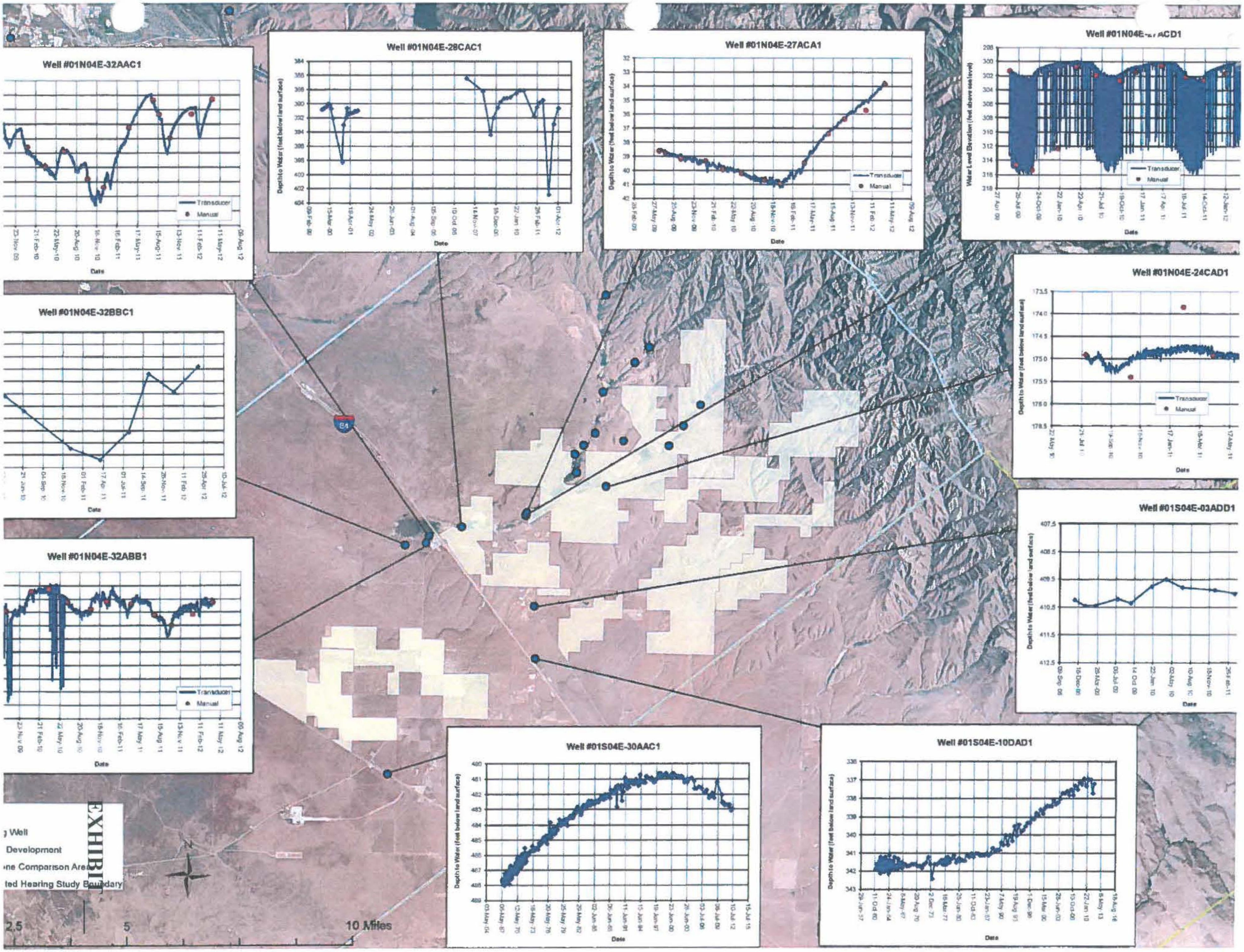
IDWR Mountain Home Network
Well #02S04E-09DDD2
IDWR Mountain Home Network
Well #02S04E-14CDD1
IDWR Mountain Home Network
Well #02S05E-03BAB1
Well #02S05E-11AAB1
IDWR Mountain Home Network
Well #02S04E-24DBB1
IDWR Mountain Home Network
Well #02S05E-26BDB1
IDWR Mountain Home Network
Well #02S04E-22CCC1
IDWR Mountain Home Network
Well #02S05E-36BBB1
IDWR Mountain Home Network
Well #02S04E-27DDD1
IDWR Mountain Home Network
Well #03S05E-06ACC1
IDWR Mountain Home Network
Well #03S05E-07BDD1
Depth to Water Below Ground Level (ft)
Date
02S05E-03BAB1
02S05E-11AAB1
02S04E-9DDD2
02S04E-14CDD1
02S04E-24DBB1
02S05E-26BDB1
02S05E-36BBB1
02S04E-27DDD1
03S05E-06ACC1
03S05E-07BDD1
EXHIBIT
Legend
Monitoring Well
Proposed Development
CCCGWA
Cinder Cone Comparison Area
Consolidated Hearing Study Bo
0 1.75 3.5 7 M

APPENDIX C
Study Area Well Hydrographs

EXHIBIT ___



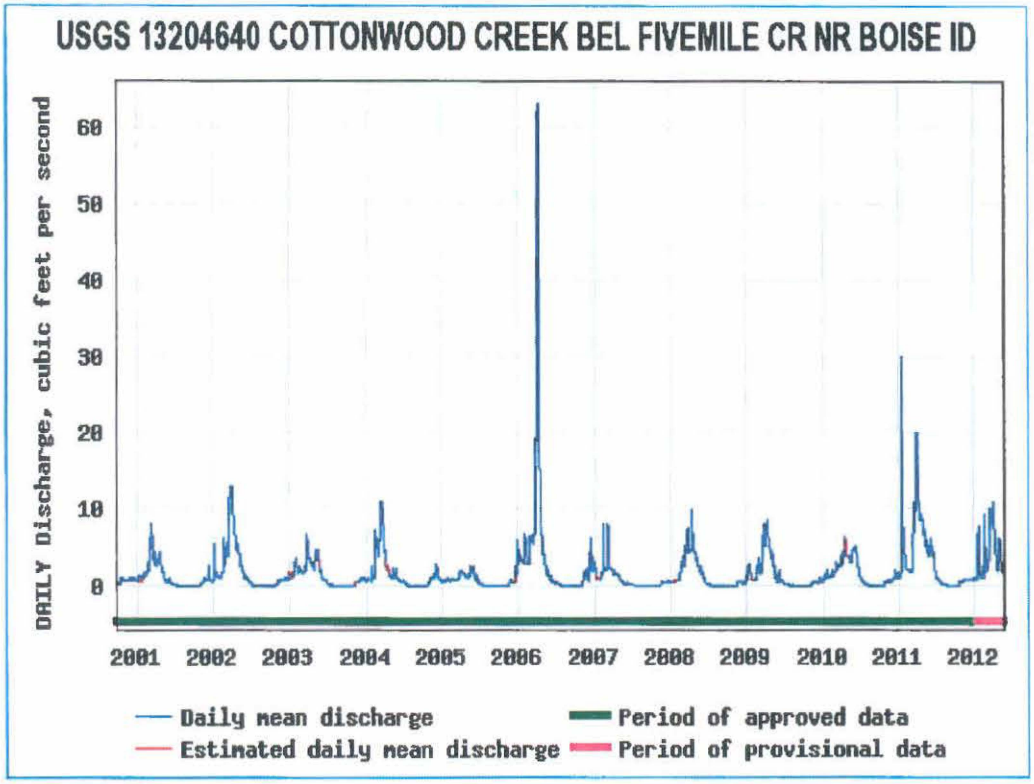
Well #01N04E-12CAC2
Well #02N04E-36CAB1
Well #01N05E-07BBB3
We... 1N05E-06CAC1
Well #01N04E-13CBA1
Well #01N05E-8CDD1
Well #01N04E-14DDAD1
Well #01N05E-17BCA1
Well #01N04E-23AAB2
Well #01S04E-23ADC1
Well #01N04E-13DDB1
Well #01N05E-18DDB1
Depth to Water (feet below land surface)
Date
Transducer
Manual
84
Legend
Monitoring Well
Proposed Development
Cinder Cone Comparison Area
Consolidated Hearing Study Boundary
0 0.75 1.5 3 Miles
N
EXHIBIT

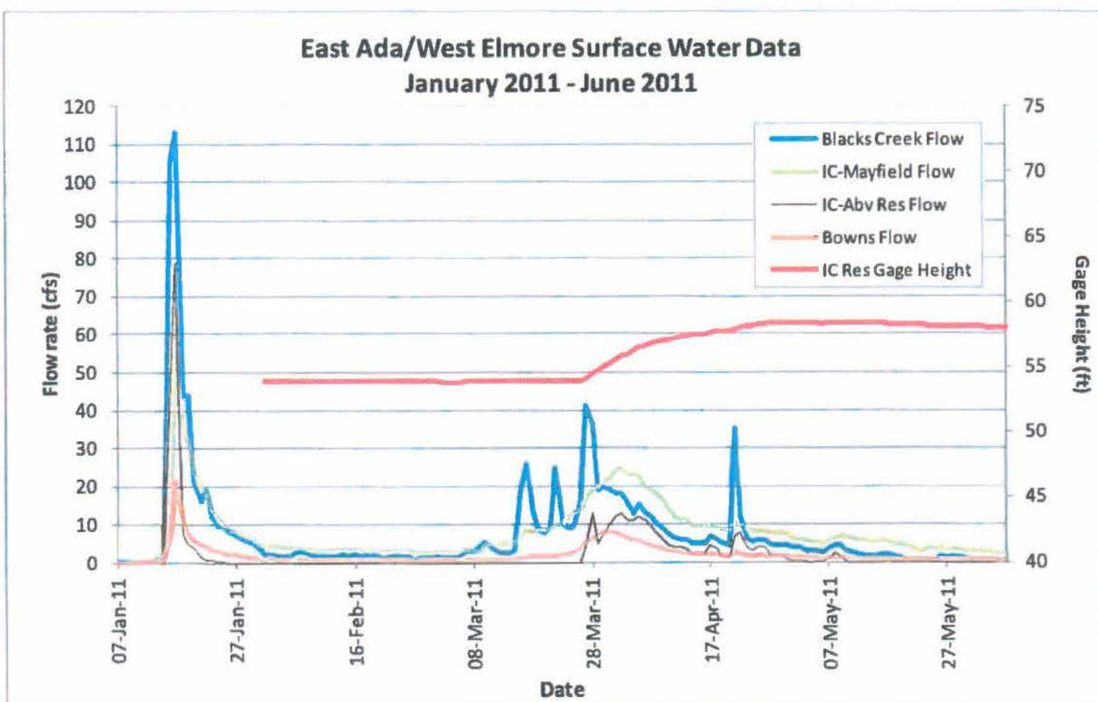


Well #01N04E-32AAC1
Well #01N04E-28CAC1
Well #01N04E-27ACA1
Well #01N04E-24CAD1
Well #01N04E-32BBC1
Well #01N04E-32ABB1
Well #01S04E-03ADD1
Well #01S04E-30AAC1
Well #01S04E-10DAD1
Transducer
Manual
Date
Depth to Water (feet below land surface)
Water Level Elevation (feet above sea level)
84
Well
Development
Comparison Area
Hearing Study Boundary
EXHIBIT
2.5
5
10 Miles

APPENDIX D
Surface Water Hydrographs

EXHIBIT ___


USGS 13204640 COTTONWOOD CREEK BEL FIVEMILE CR NR BOISE ID
DAILY Discharge, cubic feet per second
60
50
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Daily mean discharge
Estimated daily mean discharge
Period of approved data
Period of provisional data


East Ada/West Elmore Surface Water Data
January 2011 - June 2011
Flowrate (cfs)
120
110
100
90
80
70
60
50
40
30
20
10
0
Gage Height (ft)
75
70
65
60
55
50
45
40
Blacks Creek Flow
IC-Mayfield Flow
IC-Abv Res Flow
Bowns Flow
IC Res Gage Height
07-Jan-11
27-Jan-11
16-Feb-11
08-Mar-11
28-Mar-11
17-Apr-11
07-May-11
27-May-11
Date

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M/N EXHIBIT 3

SPF WATER ENGINEERING

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MEMORANDUM

DATE: November 15, 2012

TO: Gary Spackman, Director
Idaho Department of Water Resources

FROM: Christian R. Petrich, Ph.D., P.E., P.G.

PROFESSIONAL ENGINEER REGISTERED 9011 STATE OF IDAHO CHRISTIAN R. PETRICH

REGISTERED PROFESSIONAL GEOLOGIST CHRISTIAN R. PETRICH 1088 STATE OF IDAHO

11/15/2012

RE: *Response to IDWR Staff Memo regarding the sufficiency of water supply for water right applications and transfers along the I-84 corridor*

A. Introduction

The Idaho Department of Water Resources (IDWR) combined various protested applications and transfers in the Interstate 84 (I-84) corridor in Eastern Ada County and western Elmore County[1] for a consolidated hearing. IDWR staff then prepared a memorandum[2] (referred to hereinafter as the "IDWR Staff Memo") to "suggest and justify a study boundary, present data and information within the boundary, and conclude, to the extent possible the sufficiency of water supply within the suggested boundary for existing and new uses."[3]

This document provides a response to the IDWR Staff Memo. This response was prepared on behalf of Mayfield Townsite LLC (Application 63-32499), Nevid LLC (Applications 61-12095 and 61-12096), and Mayfield Townsite/ARK Properties (Application 63-33344). Conclusions from this review are listed in the following section (Section B), followed by supporting findings and opinions (Section C).

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[1] January 24, 2012 Order Creating Contested Case and Consolidating Protested and unprotested Applications in the Matter of Application for Transfer 7381 (Shekinah Industries); Application for Transfer 73834 (Orchard Ranch); Application for Permit 63-32499 (Mayfield Townsite); Application for Permit 61-12095 (Nevid-Corder); Application for Permit 61-12096 (Nevid); Application for Permit 63-32703 (Orchard Ranch); Application for Permit 61-12256 (Intermountain Sewer and Water); Application for Permit 63-3344 (Ark Properties-Mayfield Townsite).

[2] Memorandum from Craig Tesch to Gary Spackman regarding Sufficiency of Water Supply for Water Right Applications and Transfers along the I-84 corridor, dated May 31, 2012.

[3] January 24, 2012 Order Creating Contested Case and Consolidating Protested and unprotested Applications, pg. 3.

EXHIBIT M/N 3

B. Summary

IDWR used a standard methodology for estimating net average annual recharge volume (i.e., total aquifer recharge minus existing consumptive groundwater use), but any analysis of aquifer recharge in this area is constrained by lack of some water-budget data. Specific conclusions from this review include the following:

1. IDWR's estimate of average annual recharge (11,060 AFA) is likely conservative because it does not include existing upwelling of geothermal groundwater originating from outside of the study area (Welhan, 2012). A 5% contribution of geothermal groundwater from outside of the study area would represent an additional 550 AFA of recharge.

2. Actual consumptive-use volumes are likely lower than those estimated by IDWR because (a) not all stockwater, commercial, industrial, or domestic withdrawals are fully consumed and (b) some of the irrigation assumed by IDWR is on land without active water rights (and therefore likely is not irrigated). IDWR's estimate of net annual recharge might be approximately 180 AFA higher if existing-use estimates are limited to actual consumptive use.

3. IDWR's estimate of evapotranspiration has the greatest uncertainty of any water-budget parameter. Overestimating evapotranspiration by even a small amount could result in a substantial underestimation of areal infiltration and aquifer recharge.

4. The net average annual aquifer recharge, when accounting for possible geothermal recharge contributions from outside of the study area and lower consumptive uses, is 7,900 AFA (Table 1, page 14). The net average annual aquifer recharge would be even greater if evapotranspiration is less than the IDWR estimate or if recharge from areal infiltration is more than IDWR estimates.

5. Estimates of net average annual recharge will be larger if existing study-area permits are not fully developed. The undeveloped portions of these permits can be added to the estimated net annual recharge volume.

6. The IDWR Staff Memo states that "In combination with the maximum rate for recently approved water right permits (14.02 cfs), the proposed additional maximum appropriation of 84.76 cfs represents a 1,102% increase in the permissible, instantaneous withdrawal rate in the study area"[4] over the estimated net average annual recharge rate of 9.8 cfs. Maximum instantaneous withdrawal

[4] IDWR Staff Memo, page 17.

EXHIBIT _____

rates are a poor measure of aggregate aquifer impacts. The aggregate annual volume represented by all the applications and transfers in this consolidated case is approximately 14,200 AF, which is equivalent to a uniform flow rate of 19.6 cfs, and which is only two times IDWR's estimated uniform net annual recharge (9.8 cfs).

7. The ultimate decrease in discharge to the Snake River as a result of diverting IDWR's estimated net annual recharge volume (7,100 AFA) will be no more than 9.8 cfs. This amount is approximately 0.25% of the summertime minimum Snake River flow at the Murphy Gage (3,900 cfs) and an even smaller percentage of larger, typical Snake River flows. Based on water-level observations in the Cinder Cone Butte Critical Ground Water Area (CGWA), it will take decades for such a decrease in study-area discharge resulting from new groundwater pumping to occur.

8. The IDWR Staff Memo uses the historical response to groundwater pumping in the Cinder Cone Butte CGWA as an indication of potential impacts to new withdrawals within the consolidated cases study area. However, in making this comparison it is important to note the following:

   a. IDWR estimated that annual groundwater withdrawals in the CGWA are approximately 14,300 AFA, which is approximately three times IDWR's 4,900-AFA recharge estimate for the Cinder Cone study area.

   b. By comparison, the IDWR estimate of average annual aquifer recharge in the consolidated cases study area (approximately 11,000 AFA) is substantially greater than IDWR's estimate of existing withdrawals (3,900 AFA). By definition, withdrawing a volume of groundwater from within the study area equivalent to IDWR's estimate of net average annual recharge (7,100 AFA) would not induce the prolonged water-level declines seen in the Cinder Cone Butte CGWA.

9. Most of the recharge within the consolidated cases study area enters the subsurface north and east of I-84. Thus, wells located along the I-84 corridor should well-positioned to capture a large portion of the net study-area recharge.

10. Production rates from individual wells will reflect local aquifer characteristics. Some local groundwater-level declines may occur as production is developed (some drawdown is necessary to induce sufficient flow to a well), especially in the basin margin sediments north of I-84.

11. Continued groundwater production and water-level monitoring is recommended. Data from such efforts will provide additional insight into available groundwater supply within the study area.

12. Development of better evapotranspiration data within the study area are needed to refine estimates of aquifer recharge and sustainable groundwater supply.

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C. Findings and Opinions

This section lists findings and opinions based on the review of the IDWR Staff Memo. The findings and opinions are organized under the same headings used in the IDWR Staff Memo, i.e., Item 1 (Study Area), Item 2 (Data and Information), and Item 3 (Sufficiency of Water Supply).

Item 1: Study Area

1. The IDWR Staff Memo established a study boundary[5] consisting of an "11-mile wide swath oriented parallel to the southwesterly direction of regional groundwater flow." This is a reasonable study area in that it encompasses (a) all of the proposed Points of Diversion (PODs) of pending transfers, (b) recharge areas up-gradient of and surrounding the PODs, and (c) the regional discharge area along the Snake River.
2. IDWR staff also identified an adjacent Cinder Cone study area with similar hydrogeologic characteristics to that of the consolidated cases study area. The Cinder Cone study area encompasses the Cinder Cone Butte CGWA. The effects of ground water development over the past several decades in the Cinder Cone study area were used to provide context for potential hydrologic impacts of the proposed applications[6]. Although the Cinder Cone study area has similar hydrogeologic characteristics to the consolidated cases study area, aggregate groundwater production substantially exceeds the estimated aquifer recharge in the Cinder Cone study area (see below).

Item 2: Data and Information

3. The IDWR Staff Memo[7] notes that the hydraulic gradient decreases from northeast to southwest in the vicinity of I-84. The IDWR Staff Memo suggests that various mechanisms, including faulting, aquifer recharge, or reductions in aquifer transmissivity could explain the decrease in hydraulic gradient.

   A decrease in hydraulic gradient from areas north of I-84 to areas south of I-84 could also be explained by different hydraulic properties of inter-fingered basin-margin sediments north of I-84 (see cross-section A-A' in the IDWR Staff Memo).

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[5] IDWR Staff Memo, Figure 2, page 3.

[6] IDWR Staff Memo, page 3.

[7] IDWR Staff Memo, page 6.

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Basin-margin sediments with differing hydraulic properties (e.g., vertical and horizontal hydraulic conductivity), and therefore with varying patterns and rates of downward movement and/or degrees of confinement, could explain the apparent observed difference in water levels (and hydraulic gradient) north and south of I-84.

4. There clearly have been groundwater-level declines within the Cinder Cone Butte CGWA, but the degree to which water level declines within the CGWA have extended outside of the CGWA is unclear. Groundwater-level contours shown Figure 5 of the IDWR Staff Memo[8] show substantial declines extending west and southwest (i.e., outside) of the CGWA in the consolidated cases study area, but these depictions of the study-area groundwater-level declines represent a software interpolation unsupported by actual groundwater-level data.

5. Hydrographs[9] in the southwestern portion of the Cinder Cone Butte CGWA show a consistent downward trend in groundwater levels. It appears that drillers' reports are available for only 6 of the 11 wells used in this analysis[10]. Some of the wells for which drillers' reports are available have very broad completion intervals (e.g., Well 02S05E-06ACC1 has an open interval of over 1,000 feet). It is not clear whether the observed water-level declines represent aquifer conditions throughout these open intervals or in individual aquifer zones.

6. The IDWR Staff Memo refers to water levels in one of the Mountain Home Plateau wells (Well 01S04E-30AAC1) as having risen from 1967 to 2000 and decreasing since that time. As a point of clarification, this well is located in the consolidated cases study area (and outside of the Cinder Cone Butte CGWA). Groundwater levels in this well rose approximately 7 feet from 1967 to 2000 (approximately 2.5 inches per year). Groundwater levels have fallen approximately 2 feet in the last 12 years (approximately 2 inches per year).

7. Groundwater levels in the Cinder Cone Butte CGWA Well 02S04E-09DDD2, which is the closest well within the CGWA to the well referenced in the previous finding (Well 01S04E-30AAC1) have risen approximately 10 feet since 1993. It is unclear whether this rise reflects regional or local conditions.

8. The Staff Memo[11] presents hydrographs for the Cinder Cone Butte CGWA. A number of the hydrographs indicate similar downward trends. However, when re-

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[8] IDWR Staff Memo, page 7.

[9] IDWR Staff Memo, Appendix B.

[10] Based on the drillers' reports provided by IDWR in its discovery response.
[11] IDWR Staff Memo, Appendix B, Plate 1.

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plotted with consistent y-scales the hydrographs show that the area of greatest declines is limited to the southern portion of the CGWA (Figure 1, page 15).

9. The availability of groundwater-level and streamflow data from study-area wells and streams has improved substantially as a result of increased IDWR, USGS, and private measurement and monitoring efforts over the past three years.

10. The IDWR Staff Memo notes that there are not currently enough data to establish long-term groundwater-level trends in all but two of the consolidated cases study area wells (01S04E-10DAD1 and 01S04E-30AAC1). However, most of the hydrographs presented in Appendix C of the IDWR Staff Memo are based on multiple water level measurements collected since 2009 or 2010, and these hydrographs indicate relatively stable groundwater levels[12].

Item 3: Sufficiency of Water Supply

11. IDWR's water-budget approach for evaluating aquifer recharge represents standard methodology and is based on sound hydrologic principles.

12. The largest study-area water-budget component is precipitation. Precipitation estimates were based on PRISM climate-elevation regressions for digital elevation model grid cells that are approximately 0.5 mile in size (Daly et al., 2008). PRISM data are commonly accepted for interpolating precipitation values over a large area.

13. The second largest study-area water-budget component is evapotranspiration (ET). ET estimates were based on (a) ET Idaho[13] values using Mountain Home weather station data and (b) previous estimates made for a water budget covering the entire western Snake River Plain (Newton, 1991). ET data represent the most uncertain component of the study-area water budget. Additional ET data based on actual study-area measurements would improve study-area ET estimates.

14. The IDWR Staff Memo states[14] that "Using ET Idaho values from the Mountain Home station for sagebrush and range grasses in the study area likely result in underestimation because actual ET is limited by the amount of precipitation." While this may be true for growing-season months, precipitation substantially exceeds ET

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[12] Some local groundwater-level declines are anticipated in the study area as withdrawals increase under new appropriations. However, groundwater levels should stabilize as long as recharge volumes exceeds withdrawals.

[13] http://www.kimberly.uidaho.edu/ETIdaho/online.php

[14] IDWR Staff Memo, page 13.

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during non-growing season months, especially during or following high-intensity precipitation and snowmelt events.

15. IDWR's estimate of infiltration in the "non-recharge" area was based on western Snake River Plain subareas used in Newton's (1991) regional aquifer analysis. Infiltration estimates for these regional sub areas do not fully describe variations in study-area recharge patterns.

    For example, the northeastern portion of the consolidated cases study area's "non-recharge" area likely has a greater amount of shallow course-grain alluvial sediments (because of proximity to the foothills) than most portions of the western Snake River Plain, and may have a greater infiltration capacity than other rangeland portions of the western Snake River Plain having duripan and/or caliche layers. It is precisely such sediment properties (i.e. greater infiltration capacity) that allow for seepage of the entire streamflow from Indian and Bowns creeks in most years.

    Swales and channels in the study area, especially in the area north of I-84, occasionally experience overland flow during high-precipitation and/or snowmelt events. Most of these channels do not convey water over a great distance because of seepage to the subsurface. A portion of such infiltration will become aquifer recharge.

16. IDWR's estimated average annual recharge amount (11,063 AFA) did not include recharge from geothermal sources. Welhan (2012) notes that two-thirds of the East wells are in the 66 to 71°F temperature range, with the lowest temperatures observed in shallow wells. Based on these temperature observations, Welhan (2012) concludes that "Given the range of observed [groundwater] temperatures, it is likely that East Ada aquifers are recharged by a mixture of cold, shallow ground water originating in nearby highlands and geothermally heated water that originates from greater depths and geographic distances."[15]

    Welhan's conceptual model[16] (adapted from Waag and Wood, 1987) illustrates regional-scale recharge via deep circulation through the Idaho Batholith from areas that may be outside of the defined study area. Most of the geothermal upwelling likely occurs via faults along the Danskin front. Many of the diversions proposed under applications and transfers would draw water from deeper wells located along

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15

16 Welhan (2012), page 28.

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the I-84 corridor in proximity to (or hydraulically down-gradient from) inferred faulting shown in Phillips et al. (2012).

17. Welhan concluded that "the fraction of geothermal recharge to parts of the deep East Ada aquifer may exceed 20%"[17] based on observed well temperatures. A portion of this upwelling of geothermal groundwater likely originated from outside of the study area. Geothermal recharge from outside of the study area might represent an additional 5% or 10% to IDWR's cold-water recharge estimate of 11,000 AFA (or an additional 550 or 1,100 AFA) along the Danskin front.

18. IDWR's estimate of existing withdrawals appears to be high, yielding a conservative (i.e., low) estimate of net annual recharge.

    a. Some of the crops identified by IDWR using the 2011 NASS Cropland Data layer, such as approximately 400 acres of winter wheat for which a consumptive irrigation requirement (CIR) of approximately 730 AFA was estimated, are on land without active water rights (and therefore should not count as existing aquifer use). However, the IDWR aggregate CIR assessment also excluded some land in the Indian Creek drainage currently irrigated under valid water rights. In aggregate, it appears that the irrigated acreage (462 acres) in the IDWR assessment of the "non-recharge area" is approximately 50 acres more than that which is actually authorized under existing water rights (413 acres), and the CIR based on water right POUs (825 afa) is about 60 AFA less than the IDWR estimate of 884 AFA[18]. Overestimation of existing withdrawals has the effect of reducing the estimated net recharge volume available for appropriation.

    b. The IDWR Staff Memo estimated consumptive domestic and stockwater use to be 493 AFA[19] based on active water rights within the study area[20]. It appears that IDWR staff took care to eliminate duplicate and/or overlapping rights[21].

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[17] Welhan (2012), page 2.

[18] The difference in CIR based the NASS Cropland Data Layer and water right POUs is not proportional to the difference in acres because some of the land not included in the IDWR estimate is likely irrigated with greater volumes than land that IDWR incorrectly included based on NASS data.

[19] IDWR Staff Memo, page 14.

[20] See "Consumptive Use Estimates.xlsx", provided in Item 16 of IDWR's discovery response.

[21] Duplicates are indicated in the above-listed spreadsheet with red font.

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However, the remaining diversions appear to authorize year-round watering for over 8,000 cattle. Familiarity with the study area suggests that this number is in excess of actual stock numbers.

Furthermore, some of the domestic, commercial, and industrial rights are not consumptively used. For example, water right 63-11524 (having an annual volume limit of 42.8 AFA and owned by the State of Idaho Department of Transportation) is used for restrooms but also heating and cooling via a water-to-air heat pump (and is therefore mostly not consumptively used). Commercial use under water right 63-7571 (4 AFA, Boise Stage Stop) is for showers, restrooms, retail, and repair facilities, and is likely returned to the subsurface via septic system.

Table 2 (page 16) provides estimates of consumptive and not fully-consumed volumes for the water rights listed in IDWR's consumptive use spreadsheet. Of IDWR's estimated 493 AFA for stock water, domestic, commercial, and industrial rights, approximately 200 AFA may not be consumptively used.

19. This reviewer has more confidence in the IDWR net annual recharge estimate than those of Welhan (2012). Welhan used Darcy's Law and assumed aquifer transmissivity values to estimate recharge. If Darcy's Law is to be used to estimate discharge through an entire aquifer thickness, then the transmissivity term (or hydraulic conductivity and cross-sectional area) should also encompass the entire aquifer thickness.

    Welhan assumed an average transmissivity value 7,300 gpd/foot based on a pumping test conducted in the 763-foot deep Ken Agenbroad Well (SPF, 2007). The Agenbroad Well is located approximately 1.5 miles southwest of the Mayfield Townsite property and has an aggregate screened thickness of 130 feet. Transmissivity values based on this 130-foot open interval cannot reflect conditions throughout the entire aquifer thickness. Other pumping tests in this area have yielded higher transmissivity estimates. A pumping test in the nearby 627-foot deep ARK Properties Mayfield Irrigation Well No. 1 yielded a transmissivity estimate of 25,000 gpd/foot (SPF, 2007). Aquifer transmissivity based on a 4-day pumping test in the Elk Creek Canyon Production Well No. 1 was estimated to be approximately 27,000 gpd/foot (SPF, 2011). Both of these wells are screened in only a portion of the aquifer thickness. The aggregate transmissivity for the entire aquifer thickness is likely greater than even these estimates.

    The fact that a simple Darcy model cannot be used to evaluate recharge is not a surprise. The basin-margin aquifers in this area include perched, unconfined, partially-confined, and confined aquifers, which, in aggregate, do not lend themselves well to this simple Darcy analysis.

20. The amount of water available for appropriation will be greater if current permits aren't fully developed. The undeveloped portions of these permits can be added to

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the net annual recharge volume. The two largest active permits are 63-32225 (with a volume limit of 1,815 acre-feet) and 61-12090 (with a volume limit of 345 acre-feet).

21. The IDWR Staff Memo suggests that groundwater-level declines similar to those experienced in the Cinder Cone Butte CGWA could occur as new consumptive uses *approach* the current net recharge rate[22] (emphasis added). However, while some groundwater-level decline may occur (and would, in fact, be necessary to induce sufficient flow to wells), groundwater levels would not experience continued declines such as those seen in the Cinder Cone Butte CGWA unless consumptive withdrawals *exceed* the net annual recharge.

22. The IDWR Staff Memo states that "In combination with the maximum rate for recently approved water right permits (14.02 cfs), the proposed additional maximum appropriation of 84.76 cfs represents a 1,102% increase in the permissible, instantaneous withdrawal rate in the study area"[23] over the estimated net average annual recharge rate of 9.8 cfs. However, maximum authorized instantaneous diversion rates are a poor indicator of long-term diversion volumes (and therefore a poor indicator of long-term aquifer impacts). The IDWR Staff Memo recognized this: "the fraction of the maximum total appropriation that would be consumptively used depends, not on the rate limits, but rather on ... the amounts withdrawn, information that is lacking for this analysis."[24]

23. SPF estimated that the aggregate volume that would be withdrawn under the pending study-area applications and transfers (Table 3, page 17) is approximately 14,200 AFA. This estimate is based on the following assumptions (see also Table 4, page 18):
    a. Urban or semi-urban developments would be constructed with the number of equivalent dwelling units (EDUs), or numbers of homes and equivalent commercial uses, listed in individual applications;
    b. Residential developments will be constructed at an average density of 4 EDUs per acre;

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[22] IDWR Staff Memo, page 15-16: "The net recharge for the study area (7120 AFA) is positive, indicating that existing consumptive uses, including those for water rights that are not yet fully developed, are less than the rate of recharge... Additional consumptive use is approaching the amount of the difference [i.e., 7120 AFA] would be expected to result in water level declines similar to those observed in the Cinder Cone CGWA..."

[23] IDWR Staff Memo, page 17.

[24] IDWR Staff Memo, page 16.

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c. The average irrigated land irrigated per EDU will be approximately 4,900 ft^2 (or approximately 0.11 irrigated acres per EDU);

d. The average irrigation volume for residential irrigated areas will be 4.0 AF/acre/year;

e. Used in-home domestic water will be recycled (and will be used to meet irrigation demand);

f. Institutional and common-space irrigation under municipal applications will require an additional 20% of water over the consumptive use projected for listed EDUs;

g. The average irrigation volume for agricultural lands will be 3.0 AF/acre/year[25]

These assumptions are based on professional judgment. The amount of water use represented by the consolidated applications and transfers will depend on the actual number of homes constructed, businesses built, actual housing density, acres irrigated, and water-conservation strategies incorporated.

24. The annual consumptive use represented by the consolidated applications and transfers (14,200 AF) is approximately two times IDWR's estimate of net annual recharge (7,100 AF).

25. The 14,200 AFA estimated aggregate volume represented by the applications/transfers is equivalent to a constant pumping rate of 19.6 cfs. This constant flow rate is approximately two times IDWR's projected net annual recharge rate of 9.8 cfs.

26. IDWR states that pumping within the study area will not lead to induced flow from the aquifer system adjacent to the study area, i.e., "lowering of the water table in the study area will not substantively increase the amount of water available for appropriation."[26] Supporting IDWR's assertion is that pumping in the southwestern portion of the Cinder Cone Butte CGWA in excess of net recharge over approximately four decades has not led to groundwater-level declines in the portion of the study area in which appropriations are sought.

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[25] The average consumptive use by agricultural crops will likely be less than residential turf. Also, the agricultural irrigation efficiency will likely be more efficient than residential irrigation because of greater irrigation-system control and greater sensitivity to pumping costs.

[26] IDWR Staff Memo, page 16.

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27. The IDWR Staff Memo states that "Additional groundwater extraction would ... decrease aquifer storage, particularly in the short term..."[27] Some drawdown within the study area is hydraulically necessary to induce sufficient flow toward wells and effectively capture aquifer recharge within the study area.

28. IDWR also notes the additional groundwater extraction would decrease aquifer storage, and therefore decrease discharge to the Snake River.[28] There is a substantial distance between pumping proposed in the consolidated applications/transfers and the Snake River, and, based on the extent of declines within the Cinder Cone Butte CGWA over the last approximately four decades, it would take decades for the effects of the proposed pumping to be realized at the Snake River. The ultimate decrease in study-area discharge to the Snake River as a result of authorizing the appropriation 7,100 AFA would be no more than 9.8 cfs. It is highly unlikely there would be much seasonal variation in this discharge because of the distance between the proposed points of diversion and the Snake River (approximately 20 miles or more).

29. IDWR staff did not evaluate hydrologic impacts associated with the proposed ground water development, using instead data from the Cinder Cone Butte CGWA to provide an indication of potential impacts. The IDWR Staff Memo then concludes that "the data suggest an inverse relationship between the amount of ground water development and water levels in the regional aquifer."[29] It is important to note, however, that the groundwater-level declines observed in the Cinder Cone Butte CGWA reflect estimated withdrawals (14,300 AFA) that are almost three times more than estimated recharge (4,900 AFA)[30] in the CGWA area. The prolonged declines experienced in the Cinder Cone Butte CGWA are not expected within the study area if the amount appropriated does not exceed the net annual recharge.

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[27] *Ibid.*

[28] IDWR Staff Memo, page 16.

[29] IDWR Staff Memo, page 20.

[30] Based on Table 3 in IDWR Staff Memo, page 11.

EXHIBIT _____

D. References

Daly, C. et al., 2008. Physiographically-sensitive mapping of temperature and precipitation across the conterminous United States. International Journal of Climatology, 28: 2031-3064.

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Phillips, W.M., Lewis, R.S., Gillerman, V.S., Garwood, D.L. and Stewart, D.E., 2012. Geologic Map of the Mayfield Area, Ada and Elmore Counties, Idaho. Idaho Geologic Survey, 1:36,000 scale.

SPF, 2007. Ground Water Supply Evaluation for the Mayfield Townsite Property, Consulting report prepared prepared by SPF Water Engineering, LLC for Farwest, LLC.

SPF, 2011. Well Completion Report, Elk Creek Village Production Well 1, Elmore County, Idaho, consulting report prepared by SPF Water Engineering, LLC for Nevid LLC.

Waag, C.J. and Wood, S.H., 1987. Evaluation of the Boise Geothermal System; Final Report to the Idaho Department of Water Resources, 70 pp.

Welhan, J.A., 2012. Preliminary Hydrogeologic Analysis of the Mayfield Area, Ada and Elmore Counties, Idaho, staff report published by the Idaho Geological Survey, Moscow, Idaho.

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Modifications to IDWR's Estimate of Study Area Net Average Annual Recharge				
Water Budget Component	IDWR Estimate (AFA)	SPF Estimate (AFA)	Difference (AFA)	Comment
Recharge	11,060	11,610	550	Geothermal contribution
DCMI uses	3,059	2,879	-180	Reduction in stockwater/wildlife consumptive use estimate
CU for irrigated lands	884	824	-60	Net CU reduction for lands without valid water rights
Net annual average recharge rate (rounded)	7,100	7,900	800	

Table 1. Modifications to IDWR's estimate of net average annual recharge.

EXHIBIT ____

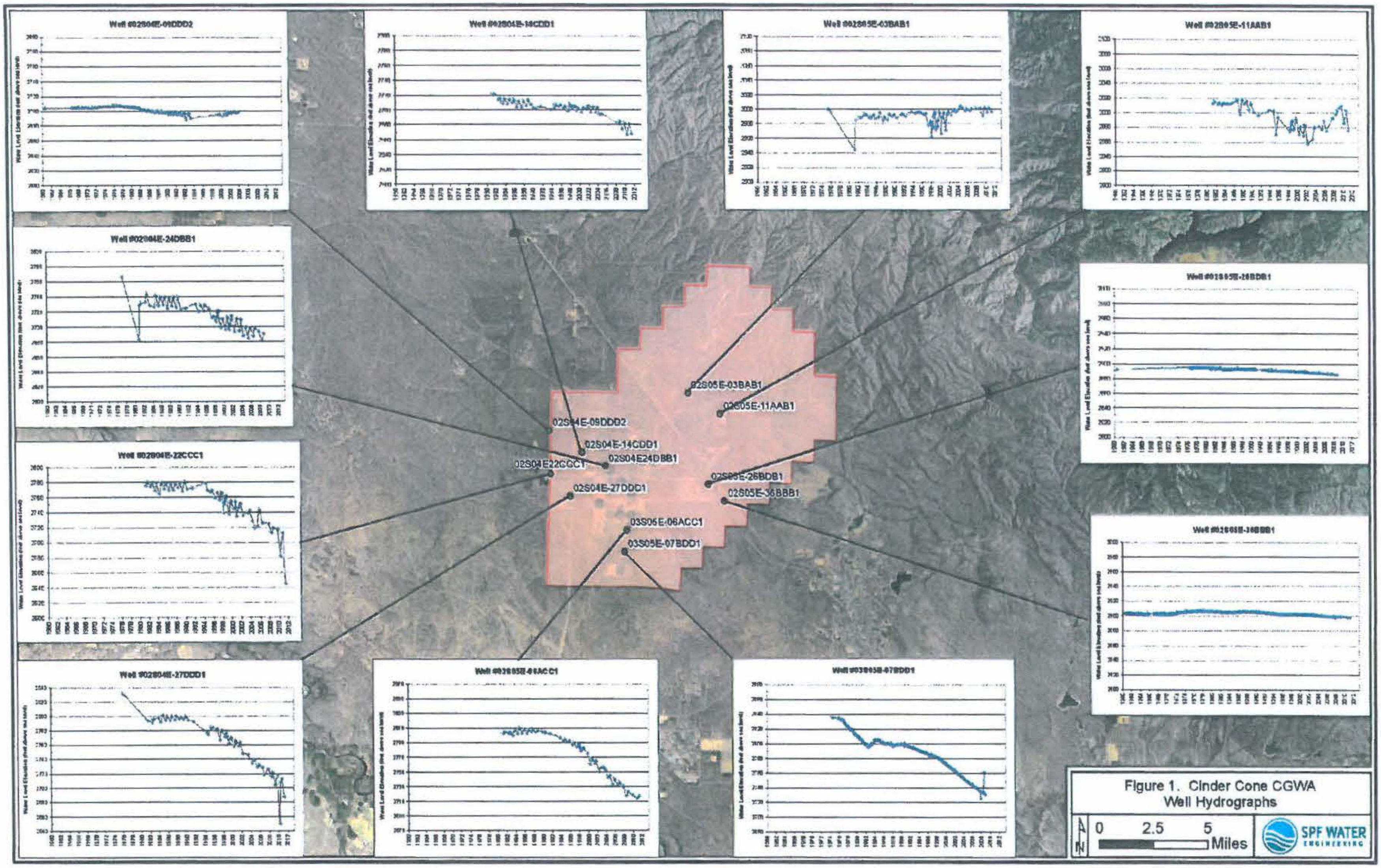

Figure 1. Cinder Cone CGWA Well Hydrographs

Consumptive Use Estimates							
Source	Ground-water	Surface Water	Springs	Total	Assumed Consumptive Use	Assumed not Fully Consumed	Note
Stockwater Calves and Cattle (count)	2,687	5,548	50	8,285			(1)
Stockwater Storage (AFA)	-	52	-	52	52	-	(2)
Stockwater/wildlife Volume (AFA)	84	118	6	209	42	167	(3)
Commercial/ Industrial Volume (AFA)	27	-	-	27	13	13	(4)
Domestic Volume (AFA)	206	-	-	206	206	-	(5)
	317	170	6	493	313	180	

Notes

(1) Based on IDWR spreadsheet.

(2) Assume most storage ponds are completely filled each year and go dry during summer (i.e., 100% consumptively used).

(3) Assume 10% is consumptively used on a year-round basis.

(4) Assume 50% is consumptively used.

(5) Assume 80% consumptively used.

Table 2. Consumptive use estimates.

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Proposed Consolidated Hearing Transfers and Applications									
Name	Number	Received	Priority	Water Use	Maximum Instantaneous Diversion (cfs)	EDUs	Agricultural Irrigation Acres	Estimated Annual Volume (AF)	Comment
Mayfield Townsite	63-32499	7/28/2006	7/28/2006	Municipal	10	8000		4,320	Assume 0.54 AF/unit
Shekinah Industries (transfer)	73811	12/4/2006	1963+	Irrigation	5.56		369	1,107	Assume 3.0 AF/acre
Nevid	61-12095	4/3/2007	4/3/2007	Municipal	5	750		405	Assume 0.54 AF/unit
Nevid	61-12096	4/3/2007	4/3/2007	Municipal & Fire Protection	20.48	4603		2,486	
Orchard Ranch (transfer)	73834	6/21/2007	1976	Irrigation (municipal)	11.36		631	1,893	Decreed volume is 2,975 (or 4.71 AFA); assume average use of 3.0 AFA
Orchard Ranch	63-32703	6/21/2007	6/21/2007	Irrigation (was municipal)	9.6		480	1,440	Assume 3.0 AF/acre
Inter-mountain Sewer & Water	61-12256	1/17/2008	1/17/2008	Municipal	13.76	2000		1,080	Assume 0.54 AF/unit
Ark Properties / Mayfield Townsite	63-33344	3/1/2010	3/1/2010	Irrigation in planned community (63-32499)	9		475	1,440	Assume 3.0 AF/acre
Total					84.76	15,353	1,955	14,171	

Table 3. Consolidated applications and transfers.

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Calculation of Annual Residential Water Requirements		
Component	**Value**	**Units**
Assumed number of EDUs/acre	4	
Land area/EDU	10,890	ft^2
Percentage irrigated area in residential areas	45%	percentage
Irrigated area per EDU	4,901	ft^2
Irrigated area per EDU	0.11	acre
Assumed irrigation application rate per net residential irrigated acre	4.0	AF/acre/year
Annual volume/EDU	0.45	AF/acre/year
Additional volume per EDU for common space, etc.	20%	percentage
Estimated average annual water volume per EDU	0.54	AF/acre/year
Note: assumes treatment and storage of domestic wastewater		

Table 4. Calculation of residential water requirements.

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I HEREBY CERTIFY that on this 16th day of November, 2012, a true and correct copy of the document(s) described below was served by placing the same in the United States mail, postage prepaid and properly addressed to the following:

Document Served: **Christian Petrich memorandum response to IDWR Staff Memo regarding the sufficiency of water supply for water right applications and transfers along the I-84 corridor.**

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M/N EXHIBIT 4

Estimated Net Annual Average Recharge into Study Area Aquifers		
Component	**Annual Volume (AF)**	**Comment**
IDWR estimate of net average annual recharge into Study Area aquifers	7,100	See IDWR Staff Memo (Tesch, 2012)
Estimated geothermal contribution	550	See Petrich (2012), Finding 17
Difference in IDWR and SPF consumptive use estimate for stockwater/wildlife	180	See Petrich (2012), Finding 18(b)
Difference in IDWR and SPF diversion estimates for irrigated land	60	See Petrich (2012), Finding 18(a)
"Non-recharge" area adjustment	340	See Petrich (2013), Item 10, Response Part 3 (beginning on page 15)
Adjusted net average annual recharge estimate	8,230	

References:

Petrich, C.R., 2012. Response to IDWR Staff Memo regarding the sufficiency of water supply for water right applications and transfers along the I-84 corridor, memorandum to Gary Spackman, Director, Idaho Department of Water Resources, November 15, 2012.

Petrich, C.R., 2013. Rebuttal report of Christian R. Petrich (for the consolidated hearing of water right applications and transfers along the I-84 corridor)

Tesch, C., 2012. Sufficiency of Water Supply for Water Right Applications and Transfers along the I-84 Corridor, IDWR memorandum addressed to Gary Spackman, Hearing Officer, May 31, 2012.

Supplemental Table 1. Estimated net annual average recharge into Study Area aquifers.

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M/N EXHIBIT 5

Consolidated Cases Transfers and Applications									
Name	Number	Received	Priority	Water Use	Maximum Instantaneous Diversion (cfs)	EDUs	Agricultural Irrigation Acres	Estimated Annual Volume (AF)	Comment
Mayfield Townsite	63-32499	7/28/2006	7/28/2006	Municipal	10	8,000		4,320	Assume 0.54 AF/unit
Shekinah Industries (transfer)	73811	12/4/2006	1963+	Irrigation	5.56		369	1,107	Assume 3.0 AF/acre
Nevid	61-12095	4/3/2007	4/3/2007	Municipal	5	750		405	Assume 0.54 AF/unit
Nevid	61-12096	4/3/2007	4/3/2007	Municipal & Fire Protection	20.48	4,603		2,486	
Orchard Ranch (transfer)	73834	6/21/2007	1976	Irrigation (municipal)	11.36		631	1,893	Decreed volume is 2,975 (or 4.71 AFA); assume average use of 3.0 AFA
Orchard Ranch	63-32703	6/21/2007	6/21/2007	Irrigation (was municipal)	9.6		480	1,440	Assume 3.0 AF/acre
Intermountain Sewer & Water	61-12256	1/17/2008	1/17/2008	Municipal	13.76	4,200		2,268	Assume 0.54 AF/unit
Ark Properties/ Mayfield Townsite	63-33344	3/1/2010	3/1/2010	Irrigation in planned community (63-32499)	9		475	1,440	Assume 3.0 AF/acre
Total					84.76	17,553	1,955	15,359	

Supplemental Table 2. Consolidated cases applications and transfers.

Note: This table replaces Table 3 in SPF's November 15, 2012 memorandum, which incorrectly listed the number of anticipated EDUs for Application 61-12256.

MYN

EXHIBIT 5

M/N EXHIBIT 6

Rebuttal Report of Christian R. Petrich

In the Matter of Application for Transfer No. 73811 (Shekinah Industries); Application for Transfer No. 73834 (Orchard Ranch); Application for Permit No. 63-32499 (Mayfield Townsite); Application for Permit No. 61-12095 (Nevid-Corder); Application for Permit No. 61-12096 (Nevid); Application for Permit No. 63-32703 (Orchard Ranch); Application for Permit No. 61-12256 (Intermountain Sewer & Water); Application for Permit No. 63-33344 (ARK Properties-Mayfield Townsite) before the Idaho Department of Water Resources

Prepared on behalf of

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1/30/2013

January 30, 2013

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SPF WATER ENGINEERING

EXHIBIT M/N 6

Summary

This document summarizes a review of two reports submitted by ERO Resources Corporation and Brockway Engineering, PLLC. Conclusions from this review include the following:

1. Contrary to ERO's assertions, the study area defined for this matter by the Idaho Department of Water Resources (IDWR) is appropriately sized and technically defensible. Constraining study-area dimensions to hydrogeologic features such as faults or geologic contacts (as ERO suggests) would require extending the study area to include the entire western Snake River Plain, an unwieldy and impractical study area for answering the specific water-budget questions at hand.
2. ERO uses the Theis (1935) method to show hydraulic connection between the consolidated cases study area and the adjacent comparison area, suggesting that IDWR's boundaries were therefore invalid. However, use of the Theis method to project impacts over a 20-or 40-year timeframe is inappropriate.
3. ERO uses Figure 5 of the IDWR Staff Memo to suggest that a 20-mile diameter area of groundwater-level decline stemming from pumping in the Cinder Cone Butte Critical Ground Water Area (CGWA) extends substantially into the consolidated cases study area. However, the IDWR depictions of groundwater-level declines outside of the CGWA are based on software interpolation unsupported by actual groundwater-level data.
4. ERO suggests that processing of the pending applications and transfers should be delayed until current studies and data-gathering efforts are complete. However, it appears unlikely that current studies (Indian Creek Reservoir seepage analysis, groundwater chemistry analysis, and ongoing groundwater-level and streamflow measurements) will change IDWR's water-budget estimates. Ultimately, additional groundwater development, and the monitoring of groundwater-level responses to new withdrawals, will confirm current estimates of water availability.
5. Inclusion of a portion of the Blacks Creek drainage within the consolidated cases study area is appropriate. IDWR staff correctly subtracted surface water flowing out of this portion of the study area from the study-area water budget.
6. IDWR slightly underestimated the amount of recharge generated within the "non-recharge" area. Using the same approach used by IDWR staff, the total recharge in the "non-recharge" area was calculated to be approximately 3,000 AF/year (approximately 340 AF more per year than the 2,660 AF listed in the IDWR Staff Memo).
7. Although it may be difficult to capture all of the recharge generated in IDWR's "non-recharge" area under the proposed applications and transfers, most of the recharge

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generated in this "non-recharge" area occurs in portions of the study area where capture is more likely.

8. ERO comments that existing permits authorizing the use of ground water within the study area were approved without regard to trust-water impacts. However, all of the points of diversion for these permits – and PODs for the pending applications and transfers in this matter – are outside of the trust-water area.

9. ERO alleges that approval of the pending applications/transfers will injure existing water rights. ERO presumably refers to hydropower rights held by the Idaho Power Company authorizing hydroelectric generation Swan Falls Dam. However, these Idaho Power rights are subordinate to junior-priority upstream uses as long as Snake River flows remain above established minimum flows. Furthermore, ERO has provided no data suggesting that approval of all, or some, of the pending applications/transfers will cause Snake River flows to dip below established minimum flows.

10. ERO provides multiple photographs of springs in the Snake River Canyon. ERO does not quantify the amount of water (if any) that actually reaches the Snake River from these springs. It appears from the photographs that much of the spring discharge in this area is lost to evapotranspiration. As such, long-term withdrawals under pending applications and transfers (if approved) could lead to reduced evapotranspiration in the vicinity of these Snake River Canyon springs, not necessarily a reduction in discharge to the Snake River.

11. Denial of the proposed consolidated-case applications and transfers because Snake River flows may dip below an established minimum sometime in the future would preclude the full economic development of an available groundwater resource.

12. The usefulness of a computer model developed by Brockway Engineering on behalf of Shekinah Industries for the purposes of evaluating pumping effects within or around the consolidated study area is limited. The model pre-dates the IDWR Staff Memo, and therefore does not incorporate the results of recent groundwater-level measurements, stream-monitoring data, and water-budget analyses. Also, the 2-dimensional discretization cannot adequately describe groundwater flow in perched, unconfined, semi-confined, or confined aquifers present in the study area, especially in the northern portion of the study area.

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1. INTRODUCTION

The Idaho Department of Water Resources (IDWR) combined various protested applications and transfers in the Interstate 84 (I-84) corridor in eastern Ada County and western Elmore County[1] for a consolidated hearing focusing on available water supply. IDWR staff prepared a memorandum (Tesch, 2012, referred to herinafter as the IDWR Staff Memo) regarding the sufficiency of water supply for this area. Expert reports were submitted on behalf of the Idaho Power Company (Shaw and Young, 2012), Shekinah Industries (Powell and Brockway, 2009), Nevid LLC (Petrich, 2012), and ARK Properties LLC (Petrich, 2012).

This report provides responses to certain assertions and conclusions in the following two reports submitted on behalf of the Idaho Power Company and Shekinah Industries:

1. Water Supply Evaluation for Proposed Projects along the I-84 Corridor, prepared by David B. Shaw and Norman C. Young (ERO Resources Corp.) on behalf of the Idaho Power Company (referred to hereinafter as the ERO Report).
2. Shekinah Industries Groundwater Model Development and Transfer Scenario Runs, prepared by G. Erick Powell, PhD., P.E., and Charles E. Brockway, PhD., P.E. on behalf of Shekinah Industries (referred to hereinafter as the Brockway Report).

2. RESPONSES TO THE ERO REPORT

The ERO Report makes three general assertions. First, ERO suggests that the study area proposed by IDWR is incorrectly drawn. Second, ERO argues that there is an insufficient water supply for any of the proposed applications/transfers. Finally, even if there is sufficient water, ERO argues that IDWR approval of the proposed

[1] January 24, 2012 Order Creating Contested Case and Consolidating Protested and unprotested Applications in the Matter of Application for Transfer 7381 (Shekinah Industries); Application for Transfer 73834 (Orchard Ranch); Application for Permit No. 63-32499 (Mayfield Townsite); Application for Permit No. 61-12095 (Nevid-Corder); Application for Permit No. 61-12096 (Nevid); Application for Permit No. 63-32703 (Orchard Ranch); Application for Permit No. 61-12256 (Intermountain Sewer and Water); Application for Permit No. 63-3344 (Ark Properties-Mayfield Townsite).

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applications/transfers will cause injury to Idaho Power. The following paragraphs rebut these assertions.

• IDWR Study Area Boundaries are Defensible

1. *ERO argues that the "size and location of the study area are arbitrary and not supported by technical analysis" (ERO, page 14).*

   Response. The study area designated by IDWR for evaluating groundwater supply is appropriately sized and technically defensible. The study area encompasses all of the proposed points of diversion and proposed places of use. The study area is defined by defensible boundaries.

   The up-gradient boundary was defined as a surface-water flow divide (e.g., the ridge separating the Snake River and South Fork Boise River drainages). Similarly, the down-gradient boundary was established at the Snake River, which clearly is a groundwater-flow divide based on regional groundwater-level contours (Lindholm et al., 1988). There does not appear to be any disagreement regarding the use of these up-gradient and down-gradient boundaries.

   The southwest-northeast study-area boundaries are based on groundwater flow lines. Groundwater flow lines can be used to represent no-flow hydraulic boundaries (Anderson and Woessner, 1992), as long as cones of depression from the proposed pumping do not substantially impact groundwater levels at the boundary. In this case, there is no evidence that existing pumping inside or outside of the study area has materially impacted groundwater levels within the study area.

   That said, the southwest-northeast study-area boundaries are not entirely perpendicular to IDWR's groundwater-level contours (see Figure 4 of the IDWR Staff Memo) in the southern portion of the study area. As such, the study boundaries appear to not be aligned along regional flow lines in this area. However, Lindholm et al. (1988) defined regional groundwater-level contours using a much larger (and more regional) data set. Figure 1 shows (a) Lindholm et al.'s groundwater-level contours, (b) IDWR groundwater-level contours presented in Figure 4 of the IDWR Staff Memo, and (c) IDWR water-level contours that SPF reinterpreted based on the previous Lindholm et al. contours. Inferred groundwater flow lines based on the IDWR contours and Lindholm et al. regional groundwater-level contours represent a reasonable basis for IDWR's southwest-northeast study-area boundaries.

   It is conceivable that pumping in excess of recharge from within the study area could someday reach the study-area boundaries. However, the focus of this consolidated hearing is not whether – or under what conditions – impacts from pumping could reach the study boundaries, but one of water supply within the

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study area[2]. As such, the study area defined by IDWR for purposes of computing a water budget and evaluating water supply is reasonable.

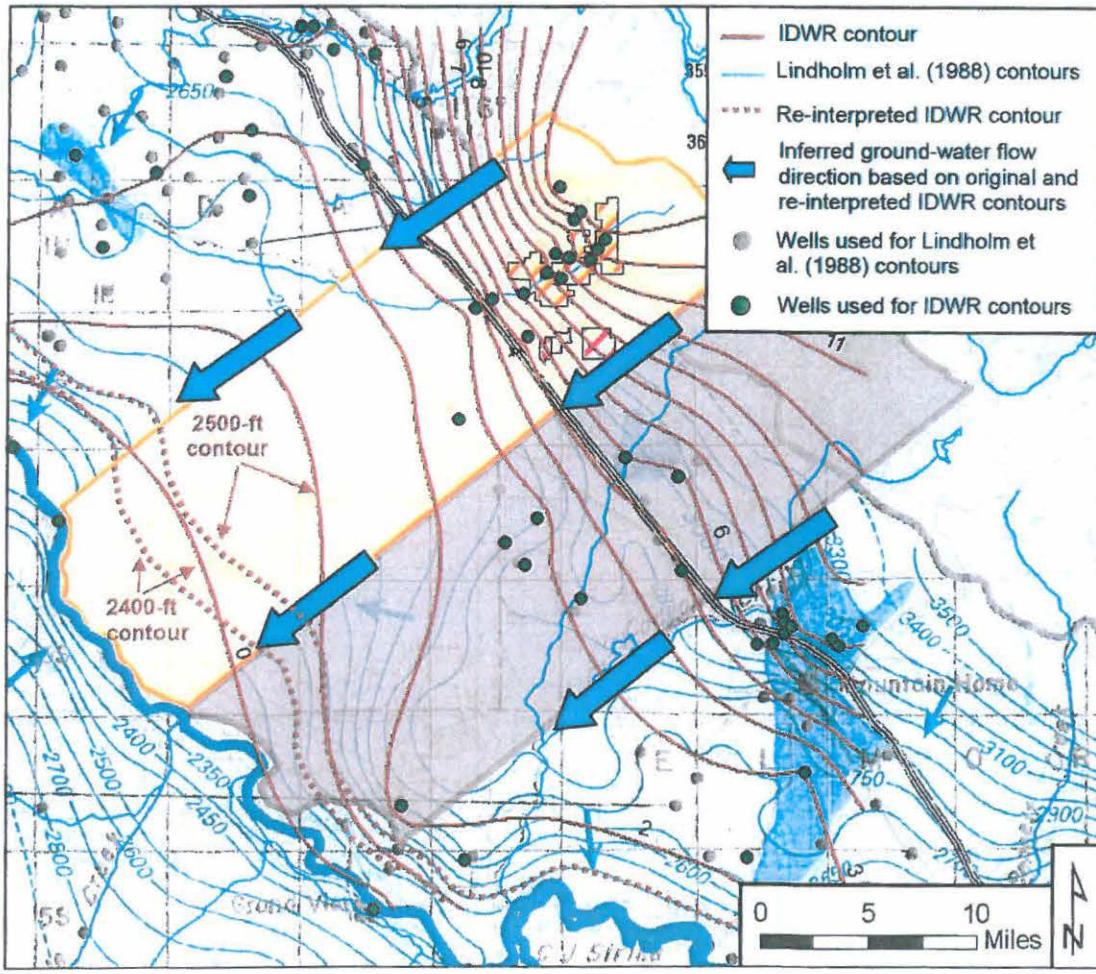

Figure 1. Inferred groundwater flow directions at study-area boundaries.

2. *ERO states that the IDWR Staff Memo "does not identify a fault or other discontinuity in the regional aquifer oriented to provide a basis for concluding*

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[2] Director Spackman's January 24, 2012 Order consolidating protested applications specified that the hearing will focus on "the limited issue of sufficiency of ground water supply."

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that the study area and comparison area are hydrologically separate" (ERO Report, page 15), and that the study area and comparison area should have been considered as one (ERO Report, page 18).

Response. A fault or other hydrogeologic discontinuity is not needed to draw a study-area boundary for the purposes of computing a water budget. If a hydrogeologic discontinuity were needed to define a water-budget area, the only logical alternative study-area boundary would be the entire western Snake River Plain, as there are no distinct structural or geologic features that would spatially divide sediments within the western Snake River Plain. Including such a large area (i.e., entire western Snake River Plain) is unwieldy and unnecessary for assessing groundwater supply in the area of these pending consolidated-case applications and transfers. Instead, IDWR staff correctly sought to define the study area such that it includes points of diversion, places of use, and likely impact area.

3. *ERO argues that "The diameter of the water level decline attributed to pumping in the CCBCGWA is approaching 20 miles" based on Figure 5 in the IDWR Staff Memo (ERO review, page 15), implying that pumping from the Cinder Cone Butte CGWA has materially impacted groundwater levels in the study area, rendering the boundary separating the study area and the comparison area invalid.*

   ERO's argument appears to be based on a map of purported groundwater-level declines stemming from Cinder Cone Butte CGWA pumping (see Figure 5, IDWR Staff Memo). However, the IDWR depictions of groundwater-level declines outside of the CGWA are based on software interpolation unsupported by actual groundwater-level data. Furthermore, Figure 4 of the IDWR Staff Memo also does not appear to indicate groundwater-level declines within the study area stemming from Cinder Cone Butte CGWA pumping. Thus, neither Figures 4 nor 5 of the IDWR Staff Memo support the concept of a 20-mile diameter water-level decline attributable to pumping in the Cinder Cone Butte CGWA.

4. *ERO used a Theis analysis to show 8 feet of drawdown after 20 years of pumping and about 23 feet of drawdown after 40 years of pumping at the study area boundary. ERO then projects that all of the requested new diversions and existing diversions would lead to 47 feet of drawdown after 40 years. ERO recognizes that the "Theis analysis is a simplification of the actual conditions that may exist in both the study area and the comparison area" but then goes on to say that this analysis points to "the potential interconnection between the two areas" (ERO Review, page 19), and thereby implies that IDWR's study-area boundary is incorrectly drawn.*

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ERO's use of the Theis (1935) solution to project drawdown over 20-year and 40-year periods is insufficiently documented and inappropriately applied. ERO's use of this method to draw inferences about the study area boundary is therefore invalid.

First, ERO does not provide relevant information used in its analysis, such as (1) the locations of simulated pumping well(s) and (2) simulated pumping rate. These are important components, without which ERO's analysis cannot be verified.

Second, and more importantly, ERO's analysis violates basic assumptions inherent to the Theis solution. The Theis solution is based on several assumptions: the aquifer is homogeneous and isotropic, uniform in thickness and areal extent, the aquifer receives no recharge, the pumping well penetrates the full aquifer thickness, water removed by discharge is removed instantaneously, the pumping well is 100 percent efficient, laminar flow exists throughout the aquifer, and the water table or potentiometric surface has no slope (Theis, 1935).

The Theis solution is a widely accepted method for evaluating hydraulic responses to pumping even though the Theis assumptions are not often satisfied under field conditions. However, use of this method to project pumping for 20 or 40 years – ignoring all recharge – is a substantial violation of the Theis assumptions. Results from ERO's 20- or 40-year Theis projections are therefore invalid.

Perhaps more telling is that approximately 40 years of pumping in the Cinder Cone Butte area has not resulted in the type of water-level decline projected by ERO's Theis results. IDWR Figure 5(d) suggests that there has been zero water-level decline since 1981 in the vicinity of the proposed applications and transfers as a result of Cinder Cone Butte area pumping over the past several decades. Thus, although ERO's Theis analysis might predict widespread water-level decline within the study area as a result of proposed pumping, monitoring data from actual pumping in the Cinder Cone Butte area demonstrate otherwise.

5. *ERO concludes that "The diversion and use of water under the applications, if approved, will cause impacts that cross administrative and study boundaries" (ERO report, page 4).*

Other than the incorrectly applied Theis analysis (described above), ERO has provided no information to support this conclusion. Whether or not impacts from the proposed pumping reach administrative or study boundaries depends on factors such as average diversion rates and proximity to the boundaries, none of which have yet been definitively established.

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This administrative process focuses on sufficiency of supply within the study area identified by IDWR[3]. Even if the effects of extended pumping under some conditions could reach administrative or study boundaries, the study-area "volume" nonetheless represents a valid basis for estimating aquifer inflows, outflows, and water supply.

- **Water is Available for Appropriation**

6. *ERO writes that "several studies now underway could provide data and information to refine the estimate of water availability in the aquifer. Even so, the staff memorandum [IDWR Staff Memo] does not suggest delaying consideration of the applications until the information's from these studies is available" (ERO Report, page 17). ERO appears to imply that processing of pending applications should be delayed pending the outcome of these studies.*

Three studies pertaining to geologic mapping and hydrogeology (Liberty, 2012; Phillips et al., 2012; Welhan, 2012) have recently been completed. The IDWR Staff Memo (page 8) indicates that the USGS is conducting a water-balance study of the Indian Creek Reservoir and that the USGS will release its report soon[4]. However, IDWR staff assumed little or no seepage from Indian Creek reservoir in their analysis, so delaying consideration of the pending applications based the completion of this USGS report is not necessary.

The IDWR Staff Memo (page 10) also describes USGS geochemical analyses being conducted on groundwater samples from 14 wells to determine the relative timing of recharge to area aquifers. It is unlikely that this analysis will impact IDWR's water-budget calculations, as the analysis relates to timing of recharge not quantity of recharge. IDWR anticipates that this USGS report will be released later this spring (e.g., April or May)[5]. Again, it is not necessary to delay consideration of pending applications based on the completion of this study.

Finally, IDWR, the USGS, and private entities are engaged in ongoing streamflow and in groundwater-level measurements. These ongoing efforts should not be a basis for delaying consideration of pending applications. On

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[3] Director Spackman's January 24, 2012 Order consolidating protested applications specified that the hearing will focus on "the limited issue of sufficiency of ground water supply."

[4] Sean Vincent, personal communication, January 2, 2013.

[5] *Ibid.*

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the contrary, ongoing monitoring will provide valuable insight regarding the effects of groundwater development in this area.

Ultimately, additional groundwater development, and the monitoring of groundwater-level responses to new withdrawals, will confirm current estimates of water availability. Thus, groundwater development with water-level monitoring under approved permits is precisely what is needed to refine estimates of available water supply in this area.

7. *ERO suggests that IDWR should have considered maximum volumes authorized under existing rights, not estimates of "'actual' consumptive use" (ERO Report, page 16).*

   Nearly all water rights in the State of Idaho authorize volumes in excess of what is consumptively used, especially for rights authorizing stock water, wildlife, and aesthetic uses, and for most rights authorizing commercial uses (Petrich, 2012). It would be unreasonable to assume that all currently irrigated land is planted with the most water-intensive crops every year, and that these water-intensive crops receive the maximum authorized volume every year. Although the maximum consumptive use assumed by IDWR for processing new irrigation applications is 3.0 feet/acre/year throughout most of the study area[6], it reasonable to assume that typical crop rotations, influenced in part by high pumping costs, result in less than the maximum volume of use on a multi-year basis. Thus, IDWR's use of typical volume requirements for existing irrigated area is reasonable and appropriate.

8. *ERO states that "inclusion of a portion of the Blacks Creek drainage in the area used for the recharge estimate is an unwarranted complication in the water budget because there is no information indicating the direction of groundwater flow in the Blacks Creek basin is different than observed regionally" (ERO Report, page 15).*

   Inclusion of a portion of the Blacks Creek drainage within the consolidated cases study area is not, in my view, an unwarranted water-budget complication. On the contrary, it is only reasonable to assume that groundwater flow within the study area remains within the study area.

   The general direction of groundwater flow from this portion of the Blacks Creek drainage is towards the southwest (see Figure 4 in the IDWR Staff

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[6] IDWR "consump_irr.shp" shapefile.

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Memo). Alluvial sediments at the granitic bedrock contact (Figure 2) provide a pathway for downward groundwater movement along flow lines in Figure 4 of the IDWR Staff Memo toward deeper sedimentary zones. Similarly, infiltration into granitic joints and fractures in upper portions of the Blacks Creek drainage also likely migrates basinward within study boundaries, as illustrated in Figure 18 of the Welhan report (Welhan, 2012).

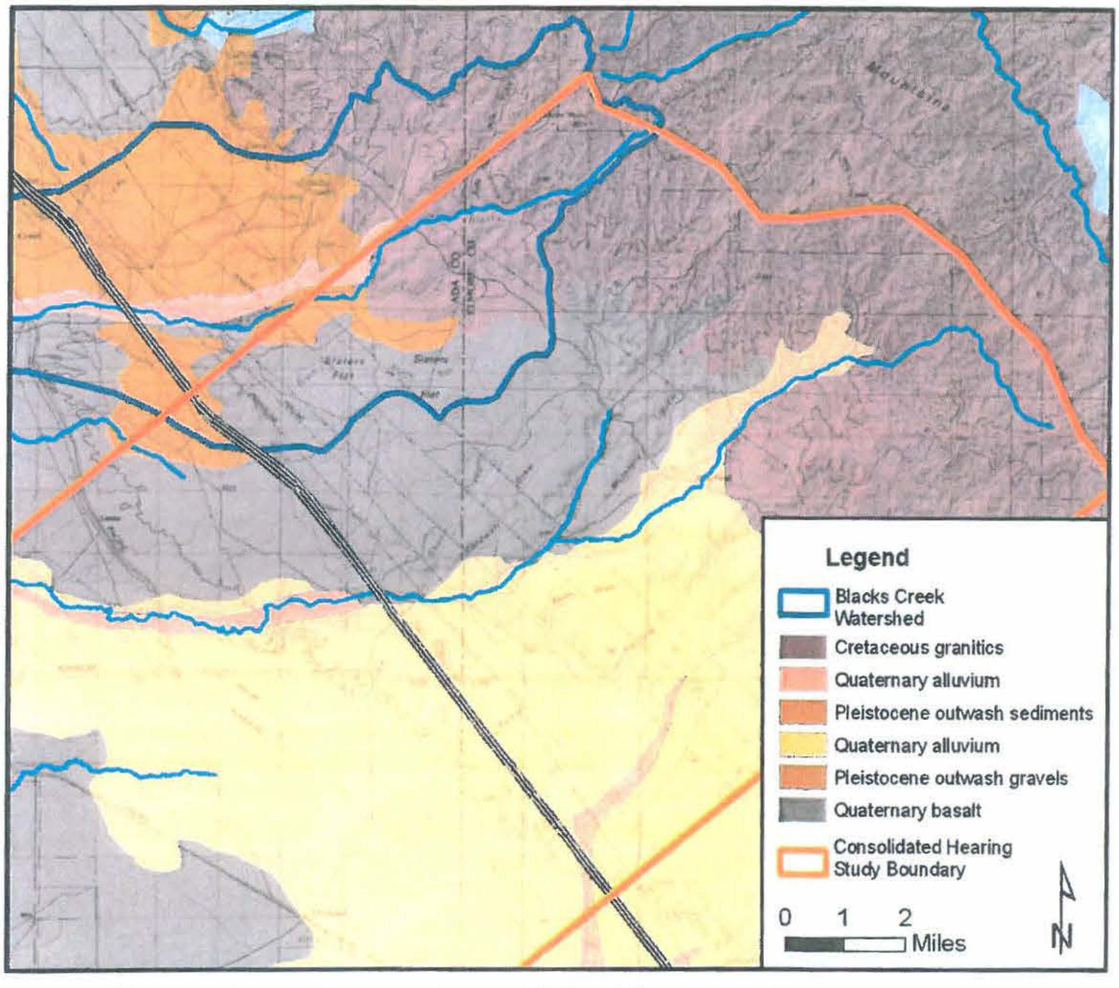

Figure 2. Surficial geology in the vicinity of the upper Blacks Creek drainage.

9. *ERO also argues that "long-term effects of pumping in the Blacks Creek drainage just outside of the study area" should be included in IDWR's analysis (ERO Report, page 15).*

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The only water right within the upper Blacks Creek drainage near the study-area boundary authorizing substantial diversions is water right 63-11540, which authorizes a maximum diversion of 3.1 cfs for the irrigation of 287 acres approximately 2.5 miles outside of the study-area boundary. This water right was fully exercised by 2006 (permit proof was made on September 29, 2006), and the right was licensed on November 1, 2010. There is no evidence that pumping under this right has or will create regional groundwater-level declines.

Locations of wells in the upper Blacks Creek drainage with publicly-available groundwater-level data are shown in Figure 3. Hydrographs from these wells (Figure 4 and Figure 5), including a well within ¼-mile from the point of diversion for water right 63-11540, show no groundwater-level declines, indicating that diversions authorized under water right 63-11540 have not created (and therefore likely will not create) groundwater-level declines in the upper Blacks Creek drainage area. Thus, it appears that ERO's concerns about long-term effects of pumping outside this portion of the study area are unfounded.

10. *ERO argues that IDWR estimates of recharge from the "non-recharge" area (2,656 AFA) should be excluded from the water budget for three reasons: (1) the amount of potential evapotranspiration on the non-recharge area significantly exceeds precipitation (and therefore "little if any water is lost to deep percolation"); (2) impermeable zones prevent precipitation from reaching the regional water table; and (3) portions of the non-recharge area are "outside of and down gradient of the 'reach' of the proposed wells" (ERO Report, page 16). These three assertions are addressed below.*

    Response, Part 1: ERO refers to a comment in a previous USGS report that suggests "little recharge" occurs in "lowlands of the plateau" (Young, 1977, page 11). However, it seems unlikely that Young was referring to all portions of the Mountain Home plateau between the Danskin Foothills and the Snake River in making this statement. In a more recent USGS study, Newton was more specific: he assumed recharge from precipitation to be negligible only in non-irrigated lands with precipitation of less than 9 inches per year (Newton, 1991, page G16).

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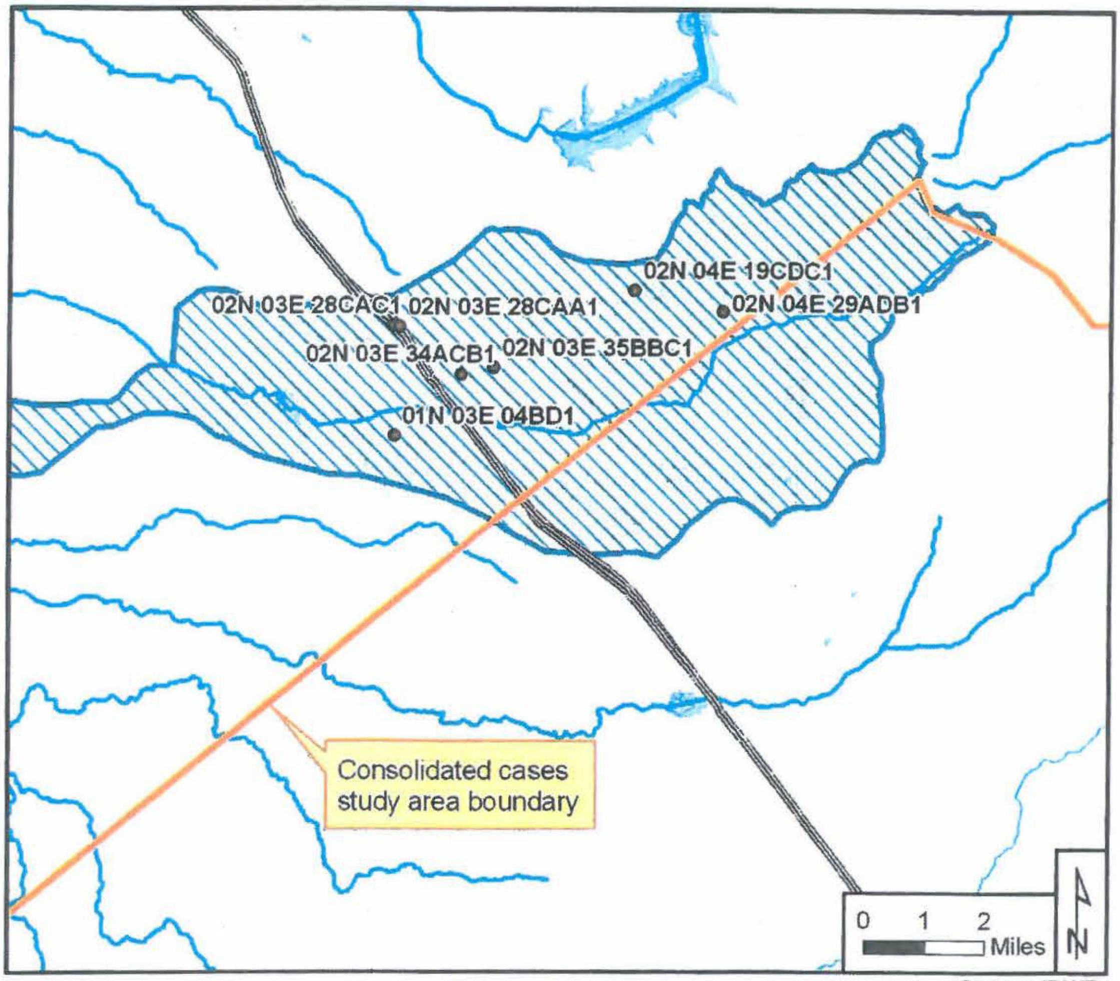

Source: IDWR

Figure 3. Locations of wells in the upper Blacks Creek drainage with groundwater-level data.

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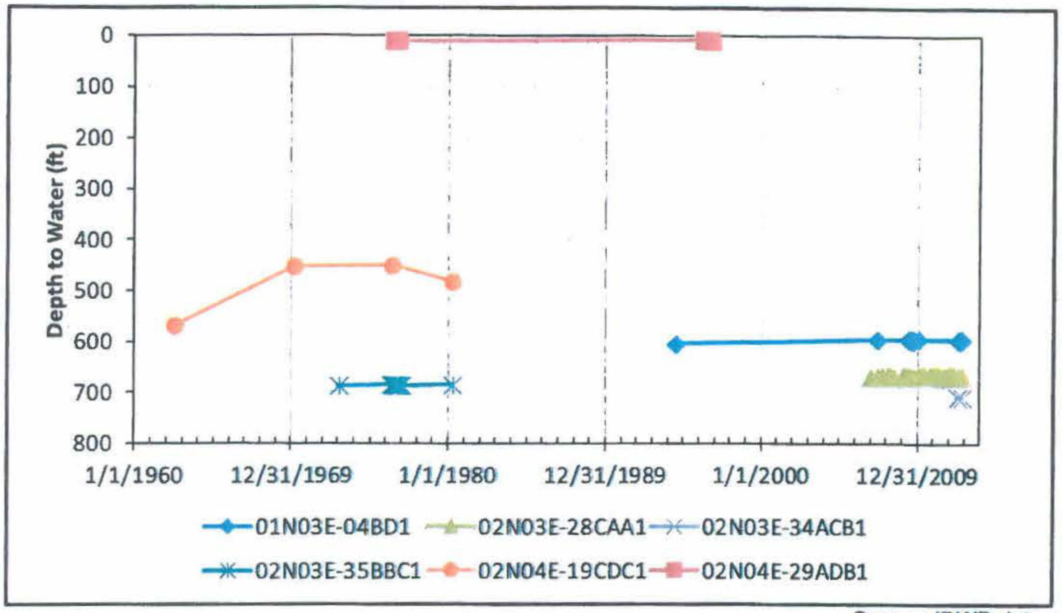
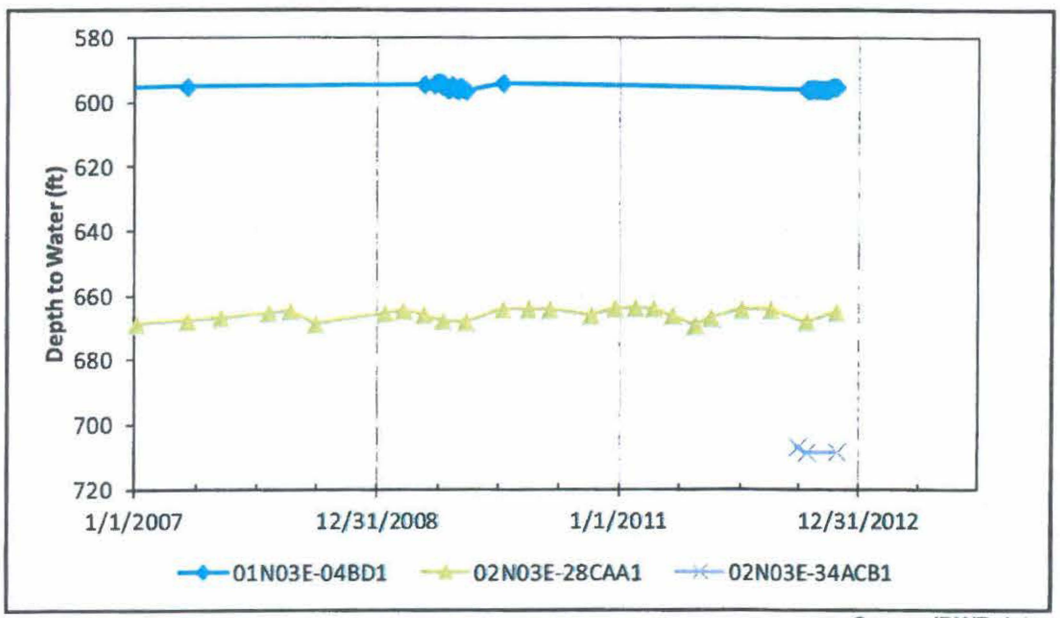


Source: IDWR data.

Figure 4. Groundwater levels in upper Blacks Creek wells (1960-2012).



Source: IDWR data.

Figure 5. Groundwater levels in upper Blacks Creek wells (2007-2012).

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The "non-recharge" portion[7] of the consolidated cases study area ranges in elevation from approximately 2,300 feet (at the Snake River, or approximately 2,800 feet at the canyon rim above the Snake River) to 3,600 feet[8]. Low-elevation portions of the "non-recharge" area receiving an average of 8 to 10 inches (or less) of annual precipitation (Figure 6) represent a relatively small portion of the "non-recharge" area. However, higher-elevation portions of the "non-recharge" area receive 14-16 inches of precipitation per year (or more).

Newton (1991) recognized that greater amounts of precipitation generate greater amounts of aquifer recharge. He divided the western Snake River Plain into subareas – several of which coincide with the consolidated cases study area – having different recharge characteristics. Newton estimated that 3% of the precipitation falling in Subarea 4 (which covers higher-elevation portions of the "non-recharge" area) becomes aquifer recharge, 1.29% of the precipitation in Subarea 8 becomes aquifer recharge, and 0.74% of the precipitation in Subarea 10 becomes aquifer recharge[9] (Figure 6). IDWR used these percentages to estimate recharge the non-recharge area (IDWR Staff Memo, page 13).

Higher recharge rates in proximity to the Danskin Front are to be expected based on greater precipitation rates. Alluvial sediments in the "non-recharge" area – especially near the Danskin Front – are clearly capable of accepting deep percolation from precipitation. By example, these alluvial sediments typically accept the entire flow from Indian Creek and Bowns creeks as seepage within a few miles of the Danskin Front. Similarly, any overland flow in ephemeral channels within the "non-recharge" area following substantial precipitation events likely becomes deep percolation.

Response, Part 2: ERO suggests that "impermeable zones above the regional water table described in drillers' reports for wells constructed in Townships 2 and 3 South and Ranges 4 and 5 East prevent precipitation from reaching the regional water table" (ERO Report, page 16), and argues that this is another reason that recharge from precipitation in the "non-recharge" area should not

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[7] The "non-recharge" portion of the study area is inappropriately named by IDWR in its staff memo, because recharge in this portion of the study area does, in fact, occur.

[8] The 3,600-foot contour is used to define the boundary between the "recharge" and "non-recharge" portions of the IDWR study area (IDWR Staff Memo, page 5).

[9] Based on percentages calculated from precipitation and recharge estimates in Newton (1991), Table 6, page G31.

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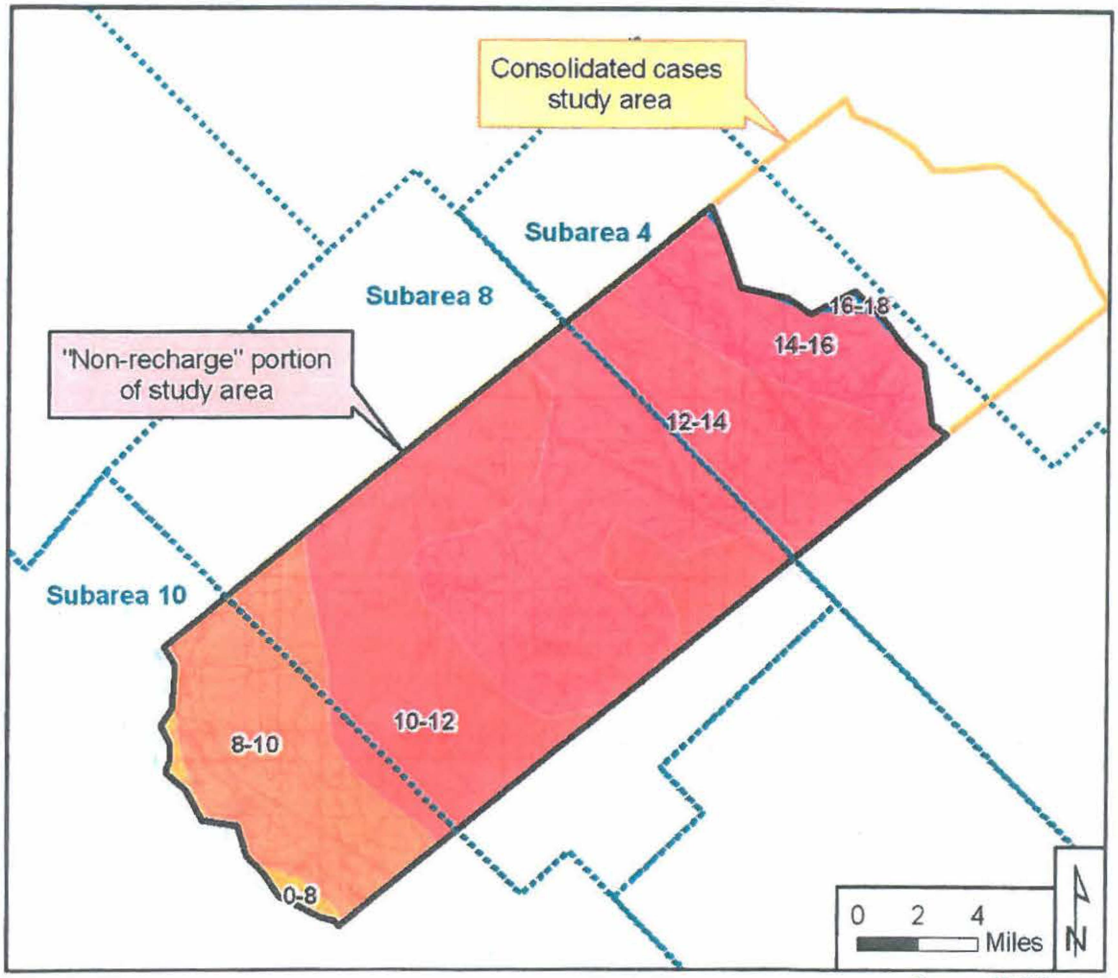
be included in the water budget. However, the wells to which ERO refers are in the Cinder Cone Butte comparison area, not the study area (see Figure 7). Lithologic descriptions from these Cinder Cone Butte CGWA wells do not adequately describe stratigraphy in the consolidated cases study area.



Source: IDWR

Figure 6. Average annual precipitation (in inches) in the consolidated cases "non-recharge" area.

Cross-sections C-C' and D-D' in Appendix A of the IDWR Staff Memo illustrate a greater prevalence of sedimentary layers (especially sand) in the study area than in the comparison area. Many drillers' reports from wells used to generate hydrographs and water-level contours plots (IDWR Discovery

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Response #9), especially drillers' reports with detailed lithologic descriptions, list clay layers no greater than 5 or 10 feet in thickness. Some wells list thicker clay or basalt layers, but none of these thicker, ostensibly less impermeable zones appear to have great areal extent. Thus, it is difficult to identify areally-extensive impermeable zones within the study area that would prevent recharge from reaching the regional aquifer.

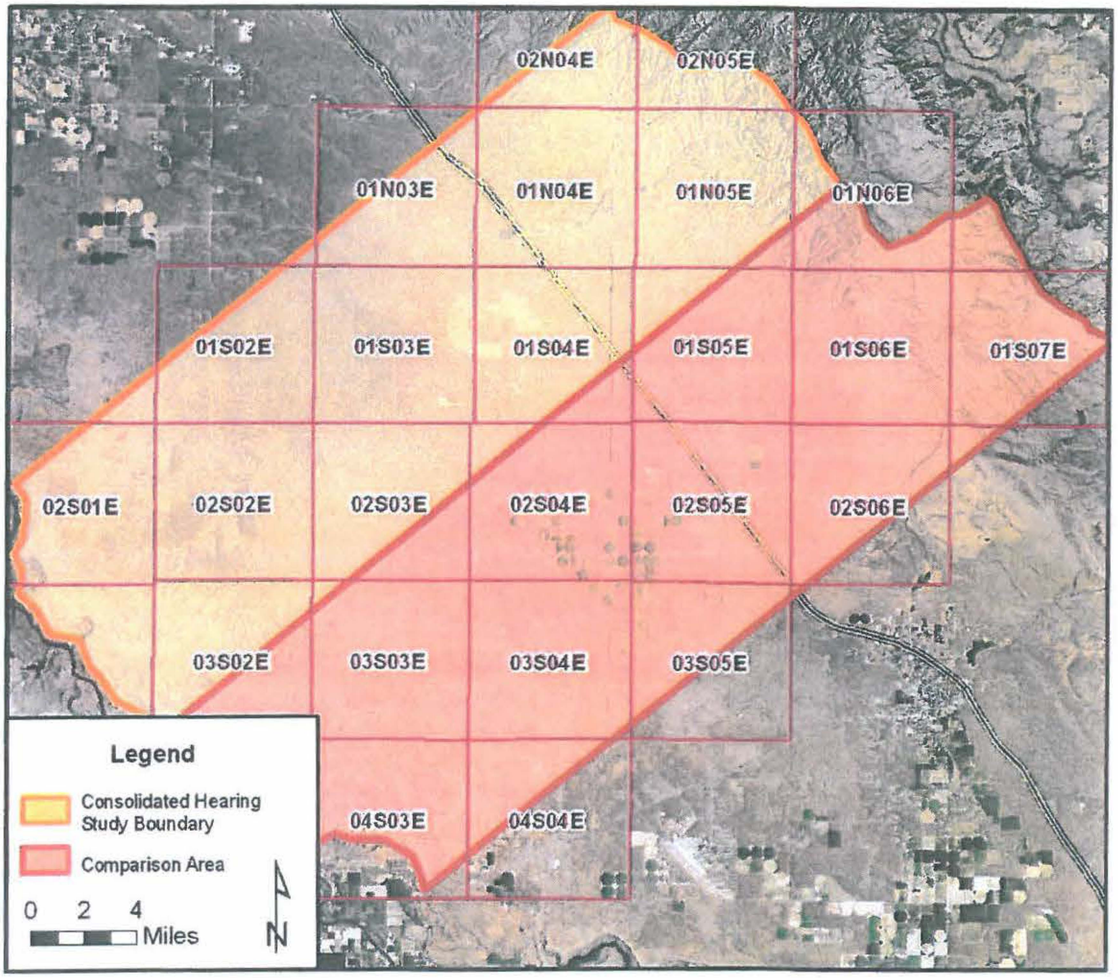

Figure 7. Townships in the consolidated cases study area and adjacent comparison area.

While clay and basalt layers may have low permeability, no geologic layers are truly impermeable. If precipitation can initially infiltrate a few feet below the root zone or capillary zone, the infiltrated water will continue to move

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downward to the water table over time, provided that the annual rate of recharge does not exceed the average permeability of the most limiting layer. Given the low amounts of estimated recharge within the "non-recharge" area, the average permeability of any clay and basalt layers should be adequate to allow recharge to reach the water table.

Areally-extensive, extreme low-permeability layers throughout the study area that truly prevented surface infiltration from reaching the regional aquifer would lead to the creation of widespread perched aquifer zones in the study area. Such perched zones, if present, would be noted in drillers' reports, which is not the case. Thus, one can only surmise that stratigraphic layers of low permeability are not entirely impermeable and/or are not areally extensive.

Response, Part 3: ERO maintains that portions of the non-recharge area are "outside of and down gradient of the 'reach' of the proposed wells" (ERO Report, page 16). However, there is no basis for concluding that recharge from the entire "non-recharge" area cannot be captured. On the contrary, it is quite likely that wells proposed under pending applications/transfers can capture recharge originating as precipitation infiltration within the northern portion of the "non-recharge" area.

Figure 8 illustrates a portion of the "non-recharge" area with greater potential of capturing recharge originating from the "non-recharge" area and an area with reduced capture potential. The line separating these two portions of the "non-recharge" area is approximately 3 miles down-gradient of the Orchard Ranch wells, which presumably could develop an approximate 3-mile capture radius.

The amount of average annual recharge generated within the portion of the "non-recharge" area having greater capture potential was estimated using the same estimated USGS recharge percentages (Newton, 1991) and PRISM data that IDWR used in developing a recharge estimate for the "non-recharge" area. Using this approach, the amount of recharge within the portion of the "non-recharge" area having greater capture potential is approximately 1,950 acre-feet per year (Table 1).

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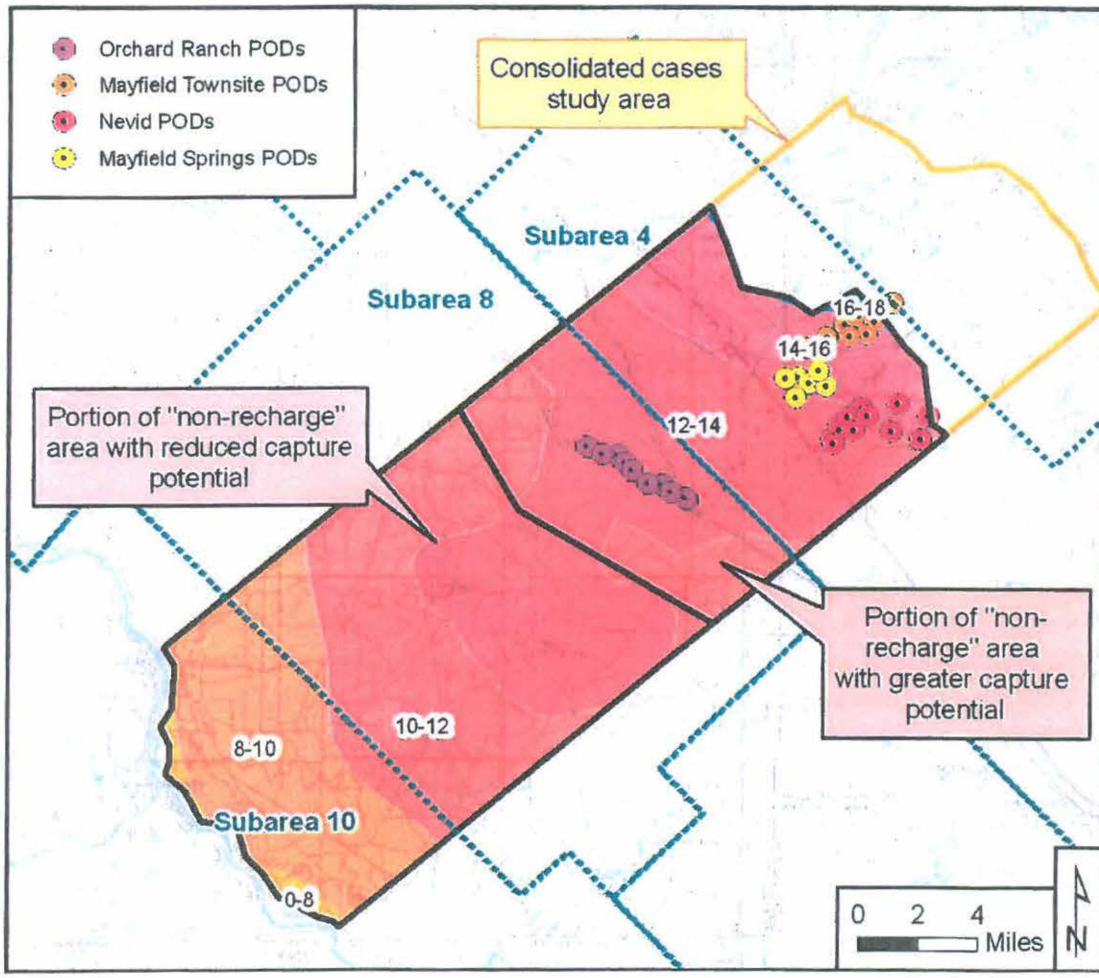

Figure 8. Portion of "non-recharge area" from which recharge capture is likely.

In calculating recharge for the "non-recharge" area using USGS subareas we found a discrepancy in IDWR's geo-referencing of the Newton (1991) subarea map. Correcting this discrepancy resulted in a recharge estimate of 3,000 AF for the "non-recharge" area, which is approximately 340 AF greater than the 2,660 AF recharge volume estimate presented in the IDWR Staff Memo (Table 2).

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Recharge in "Capture Portion" of "Non-Recharge" Area				
USGS Subarea	Study Area within USGS Subarea (acres)	Study Area Annual Precipitation Volume	USGS Estimated Recharge Percentage	Estimated Average Annual Recharge (AF, rounded)
4	44,836	51,748	3.00%	1,550
8	31,733	31,307	1.29%	400
Total	0	0		1,950

Table 1. Estimated recharge volume in portion of the "non-recharge" areas having greater capture potential.

Comparison of Recharge Estimates for "Non-Recharge" Area					
	USGS Subarea	Study Area within USGS Subarea (acres)	Study Area Annual Precipitation Volume (AF)	USGS Estimated Recharge Percentage	Estimated Average Annual Recharge (AF, rounded)
SPF Estimates	4	44,836	51,748	3.00%	1,550
	8	98,293	96,847	1.29%	1,250
	10	34,309	27,429	0.74%	200
	Total	177,438	176,023		3,000
IDWR Estimates	4	30,196	36,515	3.00%	1,100
	8	97,153	97,281	1.29%	1,250
	10	50,089	41,866	0.74%	310
	Total	177,438	175,662		2,660

Table 2. Comparison of IDWR and SPF recharge estimates for "non-recharge" area.

The geo-referencing discrepancy is illustrated in Figure 9. SPF scanned Figure 17 in the Newton (1991) report and geo-referenced this map using county shapefile polylines (6 points) as reference points. IDWR's geo-referencing was off by distances

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of 1.8 to 3.3 miles at four representative corner points (Figure 9). Examples of SPF's geo-referencing points are shown in Figure 10. The net result is that there is a larger portion of USGS subarea 4 and a smaller portion of Subarea 10 in the consolidated cases study area than calculated by IDWR.

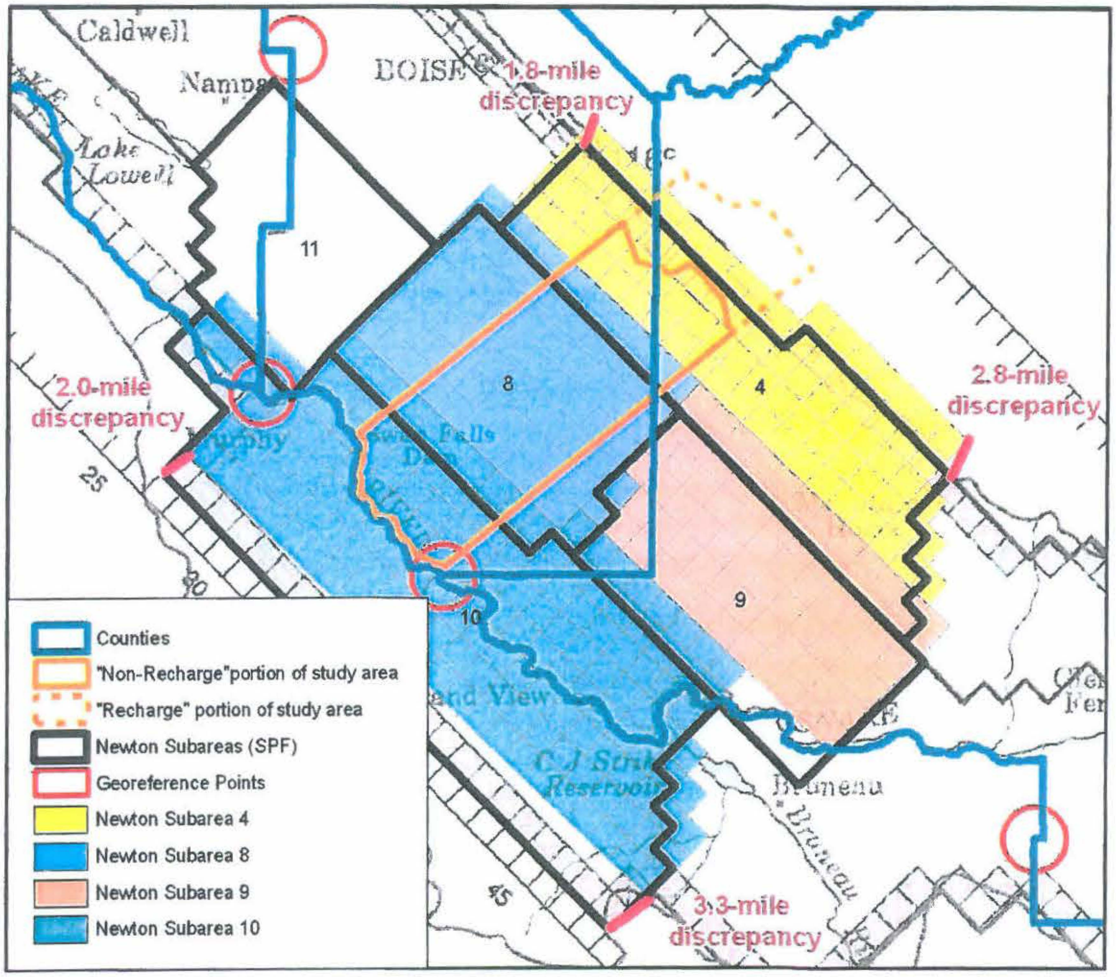

Figure 9. Comparison of Newton (1991) model zone locations interpreted by IDWR and SPF.

Recharge was recalculated using IDWR's PRISM dataset and the revised subarea acreages within the consolidated cases study area (PRISM raster data were converted to point shapefiles to simplify analysis in ArcGIS v9.2). Points lying within the boundaries of the "non-recharge" area and Newton subarea were selected and precipitation summed. Recharge was computed based on the recharge ratios

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presented by Newton (1991, Table 6). This resulted in a recharge estimate for the "non-recharge" area that is 340 AF (13%) greater than that calculated by IDWR.

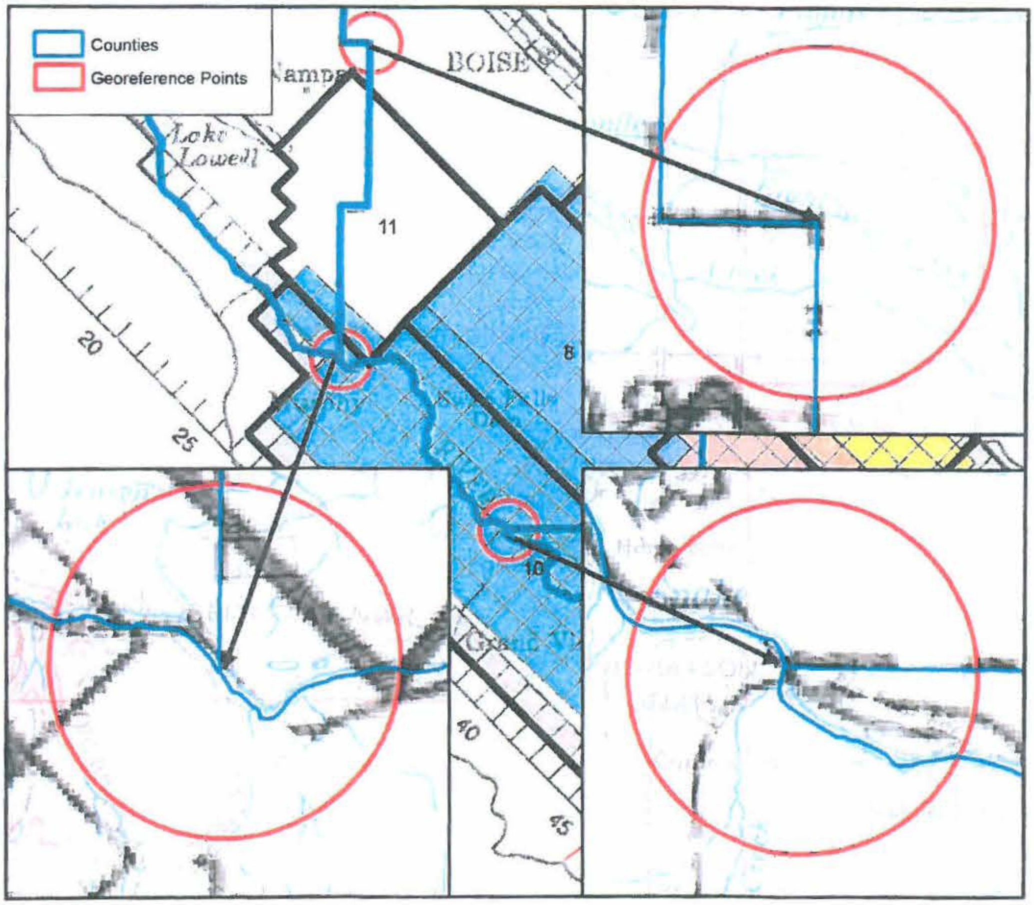

Figure 10. Representative geo-referencing points.

11. *ERO argues that "water pumped from the regional aquifer is unlikely to return to the regional aquifer at a location or within a time interval to make water available for re-diversion and should not be included in the estimate of volume available in the water budget" (ERO report, page 17).*

IDWR used crop irrigation requirement (CIR) values in estimating irrigation withdrawals. Implicit in the use of CIR values is the assumption that growers will pump no more water than is necessary to adequately irrigate crops, which is a reasonable assumption given typical pumping lifts within the study area. IDWR made no assumptions regarding the percentage of pumped irrigation

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water returning to the regional aquifer. However, it is logical to assume that water pumped for domestic purposes and discharged via septic systems, or water withdrawn under commercial rights for heating and cooling purposes (e.g., 63-11524), eventually returns to the aquifer.

12. *ERO notes that groundwater levels "in and around the Cinder Cone Butte Critical Ground Water Area continue to decline indicating the reasonably anticipated rate of future natural recharge is being exceeded" (ERO Report, page 4).*

    Groundwater levels have declined in portions of the Cinder Cone Butte CGWA, indicating that groundwater pumping has not yet reached equilibrium with recharge in this area. However, groundwater levels in the study area remain stable, indicating water available for appropriation.

- **No Injury to Idaho Power Water Rights**

13. *ERO states that "Diversion and use of ground water as proposed in the applications will injure existing water rights" (ERO Report, page 4).*

    ERO does not identify specific water rights that it believes will be injured by the proposed applications. Because ERO's report was prepared for Idaho Power, it can be assumed that ERO is concerned about multiple Idaho Power water rights authorizing water use for hydroelectric generation at Swan Falls Reservoir. However, these Idaho Power hydropower rights are subordinate to "subsequent beneficial upstream uses" (such as uses represented by the pending applications/transfers in these consolidated cases) as long as Snake River flows remain above established minimum flows.[10]

    Minimum streamflow rights held by the Idaho Water Resource Board establish a minimum flow of 3,900 cfs between April 1 and October 30 and 5,600 cfs between November 1 and March 31) at the USGS Gaging Station 13172500 near Murphy, Idaho. Idaho Power's Swan Falls hydropower rights cannot be injured as long as Snake River flows remain above these minimums.

14. *ERO notes that "Permits to use ground water have previously been issued to allow the initial phases for two of these projects without regard for trust water impacts" (ERO report, page 2), implying that trust water impacts should have*

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[10] Swan Falls Settlement Paragraph 7(B); Idaho Code § 42-203B.

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been considered to avoid injury to Idaho Power water rights authorizing hydroelectric generation at Swan Falls Dam.

Points of diversion and places of use for the two referenced permits (63-32225 and 61-12090) are not within the trust area boundary defined under IDAPA 37.003.008 (Figure 11). These applications were not protested based on concerns regarding trust water impacts. Consideration of trust water impacts was therefore not required for the processing of these permits. Furthermore, points of diversion and or places of use for applications that are part of this consolidated administrative process (Applications 63-32499, 61-12095, 61-12096, 63-32703, 61-12256, and 63-33344) also lie outside of the trust area (Figure 11).

15. *ERO conducted an analysis of Snake River flows "to evaluate the current conditions of the Snake River at Murphy" (ERO Report, page 22). ERO provides three graphs of Snake River discharge at Murphy less all flow passing Milner Dam. ERO states that "In order to evaluate the water supply defined as trust water, the discharge measured at Murphy must first be reduced by subtracting the flow passing Milner Dam" (ERO report, page 22).*

The pending applications and transfers in this consolidated case are not in the trust area, so the trust-area analysis of Snake River flows does not apply. If the trust-area analysis did apply, calculating average daily discharge for the purposes of monitoring compliance with established minimum flows and the Swan Falls Agreement does not require subtracting all flows passing Milner Dam. "Average daily flow" was defined in the Swan Falls Agreement to mean "actual flow conditions" and excluded "fluctuations" resulting from Idaho Power operations[11]. Idaho Power occasionally conveys water leased, purchased, or otherwise owned through the Snake River reach between Milner and Swan Falls. The Swan Falls Agreement specifies that "Such flows shall be considered fluctuations resulting from operation of Company facilities."[12] Thus, only water leased, purchased, or released from storage owned by Idaho Power passing Milner Dam is relevant to a trust-water analysis of Snake River flows.

ERO may have assumed that the discharge measured at Murphy must be reduced by the flow passing Milner Dam based on its reference to Idaho Code § 42-203B(2), which reads, "For the purposes of the determination and

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[11] Swan Falls Agreement, Paragraph 7(B), page 4.

[12] Swan Falls Agreement, Paragraph 7(E), page 4.

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administration of rights to the use of the waters of the Snake River or its tributaries downstream from Milner Dam, no portion of the Snake River or surface or ground water tributary to the Snake River upstream from Milner Dam shall be considered" (ERO Report, page 22). However, this sentence does not appear to preclude the assessment of flows not associated with Idaho Power operations in an evaluation of water supply in the Milner to Swan Falls reach of the Snake River, especially of flows in excess of generating capacity (8,400 cfs) at Swan Falls Dam.

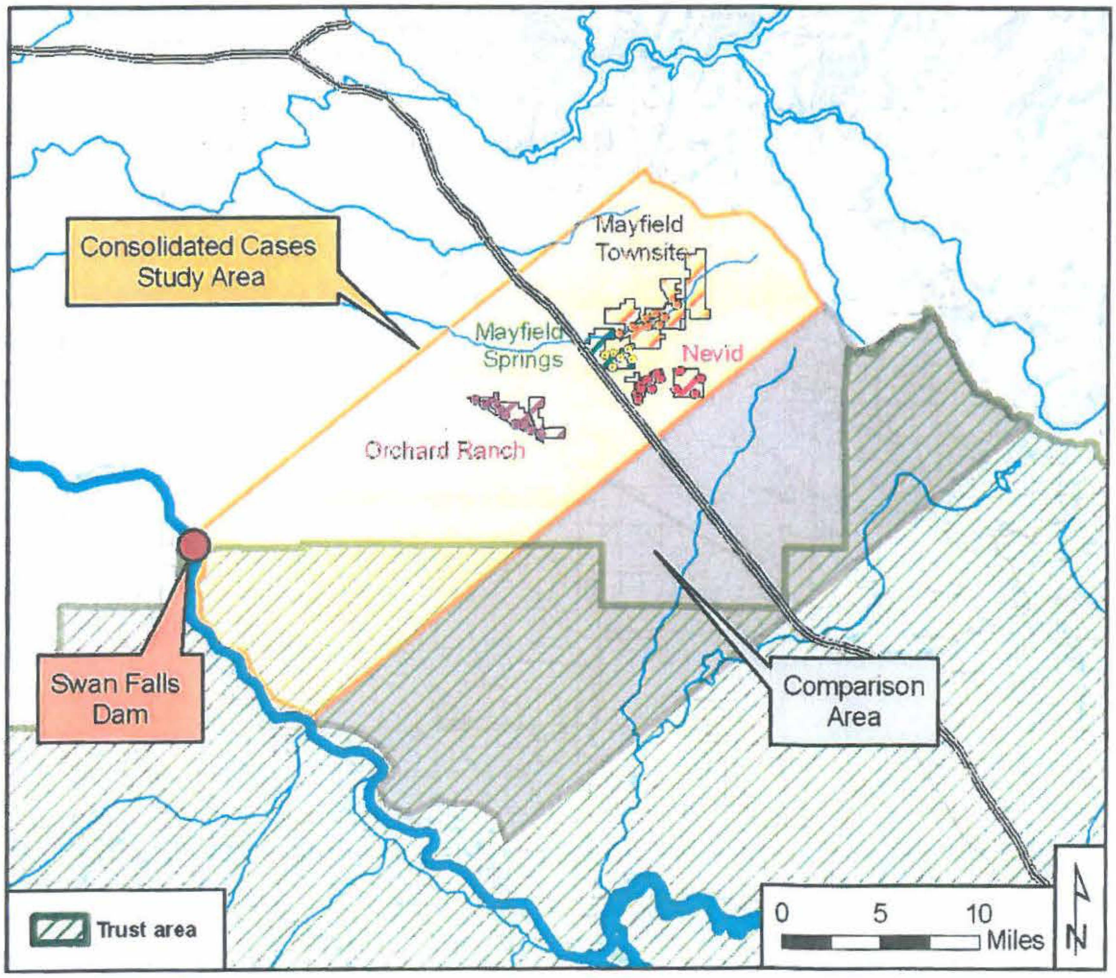

Figure 11. Trust area and places-of-use for consolidated applications.

16. ERO presents graphs showing a downward trend in Snake River flows based on average flows between November-March, April-October, and July 1-July 10 (ERO Report, Figures 3, 4, and 5).

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The squared correlation coefficient (R^2) for each of the graphs prepared by ERO is low (Table 3). The R^2 value is often used to characterize the variability explained by the straight-line regression model. For example, an R^2 value of 0.30 suggests that only 30% of the variability in a data set is explained by a given regression line (trend line). Most of the variability observed in the average flow values graphed by ERO is not explained by the trend line. This makes multi-year projections of future flow values based on these data tenuous.

Coefficients of Determination (R^2) in ERO Report Figures 3-5		
ERO Report Figure Number	Graph	R^2
3	Murphy minus Milner Discharge, November-March	0.49
4	Murphy minus Milner Discharge, April-October	0.27
5	Murphy minus Milner Discharge, July 1-10 mean	0.30

Table 3. Coefficients of Determination (R^2) in ERO Report Figures 3-5.

Most of the "base flow" in the Milner-to-Murphy reach of the Snake River is present as a result of eastern Snake Plain Aquifer discharge at Thousand Springs. Historical decreases in average Snake River flows have been attributed to several factors, including conversions of gravity surface-water irrigation systems to sprinklers (resulting in less aquifer recharge as a result of more efficient irrigation), extended drought conditions, and historical increases in groundwater pumping. However, drought conditions and increases in groundwater pumping may be moderating, although efficiency improvements in surface-water irrigation continue.

The bottom line is this: multi-year straight-line projections based on relatively weak correlations are not very reliable. In fact, Snake River discharge in the last decade (e.g., since about 2000 – see Figures 3 and 4 in the ERO Report) show relatively consistent average year-to-year flows. This recent pattern of consistent average flows is noteworthy because it better reflects the current management of the Eastern Snake River Plain Aquifer.

17. *ERO provides multiple photographs of springs in the Snake River Canyon between CJ Strike Dam and Falls Dam (Appendix A, ERO Report), and implies that these springs represent discharge from the study area.*

ERO provides no measurements of discharge rates from the springs shown in these photographs, and does not quantify the amount of water (if any) that

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actually reaches the Snake River from these springs. It appears from ERO's photographs that much of the spring discharge in this area is lost to evapotranspiration.

18. *ERO implies with its flow characterizations (ERO Report, pages 22-27) that approval of pending consolidated-case applications will cause declines in Snake River flows, thereby injuring (or contributing to injury of) existing Idaho Power water rights.*

The ERO Report explicitly or implicitly argues that (a) aquifers in the study area discharge to the Snake River, (b) average Snake River flows are decreasing, (c) future Snake River flows may dip below established minimum flows (d), new diversions under pending applications will reduce the discharge to the Snake River, (e) and, when this occurs, Idaho Power water rights will be injured by approval of the pending consolidated-case applications. However, ERO does not explain specifically how approval of all or a portion of the consolidated-case pending applications/transfers will injure Idaho Power. Injury is not a foregone result of approving consolidated-case applications/transfers.

Any potential impacts to the Snake River as a result of diversions under the pending consolidated-case applications and transfers cannot be expressed in terms of maximum diversion rates. Instead, because of the distance between the proposed points of diversion and the Snake River, any impact would be in the form of a uniform rate reflecting annual volumetric withdrawals (approximately 11 cfs with annual withdrawals of an estimated net recharge rate of 7,900 AFA – see Petrich, 2012).

Over an extended time, withdrawals under the proposed applications and transfers may result in decreased spring discharge in the Snake River Canyon. Decreases in spring discharge may result in decreased evapotranspiration from springs such as those shown in ERO's Appendix A. If springs such as those shown in the ERO report currently do not discharge to the Snake River, then reductions in discharge from the springs will not impact the Snake River.

It is important to recognize that average Snake River flows remain well above established minimums. Average daily flows since 1984 (Figure 12) have not only been greater than established minimum flows, but during substantial portions of the year have been greater than the 8,400-cfs generating capacity at Swan Falls Dam. Approval of consolidated-case applications and transfers would represent absolutely no impact to hydroelectric generation during times of the flows greater than 8,400 cfs.

Recent low-flow years (e.g. 2003 – see Figure 12) have seen average daily flows less than 8,400 cfs (but more than minimum flows). However, hydropower rights

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for authorizing electrical generation at Swan Falls Dam are subordinate to new, approved uses as long as flows remain above established minimums[13].

Based on the hydrographs in Figure 12, it appears unlikely that a future dip below established minimum flows, if it occurs, would have a long duration. Non-approval of the proposed consolidated-case applications and transfers because Snake River flows may dip below established minimums for a short period of time sometime in the future would preclude the full economic development of the study-area groundwater resource as provided under Idaho Code § 42-226. Furthermore, attempting to prevent a dip in minimum flows by disapproval of these consolidated applications and transfers would be futile because of the relatively small amount of water involved[14].

However, even a short-term dip in Snake River flows below established minimums would have important significance to the State of Idaho and Idaho Power. That is why the recent Idaho State Water Plan (IWRB, 2012) includes implementation strategies to maintain Snake River flows above established minimums:

- Develop and implement a monitoring program to better predict the occurrence and duration of future low flows in the Snake River (Implementation Strategy #3, Policy 4D).
- Develop by 2014 management scenarios to ensure that Snake River flows at the Murphy and Weiser gages remain above established minimum stream flow levels (Implementation Strategy #3, Section 4A).

The 2012 State Water Plan (page 47) recognizes that "one of the core principles of the Swan Falls Settlement was that flow of the Snake River downstream from Milner Dam in excess of the Murphy minimum average daily flow... would be available for future development." Consequently, the 2012 State Water Plan lists implementation strategies in anticipation of additional water development under water rights held in trust by the state within the "trust-water" area:

- Develop a conjunctive management plan setting forth measures necessary for future development of trust water (Implementation Strategy #2, Policy 4C).

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[13] Swan Falls Settlement Paragraph 7(B); Idaho Code § 42-203B.

[14] The long-term uniform diversion rate consistent with an average annual net recharge of 7,900 AF is approximately 11 cfs (Petrich, 2012). Some of this impact may manifest itself as reduced evapotranspiration from springs discharging in the Snake River Canyon. Any remaining decrease in flow to the Snake River as a result of groundwater withdrawals under the pending applications and transfers is well within Snake River measurement error.

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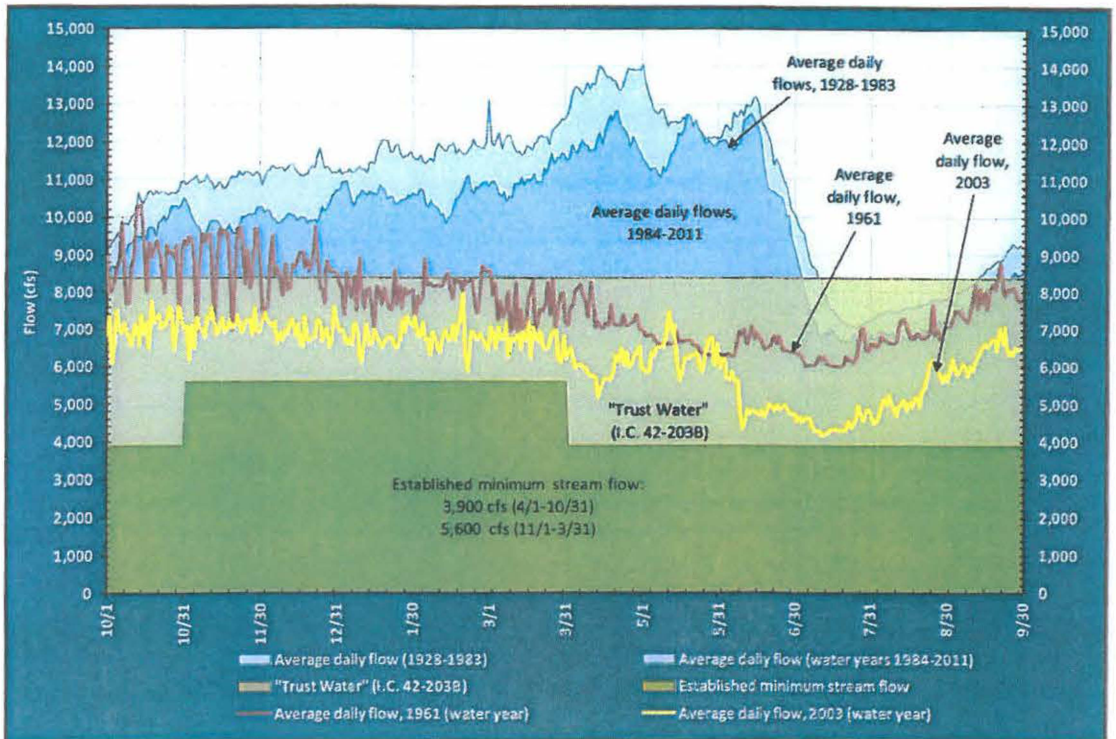
- Conduct hydrologic studies to determine the amount of additional development possible within the Murphy minimum stream flow constraint (Implementation Strategy #1, Policy 4C).



Source: Idaho State Water Plan (IWRB, 2012).

Figure 12. Snake River minimum flows.

• Other ERO Concerns

19. Referring to "appropriate and timely curtailment of junior priority" surface-water rights, ERO states that "such direct administration is not possible for an over-appropriated aquifer" (ERO Report, page 16).

IDWR currently administers rights authorizing the diversion of groundwater throughout the state in aquifers with varying degrees of "appropriation." Junior-priority groundwater users have been required to provide mitigation for impacts to senior-priority groundwater users or risk curtailment in times of shortage. However, aquifers are generally not managed on a "real time" basis – such administration would not be effective because of aquifer response lag times.

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One approach to confirming availability – and lack of injury to existing rights – for municipal uses prior to the construction of homes and businesses within the study area would be to require a period of temporary irrigation (e.g., 3 to 5 years) under a new municipal permit prior to diverting for municipal purposes. Such temporary irrigation diversions would provide a low-risk opportunity to monitor pumping effects on local groundwater levels prior to committing to municipal development.

20. *ERO summarizes Applications for Permit and Transfer seeking groundwater in the consolidated hearing (ERO Report, Table A). The following two comments are clarifications to this ERO table.*

First, the diversion rates reported for Permit 61-12090 and Application 61-12096 include flows dedicated to fire protection only. The rate for Permit 61-12090 is reported as 4.02 cfs, which includes 1.82 cfs for municipal use, and 2.20 cfs for fire protection. The rate for Application 61-12096 is reported as 20.48 cfs, which includes 14.91 cfs for municipal use, and 5.57 cfs for fire protection. Obviously, the fire protection flows will only be used in emergency situations. If these two fire protection flows are removed, the total on Page 31 of the ERO Report is 95.01 cfs (instead of the 102.78 cfs reported by ERO).

Second, the irrigated acreage for Permit 61-12090 is reported as 109 acres. This figure appears to include common areas, which, by condition, can be irrigated only with recycled water. The permit limits residential lot irrigation to 1/3-acre per developed lot when the license is issued. In other words, if homes are constructed on all 176 lots, Permit 61-12090 authorizes diversion of groundwater for irrigation of a maximum of 52.8 acres.

3. Comments Regarding the Brockway Report

The Brockway Report describes the construction of – and results from – a MODFLOW computer model used to assist in the evaluation of impacts associated with proposed water right transfer 73811. The following paragraphs provide some general comments regarding aspects of this model and/or modeling results.

1. The model was built to simulate 2-dimensional groundwater flow (Brockway Report, page 11). While this approach might suffice over large portions of the Mountain Home Plateau, a 2-dimensional model does not adequately describe groundwater flow in perched, unconfined, semi-confined, and confined aquifers present especially in the northern portion of the study area.

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2. Because the Brockway model (2009) was prepared several years prior to the IDWR Staff Memo (2012), the Brockway model does not incorporate the results of recent groundwater-level measurements, stream-monitoring data, and water-budget analyses. Thus, Brockway's assumed specified-head and specified-flux boundary conditions do not reflect current understanding within the consolidated cases study area.

3. Zonation used to distribute hydraulic conductivity values throughout the model domain (Brockway Report, Figure 14) does not appear to correspond with transitions in subsurface materials illustrated in the geologic cross-sections presented in the IDWR staff memo.

4. In summary, although it appears Powell and Brockway used "best available data" at the time the model was constructed, the usefulness of the model for the purposes of evaluating pumping effects within or around the consolidated study area is questionable.

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