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WYOMING WATER DEVELOPMENT OFFICE

Spring 2012



Water News

Weather Modification Pilot Project Wraps Up Another Successful Year



Ground-Based Cloud Seeding Generator

Inc. (WMI), Fargo, ND, while the evaluation activities fall under a separate contract with the National Center for Atmospheric Research (NCAR), Boulder, CO. Still other physical evaluation activities are being conducted by the Desert Research Institute (DRI), Reno, NV. The University of Wyoming (UW) and University of Tennessee (UT) are conducting the hydrologic analyses portion of the study and participating in companion research. Technical review expertise is provided to the WWDC by the Department of Atmospheric Science at UW.

Ending on April 15th, the Wyoming Weather Modification Pilot Program (WMMPP) concludes yet another successful research season with several milestones achieved along the way. The WMMPP is funded by the State of Wyoming through the Water Development Commission (WWDC) and is a winter cloud seeding research program operating in the Medicine Bow, Sierra Madre, and Wind River Ranges. It is unique among state-sponsored programs in that it includes a substantial independent evaluation component to determine the feasibility of cloud seeding, and to quantify its effectiveness. The infrastructure and operations of the program are covered under a contract with Weather Modification,

CO. Still other physical evaluation activities are being conducted by the Desert Research Institute (DRI), Reno, NV. The University of Wyoming (UW) and University of Tennessee (UT) are conducting the hydrologic analyses portion of the study and participating in companion research. Technical review expertise is provided to the WWDC by the Department of Atmospheric Science at UW.



Snow Sampling by Desert Research Institute

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rehabilitation study. Appropriation: \$150,000.

Basin-Big Horn Canal: This is a municipal master plan and canal leakage study. Appropriation: \$150,000.

Hawk Springs Master Plan: This updates the irrigation system master plan and prepares a reservoir operations model. Appropriation: \$200,000.

Lakeview Irrigation: This is an irrigation system master plan. Appropriation: \$250,000.

Level II Feasibility Studies -- Storage
Nowood River Storage: This funds the next phase of work on the Nowood River Storage Study. Appropriation: \$350,000.

Shell Valley Storage: This funds the next phase on the

Shell Valley Storage Study. Appropriation: \$350,000.

Sheridan Supplemental Storage: This funds the next phase of the Sheridan Supplemental Storage Study. Appropriation: \$250,000.

Calendar of Water Events

April 11, 2012 - Yellowstone River Compact Commission Technical Meeting; Billings, MT

April 16-17, 2012 - Bear River Commission Meeting; Salt Lake City, UT

April 19, 2012 - Colorado River Basin States Technical Committee Meeting; Las Vegas, NV

May 9-10, 2012 - WWDC consultant interviews; Cheyenne, WY

May 11, 2012 - WWDC Meeting; Cheyenne, WY

May 7-11, 2012 - Board of Control Meeting; Cheyenne, WY

May 8-10, 2012 - Missouri River Recovery Implementation Committee Meeting; Rapid City, SD

May 17-18, 2012 - Colorado River Basin Salinity Control Forum Meeting; Midway, UT

May 23-24, 2012 - Upper Colorado River Commission Meeting; Page, AZ

June 7, 2012 - WWDC/SWC Meeting; Cheyenne, WY

July 31-August 2, 2012 - Missouri River Recovery Implementation Committee Meeting; Billings, MT

August 13-17, 2012 - Board of Control Meeting; Saratoga, WY



August 15-17, 2012 - WWDC/WDC summer tour/meeting; Riverton, WY

August 15, 2012 - On-going WWDC project applications due

The Bear River Basin Plan Update Draft Report is available online at (<http://waterplan.state.wy.us/plan/bear/2011/finalrept/draftrept.html>)

The newsletter is available online at (<http://wwdc.state.wy.us/newsletter/>)

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Weather Modification Pilot Project
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Doppler on Wheels Radar Truck

The evaluation of the WWMPP is based on two avenues: 1) a statistical experiment to collect a randomized set of seeded and unseeded cases, and 2) exploratory observations to investigate the different physical processes in cloud seeding to show that the seeding hypothesis is physically-based. Collaborations with other scientists at UW have led to "piggy-back" studies applicable to the assessment of seeding impacts on precipitation formation. Of particular note is "ASCII", or "Agl (silver iodide) Seeding of Clouds Impact Investigation", a National Science Foundation funded project that piggy-backed on this past winter's WWMPP operations in the Sierra Madres. The project included use of UW's King Air research aircraft with airborne radar, weather balloon launches, and established a manned mountain research station near Battle Pass with a host of sensors, including a "Doppler on Wheels" radar

truck. The core objective of ASCII was to independently examine the impact of cloud seeding not just on snowfall, but mainly on cloud micro-physical processes, and was the first federally funded weather modification research program in more than fifteen years.

The randomized seeding experiment (RSE) design of the WWMPP includes the following: 1) target areas near the crests of the Medicine Bows and Sierra Madres; 2) a cross-over design in which one range is randomly seeded and the other acts as the control, resulting in paired cases; 3) a seeding period of four hours with a "buffer" period of four hours to clear the areas of seeding material; 4) high-resolution precipitation gauge measurements within each target area; 5) two control gauge sites (unaffected by seeding) in each range to help describe the natural variability in precipitation between target areas, and between snowfall events; 6) seeding conditions occurring in each range simultaneously (i.e., cold enough temperatures for the seeding material to work, wind flow of the right

direction for the seeding generators to affect snowfall in the target areas, and the presence of super cooled liquid water - SLW); and 7) enough cases to provide quantifiable results with statistical significance (i.e., high level of confidence in the results).

Resources used for carrying out the experimental design include 16 ground-based seeding generators (8 in each range), 20-23 precipitation gauges at 8 sites (with redundancy at each site and some experimental gauges), 12 weather stations, two microwave radiometers for detecting SLW, a radiosonde unit (balloon-borne instrument for measuring temperature and winds at cloud heights), and a numerical forecast model cycling every three hours with updated observations.



"Control" Precipitation Gauges

Analyzing the cases collected thus far, the results of a seeding effect are not yet statistically significant, and thus no conclusions should be drawn regarding any effect. Determination of

the amount of data required is based on the quality of the precipitation data, the correlation in target areas between the ranges, and the variability of precipitation amounts during the 4-hr periods of the cases. Preliminary analysis of the data, however, shows that the significance of the results has increased with each successful year of the program, and that the results are consistent with a positive seeding effect. While this is a promising trend, the number of cases is still too small to reach a credible conclusion concerning the effect of seeding, assuming a seeding effect of 10% or more. To achieve that result requires an additional 50-60 cases, or two more operational seasons. At that point the WWMPP would be uniquely successful in completing such a randomized

statistical experiment testing the efficacy of winter-time cloud seeding from ground-based generators. The 2012 Wyoming State Legislature recently approved the funding necessary to continue the project for these final two years, so the project can be completed with scientifically credible results.

New Water Planning Projects for 2012

The 2012 Legislature approved the Omnibus Water Bill – Planning, which includes \$6,370,000 for 20 new and ongoing Level I and II water projects. A brief description of each project follows. If additional information is desired, please contact the Water Development Office.

Level I Reconnaissance Studies -- New Development

Bear River Hydrology Model: A StateMod hydrology model will be developed by the Office for the Wyoming Bear River Basin. Appropriation: \$50,000.

Guernsey Master Plan: This is a master plan for Guernsey to analyze the existing water supply and develop recommendations and financing plans. Appropriation: \$125,000.

Lovell Master Plan: This is a master plan for Lovell to analyze the existing water supply and develop recommendations and financing plans. Appropriation: \$110,000.

Middle North Platte Watershed Study: This is a watershed study for the Middle North Platte River watershed. Appropriation: \$250,000.

North Platte Water Yield Analysis: This will update the 2003 North Platte Water Yield Analysis to consider the effects of beetle kill on forest runoff. Appropriation: \$75,000.

Sundance Master Plan: This is a master plan for Sundance to analyze the existing water supply and develop recommendations and financing plans. Appropriation: \$150,000.

Level I Reconnaissance Studies -- Storage

Badwater-Poison Creek Watershed Study: This is a watershed study for the Badwater/Poison Creek watersheds. Appropriation: \$250,000.

Upper Green River Watershed Study: This is a watershed study for the Upper Green River watershed. Appropriation: \$300,000.

Level II Feasibility Studies -- New Development

Gillette Regional Connections I: This study includes water system analyses for Benmor Estates Improvement and Service District (ISD) and Antelope Valley ISD. Appropriation: \$250,000.

Gillette Regional Connections II: This includes water system analyses for Peo-

ples ISD, South Fork Estates ISD, and Freedom Hills ISD. Appropriation: \$250,000.

Greybull Valley Hydropower: This examines hydropower potential at two of GVID's reservoirs. Appropriation: \$85,000.

Indian Paintbrush Water Supply: This study examines system improvements with a groundwater exploration component. Appropriation: \$375,000.

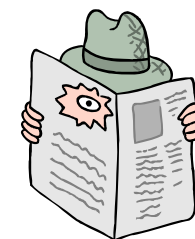
Weather Modification Pilot Program: This funds the final two years of the ongoing Weather Modification Pilot Program. Appropriation: \$2,400,000.

Level II Feasibility Studies -- Rehabilitation

Austin Wall Canals: This funds the next phase of work on the Austin Wall Canals

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News from the Water Resources Data System



Online Maps and Climate Data Tools from WRDS

As more and more municipalities, irrigation districts, and other water-related entities begin to use the World Wide Web, WRDS and the State Climate Office have taken the opportunity to make water and climate data available using customized Google Map services. Customized Google Map applications allow users to examine numerous aspects of

Wyoming water and climate simultaneously, and this approach provides "one-stop shopping" for access to important sources of data and information.

The PRISM Climate Data Server (www.wrds.uwyo.edu/sco/data/PRISM/PRISM.html), a web-mapping application, uses modeled GIS climate data in a Google Map platform to provide key climate datasets. Capitalizing on the success of previous online mapping efforts, i.e. the Wyoming Water and Climate Map Server, WRDS has developed this new climate data retrieval tool that allows the user to zoom into specific areas of interest to get

PRISM climate data.

PRISM climate data, provided by the PRISM Group at Oregon State University (<http://prism.oregonstate.edu>), uses point measurements of precipitation, temperature, and other climate parameters to produce continuous, digital grid estimates of monthly, yearly, and event-based climate parameters from 1895 through 2010. Using a routine to query a specific PRISM raster cell, this web-mapping tool allows users to retrieve monthly and annual climate data for mean, maximum, and minimum temperature as well as precipitation for any point in Wyoming from 1895 to

2010. These data are returned to a user in a separate browser window in a text format that can be copied to a user-preferred database or spreadsheet. Graphs of annual and monthly data may also be viewed for each parameter.

While the Snake/Salt River Basin Consumptive Use Model is currently being developed with these climatological data, it is WRDS hope that this climate data server will also be of use to multiple stakeholders. From hydrologic modelers to local irrigators, and conservation districts understanding long-term climate variability at a specific point should prove to be a useful tool-set.