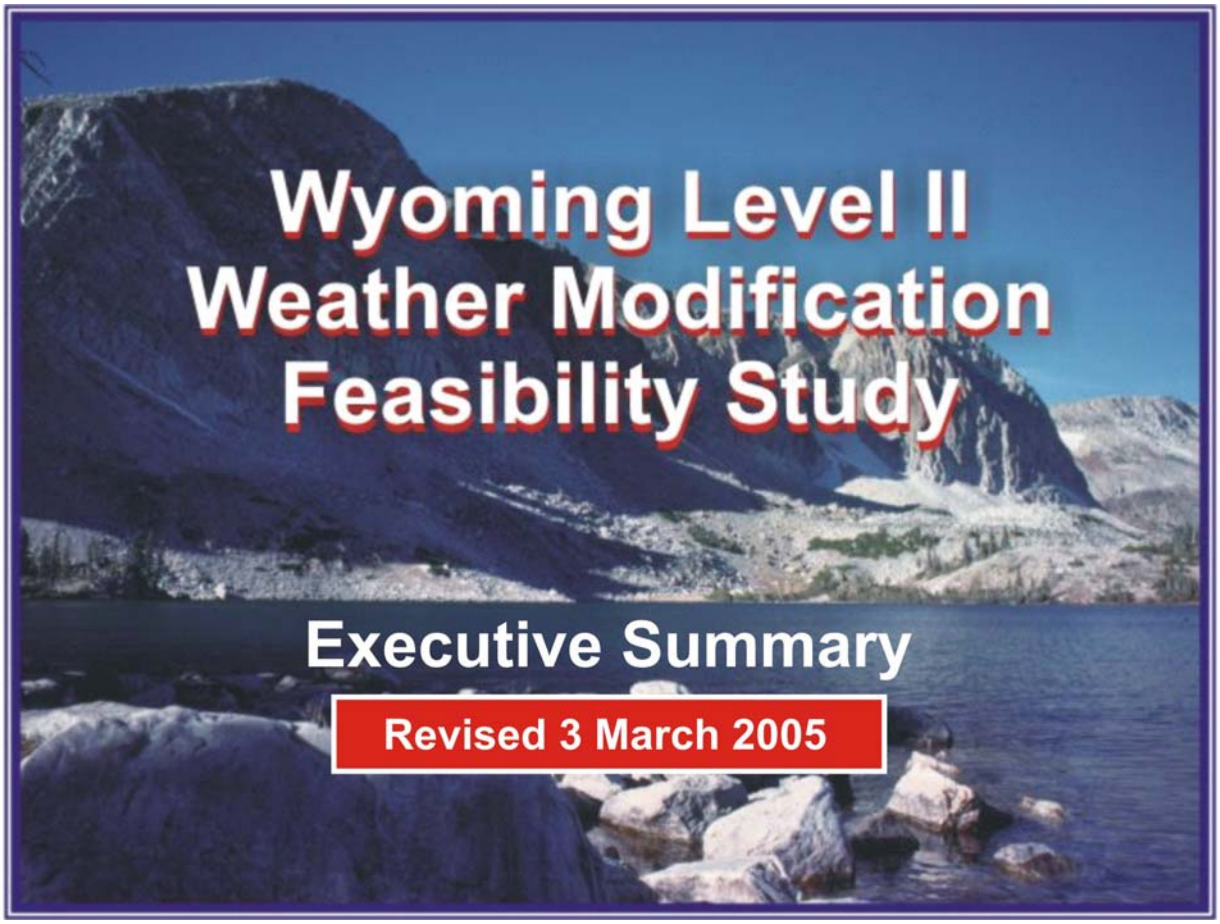
Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission (http://wwdc.state.wy.us)



Prepared by

Weather Modification, Inc.
3802 20th Street North
Fargo, ND 58102
701.235.5500 tel
701.235.9717 fax
www.weathermod.com

for the

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002
307.777.7626 tel
307.777.6819 fax
wwdc.state.wy.us

3 March 2005

BACKGROUND

This Executive Summary has been updated to reflect estimates of program benefits based on all streamflows originating within the proposed target areas. Previous estimates had inadvertently excluded a significant number of gaged flows, which are now included. In addition, current estimates assume only 80% of the additional snowpack will contribute to runoff, whereas previous estimates did not account for this reduction.

In the spring of 2004, the Wyoming Water Development Commission (WWDC) issued a request for proposals for a Level II Weather Modification Feasibility Study. After a competitive screening process, the WWDC awarded the study to Weather Modification, Inc. (WMI) of Fargo, North Dakota. To complete essential modeling work, WMI subcontracted with the National Center for Atmospheric Research (NCAR), in Boulder, Colorado. The RFP required the study of two possible target areas within the State of Wyoming: the Wind River Mountains in west-central Wyoming, and the Medicine Bow and Sierra Madre Mountains in the southeast.

The feasibility study enumerated 15 specific tasks listed below:

1. Scoping and project meetings
2. The review of related data previously collected in Wyoming and/or relevant to Wyoming
3. Study of the climatology of the proposed target areas
4. Preliminary project design
5. Establishment of operations criteria
6. Summary of environmental and legal issues
7. Permitting and reporting requirements
8. Site access and easements
9. Evaluation methodology
10. Potential benefit and hydrologic assessment
11. Cost estimates
12. Preliminary benefit-to-cost analysis
13. Reports and executive summaries
14. Presentations and public hearings
15. Monitoring of study areas

The notification to proceed was given to WMI by the WWDC on 26 June 2004. Scientists within the Research Application Laboratory (RAL) at NCAR assisted with the modeling of the complex terrain, and also with the development of the preliminary project design, the evaluation methodology and assessment of the potential benefits and hydrology. Since that time, work has been ongoing.

The balance of this Executive Summary summarizes the findings of this Level II study, and provides general recommendations as to how such a project should be structured and operated. The complete feasibility study provides much greater detail with regard to all of these tasks and was completed in early February 2005. Copies were distributed to all Commissioners, and the study is available to other interested parties from the WWDC web site.

PROGRAM OVERVIEW

This pilot program, as defined, would be conducted for five winter seasons and would treat clouds with a silver-iodide-based seeding agent to increase snowpack in the Wind River and Medicine Bow-Sierra Madre Ranges. Seeding would be conducted with ground-based and airborne facilities. It is estimated that snowpack would be increased by a minimum of ten percent, and quite possibly twenty percent, based on the findings from other recent programs whose evaluations have been published in the reviewed scientific literature.

Evaluation would be double-faceted: effects upon precipitation would be assessed, and physical measurements of cloud processes within both natural and seeded clouds would be made. Advanced numerical (computer) modeling would be included to select optimum seeding sites, predict which seeding facilities should be used in each storm, and to enable detailed analysis of program effects.

Total projected cost for the five-year program is $8.825 million, for an annual cost of $1.765 million. Conservative estimates of projected benefits range from a minimum of 223,000 to 446,000 acre-feet per season. Cost per acre-foot is estimated to be a maximum of $7.91, to a minimum of $3.96 per acre-foot. The value of the additional water thus generated is conservatively estimated to range from $4.2 million to $8.3 million per season, *however these estimates do not include any benefits that might be realized though increased hydro-electric power generation, improved recreation and fisheries, tourism, slowing the melting of glaciers, improved water quality and conditions for certain endangered species, or by meeting downstream water requirements*.

Value of the additional water generated is estimated to range from $10-$12 per acre-foot for agricultural uses, and from $75-$100 per acre-foot for municipal and industrial uses. However, water demand, and thus values are constantly increasing. According to Ed Harvey, Inc., an economic consulting firm that has contributed significantly to Wyoming river basin planning, the City of Fort Collins is presently paying $400 per acre-foot for water rights to satisfy its municipal demands, and in some industrial applications the value is know to be up to $5,000 per acre foot. The above-mentioned estimated benefits reflect only the current, conservative values, however.

WYOMING CLOUD SEEDING HISTORY

Wyoming has a rich history of cloud seeding and cloud physics research. Efforts began in the 1970s under the auspices of the Natural Resources Research Institute (NRRI) at the University of Wyoming (UW) in Laramie. The atmospheric science sub-group of NRRI later “spun off” and became the UW Department of Atmospheric Science, which remains today as part of the College of Engineering.

Considerable effort was spent in literature review, not only in the published, refereed publications such as the journals of the American Meteorological Society, but also reports, theses, and dissertations produced at the University of Wyoming (UW) Department of Atmospheric Science (DAS). The results of this review are summarized in the full feasibility study, and the study itself builds on the work previously done by the University. Complete references are also provided therein, so that anyone wishing to review in detail the sources cited can do so.

A significant focal point of the UW DAS research has been the research laboratory located atop Elk Mountain just south of I-80 on the north end of the Medicine Bow Range. Much has been learned through the research at Elk Mountain. The primary conclusion to be drawn from this research is that many orographic clouds develop and persist over Wyoming mountains for extended periods during the winter months, often without significant precipitation. These "cap clouds" contain significant amounts of "supercooled" liquid water (SLW) that, if frozen by artificial means (cloud seeding) could readily grow to precipitation sizes and be made to contribute to the snowpack. If not converted to ice naturally, this SLW is transported by the wind flow to the lee side of the mountains, where the air descends and warms, evaporating the cloud. It is therefore possible to convert this unprecipitated water to ice through seeding, thus augmenting the mountain snowpack. Over the course of a winter season, evidence suggests that natural precipitation could be increased by a minimum of ten percent, and perhaps more than twenty percent. A research program that treated similar clouds in southwestern Montana in the 1980s shows strong physical and statistical evidence of a 15% increase using only ground-based seeding. The UW research eventually led to the design and implementation of an operational cloud seeding program for the Eden Valley Irrigation District (Farson), which is still in operation today. The proposed project will incorporate the existing Eden Valley seeding facilities, located on the southern end of the Wind River Mountains, in its final design.

THE PROPOSED TARGET AREAS

The WWDC directed that two areas be closely examined for potential cloud seeding programs. These two areas are the Wind River Mountains of west-central Wyoming, and the Medicine Bow and Sierra Madre Mountains of southeastern Wyoming.

The Medicine Bow-Sierra Madre target lies within the Medicine Bow National Forest. While some wildernesses are located in the area, all are relatively small, and it is believe that there should be no need to site any equipment within any of them (see Figure 1). Present plans are to target only snowfall for Wyoming (not Colorado), so there is no present need to consider effects within the Routt National Forest, which extends southward from the Medicine Bow National Forest into Colorado. Colorado water interests have informally expressed an interest on possible future collaboration in the Routt National Forest, but this is not part of the present proposal.

Much of the land surrounding the Medicine Bow National Forest is privately owned, with a lesser fraction being managed by the Bureau of Land Management (BLM) or the State of Wyoming. All land within national forests is managed by the USDA Forest Service. It is therefore essential that the Forest Service and the BLM be involved with program planning from the outset. Both agencies are well aware of the potential program, and have had representatives at project informational meetings.

Figure 1. Wilderness areas within the State of Wyoming are shown by the green boundaries. The Medicine Bow-Sierra Madre target area includes the Encampment River, Huston Park, Platte River, and Savage Run Wildernesses. The Wind River target area include three much larger wilderness areas: the Bridger, the Fitzpatrick, and the Popo Agie. Other wilderness areas to the north and west do not lie within the proposed target areas.

The Wind River target area lies within the Bridger-Teton National Forest and the Shoshone National Forest. All three of the wilderness areas in the Wind Rivers are of significant size (see again Figure 1). In addition, a significant fraction of the eastern slope of the Wind Rivers lies within the Wind River Indian Reservation, and so access there must be coordinated with the tribes. WWDC and WMI staff have met with the Joint Tribal Water Board (1 September 2004), they are aware of the program and have informally indicated their interest in the project. Like the Medicine Bow National Forest, much of the surrounding land is privately owned with a significant fraction being managed by the Bureau of Land Management (BLM) and a lesser fraction by the State of Wyoming.

Wilderness areas are closed to mechanized vehicles throughout the year, and siting of any equipment within them is subject to strict regulation. The WWDC has engaged U.S. Forest Service Liaison to the State, Ms. Jane Darnell, to coordinate activities and decisions among the three National Forests involved. The Forest Service has indicated that ultimately it is their intention to have a unified approach to the proposed project in all three national forests, which will be very helpful. Nevertheless, initial plans are to avoid siting equipment within wilderness areas.

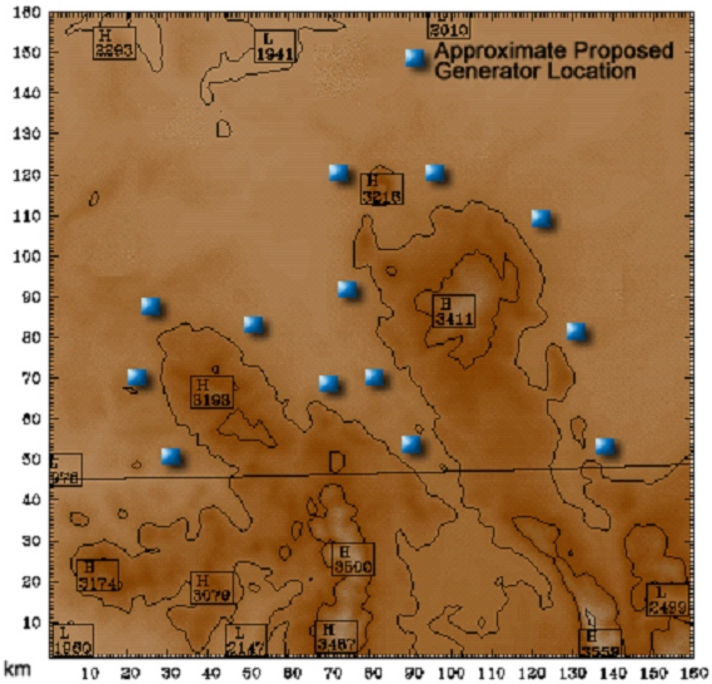


***Figure 2.** Approximate positions are shown for ground based seeding generators near the Medicine Bow and Sierra Madre Mountains, based upon the transport and dispersion of seeding agent and the locations of supercooled liquid water predicted by the Weather Research and Forecasting model (WRF), employed by NCAR in this study. Positions shown are conceptual and will be adjusted according to the findings of future model runs in a greater variety of weather conditions.*

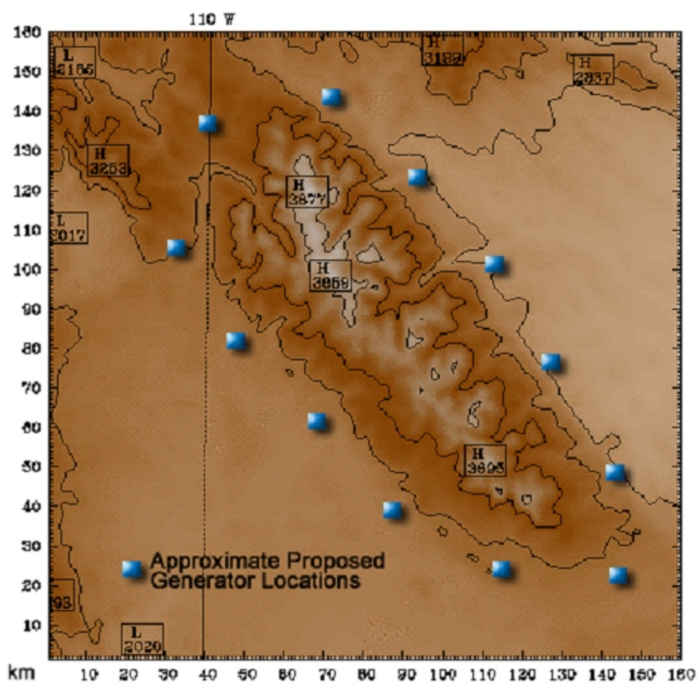


***Figure 3.** Approximate positions are shown for ground based seeding generators around the Wind River target area. As in Figure 2, positions shown are conceptual and will be adjusted according to the findings of future model runs in a greater variety of weather conditions.*

POTENTIAL OPPORTUNITIES FOR EFFECTIVE SEEDING

Review of Figures 2 and 3 show that the target areas should be surrounded by ground-based facilities to the maximum extent possible. This is because significant snowfalls can occur over both targets in both westerly and easterly flow. Thus to target effectively in westerly flow, one needs sites west of the targets, and for easterly flow, east of the targets. The reader should note that in any given weather conditions, only a fraction of the generators would be needed, perhaps up to half a dozen per target area. Thus, all generators would never be operated at the same time.

The *Wyoming Climate Atlas* (2004) by Curtis and Grimes, has proven to be an excellent resource for this study. While available in book form, it is also available on electronic media and on-line at http://www.wrds.uwyo.edu/wrds/wsc/climateatlas/. Long-term 30-year climatic averages for frequency of snowfall events and total seasonal snowfall both indicate that there should be no shortage of opportunities to treat (seed) suitable clouds. Typically, between 200 and 250 inches of snow falls each season in each target, slightly more in the Wind Rivers than in the Medicine Bow-Sierra Madre Ranges. In addition, there are typically 50 to 80 days per season having snowfall events greater than 1 inch in depth, primarily between November and April.

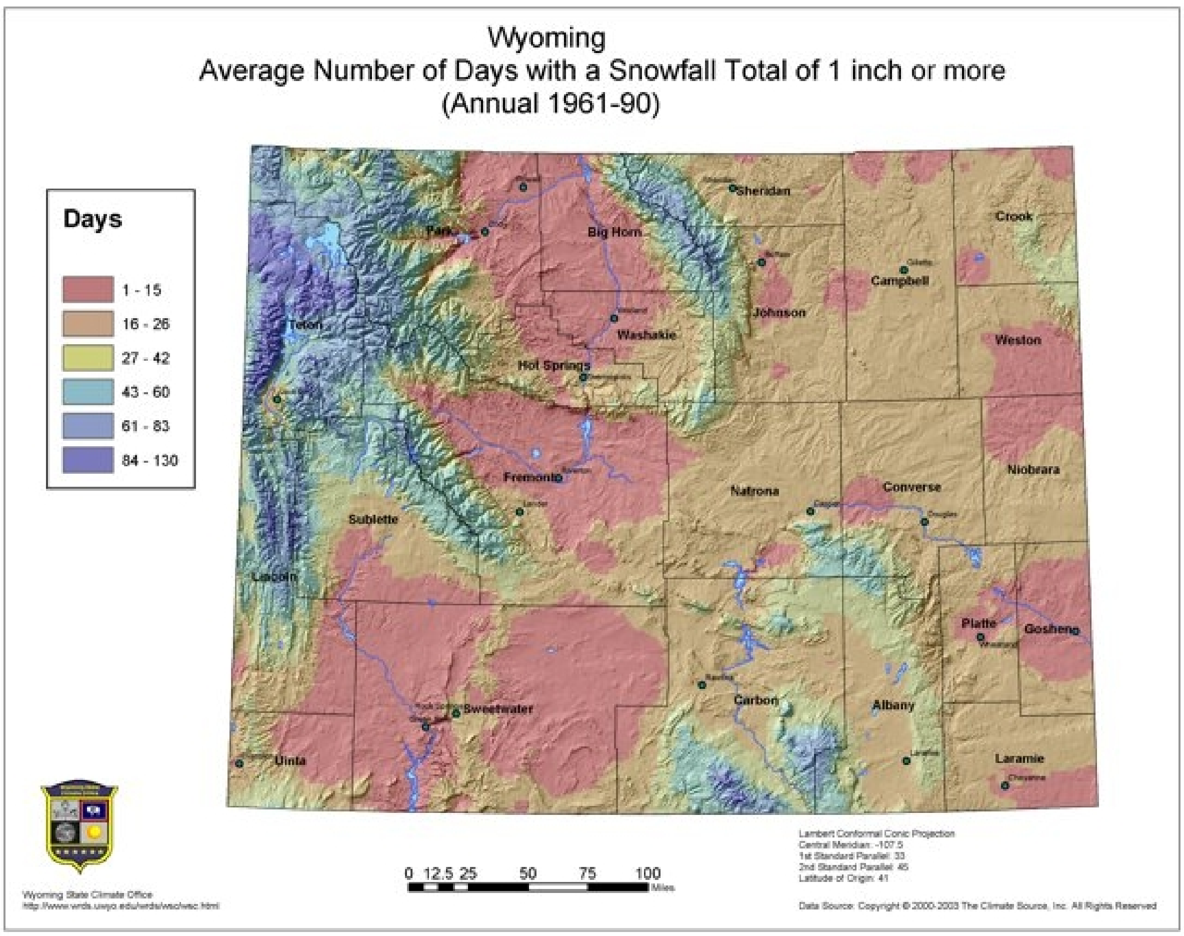


Figure 4. Average number of days with snowfall of one inch or greater in Wyoming, from the Wyoming Climate Atlas by Curtis and Grimes (2004). Used by permission.

HOW WINTER OROGRAPHIC CLOUD SEEDING WORKS

Cloud seeding in wintertime is one of the most proven cloud seeding technologies. The American Meteorological Society maintains that credible evidence exists for 10% seasonal increases in snow water content in well-designed and well-run programs. Recent publications in the reviewed scientific literature suggest seasonal increases from 15% to 20%. ***The project closest to the proposed Wyoming target areas, the Bridger Range Experiment (SW Montana) showed increases of 15%. The Hydro Tasmania winter orographic program has realized increases on the order of 20%.***

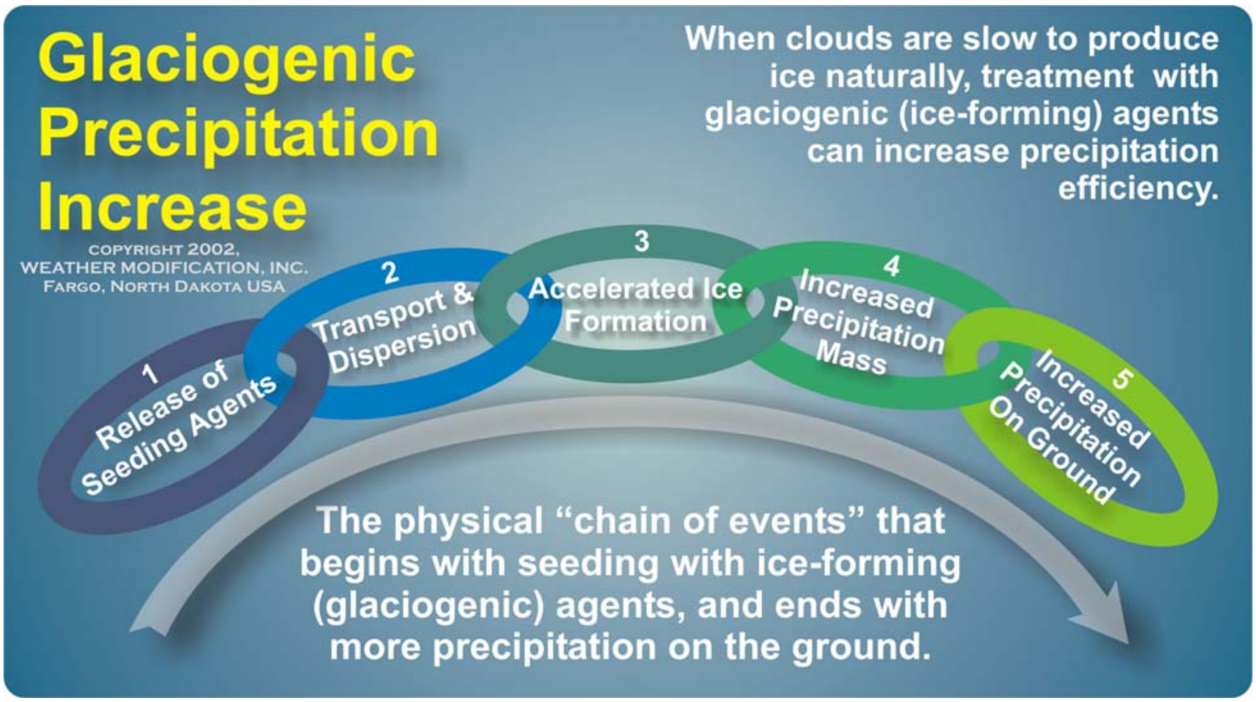


Figure 5. The seeding agent of preference for snowpack augmentation programs is primarily silver iodide, coupled with trace amounts of common salts that serve to accelerate how quickly the seeding agent will form the desired cloud ice crystals. The process begins with the release of seeding agents (1) from the ground or from aircraft. The seeding agent is then transported and dispersed by the winds (2) into the target cloud over the mountain. When the seeding agent encounters unfrozen water droplets, it quickly freezes them, (3) and within perhaps five minutes they grow large enough to begin to fall. The cloud thus has a net increase in precipitation mass (4), which leads to increased precipitation at the surface (5).

For a program to be successful, it is essential that seeding agent reach the supercooled cloud while the cloud is still over high terrain, so that snow has time to form and precipitate, contributing to the snowpack. This requires that seeding needs to begin upwind of the high terrain, at elevations high enough to be exposed to winds blowing over the mountains, rather than in the quasi-stagnant air in the valleys. Seeding from aircraft allows targeting of supercooled liquid water produced well above the mountain crest line, by a flow phenomenon known as "gravity waves". These zones of supercooled water are much too high to be effectively targeted by any ground-based seeding efforts, yet the quantity of supercooled water usually significantly exceeds that found in the lower levels. Seeding by aircraft is the only way to consistently treat gravity waves. Aircraft would also be used to seed certain mountain "cap clouds" and also cold convective towers (cumulus) during the spring and fall.

THE PROGRAM COMPONENTS

The proposed cloud seeding program consists of the following components:

Remote-controlled, ground-based seeding generators. The program proposes the deployment of state-of-the-science ground-based cloud seeding generators around the perimeters of both target areas (see again Figures 2, 3). The proposed generators would be leased from the contractor. Siting, maintenance, sensor calibration, communications, and resupply of these generators would be the responsibility of the contractor. Siting at or above elevations where temperature inversions might trap the seeding agent in low levels (as is often seen with smoke emitted from valley homes) necessitates that the generators be fully remote-controlled, and capable of real-time telemetry of generator status to the operations center. Parameters included in the data stream should include: site temperature, humidity, flame temperature, and seeding solution flow rate. Wind data are also desirable. Real-time telemetry will confirm proper generator operation, and enable generators to be turned on and off as needed as winds change. Recommended mode of communication is through satellite telephone, as cellular phone service will not be sufficiently reliable in most locations. It is anticipated that many if not most sites will be in remote locations, removed from commercial electrical power and far from roadways. ***Thus, full remote control and monitoring of generator performance is highly desirable***. Manually-controlled generators are a scientifically-viable option for this program only in areas where they can be sited such that valley inversions will not often prevent the dispersion of their plumes into the targeted clouds over the mountains. Such examples are the sites of the Eden Valley Irrigation District generators, which are on the gently-sloping south end of the Wind River Range. A comparison of the advantages and disadvantages of both generator types is provided in the full feasibility study.

High-performance seeding aircraft. Seeding supercooled wintertime clouds requires flight in known aircraft icing conditions. Unlike California or other warmer climes, in Wyoming most storms will be cold enough that descent to warmer temperatures to melt ice from the airframe will not be an option. Therefore, the seeding aircraft has to be fully deiced, certified for flight in known icing, and have enough excess power to carry large accumulations of ice. The same aircraft is also proposed to carry a full suite of cloud physics instrumentation; therefore, the aircraft must also be able to safely transport the additional weight of the data system and instrumentation, and also provide the needed electrical power. At a minimum this mandates the use of a twin-engine turboprop (prop-jet) aircraft. Piston-engine aircraft lack the performance to provide the safety

margin required for sustained operations in supercooled winter orographic clouds. ***If aircraft seeding is not included, a significant number of opportunities will not be targetable by ground-based means***.

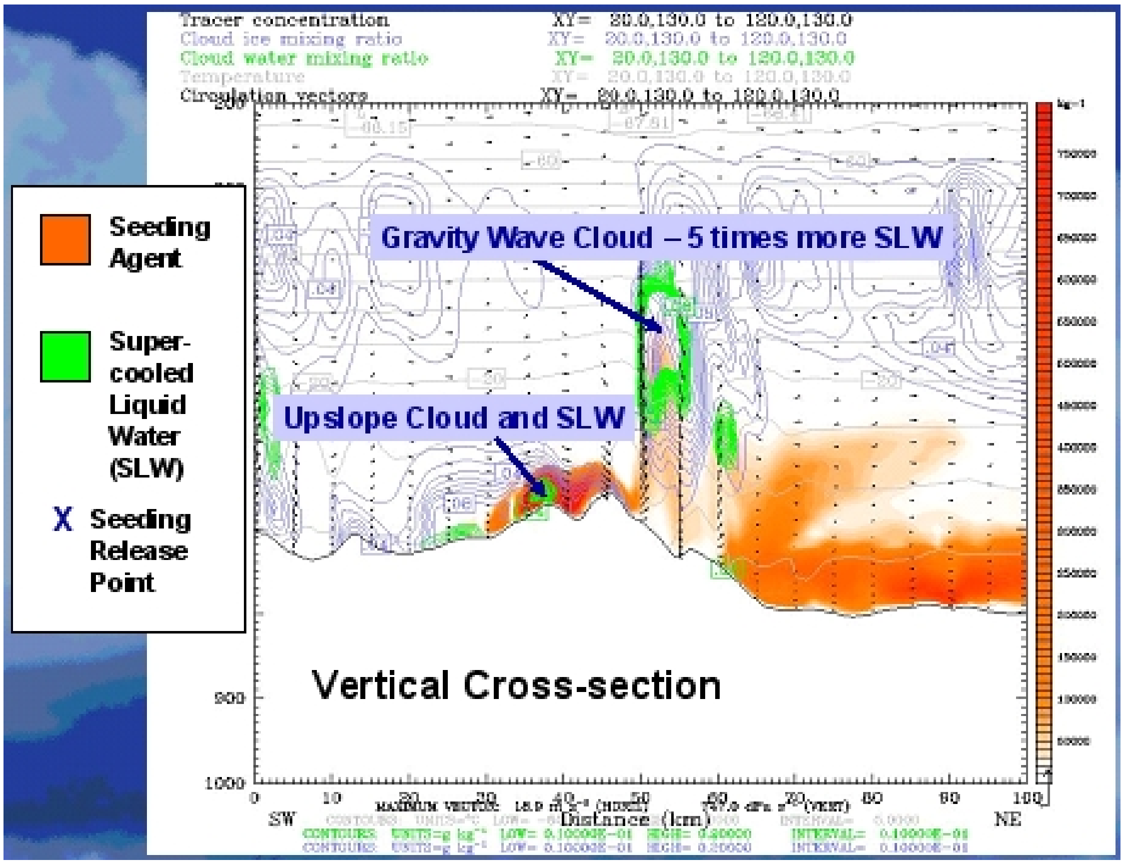


Figure 6. A west-to-east (left-to-right) vertical cross section through the Wind River Mountains is depicted in this output from the WRF model, for a storm observed on 7 February 2004. In this graphic, the location and concentration of surface-released seeding agent is orange, and supercooled cloud water is shown in green. The clouds are correctly targeted when the orange and green coincide. The higher-altitude supercooled liquid water (the "gravity wave cloud") is too high to be effectively targeted from the surface, thus the need for airborne seeding. (Graphic produced by T. Jensen, Research Applications Laboratory, National Center for Atmospheric Research.)

<u>Numerical (computer) cloud, precipitation, and dispersion modeling</u>. The feasibility study that in large part defined this proposed project made use of the Weather Research and Forecasting (WRF) numerical model. Within the next few years, this model will become a mainstay in the National Weather Service forecasting toolbox. In the configuration used for this study, and proposed for use in the actual seeding program and subsequent evaluation, grid spacing down to 1 km (0.6 mi) resolution was used and should be used, to resolve the very complex mountainous terrain to the maximum extent possible. This is illustrated in Figure 6. ***This model, developed and applied by NCAR, offers more precise weather prediction and seeding agent targeting (guidance) than any other.*** This model is needed to determine the optimum ground-based seeding sites. A numerical model of this resolution and complexity is essential for evaluation as well, as with it definition of the area(s) seeded will be possible on a

day-by-day basis, presuming that all seeding operations are fully documented and verified. Lesser models may be easier to run, but cannot provide the detail needed for precise targeting and post-hoc definition of seeded area(s) on a daily basis.

Measurement of characteristics of the subject clouds, and their response to seeding. This proposal includes the use of microphysical instrumentation that measures the sizes and numbers of cloud droplets, the sizes shapes, and number of ice crystals, the sizes and numbers of atmospheric aerosols (that determine many of the cloud characteristics), cloud liquid water content, temperature, pressure, and dew point temperature (humidity). ***This instrumentation is essential, especially during the initial project seasons, in order that the characteristics of the clouds before and after seeding be fully documented.*** Without this instrumentation, little will be known of the actual cloud properties, and the effects of seeding efforts accordingly will be more difficult to understand. The instrumentation will be especially useful as the program is fine-tuned (optimized) during its first few seasons.

Upper air measurements by instrumented weather balloons. The proposed program includes atmospheric soundings to supplement those made twice daily by the National Weather Service (NWS) in Riverton. ***The soundings will be used to obtain vertical profiles of temperature, humidity, and wind that in turn would be input into the numerical model***. These soundings could be made whenever meteorological conditions warranted. Typically, this would be in pre-storm and storm conditions. The NWS soundings from Riverton, also used as model input, are made twice daily, but always at pre-established times, in the early morning and early evening, regardless of storm conditions.

Measurement of atmospheric water vapor and liquid water content by radiometer. The microwave radiometer proposed is a passive instrument that measures the absorption of incoming radiation by water vapor and liquid water. The device is steerable, meaning it can be pointed at clouds of interest. ***Its use has been proposed for this program because it can quickly identify cloud volumes containing liquid water, which could then be immediately targeted by the appropriate means.*** In most cases, the radiometer will identify liquid in the higher portions of the clouds where seeding by aircraft will be most effective. ***It will also be used to verify the existence of liquid water predicted by the WRF numerical model.***

Evaluation through statistical analysis of precipitation. The most common means of evaluating cloud seeding programs is to examine precipitation recorded at the surface, and to compare the amounts observed in the target area with those observed in nearby "control" areas that are ostensibly never seeded. Comparisons are generally made on a seasonal basis, that is, once at the conclusion of the winter precipitation season. With the use of the WRF model in this program, it will be possible to identify which areas were actually seeded on a day-by-day basis so that evaluation can be done in much greater detail and more often. ***Without the WRF model or another of similar capability, this level of analysis will not be possible, and indications of program efficacy could be determined only seasonally, never on a storm-by-storm basis.*** This evaluation can easily be extended to areas beyond the intended targets to assess extra-area impacts upon precipitation. Such extra-area evaluation is included in the present program plan.

Evaluation through the detailed analysis of physical measurements of the clouds and their response to seeding. The aircraft instrumentation proposed for in-cloud sampling of cloud microphysical characteristics will allow documentation of the chain of events, from release of the seeding agent to ice formation to the development of precipitation. These airborne measurements could be augmented to some degree by those made by a ground-based radiometer. Physical measurements that document the chain of events in cloud, and show that chain of events to be consistent with the cloud seeding methods used will greatly strengthen the credibility of the evaluation. ***Without them, documentation of cloud processes and responses to seeding cannot be assessed.*** It may be necessary to make detailed microphysical measurements for the first few seasons, however. Because this is yet undetermined, the present budget includes the microphysical aircraft instrumentation for all five seasons.

Trace chemistry analysis of snowpack to verify correct targeting. Chemical analysis of the snowpack for silver content will provide another means to verify the WRF model targeting predictions, and will further strengthen the statistical evaluation of the program. It will also be of interest from the environmental standpoint, for although numerous programs have found no deleterious environmental impacts from silver-based seeding agents, ***such trace chemistry analysis will also serve as a check on these previous conclusions. The extent to which the seeding agent travels beyond the intended targets can also be determined***.

Reporting. The present program budget also includes all permit application costs, full seasonal reporting of seeding activities, as well as the completion of a final report at the conclusion of the program. Reporting to the Wyoming State Engineer's Office (the authorizing authority in Wyoming) is required, as well as to the National Ocean and Atmospheric Administration (NOAA).

SUMMARY

Present cloud seeding technology is not a "drought-busting" tool, but should be viewed as a long-term water management tool. It works best in normal or near-normal weather conditions, by improving soil moisture, stream flows, and by helping fill reservoirs. This may reduce groundwater mining, and will improve water supplies for municipalities, industry, and irrigation. The additional water can be stored in existing reservoirs, and would help fill new ones. Recreational opportunities (e.g. boating, fishing) will be enhanced. Increased hydroelectric power generation potential will result. Increased stream and river flows may aid recovery of certain endangered species, and may improve overall water quality in some locations.

The proposed program would be comprehensive, state-of-the-science, and recommends comprehensive independent evaluation of both statistical results and physical measurements. Assessment of environmental and extra-area (downwind) effects is included.

This program, if funded, would be consistent with recent recommendations made by the National Research Council of the National Academy of Sciences to the National Oceanic and Atmospheric Administration, which recommended that current technologies should be engaged to strengthen the scientific basis for operational weather modification programs, and confirm their efficacy.

The affected state, federal, and tribal agencies have been engaged in the process, and will continue to be involved if a program is implemented.

The pilot program is recommended to continue for a period of five years because natural variability is great, and it is felt that the program should be conducted for at least five years to allow the technology to be fully demonstrated in a range of climatic conditions.

Runoff Source	***Mean Annual Runoff (acre-feet)***	***Project Yield if 10% Increase***	***Estimated Economic Value***
Wind Rivers	1,676,477	134,118	$2,501,303
Medicine Bow-Sierra Madres	1,112,844	89,028	$1,660,363
Estimated Totals:	2,789,321	223,146	$4,161,667
Project Cost:			$1,765,000
Benefit:Cost Ratio			2.36

Table 1. Conservative estimates of the economic return if a 10% increase in snow water content is achieved with 80% runoff of the additional snow. The estimated economic value does not include any benefits that would be realized though increased hydro-electric power generation, improved recreation and fisheries, tourism, slowing the melting of glaciers, improved water quality and conditions for certain endangered species, or by meeting downstream water requirements.

The project annual cost of $1.765 million is exceeded by about $2,400,000 in benefits (136%), in the most conservative estimates. These estimates include only the value of water produced if utilized by agriculture, municipalities, and industry, and do not include any benefits that might be realized though increased hydro-electric power generation, improved recreation and fisheries, tourism, slowing the melting of glaciers, improved water quality and conditions for certain endangered species, or by meeting downstream water requirements.

Additional scenarios for greater increases in precipitation are provided in the complete feasibility study. For example, a 16% increase in runoff is expected to result in a benefit-to-cost ratio of 4.7 to 1, again, without including the additional benefits listed in the previous paragraph.

For comprehensive details, a complete listing of the scientific literature cited, and a glossary of terms and acronyms, the reader is referred to the complete feasibility study.

Project cost estimates are detailed on the following page.

WYOMING LEVEL II FEASIBILITY STUDY PROGRAM BUDGET NOVEMBER 15 THROUGH MARCH 31 FIVE-YEAR PROGRAM COMBINED COMPREHENSIVE PROGRAM		
	One Time Budget	Annual Budget
ENVIRONMENTAL, PERMITS AND EASEMENTS		
2 Environmental Assessments (if necessary)	$100,000	
Permits	$4,000	
Landowner Easements	$2,000	
DATA MODELING SYSTEM		
Computer Bank for Real-Time Data Modeling (annual lease)		$50,600
Annual Model Implementation and Maintenance		$50,000
STATISTICAL EVALUATION		$100,000
MODELING – CLOUD AND PRECIPITATION FORMATION		$60,000
NCAR SOFTWARE (TITAN/CIDD/REC) FOR RADAR UPGRADE (annual lease)		$38,000
RADIOMETER (annual lease)		$50,600
VAISALA WEATHER BALLOON SYSTEM WITH DAILY LAUNCH (includes annual lease and daily launch costs)		$58,050
SEEDING AND RESEARCH EQUIPMENT		
1 Propjet Research Aircraft with Cloud Seeding		$488,704
Complete Cloud Physics Research Package		
20 Flight Hours per month total		
Configured for Cloud Base and Cloud Top Seeding		
Qty. 3,000 20-gram Ejectable Flares		
Qty. 1,500 150-gram Burn-in-Place Flares		
All Fuel, oil, maintenance, parts and insurance		
24 Remote-Control Ground-Based Ice Nuclei Generators		$277,619
4 Meteorological Stations		
100 gallons Seeding Agent per Generator for the season		
PERSONNEL – FIELD PROGRAM		$444,452
1 Program Manager Meteorologist		
1 Propjet Captain		
1 First Officer		
1 Assistant Meteorologist		
2 Data System/Ground Generator Technicians		
TIME FRAME FIELD PROGRAM		
November 15 through March 31		
TOTALS	**$106,000**	**$1,618,025**
FOR EACH YEAR AFTER YEAR ONE, INCLUDE A 3% COST INCREASE		