North Dakota Atmospheric Resource Board
Video/Audio Conference Call Meeting
1:30 p.m. CDT, Tuesday, April 29, 2025

Connection information is on page 2.

AGENDA

1. Call to order, Roll Call

2. ***Approval of Minutes: November 12, 2024*** (attachment)

3. Financial Status Report: March 31, 2025 (attachment) (Kelli)

4. ***2025 NDCMP Permit Applications*** (Darin)
   a. ***Public Comment*** (attachment)
   b. ***Weather Modification LLC - NDCMP District 1*** (attachment)

5. North Dakota Cloud Modification Project
   a. 2025 Budget (attachment) (Darin)
   b. County contracts (Darin)
   c. Staffing (Mark and Kelli)
   d. Seeding agent and supplies procurement (Mark)

6. ARB Cooperative Observer Network (ARBCON) Report (Dan)
   a. Growing season rainfall totals and grid maps
   b. Pushing Remote Sensors (PReSens) – 2025 site deployment

7. Legislative Updates (Darin)

8. Adjourn

Bold, italicized items require Board action.

Microsoft Teams meeting

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MINUTES - NORTH DAKOTA ATMOSPHERIC RESOURCE BOARD

NOVEMBER 12, 2024

Chairman Christopher Theisen called a meeting of the Atmospheric Resource Board (ARB) to order at 1:32 p.m., November 12, 2024.

ROLL CALL

Roll call was taken. Members present were Christopher Theisen, District IV; Steve Kemp, District I; Gail Yuly, District II; David Monson, District III; Jessica Magilke, District VI; Thomas Burke, District VII; Abby Ebach for Dr. Andrea Travnicek, Department of Water Resources (DWR); Kyle Wanner, North Dakota Aeronautics Commission; and Rebekah Pfaff, North Dakota Department of Environmental Quality.

Others present were Darin Langerud, Director; Kelli Schroeder, Program Manager; Mark Schneider, Chief Meteorologist; Daniel Brothers, Meteorologist; Jody Fischer and Kirk Hamilton, Weather Modification International (WMI) and one member of the public online.

MINUTES

IT WAS MOVED BY MRS. YULY, SECONDED BY MR. WANNER, AND CARRIED ON A VOICE VOTE TO APPROVE THE MINUTES OF THE APRIL 24, 2024, MEETING AS DISTRIBUTED.

FINANCIAL STATUS REPORT

Ms. Schroeder reviewed the financial status report for the period ending September 30, 2024.

In response to a question, Mr. Langerud noted that county funds we received used to come from property taxes as North Dakota Century Code allowed weather modification authorities to levy up to 7 mills. In the 2015 legislative session, tax code was overhauled for many entities. With those changes, weather modification funds must now come from the county general funds.

REVIEW OF THE 2024 NORTH DAKOTA CLOUD MODIFICATION PROJECT (NDCMP)

Project Overview

Mr. Langerud reviewed operations of the 2024 NDCMP, including extension through September 8 for Williams and Mountrail Counties. Williams and Mountrail Counties were on rain enhancement suspension for the entire project. This was not due to excess moisture but rather local feedback.

Mr. Langerud reported having guests from South Korea and Romania at Ground School in May. After Ground School, two of the South Koreans spent a couple weeks in Bowman observing operations and one was able to ride along on a cloud seeding flight. The Romanians are transitioning from seeding with rockets to aircraft and just took delivery of their first cloud seeding aircraft from WMI last month.

Cost Summary

Ms. Schroeder reviewed the cost report for the 2024 NDCMP. There were some budget overages in the areas of radar maintenance and parts category and the building, equipment, utility and insurance category. We purchased two TR tubes that were unplanned but inexpensive from a colleague in South Africa. We also purchased several LNAs for the radar as we went through a lot of them determining what parts were affected by the lightning strike last fall. Still, we expect to end the calendar year around $41,000 under budget.

In response to a question, Ms. Schroeder indicated that we will not see budget issues for the NDCMP related to employee fringe benefit costs as they do not qualify for the health insurance benefits and such. Mr. Langerud noted that our budget may be affected by changes that are expected related to Fair Labor Standards Act overtime exempt salary minimums.

In response to a question, Ms. Schroeder indicated that the insurance premiums were reported to have gone up 25%. Mr. Monson indicated that re-insurance costs are driving the premium increases.

In response to a question, Ms. Schroeder indicated that the Stanley and Bowman radars and buildings are covered under our Fire and Tornado policy. Our policy also includes our steel cargo containers we maintain for chemical storage in Stanley, Bowman and Bismarck, along with chemical supply at each field site.

In response to a question, Mr. Langerud indicated that we started the project this year with a healthy inventory of chemical.

Seeding Agent Usage / Inventory

Mr. Schneider reviewed the ending chemical inventory and usage for the 2024 NDCMP.

Mr. Langerud mentioned that the amount of chemical used was also affected by Williams County and Mountrail County operating on rain enhancement suspension.

Generator Performance

Mr. Schneider reviewed generator performance statistics – a percentage of generator failure versus hours of generator usage. In 2024, generators had a 2.06% failure rate. Our 10-year average generator failure rate is 2.27%. We attribute this low failure rate to WMI's training of pilots on burner maintenance.

Intern Programs

Mr. Schneider reported on hiring intern meteorologists for 2024 from Minnesota, Missouri and Oklahoma. Our Stanley radar meteorologist was here for his fourth year. He did a great job training the interns. Should any of these interns apply to return next summer, they should be well trained.

Ms. Schroeder reviewed the internship final report for the 2024 NDCMP. As of the end of the 2024 project, we have trained 412 intern co-pilots and 76 intern meteorologists. The intern co-pilots worked a total of 2,113.5 hours this year. The intern meteorologists worked 1,258 hours this year. Staff recommendations were also reviewed.

In response to a question, Mr. Langerud indicated that we have had no issues with airport operations. The airports have been good to work with.

In response to a question, Ms. Schroeder indicated that she attends the Student Aviation Management Association (SAMA) Career Fair yearly in the spring. She also attended the University of North Dakota (UND) Fall Career Fair in late September. Both fairs were successful and provided many contacts.

UND Weather Research and Forecasting (WRF) Numerical Modeling

Mr. Brothers reviewed the WRF numerical modeling effort agreement with UND. This effort supports numerical weather modeling in support of our forecasting operations for the NDCMP at a 3km resolution. He discussed the HAILCAST parameter that is run as part of this model, which forecasts potential hail size in thunderstorms.

Mr. Langerud noted that we are also running two different iterations of the model – one with standard microphysics and the other with Thompson microphysics. These different iterations are assessed, and we are provided with reports on which one does better in certain situations. This is an ongoing process to improve the model, overall.

In response to a question, Mr. Langerud noted that we have experimented with 1km resolution a few years ago. However, at the time, it didn't show any improvement in skill. Mr. Brothers indicated that this same discussion was held at a recent severe storms conference that he attended. They also found little skill improvement below 3km resolution.

Aircraft Operations

Mr. Langerud reviewed his memo to the board regarding liquidated damages recommendations. There were four cases reviewed with two penalties recommended (one half day plus one day) for a total of $3,929.73.

IT WAS MOVED BY MR. MONSON AND SECONDED BY MRS. PFAFF TO APPROVE THE DIRECTOR'S RECOMMENDATION RELATED TO LIQUIDATED DAMAGES AS PRESENTED. THE MOTION CARRIED UNANIMOUSLY.

Contractor's Final Report

Mr. Fischer briefed the board on operations this summer.

Ms. Schroeder indicated that the digital copy of the final report will be uploaded to our web site after the meeting. Paper copies will be mailed to the board as soon as we receive them.

IT WAS MOVED BY MR. BURKE AND SECONDED BY MR. MONSON TO ACCEPT THE CONTRACTOR'S FINAL REPORT AND APPROVE THE FINAL CONTRACT PAYMENT. THE MOTION CARRIED UNANIMOUSLY.

MOUNTRAIL COUNTY AND WILLIAMS COUNTY BALLOT MEASURES ON WEATHER MODIFICATION

Mr. Langerud reported that Mountrail County and Williams County had ballot measures on their general election ballots to abolish weather modification authority. Both measures passed, ending weather modification authority in their counties at the end of the calendar year. They will not be part of the NDCMP in 2025.

Logistics and future operations were discussed. Mr. Langerud noted that we will be meeting with the remaining counties early next year to discuss what they can provide for funding, what state cost-share will look like, and plan for the 2025 project.

In response to a question, Mr. Langerud noted there has been discussion in the past regarding insurance industry participation in the program. We received a lukewarm reception from the insurance industry. In the most recent evaluation of our program from Michigan State University, they stated that insurance companies in North Dakota are gaining revenue from this program by reduced losses without insurance industry participation.

In response to a question, Mr. Langerud noted that the primary concerns of those who started the petition included health concerns, perception of ineffectiveness, and cost. He thought cost was the lowest of those concerns and indicated that there have been dozens of studies that have looked at impacts of silver iodide in the environment. None of them have found any problem. Based on the amount of material we put out on this program in an average year, we would expect to find one tenth of one gram of silver iodide per acre per year.

ARB / NDCMP PUBLIC SURVEY AND LISTENING SESSIONS

Mrs. Ebach reported on the DWR's efforts, in collaboration with the North Dakota Weather Modification Association (NDWMA), towards a public survey and listening sessions regarding activities of the Atmospheric Resource division.

Discussion was held regarding the options for consideration that Dr. Travnicek outlined in her memo. Mrs. Ebach noted that the Department of Agriculture and Insurance Department are aware of these surveys and are open to discussions about collaboration.

Mr. Langerud called attention to the last three items included in the packet for this agenda item, which are public awareness items that have already been completed after the surveys.

Mr. Theisen summarized the board recommendation is to look at alternative ways to get the message out regarding this program and its benefits. Mr. Wanner suggested collaboration with the League of Cities or the ND Association of Counties.

ARB RESEARCH & EVALUATION PROGRAM

Hail Retrieval Algorithm (HRA) Assessment

Mr. Langerud reviewed the HRA Assessment project. Lynnlee Rosolino, a graduate student from UND, is using the HRA program and the Weather Research and Forecasting (WRF) model to run several seasons of NDCMP data for evaluating if there are any indications of hail suppression seeding effects in our project area versus areas nearby that are not in the project area. Both areas have cases of seeded versus unseeded storms. Ms. Rosolino is defending her thesis on this project this week. She reviewed 2016 through 2018. While there is not yet enough data to say definitively, indications are positive that seeded storms are having a lower size hail coming from them than unseeded storms, which is what we expect to see if seeding is working. Ms. Schroeder downloaded the data from the National Centers for Environmental Information. Mr. Brothers prepared the data to be evaluated and then sent the data to Ms. Rosolino for evaluation. Our staff is not involved in the evaluation.

Ms. Rosolino is planning on working towards her Ph.D. at UND. We are hopeful that, if she cannot help with further evaluation, another UND graduate student could carry on this evaluation adding on more years of data. Over time, we would like to get enough data to definitively show the effect of seeding on these hailstorms.

Mr. Langerud noted that, when we get our new radar in Bowman up and running, we will be able to adapt this process to using data from the Bowman radar for the Bowman operations area. Currently we are constricted to looking at the eastern half of the northern district due to proximity to the Minot radar.

WRF model enhancements through a Machine Learning Neural Network

Mr. Langerud updated the board on a new project with UND to do more to enhance the WRF model through a machine learning algorithm that UND will develop. The purpose is to improve the forecasting capability of the model by improving its forecasting of temperature and moisture in the lower layers of the atmosphere in the summertime. By using a machine learning process to integrate various data from various sources, they

will try to fine-tune those forecasts. In addition to this, we will be launching windsonde mini balloon sondes to validate the model sounding that is improved with the machine learning, so that we can get an idea of the air that is in place even after the enhancement. But the key is to try to better understand the moisture and temperature at those levels on a convective day to better determine when and where the storms will eventually form. This will help our forecasting opportunities.

WEATHER RADAR OPERATIONS

Mr. Langerud briefed the board on operations of the Stanley and Bowman radars.

In late 2023, the Stanley radar took a lightning strike which fried several components. In trying to solve the issue, other components were plugged in without success. A few low-noise amplifiers (LNAs) burned out in the process of troubleshooting. We had to order replacement LNAs, which are reflected in the NDCMP Cost Report.

Mr. Langerud reported on a contract with Vaisala for a new dual-polarization radar that the 2023 Legislature authorized. The radar is expected to be delivered to us sometime this winter. A radar tower vendor has been selected. We are hopeful they can start construction on the footings this fall. We expect the entire project to be completed by the end of June 2025. Once the new radar is running, we can decommission the old radar in Bowman.

Mr. Langerud also reported that eight counties in the Bowman area support running the radar in the NDCMP off-season. We will be contacting those counties in the next few weeks to contract for 2025.

ARB COOPERATIVE OBSERVER NETWORK (ARBCON) REPORT

Growing season rainfall totals and grid maps

Mr. Brothers reported that we have 398 volunteer precipitation observers. 152 observers report precipitation online. He noted that our precipitation maps are available on our website.

Pushing Remote Sensors (PRESENS) – 2024 site deployment

Mr. Brothers reviewed the DWR's PRESENS remote sensor suite that was developed by the DWR's Water Appropriations division for groundwater and surface water remote monitoring and has been modified with atmospheric sensors. There are a total of 53 sites with weather monitoring equipment, 21 of which were deployed in 2024. There are

close to 672 PRESENS sites statewide that report temperature and atmospheric pressure. The DWR is currently working on a public facing database interface.

In response to a question, Mr. Brothers indicated that none of these PRESENS sites are deployed with landowner contract. So far, the site at the Kenmare Airport is the only one needing to be uninstalled. There was construction at the airport and the site was the only place they could move heavy equipment for the construction.

In response to a question, Mr. Brothers indicated that we do not use crowd-sourced data. He indicated this is due to the level of confidence that proper equipment is used or sited properly.

Mr. Brothers noted that this year he utilized North Dakota State University (NDSU) County Extension Agents from some counties as contact points for potential landowners who may be willing to cooperate on this project.

2025 MEETING SCHEDULE

Tentative dates for 2025 board meetings were discussed. The spring meeting will be tentatively scheduled for Thursday, April 24th. The fall meeting will be tentatively scheduled for Thursday, November 13th.

ELECTION OF OFFICERS

Mr. Theisen called for nominations or volunteers.

IT WAS MOVED BY MR. WANNER AND SECONDED BY MR. MONSON TO NOMINATE MR. THEISEN AS CHAIR. THE MOTION CARRIED UNANIMOUSLY.

IT WAS MOVED BY MR. WANNER AND SECONDED BY MR. BURKE TO NOMINATE MRS. YULY AS VICE-CHAIR AND MRS. PFAFF AS SECRETARY. THE MOTION CARRIED UNANIMOUSLY.

Mr. Theisen thanked the officers for being willing to fulfil those roles.

INTERNATIONAL COLLABORATION WITH KOREA METEOROLOGICAL ADMINISTRATION

Mr. Langerud reviewed collaboration our staff has had recently with the Korea Meteorological Administration (KMA). He will be sending a report to the KMA later this

week regarding our collaboration. We are anticipating the KMA sending a Ph.D. scientist to UND, working with Dr. Delene, for the 2025 calendar year but will also be collaborating with us. We expect that their staff will participate in our 2025 Ground School as well.

OTHER BUSINESS

Mr. Wanner requested an email update for the board once decisions have been made regarding continuation of the NDCMP with the remaining two counties and any related legislation that may come. Mr. Langerud agreed to do that.

IT WAS MOVED BY MRS. PFAFF, SECONDED BY MR. WANNER, AND CARRIED ON A VOICE VOTE TO ADJOURN THE MEETING. Being no further business, the meeting adjourned at approximately 3:55 p.m.

CHRIS THEISEN CHAIRMAN	REBEKAH PFAFF SECRETARY

Transcribed by Kelli Schroeder

ATMOSPHERIC RESOURCE BOARD
PROJECT BUDGET EXPENDITURES
FOR THE PERIOD ENDED MARCH 31, 2025
BIENNIUM TIME: 88%

	SALARIES & WAGES	OPERATING EXPENSES	CAPITAL ASSETS	GRANTS	PROGRAM TOTALS
	77010	77030	77050	77063	
ADMINISTRATION (7500) - $1,123,800.00					**Project: WA75023**
Budget *	1,047,993.00	75,807.00	-	-	1,123,800.00
Expended	932,958.30	59,644.13	-	-	992,602.43
Percent	89%	79%	0%	0%	88%
OPERATIONS & RESEARCH (7600) - $7,019,850.00					**Projects: WA62023, WA62024, WA62025, WA68023, WA68024, WA68025, & WA69998**
Budget	240,724.00	571,100.00	1,845,000.00	4,363,026.00	7,019,850.00
Expended	139,208.72	248,194.23	24,855.92	1,182,423.32	1,594,682.19
Percent	58%	43%	1%	27%	23%
BUDGET *	1,288,717.00	646,907.00	1,845,000.00	4,363,026.00	8,143,650.00
EXPENDED	1,072,167.02	307,838.36	24,855.92	1,182,423.32	2,587,284.62
PERCENT	83%	48%	1%	27%	32%

FUNDING SOURCE:	**APPROPRIATION**	**EXPENDITURES**	**BALANCE**	**PERCENT**
General Funds	-	-	-	0%
Resource Trust Funds *	4,240,155.00	1,544,527.27	2,695,627.73	36%
County Funds	2,343,776.00	1,042,757.35	1,301,018.65	44%
Federal Funds	1,500,000.00	-	1,500,000.00	0%
TOTAL FUNDS: *	**8,083,931.00**	**2,587,284.62**	**5,496,646.38**	32%

** NOTE: FTE and board salary budget is shown under ARB Administration (7500) here for tracking purposes; but,it is held agency-wide under the DWR Administration Division. Actual ARB division appropriation budget total is $7,095,657.*

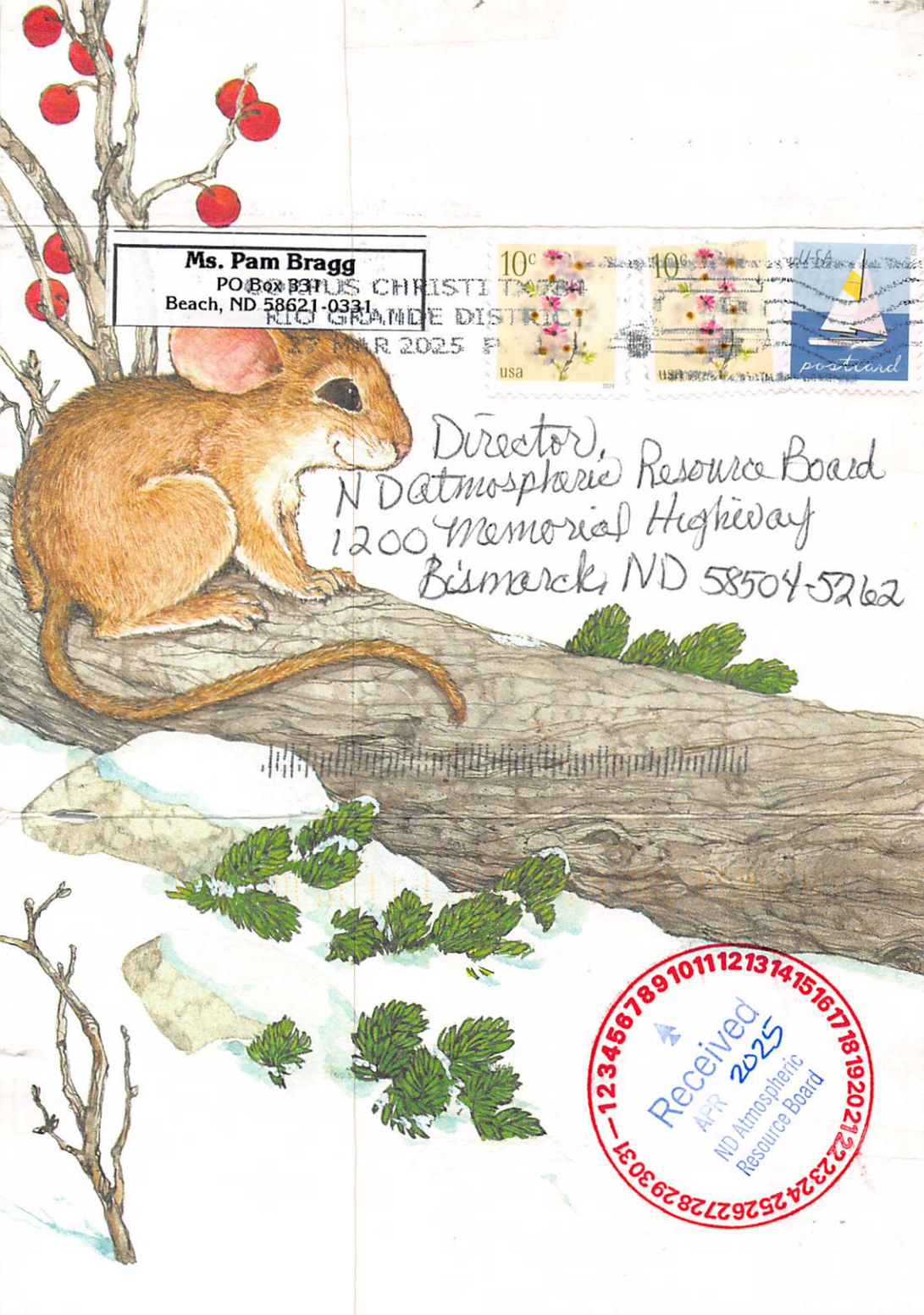
REVENUE:	
General Funds	200.00
County Funds	728,491.87
Resources Trust Funds	11,942.00
Federal Funds	-
TOTAL	**740,633.87**

Dear Sirs/Madams,

I am writing a protest in response to the Notice of Intention printed in the March 20th Golden Valley News. I am a landowner in Golden Valley, and I have definite opinions about cloud seeding and weather modification. Though I admit to not being an expert, I have a serious concern about the use of silver iodide & its effects on the soil, as it's been proven to be adverse to the ability to raise crops. I also don't like the idea of producing moisture to the possible detriment of surrounding lands - who knows what effects it has on our national weather as a whole -

Thank you for the opportunity to voice my opinion. I'd appreciate a notice on your decision.

Sincerely, Pam Bragg
P.O. Box 331
Beach, ND 58621



Ms. Pam Bragg
PO Box 331
Beach, ND 58621-0331

CORPUS CHRISTI TX 784
RIO GRANDE DISTRICT
27 MAR 2025 P

10c usa 2024

10c

USA postcard

Director,
ND Atmospheric Resource Board
1200 Memorial Highway
Bismarck, ND 58504-5262

Received
APR 2025
ND Atmospheric
Resource Board

NORTH Dakota
Be Legendary.

Atmospheric Resource Board
WATER RESOURCES

DATE: APRIL 16, 2025

TO: ATMOSPHERIC RESOURCE BOARD

FROM: DARIN LANGERUD, DIRECTOR

RE: DIRECTOR'S RECOMMENDATION FOR NDCMP PERMIT APPLICATION

Background

The North Dakota Cloud Modification Project (NDCMP) is a grass-roots, local-control project. Funding for the NDCMP is provided through local funds from the participating counties (or townships) combined with state cost share. Overall, two-thirds of project funding comes from the counties while the state contributes one-third.

To participate in the NDCMP, a process must be followed whereby the public, through petition or vote, creates a weather modification authority. Once that authority is created, a board of five members is appointed by the county commission to oversee the project for that county. A project cannot occur in North Dakota under state law without this process, and state funding would not be applied to cloud seeding operations without a local sponsor.

To solicit public comments per N.D.C.C. § 61-04.1-17 and N.D.A.C. § 89-07-02-15, the Board published notice for two consecutive weeks in the county newspapers in the "area of the state reasonably expected to be affected by operations conducted under a permit." During the 20-day comment period, which ended on April 11, 2025, one comment was received (attached). A summary of information relevant to the comment follows below.

Science/Efficacy

Regarding the science and program efficacy, several studies have been conducted of the NDCMP. Five studies using crop insurance data have been conducted looking at the effects of seeding on hail. Miller et al. (1975) found: (1) the ratio of average rainfall to hail energy was greater for seed days than no-seed days, (2) crop-hail insured losses were lower on seed days than on no-seed days, (3) radar characteristics of seeded storms differed from those of unseeded storms, and (4) case studies of 34 storms indicated that damaging hail was usually suppressed when their updraft areas were continuously seeded at cloud base.

Smith et al. (1987) found a 43.5% reduction in crop hail losses in seeded counties during a 10-year period (1976-85). Following on the prior study, Smith et al. (1997) reported a 45% reduction in crop hail losses in the NDCMP counties over a 13-year period (1976-88).

A Nodak Mutual Insurance Company internal study (1995) of seven years of data found 43% lower incidence of hail claims in the NDCMP counties versus the rest of the state.

Finally, Knowles and Skidmore (2021) at Michigan State University recently evaluated thirty years of USDA Risk Management Agency data in an effort to review crop yields and insurance loss ratios. They concluded that "our evaluation indicates that the cloud seeding program had significant positive effects on crop yields and improved (insurance) loss ratios."

Miller, J.R., Jr., E.I.Boyd, R.A. Schleusener, and A.S. Dennis, 1975: Hail suppression data from western North Dakota, 1969-1972. *J. Appl. Meteor.*, **14**, 755-762.

Smith, P. L., J.R. Miller, Jr., and P.W. Mielke, Jr., 1987: An exploratory study of crop-hail insurance data for evidence of seeding effects in North Dakota. 24 pp. (Final Report)

Smith, P.L., L.R. Johnson, D.L. Priegnitz, B.A. Boe, and P.W. Mielke Jr.,1997: An exploratory analysis of crop hail insurance data for evidence of cloud seeding effects in North Dakota. *J. Appl. Meteor.*, **36**, 463-473.

Pifer, K.D., 1995: Personal communication with Bruce A. Boe, NDARB Director.

Knowles, S., and M. Skidmore, 2021: Cloud Seeding and Crops Yields: Evaluation of the North Dakota Cloud Modification Project. *J. Wea., Clim., And Soc.,* **13**, 885-898.

In addition to hail, several studies have looked at seeding effects on rainfall in North Dakota. The North Dakota Pilot Project (NDPP), a randomized seeding program was conducted in McKenzie County from 1969-1972 (Dennis et al., 1975). Mountrail and Ward counties were added to the project in 1972. The NDPP found statistically-significant results that silver iodide seeding of convective clouds leads to: (1) an increase in the frequency of rainfall events at the target gauges, (2) an increase in the average rainfall recorded per rainfall event, and (3) an increase in total rainfall over the target area. These results apply on days with dynamic seedability, that is, days when a cloud model predicted an increase in cloud top height under the influence of silver iodide seeding. The authors estimated there were about 50 days with dynamic seedability each summer during the NDPP. Further, they estimated a potential increase of one inch of rainfall per growing season for western North Dakota from cloud seeding.

Additional studies, using various datasets have also indicated positive results. Studies by Eddy & Cooter (1979); Johnson (1985); Wise (2005); and Tuftedal et al. (2022) have suggested percentage rainfall increases from the low single digits to the low teens in and slightly downwind of the target areas.

Other concerns about downwind effects are addressed by a recent study of several operational projects by DeFelice et al. (2014), which concluded that seeding for precipitation enhancement in the target area increased precipitation downwind.

Dennis, A.S., J.R. Miller, Jr., D.E. Cain, and R.L. Schwaller, 1975: Evaluation by Monte Carlo tests of effects of cloud seeding on growing season rainfall in North Dakota. *J. Appl. Meteor.*, **14**, 959-969.

Eddy, A., E. Cooter and W. Cooter, 1979: An evaluation of operational cloud seeding in North Dakota: An exploratory analysis. Final Report to the North Dakota Weather Modification Board, Bismarck, ND, 146 pp.

Johnson, H.L, 1985: An Evaluation of the North Dakota Cloud Modification Project. A final report to the North Dakota Weather Modification Board, June 1985. 35 pp.

Wise, E.A., 2005: Precipitation evaluation of the North Dakota Cloud Modification Project (NDCMP)., M.S. Thesis, Department of Atmospheric Sciences, University of North Dakota, Grand Forks, ND., 63 pp.

DeFelice, T.P., J. Golden, D. Griffith, W. Woodley, D. Rosenfeld, D. Breed, M. Solak, and B. Boe, 2014: Extra area effects of cloud seeding – An updated assessment. *Atmos. Res*., 135-136, 193-203.

Tuftedal, M.E., D.J. Delene, and A. Detwiler, 2022: Precipitation Evaluation of the North Dakota Cloud Modification Project (NDCMP) Using Rain Gauge Observations. *Atmos. Res.,* 269.

Environment/Health

Concerns raised about the potential environmental effects of cloud seeding in North Dakota constituted the majority of comments received. Silver iodide, the most commonly used seeding agent, has been rigorously studied in its use on programs all around the globe. The Weather Modification Association (2009) conducted a review of the published scientific literature and found "no environmentally harmful effects arising from cloud seeding with silver iodide aerosols have been observed, nor would they be expected to occur." Environmental impact studies related to silver iodide usage in cloud seeding were reviewed from the 1960s to today, with all findings indicating no adverse environmental or human health impacts.

Silver iodide is exceedingly efficient as an ice nucleus, thus its use on the NDCMP is quite low. Seeding activity also varies from year to year depending on weather conditions. Generally, the total amount of silver iodide dispersed from both seeding generators and flares ranges from 50 to 100 kilograms per season. Based on the average rate of seeding material dispersed, only one one-hundredth of a gram (0.01g) would be expected to fall on an acre of land during the summer.

Director's Recommendation

In consideration of the comment received, the Director's recommendation on the permit application from Weather Modification LLC follows:

District 1: Bowman County and the townships of Connor, Hume, Carroll, Cash, Sheets, Mineral Springs, and Cedar Creek in Slope County.

Director recommends the Board approve the permit for the District 1 target area as publicly noticed. Concerns regarding the environment, health effects, science, and program efficacy are not borne out by independent evaluations of the NDCMP or other external evaluations relevant to North Dakota seeding operations.

2025 NDCMP Project - 2 Cloud-base Piper Seneca II - 100 Flight Hours

LINE ITEM	BUDGET	COMMENT / NOTATION	
Radar Maintenance & Parts	10,000	Includes technician, preventive maintenance and misc. parts & materials (Contract)	
Aircraft Base Cost	180,948	Aircraft, seeding equipment, pilots and related services	
Top Aircraft	*0*	0 A/C per year @ $	
Base Aircraft	*180,948*	2 A/C per year @ 2024 cost plus 4%	
Cloud Base Flight Hours (Seneca)	13,791	100 hours @ 2024 cost plus 4%	
Fuel Surcharge	1,000	Excess above $6.50 per gallon	
Cloud Top Flight Hours (KAC90)	0	0 hours @ $	
Meteorologists	20,752	1 Meteorologist, 1 Intern Meteorologist	11,599.28
Chemicals	0	All chemicals, flares, and dry ice	5799.64
Dry Chemicals / Acetone	*0*	Ammonium Iodide, Sodium Perchlorate, Acetone (sufficient inventory of AgI)	
Ejectable Flares	*0*		
Burn-In-Place Flares	*0*		
Dry Ice	*0*	0 lbs @ $1.10 (est.)	
Housing	0		
Travel / Delivery / Freight	1,200		
Chemical Storage	0		
Ground School	1,750	Hotel and meals	
Communications/Data	250	Telephone and internet	
Newspaper Fees	1,000	Permitting requirements	
Supplies / Postage	400		
Bldg & Equip/Utilities/Insurance	5,600		
TOTAL:	236,691		
COUNTY FUNDING:	140,975		
OTHER LOCAL FUNDS:	15,250	Carry-over funds	
STATE COST-SHARE:	80,466		
BALANCE:	0		

2025 Rev. Increase: 1

Per Wayne, 2

County Contracts	2024	2025
Bowman	120,802	128,000
SWMA	12,975	12,975
Total	133,777	140,975

county share	66.00%
state share	34.00%
cost per acre	$0.261