BEFORE THE INDUSTRIAL COMMISSION

OF THE STATE OF NORTH DAKOTA

CASE NO. 30122
ORDER NO. 32806

IN THE MATTER OF A HEARING CALLED ON A MOTION OF THE COMMISSION TO CONSIDER THE APPLICATION OF DCC WEST PROJECT LLC REQUESTING CONSIDERATION FOR THE GEOLOGIC STORAGE OF CARBON DIOXIDE IN THE BROOM CREEK FORMATION FROM THE MILTON R. YOUNG STATION AND OTHER SOURCES IN THE STORAGE FACILITY LOCATED IN SECTIONS 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, AND 32, TOWNSHIP 141 NORTH, RANGE 84 WEST, SECTIONS 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27, AND 36, TOWNSHIP 141 NORTH, RANGE 85 WEST, SECTIONS 19, 20, 21, 28, 29, 30, 31, 32, 33, AND 34, TOWNSHIP 142 NORTH, RANGE 84 WEST, AND SECTIONS 24, 25, 33, 34, 35, AND 36, TOWNSHIP 142 NORTH, RANGE 85 WEST, OLIVER COUNTY, NORTH DAKOTA PURSUANT TO NORTH DAKOTA ADMINISTRATIVE CODE CHAPTER 43-05-01.

ORDER OF THE COMMISSION

THE COMMISSION FINDS:

(1) This cause originally came on for hearing at 9:00 a.m. on the 30th day of June, 2023. The initial public notice of this application was not properly published in the Center Republican, the official Oliver County newspaper. Evidence and testimony were taken on June 30, 2023 but the record in this case was left open until August 7, 2023 to allow the required notice to be published and afford any interested parties the opportunity to appear. No further appearances were made on August 7, 2023.

(2) DCC West Project LLC (DCC West) made application to the Commission for an order requesting consideration for the geologic storage of carbon dioxide in the Broom Creek Formation from the Milton R. Young Station (MRYS) and other sources in the storage facility located in Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, and 32, Township 141 North, Range 84 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27,

and 36, Township 141 North, Range 85 West, Sections 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, Township 142 North, Range 84 West, and Sections 24, 25, 33, 34, 35, and 36, Township 142 North, Range 85 West, Oliver County, North Dakota, pursuant to North Dakota Administrative Code (NDAC) Chapter 43-05-01.

(3) DCC West submitted an application for a Storage Facility Permit and attachments pursuant to NDAC Section 43-05-01-05 and all other provisions of NDAC Chapter 43-05-01 as necessary.

(4) Case Nos. 30122, 30123, 30124, and 30125 were combined for the purposes of hearing.

(5) Case No. 30123, also on the June 30, 2023 docket, is a motion of the Commission to consider the amalgamation of storage reservoir pore space, pursuant to a Storage Agreement by DCC West for use of pore space falling within portions of Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, and 32, Township 141 North, Range 84 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27, and 36, Township 141 North, Range 85 West, Sections 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, Township 142 North, Range 84 West, and Sections 24, 25, 33, 34, 35, and 36, Township 142 North, Range 85 West, Oliver County, North Dakota, in the Broom Creek Formation, and to determine it has been signed, ratified, or approved by owners of interest owning at least sixty percent of the pore space interest within said lands, pursuant to North Dakota Century Code (NDCC) Section 38-22-10.

(6) Case No. 30124, also on the June 30, 2023 docket, is a motion of the Commission to determine the amount of financial responsibility required of DCC West for the geologic storage of carbon dioxide from the MRYS and other sources in the storage facility located in Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, and 32, Township 141 North, Range 84 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27, and 36, Township 141 North, Range 85 West, Sections 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, Township 142 North, Range 84 West, and Sections 24, 25, 33, 34, 35, and 36, Township 142 North, Range 85 West, Oliver County, North Dakota, in the Broom Creek Formation, pursuant to NDAC Section 43-05-01-09.1.

(7) Case No. 30125, also on the June 30, 2023 docket, is a motion of the Commission to consider establishing the field and pool limits for lands located in Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, and 32, Township 141 North, Range 84 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27, and 36, Township 141 North, Range 85 West, Sections 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, Township 142 North, Range 84 West, and Sections 24, 25, 33, 34, 35, and 36, Township 142 North, Range 85 West, Oliver County, North Dakota, subject to the application of DCC West for the geologic storage of carbon dioxide in the Broom Creek Formation, and enact such special field rules as may be necessary.

(8) The record in these matters was left open to receive additional information from DCC West. Such information was received on August 18, 2023, and the record was closed.

(9) The Commission gave at least a thirty-day public notice and comment period for the draft storage facility permit and issued all notices using methods required of all entities under NDCC Section 38-22-06 and NDAC Section 43-05-01-08. First publication was made May 22, 2023, and the comment period for written comments ended at 5:00 PM CDT June 29, 2023. The hearing was open to the public to appear and provide comments. The first public notice of this application was not properly published in the Center Republican, the official Oliver County newspaper. Second publication was made June 29, 2023, in the Center Republican, and the comment period for written comments ended at 5:00 PM CDT August 6, 2023. The August 7, 2023, hearing was open to the public to appear and provide comments.

(10) The Commission received a letter from the State Historical Society of North Dakota (SHPO) on May 31, 2023, indicating it reviewed the application of DCC West and found known archeological sites around the proposed wells and flow line. They requested the submittal of maps at a scale of 1:24,000 or larger denoting the locations of the proposed wells and flow line along with a ND Cultural Resources Survey Class I Literature Review to fully evaluate the potential impacts. DCC West testified that they completed a Class I Literature Review and Class III Pedestrian Survey of the initial flow line route and are in communication with SHPO to seek a no impact determination for the updated route of the flow line.

(11) The Commission received a letter from Kenneth A. and Marilyn J. Barnhardt (Barnhardts) on June 1, 2023, that was incorrectly addressed to the Public Service Commission. The letter stated they would be unable to attend the hearing and were requesting a copy of the permit application, draft permit, and the storage facility permit that will be presented at the hearing. Barnhardts also stated the address the hearing notification was sent to was incorrect. North Dakota Oil and Gas Division staff responded to Barnhardts, in a letter dated June 1, 2023, on how to obtain a copy of the permit application, draft permit, and storage facility permit digitally at no cost and included directions to request a hard copy. DCC West responded to Barnhardts, in a letter dated June 14, 2023, that they were in receipt of their request for a printed-out version of the permit application and draft permit. DCC West also stated it would follow up with a final permit at such time as it is issued.

(12) The Commission received an email from Blane and JoAnne Hoesel (Hoesels) on June 25, 2023. Hoesels are owners of land within the proposed storage facility and hearing notification areas in Section 9 and 14, Township 141 North, Range 85 West, Oliver County, North Dakota. In the email Hoesels brings up three concerns they have with DCC West's application for a carbon dioxide storage facility:

1. Hoesels feel it is premature to implement this massive project to bring carbon dioxide from thirty ethanol plants in five states to a storage facility in Oliver County due to the risks of failure and provided two real-world examples of failures to keep gas underground (California Aliso Canyon gas leak in 2015 and Salah project in Algeria);

2. Hoesels feel a good-faith effort was not made to them. Hoesels state they only received two packets of information by mail, one in October and one in December 2022, before receiving the Notice of the Hearing in May 2023 sent by Minnkota Power Cooperative Inc. (Minnkota) and that no communications occurred beyond sending letters. Hoesels also state the certified notice received from Minnkota only referred to the "The Commission" as the regulatory contact to send questions and comments. Hoesels contacted the Industrial Commission, Public Service Commission, Minnkota and finally the Department of Mineral Resources – Oil and Gas Division (DMR-OG), before receiving direction on how to submit questions and comments from DMR-OG; and

3. Hoesels do not support the use of the amalgamation process. They feel the amalgamation process impedes landowner rights and they have no rights or options other than to submit their concerns and questions. Further, they state past efforts to take away landowner rights have been supported by the Industrial Commission and DMR-OG and feel the appearance at the hearing is pointless. Hoesels ask the following two questions in the letter:

   a.) Is it the intent of the Industrial Commission to force all owners of pore space to participate? and

   b.) Will wastewater injection be allowed and is it planned for this project?

The Commission notes the following in response to Hoesels' question related to pore space participation: NDCC Section 38-22-08(4) requires the storage operator to make a good-faith effort to get the consent of all persons who own the storage reservoir's pore space and NDCC Section 38-22-08(5) requires the storage operator to obtain the consent of persons who own at least sixty percent of the storage reservoir's pore space. Exhibit 2 shows DCC West has leased approximately 80.3% of the pore space acreage. NDCC Section 38-22-10 states "If a storage operator does not obtain the consent of all persons who own the storage reservoir's pore space, the Commission may require that the pore space owned by nonconsenting owners be included in a storage facility and subject to geologic storage." DCC West filed a copy of the "Notice of Hearing" pursuant to NDAC Section 43-05-01-08(2) and in that notice it states DCC West has made application to the North Dakota Industrial Commission and that the affidavit of service lists JoAnne Hoesel as a notified party.

DCC West testified it spoke to JoAnne Hoesel prior to the hearing and confirmed that she had no interest in reaching an agreement on a lease at this time but was okay with DCC West continuing to send her mailings and information about project updates. DCC West invited her to reach out if she had any additional questions or concerns. DCC West also testified that no wastewater injection will be associated with the DCC West injection process within the project boundary but that for project Tundra and the MRYS, a Class I well is being pursued through the Department of Environmental Quality.

The Commission finds the information and opinions included in Hoesels' letters, that were not addressed, to be either inapplicable or irrelevant to this case.

(13) The Commission received a letter from Leslie Weaver with Amarillo National Bank (ANB) on June 26, 2023. The letter states ANB acts as Trustee for the Lolisa Horton Revocable Living Trust, Sally Ingerton Grantor Trust, and Susan Landers Grantor Trust, which own oil, gas, and other minerals in portions of Section 31 and Section 32, Township 142 North, Range 84 West, Oliver County, North Dakota. In the letter, ANB provides the correct mailing address for the trusts and requests that the trusts' ownership not be pooled (amalgamated) at this time because it would make potential production of its oil, gas, and other minerals in zones below, above, and in the Broom Creek Formation unavailable. ANB, as Trustee, is open to the possibility of an Accommodation Agreement with adequate compensation by Minnkota/DCC West to attempt to arrive at a middle ground.

DCC West testified its title work indicates that the three trusts ANB is trustee for do not own any surface or pore space interest within the proposed storage facility area but do own mineral interests in Township 142 North, Range 84 West, in Oliver County, North Dakota. DCC West testified it found no known producible accumulations of hydrocarbons in or under the storage reservoir, but should operators decide to drill wells for hydrocarbon exploration or production in the future, the lateral extent of the stabilized plume and the pressure differential are minor enough to allow for either horizontal drilling without penetrating the stored carbon dioxide or vertical drilling with proper controls, for hydrocarbon exploration under the Broom Creek Formation. The Commission agrees.

(14) The Commission received an email from Dakota Resource Council (DRC) on June 29, 2023. DRC is requesting that the Industrial Commission not amalgamate private property for this application as outlined in docket number 30123 [sic; DRC meant to reference case number] because Northwest Landowners Association has a pending lawsuit in district court on this issue and if the court concludes the state law is unconstitutional it would adversely impact those landowners who were forced into this project through amalgamation and equitable compensation. Additionally, DRC requests that the Industrial Commission ensure that the emergency remedial response plan and associated emergency plans are shared thoroughly with first responders and communities.

DCC West testified it has demonstrated that individuals who own pore space within the storage facility area, that have not signed leases, are going to be equitably compensated and that DCC West is the entity that is at risk for expending time and money putting the project together should amalgamation be determined to be unconstitutional. DCC West additionally testified that a decision by the North Dakota Supreme Court on the pending lawsuit may occur before DCC West actually starts injecting carbon dioxide into the ground. The Commission agrees.

NDAC Section 43-05-01-13 states in part in reference to emergency and remedial response plans, "Copies of the plans must be available at the storage facility and at the storage operator's nearest operational office." DCC West testified that copies would be maintained at the control house for the facility once constructed, that it would continue to work with first responders and do

coordinated training with local response teams at least annually, and it has had and will continue to have active landowner meetings to keep the community and public informed about any risks or response plans in place.

(15) DCC West's application provides adequate data to show suitability of the Broom Creek Formation for geologic storage of carbon dioxide in the facility area.

(16) DCC West's application provides adequate modeling of the storage reservoir for delineation of the facility area, and adequate monitoring to detect if carbon dioxide is migrating into properties outside of the facility area pursuant to NDAC Section 43-05-01-11.4. Vertical release of carbon dioxide is addressed by the application pursuant to NDAC Section 43-05-01-13, and lateral release of carbon dioxide from the facility area is addressed by the application pursuant to NDAC Section 43-05-01-05.

(17) The amalgamated storage reservoir pore space to be utilized is not hydrocarbon bearing as determined from test data included with the application. There has been no historic hydrocarbon exploration, production, or studies suggesting there is an economic supply of hydrocarbons from formations above or below the Broom Creek Formation within the proposed storage facility area. Lignite coal is mined in the area from the Sentinel Butte Formation in the area above the proposed facility area. Coal seams exist in the Bullion Creek Formation. All coal seams present in the Fort Union Group above the facility area will not be impacted by this project as there are no current or future planned mining activities at the proposed location of the wells and flow line. As previously mentioned, DCC West testified that should operators decide to drill wells for hydrocarbon exploration or production in the future, the lateral extent of the stabilized plume and the pressure differential are minor enough to allow for either horizontal drilling without penetrating the stored carbon dioxide or vertical drilling with proper controls, for hydrocarbon exploration under the Broom Creek Formation. The Commission agrees.

(18) Minnkota's MRYS is a two-unit mine-mouth lignite coal-fired power plant located in Oliver County, North Dakota, near the city of Center. The lignite used as fuel for electrical generation is the source of the carbon dioxide. DCC West testified that DCC West Project LLC and DCC East Project LLC (DCC East) are both wholly owned subsidiaries of Minnkota Power Cooperative, Inc. and that a transfer request has been submitted to the North Dakota Oil & Gas Division to transfer ownership of the permitted Minnkota Center MRYS Broom Creek Storage Facility #1 (Facility No. 90000330) and Minnkota Center MRYS Deadwood Storage Facility #1 (Facility No. 90000332) from Minnkota to DCC East.

DCC West testified that the intent of the DCC West storage facility is to provide additional redundancy and flexibility to store carbon dioxide from the MRYS to provide for long-term risk management. In addition to providing storage services for MRYS carbon dioxide, to the extent there is additional storage capacity, DCC West proposes the following industrial sources of carbon dioxide from other third-party entities may be available over the life of the storage project: postcombustion of fossil fuel electric power generation (natural gas or lignite coal), ethanol manufacturing, manufactured agricultural products (e.g., fertilizer, urea, and ammonia),

cement/concrete production, direct air capture, and other industrial sources within the state and regionally.

(19) DCC West's storage facility will be designed to receive up to 6,110,000 metric tons of carbon dioxide annually. The captured carbon dioxide from the MRYS will be dehydrated, compressed, transported to a Class VI well by flow line, and then injected. DCC West testified that the MRYS capture system is designed to capture 13,000 metric tons per day, but due to outages, is anticipated to capture on average 4,000,000 metric tons of carbon dioxide annually. The dynamic reservoir simulation for DCC West's application indicated approximately 122,900,000 metric tons could be stored over the 20-year injection period without exceeding the maximum bottom hole pressure constraint, derived as 90% of the formation fracture pressure for the Broom Creek Formation and a wellhead pressure of 2,100 psi during injection.

(20) The pipeline that transports carbon dioxide from the MRYS to the custody transfer point is a flow line permitted as part of the Minnkota Center MRYS Broom Creek Storage Facility #1 and Minnkota Center MRYS Deadwood Storage Facility #1 storage facilities. The entire length of the 7.4-mile flow line to be utilized for carbon dioxide transportation from the custody transfer point on the Liberty #1 well pad (File No. 37672) to the proposed DCC West Broom Creek Storage Facility (the custody transfer point is considered the injection facility for the proposed DCC West Broom Creek Storage Facility) is under the jurisdiction of the Commission.

(21) The flow line will be constructed using materials that will be carbon dioxide resistant in accordance with API 171J (2017) requirements and has capacity to transport 7,000,000 metric tons a year. DCC West testified that the 20-inch flow line would be constructed using carbon steel, have a cathodic protection system installed, and is anticipated to have a maximum design pressure of 2,200 psig and maximum operating pressure of 1,750 psig, as limited by the compressor at the capture system. A booster pump is included in the surface facility design as shown in hearing Exhibit #4 (Figure X-1) and was testified to being necessary to meet maximum rates.

(22) The flow line will be equipped with flowmeters, pressure gauges, and a Supervisory Control and Data Acquisition (SCADA) system to detect leaks. The SCADA system will be integrated to allow DCC West, DCC East, and MRYS to share operational data and controls in real-time, as stated in Section 5.2.1 of the application and provided for in hearing Exhibit #6 (CO2 Flowline Pressure Control). Acoustic detectors will be installed at strategic locations along the flow line path to help detect any auditory signs of equipment failure. Carbon dioxide detection stations will be located on the flow line risers and wellhead. DCC West testified that a feed design would be completed prior to a third-party system connecting into the system to ensure they are integrated into the SCADA system. Exhibit #6 details the anticipated process flow between DCC West, DCC East, MRYS and a third-party inlet.

(23) The projected composition of the MRYS carbon dioxide stream is to be at least 98% carbon dioxide and less than 1.7% nitrogen, with trace quantities of water, oxygen, hydrogen sulfide, sulfur, hydrocarbons, glycol, amine, aldehydes, nitrogen oxides, and ammonia, equaling less than 0.03% combined. DCC West is proposing that if a third-party carbon dioxide stream is accepted, the combined carbon dioxide stream must be at least 96% carbon dioxide and less than

3.7% nitrogen, with trace quantities of water, oxygen, hydrogen sulfide, sulfur, hydrocarbons, glycol, amine, aldehydes, nitrogen oxides, and ammonia, equaling less than 0.03% combined. The carbon dioxide stream composition used in the dynamic reservoir simulation was 98.25% carbon dioxide which DCC West testified represents the averaged stream composition on a weighted basis and provides for a more conservative plume boundary.

(24) The proposed IIW-N well located approximately 1,008 feet from the south line and 402 feet from the east line of Section 6, Township 141 North, Range 84 West, Oliver County, North Dakota, will be tested, logged, and constructed to Class VI requirements. This proposed well is to be a Class VI injection well.

(25) The proposed IIW-S well located approximately 908 feet from the south line and 402 feet from the east line of Section 6, Township 141 North, Range 84 West, Oliver County, North Dakota, will be tested, logged, and constructed to Class VI requirements. This proposed well is to be a Class VI injection well.

(26) The J-LOC #1 (File No. 37380) well located 1,373 feet from the north line and 2,515 feet from the east line of Section 27, Township 142 North, Range 84 West, Oliver County, North Dakota, is a stratigraphic test well that was used for reservoir characterization and constructed to Class VI requirements. This well is to be utilized as a direct method of monitoring the injection zone pursuant to NDAC Section 43-05-01.11.4.

(27) DCC West created a geologic model based on site characterization as required by NDAC Section 43-05-01-05.1 to delineate the area of review. Data utilized included seismic survey data, geophysical logs from nearby wells, and core data. Structural surfaces were interpolated with Schlumberger's Petrel software, and included formation top depths, data collected from the Milton Flemmer #1 (File No. 38594), Archie Erickson #2 (File No. 38622), Slash Lazy H #5 (File No. 38701), Flemmer #1 (File No. 34243), ANG #1 (Class I well), J-LOC #1, Liberty #1, BNI #1 (File No. 34244), MAG #1 (File No. 37833), and Coteau #1 (File No. 38379) wells, three 3D seismic surveys conducted at the Milton Flemmer #1, Archie Erickson #2, and Slash Lazy H #5, the J-LOC #1 and BNI #1, and the Liberty #1 locations, and approximately 45 miles of 2D seismic lines. Well log data was used to pick formation tops, interpret lithology, estimate petrophysical properties, and determine a time-depth shift for seismic data in the Amsden Formation, the lower confining zone, the undifferentiated Spearfish/Opeche Formation, and Picard Member of the Piper Formation, the upper confining zone, and the Broom Creek Formation, the injection zone. Geostatistics were used to distribute petrophysical properties within the model. Seismic data was used to reinforce interpolation of the formation tops to create structural surfaces, and to distribute lithologies and geologic properties in the model. Based on the reservoir pressure obtained from the J-LOC #1 well, critical threshold pressure for this storage facility exists in the Broom Creek Formation prior to injection. Critical threshold pressure has the same meaning as pressure front, defined in NDAC Section 43-05-01-01, for area of review delineation purposes. The Environmental Protection Agency's "UIC Program Class VI Well Area of Review Evaluation and Corrective Action Guidance" lists several methods to estimate an acceptable pressure increase for over-pressurized reservoirs, including a multiphase numerical model designed to model leakage through a single well bore, or through multiple well bores in the formation. DCC West

used this method to determine cumulative leakage potential along a hypothetical leaky wellbore without injection occurring, estimated to be 0.012 cubic meters over 20 years. Incremental leakage with injection occurring was estimated to be a maximum of 0.033 cubic meters over 20 years. A value of 1 cubic meter is the lowest meaningful value that can be produced by the Analytical Solution for Leakage in Multilayered Aquifers (ASLMA) model as smaller values likely represent statistical noise. An actual leaky wellbore or transmissive conduit would likely communicate with the Inyan Kara Formation. DCC West's application noted no indications of communication between the Broom Creek Formation and Inyan Kara Formation were observed, and that nothing in fluid samples indicated communication to an Underground Source of Drinking Water (USDW). The predicted extent of the carbon dioxide plume from beginning to end of life of the project, at the time when the carbon dioxide plume ceases to migrate into adjacent cells of the geologic model, was used to define the area of review in this case. Pursuant to NDAC Section 43-05-01-05(1)(b)(2) the area of review included a one-mile buffer around the storage facility boundaries. Time lapse seismic surveys will be used to monitor the extent of the carbon dioxide plume.

(28) The area proposed to be included within the storage facility is as follows:

TOWNSHIP 142 NORTH, RANGE 85 WEST
ALL OF SECTIONS 25, 34, 35, AND 36, THE S/2 OF SECTION 24, AND THE E/2 OF SECTION 33,

TOWNSHIP 142 NORTH, RANGE 84 WEST
ALL OF SECTIONS 29, 30, 31, AND 32, THE S/2 OF SECTION 19, THE S/2 OF SECTION 20, THE W/2 SW/4 OF SECTION 21, THE W/2, W/2 SE/4 AND SW/4 NE/4, OF SECTION 28, THE S/2, NW/4, W/2 NE/4, AND SE/4 NE/4, OF SECTION 33, AND THE S/2 AND S/2 N/2 OF SECTION 34,

TOWNSHIP 141 NORTH, RANGE 85 WEST
ALL OF SECTIONS 1, 2, 3, 4, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, AND 27, THE NE/4 NE/4 OF SECTION 9, THE N/2, SE/4, AND E/2 SW/4 OF SECTION 10, THE NE/4 SE/4 OF SECTION 16, AND THE N/2 OF SECTION 36,

TOWNSHIP 141 NORTH, RANGE 84 WEST
ALL OF SECTIONS 3, 4, 5, 6, 7, 8, 9, 10, 16, 17, 18, 19, 29, AND 30, THE W/2 W/2 AND W/2 E/2 NW/4 OF SECTION 2, THE W/2 OF SECTION 11, THE NW/4 OF SECTION 14, THE N/2 OF SECTION 15, THE N/2, SW/4, NE/2 SE/4, AND SW/4 SE/4 OF SECTION 20, THE N/2 NW/4 AND SW/4 NW/4 OF SECTION 21, THE N/2 AND N/2 SE/4 OF SECTION 31, AND THE NW/4 OF SECTION 32.

ALL IN OLIVER COUNTY AND COMPRISING OF 29,775.55 ACRES, MORE OR LESS.

(29) In the J-LOC #1 well, the undifferentiated Spearfish and Opeche Formations, hereinafter referred to as the Spearfish/Opeche Formation, unconformably overlie the Broom Creek Formation. The Picard and Poe members of the Piper Formation, hereinafter referred to as the Lower Piper Formation, overlie the Spearfish/Opeche Formation. Together, the Spearfish/Opeche

and Lower Piper Formations, hereinafter referred to as the Picard-Opeche interval, serve as the primary upper confining zone. The Broom Creek Formation, the upper confining Picard-Opeche interval, and the lower confining Amsden Formation are laterally extensive throughout the area of review.

(30) Core analysis of the Broom Creek Formation shows sufficient permeability to be suitable for the desired injection rates and pressures without risk of creating fractures in the injection zone. Thin-section investigation shows the Broom Creek Formation's sandstone intervals are comprised primarily of quartz, with minor occurrences of feldspar, dolomite, and anhydrite as cement. Two distinct carbonate intervals are present consisting of dolostone, dolomite, quartz, feldspar, and clay. Anhydrite intervals are expressed as thin beds that separate different sand bodies. Microfracture testing in the J-LOC #1 well, near, but outside of the delineated facility area, at a depth of 5,045 feet determined the breakdown pressure of the formation to be 6,385 psi, with a fracture propagation pressure of 3,593 psi, and a fracture closure pressure of 3,203 psi, yielding a formation fracture gradient of 0.712 psi/ft. The Commission indicated microfracture testing in the Broom Creek Formation may be required on one of the proposed injection wells, to be submitted to the Commission for review prior to injection of carbon dioxide.

Core analysis of the overlying Spearfish/Opeche Formation shows sufficiently low permeability to stratigraphically trap carbon dioxide and displaced fluids. Thin-section investigation shows the Spearfish/Opeche Formation is comprised predominantly of siltstone with interbedded dolostone and anhydrite. The transition zone present at the top of the Broom Creek Formation is comprised of clay-rich siltstone. Core analysis of the confining formations is proposed on the IIW-N and IIW-S injection wells and will be submitted to the Commission for review prior to injection of carbon dioxide. Microfracture testing in the J-LOC #1 well at depths of 4,888 and 4,889 feet observed no formation breakdown with a maximum of 8,162 psi and 8,151 psi applied, respectively. The inability to break down the Spearfish/Opeche Formation at the two depths indicate the formation is very tight competent rock and exhibits sufficient geologic integrity to contain the injected carbon dioxide. A one-dimensional mechanical earth model (1D MEM) was also used to evaluate geomechanical properties of the Spearfish/Opeche Formation. The maximum bottomhole pressures of 3,233 psi and 3,242 psi, respectively for the proposed IIW-N and IIW-S injection wells are estimated to be 90% of the formation fracture pressure as calculated by the 0.712 psi/ft fracture gradient of the Broom Creek Formation multiplied by the depth of the top perforation in the injection zone. Injection formation breakdown would be observed and recorded if permitted operational pressures were exceeded before compromising the confining zone. The Commission indicated microfracture testing in the Spearfish/Opeche Formation may be required on one of the proposed injection wells, to be submitted to the Commission for review prior to injection of carbon dioxide.

Core analysis of the underlying Amsden Formation shows sufficiently low permeability to stratigraphically contain carbon dioxide and displaced fluids. Thin-section investigation shows the Amsden Formation is comprised of dolomite, sandy dolomite, shaly sandstone, and anhydrite.

(31) The in situ fluid of the Broom Creek Formation in this area is in excess of 10,000 parts per million of total dissolved solids.

(32) Investigation of wells within the area of review found no vertical penetrations of the confining or injection zones requiring corrective action. The area of review will be reevaluated at a period not to exceed five years from beginning of injection operations. DCC West testified that the testing and monitoring plan was developed to proactively monitor the plume's location and provide additional near-surface monitoring assurance of nonendangerment to USDWs near the following plugged legacy wells: Raymond Henke 1-24 (File No. 4940), Paul Bueligen #1 (File No. 2183), and Herbert Dresser 1-34 (File No. 4937).

(33) The Fox Hills Formation is the deepest USDW within the area of review. Its base is situated at a depth of 1,287 feet at the location of the J-JOC #1 well, leaving approximately 3,620 feet between the base of the Fox Hills Formation and the top of the Broom Creek Formation.

(34) Fluid sampling of shallow USDWs has been performed to establish a geochemical baseline, with additional baseline sampling proposed for the Fox Hills Formation and other shallow wells under investigation. Future sampling is proposed in DCC West's application pursuant to NDAC Section 43-05-01-11.4.

(35) Soil sampling is proposed pursuant to NDAC Section 43-05-01-11.4. A baseline of soil gas concentrations will be established and submitted to the Commission for review prior to injection operations. Soil gas profile stations will be located near the injection well pad, the J-LOC #1 well, and the Herbert Dresser 1-34 well locations.

(36) The top of the Inyan Kara Formation is at 3,860 feet, approximately 2,573 feet below the base of the Fox Hills Formation at the location of the J-LOC #1 well and it provides an additional zone of monitoring between the Fox Hills Formation and the Broom Creek Formation to detect vertical carbon dioxide or fluid movement.

(37) No known or suspected regional faults or fractures with transmissibility have been identified during the site-specific characterization. Formation imaging logs showed conductive, resistive, and mixed fractures were observed in the Lower Piper Formation. The fractures observed in the Spearfish/Opeche Formation were primarily resistive and mixed fractures that exhibited horizontal and oblique orientation. Core analysis confirmed that resistive fractures were anhydrite filled, conductive fractures were clay filled, and mixed fractures were filled with anhydrite and clay. Two microfaults were found at the base of the Spearfish/Opeche Formation and interpreted as healed microfaults filled with anhydrite. The Amsden Formation log was dominated by stylolite–tension pairs, which are an indication that the formation has undergone a reduction in porosity in response to post depositional stress. Resistive fractures and mixed fractures were found and thin section suggests these features are anhydrite filled. A suspected Precambrian basement fault was interpreted in the 3D seismic data set evaluated as part of site characterization. This suspected fault vertically terminates well below the injection and confining formations, creating no risk to containment. DCC West testified that by interpreting dimensions, orientation, and characteristics of the fractures and microfaults found they determined they lack sufficient permeability or vertical extent to act as fluid pathways.

(38) Fluid samples from the Inyan Kara Formation and Broom Creek Formation suggest that they are hydraulically isolated from each other, supporting that the confining formations above the Broom Creek Formation are not compromised by migration pathways.

(39) Geochemical simulation performed with the injection stream and data obtained from the confining and injection zones determined no observable change in injection rate or pressure, and simulations of conservatively high carbon dioxide exposure to the cap rock determined that geochemical changes will be minor and will not cause substantive deterioration compromising confinement. The injection stream composition used for geochemical modeling contained a higher amount of oxygen to represent a conservative scenario because oxygen is the most reactive constituent in the anticipated injection steam.

(40) Risk of induced seismicity is not a concern based on existing studies of major faults within the area of review, tectonic boundaries, and relatively stable geologic conditions surrounding the proposed injection site.

(41) NDAC Section 43-05-01-11.3(3) requires the storage facility operator to maintain pressure on the annulus that exceeds the operating injection pressure, unless the Commission determines that such a requirement might harm the integrity of the well or endanger USDWs. DCC West testified their intention is to submit a variance request with the injection permit to use a 250 psi nitrogen cushion to maintain constant positive pressure on the well annulus in each injection well. The Commission believes placing pressure on the annulus that exceeds the operating injection pressure will create a risk of micro annulus by debonding of the long string casing-cement sheath during the operational life of the well. A micro annulus would harm external mechanical integrity and provide a potential pathway for endangerment of USDWs.

(42) The two injection wells are proposed to be equipped with DTS fiber optic cables enabling continuously monitored external mechanical integrity.

(43) The approval of this application is in the public interest by promoting the policy stated in NDCC Section 38-22-01.

IT IS THEREFORE ORDERED:

(1) The creation of the DCC West Center Broom Creek Storage Facility #1 in Oliver, County, North Dakota, is hereby authorized and approved.

(2) DCC West Project LLC, its assigns and successors, is hereby authorized to store carbon dioxide in the Broom Creek Formation in the DCC West Center Broom Creek Storage Facility #1.

(3) The DCC West Center Broom Creek Storage Facility #1 shall extend to and include the following lands in Oliver County, North Dakota:

TOWNSHIP 142 NORTH, RANGE 85 WEST
ALL OF SECTIONS 25, 34, 35, AND 36, THE S/2 OF SECTION 24, AND THE E/2 OF SECTION 33,

TOWNSHIP 142 NORTH, RANGE 84 WEST
ALL OF SECTIONS 29, 30, 31, AND 32, THE S/2 OF SECTION 19, THE S/2 OF SECTION 20, THE W/2 SW/4 OF SECTION 21, THE W/2, W/2 SE/4 AND SW/4 NE/4, OF SECTION 28, THE S/2, NW/4, W/2 NE/4, AND SE/4 NE/4, OF SECTION 33, AND THE S/2 AND S/2 N/2 OF SECTION 34,

TOWNSHIP 141 NORTH, RANGE 85 WEST
ALL OF SECTIONS 1, 2, 3, 4, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, AND 27, THE NE/4 NE/4 OF SECTION 9, THE N/2, SE/4, AND E/2 SW/4 OF SECTION 10, THE NE/4 SE/4 OF SECTION 16, AND THE N/2 OF SECTION 36,

TOWNSHIP 141 NORTH, RANGE 84 WEST
ALL OF SECTIONS 3, 4, 5, 6, 7, 8, 9, 10, 16, 17, 18, 19, 29, AND 30, THE W/2 W/2 AND W/2 E/2 NW/4 OF SECTION 2, THE W/2 OF SECTION 11, THE NW/4 OF SECTION 14, THE N/2 OF SECTION 15, THE N/2, SW/4, NE/2 SE/4, AND SW/4 SE/4 OF SECTION 20, THE N/2 NW/4 AND SW/4 NW/4 OF SECTION 21, THE N/2 AND N/2 SE/4 OF SECTION 31, AND THE NW/4 OF SECTION 32.

ALL IN OLIVER COUNTY AND COMPRISING OF 29,775.55 ACRES, MORE OR LESS.

(4) Injection into the DCC West Center Broom Creek Storage Facility #1 shall not occur until DCC West Project LLC has met the financial responsibility demonstration pursuant to Order No. 32808.

(5) This authorization does not convey authority to inject carbon dioxide into the DCC West Center Broom Creek Storage Facility #1; an approved permit to inject for the proposed IIW-N and IIW-S wells shall be issued by the Commission prior to injection operations commencing.

(6) The authorization granted herein is conditioned on the operator receiving and complying with all provisions of the injection permit issued by the Oil and Gas Division of the Industrial Commission and complying with all applicable provisions of NDAC Chapter 43-05-01 and this order.

(7) Definitions.

“Area of review” in this case means an area encompassing a radius around the facility area of one mile.

“Cell” in this case means individual cell blocks of the geologic model; each cell is approximately 1,000 feet by 1,000 feet.

"Facility area" means the areal extent of the storage reservoir as defined in paragraph (3) above, that includes lands within the lateral boundary of the carbon dioxide plume from beginning of injection to the time the carbon dioxide plume ceases to migrate into adjacent geologic model cells.

"Storage facility" means the reservoir, underground equipment, and surface facilities and equipment used or proposed to be used in the geologic storage operation. Pursuant to NDCC Section 38-22-02, it does not include pipelines used to transport carbon dioxide to the storage facility.

(8) The storage facility operator shall comply with all conditions of this order, the permit to inject, and applicable provisions of NDAC Chapter 43-05-01. Any noncompliance constitutes a violation and is grounds for enforcement action, including but not limited to termination, revocation, or modification of this order pursuant to NDAC Section 43-05-01-12.

(9) In an administrative action, it shall not be a defense that it would have been necessary for the storage facility operator to halt or reduce the permitted activity in order to maintain compliance with this order, the permit to inject, and applicable provisions of NDAC Chapter 43-05-01.

(10) The storage facility operator shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this order, the permit to inject, and applicable provisions of NDAC Chapter 43-05-01.

(11) The storage facility operator shall implement and maintain the provided emergency and remedial response plan pursuant to NDAC Section 43-05-01-13.

(12) The storage facility operator shall cease injection immediately, take all steps reasonably necessary to identify and characterize any release, implement the emergency and remedial response plan approved by the Commission (insofar as the Commission has jurisdiction), and notify the Commission within 24 hours of carbon dioxide detected above the upper confining zone.

(13) The storage facility operator shall at all times properly operate and maintain all storage facilities which are installed or used by the storage facility operator to achieve compliance with the conditions this order, the permit to inject, and applicable provisions of NDAC Chapter 43-05-01. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance.

(14) This order may be modified, revoked and reissued, or terminated pursuant to NDAC Section 43-05-01-12. The filing of a request by the storage facility operator for and order modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any condition contained herein.

(15) The injection well permit or the permit to operate an injection well does not convey any property rights of any sort of any exclusive privilege.

(16) The storage facility operator shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this order, or to determine compliance thereof. The storage facility operator shall also furnish to the Director, upon request, copies of records required to be kept by this order, the permit to inject, and applicable provisions of NDAC Chapter 43-05-01.

(17) The storage facility operator shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

(a) Enter upon the storage facility premises where records must be kept pursuant to this order and NDAC Chapter 43-05-01.

(b) At reasonable times, have access to and copy any records that must be kept pursuant to this order and NDAC Chapter 43-05-01.

(c) At reasonable times, inspect any facilities, equipment, including monitoring and control equipment, practices, or operations regulated or required pursuant to this order, the permit to inject, and NDAC Chapter 43-05-01.

(d) At reasonable times, sample or monitor for the purposes of assuring compliance, any substances or parameters at any location.

(18) The storage facility operator shall maintain and comply with the proposed testing and monitoring plan pursuant to NDAC Section 43-05-01-11.4.

(19) The storage facility operator shall comply with the reporting requirements provided in NDAC Section 43-05-01-18. The volume of carbon dioxide injected, the average injection rate, surface injection pressure, and down-hole temperature and pressure data shall be reported monthly to the Director on or before the fifth day of the second succeeding month once injection commences regardless of the status of operations, until the injection well is properly plugged and abandoned.

(20) The storage facility operator must obtain an injection well permit under NDAC Section 43-05-01-10 and injection wells must meet the construction and completion requirements in NDAC Section 43-05-01-11.

(21) The storage facility operator shall notify the Director at least 48 hours in advance to witness all mechanical integrity tests of the tubing-casing annulus in the injection well. The packer must be set within 100 feet of the upper most perforation and in the chrome enhanced casing, as an exception to NDAC Section 43-05-01-11. However, the packer must also be set within confining zone lithology, within carbon dioxide resistant cement, and not interfere with down-hole monitoring equipment.

(22) The storage facility operator shall maintain and comply with the prepared plugging plan pursuant to NDAC Section 43-05-01-11.5.

(23) The storage facility operator shall establish mechanical integrity prior to commencing injection and maintain mechanical integrity pursuant to NDAC Section 43-05-01-11.1.

(24) The storage facility operator shall implement the worker safety plan pursuant to NDAC Section 43-05-01-13.

(25) The storage facility operator shall comply with leak detection and reporting requirements pursuant to NDAC Section 43-05-01-14.

(26) The storage facility operator shall implement the proposed corrosion monitoring and prevention program pursuant to NDAC Section 43-05-01-05.1.

(27) The storage facility operator shall maintain financial responsibility pursuant to NDAC Section 43-05-01-09.1 and Order No. 32808.

(28) The storage facility operator shall maintain and comply with the proposed post-injection site care and facility closure plan pursuant to NDAC Section 43-05-01-19.

(29) The storage facility operator shall notify the Director within 24 hours of failure or malfunction of surface or bottom hole gauges in the proposed IIW-N and IIW-S injection wells.

(30) The storage facility operator shall implement surface air and soil gas monitoring as proposed.

(31) This storage facility authorization and permit shall be docketed for a review hearing at least once every five years from commencement of injection to determine whether it should be modified, revoked, or minor modification made, pursuant to NDAC Section 43-05-01-05.1(4).

(32) The storage operator shall file minor modification to the permit requests pursuant to NDAC Section 43-05-01-12.1 through a Facility Sundry Notice form.

(33) The storage facility operator shall pay fees pursuant to NDAC Section 43-05-01-17 annually, on or before the last business day in June, for the prior year's injection, unless otherwise approved by the Director.

(34) For each new additional carbon dioxide source, the storage facility operator must obtain a Commission determination on whether the source contributes to the energy and agriculture production economy of North Dakota, before it is approved to be stored. If the Commission deems a carbon dioxide source does not contribute to the energy and agricultural production economy of North Dakota, the fees will be determined by hearing.

(35) The operator shall implement a data sharing plan that provides for real-time sharing of data between DCC West's operations, the permitted operations of the east carbon dioxide storage facilities, Minnkota Center MRYS Broom Creek Storage Facility #1 (Facility ID: 90000330) and Minnkota Center MRYS Deadwood Storage Facility #1 (Facility ID: 90000332), and any other third-party sources that are piped in. If a discrepancy in the shared data is observed, the party observing the data discrepancy shall notify all other parties, take action to determine the cause, and record the instance. Copies of such records must be filed with the Commission upon request.

(36) This order shall remain in full force and effect until further order of the Commission.

Dated this 4th day of October, 2023.

INDUSTRIAL COMMISSION
STATE OF NORTH DAKOTA

/s/ Doug Burgum, Governor

/s/ Drew H. Wrigley, Attorney General

/s/ Doug Goehring, Agriculture Commissioner