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September 21, 2012

Robert Rohland
Wisconsin Department of Natural Resources
5301 Rib Mountain Drive
Wausau, WI, 54401
Robert.rohland@wisconsin.gov

RE: Central Sands Dairy, Tn. of Armenia, Juneau Co., WI, WPDES #WI-0063533-02-0 – Comments Regarding Environmental Conditions

Dear Mr. Rohland:

On behalf of Nicholas Karris of Karris Family Farms, I have reviewed the hydrogeological conditions, design and operations at the Central Sands Dairy (CSD) facility and am providing the following observations, conclusions and recommendations:

Central Sands Dairy Facility Description:

The 80-acre dairy facility is located in the S ½ of the NW ¼ of Section 12, T20N, R4E, Tn. of Armenia, Juneau County (see locator map, Attachment 1). The WPDES permit WI-0063533-01-0 was approved October 27, 2006 and operation began in 2007. The WPDES permit was reapproved as WI-0063533-02-0 on January 1, 2012. The facility includes cow barns, milking parlor and holding area, concrete silage storage pad, one concrete liquid manure storage basin, two concrete manure solids storage pads, one digester, five concrete tanks for soaker water, one concrete tank for solids pad runoff, one hay storage area, and runoff infiltration basins (see 2010 aerial photo of facility and monitoring wells, Attachment 2). The dairy is permitted for 3000 milking cows, 500 dry cows, 250 heifers, and 640 calves with animal waste land-spread in the surrounding area following a nutrient management plan.

The Central Sands is estimated to generate 802,339 lbs. of nitrogen and 280,116 lbs. of phosphorus per year according to historic manure sampling presented in waste spreading reports.

Historic Land Use Activities

The 1938 aerial photo (Attachment 3) shows the future CSD site to be agricultural fields with lands to the west forested. The lands to the east transition to increased agriculture use. The 2005 aerial photo

(Attachment 4) shows the future CSD site to be irrigated agriculture with forested lands to the west. The 2008 aerial photo (Attachment 5) shows the CSD has been constructed and the lands to the west in forest. The 2010 aerial photo (Attachment 6) shows the extent of irrigated area in the CSD area and documents the conversion of 160 acres of forested land to the west of the CSD site (NE ¼ of Sec. 11) and also the 320 acres to its west (W1/2 of Sec. 11) to irrigated agriculture.

Hydrogeology

The site is located in the Wisconsin Central Sands region over 150 feet of very permeable sand and gravel glacial outwash sediments overlying bedrock. The site has little topographic relief and is located approximately 1.75 miles west of the Wisconsin River Petenwell Flowage and 4.5 miles east of the main branch of Cranberry Cr. See topographic map, Attachment 7. The Cranberry Cr. tributary located 2.5 miles west of the site has intermittent flow. Regional groundwater flow in the site area is shown on the 1981 Wisconsin Geologic and Natural History Water Table Map (Attachment 8). With water table elevations of 940 to 945 feet MSL and a surface elevation of 960 feet MSL the water table would be approximately 15 to 20 feet below the surface and flow to the southeast. Ground water measurements in borings made for CSD in 2006 gave elevations from 940.81 to 942.34 feet MSL with the direction of flow generally to the southeast. Groundwater elevations would be expected to fluctuate seasonally due to variations in precipitation and recharge and also in response to the extensive irrigation well pumping in the area and the CSD facility high capacity well. Groundwater elevations measured from 2004 through 2010 at the Agri-Alliance spill site, located 650 feet southeast of the CSD entrance at CTH "G", document up to 4.0 feet of water table elevation fluctuation with the 2010 elevations being two to four feet higher than the 2006 elevations(see Attachment 9). The Agri-Alliance monitoring also confirmed flow was generally to the southeast, with minor variation that may be due to irrigation pumping or Lake Petenwell stage elevation fluctuations.

Sandy highly permeable soils with little organic material content characterize the Central Sands and site area. The water infiltration rates are high and the runoff rates low. The soils are droughty, requiring irrigation for most commercial crops. The rapid infiltration, rapid draining and large soil pores allow for rapid movement of oxygenated surface water into and through the root zone. Large portions of commercial crop nutrient and dairy waste applications (fertilizer and manure) are rapidly washed below the root zone becoming inaccessible to plants and therefore larger nutrient additions are required to produce commercially viable crops. The reduced forms of nutrient nitrogen are usually rapidly oxidized to nitrate-nitrogen. It has been documented that, even with best management agricultural practices, cropping in the Central Sands has led to extreme inputs of nitrogen into the groundwater with approximately 75 to 125 lbs. of nitrogen per acre leaching into the groundwater below the cropped fields (Kraft & Mechenich, 1997),(Kraft, G.J. and W. Stites. 2003),(Stites, W. and G.J. Kraft. 2000 & 2001). The cumulative result is basin-wide nitrogen loading of the groundwater system with large areas of the groundwater system contaminated above the safe drinking water standard of 10 mg/l nitrate-N. The basin groundwater system has not yet reached equilibrium with the nitrogen loading; therefore, nitrate concentrations are anticipated to increase through time as continued nitrogen inputs cause nitrate-impacted groundwater to replace the remaining non-impacted water (Kraft & Mechenich,

1997). In addition to the impacts to private water supplies and groundwater-dependent aquatic systems, some municipal water systems now have the costs for nitrate treatment system installation and operation (Kraft & Mechenich, 1997. Studies in the Central Sands have documented that 70% of water supply wells within irrigated areas may exceed the safe drinking water standard of 10 mg/l nitrate-N (Stites, W. and G.J. Kraft. 2000 & 2001). In contrast, uncropped lands such as the forested areas west of CSD have very low nitrogen inputs and the underlying groundwater nitrate concentrations would be expected to be very low, generally less than the NR 140 PAL of 2.0 mg/l.

Water Quality Monitoring at the CSD Wells

CSD installed test wells at three locations near the dairy to monitor the nitrate levels of the ground water. These wells help develop background information on nitrate concentrations and indicate if a problem develops near the dairy. Inquiries to WDNR staff (Terry Kafka, Laura Chern, Gretchen Wheat and Robert Rohland) regarding the availability of any groundwater quality monitoring at the CSD indicated they were unaware of the installation or monitoring of any wells at the CSD facility.

However the Agri-Alliance Spill Site (WDATCP #02406071101), referenced above regarding water levels, utilized two of the CSD wells referenced as part of their spill investigation ("MW-1" and "PZ-1"). The well logs for these wells are described in "Appendix B, Off-Site Well Construction Data" (Attachment 10). The logs document the wells were installed by Dave Paulson of "Soil Essential" on January 10, 2008 and certified by Ryan S. Haney of Sand Creek Consultants, Inc. The well contact was listed as Gordon Jones, Central Sands Dairy, LLC, 8550 Central Sands Rd., Bancroft, WI, 54921. The boring log showed sand to 45 feet. MW-1 was screened from 20 to 30 feet below the surface and PZ-1 was screened from 40 to 45 feet below the surface. The bottom of the well forms notes that the completed forms must be filed with the DNR per State law and administrative code requirements.

Copies of groundwater sampling results from the five monitoring wells which were placed at three locations were provided by Ken Winters, Town of Armenia Zoning Commission (see Attachment 11, "Table 1"). Approximate locations of the wells are noted on the 2010 Aerial – Central Sands Dairy Groundwater Monitoring Locations" (Attachment 2). This information provided conforms to the well construction data contained in the logs referenced above and includes well screen depths for: MW-2 (15 to 25 feet), PZ-2 (35 to 40 feet), and MW-3 (14 to 24 feet). NO3/NO2 and NH3/NH4 analyses were reported once for each well for 2008, 2009, 2010, and 2011. Since the wells have been sampled in either January or February for each of those years it is expected that sampling results from 2012 may also be available.

MW-3 is in an up-gradient position relative to the CSD facility and showed very low NO3/NO2 values for 2008 and 2009 (1.8 and 1.3 mg/l), but increased in 2010 and 2011 (16.2 and 17.8 mg/l) with the concentrations greater than the NR 140, Wis. Adm. Code Enforcement Standard (ES) of 10 mg/l. It was noted that the forested area, reportedly owned by Okray, west and up-gradient of the well, was cleared for irrigated agriculture in 2009. It is likely the spike in NO3/NO2 is due to the addition of excess

nutrients in the cleared area. It is probable the NO3/NO2 concentrations will continue to increase until steady state conditions are reached.

MW-2 and PZ-2 are immediately down-gradient from the CSD liquid manure storage basin. Total nitrogen in MW-2 increased from low levels in 2008 and 2009 (2.8 and 2.0 mg/l) to over the ES in 2010 and 2011 (13.3 and 10.1 mg/l). It is noted that NH3/NH4 was a significant component of the total nitrogen in 2010 and 2011 (5.8 and 6.5 mg/l). This level of NH3/NH4 would not naturally be expected in even a fertilized sandy soil. It is more likely due to the anaerobic conditions resulting from leakage of manure from the CSD liquid manure storage basin or other manure sources further up-gradient such as the barns. The liquid manure storage basin is the most likely source since the base of the basin was designed for an elevation of 944 feet MSL and groundwater fluctuations, as described previously, are likely to rise to that elevation or above. With little or no unsaturated soil below the liner the reduced nitrogen species in the manure (NH3/NH4) can move into the groundwater without significant oxidation. The five-inch thick concrete manure storage basin liner is not backed by compacted clay or a plastic liner nor is there an underdrain system or lysimeter to monitor liner leakage. Even a small number of cracks or voids in the concrete could allow significant leakage due to the hydraulic head on the liner (972.6 – 944 = 28.6 feet). PZ-2 NO3/NO2 concentrations decreased significantly from a high of34 mg/l in 2008 to a low of 0.2 mg/l in 2011. The high level in 2008 is most likely due to residual excess nutrient additions from the irrigated agriculture in the site area prior to the CSD facility construction. Though the NH3/NH4 concentrations in PZ-2 are relatively low it is noted they increase significantly from 0.03 mg/l in 2010 to 0.55 mg/l in 2011. This most likely is a result of the leakage of manure into an anaerobic groundwater condition as described previously.

MW-1 and PZ-1 are located immediately down-gradient from a 160-acre irrigated field. NO3/NO2 concentrations for MW-1 and PZ-1 are not significantly different. They are over the ES and have ranged from 16.3 to 34.1 mg/l, with all values over the ES of 10 mg/l. The lack of very significant concentration changes with time or depth at this location is most likely a reflection of a long history of irrigated crop land use over the large field area up-gradient of the wells. The long term over-application of fertilizer or nutrient wastes has allowed the nitrate concentrations to approach a steady-state condition to at least the depth of the piezometer (45 feet).

Other Water Quality Observations in CSD Facility Area

1. NO3/NO2 measurements at the Hoffman residence at N15883 CTH "G" (35.9 and 37.8 mg/l) located immediately east and down-gradient of either the same field discussed for MW-1 and PZ-1 or the irrigated field across the CSD entrance drive south of it.

2. NO3/NO2 measurement at the Bob Owens residence 23.9 mg/l) located on CTH "G" east of the CSD.

3. NO3/NO2 measurement at N15761 23rd Ave. N., Nekoosa (30.7 mg/l).

4. Pivot well sample north of CSD south of 3rd St. taken in August of 2012 when manure was not being spread. This sample had a positive E. coli result of 6000 cfu/mL (See photo, Attachment 12).

5. Water sample from Spud Creek along manure spread field (19th and 4th St.) with no inflow or outflow from creek tested unsafe at 376 cfu/100mL E. coli.

See Attachment 14.

NR214, Wis. Adm. Code Spray Irrigation Requirements

CSD has been conducting its spray irrigation waste application without conformance to the requirements of NR 214, Wis. Adm. Code (which is also incorporated through reference in NR243.15(6)):

NR 214.14(1)(b) requires that the nearest edge of wastewater spray shall be separated by at least 500 feet from the nearest inhabited dwelling, except that the distance may be reduced with the written consent of any affected owners and occupants. The department may require a greater distance depending on the type of distribution system and potential for aesthetic and public health impacts. The CSD is not in conformance with this requirement.

NR 214.14(3)(b) requires discharge to be limited to prevent exceedence of a substance's preventive action limit (PAL) in groundwater.

NR 214.12(3)(c) limits total nitrogen application to the annual nitrogen need of the cover crop.

NR 214.14(4)(b) requires monitoring of irrigation discharge for total daily flow and may also include analysis of BOD_5, TSS, N, Cl, metals or other pollutant that may be present and may require per (c) submittal of electronic monitoring reports.

NR 214.14(5)(b) requires twice yearly cutting of cover crops in order to remove nutrients from the system or if cut only once the applied nutrients limited accordingly.

NR 214.14(5)(c) requires annual soil testing of each individual spray irrigation field for available nitrogen, phosphorus, and potassium and used to determine the agronomic needs of the cover crop.

NR 214.14(5)(d) requires submittal of a management plan that insures conformance with NR 214.

NR 214.20 requires soil investigations for spray irrigation systems that include: identification of spreading sites, existing soil survey data, detailed soils map, soil cation exchange capacity, agronomic soil nutrient testing. Per NR 214.20(6) test pits and preliminary site investigation is required followed by a full scale treatment site investigation that includes additional test pits, soil borings to either 25 feet or the groundwater, with description of the soils.

NR 214.21 requires a comprehensive multi-level groundwater monitoring system for systems treating equal to greater than 1.0 million gallons a day (gpd) or a single level groundwater monitoring system for

systems that treat 15,000 gpd or more, but less than 1.0 million gpd. However, NR 214.21(1)(c) allows the department to require either a single- or multi-level groundwater monitoring system for any land treatment system regardless of treatment volume in consideration of waste strength and characteristics, waste volume, dosage schedule, geology of the area, soil type, and application rates relative to groundwater flow velocity .

The groundwater monitoring system must conform to NR 141 and consist of an adequate number of wells to define groundwater flow direction and determine land treatment groundwater impacts. In-field well tests are required to determine hydraulic conductivity and gradients. A map showing the wells, treatment area, property boundaries, and the location of all wells, wetlands, streams, and lakes within 0.5 miles of the treatment site. Sampling for seasonal operations minimal sampling is required prior to system startup and 2 times during or within 2 months after the time the treatment system is used. The department may require analysis of: elevation, depth to groundwater, organic N, NH3/NH4-N, NO3/NO2-N, chloride, sulfate, TDS, alkalinity, hardness, field pH and conductivity, BOD_5, COD, sodium, calcium, magnesium, iron and manganese with other substances required dependent on the waste characteristics and the potential for groundwater contamination.

Nutrient Loading Rates (Phosphorus)

WDNR correspondence indicates excess phosphorus (greater than 100 ppm) has accumulated in the soils in the CSD waste spreading areas with a majority exceeding 200 ppm and that additional action should be taken to reduce soil phosphorus to below 100 ppm.

2011 Spreading Report and Snap-Plus Data and 590 Assessment Plan

A review of the 2011 waste spreading report indicated the following:

1) The report appears to be incomplete with the following data categories missing:
    a) Date of waste application.
    b) Soil conditions at time of application.
    c) The report section for description of "Rotation" and "Tillage" was not completed.
    d) The report section for reporting phosphorus field rotation budgets and target values (the phosphorus index (PI), P2O5 balance and P2O5 Balance Target) were checked "NA", though it would appear that phosphorus management as part the waste spreading program would be necessary.
2) The phosphorus soil tests showed all spreading fields with phosphorus well above 100 ppm with 7 fields above 200 ppm.

3) The application rates reported in the spreading report (see Attachment 13) for the post digester solids appear to be excessive and may account for some of the soil accumulation of phosphorus reported by the DNR. A calculation of the phosphorus loading rates from the reported data is tabulated below:

Field Name	Field Size Acres	Manure Analysis P (lbs./ton)	Application Rate, tons/A	P Application Rate, lbs/A
Casino N	110	60	500	273
Casino S	79	60	350	266
NO1	60	60	200	200
NO2	60	60	200	200
NO3	65	60	350	323
NO4	65	60	350	323
NO5	65	60	200	185
NO7	65	60	350	323
NO8	75	60	500	400
NO9	75	60	460	368

Conclusions

1. CSD and its waste land spreading areas are located in a hydrogeologic environment very susceptible to groundwater contamination with significant documented water quality impacts related to over-application of crop and animal waste nutrients on irrigated lands with development of extensive areas of groundwater with nitrate concentrations exceeding the NR 140 ES of 10 mg/l.

2. Groundwater monitoring wells were installed and monitored by CSD since January 2008, apparently without reporting to the DNR. Monitoring results with contaminant levels exceeding the NR 140 ES and increasing contaminant concentration trends signifying a contaminant release were apparently not reported to the DNR.

3. The spike in NO3/NO2 in MW-3 indicates a significant release of contaminants from the upgradient irrigated field. The contaminants are most likely related to the excess crop application of nitrogen nutrients.

4. The increase in reduced nitrogen at MW-2 and PZ-2 indicates a release of manure contaminants from the up-gradient liquid manure storage basin is occurring. The lack of adequate liner separation above the groundwater and potential liner design and installation deficiencies are the most likely cause of the release.

5. The high levels of groundwater nitrate documented in MW-1, PZ-1 and nearby private water supply wells indicate the up-gradient irrigated field has received excess nitrogen loading from crop nutrients or waste manure application.

6. The documentation of E. coli from a pivot well sample and from the Spud Cr. drainage along with documented E. coli impacts at other CAFOs indicates E. coli and total coliform are potential contaminants of concern warranting comprehensive monitoring in both land-applied wastewater and groundwater at the CSD facility and its land application fields.

7. The CSD is not in conformance with the spray irrigation requirements of NR 214.

8. Excessive accumulation of phosphorus in CSD waste application fields appears to be a result of over-application of waste nutrients and poses a risk to Lake Petenwell due to eutrophication impacts.

Recommendations

As part of WDNR's investigation and determination of what enforcement activities may be required for the Central Sands Dairy I make the following suggestions for some of the specific actions and activities that should be considered.

1. The CSD WPDES permit could be modified to include:

    a. A groundwater monitoring plan conforming with NR 141 for the dairy facility using the existing wells supplemented by two additional well nests located up-gradient of any irrigated fields and two additional well nests located in potential down-gradient directions. The plan should include quarterly measurement of water level (MSL and BGS), organic-N, NH3/NH4-N, NO3/NO2-N, total coliform and E. coli bacteria. The data should be reported electronically to the DNR quarterly with an annual report summarizing the results and providing recommendations for additional investigation or facility design or operational modifications that may be indicated. A map showing the wells, facility design features, property boundaries, and the location of all wells, wetlands, streams, and lakes within 0.5 mile of the site should be provided.

b. A comprehensive groundwater monitoring plan conforming to NR 141 for all non-spray irrigation dairy facility waste land spreading fields should be required. The plan should include quarterly measurement of water level (MSL and BGS), organic-N, NH3/NH4-N, NO3/NO2-N, total coliform and E. coli bacteria. The data should be reported electronically to the DNR quarterly with an annual report summarizing the results and providing recommendations for additional investigation or waste application modifications that may be indicated. A map showing the wells, field application areas, property boundaries, and the location of all wells, wetlands, streams, and lakes within 0.5 mile of the treatment site should be provided.

c. A study of the CSD liquid waste manure storage basin and any other concrete-lined facilities, such as the cow barns, that may be leaking organic contaminants into the groundwater should be required. Any existing as-built documentation should be reviewed and reports of deficient construction evaluated as to their significance. The manure basin should be drained and inspected and a remedial lining plan implemented as needed. The basin liner elevation should be field documented. The potential groundwater elevation fluctuation under the basin should be evaluated and a remediation redesign that maintains a substantial separation of the liner bottom and the groundwater implemented.

d. Phosphorus and nitrogen soil and waste characterization monitoring requirements and waste application rates for all field waste application sites should be modified to insure excessive soil phosphorus does not accumulate and groundwater loading of nitrogen does result in a continued exceedence of the NR 140 ES of 10 mg/l.

e. The CSD waste spray irrigation fields should be required to conform with NR214 including:

    i. A separation of 500 feet between the edge of spray and all inhabited buildings.

    ii. Monitoring total daily spray flow, organic-N, NH3/NH4-N, NO3/NO3-N, total coliform and E. coli

    iii. Establishment of total nitrogen application rates that ensure the groundwater nitrate concentrations will not exceed or continue to exceed the NR 140 ES of 10 mg/l.

    iv. Require twice yearly cutting of field cover crops or if cut only once the applied nutrients limited accordingly.

    v. Require annual soil testing of each individual spray irrigation field for available nitrogen, phosphorus, and potassium and used to determine the agronomic needs of the cover crop.

vi. Submit a management plan that insures conformance with NR 214.

vii. Require a soil investigation for the spray irrigation system that includes: identification of spreading sites, existing soil survey data, detailed soils map, soil cation exchange capacity and agronomic soil nutrient testing. Per NR 214.20(6), test pits and preliminary site investigation should be required followed by a full scale treatment site investigation that includes additional test pits, soil borings to either 25 feet or the groundwater, with description of the soils.

viii. Require a comprehensive multi-level groundwater monitoring system that conforms to NR 141 and includes an adequate number of wells to define groundwater flow direction and determine land treatment groundwater impacts. In-field well tests should be required to determine hydraulic conductivity and gradients. A map showing the wells, treatment area, property boundaries, and the location of all wells, wetlands, streams, and lakes within 0.5 mile of the treatment site should be provided. Quarterly sampling for measurement of water level (MSL and BGS), organic-N, NH3/NH4-N, NO3/NO2-N, total coliform and E. coli bacteria should be required and reported electronically to the DNR quarterly with an annual report summarizing the results and providing recommendations for additional investigation or waste application modifications that may be indicated.

Include the sampling of any private water supply wells within ¼ mile of each of the spreading fields for the same parameters except for water level , whenever the owner's permission can be obtained.

2. DNR should require CSD to immediately submit all existing groundwater monitoring data, including well construction logs, borings, and analyses (including 2012).

3. DNR should require CSD to immediately identify all private water supply wells within ½ mile of all designated waste spreading fields and begin quarterly groundwater sampling for NO3/NO2, total coliform and E. coli bacteria for all wells within ¼ mile of the spreading fields with electronic reporting to the DNR quarterly. A locator map of all sampled wells, GPS located, with accompanying well logs where obtainable from public records or well owner contact, should be provided.

4. An inspection of operations should be conducted that insures that land application of any wastes by other than spray irrigation maintains a separation from the spreading areas of at least 100 feet from private wells or direct conduits for movement into the groundwater(per NR243.14(2)(8) and (9)).

5. DNR should require CSD to immediately begin sampling of the five existing dairy groundwater monitoring wells for water level, organic-N, NH3/NH4, NO3/NO2, total coliform and E. coli

bacteria for all wells within ¼ mile of the spreading fields with electronic reporting to the DNR quarterly.

Prepared by Kenneth S. Wade, P.E., P.G. – September 20, 2012

References

Kraft, G.J., B.A. Browne, W.M. DeVita, & D.J. Mechenich. 2004. Nitrate and Pesticide Penetration into a Wisconsin Central Sand Plain Aquifer, College of Natural Resources, University of Wisconsin – Stevens Point

Kraft, G.J., D.J. Mechenich. 1997. Contaminant Source Assessment and Management Using Groundwater Flow and Contaminant Models in the Steven Point – Whiting Plover Wellhead Protection Area

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Stites, W. and G.J. Kraft. 2001. Nitrate and chloride loading to groundwater from an irrigated north-central U.S. sand-plain vegetable field. J. of Environmental Quality. V. 30:1176-1184.

Stites, W. and G.J. Kraft. 2000. Groundwater quality beneath irrigated vegetable fields in a north central U.S. sand plain. J. of Environmental Quality. 29:1509-1518

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Experience

2011 to present – Hydrogeological and environmental engineering consulting in areas of waste land spreading, high capacity wells, chlorinated solvent spills, and wetland hydrology.

1993 to 2011 – manage the hazardous materials program for Wisconsin Department of Transportation, Southeast Region. Major projects include Miller Park Baseball Stadium, Lake Arterial Parkway, Park East, and Marquette Interchange. Manage hydrologic assessment of WisDOT wetland program issues.

1987 to 1993 – Wisconsin Department of Natural Resources, Bureau of Solid Waste Management, made feasibility determinations for solid waste facilities, coordinated hydrologic assessments of Crandon Mine Environmental Impact Statement.

1986 to 1987 – Idaho National Engineering Laboratory, Department of Energy (EG&G), hazardous and radioactive waste assessments for soil and groundwater, dioxin soil testing at Agent Orange storage sites (U.S. Department of Defense), with Level 1 security clearance.

1980 to 1985 – Wisconsin DNR, Bureau of Solid and Hazardous Waste Management with duties similar to DNR above.

1978 to 1980 – Colorado State University, graduate research, uranium solution mining impacts, reported to Colorado Dept. of Health.

1976 to 1977 – Brodhead High School, taught chemistry, advanced chemistry, and physics

1975 to 1976 – Solar Specialists, Inc., solar space heating and hot water installation

Education

1981 – 1985, U. of Wisconsin-Madison, graduate study in numerical groundwater flow and contaminant transport modeling; USGS Training Center, groundwater modeling

1978 – 1980, Colorado State University, Master of Geology

1970 – 1974, U. of Wisconsin-Madison, BS in secondary education

Other Experience

Town Board Chair – Town of Middleton, Dane County Wisconsin, 1989-1990

Restoration Ecology – Ongoing prairie, oak-savanna, wetland restoration in conjunction with "The Prairie Enthusiasts" on 226 acres of land in western Dane County.

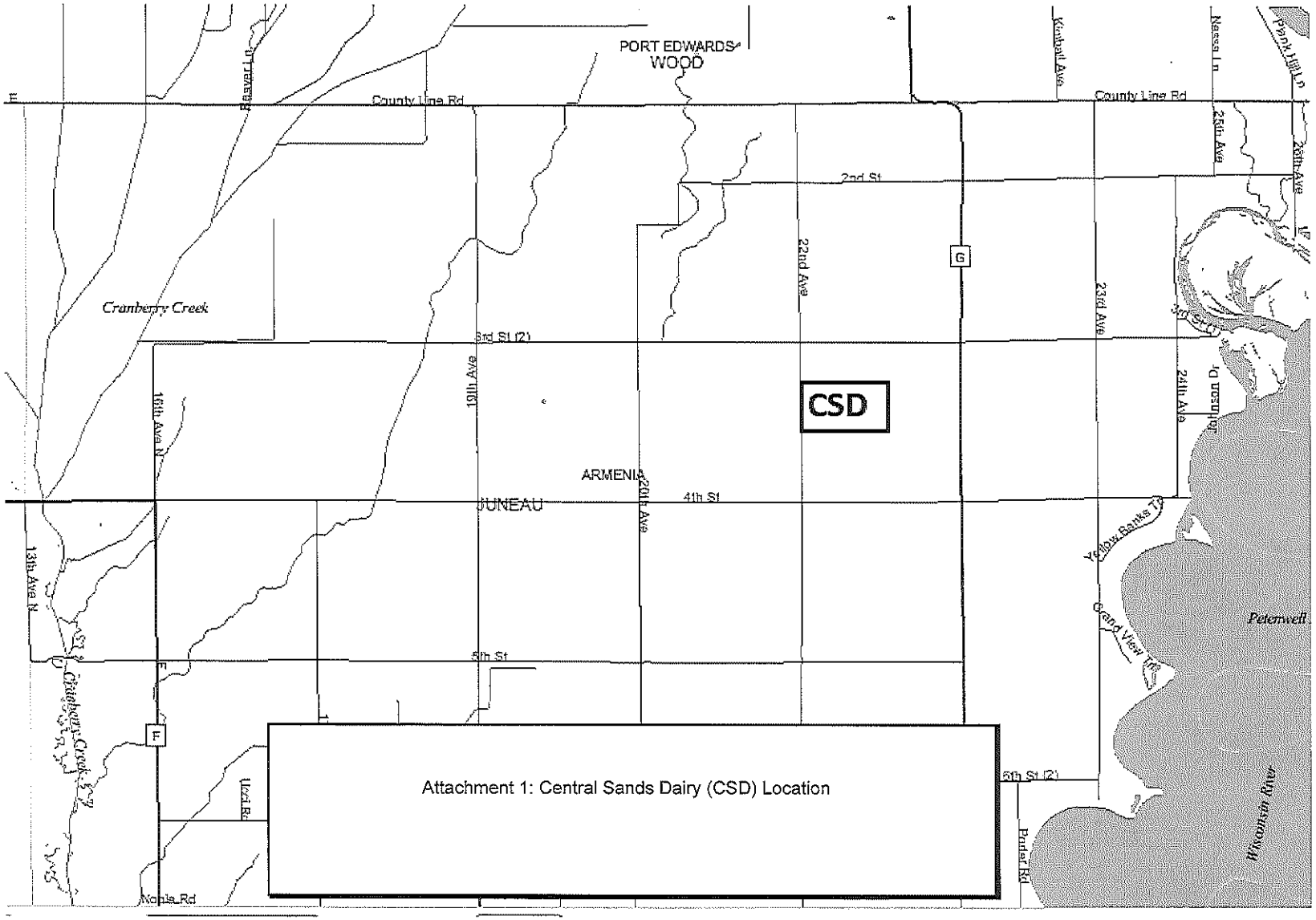
Extensive outdoor experience including: mountaineering and rock climbing, winter camping, bicycling, and kayaking

Registration

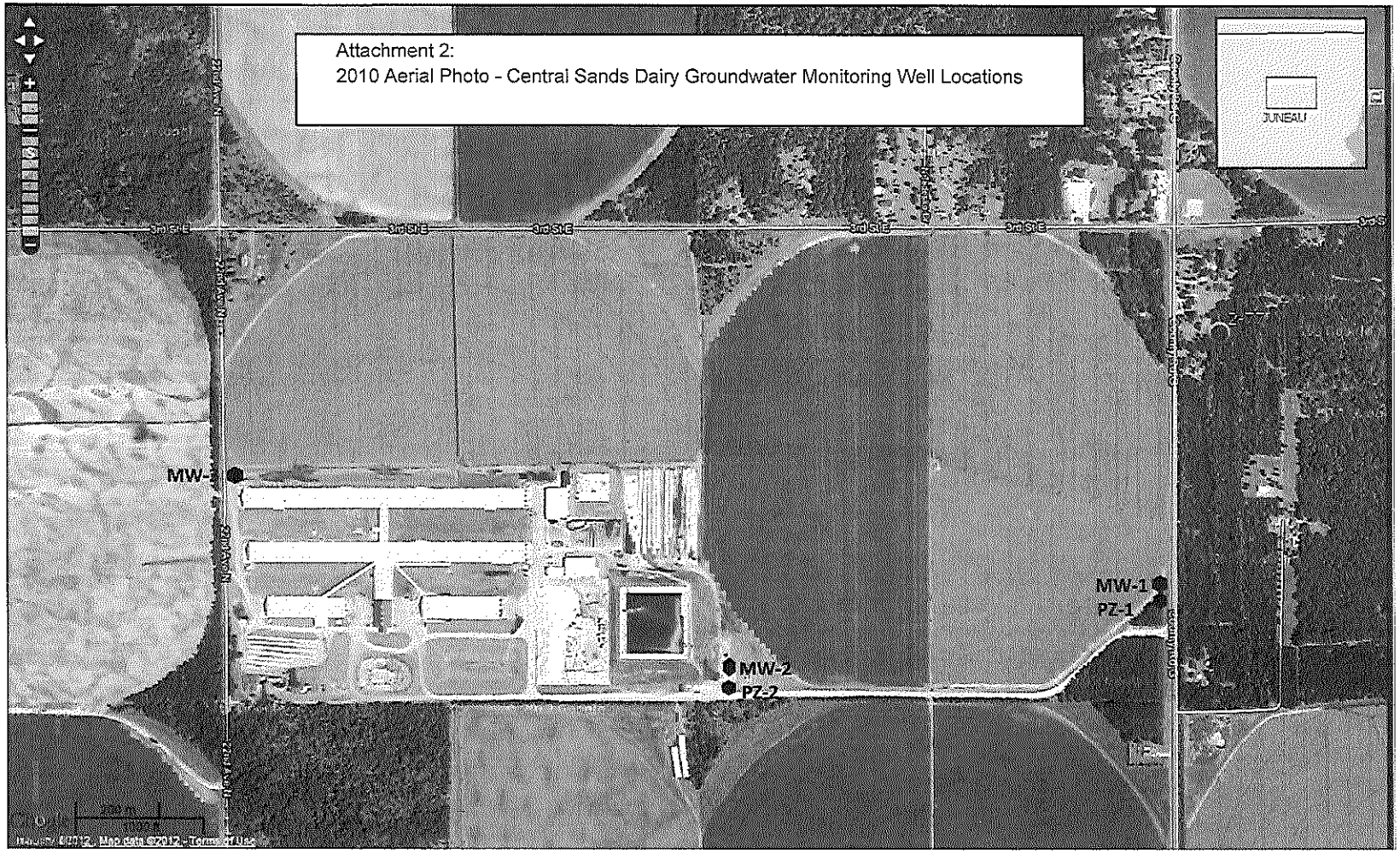
Wisconsin Professional Engineer, # 30156

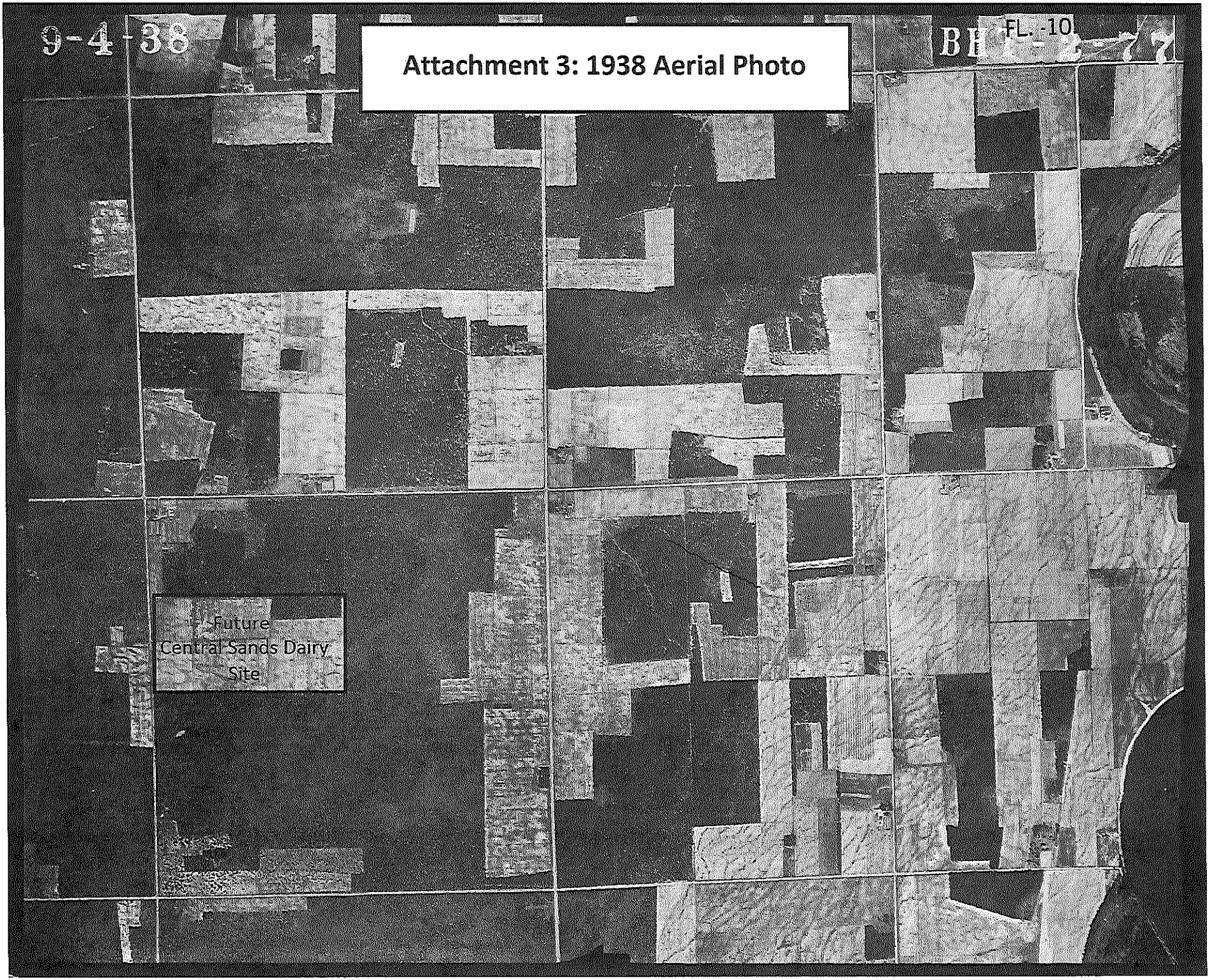
Wisconsin Professional Geologist, # 556

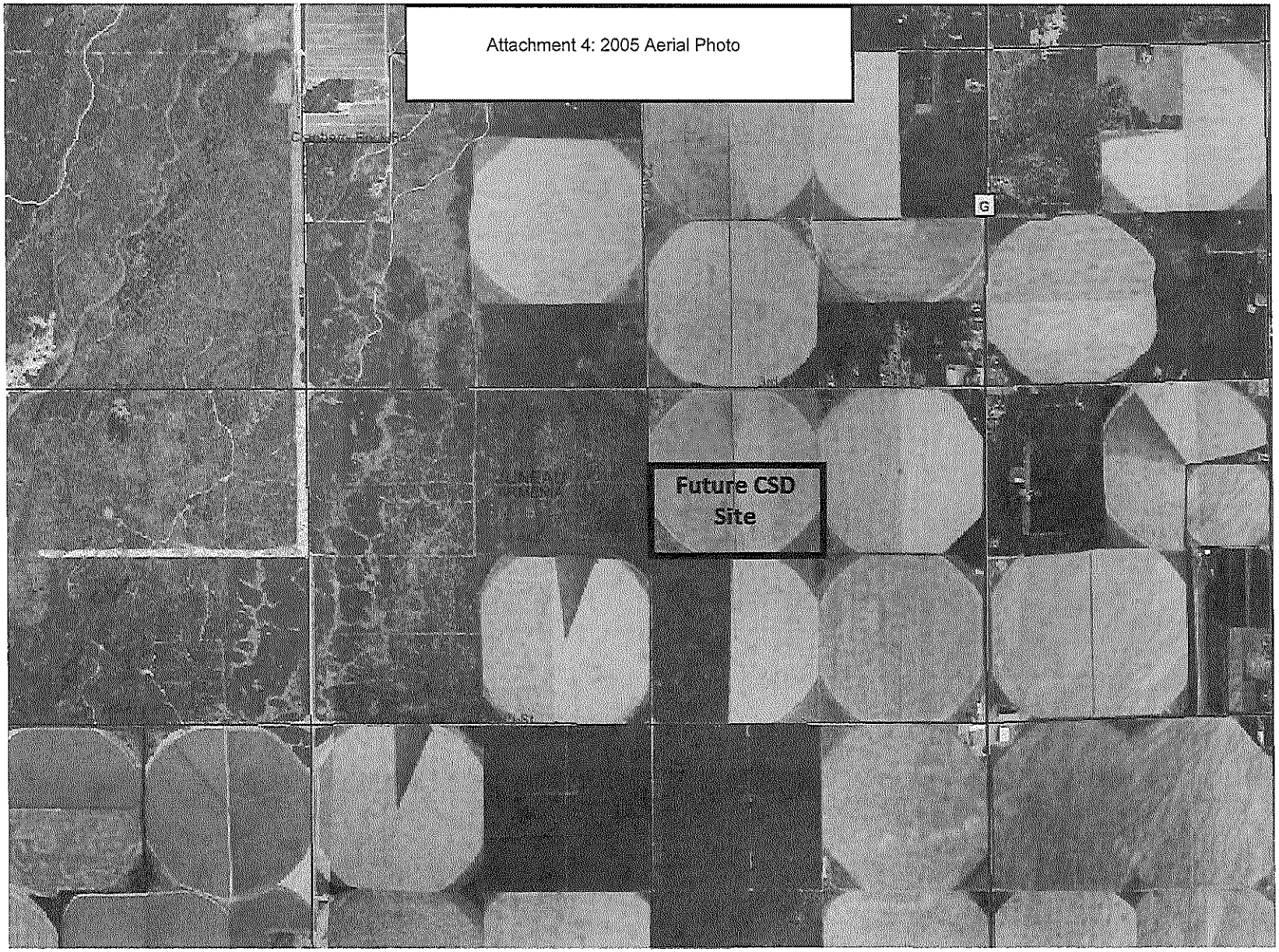
Hazardous Waste Operations and Emergency Response Certified (29 CFR1910.120)



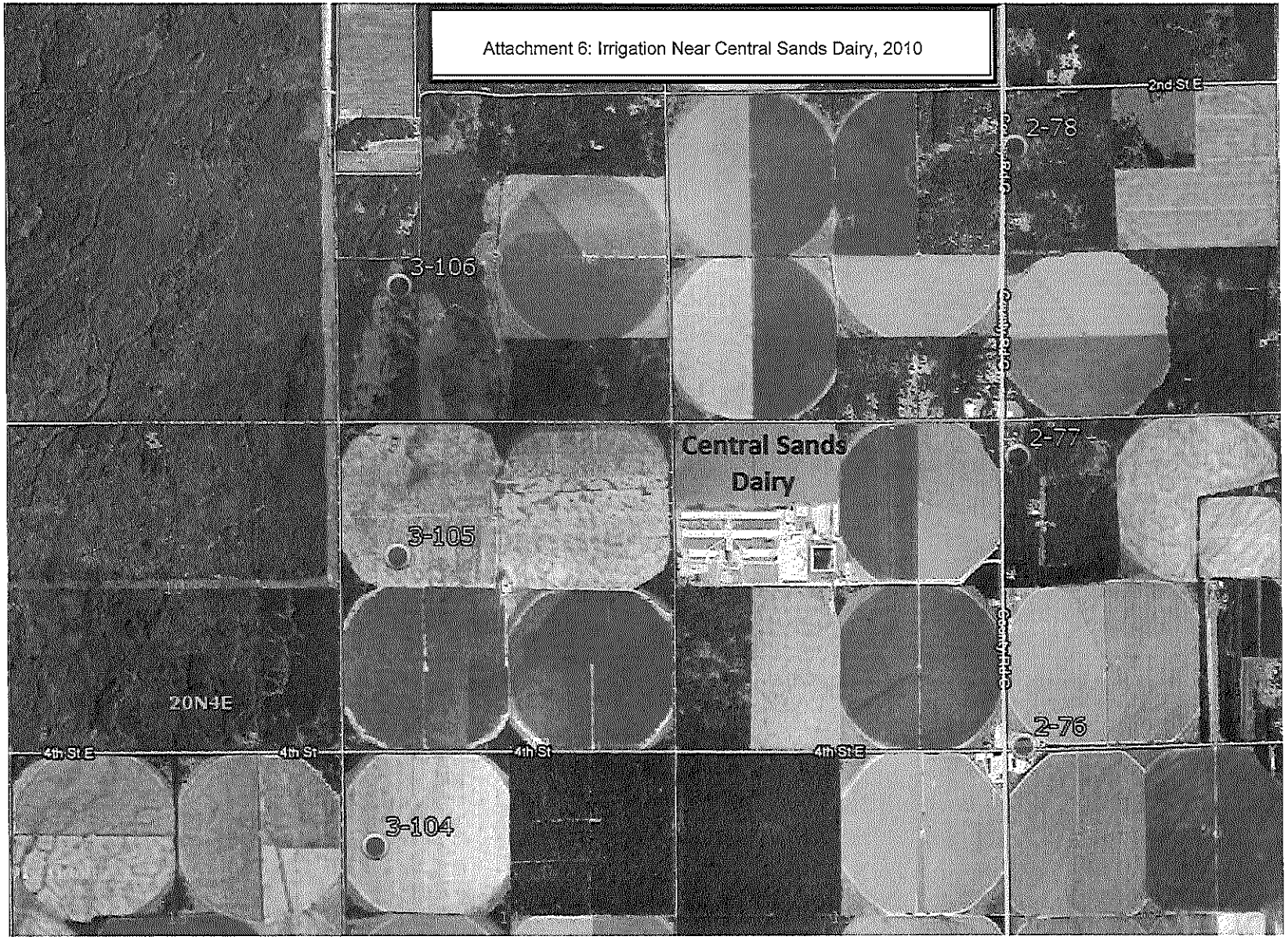
Attachment 1: Central Sands Dairy (CSD) Location

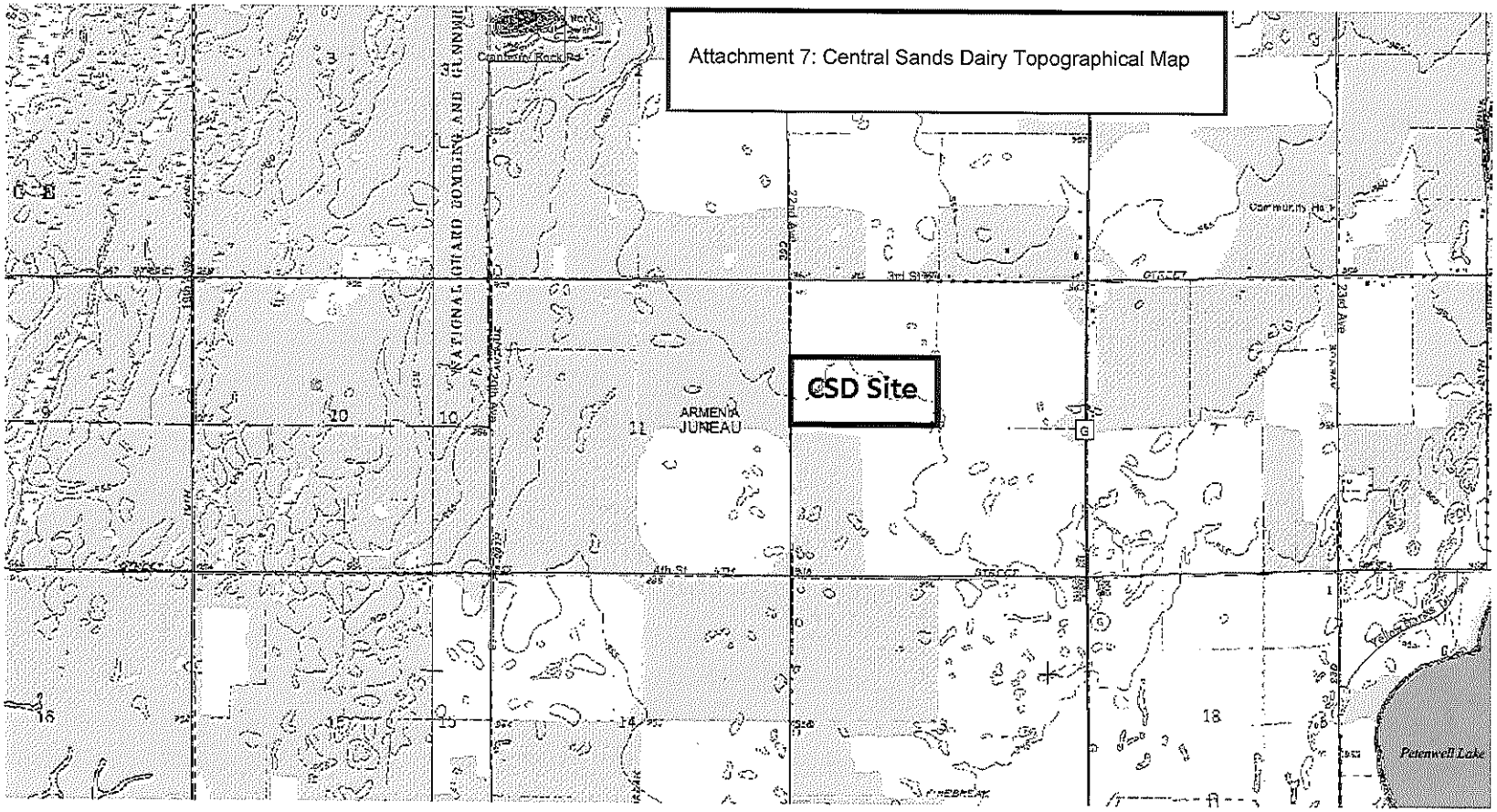

Attachment 2:
2010 Aerial Photo - Central Sands Dairy Groundwater Monitoring Well Locations
JUNEAU
3rd St E
22nd Ave N
MW-3
MW-1
PZ-1
MW-2
PZ-2


9-4-38
FL.-10
Attachment 3: 1938 Aerial Photo
Future
Central Sands Dairy
Site


Attachment 4: 2005 Aerial Photo
Future CSD Site


Attachment 5: 2008 Aerial Photo - Central Sands Dairy (CSD)
G
CSD Site


Attachment 6: Irrigation Near Central Sands Dairy, 2010
2nd St E
2-78
3-106
Central Sands
Dairy
2-77
3-105
20N3E
4th St E
4th St
4th St
4th St E
2-76
3-104


Attachment 7: Central Sands Dairy Topographical Map
CSD Site
ARMENIA
JUNEAU
NATIONAL GUARD BOMBING AND GUNNERY
Petenwell Lake