Richfield Dairy High Capacity Well Supplemental Environmental Assessment – 72.5 MGY

Background

In May 2011 Milk Source Holdings, LLC, dba Richfield Dairy submitted a high capacity well application to the Department of Natural Resources (DNR) to construct two high capacity wells with pumping capacities of 500 gallons per minute (gpm) each. One well would serve as the primary water supply well for dairy operations, while the other would function as a back-up well. Water would be used year-round for animal watering and cleaning, and in summer for evaporative cooling of the barn. An existing irrigation well on the property would be abandoned.

The proposed Richfield Dairy facility and wells are located approximately 1.1 mile west of the north-south-trending Johnstown Moraine, which forms the surface water divide between the Mississippi River and Lake Michigan drainage basins. The facility is roughly 0.4 miles east of the Mississippi River/Lake Michigan groundwater divide, and groundwater at the site generally flows in a southeasterly direction. The aquifer consists of 150-200 feet of sand and gravel overlying about 300 feet of sandstone bedrock. Based on soil borings in the area, the static groundwater level at the site is no less than 32 feet below ground surface. The proposed wells would be drilled to a depth of around 350 feet and be cased into the sandstone.

The Department held an informational session and public hearing on the Environmental Assessment (EA) and proposed WPDES permit for the facility on July 18, 2011 at the Adams County Community Center in Adams, Wisconsin. Department staff estimated that approximately 340 individuals attended the hearing. The Department allowed a 30-day comment period on the EA. The EA and addendum, including responses to comments, are available at the following website: http://dnr.wi.gov/topic/AgBusiness/documents/finalEnvironmentalAssessment.pdf

In November 2011, the DNR issued a high capacity well approval for two wells to Milk Source Holdings, LLC for the Richfield Dairy facility. The November 2011 approval restricted the maximum total gallons pumped from the two wells in any 365-day period to 131.2 million gallons. A group of petitioners challenged the DNR's decisions regarding the Richfield Dairy facility, seeking both contested case hearings and judicial review. The judicial cases were filed in Dane County Circuit Court and asserted, among other things, that the DNR's EA for the project was not adequate. On July 20, 2012, the Circuit Court Judge ruled that the EA prepared by the DNR was deficient because it failed to sufficiently evaluate the environmental effects of the DNR-approved 131.2 million gallons per year (MGY) pumping rate, in conflict with ss. NR 150.22 and 150.02(9), Wis. Adm. Code. Consequently, the Court remanded the matter back to the DNR "to provide a preliminary factual investigation of sufficient depth to allow a reasonably informed

preliminary judgment and the opportunity for public comment about the environmental and cumulative effects of the high capacity wells operating at 131.2 million gpy."

On July 27, 2012, DNR received a request from Richfield Dairy that pumping on the high capacity property be limited to 72.5 MGY. In view of Richfield Dairy's request for an annual pumpage limit of 72.5 MGY, the supplemental EA addresses the environmental and cumulative effects of operating the wells on the property at the pumping rate of 72.5 MGY, rather than 131.2 MGY. The Circuit Court Judge also noted, in a Decision and Order on Motion for Relief from Judgment or in the Alternative to Amend and Clarify, dated October 2, 2012, that the EA should evaluate the impact of the high capacity wells at whatever pumping limit is anticipated to be approved.

Based on pumpage reported for the years 1978-1980, 1982-1989, and 2007-2011, 72.5 MGY is roughly twice the amount of water that was previously pumped for irrigation purposes. In conjunction with its request to limit pumping to 72.5 MGY, Richfield Dairy provided DNR with numerical groundwater modeling results and an evaluation of the effects of pumping on lakes and streams in the vicinity of the proposed wells (S.S. Papadopulos & Associates, 2012, attached – referenced as "SSPA"). Numerical groundwater modeling is currently the best tool available for evaluating the long-term effects of groundwater withdrawals in a large, complex system.

The *MODFLOW* model provided by SSPA is based on the calibrated regional groundwater model of the Central Sands developed by Mechenich and others (2009), with site-specific refinements. Model grid spacing ranged from 125 square feet (ft^2) in the vicinity of the Dairy to 1000 ft^2 near the boundaries of the model. The site-specific model was constructed with model layers for the upper sand and gravel aquifer and for the lower sandstone aquifer. Hydraulic conductivity in the upper aquifer was zoned to reflect different geology east and west of the terminal moraine and modified to produce the best representation of actual conditions using *PEST* parameter estimation software. Pleasant Lake and Lake Burnita were modeled using the *MODFLOW* lake package. Pumping from existing irrigation wells was explicitly modeled, with an irrigation water loss equivalent to the 2 inches of "missing water" identified in work by Kraft and others, 2012. The proposed Dairy wells were assumed to have 100% water loss.

The site-specific model was run under background conditions (no pumping), current conditions (pumping from all existing irrigation wells), and existing irrigation pumping plus 72.5 MGY withdrawal from the Dairy. The first two scenarios were run at steady state (infinite time). The simulation of the effects of pumping at Richfield Dairy was run in a transient mode, which allows observation of the effects of pumping over time. During the Richfield Dairy pumping scenario, no water withdrawal was simulated from the existing irrigation well on the property, because this well would be abandoned prior to operation of the Dairy wells. Model results were reported at 5 and 25 years of operation. After 25 years, the modeled system had equilibrated until groundwater

drawdown was no longer increasing significantly with time (see graph of Pleasant Lake drawdowns over time, p. 17 of SSPA).

The DNR's Water Use Section conducted a review of the potential impacts of the Dairy's high capacity wells on waters of the state. The DNR analysis focused on the long-term (25-year) impacts of pumping.

Analysis of Environmental Impacts

Private Wells: There is an existing residential well roughly 400-500 feet from the Dairy's proposed north well (Well #71787). Initial screening indicated that drawdown would not exceed five feet after extended pumping at the proposed rate of 72.5 MGY. In almost all cases where private wells have been constructed in accordance with the state's well code, water table drawdown of less than five feet will not cause significant impacts to private wells. Results of the site specific model indicate that after 25 years of sustained pumping at 72.5 MGY, water table drawdown at the existing well would be roughly 18 inches (1.5 feet). The expected level of drawdown does not constitute a significant impact.

Public Wells: The nearest public utility well is the Village of Coloma Well #1. The village well is 4.8 miles northeast of the proposed Richfield Dairy wells. After 25 years of pumping at 72.5 MGY, water table drawdown at Well #1 is modeled to be 1-2 inches; which would not impair the water supply of the Village of Coloma Well #1. (Estimated drawdown of 10 feet or more in a public utility well after 30 days of continuous pumping from a proposed high capacity well would indicate reduced availability of groundwater to a public utility well, under s. NR 812.09(4) (a), Wis. Adm. Code.)

Wetlands: The nearest mapped wetland is approximately 1.5 miles northwest of the proposed wells. The expected drawdown from the proposed wells at this wetland would be less than one inch after 25 years of pumping at the maximum proposed pumping rate (72.5 MGY), and this is not expected to cause significant environmental impacts.

Springs: A large spring is located 3.5 miles east of the proposed well site, at the headwaters of Chaffee Creek. The Wisconsin Springs Inventory identifies the spring's flow as approximately 2 cubic feet per second (cfs), measured in August, 1963. In July of 2003, flow at a monitoring station roughly 3800 feet downstream of the headwater spring was 1.2 cfs. The proposed wells at Richfield Dairy are located outside of the expected contributing area for the Chaffee Creek headwater spring (springs generally have a contributing area of one square mile per cfs of flow). Modeling results confirm that flow reduction is expected to be around 0.05 cfs (Chaffee Creek gaging station 1 mile downstream of the headwater spring), or less than 5% of the spring's flow. The proposed wells are very unlikely to cause a significant decrease in flow from the spring and are not expected to have a significant environmental impact on the spring.

Streams: The following streams are located within five miles of the proposed wells: Unnamed headwaters of Little Roche a Cri Creek (~2.5-2.9 miles north and west), Little Roche a Cri Creek (4.6 miles west), Fordham Creek (4.5 miles southwest), Chaffee Creek (3.5 miles east), and Tagatz Creek (3.5 miles southeast). All of the named streams are Class I or II trout streams; Little Roche a Cri and Fordham Creeks are Exceptional Resource Waters, and Chaffee and Tagatz Creeks are Outstanding Resource Waters.

The SSPA model evaluated the impacts of the proposed wells on stream flows at gaging stations within the model domain on Little Roche a Cri Creek, Fordham Creek, Chaffee Creek, Tagatz Creek, Campbell Creek, Neenah Creek, Lawrence Creek, Carter Creek, the Mecan River, Schmudlack Creek, and the South Branch of Wedde Creek. The maximum modeled flow reduction was 0.10 cfs (43 gallons per minute) in Little Roche a Cri Creek at 10th Ave. This flow reduction constitutes about 0.3% of the measured baseflow (34 cfs) at this location. In terms of percent reduction, the maximum modeled change in streamflow was 3.4% (0.05 cfs removed from 1.47 cfs baseflow) in Chaffee Creek at County Highway CH. Modeled flow reductions were less than 1% at all other gaging locations (see Table 1). At flow reductions of less than 4%, even sensitive stream types do not typically experience observable changes in fish populations (Hamilton and Seelbach, 2011). The expected flow reductions due to the proposed Dairy wells are unlikely to cause a significant environmental impact to the streams.

Lakes: Pleasant Lake is a deep seepage lake located at the border of Waushara and Marquette Counties, about 2.5 miles southeast of the proposed dairy. The lake has a surface area of approximately 129-135 acres, a maximum depth of 23.7 feet, and an average depth of 15 feet. Pleasant Lake is a groundwater seepage lake with no surface water inlet or outlet. Groundwater enters the lake from the west and north and exits to the east and south, feeding the headwaters of Chaffee and Tagatz Creeks. Water levels in Pleasant Lake are generally an expression of the elevation of the water table. For the period of 1964-2012, measured lake levels have varied by 5.5 feet. This amount of fluctuation over a period of several decades is typical of a groundwater seepage lake in Wisconsin. On a *seasonal* basis, water level fluctuations in seepage lakes typically vary by an average of 1.4 feet (Novitski & Devaul; House). The lake level record for Pleasant Lake includes four years with multiple water level measurements, including several measurements for 2012 submitted by the Dairy. These show annual variability ranging from 0.49 to 0.86 feet (5.9 to 10.3 inches). The measurements were not collected to represent maximum and minimum lake levels, but suggest that the seasonal water level fluctuation in Pleasant Lake could be between 6 inches and 1 foot. Evaluation of the bathymetry of Pleasant Lake and historical air photos indicates that for historically-observed lake levels, a one-foot change in lake elevation results in a change of 2 - 5.3 acres in the surface area of the lake.

Because Pleasant Lake's water budget is dominated by groundwater, it is relatively well-buffered (pH > 8, alkalinity >100 mg/L) and experiences good water clarity for the most part (average summer water clarity of 10 feet in 2011). Aquatic vegetation is most

abundant in the 3 - 5 foot depth zone, and consists primarily of submerged species (data provided by UW Stevens Point). Emergent vegetation and submerged species in the nearshore zone (less than 3 feet) are likely limited due to historical water level fluctuations and shoreland development and associated human activities.

The site-specific SSPA groundwater model indicates that 25 years of pumping at the maximum proposed withdrawal amount of 72.5 MGY would result in 1.6 ± 0.26 inches of drawdown to Pleasant Lake. This change is small relative to the historically recorded 5.5-foot variation in water level. For the lowest recorded historic water level (978.27 feet above mean sea level), the modeled drawdown would constitute a percent change in lake surface area and volume of less than 2%. For higher historic lake levels, the modeled drawdown would constitute a lower percentage change in lake surface area and volume.

Reductions in groundwater inputs to a seepage lake have the potential to impact water quality, chemistry, temperature, and aquatic life, including aquatic vegetation and fisheries. The Department evaluated data regarding lake morphometry, water budget, water chemistry, aquatic and nearshore vegetation, and historic lake levels to determine whether the projected ~1.6 inches of additional drawdown and 1.5% reduction in groundwater inflow to Pleasant Lake could result in significant impacts. The projected water level drawdown is small relative to historically-measured fluctuations, and it also represents a small percentage change in lake area and volume. Therefore, changes in lake clarity, temperature or dissolved oxygen concentrations due to changes in lake depth are unlikely. Because Pleasant Lake's water budget is dominated by groundwater and well-buffered, the expected change in groundwater input is small enough that no measurable changes to lake chemistry or clarity are expected.

Shoreline ecology has been significantly altered by existing human development, and Pleasant Lake currently supports little emergent vegetation of the type that would be most susceptible to small changes in lake level. It is not expected that the lake's plant communities will experience significant changes due to pumping from the proposed wells. Because habitat (chemistry/temperature/vegetation) will not be significantly altered, it is not expected that there will be any impacts to the fishery. It is very unlikely that projected drawdown due to operation of the dairy's wells would result in measurable changes or significant impacts to aquatic plant life, wildlife, or water temperature relative to the effects of existing shoreland use and water level fluctuations.

Overall, the impacts of the proposed wells on Pleasant Lake are likely to be insignificant, especially compared to the natural variability in lake level, the impact of existing shoreland development and lake use, and the cumulative impacts of existing pumping in the vicinity of Pleasant Lake. Cumulative impacts are discussed in the following section.

The SSPA report also modeled lake level drawdowns in Lake Burnita, a 10.5 - 13.5-acre seepage lake 3.7 miles southeast of the proposed dairy. The maximum depth of Lake Burnita is reported to be 8 feet, and a 1963 water body description reports that the lake experiences winterkill and fluctuating water levels. There is no historical water level record available for Lake Burnita. Water level drawdown in the lake due to operation of the proposed dairy wells was estimated to be less than 1.3 inches. A reasonable estimate of mean lake depth is between four and five feet, based on regression analysis of depth data from other lakes in Wisconsin. At this lake volume of between 42 and 67.5 acre-feet, the modeled drawdown would constitute a volume reduction of 2.2 - 2.7%. As with Pleasant Lake, the impacts associated with the proposed wells on water levels and the ecology of Lake Burnita are likely to be insignificant, especially compared to the natural variation and existing pumping impacts.

Cumulative Impacts

The area of the state where the Richfield Dairy wells are proposed is a center of irrigated agriculture. There are currently about 90 wells with the capacity to pump over 70 gpm, often with capacities of 800-1200 gpm, within 4 miles of the proposed wells.

Groundwater modeling and observations of various water bodies indicates that a reduction in water quantity has occurred due to the high volume of irrigation and other water withdrawals in the Central Sands region of the state; this region includes the proposed Richfield Dairy well locations. Modeling by Kraft and Mechenich (2010) shows an average water table drawdown of 1.5 feet at Pleasant Lake and streamflow reductions of 1.5 - 15% in headwater areas of nearby trout streams. This is attributed to water “missing” due to irrigation. The SSPA site-specific model also calculated impacts due to the cumulative impact of irrigation pumping. Irrigation pumping from area high capacity wells was calculated to have depressed the water level in Pleasant Lake by 0.7 feet and reduced flow in nearby trout streams by 3-6% (0.5 - 1.8 cfs). Some streams within the model domain were calculated to have flow reduced by higher percentages (up to 41%) due to existing irrigation pumping.

In the last ten years, the Department has approved seven new wells with pumping capacities greater than 70 gpm within five miles of the proposed Richfield Dairy. Six of these were agricultural irrigation wells with pump capacities of 400-1200 gpm, and one was a greenhouse well with a pumping capacity of 125 gpm. It is expected that similar increases in groundwater withdrawal could continue in the future.

The addition of the Richfield Dairy wells, or any additional water withdrawal in the area, will increase existing stresses on the availability of groundwater to supply surface water bodies. The effects of this type of cumulative reduction in groundwater availability include decreased flow and increased temperature in headwater streams, and lowered lake levels in nearby lakes (such as Pleasant Lake). DNR has evaluated these cumulative effects for purposes of the EA, in order to inform its decision-making regarding the

proposal. Resources used for this evaluation included groundwater modeling results and evaluations of the impacts of irrigation pumping for the entire Central Sands region by Kraft and Mechenich (2010) and Kraft et al. (2012), information presented by Kenneth Wade, modeling of cumulative impacts in the area around the proposed wells by SSPA, Department records regarding nearby high capacity wells and groundwater withdrawal capacity, and records of historic changes to water bodies.

However, when DNR determines whether or not to approve an application for a high capacity well, DNR is limited to considering whether the proposed well or wells on the high capacity property may cause significant adverse environmental impacts. In this case, as described above, the Department's assessment of the available information is that the proposed wells are not likely to cause significant adverse environmental impacts.

Since operating the wells with an annual pumping limit of 72.5 million gallons per year is not anticipated to result in significant adverse environmental effects, the Department has made a preliminary determination that an environmental impact statement is not required for the revised high capacity well approval.

Alternatives Analysis

Applicant Alternatives

In addition to the alternatives listed in the 2011 Environmental Assessment, the following alternative was considered by the applicant:

Relocate wells. The applicant considered moving the wells to a different location in order to minimize the potential impact to waters of the state. This alternative was not chosen because of the uncertainty of finding a feasible site where overall impacts would be lessened relative to the current site.

DNR Alternatives

The Department's alternatives for review of the high capacity well application are:

- Deny the application for high capacity well(s) based on probable significant adverse environmental impacts to waters of the state that cannot be avoided by placing conditions on the construction or use of the well(s).
- Approve the application for high capacity well(s) without conditions.
- Approve the application for high capacity well(s) with conditions designed to avoid significant adverse environmental impacts to waters of the state.

The selected alternative is to approve the high capacity well application with conditions to avoid significant adverse environmental impacts. The Department will require

ongoing water level monitoring and reporting of results from monitoring wells on site. Annual pumping will be limited to 72.5 MGY (as requested by the Dairy).

The following are proposed draft conditions to be included as part of Richfield Dairy's amended high capacity well approval:

> The approved pump capacity is 500 gallons per minute for each well. The approved maximum groundwater withdrawal rate for the property is 72,500,000 gallons in any 365-day period, as requested by the applicant. The purpose of this pumping limit is to avoid or minimize the potential for adverse environmental impacts to waters of the state, including Pleasant Lake, Lake Burnita, Chaffee Creek, Tagatz Creek, the headwaters of Little Roche a Cri Creek, and nearby potable well(s).
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> After reviewing the available information, including the modeling submitted by the applicant, the Department has determined that operation of the proposed wells in accordance with this approval is not likely to result in significant adverse environmental impacts to waters of the state. Monitoring of groundwater levels near the proposed high capacity wells is required to confirm the model results.
>
> As part of its WPDES permit, the applicant is required to install monitoring wells in the production area. As part of the high capacity well approval, the applicant must also install a minimum of one additional piezometer nested with a monitoring well downgradient of the high capacity wells. The applicant shall collect monthly water level information from the monitoring wells and piezometer and shall submit collected information to the Department's Water Use Section on an annual basis.
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> Any increased withdrawal over the approved amount would require a new high capacity well application, subject to DNR approval.

References

Hamilton, D.A. and P.W. Seelbach, 2011. Michigan's Water Withdrawal Assessment Process and Internet Screening Tool. Michigan Department of Natural Resources. Fisheries Special Report 55, Lansing.

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Kraft, G., Mechenich, D. J., 2010. Groundwater Pumping Effects on Groundwater Levels, Lake Levels, and Streamflows in the Wisconsin Central Sands. Report to the Wisconsin

Department of Natural Resources. Center for Watershed Science and Education, University of Wisconsin, Stevens Point, WI.

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S.S. Papadopulos & Associates, Inc., 2012. Evaluation of Groundwater Pumping for Richfield Dairy, LLC. July 27 Report.

Table 1.
S.S. Papadopulos Model Results -- Streamflow Impacts

		No Pumping (Base Case)	**Calculated Impact from <u>Existing</u> Irrigation Wells**			**Projected Impact from Richfield Dairy Wells**			
Name	Measured Baseflow (cfs)	Calculated Baseflow (cfs)	Reduction (gpm)	Reduction (cfs)	% Baseflow Removed	Reduction (gpm)	Reduction (cfs)	Baseflow Removed (%)	% Reduced Baseflow* Removed
Little Roche-A-Cri @ 10th Ave	34	35.1	812	1.81	5.3%	43	**0.10**	0.3%	**0.3%**
Campbell @ CTH A	2.4	2.3	121	0.27	11.2%	0.4	**0.00**	0.0%	**0.0%**
Neenah @ CTH G	0.8	1	63	0.14	17.5%	0.3	**0.00**	0.1%	**0.1%**
Neenah @ CTH A	42	31.4	216	0.48	1.1%	0.7	**0.00**	0.0%	**0.0%**
Chaffee @ CTH JJ	14	14.3	212	0.47	3.4%	27	**0.06**	0.4%	**0.4%**
Chaffee @ CTH CH	1.8	1.7	147	0.33	18.2%	22	**0.05**	2.9%	**3.6%**
Lawrence @ Eagle	20	17.5	237	0.53	2.6%	5	**0.01**	0.1%	**0.1%**
Lawrence nr Westfield	16	14.7	216	0.48	3.0%	4	**0.01**	0.1%	**0.1%**
Carter @ CTH G	2.5	3.3	458	1.02	40.8%	5	**0.01**	0.3%	**0.5%**
Mecan @ CTH GG	13	12.3	111	0.25	1.9%	3	**0.01**	0.1%	**0.1%**
Schmudlack @ Cottonville	1.2	2	101	0.22	18.7%	2	**0.00**	0.2%	**0.3%**
Tagatz nr Westfield	7.6	6	213	0.47	6.2%	27	**0.06**	1.0%	**1.1%**
S Br Wedde @ CTH JJ	7	2.2	51	0.11	1.6%	3	**0.01**	0.3%	**0.3%**
Fordham Cr @ 8th Dr	~13.5					13	**0.03**	<1%	**NA**
Little Roche-a-Cri @ Cypress Ave						28.5	**0.06**	<1%	**NA**

**Michigan Model (Hamilton and Seelbach, 2011): Cold Stream - Observable Effects @ 14% flow reduction, Significant Effects @ 20% flow reduction

*Reduced Baseflow = Measured Baseflow - Reduction from Existing High Caps