EXPERT REBUTTAL
OF
BYRON H. SHAW, Ph.D.

TO THE EXPERT REPORT
OF
DAVID P. TRAINOR, P.E., P.G.

Community Association for Restoration of the Environment, Inc.
and Center for Food Safety, Inc.
v.
Cow Palace, LLC, The Dolsen Companies, and Three D Properties, LLC

Docket No. 2:13-cv-3016-TOR

Prepared for:

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1. I, Byron Shaw, have been retained by Plaintiffs in the above-captioned matter to provide expert testimony about the manure management, storage, and application practices of Defendant Cow Palace Dairy, LLC ("Cow Palace" or "Defendant"). As part of this role, I have been asked by Plaintiffs to review, and rebut portions of, the expert report of David P. Trainor (the "Trainor Report" or "Report").

2. The Trainor Report primarily opines that there is no hydraulic relationship between Cow Palace's manure storage lagoons and the water table, which Mr. Trainor generalizes as being separated by "more than 100 feet" for the primary storage ponds and settling basins, 80 feet for the "storm water pump back pond," and 30 feet for the "tail water pond." Trainor Report at 5. The Report then states that, based on the well logs installed under the AOC, there is no measurable connection between "any of the ponds and the water table." *Id*. I disagree with these opinions.

3. First, the Trainor Report cites not a single well log to support the claim that the logged stratigraphy somehow proves that no hydraulic connection is present. This is unsurprising, as the air rotary drill used by Defendants to drill the monitoring wells for the AOC is not sensitive enough to detect the very first water bearing zones within the soil column, nor can it detect areas of moisture. Thus, the well logs are incapable of providing the

type of information necessary to conclude that there is no connectivity between the lagoons and the water table. Nonetheless, the well borings consistently showed significant stratification of soil materials with most soil layers having a high percentage of sand and gravel with occasional layers of finer-textured material. DAIRIES008031-8071. These conditions can lead to rapid groundwater recharge and preferential flow paths with water following the coarse-textured layers. Fine-textured layers may result in some perched water layers, which often result in significant horizontal movement of water as it finds coarse pathways for continued vertical movement. The cross-section diagrams in the Arcadis draft 4th Quarter 2013 groundwater monitoring report show some of these sloping stratified layers. DAIRIES010199-010205.

4. Second, no party has investigated under the lagoons at Cow Palace, using some type of directional drilling or other suitable means, to assess whether saturated conditions are present beneath the footprint of the lagoons. Mr. Trainor's statement that "[n]o saturated conditions are present in the soil column below the pond liners" (Trainor Report at 5) is therefore inaccurate, for no data has been generated or obtained that could support this conclusion. In fact, Plaintiffs' own drilling at the decommissioned Haak lagoon shows that there were, in fact, water bearing zones located beneath

the lagoon, indicating that manure water had leached through the bottom of the ponds and into the soil column, as one would expect based upon Darcy's law. Plaintiffs used a Geoprobe to obtain these (and other) samples, which takes a continuous core of the soil and allows for the observation of moisture and soil content as the probe is used, something that Defendants' air rotary drill could not do. The Erickson expert report showed clearly that there were saturated conditions below the Haak lagoon at two different levels, providing strong support that leaching is occurring. *See* Expert Report of David Erickson at ¶ 113. Mr. Erickson states correctly that with the limited amount of borings allowed, finding the areas of concentrated preferential flow is like finding a needle in a haystack. Erickson Report at ¶ 118. Nonetheless, contaminants were found and soil column data showed significant phosphorus and nitrogen leaching all the way down to the 45 foot depth below the lagoon bottom. Erickson Report at ¶¶ 113-18; chart at pp. 75-77. These results can be extrapolated to Cow Palace's lagoons, which are similar in construction, soil type, and operation.

5. The Trainor Report discusses the results obtained from the Haak lagoon, but only in general terms. Mr. Trainor summarizes the results from the Haak testing, Report at 10, admitting that nitrate was detected beneath the lagoon, all the way down to 45 feet below the surface of the bottom of

the decommissioned pond. While the results were highest in the foot just below the pond bottom (94.5 ppm nitrate), the fact that nitrate was present in every sample obtained down to 45 feet provides compelling evidence that lagoon water was seeping through the bottom of the lagoon, through the soil column, and toward groundwater. Mr. Trainor discusses a "surface water sample," *id*., but I understand that that sample was actually taken from a saturated area beneath the inactive lagoon. Nitrate and ammonia were present in the shallow water sample, likely diluted by precipitation sources during the approximate seven months that the lagoon had been emptied. Erickson Report at ¶ 109. Again, that saturated conditions were discovered in a shallow, perched area beneath the Haak lagoon, which is similar to the lagoons at Cow Palace, it is reasonable to believe that the Cow Palace lagoons are similarly leaking – a belief that is corroborated by the substantial nitrate contamination of the local groundwater immediately downgradient from Cow Palace Dairy.

6. The Report does acknowledge that subsurface investigations by both Cow Palace and the United States Environmental Protection Agency identified a mixture of fine and coarse grained unconsolidated sediments extending to depths of more than 200 feet. As explained in my expert report, these conditions are well-suited for the existence of preferential

pathways for downward water movement. This finding was also confirmed by the USGS. Moreover, the Report acknowledges that the predominant soils in the area are moderately to highly permeable.

7. Third, the Trainor Report selectively picks groundwater monitoring data from specific wells to support its opinion that there is no evidence of nitrate contamination originating from Cow Palace Dairy's lagoons. Mr. Trainor opines that the nitrate levels at the "upgradient wells" yielded values below and slightly above the 10 mg/L MCL, and that some of the downgradient wells yielded results higher than the MCL, and some lower than the MCL. In particular, the Report only examined monitoring wells DC-01, YVD-03, YVD-05, YVD-06, and DC-14. *See* Report at Exhibit D Entitled "Active Area Monitoring Wells – Summary of Groundwater Nitrate Analyses."

8. I believe there are several errors in how Mr. Trainor examined and interpreted the groundwater results obtained thus far, as explained more below.

9. The Report only discusses the sampling results obtained from four monitoring wells. It ignores YVD-02, which is one of the best upgradient wells for comparison at this site. YVD-02, as discussed in my report, has been sampled three times; two samples had less than 1 ppm nitrate, the third

had 5.3 ppm nitrate. Mr. Trainor should have considered these results in determining whether seepage from Cow Palace's lagoons impact groundwater quality.

10. The Report mentions the results from YVD-03, which is an upgradient well located on the northern edge of the Cow Palace property. The results have been low in nitrate relative to other downgradient wells: 4.75, 5.96, 4.75, and 3.9 mg/L, respectively, for each of the four sampling events. I believe the results of this well are indicative of the groundwater quality without significant impacts from Cow Palace Dairy. Mr. Trainor skirts over these results, merely indicating that when compared to only his selected wells, they show no evidence of contamination originating from Cow Palace. Trainor Report at 8-9 and Exhibit D ("Active Area Monitoring Wells Summary of Groundwater Nitrate Analyses").

11. Mr. Trainor also relies upon the data from DC-01 to opine that no problems can be traced to Cow Palace's lagoons. As discussed in my expert report, I do not believe that DC-01 is an appropriate upgradient monitoring well. Shaw Report at ¶ 191.f. This is because the well is not entirely hydrologically upgradient from Cow Palace or other possible sources of nitrogen loading, such as the agricultural fields located above and north of the well. One of these agricultural surface activities may be previous

manure applications by D &A Dairy or George DeRuyter & Son Dairy, which own the agricultural field upon which YVD-02 is situated, which itself is upgradient from DC-01. The results are therefore higher than what a true upgradient, background well would represent.

12. Mr. Trainor relies upon the results obtained from YVD-05 to opine that no contamination has been caused by seepage from Cow Palace's lagoons. YVD-05 is identified as an upgradient well by Cow Palace, even though it is located just south of the pens and near-pen lagoons. In my expert report, I opined that the 20-foot well screen installed at YVD-05 means that the well is sampling a wide range of groundwater. Shaw Report at 179-180. Considering that estimated groundwater flows in the northern section of the Cow Palace property are quite high – 47.7 feet per day in the upslope area, according to Arcadis's estimate – and that there is likely some seepage interference from the upgradient irrigation canal, I do not believe that YVD-05 is capable of evaluating the full impact of seepage from the Cow Palace lagoons. My opinion is supported by the results from YVD-05, which have been relatively low in nitrate and in manure-related tracer chemicals, especially chloride, indicating that the water being sampled from YVD-05 is from an aquifer mixture of upgradient water with some likely local recharge from Cow Palace's cow pens.

13. The Trainor Report relies heavily upon the results obtained from YVD-06 and DC-14 to support its conclusion that there are no measurable nitrate contributions from Cow Palace's lagoons. Mr. Trainor ignores the multitude of problems with relying upon YVD-06 as a downgradient monitoring well. That well was incorrectly installed, with the top of the well screen located 39 feet below the top of the water table. This means that the well is likely sampling water originating some distance to the north of the site. Because the well is screened deeper into the aquifer, I do not believe it is capable of evaluating nitrate contributions from Cow Palace's lagoons to the water table. The results from YVD-06 have therefore been relatively low in nitrate and manure-related tracer chemicals, supporting my opinion that the well is not capable of measuring direct contributions from Cow Palace Dairy.

14. DC-14 has similar issues. The well is screened such that the well is sampling water that has mixed with a significant amount of groundwater originating upgradient from Cow Palace Dairy, not just water from the lagoons or cow pens. Despite this condition, the water sampled by the well is still influenced by Cow Palace Dairy, especially the lagoons located immediately upgradient. The results of DC-14 sampling for nitrate have been 26, 12, 5.8, 10.6, and 6.46 mg/L, respectively for each sampling event.

Manure-related tracers have also been detected in the well, including high amounts of chloride, calcium, sodium, and sulfate. The variations in sampling results is likely due to a combination of (1) the location of the well screen beneath the water table and (2) the high linear groundwater speed in the area, which may be showing seasonal local recharge of the groundwater from the upgradient irrigation canal.

15. The Trainor Report does not discuss the sampling results obtained from a variety of other downgradient wells, all of which have very high nitrate results and the presence of manure-related chemical tracers. The most glaring omission is YVD-10, which is downgradient from the Cow Palace facility and from Cow Palace's application fields. That well has been sampled four times since September 17, 2013, and the nitrate results have been 95, 86.9, 77.6, and 86.1 mg/L. High amounts of manure-related tracers have also been observed, including chloride, calcium, sodium, sulfate, and magnesium. This well is within the flow path of groundwater passing under the Cow Palace facility, including its lagoons, and is likely impacted by seepage from the lagoons.

16. Besides YVD-10, the Report also ignores a variety of other sampling results from monitoring wells located downgradient of Cow Palace Dairy, including YVD-09, YVD-14, YVD-15, DC-3 and DC-3D, DC-04, and DC-

07. I discussed these monitoring wells and their results in my expert report, wherein I opined that the water being intercepted by these monitoring wells has likely been impacted by Cow Palace Dairy's manure management, storage, and application practices. Seepage from Cow Palace's lagoons is one likely contributor to the high nitrate results observed in these wells.

17. In addition to failing to look at a number of other monitoring wells, the Trainor Report also ignores the groundwater contour maps created by Arcadis, which show how the other downgradient wells discussed in my expert report are influenced by groundwater leaving the Cow Palace Dairy facility.

18. The Report further opines that the sampling results for manure-related tracers – bicarbonate, sulfate, chloride, magnesium, calcium, and sodium – are inconclusive to establish a direct connection between discharges from the Cow Palace lagoons and contamination of groundwater. Mr. Trainor does not reference any specific results that support his opinion. Based on my review of the sampling data obtained thus far, I disagree with this opinion. I believe that a comparison of the quantities of tracers observed from upgradient wells and downgradient wells, as detailed in my expert report, shows that the groundwater downgradient from Cow Palace Dairy is severely impacted by Cow Palace's manure management, storage, and

application practices.

19. The Trainor Report makes a conclusion that, based on the results of Plaintiffs' own subsurface investigation using the Geoprobe, "nitrate penetration is limited to the upper few feet" at Cow Palace Dairy. Trainor Report at 13. This conclusion is unsupportable. The results of Plaintiffs' sampling, detailed at length in my expert report, showed nitrate concentrations in all of the samples obtained by Plaintiffs. Nitrate was found not just beneath Cow Palace's application fields, but in *all* of Plaintiffs' samples and at all depths investigated. Thus, contrary to Mr. Trainor's opinion, nitrate penetration is not limited to the upper few feet, but rather to the entire soil column profile, from the surface feet and almost assuredly all the way down to groundwater. Indeed, if the Trainor Report were accurate, then, because there are no significant nitrogen loading sources upgradient from Cow Palace, certainly not at the level produced by Cow Palace, one would not expect to find the substantial nitrate contamination of the groundwater that is present downgradient from Cow Palace Dairy. Mr. Trainor seems to acknowledge this point, admitting that there could be a "potential minor impact" from Cow Palace's storage lagoons. Trainor Report at 13(I).

20. The Report also opines that the native soils found in and around Cow

Palace Dairy are suitable for a "liner material" for the manure storage lagoons. See Trainor Report at 6-7. The Report criticizes EPA and my own earlier declaration for failing to take any on-site testing at any storage pond to determine actual seepage rates of the soil liner materials. My understanding, however, is that Cow Palace refused to allow EPA access to their facility, and would not consent to any type of investigation into actual seepage rates through physical testing. Cow Palace also objected to Plaintiffs' proposed directional drilling underneath the lagoons. As such, this criticism is unfounded.

21. Based on my review of the native soils in and around Cow Palace Dairy, the primary soil types are Warden and Scoon series, which are well-drained and moderately permeable. Under NRCS 313 guidance, these soils may be suitable for a liner material if they are compacted and achieve the correct moisture content. However, the NRCS 313 standards specifically recognize that a synthetic liner – which would provide orders of magnitude lower permeability than native soils – should be considered in locations where a lagoon is located above an aquifer that serves as a domestic or ecologically vital water supply, which is the case here.

22. In fact, according to Cow Palace's own records, the soils in the Cow Palace area primarily fall into the ML, SM, and GM group names of the

Unified Soil Classification System. DAIRIES016868-870. Underlying the Dairy, according to the well drilling logs from wells YVD-03, YVD-05, and YVD-06, the soil types are primarily ML, SP, SC, and GP, with YVD-03 having some CL.[1] The Agricultural Waste Field Management Handbook states that ML, SC, and CL type soils are usually in "Group II" type soils, which have an estimated permeability of 5 x 10-6 cm/s to 5 x 10-4 cm/s. Sometimes, ML, SC, and CL type soils can fall into Group III, which have an estimated permeability of between 5 x 10-8 cm/s to 1 x 10-6 cm/s. SP and GP fall into Group I, which are highly permeable, having an estimated permeability of 3 x 10-3 to 2. *See* Table 10D-4 and Table 10D-5 of Agricultural Waste Field Management Handbook. The Handbook goes on to state that soils from the Group III category may be used for a liner, but only if the bottoms and sides of a lagoon are underlain by at least two feet of these materials. Soils within the Group II category, of which the ML, SC, and CL types are usually classified, are not to be used for liner material.

23. I have not seen any other compaction tests, moisture tests, permeability tests, or other sampling demonstrating the in-situ permeability of liner materials at any of Cow Palace's lagoons, besides Lagoon 4. My

[1] YVD-03 (DAIRIES010833-36) (showing ML, SP, SC, and CL type soils until hitting weathered basalt at approximately 185 ft. below ground surface of "bgs"); YVD-05 (DAIRIES010841-843) (showing ML, SP, and GP soil types all the way down to 208 ft. bgs); YVD-06 (DAIRIES010844-846) (showing SP, GP, and ML soil types down to 170 ft. bgs).

understanding is that Cow Palace also does not possess this information.

24. With regard to Mr. Trainor's claim of a soil liner's "added benefit of providing attenuation capacity by removing dissolved contaminants from the seepage passing through the liner," Trainor Report at 2, soil materials that have a significant cation exchange capacity may remove positively charged ions such as calcium and magnesium but will not remove nitrate, which has a negative charge. Phosphorus may be absorbed by soils high in calcium or iron but I know of no liner soil material that has any nitrate removal capacity as it would require an anion exchange capacity not present in these soils.

25. Finally, the Trainor Report states that the operations at Cow Palace were well-maintained, including the animal pens, composting area, and lagoons. From my personal observations of Cow Palace Dairy, this is not the case. I witnessed substantial manure and urine build-up in all of Cow Palace's holding pens. The results from Plaintiffs' borings into the pens confirm that large quantities of cow manure are left to accumulate in the pens, causing excess nutrients like nitrogen to move into the soil, where it cannot be used as fertilizer. The Trainor Report does not discuss whether the pens are a source of contamination; based on Plaintiffs' sampling results, I believe they are. My observations of the composting area, along with Plaintiffs' own sampling, paint a similar picture: manure is composted on

unlined, native soils for long periods of time, where excess moisture and manure nutrients are allowed to accumulate and migrate into the soil column. In such conditions the nutrients, including nitrogen, cannot be used as fertilizer. Plaintiffs' sampling confirms this opinion, for there were measurable amounts of nitrate found beneath the composting area. In addition, Mr. Trainor failed to even acknowledge, let alone try to explain, the large quantities of ammonia (another form of nitrogen that will likely become nitrate) present at various depths below the composting area. As to the lagoons, I observed many areas of erosion, cracking of dry manure, and plant growth around the lagoons. These problems provide further pathways for even higher preferential flows than the already permeable soils used in the lagoon bottoms. Furthermore, some of the lagoons appeared to have significant solids built up within them, diminishing capacity and increasing the risk of over-filling during a 25-year/24-hour storm event.

Dated: October 20, 2014.

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