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Via Electronic Mail

July 21, 2014

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Re: ONE MORE Reason To Issue A Strong WA CAFO General Permit: Ocean Acidification

Dear Kelly, Bill, Ron and Jon,

We write, once again, to request that you direct your staff to issue a strong National Pollutant Discharge Elimination System ("NPDES") and State Waste Discharge General Permit for Concentrated Animal Feeding Operations ("CAFOs") that do business in the State of Washington. This letter presents just one more reason why it is imperative Ecology take this opportunity to eliminate CAFO water pollution through issuance of a strong permit: to mitigate the effects of ocean acidification. The current CAFO General Permit was issued in 2006, expired July 21, 2011, and no new permit has been issued. We understand that Ecology is working on a new draft at the present time. It is imperative Ecology act now to protect the surface and ground water resources of this state, while at the same time mitigate and slow the devastating effects of ocean acidification, as well as gather much-needed data about the influence of CAFOs on ocean acidification in Puget Sound.

It is undisputed that the Puget Sound is becoming more acidic.[1] While the uptake of atmospheric carbon dioxide is the primary driver of open-ocean acidification, secondary contributions, such as nutrient pollution, also are known to exacerbate the acidification effects

[1] "Several monitoring programs indicate declining pH in the marine waters of the Pacific Northwest." Long et al., Washington State Dept. of Ecology, *Approach for Simulating Acidification and the Carbon Cycle in the Salish Sea to Distinguish Regional Source Impacts*, Ecology Publication No. 14-03-002 (January 2014).

within Puget Sound. There are areas within the Puget Sound that are particularly vulnerable to ocean acidification. For example, "coastal regions that receive large volumes of freshwater, especially when the freshwater contains high levels of dissolved nutrients or organic material" are especially susceptible to the effects of acidification.[2] Controlling nutrient pollution through regulation of industrial facilities such as CAFOs offers Ecology an unprecedented opportunity to minimize and mitigate Puget Sound acidification at the local level, while fulfilling the mandate of the federal Clean Water Act. The leading researchers in the field of ocean acidification have recognized that "addressing local factors such as nutrient pollution could offset some of the local acidification impacts . . . ."[3] The WA CAFO Permit is one way to do that.

The science is clear that the waters of Washington State are experiencing the effects of ocean acidification. Specifically, the Puget Sound experiences algal blooms. These blooms—while in part natural—are amplified by anthropogenic nutrient pollution, a process called eutrophication. Algal growth temporarily increases the dissolved oxygen of surface waters, which in turn causes a corresponding increase in pH. Eventually, the algae die and their organic matter settles towards the bottom. Here, in these subsurface waters, microbes consume this organic matter, rapidly consuming oxygen and respiring carbon dioxide. This microbial respiration is thus directly responsible for low oxygen levels ("hypoxia") in subsurface waters and localized acidification like the kind we are seeing through Puget Sound.[4] The impact on acidification from this eutrophication and microbial respiration is threefold.

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[2] California Ocean Science Trust, *Ocean Acidification in the Pacific Northwest* (May 2014), available at http://westcoastoah.org/wp-content/uploads/2014/06/OA18PNWFacts14V4.pdf?utm_source=OAH+Subscriber+Public+Newsletter&utm_campaign=e0f9076906-West_Coast_OAH_Product_Release6_12_2014&utm_medium=email&utm_term=0_e74af6963b-e0f9076906-101492161 (last visited July 2, 2014).

[3] *Id.*; Elspeth Dehnert, Acid Oceans Can Be Fought At Home, Scientific American, June 5, 2014, available at http://www.scientificamerican.com/article/acid-oceans-can-be-fought-at-home/?utm_source=OAH+Subscriber+Public+Newsletter&utm_campaign=e0f9076906-West_Coast_OAH_Product_Release6_12_2014&utm_medium=email&utm_term=0_e74af6963b-e0f9076906-101492161 (last visited July 9, 2014) ("For coastal communities in the United States, the path to confronting souring seas can likely be found close to home in their very own backyards . . . . river discharge, local-scale upwelling, and nutrient and stormwater pollution [are] some of the major factors behind ocean water's increasingly unbalanced acidity levels . . . . 'Ocean acidification should become a part of the conversation among [water] quality managers, stormwater managers, agricultural managers . . . and it tends not to be in that space.").

[4] Richard A. Feeley et al., Washington State Dept. of Ecology *The combined effects of ocean acidification, mixing, and respiration on pH and carbonate saturation in an urbanized estuary*, 88 Estuarine, Coastal and Shelf Science 442 (2010); Wei Long et al., *Approach for Simulating Acidification and the Carbon Cycle in the Salish Sea to Distinguish Regional Source Impacts*, Ecology Publication No. 14-03-002 (2014), available at https://fortress.wa.gov/ecy/publications/publications/1403002.pdf.

First, on a smaller spatial and temporal scale, respiration may have a stronger impact on pH than atmospheric acidification. In subsurface waters in the Hood Canal, one study suggests that microbial respiration accounts for *more than half* of the total change in pH. By comparison, atmospheric acidification contributes only 24–49% to the pH decrease.[5] Studies of other large estuaries likewise support the notion that respiration likely has a greater immediate acidifying effect than atmospheric acidification on subsurface waters.[6] And while these impacts may be on smaller temporal and spatial scale, "marine organisms respond to changes in local conditions, and thus are more likely to be sensitive to peaks in [carbon dioxide] or pH than to long-term shifts in average values."[7]

Second, nutrient pollution impacts areas already most at risk. Because of its geography, there are areas of the Puget Sound that may be especially prone to natural cycles of acidification.[8] Deep waters of the Pacific upwell along Washington's coast, bringing in water which is both nutrient rich but also relatively acidic.[9] This nutrient rich water, together with other nutrient loading from industrial facilities such as CAFOs, may produce cycles of acidification.[10] Additional nutrient loading may exacerbate these preexisting issues.[11] Some areas of the Puget Sound, particularly the South Sound and the Hood Canal, are at risk for eutrophication and prolonged acidification.[12] Because of their narrow inlets, these waters experience limited seaward flushing. Nutrients loaded into these waters stick around longer, increasing the risk of localized algal blooms and acidification.[13] Further, because of the limited mixing of surface and subsurface

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[5] Feeley et al., *supra* note 4.
[6] Wei-Jun Cai et al., *Acidification of subsurface coastal waters enhanced by eutrophication*, 4 Nature Geoscience, 766 (2011) (finding that in subsurface waters in the Northern Gulf of Mexico uptake of atmospheric carbon dioxide has caused a .11 unit drop in pH while *in situ* respiration of organic matter has reduced pH by .29 units). *See also* Alberto V. Borges and Nathalie Gypens, *Carbonate chemistry in the coastal zone responds more strongly to eutrophication than to ocean acidification*, 55 Limnology and Oceanography 346 (2010).
[7] Raphaël Billé et al., *Taking Action Against Ocean Acidification: A Review of Management and Policy Options*, 52 Environmental Management 761 (2013).
[8] See Feeley et al., *supra* note 4.
[9] *Id*.
[10] *Id*.
[11] Long et al., *supra* note 1 ("Regional factors have the potential to exacerbate the acidification problem. These include nutrients from organic carbon (such as plants and freshwater algae) from land as well as local emissions of carbon dioxide, nitrogen oxides, and sulfur oxides.").
[12] David L. Mackas & Paul J. Harrison, *Nitrogenous Nutrient Sources and Sinks in the Juan de Fuca Strait/Strait of Georgia/Puget Sound Estuarine System: Assessing the Potential for Eutrophication*, 44 Estuarine, Coastal and Shelf Science 1 (1997).
[13] *Id*. (noting "problem" areas have "relatively weak physical circulation. In such locations, additional nitrogen input can cause phytoplankton blooms, and subsequent sedimentation and deep-water oxygen depletion."); Long et al., *supra* note 1 ("Discharge of regional human nutrient sources into the Salish Sea could increase algal productivity.").

waters, carbon dioxide released during microbial respiration takes longer to move through the water column to the surface, prolonging the effect of acidification.

Lastly, nutrient pollution not only causes localized acidification, but it also "enhances" the impact of atmospheric acidification by reducing the natural buffering capacity of the Puget Sound.[14] Carbonate ions (CO_3^{2-}), necessary for the formation of aragonite and calcite (both shell-forming minerals), absorb free hydrogen ions produced when carbon dioxide reacts with water.[15] While seawater is generally supersaturated with carbonate, as carbon dioxide increases, waters may approach carbonate undersaturation.[16] At this point, a slight increase in carbon dioxide will cause a drastically nonlinear decrease in pH, increasing the speed and intensity at which acidification would otherwise take place.[17]

While nutrient pollution has been identified as a local, regional contributing factor to ocean acidification, Ecology has made it clear that there is more research to be done in order to ascertain "the degree to which regional human contributions exacerbate low levels of pH and aragonite saturation state."[18] But we do know that "[w]atershed inflows entering Puget Sound and the Straits deliver loads of nitrogen" and that "human activities have increased nitrogen loads above naturally occurring levels."[19] Some watersheds, such as the Nooksack River, which is heavily polluted by CAFOs, "have significantly higher unit-area loads of nitrogen."[20]

Ecology has recognized the importance of "identifying where and how much regional sources add to acidification is a first step in effective regional source management."[21] The Blue Ribbon Panel also "recommended efforts to quantify how much regional human sources (water nutrients and air emissions) exacerbate the effects of the Pacific Ocean and global atmospheric

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[14] *See* Cai et al., *supra* note 6 (microbial respiration "enhances" atmospheric acidification, causing a highly nonlinear change in pH). See also William G. Sunda & Wei-Jun Cai, *Eutrophication Induced CO_2-Acidification of Subsurface Coastal Waters: Interactive Effects of Temperature, Salinity, and Atmospheric pCO_2*, 46 Environmental Science & Technology 10651 (2012); Xingping Hu and Wei-Jun Cai, *Estuarine acidification and minimum buffer zone—A conceptual study*, 40 Geophysical Research Letters 5176 (2013).
[15] For an accessible presentation of the chemistry of climate change, in particular microbial respiration, see Sunda & Cai, *supra* note 14.
[16] *See* Cai et al., *supra* note 6.
[17] *Id*. at 768–69.
[18] Long et al., *supra* note 1.
[19] Mindy Roberts et al., Washington State Dept. of Ecology, *Puget Sound and the Straits Dissolved Oxygen Assessment: Impacts of Current and Future Human Nitrogen Sources and Climate Change through 2070* (March 2014), Ecology publication No. 14-03-007.
[20] *Id*.
[21] *Id*.

carbon dioxide."[22] "Recent model development has quantified the relative impacts of regional human nutrient sources on dissolved oxygen in the Salish Sea,"[23] and Ecology believes that there is still a need to "quantify the relative influences of regional and global sources," including "simulating total dissolved inorganic carbon and alkalinity as state variables including source/sink terms related to air-sea exchange, respiration, photosynthesis, nutrient gains and losses, sediment fluxes, and boundary conditions."[24]

Within the Puget Sound, estimating the relative contribution of nutrient pollution from animal agriculture is somewhat difficult and is an emerging field of science. Despite this difficulty, it is clear that animal agriculture is a significant source of nutrient pollution and must be further monitored. Studies of nutrient loading often lump together nutrient pollution from animal manure with anthropogenic sources (other than wastewater treatment plants) into total riverine inputs.[25] As its own category, rivers and streams are significant source of nutrients, contributing 41% of all annual local nitrogen inputs and 19% of all summer nitrogen inputs.[26] Within the rivers and streams which feed the Puget Sound, animal manure is the single largest potential nutrient contributor.[27] This conforms with other nationwide studies that identify agriculture as a major contributor to nutrient pollution, and specifically, *animal manure is the single largest source of nitrogen pollution from agriculture*.[28] In sum, while the science continues to be developed to pinpoint the relative contribution of CAFOs to excessive nutrients in the Puget Sound, animal agriculture is undoubtedly a significant exacerbating factor that needs to be addressed. Improved nutrient management regulations, in the form of a strong WA CAFO General Permit, therefore provide Ecology with the opportunity to further document site-specific sources and significantly reduce nutrient pollution into the waters of Puget Sound.

Requiring groundwater and surface monitoring of all medium and large CAFOs through the WA CAFO General Permit is the only way for Ecology to ascertain the extent to which CAFOs are contributing nutrient pollution to Puget Sound, and thereby exacerbating ocean acidification. As the agency has recognized, "Ecology must determine if and how much regional

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[22] *Id.*
[23] *Id.*
[24] *Id*
[25] *See, e.g.*, Mackas & Harrison, *supra* note 12; Teizeen Mohamedali et al., Washington State Dep't. of Ecology, *Puget Sound Dissolved Oxygen Model Nutrient Load Summary for 1999-2008*, Ecology Publication No. 11-03-057 (2011), available at https://fortress.wa.gov/ecy/publications/publications/1103057.pdf.
[26] See Mohamedali, *supra* note 25 at 56, Fig. 28.
[27] E.L. Inkpen & S.S. Embrey, *Nutrient Transport in the Major Rivers and Streams of the Puget Sound Basin*, U.S.G.S. Fact Sheet 009-98.
[28] Robert Howarth et al., *Sources of Nutrient Pollution to Coastal Waters in the United States: Implications for Achieving Coastal Water Quality Goals*, 25 Estuaries 656 (2002).

sources must be controlled."[29] The only way the agency can do that in terms of CAFOs, point sources under the federal Clean Water Act, is through the WA CAFO General Permit.

Washington can take one step towards minimizing Puget Sound acidification through effective nutrient management by regulatory requirements such as universal coverage of medium and large CAFOs by the WA CAFO General Permit. While nutrient pollution is undoubtedly a multi-causal problem,[30] ocean acidification scientists and policy experts have identified agricultural pollution, particularly point source pollution from confined animal feeding operations (CAFOs), as a target particularly appropriate for nutrient regulation.[31] CAFOs are identified as point sources under the federal Clean Water Act. Animal feeding operations produce vast amounts of animal waste—thirteen times more (on a dry weight basis) than all human sanitary waste.[32] Therefore, it is simply nonsensical to only focus on wastewater treatment plants or septic systems when assessing land-based contributing factors to ocean acidification. The rampant amount of pollution that has been documented to enter the environment from these facilities confirms that this waste is not properly managed. Leakage from unlined manure storage lagoons, overflowing of lagoons during major precipitation events, and the over application of nutrient-rich manure on surrounding fields results in massive influxes of nutrients and other pollutants (including veterinary pharmaceuticals, heavy metals, and pathogens) into the groundwater[33] and hydrologically-connected surface water.[34] CAFOs are a source of nutrient loading to Puget Sound must be regulated by the WA CAFO General Permit.

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[29] *Id*.

[30] Including inputs from both point sources, such as CAFOs, and nonpoint sources, such as atmospheric deposition or agricultural runoff. See. Mackas & Harrison, *supra* note 12.

[31] See Ryan P. Kelly & Margaret R. Caldwell, *Ten Ways States Can Combat Ocean Acidification (And Why They Should)*, 37 Harvard Envtl. L. Rev. 57, 62 (2013) (emphasis added) ("To better address the acidifying ocean, states and regional bodies could redefine the existing technology-based discharge standard for a subset of point sources that most strongly contribute to ocean acidification . . . . such as pulp mills, *concentrated animal feeding operations*, and sewage outflows . . . ."); Cai et al., *supra* note 6 ("[I]f human actions (for example, agricultural practices) can be taken to reduce acidification, seafloor carbonate mineral undersaturation may be less severe.");

[32] To put this in perspective, in 1992 animal feeding operations produced 133 dry tons of animal manure compared with 10 million tons of dry sanitary waste. *See* U.S. EPA 1998. *Environmental Impacts of Animal Feeding Operations*, Appendix IV (Dec. 31, 1998), available at http://www.epa.gov/ostwater/guide/feedlots/envimpct.pdf (last visited June 5, 2014).

[33] Groundwater can directly pollute the Puget Sound, although past studies of groundwater pollution have focused on other pollutants. *See, e.g.,* Charles F. Pitz, *Control of Toxic Chemicals in Puget Sound: Evaluation of Loading of Toxic Chemicals to Puget Sound by Direct Groundwater Discharge*, Washington State Dep't. of Ecology Publication No. Publication No. 11-03-023 (2011).

[34] *Id.*; JoAnn Burkholder et al., *Impacts of Waste from Concentrated Animal Feeding Operations on Water Quality*, 115 Environmental Health Perspectives 308 (2007).

In order to monitor and prevent the nutrient discharges from CAFOs into waters of the State, which include groundwater, Ecology must issue a permit that contains the following requirements: (1) universal coverage for all medium and large CAFOs; (2) mandatory surface and groundwater /monitoring; and (3) implementation of best management practices such as synthetically-lined storage lagoons and salmon riparian buffer requirements. While there are other mechanisms that can and should be utilized in the permit to protect human health and the environment, the failure of the 2006 permit has illustrated that these three components are essential.

Requiring ground and surface water monitoring as part of the Washington CAFO Permit will also facilitate the gathering of critical data needed to mitigate the land-based causes of ocean acidification. Experts in the field as recently as March 2014 have declared that "[i]t is becoming increasingly important to determine the relative contribution of atmospheric CO_2 vs. in-water CO_2 production from respiration, and how much respiration can be traced back to anthropogenic nutrient or organic material input, in an effort to develop effective adaptation strategies."[35] An essential component of making this determination is closely monitoring the nutrient pollution that is being discharged from CAFOs. The WA CAFO Permit is one tool that can accomplish that task.

We are not alone in asking that you implement your authority to address nutrient pollution as a means of addressing ocean acidification. The state's Blue Ribbon Panel on Ocean Acidification has made the following recommendations on November 21, 2013:

> Action 5.1.1
>
> Implement effective nutrient/organic carbon reduction programs in locations where these pollutants are causing or contributing to multiple water quality problems.
>
> Action 5.1.2

[35] National Science & Technology Council, Interagency Working Group on Ocean Acidification, Subcommittee on Ocean Science & Technology, Committee on Environment, Natural Resources & Sustainability, *Strategic Plan for Federal Research & Monitoring of Ocean Acidification* (March 2014) at 10 (recognizing that "[l]ocal nutrient input from runoff can cause algal blooms (some harmful) and hypoxia. Both primary productivity in surface waters and remineralization of organic matter in deeper waters change the chemistry of the waters influenced. Respiration induced acidification accompanies oxygen draw-down in these nutrient enriched coastal and estuarine waters. Furthermore, processes driving carbonate mineral production (calcification, precipitation) and loss (bioerosion, dissolution) can also have important localized effects on water chemistry.").

> Support and reinforce current planning efforts and programs that help address the impacts of nutrients and organic carbon.
>
> Action 5.2.1
>
> If it is scientifically determined that nutrients from small and large on-site sewage systems are contributing to local acidification, require the installation of advanced treatment technologies.
>
> Action 5.2.2
>
> If determined necessary based on scientific data, reduce nutrient loading and organic carbon from point source discharges.[36]

Discharges of nutrient pollution from CAFOs are point source discharges that should be covered by, and subject to, a NPDES/State Discharge Permit, yet only 1% of the state's medium and large CAFOs are actually subject to the permit requirement. This is a deficiency that needs to be remedied immediately.

The Puget Sound Partnership has also recognized that "[r]educing nutrient pollution in Washington State, particularly in areas like parts of Puget Sound where harmful algal blooms and depressed oxygen levels affect both aquatic life and human use and health, is important."[37] The Partnership identified issuance of the WA CAFO Permit as a Near-Term Action designed to "ensure compliance with regulatory programs designed to reduce, control, or eliminate pollution from working farms."[38] However, the WA CAFO Permit expired in 2011 and we are still waiting for a new draft three years later. Now is the time to act to protect Puget Sound from land-based causes of ocean acidification, such as discharges of nutrient pollution from CAFOs. Please act now to issue a new draft CAFO Permit that requires (1) universal coverage for all medium and large CAFOs; (2) mandatory surface and groundwater /monitoring; and (3) implementation of best management practices such as synthetically-lined storage lagoons and salmon riparian buffer requirements. Please let us know if you have any questions.

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[36] Status Blue Ribbon Panel Recommendations (Nov. 21, 2013), *available at* http://www.ecy.wa.gov/water/marine/oa/20131121BRPrecommendations.pdf (last visited June 8, 2014).
[37] Puget Sound Partnership, *The 2012/2013 Action Agenda for Puget Sound* (August 28, 2012) at 212.
[38] *Id*.

Sincerely,

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