



"We are sleepwalking to climate catastrophe." António Guterres
Secretary-General of the United Nations

To: The Humboldt County Board of Supervisors
From: 350 Humboldt Steering Committee
Subject: Comments supporting our appeal of the approval of the final EIR and staff report for Nordic Aquafarms California, LLC, Record Number PLN-2020-16698.

Daniel Chandler, Ph.D.
Steering Committee 350 Humboldt
dwchandl@gmail.com
707 677-3359
436 Old Wagon Road
Trinidad, CA 95570

**PROTECTING THE COUNTY, THE BAY AND OCEAN, AND THE CLIMATE
FROM NORDIC AQUAFARM RISKS AND IMPACTS**

Submitted By 350 Humboldt

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SUPPLEMENT

HUMBOLDT COUNTY AS AN INVESTOR IN NORDIC

We all want the jobs, the aquaculture training, the pulp mill site clean-up, the tax base that Nordic promises. However, all the risks that the EIR glossed over, or didn't study, or misrepresented are threats to the county, to fishermen and fisheries, to the Bay and ocean ecology we depend on, and to our changing climate. The first risk comes from investing in a private start-up company that is not transparent and does not have the requisite experience or financial backing for a project of this magnitude.

What are the risks of investing in Nordic?

County decision-makers are taking significant risks to, in essence, become investors in Nordic. What due diligence has the County done to protect these County from unknown but potentially large losses if the company fails, does not comply with requirements, or causes an environmental catastrophe? Will *our* Harbor Commission get trapped into issuing \$300 million in bonds to rescue the project like a Harbor Commission in Ohio has?¹

We understand from the Planning Director that neither the Planning Commission and Supervisors were provided with the basic sorts of company intelligence investors require. Besides not having reviewed detailed financial statements, do decision-makers know the multiple reasons² why industry sources say private investors are currently leery of land-based Atlantic Salmon aquafarms and banks even more so?

We have gathered information from multiple stories in aquaculture trade journals that answer some of these questions. We urge you to read the full stories. We also have obtained a financial statement from a Norwegian state-run website where even private companies are required to report. We summarize this statement but also include it in full along with information on how to get much more information about Nordic's financial status. We request the Board consult independent experts.

What do we know about Nordic that inspires confidence or doubt?

This is how Nordic describes its corporate structure:³

"Nordic Aquafarms was established in 2015 with companies in Norway, Denmark and the US. Following a demerger completed in 2022 the group of companies is split in two holding companies; Nordic Aquafarms Group AS with the US projects and Nordic Aquafarms Technology in Denmark, and Nordic Aquafarms Europe AS with Fredrikstad Seafoods in Norway and Sashimi Royal and Maximus in Denmark..... US operations are organized in the 100% owned subsidiary Nordic Aquafarms Inc with US headquarters in Portland, Maine. Execution strength is being established step by step on the ground with 10 experienced employees in the US so far, and top-rated construction partners. The US operation is set to expand in line with investments."

According to the Nordic website the overall company has 21 institutional investors. The investments are not differentiated by the five subsidiaries. The largest investor holds 35% of the shares. Since the company is private we don't know the value of the shares. However, in the most recent article we could find about investments in Nordic, Nordic announced in April 2020

¹ See below for details; source is in footnote 16.

² Please see page 4.

³ <https://www.nordicaquafarms.com/investor-relations-2/>

they had raised 7 million Euros, to go to the American subsidiary and to further developing the Danish plants.⁴ That doesn't seem like a newsworthy amount given the \$1.3 billion investments required for the American facilities alone.

What do we know about investments in each American subsidiary other than \$650 million⁵ will be needed per facility? Here are two quotations that give us pause:

- Nordic CEO Bernt-Olav Rottingsnes "estimates a construction cost between 600 and 650 million dollars for each of the US facilities. The company has an ambition that 50 percent of the completed project will be financed through bank loans." But he was quoted in July 2022 as saying: "Yes, I think it is fair to say the banks still think it is too early to lend to land-based fish farming. The banks have financed Atlantic Sapphire, and I believe the banks think they need to see some results from there before they lend."⁶
- When asked about financing in a Lost Coast Outpost interview in July, interim CEO Brenda Chandler said: "You can never be 100 percent until the money's in the bank, right? I mean, clearly it's an effort. And clearly you have to have investors who can get their brain around it and get behind it. And that's what we're working on, is cultivating those kinds of relationships with investors. But we've done a lot."⁷

The best guide to whether investment is justified is what Nordic's pilot Atlantic Salmon facility, Fredrikstad Seafoods, has done: Here is what an aquaculture investment expert advises:

"Has your pilot facility performed according to your target bio-plan with three continuous cohorts? Is it a spreadsheet bio-plan or is it based on science or actual results? If you can't do it at a pilot scale, how do you propose to do it at large scale?"⁸

So what is the Fredrikstad facility record?

- The facility is designed to harvest and sell 1,500 metric tons of head on gutted fish annually. It has been in operation since 2019. It is called in a press release Norway's "First large scale land-based salmon farm." Note that 1,500 is only 17% as large as Nordic proposes for Humboldt.
- In April 2021 the company issued this report: "Fredrikstad Seafoods has successfully harvested salmon on a weekly basis for almost a year now. We have learned a lot and gained a lot (of biomass and experience)! During the first 10 months of harvesting we have sold more than 650 tonnes (320 tonnes in Q1 2021)....⁹ [Very clearly the plant

⁴ <https://salmonbusiness.com/e8-8-million-share-issue-raised-nordic-aquafarms-fredrikstad-seafoods-celebrates-first-harvest-for-land-based-salmon/>

⁵ <https://salmonbusiness.com/it-is-fair-to-say-that-the-banks-still-think-it-is-too-early-to-lend-to-land-based-farming/>

⁶ <https://salmonbusiness.com/it-is-fair-to-say-that-the-banks-still-think-it-is-too-early-to-lend-to-land-based-farming/>

⁷ <https://lostcoastoutpost.com/2022/jul/16/interview-nordics-new-interim-ceo-brenda-chandler/>

⁸ <https://www.intrafish.com/finance/the-biggest-land-based-salmon-skeptics-companies-actually-producing-salmon-on-land/2-1-986934>

⁹ <https://salmonbusiness.com/90-superior-and-no-production-accidents-for-first-generation-salmon-at-fredrikstad-seafoods/>

cannot have produced three continuous cohorts and 16 months ago they were still not on target for annual production.]

- In a February 2022 article we are told: “Fredrikstad Seafoods is still not profitable, however, and although this is expected to change once it reaches more scale, the company sees 'greater earnings potential for yellowtail kingfish,' Bernt Olav Rottingsnes, CEO of Fredrikstad Seafoods parent Nordic Aquafarms, told IntraFish.”¹⁰ [The company applied for permits to switch from salmon to yellowtail in 2022.]

The Fredrikstad plant is an early start up that is not making money, is changing the type of fish it produces, and provides virtually no assurance that the Humboldt and Belfast Nordic plants, each 17 times larger, are a good investment.

In 2020, Nordic also purchased a one-third interest in an existing “grow-out” RAS facility called Sashimi Royal that aims to produce 900 metric tons of product a year. It also owns shares in a vertically integrated hatchery called Maximus. Sashimi Royal grows yellowtail kingfish, a specialty fish for sushi. Maximus, the hatchery, was founded in 1989 so has a long history predating Nordic. Since Nordic did not develop these firms and does not own even a majority share they provide no evidence that Nordic can design, build and operate facilities that are each 28 times bigger than this one.

In a separate section we include the financial statement that Nordic Aquafarms Group AS has been required by the Norwegian government to submit to a state website over the years.¹¹ This statement shows profits and losses over several years, and it shows investment amounts. The statement is sufficient to see that Nordic Aquafarms Group AS has yet to make a profit and had a large loss of \$26 million in 2021. Specifically, Nordic showed the following profit/loss, by year. (Note the original data were in thousands of Norwegian Kroners. Since 1000 NOK is equal to \$100.72 we multiplied the NOK figures by \$100.72 to convert to US dollars.)

Year	2015	2016	2017	2018	2019	2020	2021
Net result/profit for the year in 1000 of Norwegian Kroners	-2,691	-3,265	-5,318	-8,280	-8,005	-9,288	-262,742
In US Dollars	-271,038	-328,851	-535,629	-833,962	-806,264	-935,487	-26,463,374

Investing in land-based aquaculture

What is happening with investments in other land-based aquaculture, especially publicly traded firms? This report is from January 2022.

¹⁰ <https://www.intrafish.com/salmon/norways-first-land-based-salmon-farmer-wants-to-switch-to-yellowtail-citing-greater-earnings-potential/2-1-1160243>

¹¹ A Norwegian company makes accessing this public data (in Norwegian) relatively easy on its website: www.proff.no The overall Nordic Aquafarms Group AS data from 2014 through 2021 are available at: <https://proff.no/regnskap/nordic-aquafarms-group-as/gamle-fredrikstad/tekniske-konsulenter/IDGZRQ001OU/>

“Atlantic Sapphire, which has long held the spot as the world's most valuable salmon farmer, had a market cap of NOK 3.237 billion (\$369.9 million/€325.8 million) at the close of trading Thursday, close to an all-time low. At one point in its history, Atlantic Sapphire's market cap exceeded \$1 billion (€882 million). The company has suffered a string of setbacks over the past year, sending investors fleeing.”¹²

A September 2021 article in *Aquaculture North America* includes a list of why investors are leery of land-based RAS Atlantic Salmon farms.¹³

- Upfront capital is too high without enough access to debt to defray equity costs
- Ongoing capital needs even for established companies are too high
- Cost of production is still too high – needs to be closer to net pen costs
- Long production cycle
- Profitability
- Long-term returns low
- Consumer acceptance not assured
- Reliance on premium pricing
- Technological failure frequency too high
- Biological challenges; disease, mortality, early maturity, slow growth
- Product quality – off-flavor
- Permitting is difficult
- Acceptance by local community has been problematic
- Regulatory – water intake and discharge waste are problematic

A very recent September 9th 2022 article is entitled Land-Based Fish Farm Boom Grinds to Halt.¹⁴ Another recent article is entitled “For now, the 'little guys' of land-based aquaculture seem to be the big winners.”¹⁵ Another company CEO proclaims, “No one is making money” and “the technology is not yet even able to grow salmon to the commercial 4-5 kilo range without facing significant challenges.”¹⁶ An alarming headline about a 10,000 metric ton land-based facility in Ohio says “The cost to build its new commercial-scale, land-based salmon farm in Pioneer, Ohio, could run as much as 60 percent higher than its initial estimate...[T]o partially finance the higher costs, the company has begun the process to place a mix of tax-exempt and taxable bonds through the Toledo-Lucas County Port Authority, whose board has approved the issuance of up to \$300 million (€260 million) in bonds to support the financing of the project.”¹⁷

Besides the doubts of investors, there are reasons for thinking that Atlantic Salmon aquafarming, which has been successful on smaller scales may not scale to the level that Nordic is hoping for.

¹² <https://www.intrafish.com/finance/atlantic-sapphire-knocked-off-its-perch-as-worlds-most-valuable-land-based-salmon-farmer/2-1-1149271>

¹³ <https://www.aquaculturenorthamerica.com/viewpoint-fallout-from-the-fire-at-atlantic-sapphire-in-denmark/>
The list in the article was edited for clarity.

¹⁴ <https://salmonbusiness.com/land-based-fish-farm-boom-grinds-to-halt/>

¹⁵ <https://www.intrafish.com/technology/for-now-the-little-guys-of-land-based-aquaculture-seem-to-be-the-big-winners/2-1-1089381>

¹⁶ <https://www.intrafish.com/aquaculture/no-one-is-making-money-cooke-ceo-on-why-land-based-will-never-replace-at-sea-aquaculture/2-1-1184428>

¹⁷ <https://www.intrafish.com/salmon/cost-to-build-new-aquabounty-land-based-salmon-farming-operation-could-run-as-much-as-60-higher-than-initial-estimate/2-1-1092526>

Profitable RAS land-based aquafarms in the US have started small and expanded slowly. None of them produce as much as 4% of what Nordic proposes in Humboldt. The first US land-based RAS, Superior Fresh, is in Wisconsin. After several year of operation it has increased from one metric ton in 2018 to 750 metric tons in 2022.¹⁸ It is profitable as are many smaller aquafarms.¹⁹

The most sustainable aquafarms are those that use a new technology which is able to continuously recycle all the water used. Thus there is no effluent and no problems with intakes capturing baby salmonids and other sea life. In fact, using the technology would moot most of the biological issues in our appeal. The most developed of these firms is *Sustainable Blue*, based in Nova Scotia, which started in 2009 and has been sending fish to market all over the north east since 2015. Interestingly, they had a breakdown in 2014 from a computer problem with they had not even foreseen as a possible threat – illustrating some of the risks of the field. They have recently built a new 50,000 square foot structure and can now deliver 1,000 metric tons of Atlantic Salmon a year. This is accomplished by utilizing a combination of ozone and advanced filtration methodologies. Sustainable Blue's CEO and Chief Technology Officer has reviewed the public documents describing Nordic's proposed facility in Maine and confirmed the Sustainable Blue's technology can scale to accommodate Nordics proposed volumes of fish. They are prepared to license their technology to Nordic.²⁰ This technology is one of the alternatives that the EIR did not consider. It is worth checking out the Sustainable Blue website: <https://www.sustainableblue.com/> We realize this is not the technology that Nordic is promoting, but it would be much less risky and it was not an alternative considered by the EIR.

The largest land-based RAS facility in the world is in Florida, run by Atlantic Sapphire. This firm designed its production in two phases, its current capacity is 9,500 metric tons (which is 38% as large as the Nordic factory aims for and is also Atlantic Sapphire's ultimate goal). The company first delivered fish in 2020. But in 2021 Atlantic Sapphire had three fish die-offs, one of 500,000 fish. The Florida plant had a refrigeration failure so that they are now using rented chillers at a cost of \$11 million a year and need to do a complete redesign of the cooling system. In the second quarter of 2022 they produced 400 metric tons of fish, which would be about 1,200 metric tons a year, or about 13% of their goal.²¹ And there was a fire at its small Denmark plant that destroyed most of the facility and dumped toxic chemicals into the nearby bay.²² So there is a lot that can go wrong. Atlantic Sapphire lost \$121 million in 2021. It's CEO offered this advice to a Maine RAS facility that is just starting up: "Don't underestimate the task. It's very complicated and takes a lot of time."²³

A news article from September 19, 2022 says: "Shares of land-based salmon farming leader Atlantic Sapphire continue to slide, hitting fresh lows after falling 25 percent over the past

¹⁸ <https://salmonbusiness.com/americas-first-commercial-ras-farm-to-expand-into-two-other-states/>

¹⁹ A list of planned and actually operating land-based aquafarms is in this article:

<https://salmonbusiness.com/these-are-the-leading-land-based-salmon-farms-in-the-world-right-now/>

²⁰ [https://www.maine.gov/dep/ftp/projects/nordic/pre-filed-testimony/intervenor-](https://www.maine.gov/dep/ftp/projects/nordic/pre-filed-testimony/intervenor-Upstream%20Watch%20Northport%20Village%20Corporation/BRYDEN_NVCUPSTREAM8.pdf)

[Upstream%20Watch Northport%20Village%20Corporation/BRYDEN_NVCUPSTREAM8.pdf](https://www.maine.gov/dep/ftp/projects/nordic/pre-filed-testimony/intervenor-Upstream%20Watch%20Northport%20Village%20Corporation/BRYDEN_NVCUPSTREAM8.pdf) Availability of licensure was confirmed via an email to Jim Clark of the Audubon Society from Jeremy Lee of Sustainable Blue in September 2022.

²¹ August 2022 report to investors: <https://vimeo.com/743488805> and <https://atlanticsapphire.com/wp-content/uploads/2022/08/20220826-Atlantic-Sapphire-ASA-August-2022-Operational-Update.pdf>

²² <https://www.intrafish.com/salmon/toxic-chemical-compound-found-in-water-used-to-extinguish-atlantic-sapphire-blaze/2-1-1165285>

²³ <https://www.intrafish.com/aquaculture/atlantic-sapphire-ceos-advice-to-land-based-rival-dont-underestimate-scale-of-the-task/2-1-1197991>

month.”²⁴ Recall that the CEO of Nordic said banks will not invest in other large land-based projects until they see that Atlantic Sapphire is a success.

On an aquaculture podcast, in the context of the fish die-off, Brian Vinci, director of a non-profit called The Freshwater Institute—which supports sustainable aquaculture -- said the following about large Atlantic Salmon aquafarms: “It’s clear to me that scale is a huge issue and a challenge they have had to face. Johann (the Atlantic Sapphire CEO) was on the news media recently warning that there are massive challenges with growing Atlantic Salmon at scale. Although we at Freshwater Institute proved out land-based salmon from egg to grow-out back in 2008, we were only doing it at a small scale of 20 tons per year head and gutted. What’s going on at Sapphire at 10,000 tons is just another beast entirely.”²⁵

Erik Heim, a founding director of Nordic, argued that Nordic is different, progressing slowly but surely. But he unexpectedly left the company after the Fredrikstad plant switched from Atlantic Salmon to yellowtail kingfish and the corporation split into independent subsidiaries. On September 16, he and his wife, Marianne Naess, announced that they are founding a new RAS company. “With Xcelerate Aqua, Heim and Naess plan to create companies that offer investors lower risk by pioneering a new type of medium scale RAS, offering a lower investment threshold and reduced time-to-marketThe proposed facility will be developed in two phases of 5,000 metric tons, with an ultimate capacity of 10,000 tons.”²⁶ Their press release says: “Smaller, leaner, and faster is the motto here. Small enough to *significantly reduce complexity and local impacts*, but with key advantages that match larger scale benefits. This is what the RAS sector needs to deliver financial proof of concept on acceptable timelines....”²⁷ So even the founder of Nordic has realized – as environmental groups in Humboldt told him many times – that the goal of 25,000 metric tons is unrealistic. And it seems clear that Heim and Naess, and their investors, believe a facility of 5,000 metric tons can be profitable. The Board should consider limiting the product amount to 5,000 metric tons as a permitting condition.

In summary, the substantial resources that Humboldt is being asked to contribute to the Nordic project present multiple risks because of Nordic’s limited experience, a poor investment climate for land-based RAS, and unrealistic goals. This does not necessarily mean the County should not invest, but it does mean the County must adopt measures to reduce the potential (or known) impact of Nordic failures. This is why the fairytale EIR does not do the County a service. Specific measures are needed that will reduce risks, mitigate damage, and insure against failures that might occur.

²⁴ https://www.intrafish.com/salmon/shares-of-land-based-salmon-farmer-atlantic-sapphire-continue-losing-streak/2-1-1302411?utm_source=email_campaign&utm_medium=email&utm_campaign=2022-09-19&utm_term=intrafish_com&utm_content=americas

²⁵ The Freshwater Institute, a program of The Conservation Fund, focuses on the sustainability of the domestic seafood supply by providing solutions to enable the growth of environmentally-responsible aquaculture. Vinci’s statement is on a recording is available at <https://www.rastechmagazine.com/ras-talk-hard-path-to-innovation-with-johan-andreassen-of-atlantic-sapphire/>, starting at 1 minute 35 seconds.

²⁶ https://www.intrafish.com/aquaculture/former-top-executives-at-nordic-aquafarms-form-new-company-announce-new-land-based-salmon-farming-concept/2-1-1301672?utm_term=intrafish_com

²⁷ <https://www.linkedin.com/feed/update/urn:li:activity:6976274466154680320/> Our emphasis.

Here are our proposed mitigation measures:

A. MITIGATE FINANCIAL RISKS

1. *Hold a closed session to review Nordic's detailed financial statements and forecast for construction capitalization with an independent investment banker before issuing any permits.*
2. *Require a bond of \$20 million²⁸ so the mill site clean-up can be completed even if the American subsidiary of Nordic does not survive as a company. Add an addition \$10 million bond to ensure the remains of an incomplete Nordic site are properly disposed of in the same situation.*
3. *Require insurance to cover the many major environmental problems that could occur, such as release of fish into the Bay or contamination of our sustainable aquaculture (Bay oysters) by Nordic effluent drawn back into the Bay.²⁹ If an insurance company evaluates Nordic's plans and finds them as solid as Nordic believes them to be the policy should be reasonable but our Bay and ocean resources will be protected.*

B. SCALE THE PROJECT DOWN OR USE ADAPTIVE MANAGEMENT TO PHASE IT

1. *Permit only a moderate sized facility. Aquafarms that produce 1,000 metric tons a year are profitable and the technology is proven. That would be a reasonable starting point. If that is too small for profitability given the clean-up required, allow up to 5,000 metric tons of production a year. After three successful cohorts, a permit for another 5,000 tons could be applied for – the new Erik Heim/Marianne Ness model.*
2. *OR: Segment the permit into three to five consecutive operational stages/levels and require adaptive management to ensure threats are managed if they occur. There should be contingency clauses that allow the County to rescind the permits based on occurrence of events that permanently damage the Bay or the ocean ecology or the failure of Nordic to meet permit conditions.*

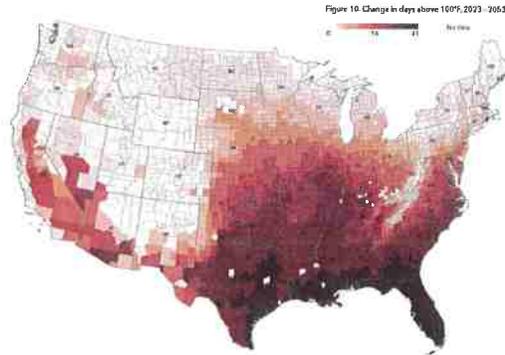
The next section identifies significant greenhouse gas impacts and mitigating actions that could be added as conditions to the permits.

²⁸ This is what Brenda Chandler said in a public meeting Wednesday September 14 that it will cost to clean up the site.

²⁹ Nordic and the EIR say escape is not possible, but the CA Fish and Wildlife disagreed in their comments on the draft EIR.

PROTECTING THE CLIMATE: MITIGATING GREENHOUSE GAS EMISSIONS

Late in August monsoon floods, made much worse by climate warming, devastated Pakistan. A million homes were lost, 32 million persons were displaced, and 1,400 persons died. In the same week we learned that the sea level rise from the melting of the Greenland ice sheet will double past predictions, and can no longer be stopped even if all emissions ceased today. And an August 15 climate study “predicts a 125-degree ‘extreme heat belt’ will stretch across a quarter of the country by 2053.”³⁰ Over 100 million Americans will experience 125-degree days.



António Guterres, the Secretary General of the United Nations said last year when the most recent Intergovernmental Panel on Climate Change reports were published: “We are sleepwalking to climate destruction.” What did he mean? We have a good example with Nordic. Instead of contributing to the 50% *reduction* in global emissions the IPCC says we need by 2030 in order not to warm the earth more than 1.5°Celsius, Nordic will add millions of tons of greenhouse gases over the next 30 years.

Fish Feed

Fish can’t grow on air. The essential inputs for an aquafarm are electricity and fish feed. In both cases, greenhouse gases are emitted in producing the input (perhaps far from California). In both cases the greenhouse gases are attributable to the aquafarm. That is how fish biologists and the Aquacultural Stewardship Council (ASC), the sustainability certification agency for fish farming, calculate greenhouse gas emissions from aquafarms. We have all grown used to the concept of a “carbon footprint,” which is essentially how the ASC requires emissions be calculated. It is the way scientists make sure all greenhouse gas emissions are accounted for, and it is also the way the aquaculture industry accounts for carbon emissions. Given the many processes occurring in multiple countries in order to make fish feed, attributing the greenhouse gas emissions to the product (salmon) is the industry standard even if it is not explicitly called for by CEQA.³¹

Nordic has ASC certification for its European factories and aspires to have it in the US. If so, the fish feed Nordic will use will come with an ASC certification of specific amounts of greenhouse gas emissions attributable to each metric ton of feed. Right now, if Nordic bought from the Norwegian firm Skretting, that would be 2.05 to 5.28 tons of carbon per ton of feed, depending

³⁰ <https://insideclimatenews.org/news/02092022/study-finds-that-mississippi-river-basin-could-be-in-an-extreme-heat-belt-in-30-years/>

³¹ CEQA does not require the “carbon footprint,” or life cycle assessment, for all analyses. As the FEIR says, it is not commonly employed. But with respect to aquaculture there is really no alternative; and that is recognized by the ASC even if not by the authors of the FEIR.

on the manufacturing factory. The ASC will require *Nordic* to multiply those fish feed emissions by the metric tons of fish feed they use annually and report their total greenhouse gas emissions to the Council.³² Since the EIR says *Nordic* projects using 36,000 metric tons of feed a year, that means *Nordic* will be reporting greenhouse gas emissions between 74,000 and 191,000 metric tons of CO₂ a year attributable just to their use of fish feed. Over 30 years this constitutes 2.2 million metric tons to 5.7 million metric tons of greenhouse gases. Please see the supplement for copies of the ASC standard and Skretting sustainability reports.

These emissions cannot be eliminated by any aquafarm, but they can be mitigated by conditioning the permit to require *Nordic* to pay – for each metric ton of emissions they document to the ASC – an amount equivalent to California’s cap and trade allowance price. Right now that is \$27 per metric ton, a bargain compared to the costs of climate damage the emissions will cause.³³ ***These funds should be paid either to:***

- a) the Northcoast Regional Land Trust and the Trinidad Coastal Land trust, which will use the funds to preserve coastal redwoods that sequester carbon; or***
- b) to a fund for regional sea level adaptation.***

Emissions from Electricity

Nordic has agreed to buy renewable electricity from RCEA or a solar purveyor outside the county or from an offshore wind farm. The major source of emissions from power bought by *Nordic*, unrecognized by the EIR, is due to the intermittency of renewable power. Even if *Nordic* buys 195 gigawatt hours of solar or RCEA renewable energy every year, that doesn't mean that 24/7 the *Nordic* facility will be powered by renewable energy.³⁴ "24/7 Carbon-free Energy (CFE) means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour of every day, everywhere."³⁵ The United Nations has a 24/7 Energy Compact that lays out the principles of such energy systems. Microsoft and Google are two of the firms that have signed the compact and are actively pursuing 24/7 clean, renewable energy. Peninsula Clean Energy CCA (the Silicon Valley equivalent of RCEA) intends to deliver 24/7 renewable power by 2025.³⁶ RCEA has said they have no plans to do so.

In the graphic below Peninsula Clean Energy shows the actual carbon intensity by hour and month for 2020. On an annual basis all its power was renewable at that time, like what *Nordic* proposes, but on a 24/7 basis only 47% is. In the graph, green is actual renewable power, the gradations of yellow and red are the gas power that is used nights and winters when there is a mismatch of renewable demand and availability.

³² The ASC adopted a new Salmon Standard in 2022 that includes this provision. See our Supplement.

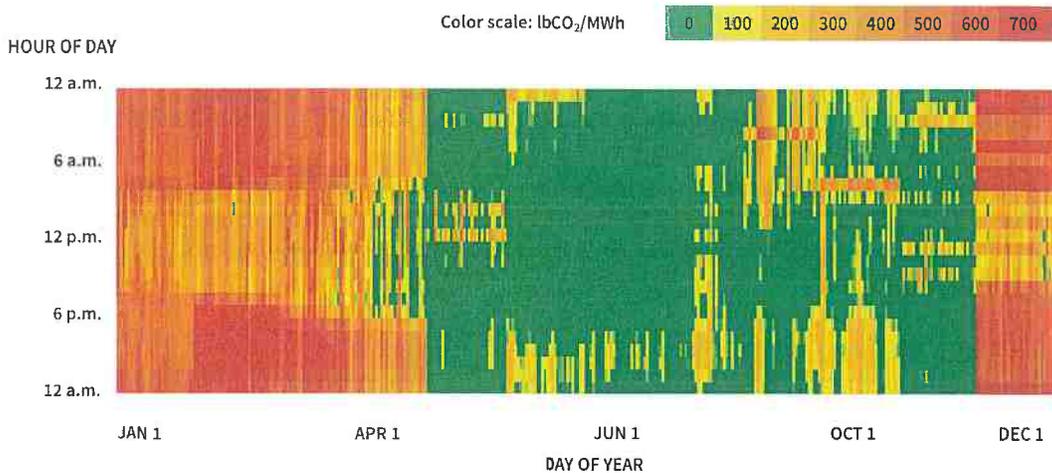
³³ If we use the official Norwegian figures for the social costs of one metric ton of CO₂ released, *Nordic* would be imposing economic costs on the world of \$459 million, at minimum.

³⁴ A very understandable explanation of this issue has been written by David Roberts at: <https://www.canarymedia.com/articles/clean-energy/google-and-others-have-committed-to-24-7-carbon-free-energy-what-does-that-mean> *Nordic* will have a constant demand, but the supply of renewable energy, including from storage, will vary across the 24 hours.

³⁵ UN 24/7 Carbon Free Energy Compact. <https://www.un.org/en/energy-compacts/page/compact-247-carbon-free-energy>

³⁶ <https://www.peninsulacleanenergy.com/wp-content/uploads/2021/11/Whitepaper-OUR-PATH-TO-247-RENEWABLE-ENERGY-BY-2025.pdf>.

FIGURE 1. Hour-by-hour emissions intensity for 2020



According to the EPA, fossil “natural” gas in power plants emits 898 pounds CO₂ per megawatt-hour³⁷ and there are 1000 megawatt-hours in a gigawatt hour, so Nordic’s actual emissions will be approximately 97.5 (half their total gigawatt hours) x 1000 x 898 or 87,555,000 pounds of CO₂ which is equivalent to 39,714 metric tons of CO₂ annually.³⁸ Thus the emissions from supplying electricity to this one aquafarm will approximately equal all the carbon sequestered by all the wetlands around the San Francisco Bay.³⁹ The discrepancy between annual and 24/7 emissions accounting will decline in Humboldt over time; for example, when (and if) offshore wind produces renewable energy at night and during the winter.

This is a very large amount of emissions, completely ignored by the EIR. Presently there is no way to mitigate these emissions directly. Right now they can be offset in the same way fish feed emissions are by Nordic contributing to land trusts or sea level adaptation costs. Nordic can pay RCEA to calculate the actual emissions figure. And a condition can be added that when RCEA offers 24/7 carbon free renewable power Nordic is required to purchase it. Or “Time-Based Energy Certificates” are being developed right now⁴⁰ and within a few years will be available for Nordic to purchase, guaranteeing a 24/7 match of demand and renewables.

Emissions from Organic Waste (Sludge)

The EIR states that 30 truck loads a week of sludge (fish offal: heads, guts, etc.) will be hauled to a composting facility in Redding or Marysville. No analysis of greenhouse gas emissions (other than VMT) is included because it is assumed the material will be composted. This waste *should* be used locally to make compost along with woody biomass, as has been done in

³⁷ EPA’s Emissions and Generation Resource Integrated Database (eGRID), released in 2018 with 2016 data, shows that at the national level, natural gas units have an average emission rate of 898 pounds CO₂ per megawatt-hour (MWh), while coal units have an emissions rate of 2,180 pounds CO₂ per MWh. https://www.epa.gov/sites/default/files/2020-12/documents/power_plants_2017_industrial_profile_updated_2020.pdf

³⁸ Calculations from EPA Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

³⁹ <https://www.pewtrusts.org/-/media/assets/2022/07/coastal-wetland-greenhouse-gas-inventory-for-the-san-francisco-bay-estuary.pdf>

⁴⁰ <https://www.wri.org/events/2022/8/tracking-and-verifying-247-carbon-free-energy-purchases>

Argentina.⁴¹ This would greatly reduce emissions from hauling. It uses a waste product from local sawmills with short transport distances and may also use clean wood waste from local demolitions and cannabis waste. This approach creates a useful product that can be sold with value added to replenish soil nutrients and water and carbon holding capacity. And it creates local job opportunities and possibly opportunities for local worker-owned small businesses.

A permitting condition should be serious attempts by Nordic to work with local forest and recycling organizations to create this local option with a report back within a year and a requirement recycling be done locally if the Planning Department judges it feasible based on the report.

Emissions from 1,693,068 truck miles

The EIR did not calculate greenhouse gas emissions from *loaded* trucks. However, because trucks will carry 19 metric tons in each load the 1.7 million truck miles in the EIR amounts to 33,861,360 ton-miles. This will produce 5,479 metric tons of CO₂eq emitted by the trucks per year, or roughly 164,000 metric tons over the life of the project.⁴²

In this case, mitigation is simple: a permitting condition should be that zero emission trucks (ZET) be used. ZETs with a 19 metric ton capacity are on the market and a new state program was just announced in August: "Privately owned and nonprofit trucking fleets of 20 or fewer vehicles and with an annual revenue of less than \$15 million are eligible and will have access to funding that can cover costs related to the purchase and operation of zero-emission trucks (ZETs)."⁴³

Emissions from HFC refrigerants

Here is why HFC refrigerants are important: Their emission warms the atmosphere from a few hundred times more than CO₂ itself to thousands of times more. The EPA says one average supermarket emits 1,556 metric tons of CO₂ a year.⁴⁴

Nordic plans to use 25% of their electric power for refrigeration.⁴⁵ They will use refrigerants to make the ice that they pack the fish in for shipping, and they will use refrigerants in "chillers" that will keep the water cool enough for the fish. The DEIR also says: "Use of water to water-heat exchangers and heat pumps will be maximized to reduce energy demands." Heat pumps also use refrigerants.

In negotiations with Marianne Naess of Nordic, we were told many times that they cannot specify the actual refrigerants and the global warming potential of them because their design team hasn't designed the system. In short, instead of describing the potential greenhouse gas

⁴¹ https://www.researchgate.net/profile/Maria-Mazzarino/publication/261619985_Composting_of_Fish_Waste_with_Wood_By_Products_and_Testing_Compost_Quality_as_a_Soil_Amendment_Experiences_in_the_Patagonia_Region_of_Argentina/links/569fa99308ae2c638eb7b9aa/Composting-of-Fish-Waste-with-Wood-By-Products-and-Testing-Compost-Quality-as-a-Soil-Amendment-Experiences-in-the-Patagonia-Region-of-Argentina.pdf

⁴² We used a calculator developed by scientists at the Environmental Defense Fund for both sea and truck transport: <https://storage.googleapis.com/scsc/Green%20Freight/EDF-Green-Freight-Handbook.pdf>

⁴³ <https://content.govdelivery.com/accounts/CARB/bulletins/32a73cb>

⁴⁴ U.S. EPA, Profile of an Average U.S. Supermarket's Greenhouse Gas Impacts from Refrigeration Leaks Compared to Electricity Consumption, https://www.epa.gov/sites/default/files/documents/gc_averagestoreprofile_final_june_2011_revised_1.pdf

⁴⁵ See the graph on page 3.5-4 of the DEIR

emissions from refrigerants they say they don't know what they are. The FEIR actually concludes they are not required to specify the greenhouse gas emissions if they follow the law. Is there any other source of greenhouse gas emissions for which this would be an acceptable answer? For example, they follow the law in transporting the fish to market in legal trucks, but that doesn't mean they don't have to count the truck emissions.

In summary, the EIR does not meet the CEQA requirement to identify and describe the potentially significant impacts of refrigerants, and Nordic has refused to adopt the mitigation measure we proposed of using very low global warming potential refrigerants, which are readily available.

Nordic must commit to using ultra-low (<10 GWP) refrigerants. If this condition is not applied, we request "adaptive management" for the heating/cooling system wherein emissions are calculated monthly and leaks fixed within a 7 day period.

[An experiment in thinking](#)

Suppose Nordic builds its facility and then something happens so that it can't operate it – maybe the price of salmon goes down, or it can't attract the investors it needs – what difference would this make for the climate? Regardless of what CEQA says, if the factory is not *operated* it is very clear that over 100,000 metric tons of greenhouse gases a year will *not* be emitted. It is the operation of the plant – the fish feed, the gas power electricity, the refrigerant leaks, and the emissions from driving trucks 1.5 million miles a year – that will cause the damage to the climate. Or to put it another way, the Board could prevent at approximately 3 million metric tons of emissions over 30 years if it stops this project in its risky tracks or at least imposes use permit conditions that will offset or reduce large amounts of those emissions.

The EPA provides a calculator that shows that 3 million metric tons of CO₂ is equivalent to burning of 6,945,634 barrels of oil, or running 7.5 gas powered powerplants for a year or consuming 294,695,481 gallons of diesel. In terms of impact on the climate there are far worse projects, a concrete plant, for example. But these figures are not small. And given the fact that the IPCC says we must *reduce* emissions worldwide by 50% in the next eleven years to have a hope of keeping warming to 1.5°C, approving a project with this much negative impact on the climate cannot be justified to your voters and constituents, to your children, and most of all to the world that is clearly threatened with climate catastrophe.

NORDIC AQUAFARMS GROUP AF FINANCIAL STATEMENT

In Norway financial statements are required of all firms, even private firms. These statements are public. A Norwegian business has made it easy to download any of these financial statements. It is at <https://www.proff.no> The specific statement for Nordic Aquafarms Group AF is at this URL: <https://proff.no/regnskap/nordic-aquafarms-group-as/gamle-fredrikstad/tekniske-konsulenter/IDGZRQ001OU/>

We downloaded the statement and had it translated from Norwegian by the online firm DeepL: <https://www.deepl.com/translator> The Norwegian abbreviation for their currency, NOK, was incorrectly translated as ENOUGH.

There are a wide range of additional reports available on Nordic at: <https://forvalt.no/Nettbutikk/Produkter/814603032>

Specific financial statements are also available for the Nordic owned Fredrikstad Seafoods and the two Danish companies Nordic bought a share in, Royal Sashimi and Maximus. The Fredrikstad Seafoods financial statement can be accessed at <https://www.proff.no> The statements for the Danish firms are available at <https://datacvr.virk.dk>

We are not financial experts. While we can see that Nordic lost money each year we cannot judge whether on the whole the financial statement can be taken to indicate support or caution to investors. We request that the County conduct due diligence by contracting with an investment bank that can analyze the statement and explain to the County how much risk, and why, is involved in investing in Nordic.

COMPANIES ROLES SHAREHOLDERS TENDER SEGMENTATION MORE

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Nordic Aquafarms Group AS Industries

Nordic Aquafarms Group AS

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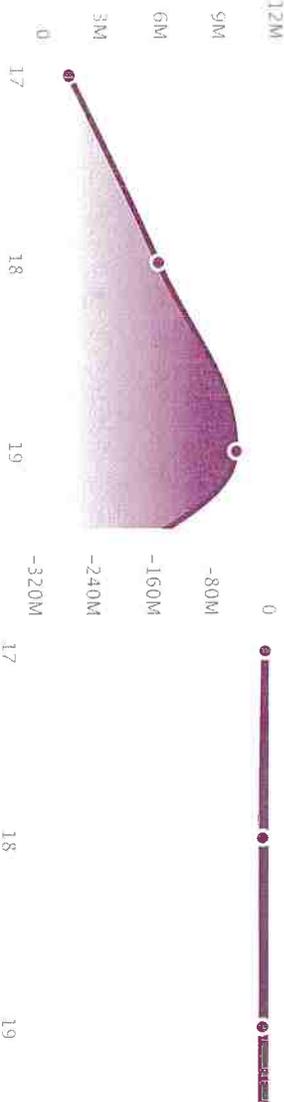
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Total amount of 1000

Sum driftsintekster

Resultat før skatt



ACCOUNTING PERIOD	2021	2020	2019	2018	2017
Start date	01.01.21	01.01.20	01.01.19	31.12.17	01.01.17

Other suppliers in the same industry

- Brevik Engineering AS
- Foyrn Consult AS
- Foyrn Consult AS
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ACCOUNTING PERIOD	2021	2020	2019	2018	2017
End date	31.12.21	31.12.20	31.12.19	30.12.18	31.12.17
MANAGERS SALARY in full 1000	2021	2020	2019	2018	2017
Currency code	ENOUGH	ENOUGH	ENOUGH	ENOUGH	ENOUGH
Payment	-	2,355	1 631	1 810	1,686
Manager other remuneration	-	230	164	113	105

INCOME STATEMENT in the whole 1000	2021	2020	2019	2018	2017
Currency code	ENOUGH	ENOUGH	ENOUGH	ENOUGH	ENOUGH
total sales income	364	0	9,939	5,973	1,354
Other operational income	-	-	-	-	0
Total operating income	364	0	9,939	5,973	1,354
Cost of goods	0	0	-	-	0
Inventory changes	-	-	-	-	0
Salary costs	8,054	9,060	11,690	10,402	4,600
Of which only salary	5,328	6,516	9 188	7,094	3,532
ordinary depreciation	513	634	2,923	377	156
Impairment	-	-	1,082	-	-
Other operating expenses	5,021	5,521	3,383	5,728	2,946
Operating result	-13,223	-15,215	-9 139	-10,533	-6 347
Income on invest. other company in the sm group	-	-	-	-	0

- Complete annual accounts
Copy of approved annual accounts from the Brønnøysund registers. **NOK 9**
- Copy of company certificate
Legitimation for the company from the Brønnøysund registers. **NOK 10**
- Role, enterprise
What roles does a company have in other companies from the Brønnøysund registers. **NOK 10**



[See all products](#)

INCOME STATEMENT in the whole 1000	2021	2020	2019	2018	2017
Income on investment in subsidiaries	-	-	-	-	0
Total other interest income	207	211	1,571	1,090	442
Income on invest. in an associated company	-	-	-	-	0
Total other financial income	16	2,623	0	1 188	624
Total financial income	3 120	6,274	1,571	2,278	1,065
Impairment fine, fixed assets	-	-	-	-	-
Total other interest expense	16,850	347	16	13	15
Other financial costs	2 162	0	421	12	21
Total other finance costs	235,788	0	421	12	21
Total financial costs	252,638	347	437	24	36
Result before taxes	-262,742	-9,288	-8,005	-8,280	-5 318
Sum tax	-	-	-	-	0
ordinary result	-262,742	-9,288	-8,005	-8,280	-5 318
Extraordinary income	-	-	-	-	-
Extraordinary costs	-	-	-	-	-
Tax extraordinary	-	-	-	-	0
Annual result	-262,742	-9,288	-8,005	-8,280	-5 318
Ordinary dividend	-	-	-	-	-
Extraordinary dividend	-	-	-	-	-
Additional dividends	-	-	-	-	-

INCOME STATEMENT in the whole 1000	2021	2020	2019	2018	2017
Total dividend	-	-	-	-	-
Group contribution	-	-	-	-	-
BALANCE SHEET for the whole 1000	2021	2020	2019	2018	2017
Currency code	ENOUGH	ENOUGH	ENOUGH	ENOUGH	ENOUGH
Goodwill	-	-	-	-	-
Total intangible assets	27,650	19,147	12,401	9,531	848
Total fixed assets	631 687	685 478	498 124	424,454	228,518
Land, buildings and other real estate	-	-	-	-	-
Machines/plants /vehicles	-	-	-	-	-
Operating assets/ fixtures/ tools/ Cars	152	291	511	692	781
Total fixed assets	152	291	511	692	781
Shares/Investments in subsidiaries	569,651	575 318	423 640	347,907	195,084
Change Stock, goods under production/finished	-	-	-	-	0
Investments in stocks and shares	-	-	-	-	-
Other changes	96	96	96	96	-
Total financial fixed assets	603 885	666 039	485 212	414 231	226,888
Total inventory	-	-	-	-	0
Accounts receivable	99	1 919	6,449	3,061	938
Group receivables	43 237	12,950	36,835	2,480	-
Total receivables	44,043	15,530	46 142	6,923	1 336
Total investments	-	-	-	-	0

BALANCE SHEET for the whole 1000	2021	2020	2019	2018	2017
Extraordinary dividend	-	-	-	-	-
Additional dividends	-	-	-	-	-
Total dividend	-	-	-	-	-
Short-term group debt	-	-	-	-	-
Other short-term debt	1 191	2 114	1,476	1 859	587
Total current liabilities	2,922	4,051	3,394	5,708	1 409
Total debt	313,880	214 201	3,595	5,965	1 709
TOTAL EQUITY AND DEBT	703 571	866 634	578 159	507,824	278,909
Guarantees	-	-	-	-	-
Mortgages	-	-	-	-	-

Source: Annual accounts, Brønnøysund registers
 Financial year 2021 : Accounting figures and auditor information are available on the service, but Proff has not registered any other company information from the annual accounts of this company

Mortgages and other land registrations



There are liens and/or land registrations on this company.



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Source: Brønnøysund registers

Credit assessment and risk analysis



SUPPLEMENT
TO
PROTECTING THE COUNTY, THE BAY AND OCEAN, AND THE CLIMATE
FROM NORDIC AQUAFARM RISKS AND IMPACTS

Submitted By 350 Humboldt

This supplement provides more information on the major sources of greenhouse gas we are requesting be mitigated. Fish feed, emissions from “renewable” energy, and refrigerants are all technical issues. In this supplement we have tried to explain more about each source of greenhouse gas emissions and why the EIR findings were inadequate in each case.

Another way to explain it, is that in our primary comments we have ignored the EIR to focus on asking for permit conditions. In this supplement present the reasons why the greenhouse gas components of the EIR should not be certified.

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FISH FEED

Fish food for aquaculture is viewed by fish biologists as a major source of greenhouse gas emissions. Based on data from many different scientific studies that estimate the CO₂ equivalent emitted by fish food for Atlantic Salmon, the average emissions at the Nordic aquafarm are likely to be 55,000 to 150,000 metric tons per year, at least two times the amount needed to meet a threshold of environmental significance under CEQA. We have included the findings of these studies as Appendix I. What we did not know when we summarized these scientific studies in our comments on the DEIR is how much the salmon farming industry as whole has adopted the scientific methods used in these studies. And this makes sense: the aquaculture industry compares itself favorably to other sources of protein like cattle, pigs, and chickens. But these comparisons all use the life cycle assessment method that scientists apply to salmon farming.¹ As an article on the website of feed manufacturer Cargill says, "Feed makes up the vast majority of fish farmers' carbon emissions, so companies like Cargill are under increasing pressure from customers, lenders and buyers at retail and foodservice to reduce their footprint."²

- a. The major organization responsible for certifying quality in the land-based growth of Atlantic Salmon, the Aquaculture Stewardship Council (ASC), includes greenhouse gases as part of their certification and requires each aquafarm to do a greenhouse gas inventory each year. The inventory must document the greenhouse gases attributable to the fish food consumed. It also requires fish feed manufacturers to state on their product the greenhouse gases released in their manufacture. Here is the ASC statement to this effect as it applies to aquafarms such as the facility Nordic seeks to permit:³

"GHG accounting for feed –

[R]equires the calculation of the GHG emissions for the feed used during the prior production cycle at the grow-out site undergoing certification. This calculation requires farms to multiply the GHG emissions per unit of feed, provided to them by the feed manufacturer, by the amount of feed used on the farm during the production cycle. The feed manufacturer is responsible for calculating GHG emissions per unit feed...

The scope of the study [by feed manufacturers ASC certifies] to determine GHG emissions should include the growing, harvesting, processing and transportation of raw materials (vegetable and marine raw materials) to the feed mill and processing at feed mill. Vitamins and trace elements can be excluded from the analysis. The method of allocation of GHG emissions linked to by-products must be specified. The study to determine GHG emissions can follow one of the following methodological approaches:

1. A cradle-to-gate assessment, taking into account upstream inputs and the feed manufacturing process, according to the GHG Product Standard
2. A Life Cycle Analysis following the ISO 14040 and 14044 requirements for life cycle assessments."

These are the same methods used by the scientists cited in Appendix I.

- b. One of the three biggest fish feed manufacturers, Cargill, notes that fish farming contributes 250 million metric tons of CO₂e per year, and salmon contributes 10 million metric tons of CO₂e per year. Cargill says: "Feed contributes significantly to the carbon footprint of seafood farming, and

¹ <https://www.asf.ca/news-and-magazine/salmon-news/assessing-the-carbon-footprint-of-aquaculture>

² <https://www.intrafish.com/feed/i-want-to-see-results-cargill-aqua-nutrition-president-ramps-up-efforts-to-improve-feed-sustainability/2-1-1212928>

³ https://www.asc-aqua.org/wp-content/uploads/2019/12/ASC-Salmon-Standard_v1.3_Final.pdf

feed producers hold the key to achieving large emissions reductions throughout the value chain. Using that key to its full effect depends on seafood farmers and retailers sharing the same drive for sustainability.”⁴ Nordic, of course, claims sustainability as a value.

- c. *To summarize: ASC, the certification agency for aquafarms like Nordic, requires food manufacturers to calculate GHG emissions using the methods that fish biologists use; and ASC requires the aquafarms themselves to count these feed emissions in the GHG emissions inventory they are required to report to ASC. So all three components of the industry are on the same page with how to calculate greenhouse gases from fish food. Nordic will be reporting every year to the ASC the greenhouse gases attributable to their fish feed and thus to their fish. Yet, at the same time the FEIR argues that none of those greenhouse gases should count in the CEQA analysis! So everyone except the people who prepared the FEIR buys into the idea that greenhouse gases from fish feed have to be calculated and reported by the aquafarm using a life cycle or carbon footprint method. Why this difference?*
- d. First of all, Nordic Vice President Nick King basically admitted the above information in his statement to the Planning Commission, he just said the County can’t hold them to it because it is not required under CEQA: “While CEQA does not require life cycle analysis of feed for greenhouse gases, we feel it is appropriate in the context of aquaculture to integrate this information into our company’s sustainability goals. NAF will establish a corporate sustainability program specifically for CA that will measure monitor, report, and set goals for greenhouse gas emissions.” However, this admission is misleading because King says they will be reporting the greenhouse gases (that the EIR says don’t exist) “voluntarily” and “specifically for California,” whereas in fact, as shown above, it is *required* of any aquafarm certified by the ASC in any state or country.
- e. The FEIR and Nordic say that these greenhouse gases don’t count under CEQA. They have three arguments, each of which is wrong or beside the point.
- The first argument is that there is no *specific* mention of greenhouse gases from fish feed. That is true but the whole point of CEQA is to identify greenhouse gases associated with a project and mitigate them. If there are greenhouse gases they must be identified. In this case there are massive amounts of greenhouse gases but they have not been identified by the EIR and mitigated to the extent possible.
 - The second argument is that CEQA does not require life cycle assessments. This is true. As the FEIR says, life cycle assessments are “not commonly” used. However, they are not prohibited and the clear implication is that there are circumstances when they are appropriate even if such circumstances are not common. The state has explained the rationale for certain changes to CEQA Guidelines in part as follows:

“[A] new subdivision (b) cautions that the analysis of energy impacts is subject to the rule of reason, and must focus on energy demand caused by the project. This sentence is necessary to place reasonable limits on the analysis. Specifically, it signals that a full “lifecyle” analysis that would account for energy used in building materials and consumer products will generally not be required.”⁵

But the fish feed is an entirely different category. We have not asked that greenhouse gases in the building be calculated with a life cycle assessment – only those from fish feed. And since fish biologists all use the life cycle assessment method, and that method is required to

⁴ <https://www.cargill.com/doc/1432196768685/cargill-aqua-nutrition-sustainability-report-2020.pdf>

⁵ California Department of the Interior. Final statement of reasons for regulatory action amendments to the state CEQA guidelines OAL notice file no. Z-2018-0116-12. Our emphasis.

be used by fish feed manufacturers by the ASC, and the ASC requires that the farm use those same figures multiplied by the feed they use annually and report that as greenhouse gas emissions of the farm, it is clearly appropriate for CEQA.

- The FEIR also says only greenhouse gases produced in California count. With dubious relevance, they base this on statements from an association of environmental engineers. However, those statements on the face of it do not make sense. After all, greenhouse gas emissions are a global problem; they don't just affect California as the FEIR argument implies. Fish food is manufactured in many places around the world, but it is consumed here. Like airline emissions from flights crossing national borders emissions have to be counted at the point of consumption. Fish scientists and all elements of the aquaculture business have agreed that the greenhouse gases from manufacturing fish feed are counted where they are fed to fish. The FEIR must be changed to recognize and require mitigation of the fish feed greenhouse gas emissions that the ASC will require Nordic to report.
 - Finally, the argument that only emissions actually generated in California and counted in the state's emissions inventory count would prohibit us from counting the emissions from electricity generation, which is universally acknowledged as relevant (including by the FEIR). California has reduced its GHG emissions in the power sector by not buying electricity from out of state coal plants as well as by adding renewables. Electricity is part of a grid that crosses state borders. We still get a small amount of coal-based electricity from out of state. Only Texas has a grid that is confined to one state. So limiting emissions to those actually produced in-state would mean we couldn't account for electricity's GHG in the way we do.
- f. At the Planning Commission staff member Cade MacNamara said the following: "Nordic aspires to be certified through ASC. The ASC requires that feed mills report greenhouse gases. This is not a requirement for feed purchasers. Because Nordic aquafarm is not producing its own feed within this project, that would be analysis of a different project and is not within the purview of CEQA for this project." In other words only manufacturers of fish feed are required to report their greenhouse gases. This is a false statement and misled the Planning Commission. Below are quotations from the standard. (The entire standard is included as an appendix to this document.) They clearly indicate the farm itself must calculate and report the greenhouse gases from the fish feed:

Criterion 4.6 Energy consumption and greenhouse gas emissions on farms⁸⁴

INDICATOR	REQUIREMENT
4.6.1 Presence of an energy use assessment verifying the energy consumption on the farm and representing the whole life cycle at sea, as outlined in Appendix V-1	Yes, measured in kilojoule/t fish produced/production cycle
4.6.2 Records of greenhouse gas (GHG ⁸⁵) emissions ⁸⁶ on farm and evidence of an annual GHG assessment, as outlined in Appendix V-1	Yes
4.6.3 Documentation of GHG emissions of the feed ⁸⁷ used during the previous production cycle, as outlined in Appendix V, subsection 2	Yes

Notice that the title is greenhouse gas emissions "on farms". What does this entail? "Feed manufacturer is responsible for calculating GHG emissions per unit feed. Farm site then shall use that information to calculate GHG emissions for the volume of feed they used in the prior production cycle." So the Planning Commission was misinformed by Planning Department staff.

- g. We used the “sustainability reports” that fish food manufacturers Skretting⁶ and Cargill⁷ produce annually to calculate what the Nordic aquafarm greenhouse gas emissions would be. On their website, Skretting lists the values for the tons of CO₂e per ton of feed in their four Canadian and four Norwegian factories: they range from 2.05 at a minimum to 5.28 for the maximum (t CO₂e/t feed).⁸ Cargill, instead of providing figures for different factories, provides an average for salmon fish food of 2.67t CO₂e/t of feed.⁹ We can calculate the greenhouse gas emissions if we know how much fish food will be used. The Staff Report to the Planning Commission says: “At full scale operations, NAFC expects to use approximately 36,300 metric tons of feed per year.” To get the range of fish feed greenhouse gases attributable to Nordic at full build-out using Skretting’s data, we multiply respectively the 2.05 and the 5.28 of CO₂e t/t of fish food by the 36,300 tons of fish food. For the low figure it is 74,415 and for the high figure it is 191,664. For Cargill’s factory average it is 2.67 times 36,300 or 96,921 metric tons of greenhouse gases per year.
- h. These are huge figures. For illustration, the EPA emissions calculator says 191,000 metric tons of CO₂ is equal to burning 443,810 barrels of oil per year.¹⁰

REFRIGERANTS

- a. Here is why refrigerants are important: Their emission warms the atmosphere from a few hundred times more than CO₂ itself to thousands of times more.
- b. Nordic plans to use 25% of their electric power (which in total is equal to all that used by Eureka and Fortuna combined) for refrigeration.¹¹ They will use refrigerants to make the ice that they pack the fish in for shipping, and they will use refrigerants in “chillers” that will keep the water cool enough for the fish. The DEIR also says: “Use of water to water-heat exchangers and heat pumps will be maximized to reduce energy demands.” Heat pumps also use refrigerants.
- c. In negotiations with Marianne Naess of Nordic, we were told many times that they cannot specify the actual refrigerants and the global warming potential of them because their design team hasn’t designed the system. In short, instead of describing the potential greenhouse gas emissions from refrigerants they say they don’t know what they are. The FEIR, however, says they are not required to specify the greenhouse gas emissions they will follow the law. Is there any other source of greenhouse gas emissions that this would be an acceptable answer for? They follow the law in transporting the fish to market in legal trucks, but that doesn’t mean they don’t have to count the truck emissions. In fact, the relevant CEQA standard is “Would the Project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?” The answer is we don’t know because the data are not available.
- d. In emails to Marianne Naess we asked that Nordic commit to using natural refrigerants. These are refrigerants that have a minimal effect on the climate. There is refrigeration equipment that uses natural refrigerants for chillers, heat pumps and virtually every other heating or cooling use. Nordic refused to commit to this. We believe it should be a condition of the permit.
- e. We asked for information that would allow us to judge how much refrigerants with a high global warming potential they will use. (The regulation going into effect in 2025 will allow them to use HFC

⁶ <https://www.cargill.com/doc/1432196768685/cargill-aqua-nutrition-sustainability-report-2020.pdf>;

<https://www.skretting.com/en/sustainability/sustainability-reporting/sustainability-report-2020/>

⁷ <https://www.skretting.com/en/sustainability/sustainability-reporting/sustainability-report-2020/climate--circularity/the-carbon-footprint-of-feed/>

⁸ <https://www.skretting.com/en/sustainability/sustainability-reporting/sustainability-report-2020/climate--circularity/the-carbon-footprint-of-feed/>

⁹ <https://www.cargill.com/doc/1432196768685/cargill-aqua-nutrition-sustainability-report-2020.pdf>

¹⁰ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

¹¹ See the graph on page 3.5-4 of the DEIR

refrigerants with up to 2,200 times more global warming potential than CO₂). Namely, what do they use in their Norwegian factory? This is actually easy to provide and highly relevant because they plan to use a number of modular tanks that are similar to the much smaller Norwegian factory. Nordic refused to provide this information. It should not be proprietary information. We contacted the DeepChill company in Canada that works with RAS facilities. They said they use R 404A, which warms 3,922 times as much as CO₂; they also use a lower GWP substitute for R404A called R448A which warms 1,386 times as much as CO₂; and they use R770 which is ammonia, a natural refrigerant with zero warming effects.

- f. Refrigeration is a technology that can go drastically wrong with huge emissions consequences. The following quotation is from the shareholder statement of Atlantic Sapphire's RAS facility in Florida: "The increase [in costs] is mainly explained by the \$11 million in temporary chiller and generator rental costs in the U.S. following the breakdown of the chiller plant...in Q1 2021." So chillers have not yet been proven to work in a facility less than half the size of what Nordic proposes.
- g. The EIR states that since Nordic will not violate any state or federal law or regulation, no estimate of greenhouse gas emissions is required. If you think about it, this is a ridiculous argument. You could just as well say that if trucking firms follow the law and used legally required emissions equipment (catalytic converters) there is no need to calculate their greenhouse gas emissions. The legality of a source has nothing to do with the environmental impact of that source, especially because until 2024 there are *no* limits on the global warming potential of chillers and at that point, limits apply only to new chillers and even then, there is a maximum allowed of 2,200 times the warming effect of CO₂.
- h. In summary, the EIR does not meet *the legal requirement to identify and describe the potentially significant impacts of refrigerants* and Nordic has refused to adopt the mitigation measure of using very low global warming potential refrigerants, which are readily available.

SOURCES OF GREENHOUSE GASES FROM RENEWABLE ELECTRIC POWER

- a. Nordic has committed to either buy its electricity from RCEA or buying renewable or low carbon electricity from another provider, presumably a solar provider outside the county. As a result the final EIR incorrectly states: "A more appropriate carbon intensity factor would be zero pounds of carbon dioxide equivalent per megawatt hour (0 lbs. CO₂e/MWh)."
- b. We are very appreciative that Nordic has decided to go with renewable energy. However it will *not* be zero emissions from power, not even close.
 - i. The major source of emissions from power that is unrecognized by the EIR is due to the intermittency of renewable power. Even if one buys 195 gigawatt hours of solar every year, that doesn't mean that 24/7 the Nordic facility will be powered by solar.¹² "24/7 Carbon-free Energy (CFE) means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour of every day, everywhere."¹³ The United Nations has a 24/7 Energy Compact that lays out the principles of such energy systems. Microsoft and Google are two of the firms that have signed on. Below is an extensive quotation from a white paper¹⁴ from the Peninsula Clean Energy CCA (the Silicon Valley equivalent of RCEA). Peninsula

¹² A very understandable explanation of this issue has been written by David Roberts at:

<https://www.canarymedia.com/articles/clean-energy/google-and-others-have-committed-to-24-7-carbon-free-energy-what-does-that-mean> Nordic will have a constant demand, but the supply of renewable energy, including from storage, will vary across the 24 hours.

¹³ UN 24/7 Carbon Free Energy Compact. <https://www.un.org/en/energy-compacts/page/compact-247-carbon-free-energy>

¹⁴ <https://www.peninsulacleanenergy.com/wp-content/uploads/2021/11/Whitepaper-OUR-PATH-TO-247-RENEWABLE-ENERGY-BY-2025.pdf> We have removed the footnotes for clarity. See the original for those.

Clean Energy intends to deliver 24/7 renewable power by 2025. The white paper explains and shows graphically why annual purchases of renewable energy such as Nordic proposes do not reflect actual carbon emissions. The quotation is shown in blue type.

[In 2018] Google described its vision of a 24/7 carbon-free goal for their data centers and campuses, and in 2020 set a goal to achieve this by 2030. Cities such as Los Angeles, Sacramento, and Des Moines have now set similar goals, and researchers at RMI (formerly Rocky Mountain Institute) and Princeton have begun studying the trend. Earlier this year, the United Nations started building a global coalition for 24/7 carbon free energy....

To better understand what it means for Peninsula Clean Energy to deliver renewable energy to our customers, it is first necessary to explain generally how the electric grid works. In physical terms, the electric grid is a system of wires that transmits and distributes electricity throughout the state, connecting our customers with the renewable energy generators under contract with us. As an analogy, it can be helpful to think of the electricity grid as a river. Just as streams and tributaries add their water flow to larger rivers, power plants throughout California add their energy to the electricity grid. Just as downstream customers can draw water from the river to use in their homes and businesses, our customers consume energy from the grid. The key point of this analogy is that just as it is impossible to track the source of a single molecule of water drawn from a river, it is similarly impossible to track exactly where each electron you consume comes from.

The electricity that we deliver to customers is therefore tracked based on contractual terms, rather than physical terms. We know how much metered energy our contracted generators deliver to the grid, and we make sure that it is the same amount of metered energy that our customers use. While in contractual terms we currently deliver a specific mix of renewable and carbon-free electricity to our consumers, the physics of the power grid means that everyone consumes a mix of electrons from both the carbon-free and fossil-based resources that deliver energy to the grid.

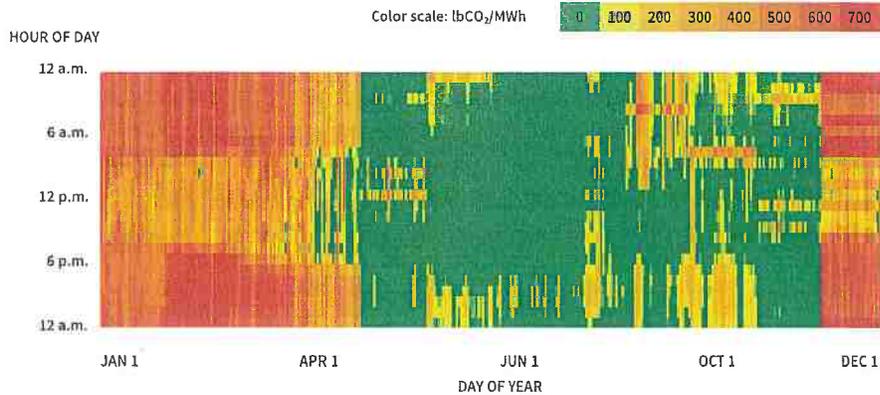
In addition, the timescale that we use to track our contractual renewable energy deliveries matters.

California's current regulatory standards for procuring and reporting clean electricity, such as the Renewables Portfolio Standard and Power Source Disclosure program, are tracked on an annual basis. We count how many megawatt-hours (MWh) of electricity our contracted generators produce in a year and match that to the number of MWh that our customers consume in a year. This annual accounting framework is how we are required to report our procurement to the state and report in our Power Content Label sent to our customers.

However, this annual accounting standard ignores whether our contracted generators produce electricity at the same time our customers use it. At certain hours, our contracts generate less clean energy than our customers are using. During those times, we must rely on generic grid electricity (most of which in California comes from methane gas power plants) to make up the difference. In other hours, our contracts

generate more clean energy than our customers use. Under the current standards, we can “credit” this excess clean generation to the hours when we rely on fossil-based grid energy and net out our grid energy use on an annual basis. While the excess renewable generation we contribute to the grid in some hours generally displaces fossil generation, we continue to send a demand signal for fossil-based energy in those hours when our clean energy contracts do not match the timing of our customers’ energy demand (see figure 1).

FIGURE 1. Hour-by-hour emissions intensity for 2020



This is why a 24/7 renewable energy approach, which matches renewable energy supply with demand on an hour-by-hour basis, is so important for the success of our state and global decarbonization goals. It enables us to help eliminate the demand signal for fossil-based electricity from the grid that our customers’ electricity consumption presently provides at the times when our contracted renewable generation does not match our load.

As of 2020, based on the annual accounting standard, Peninsula Clean Energy delivered 52% renewable energy and 47% large hydro to our customers. Our delivered electricity had a GHG emissions intensity of 12 lbCO₂e/MWh, compared to the California utility average of 466 lbCO₂e/MWh.

Also as of 2020, 47% of our hourly load was matched by contracted renewable energy generated in the same hour. Using an hourly, time-coincident accounting method, we estimate that the GHG emission intensity of our delivered electricity was closer to 187 lbCO₂/MWh than 12 lbCO₂e/MWh.

Based on contracts signed to date, we are currently on track to be 64% renewable on a time-coincident basis in 2025, and we are actively working to plan and procure the remaining 36% by that year. [End Quote]

So rather than zero the actual amount of CO₂e released by the Nordic facility from energy usage will be far higher.¹⁵ Peninsula’s actual hourly carbon intensity is 15 times the amount

¹⁵ A competitor in Norway, Sustainable Evolution, is backed by Cargill and a giant Korean food corporation to the tune of over \$300 million. It has just signed an agreement with a state run Norwegian power company for 100%

shown with annual accounting. Based on Peninsula's information, buying renewable energy with annual accounting results in about half of the hourly use actually coming from natural gas (because 47% of their hourly load was matched by contracted renewable energy generated in the same hour). Since according to the EPA fossil "natural" gas in power plants emits 898 pounds CO₂ per megawatt-hour¹⁶ and there are 1000 megawatt-hours in a gigawatt hour, Nordic's actual emissions (absent mitigation) will be approximately 97.5 x 1000 x 898 or 87,555,000 pounds of CO₂ which is equivalent to 39,714 metric tons of CO₂ annually.¹⁷

- ii. The discrepancy between annual and 24/7 emissions accounting will decline in Humboldt over time; for example, when (and if) offshore wind produces renewable energy at night and during the winter. While RCEA has no specific plans to adopt 24/7 accounting the way Peninsula is, the RCEA Board has passed an authorization that would allow a specific contract with Nordic or other large user of electricity to purchase only renewable power to the extent possible.¹⁸ As shown above, there is a limit to how much such a contract (like Peninsula has with Google) reduces emissions at this time. But it is the only feasible mitigation for what otherwise will result in roughly half of the 195 gigawatt hours Nordic uses being from fossil gas.

TRANSPORTATION GREENHOUSE GASES

- a. The EIR estimates 2,268,907 vehicle miles traveled (VMT) in 2029, most of which is driving loaded trucks (1,693,068). The EIR estimates these trips will emit 2,371 metric tons of CO₂e. The modeling tool is obviously the wrong one since the analysts had to fudge the data inputs, using multiple short trips instead of the actual long trips. In fact, data-based estimates about trip length were not used in the EIR: "Annual VMT data was provided for short-hauling and long-hauling trips for GHG emissions analysis; detailed hauling data, such as specific destinations or trip routes was not provided. Specific trip lengths (such as minimum, maximum, average, or distribution) for short-hauling and long-hauling were not known."¹⁹ In short, the EIR does not contain an independent or accurate estimate of VMT.

We redid the 2029 greenhouse gas emissions based on the Nordic-provided but unverified VMT using a formula from a manual for green trucking.²⁰ (We did not change the estimate for passenger vehicles going to and from work.) We first had to know roughly the tonnage of each truck load. The DEIR does include this for the fish food: 19 metric tons per truckload. Fish on ice, being more dense, might weigh more, so we used 20 metric tons as the tonnage. With 20 tons, the CO₂ emitted is

renewable power. This is "actual" renewable since it is hydropower and runs night and day.

<https://www.intrafish.com/salmon/land-based-salmon-farmer-salmon-evolution-signs-deal-for-100-percent-renewable-energy/2-1-1133585>

¹⁶ EPA's Emissions and Generation Resource Integrated Database (eGRID), released in 2018 with 2016 data, shows that at the national level, natural gas units have an average emission rate of 898 pounds CO₂ per megawatt-hour (MWh), while coal units have an emissions rate of 2,180 pounds CO₂ per MWh. https://www.epa.gov/sites/default/files/2020-12/documents/power_plants_2017_industrial_profile_updated_2020.pdf

¹⁷ Calculations from EPA Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

¹⁸ Personal communication.

¹⁹ FEIR 2-19

²⁰ This calculator was developed by scientists at the Environmental Defense Fund for both sea and truck transport: <https://storage.googleapis.com/scsc/Green%20Freight/EDF-Green-Freight-Handbook.pdf>

161.8 grams of CO₂/ton-mile.²¹ To get the ton miles we multiply 20 by the 1,693,068 truck VMT in a year or 33,861,360 ton miles. Multiplying the emissions factor by the ton miles,²² we get 5,479 metric tons emitted by the trucks per year; then we add the 152.7 metric tons for passenger vehicles, yielding a total of 5,631 metric tons of CO₂ per year from vehicle traffic. This is 2.4 times the FEIR estimate from their inappropriate modeling software and certainly justifies using electric or hydrogen trucks as a mitigation measure.

The draft and final EIR modeling tool did not include other important variables that must be used in accurately estimating CO₂e from truck transportation. The federal EPA SmartWay Program encourages haulers to reduce emissions and has software to provide accurate greenhouse gas emissions calculations for trucking firms. Nordic should join this program and get an accurate estimate for a redone FEIR (based on actual distances to actual destinations with accurate loads).²³

²¹ Ibid.

²² There are 1,000,000 grams in a metric ton. We divided the ton miles by one million and multiplied by the emissions factor of 161.8.

²³ <https://nepis.epa.gov/Exe/ZyPDF.cgi/P1013TIJ.PDF?Dockkey=P1013TIJ.PDF>

APPENDIX I: SCIENTIFIC STUDIES SHOWING THAT GROWING 25000 METRIC TONS OF ATLANTIC SALMON A YEAR WILL BE RESPONSIBLE FOR AT LEAST 55,00 TO 150,000 METRIC TONS OF GREENHOUSE GASES

Scientists consistently state that lifecycle analysis (LCA) is required for understanding the effects of aquaculture.²⁴ The life cycle assessment of aquaculture is the method used by the IPCC²⁵ and all scientific studies of greenhouse gasses and aquaculture. It makes possible the comparison of aquaculture using different methods (a pen in the ocean vs. a land-based system, for example) and the comparison of emissions from different species of fish; it also allows comparison of aquaculture to raising cattle or chickens or catching wild fish. An explanation of why and how this method is used is available in *Nature: Scientific Reports* in 2020.²⁶

It is impossible to analyze the cumulative effects of the project on climate change over the 30 years or more the facility operates, as required by CEQA, without including energy the CO₂e emissions attributable to the fish food to be used in large quantities over the life of the project.

In a 2009 article on global aquaculture, production of fish food drove 93% of energy use and 95% of greenhouse gas emissions.²⁷ Because the use of wild fish products in feed has declined considerably and because open pen aquaculture uses less electricity, the balance between food production and electricity has changed. But they are still the two major sources of greenhouse gas emissions associated with aquaculture.

For understanding the Nordic facility, we need studies that focus on land-based closed containment recirculating aquaculture systems (LBCC-RAS), which is how the proposed Nordic facility is classified.²⁸ A few of these kind of studied are reported below:

- A 2016 study compared a hypothetical RAS facility in the United States with an open pen design in Norway.²⁹ Exclusive of transportation costs, the LBCC-RAS-produced salmon has a carbon footprint that is double that of the open pen-produced salmon, 7.01 versus 3.39 kg

²⁴ Cao, Ling, James S. Diana, and Gregory A. Keoleian. "Role of life cycle assessment in sustainable aquaculture." *Reviews in Aquaculture* 5, no. 2 (2013): 61-71. ["Life cycle assessment (LCA) has become the leading tool for identifying key environmental impacts of seafood production systems."; Bartley, Devin M., Cecile Brugere, Doris Soto, Pierre Gerber, and Brian Harvey. *Comparative assessment of the environmental costs of aquaculture and other food production sectors: Methods for meaningful comparisons: FAO/WFT Experts workshop 24-28 Apr 2006 Vancouver, Canada*. FAO, Roma (Italia)., 2007. [See the chart from this paper with pros and cons of different methods. It is attached.]

²⁵ IPCC 2013 100a in IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

²⁶ MacLeod, Michael J., Mohammad R. Hasan, David HF Robb, and Mohammad Mamun-Ur-Rashid. "Quantifying greenhouse gas emissions from global aquaculture." *Scientific reports* 10, no. 1 (2020): 1-8.

²⁷ Pelletier, Nathan, Peter Tyedmers, Ulf Sonesson, Astrid Scholz, Friederike Ziegler, Anna Flysjo, Sarah Kruse, Beatriz Cancino, and Howard Silverman. "Not all salmon are created equal: life cycle assessment (LCA) of global salmon farming systems." (2009): 8730-8736.

²⁸ DEIR 2-1

²⁹ Liu, Yajie, Trond W. Rosten, Kristian Henriksen, Erik Skontorp Hognes, Steve Summerfelt, and Brian Vinci. "Comparative economic performance and carbon footprint of two farming models for producing Atlantic salmon (*Salmo salar*): Land-based closed containment system in freshwater and open net pen in seawater." *Aquacultural Engineering* 71 (2016): 1-12.

CO₂e/kg salmon live-weight, respectively.³⁰ The 7.41 kg CO₂e/kg salmon, when translated to the 25,000 - 27,000 metric tons of salmon production annually planned by Nordic, would equate to 185,250 - 200,070 MT CO₂e/yr. If we assume, as the authors of this study did, that alternatively 90% renewable energy is available, then the kg CO₂e/kg salmon went to 4.1, which for Nordic translates to 102,500 - 110,700 MT CO₂e/yr.

- A second LCA study, of a land-based RAS, was done in China by Norwegian, Swedish and Chinese researchers in 2019.³¹ It is also far smaller than the Nordic facility since only 29,000 fish at 5kg each were produced in a year: 145 metric tons rather than 25,000. However, it is an operating version of a land based Atlantic Salmon RAS. We are hampered in assessing the proposed Nordic facility in that no facility of its type and size exists anywhere in the world. The energy source in China was 65% coal and 35% renewables, so it was more carbon intensive than the Nordic facility is likely to be unless Nordic contracts directly for biomass power. Electricity use and fish feed dominated eight of the environmental effects assessed by the study, including greenhouse gasses. For greenhouse gasses, electricity was the cause of 45% and fish food 30% of emissions. The total CO₂e emissions were 16.747 kg per kg of salmon, or CO₂e of 418,675 – 452,169 MT CO₂e/yr for Nordic's proposed project.
- For comparison with LBCC-RAS, we present results from a life-cycle analysis for a Canadian open pen Atlantic Salmon facility. Using IPCC methodology, one kg of salmon contributed to 2.26 kg CO₂e of GWP. Agricultural feed components include by-product poultry meal, wheat, corn gluten meal, canola seed and meal, canola oil, and soy meal, while marine-based ingredients include fish meal, by-product fish meal and oil, fish oil, and menhaden oil. Agricultural products lead impacts in GWP, acidification, eutrophication, and ecotoxicity, while impacts are more evenly distributed in ozone depletion and smog. Using the 25,000 – 27,000 metric ton annual production of the Nordic facility at buildout, this would be 56,500 to 61,020 MT CO₂e emitted indirectly annually. It is attributable primarily to the feed because open pen facilities are much less electricity intensive — and so constitutes a minimum estimate.³²
- In 2019,³³ a meta-analysis of LCA studies on salmonids (a much broader category than Atlantic Salmon) was performed with important conclusions both about LCA results and limitations of the method. Twenty four studies were found, nine dealing with Atlantic Salmon. The 24 studies were grouped into Open or Closed and Land vs Sea-based, forming

³⁰ An earlier LCA study found a huge discrepancy in CO₂e produced per ton of fish between open pen (2,073) and a closed circulation land based facility like the proposed Nordic design (28, 200). Ayer, Nathan W., and Peter H. Tyedmers. "Assessing alternative aquaculture technologies: life cycle assessment of salmonid culture systems in Canada." *Journal of Cleaner production* 17, no. 3 (2009): 362-373.

³¹ Song, Xingqiang, Ying Liu, Johan Berg Pettersen, Miguel Brandão, Xiaona Ma, Stian Røberg, and Björn Frostell. "Life cycle assessment of recirculating aquaculture systems: A case of Atlantic salmon farming in China." *Journal of Industrial Ecology* 23, no. 5 (2019): 1077-1086.

"Results showed that 1 tonne live-weight salmon production required 7,509 kWh farm-level electricity and generated 16.7 tonnes of CO₂ equivalent (eq), 106 kg of SO₂ eq, 2.4 kg of P eq, and 108 kg of N eq (cradle-to-farm gate). In particular, farm-level electricity use and feed product were identified as primary contributors to eight of nine impact categories assessed (54-95% in total)...."

³² Sherry, Jesse, and Jennifer Koester. "Life Cycle Assessment of Aquaculture Stewardship Council Certified Atlantic Salmon (*Salmo salar*)." *Sustainability* 12, no. 15 (2020): 6079.

³³ Philis, Gaspard, Friederike Ziegler, Lars Christian Gansel, Mona Dverdal Jansen, Erik Olav Gracey, and Anne Stene. "Comparing life cycle assessment (LCA) of salmonid aquaculture production systems: status and perspectives." *Sustainability* 11, no. 9 (2019): 2517.

four groups. Differences by production grouping are more important than differences by the fish type. The GHG impacts of land based recirculating systems are higher than other models. The three studies we presented above are in line with the averages shown in Figure 1 in the Appendix, with the LBCC-RAS studies showing in yellow. For 25,000 metric tons of fish from Nordic the metric tons of CO₂eq would be 150,000 if we use the average.

The EIR does not discuss the greenhouse gas impacts of the food and give us a range based on what percentages of different types of ingredients might be used. It commits fairly strongly to environmental safety, but ignores the carbon footprint of the food. If the standard for an EIR is a “reasonable” expectation of impact, then this EIR is clearly insufficient since it fails to describe one of the two largest contributors to greenhouse gasses from the facility.

ASC certification requires reporting of greenhouse gases, but does not in itself limit them. A 2020 study open pen study examined, using life cycle assessments, the “the environmental impacts of salmon raised to Aquaculture Stewardship Council (ASC) certification standards in order to determine if ASC certification achieves the intended reductions in [environmental] impact.” It found:

We find that environmental impacts, such as global warming potential, do not decrease with certification. We also find that salmon feed, in contrast to the on-site aquaculture practices, dominates the environmental impacts of salmon aquaculture and contributes to over 80% of impacts in ozone depletion, global warming potential, acidification, and ecotoxicity.³⁴

There have been recent studies on the GHG impact of fish food that actually test the commercially available feed products. A 2021 study in the Nature journal Scientific Reports says: “Importantly, we have used recent commercial feed formulations for the main species groups and geographic regions, thereby providing a more up to date and detailed analysis than is generally provided in academic literature.”³⁵ To assess the impact of the commercial feed they used a standard model from the Food and Agriculture Organization of the United Nations (FAO).³⁶ The article is designed to compare aquaculture to other livestock.

Production of crop feed materials (the green segments of Fig. 2) accounted for 39% of total aquaculture emissions. When the emissions arising from fishmeal production, feed blending and transport are added, feed production accounts for 57% of emissions.... For most of the finfish, the EI [Emissions intensity] lies between 4 and 6 kgCO₂e/kg CW (carcass weight, i.e. per kg of edible flesh) at the farm gate....[T]he carnivorous salmonids have more emissions associated with fishmeal and higher crop land use change (LUC) emissions (arising from soybean production), reflecting their higher protein rations.³⁷

³⁴ Sherry, Jesse, and Jennifer Koester. "Life Cycle Assessment of Aquaculture Stewardship Council Certified Atlantic Salmon (*Salmo salar*)." Sustainability 12, no. 15 (2020): 6079. Our italics.

³⁵ MacLeod, Michael J., Mohammad R. Hasan, David HF Robb, and Mohammad Mamun-Ur-Rashid. "Quantifying greenhouse gas emissions from global aquaculture." Scientific reports 10, no. 1 (2020): 1-8.

³⁶ FAO.GlobalLivestockEnvironmentalAssessmentModel(GLEAM)109(FAO,Rome,2017)www.fao.org/gleam/en/.

³⁷ MacLeod, op cit.

With the production amount from Nordic and the energy intensity found in the above study, the range in GHG emissions annually would be between 100,000 and 162,000 MT CO₂e.

APPENDIX II. AQUACULTURE STEWARDSHIP COUNCIL STANDARDS FOR ATLANTIC SALMON GREENHOUSE GAS REPORTING

Aquaculture Stewardship Council Standards for Farms and Fish Feed Manufacturers

The standards are found at: https://www.asc-aqua.org/wp-content/uploads/2019/12/ASC-Salmon-Standard_v1.3_Final.pdf

Criterion 4.6 Energy consumption and greenhouse gas emissions on farms⁸⁴

INDICATOR	REQUIREMENT
4.6.1 Presence of an energy use assessment verifying the energy consumption on the farm and representing the whole life cycle at sea, as outlined in Appendix V-1	Yes, measured in kilojoule/t fish produced/production cycle
4.6.2 Records of greenhouse gas (GHG ⁸⁵) emissions ⁸⁶ on farm and evidence of an annual GHG assessment, as outlined in Appendix V-1	Yes
4.6.3 Documentation of GHG emissions of the feed ⁸⁷ used during the previous production cycle, as outlined in Appendix V, subsection 2	Yes

Rationale - Climate change represents perhaps the biggest environmental challenge facing current and future generations. Because of this, energy consumption used in food production has become a source of major public concern. The ASC Salmon Standard recognizes the importance of efficient and sustainable energy use. Therefore, these indicators will require that energy consumption in the production of fish should be monitored on a continual basis and that growers should develop means to improve efficiency and reduce consumption of energy sources, particularly those that are limited or carbon-based. The data collected in this process will help the ASC Salmon Standard set a meaningful numerical requirement for energy use in the future. Energy assessments are a new area for producers. Requiring that farms do these assessments will likely raise awareness of the issues related to energy and build support for adding a requirement in the future related to the maximum energy of GHG emissions allowed.

⁸⁴ See Appendix VI for transparency requirements for 4.6.1, 4.6.2 and 4.6.3.

⁸⁵ For the purposes of this standard, GHGs are defined as the six gases listed in the Kyoto Protocol: carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF₆).

⁸⁶ GHG emissions must be recorded using recognised methods, standards and records as outlined in

Appendix V.

⁸⁷ GHG emissions from feed can be given based on the average raw material composition used to produce the salmon (by weight) and not as documentation linked to each single product used during the production cycle. Feed manufacturer is responsible for calculating GHG emissions per unit feed. Farm site then shall use that information to calculate GHG emissions for the volume of feed they used in the prior production cycle

Appendix V-1. Energy use assessment and GHG accounting for farms

The ASC encourages companies to integrate energy use assessments and GHG accounting into their policies and procedures across the board in the company. However, this requirement only requires that operational energy use and GHG assessments have been done for the farm sites that are applying for certification.

Assessments shall follow either the GHG Protocol Corporate Standard or ISO 14064-1 (references below). These are the commonly accepted international requirements, and they are largely consistent with one another. Both are also high level enough not to be prescriptive and they allow companies some flexibility in determining the best approach for calculating emissions for their operations.

If a company wants to go beyond the requirement of the ASC Salmon Standard and conduct this assessment for their entire company, then the full protocols are applicable. If the assessment is being done only on sites that are being certified, the farms shall follow the GHG Protocol Corporate Standard and/or ISO 14064-1 requirements pertaining to:

- Accounting principles of relevance, completeness, transparency, consistency and accuracy
- Setting operational boundaries
- Tracking emissions over time
- Reporting GHG emissions

Regarding the operational boundaries, farm sites shall include in the assessment:

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
 - o For example, if the farm has a diesel generator, this will generate Scope 1 emissions. So will a farm-owned/-operated truck.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating, or cooling.

Quantification of emissions is done by multiplying activity data (e.g. quantity of fuel or kwh consumed) by an emission factor (e.g. CO₂/kwh). For non-CO₂ gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO₂ gases into the CO₂-equivalent. Neither the GHG Protocol nor the ISO require specific approaches to quantifying emissions, so the ASC Salmon Standard provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors. Recommended sources include the Intergovernmental Panel on Climate Change (IPCC) or factors provided by national government agencies such as the United States

Environmental Protection Agency (USEPA). Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.

Appendix V-2. GHG accounting for feed

The requirement requires the calculation of the GHG emissions for the feed used during the prior production cycle at the grow-out site undergoing certification. This calculation requires farms to multiply the GHG emissions per unit of feed, provided to them by the feed manufacturer, by the amount of feed used on the farm during the production cycle.

The feed manufacturer is responsible for calculating GHG emissions per unit feed. GHG emissions from feed can be calculated based on the average raw material composition used to produce the salmon (by weight) and not as documentation linked to each single product used during the production cycle. The scope of the study to determine GHG emissions should include the growing, harvesting, processing and transportation of raw materials (vegetable and marine raw materials) to the feed mill and processing at feed mill. Vitamins and trace elements can be excluded from the analysis. The method of allocation of GHG emissions linked to by-products must be specified.

The study to determine GHG emissions can follow one of the following methodological approaches:

1. A cradle-to-gate assessment, taking into account upstream inputs and the feed manufacturing process, according to the GHG Product Standard
2. A Life Cycle Analysis following the ISO 14040 and 14044 requirements for life cycle assessments

Should the feed manufacturer choose to do a cradle-to-gate assessment:

1. It shall incorporate the first three phases from the methodology, covering materials acquisition and processing, production, and product distribution and storage (everything upstream and the feed manufacturing process itself).

Should the manufacturer follow the ISO 14040 and 14044 requirements for Life Cycle Assessment:

1. Feed manufacturers may follow either an ISO-compliant life cycle assessment methodology or the GHG Protocol product standard.

Regardless of which methodology is chosen, feed manufacturers shall include in the assessment

- Scope 1 emissions, which are emissions that come directly from a source that is either owned or controlled by the farm/facility.
- Scope 2 emissions, which are emissions resulting from the generation of purchased electricity, heating or cooling.
- Scope 3 emissions, which are emissions resulting from upstream inputs and other indirect emissions, such as the extraction and production of purchased materials, following the Scope 3 standard.

Quantification of emissions is done by multiplying activity data (e.g. quantity of fuel or kwh consumed) by an emission factor (e.g. CO₂/kwh). For non-CO₂ gases, you then need to multiply by a Global Warming Potential (GWP) to convert non-CO₂ gases into CO₂-equivalent. The ASC Salmon Standard provides the following additional information on the quantification of emissions:

- Farms shall clearly document the emission factors they use and the source of the emission factors.

Recommended sources include the IPCC or factors provided by national government agencies, such as the USEPA. Companies shall survey available emission factors and select the one that is most accurate for their situation, and transparently report their selection.

- Farms shall clearly document the GWPs that they use and the source of those GWPs.

Recommended sources include the IPCC 2nd Assessment Report, on which the Kyoto Protocol and related policies are based, or more recent Assessment Reports.

References:

- GHG Product Standard: <http://www.ghgprotocol.org/product-standard>
- ISO 14044 available for download (with fee) at:
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38498
- Some information on ISO 14064-1 is at: <http://www.iso.org/iso/pressrelease.htm?refid=Ref994>
- IPCC 2nd Assessment Report: <http://www.>
- All IPCC Assessment Reports:
http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1



HUMBOLDT BAY MUNICIPAL WATER DISTRICT

828 SEVENTH STREET, PO BOX 95 • EUREKA, CALIFORNIA 95502-0095

OFFICE 707-443-5018 ESSEX 707-822-2918

FAX 707-443-5731 707-822-8245

EMAIL OFFICE@HBMWD.COM

Website: www.hbrwd.com

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JOHN FRIEDENBACH

September 15, 2022

County of Humboldt
Board of Supervisors
825 5th Street, Eureka, CA 95501

Via email: cob@co.humboldt.ca.us



RE: Nordic Aquafarms California, LLC, PLN-2020-16698-APPEAL

Dear Supervisors,

We are writing to express our support for the Nordic Aquafarms project. As you may be aware, the Humboldt Bay Municipal Water District was formed in the 1950's to attract industry and supply water (untreated surface water) from the Mad River to two pulp mills which were located on the Samoa Peninsula. Our District entered into contracts with the two pulp mills to provide up to 65 MGD (million gallons per day) of untreated water from the Mad River. Both pulp mills constructed and maintained on-site clarifiers to remove/reduce the turbidity from the industrial water prior to utilizing it in their pulp making process. As you also know, the first pulp mill ceased operation in the mid 1990's and the second in 2009.

Since that time, our District, through its public engagement process which we call our Water Resource Planning effort, has been seeking alternate beneficial uses of our excess water. The three focus areas as determined by that public process are: 1) Local Sales; 2) Instream Flow; and 3) Transport. Our Board has allocated 20 MGD to Local Sales; 20 MGD to Instream Flow; and 35 MGD to Transport. Nordic Aquafarms would be considered local sales and the District has the ability to provide the required water needs, both industrial and domestic.

The Nordic Aquafarms project would revitalize not only our industrial water system but our community as well by providing jobs and aquaculture. As you are aware, Nordic has completed a full EIR for their project which addressed the concerns of the community. Therefore, we request that you deny the appeal of their project and allow Nordic to proceed with their project.

Respectfully,

A handwritten signature in blue ink that reads "John Friedenbach".

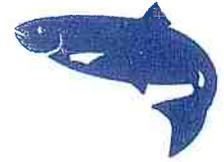
John Friedenbach
General Manager

cc: David Noyes, Scott Thompson: Nordic Aquafarms

HUMBOLDT FISHERMEN'S MARKETING ASSOCIATION, INC.3 Commercial Street
Eureka, California 95501-0241

(707) 443-0537

FAX (707) 443-1724

**Nordic Appeal Letter from HFMA**

September 5, 2022

To whom it may concern:

Commercial fishermen continue to oppose the Nordic Aquafarms Project. The Nordic Project has nothing but negative impacts to the the West Coast Fishing Industry — competition for the fish processing workforce, massive amounts of fish dumped onto an already weak wild fish market, a gargantuan carbon footprint when compared to wild sourced fish and the Nordic project is a total distraction away from repairing human damage to natural systems that have produced food for the planet since life began.

Fishermen's concerns have been magnified by the flawed final EIR in that it takes an incomplete, piecemeal approach to the listing and evaluation of serious biological impacts to Humboldt Bay and the surrounding offshore environs by the Nordic project.

The Nordic project is totally dependent on one main natural resource, the availability and access to massive amounts of both fresh and saltwater. **No water = no project.** And yet, the EIR makes light of the seriousness and magnitude of the Nordic project water demands by not including all aspects of Nordic access and use of water.

According to a description of the project, each year three billion six hundred and fifty million gallons of Humboldt Bay salt water will be pumped, filtered, heated or cooled, and then used as a vehicle to remove and transport thousands of tons of biological wastes generated by Nordic's fish back into the community ocean after some degree of processing to partially remove biological wastes and pathogens.

- A. Humboldt Fishermen's Marketing Association (HFMA) opposes the sourcing of saltwater from Humboldt Bay for use by Nordic. Our concerns include the entrainment and "take" of millions of larval fish (juvenile), invertebrates and phytoplankton into the non-evaluated, non-permitted pump intake system advocated for by Nordic and the Harbor District. Nordic has clearly stated that saltwater pump intake responsibilities lay within the jurisdiction of the Harbor District. The Harbor Distict is incompetent and unreliable to operate any saltwater intake system (See Woodley Island Marina, dredge purchase, Fields Landing Boatyard operations, Samoa Pulpmill Aquisition). **Solution:** HFMA requests/requires that Nordic and the County of Humboldt follow National Ocean and

Atmospheric Administration (NOAA) guidelines and source saltwater from the ocean west of the Samoa Peninsula via an offshore water intake system. Nordic has an agreement with the Harbor District for use of the ocean discharge outfall pipe that was left over from the pulp mill operation. Nordic can insert a separate intake pipe into the outfall, pierce the outfall pipe at a sufficient distance away from the outfall diffuser and source saltwater relatively free of the larval fish and invertebrate population load in the Humboldt Bay nursery.

- B. HFMA continues to have serious concerns over the daily disposal of more than ten million gallons of partially treated Nordic waste water into the community Dungeness crab grounds off of Samoa Beach. **Solution:** HFMA requests/requires that the Nordic wastewater discharge permit be conditioned to require an independent verifiable and enforceable biological waste monitoring program. This monitoring program will be conducted throughout the life of the Nordic Project (or any and all later owner/operators) on a weekly basis to monitor all components of the Nordic wastewater discharge. This wastewater discharge monitoring program will also track the movement and dispersal of the wastewater plume to ensure that Nordic discharges are not re-entering the Humboldt Bay marine ecosystem nursery. Lastly, both Nordic Aquafarm and the Humboldt Bay Harbor District are conditionally prevented from any and all aspects of influencing or participating in the Nordic wastewater discharge monitoring program. This program needs to be completely independent of these two applicants.

Sincerely,



Nick Colazas, Vice-President, HFMA



Brendan Semmes, Board Member, HFMA



Letter of Support for Nordic Aquafarms Facility

September 20, 2022

PreZero US, Inc.
4388 Serrano Drive
Jurupa Valley, CA 91752

Attn: Humboldt County Board of Supervisors

PreZero is an international waste and recycling management company and a subsidiary of the Schwarz Group. Schwarz Group is the largest grocery retailer in Europe and the fourth largest in the world. Headquartered in California, PreZero US focuses its efforts on circular economy solutions for plastic and organic waste.

PreZero US submits this letter in support of the proposal for the Nordic Aquafarms Facility in Humboldt County. This facility, and others like it, will help improve the sustainability of the food and feed supply chain and will be an integral part of creating a closed loop for organic waste in California.

On average, 40% of food produced in the US is wasted. Discarded food typically goes to landfills where it creates methane, a greenhouse gas 25x more potent than carbon dioxide according to the EPA. To combat this problem, the State of California passed SB 1383, requiring businesses to find alternative disposal for their organic waste. As a result, infrastructure is needed to process this surplus of organic material. In Southern California, PreZero operates a Black Soldier Fly (BSF) Technology Center that recovers pre-consumer food waste and upcycles it via BSF larvae which are harvested as protein and oil for animal and aquaculture feed. At the Jurupa Valley headquarters, PreZero is in the process of developing an industrial scale operation for this technology that will produce commercial quantities of the protein and oil per year.

PreZero has been in contact with Nordic Aquafarms about supplying BSF ingredients for use in their salmon feed. Recycled aquaculture systems (RAS), such as theirs, have a lower environmental impact than conventional aquaculture systems. This is thanks to reduced water use and improved quality control resulting in maximized feed conversion and optimal growth. However, both conventional systems and RAS have issues with the sustainability of the ingredients used to make fish feed. Based on conversations between PreZero and Nordic Aquafarms, it has been established that Nordic Aquafarms is committed to using more sustainable feed ingredients, such as PreZero BSF protein and oil which can reduce environmental impact due to lower global warming potential of the ingredients, and functional benefits that improve feed conversion, resulting in less waste. Additionally, PreZero's black



soldier fly larvae are reared on California food waste and produced in California. When fed to fish in California that are then consumed by California residents, we create a circular economy.

Nordic Aquafarms have made it clear that sourcing replacements to fishmeal and fish oil is a top priority, and recognize the benefits of using alternative, more sustainable ingredients. This environmentally sustainable approach matches PreZero's goals of closing loops and preserving resources in California.

Regards,

A handwritten signature in black ink, appearing to read "Ray Deidrick". The signature is stylized and somewhat abstract, with overlapping loops and a long horizontal stroke at the end.

Ray Deidrick
Vice President – Organics, PreZero US

About PreZero

With around 30,000 employees at 475 locations in Europe and North America, PreZero is an international company in waste and recycling management. The company provides waste disposal, sorting, processing and recycling services, combining all the expertise along the value chain under one roof. PreZero therefore positions itself as an innovation driver in the industry with the goal of creating a world in which resources are no longer wasted thanks to closed loops. Zero waste, 100 percent reusable material.



REDWOOD COAST Energy Authority

September 22, 2022

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MUNICIPAL WATER
DISTRICT**

**Rex Bohn
COUNTY OF HUMBOLDT**

**Frank Wilson
CITY OF RIO DELL**

**Jack Tuttle
CITY OF TRINIDAD**

David Noyes
Nordic Aquafarms
Senior Vice President of Technology
159 High St.
Belfast, Maine 04915

Dear Mr. Noyes,

This letter is to confirm that Redwood Coast Energy Authority (RCEA) can provide generation capacity to serve Nordic Aquafarms' expected electric load for its planned aquaculture project in Humboldt County, California.

Based on data you have provided, we expect an average load of 22.3 MW or 195 GWh per year at full build-out six to eight years from now, with the load coming online in phases as the project is built and fish stocks increase over time. RCEA's goals as approved by our Board of Directors are to provide 100% of energy to our customers from renewable and carbon-free sources by 2025, and to provide 100% locally generated renewable energy by 2030. With sufficient advance notice, we can adjust our procurement volumes as needed over time to include Nordic Aquafarms' expected load.

RCEA is a community choice aggregator, and therefore our role in providing electric power is limited to energy and capacity procurement. Physical delivery of power remains the responsibility of the local investor-owned utility, Pacific Gas & Electric Company (PG&E) and is not controlled by RCEA.

We look forward to the opportunity to serve Nordic Aquafarms' electric power needs in the future. Please let me know if you have any questions regarding our capacity to serve your expected load.

Sincerely,

A handwritten signature in blue ink, appearing to read "Richard Engel".

Richard Engel
Director of Power Resources

cc: Matthew Marshall, RCEA Executive Director



633 3rd Street
Eureka, CA 95501
(707) 269-1700

info@redwoodenergy.org

www.RedwoodEnergy.org