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CDR Strategy Section	Reviewer Group	Comment Type	Comment	Classification				Action Y/N	What Action or why not	Assigned To	Resolved Y/N/NA	Notes
				Complimentary	Minor	Substantive	Critical					
Figures	FECM	WRitten	Pgs 19-23: These figures including visualizations of CDR pathways, respective NOAA readiness levels, carbon budgets and reservoirs, and processes influencing the carbon system are excellent.	XX				N	None required	NA	NA	
Marine Approaches	FECM	Written	Pages 28-41 on Marine CDR approaches are very well-written; the content is both accessible and richly informative.	XX				N	None required	NA	NA	
General	NSF	Written	First, I would like to express my appreciation for the opportunity to read and review this document. Had I thought about it beforehand, I probably would have realized this, but the white paper really brought it home: NOAA is really uniquely well poised to lead in all areas of carbon dioxide removal and perhaps other climate intervention strategies. The assembled expertise, observing assets, in-house research units, stated missions/mandates, and established programs for stakeholder engagement are unequaled. Research expertise and capabilities cover atmospheric and ocean sciences, the carbon cycle and climate science at every possible scale, numerical modeling, mid ocean ridge research (relevant to enhanced weathering, OAE, etc.), marine and coastal ecosystems, and fisheries. Observing assets run from local/coastal through regional to global. About the only piece of the CDR puzzle that is not squarely in NOAA's wheelhouse is boots on the ground terrestrial ecosystem research. As gaps go, I'd call that truly minor.	XX				N	None required	NA	NA	
Table 2	NSF	Written	The development needs identified in Table 2 (page 43) embody the strength of these foundations – it is clear that no wholesale reenvisioning of the organization, or new base capabilities, are needed. It's a matter of capitalizing on, leveraging, and expanding on existing strengths.	XX				N	None required	NA	NA	
Part IV Generally	NSF	Written	I really like the recognition, in the beginning of this chapter, of the importance of central coordination. It will be through the combination of NOAA's existing strengths that new ones can be developed and leadership will be realized.	XX				N	None required	NA	NA	
Synthesized Research Strategy	NSF	Written	I like the "three waves" construction.	XX				N	None required	NA	NA	
Figures	Ocean Conservancy	Written	The figures in the paper, especially the schematics beginning with Figure 2, are extremely useful and would be valuable to many for science communication about CDR let alone agency-wide planning. Breakout boxes and captions are helpful and clear.	XX				N	None required	NA	NA	
General	Planetary	Written	Thanks to NOAA for stepping up and taking a serious and thorough look at how they can best employ their considerable expertise and resources in CDR R&D. As for mCDR, such an evaluation is long over-due considering the long and sometimes lavish attention, funding and support given to land-based CDR. It's reports like this one and NASEM's (2021) that mCDR may at last get a seat at the climate intervention table.	XX				N	None required	NA	NA	
Ocean Alkalinity Enhancement	Planetary	Written	Pg 31 Great to hear that next steps to develop NOAA's capabilities re OAE include "Conduct small-scale proof-of-concept closed-tank (e.g., MERL) and field testing of ocean alkalinization to better quantify CDR potential. Develop models and new observational tools, including sensors, capable of monitoring ocean alkalinization efforts and verifying carbon dioxide storage. Develop models to help identify suitable locations for various ocean alkalinity enrichments, potential co benefits, and detriments to marine ecosystems impacts. Sustain and expand ocean carbon observations and develop deployable, mobile autonomous platforms and strategies for monitoring and verification of ocean alkalinity."	XX				N	None required	NA	NA	
Transformative Opportunities / Ocean	WPTO	Written	From DOE: we would love to work on this together!	XX				N	Partnerships Breakout Box	Kitch	NA	
Transformative opportunities / Atmosphere	WPTO	Written	This is a great explanation of C-14 and should appear earlier in the document when C-14 is first mentioned.	XX				N	None required	NA	NA	
Introduction	EPA	Written	Page 15: These data will be essential to supporting regulatory decisions and permitting of CDR activities to ensure the protection of the environment and human health.		XX			Y	Add text; see also Breakout box	Cross, Kitch	Y	
Part I: Introduction	DIR	Written	Page 14: End of first paragraph: I would add food security to the list of impacts.		XX			Y	Added	Cross	Y	
Part I: Introduction	DIR	Written	Page 15: end of first paragraph: The last statement seems a little out of place/abrupt. Also, to balance this statement, briefly state perhaps the less desirable consequences of DAC (e.g., associated with manufacturing, waste, transportation, etc).		XX			Y	Added reference to WG3 IPCC report	Cross	Y	
Table 1	DIR	Written	Table 1. I would place the technological readiness of OAE is moderate rather than low. Presumably OAE includes the electrochemical production of alkali? Maybe explicitly state this. Why is OAE highlighted as a method in Figure 1?		XX			Y	Highlight removed; CF technical readiness from forensic audit and given by NASEM; CF text below on OAE vs electrochemical additions	Cross	Y	
Figure 3	DIR	Written	Figure 3: Is it necessary to include the role of the proliferation of CaCO3-producing organisms or the cycling of inorganic as well as organic matter? Probably not given the scales but just a thought.		XX			N	Introduces too much complexity to the figure, but feedbacks are discussed in the text.	Cross	Y	
Macroalgal Approaches	DIR	Written	Second paragraph: It should be stated that hypoxia and acidification are two potential consequences of sinking macroalgal material to depth.		XX			Y	Added reference to Wu et al., 2023 describing these risks in a simulated experiment	Cross	Y	
Ocean Alkalinity Enhancement	DIR	WRitten	Next steps: mention MRV specifically as an urgent need to make progress in a safe and transparent manner.		XX			Y	Already stated in the text of this section, but relevant to new MRV breakout box	Cross	Y	

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Ecosystem and species-focused experimentation	DIR	Written	in addition to continuing conducting laboratory and field experiments on species responses to warming, acidification, and other environmental changes, I would add expand the current infrastructure to include experimentation on alkalinization and in conjunction with other stressors such as warming (multiple stressor experimentation).		XX			Y	Added text	Cross	Y	
Earth System Modeling	DIR	Written	Last section: Include the development of a modeling framework aimed at designing MRV tools.		XX			Y	CF MRV breakout box	Cross	Y	
Part II: Overview of CDR Approaches	DIR	Written	Page 17: The first time that the concept of permanence of CO2 removal is brought up, permanence should be clearly defined (specifically referring to centennial timescales). The is a reference later but buried in the text on page 28, at the end of the first paragraph.		XX			Y	"Permanence" should be discussed throughout as durability. Year classes for high durability (>1000 years) and low durabiltiy (years - decades) now defined in the text.	Cross	Y	
Modeling, Scaling, and Projection	FECM	Written	Can the integration of CO2 quantification and ecological impacts monitoring studies in mCDR pilot plants be more thoroughly explained (pg. 51)?		XX			Y	Added example of BACI studies	McElhany	Y	
Introduction	FECM	Written	P. 14 These paragraphs overview the three primary actions detailed by the IPCC's WG3 in the AR6 report. They are then described as pathways as opposed to actions; staying consistent the language employed in the report itself could clarify in the ordering, or simply adding the word pathways (e.g. "three primary actions, or pathways, that can help keep the temperature increase below…") to be sure that is what meant by actions.		XX			Y	Swapped "pathway" for "action" to be more consistent with IPCC usage of these terms	Cross	Y	
Introduction	FECM	Written	P 15: For better flow, I would combine paragraphs that begin "Given the potential economic and climate benefits…" with "These early investments are essential…".		XX			Y	Done	Cross	Y	
Part II: Overview	FECM	Written	P. 17 It could be helpful to, in this paragraph, define the estimated ramp-up that is required in terms of the scale of 1) efficiency increase and 2) the number of projects from here to midcentury to reach the target removing approximately 10 - 15 GT CO2 removal each year.		XX			N	See footnotes 2 and 4, which already describe this ramp-up	Cross	Y	
Part II: Overview	FECM	Written	P. 18 Oliver Geden writes extensively l about the need for "both/and" thinking about CDR methods as a portfolio where each method is necessary; this could enrich your point illustrated by the diagram that no single method scores perfectly across each metric.		XX			N	Could not find an appropriate reference with this language - O Geden writes primarily about political motivations for CDR in the EU, with both/and thinking applied to CDR, emissions reductions, loss and damage, carbon taxes... etc., The broader context of these comments is tangential to the content of this report.	Cross	Y	
Part II: Overview	FECM	Written	On pg. 17, I think it is also worth highlighting that the diversity of these larger scale projects (mostly DAC currently) is still limited as well (in addition to the low volumes of CDR)		XX			Y	Added statement to footnote 3 with reference to Bowman et al., 2022 calling for such diversity.	Cross	Y	
Part II: Overview	FECM	Written	On pg. 17, worth clearly identifying that the Climeworks plant is storing all of the CO2 captured, which would constitute removal		XX			Y	Noted in footnote 3	Cross	Y	
part II: Overview	FECM	Written	P. 18 In science and technical writing, the prevailing style is to write out numbers under 10, so one would write three instead of 3.		XX			Y	Written out as suggested	Cross	Y	
Atmospheric observing networks	FECM	Written	Are there relevant links that can be included in the Atmospheric observing networks section?		XX			Y	Links added	Sweeney	Y	
Wave I	FECM	Written	On pg. 60, can a couple general examples of key stakeholders at the local, state and regional level be provided?		XX			Y	Edits to text; See research code of conduct breakout box	Kitch	Y	some local, state and regional stakeholders added to the partnership box on pg. 69
Introduction	FECM	Written	On pg. 14-15, the benefits of improving energy efficiencies, renewables and CDR are highlighted, though there is little mention of the overarching challenges these undertakings will require. A summary sentence in each of these paragraphs would suffice.		XX			Y	Challenges mentioned to introduce third action of CDR, as a way to "buy time" to overcome these challenges. CF WH 2022 "Net Zero Game Changers" report.	Cross	Y	
Part III: NOAA's Role	NSF	Written	The bullet points on page 42 (first page of Part III, in case by the time these comments are received you are working from a new version) are absolutely key. These points need to be made much earlier in the document, ideally in the Executive Summary. I also think that they should be more clearly echoed in the structure of the remainder of Part III. Looking at the Table of Contents, it is clear that the five main sections of Part III map to the five bullet points on page 42, but I think you could make this more clear by both a) echoing the wording between the bullets and the section titles and b) presenting them in the same order.		XX			Y	Page 42 copied to executive summary as suggested	Cross	Y	
Observing networks	NSF	Written	on p. 43, first line under "Development Necessary for CDR," suggest changing "fill regional gaps" to "enhance regional coverage."		XX			Y	Revised as suggested	Cross	Y	
General	NSF	Written	One minor note, check consistency of alkalinization/alkalization usage.		XX			Y	Usages of "alkalization" removed	Cross	Y	
Part IV Generally	NSF	WRitten	the recommendation for formation of a CDR Program Office is buried in the very last section of the document. I think this needs to go in the Executive Summary.		XX			N	As this is one of several discussed pathways, we believe discussion of this belongs in the text rather than the executive summary.	Cross	Y	
Breakout Box: Carbon Budget	NSF	Written	o "Without this natural CDR" – Suggest putting "natural CDR" in quotes o Avoid using the term "positive feedback" – it's a classic disconnect in science communication (most people think that positive feedback is a good thing). Try "leading to a self-reinforcing cycle" or some such.		XX			Y	resolved as suggested	Cross	Y	

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Breakout Box: Carbon Budget	NSF	Written	o Typo/grammar in the following sentence: “permafrost soils contain enormous amounts of organic carbon that may respire as be released to the atmosphere as Earth’s climate warms.” Suggest, “permafrost soils contain enormous amounts of organic carbon that may be respired and released to the atmosphere as Earth’s climate warms.”		XX			Y	Resolved as suggested	Cross	Y	
Breakout Box: Carbon Budget	NSF	Written	o I don’t think “like permafrost sequestration” works as an example of “feedback.” How about “like permafrost carbon release?”		XX			Y	Resolved as suggested	Cross	Y	
Macroalgal cultivation for carbon sequestration	NSF	Written	- On page 29, what is meant by “the willful destruction of viable food sources?” I cannot figure this out.		XX			Y	Text and citations added to explain	Cross	Y	
Direct Ocean Capture	NSF	Written	- Please don’t use “DOC” as an abbreviation for Direct Ocean Capture. It means dissolved organic carbon to every geochemist on the planet. How about “OCC” for Ocean Carbon Capture?		XX			N	Unfortunately this is already the terminology of record, as it emphasizes parallels with Direct Air Capture (DAC).	Cross	Y	
Part II	NSF	Written	As a subheading under each strategy, you recap the information from Table 1. For example: Ocean Alkalinity Enhancement Low-Moderate Cost, Moderate-High Scale, High Duration, Low-Moderate Readiness NOAA Potential Impact: High		XX			Y	Excellent idea; added formatting	Cross, Battle	Y	
Figure 2	NSF	Written	Figure 2 – in combining sources/terminology, I think you’ve lost a little information. Specifically, you call out DOC in the surface and deep ocean, but don’t specify that the two pools referred to on the left (“Surface Ocean” and “Intermediate and Deep Ocean”) refer to dissolved inorganic carbon. I think it needs to be spelled out.		XX			Y	Revise Figure 2	Battle	Y	
Executive Summary / Footnote	Planetary	Written	Pg. 12 “The total amount of carbon needed to be removed today from the atmosphere to reach pre-industrial concentrations (~280 ppm) is ~1064 GT CO2. To bring today’s concentration of ~415 ppm down to 350 ppm, a number once touted by many as acceptable, would require the removal of ~514 GT CO2.” Actually, about twice those amounts of CDR are needed to create a stable air ppm of 280 or 350, considering rebound from leaky ocean and land reservoirs. https://iopscience.iop.org/article/10.1088/1748-9326/5/2/024011 https://link.springer.com/article/10.1007/s10584-012-0677-0		XX			Y	References added to footnote 1 in the executive summary.	Cross	Y	
Ocean Alkalinity Enhancement	Planetary	Written	Pg. 30 “Strategies for increasing seawater alkalinity include electrochemical acid removal and accelerated weathering of alkaline minerals on land (Figure 7)” The idea that manufactured chemical bases (not just minerals) could be added to the ocean is missing here and in Fig.7, as proposed in the first OAE paper by Kheshgi (1995) and as being actively researched by several groups. https://www.sciencedirect.com/science/article/abs/pii/036054429500035F		XX			Y	Resolved as split figures; CF new Figures 7a and 7b	Cross	Y	
Syntehsized research strategy	Planetery	Written	Pg 59 “A substantial gap exists between the upscaling and rapid diffusion of NETs implied in scenarios and the actual progress in innovation and deployment (Minx et al., 2018), especially for the ocean space (NASEM, 2019).” Don’t you mean NASEM, 2021?		XX			Y	Both are appropriate; the 2019 report called out the gap that the 2021 report focused on. Added 2021 reference	Cross	Y	
General	WPTO	Written	The fact that some CDR approaches are energy intensive is mentioned multiple times. Suggest including that renewable energy must be used to power these approaches in order for the approach to have the biggest net carbon removal each time energy intensity is mentioned.		XX			N	CF text already in introduction; DAC subsection; breakout box on geologic storage; caption to Figure 10; ocean tech dev subsection. No reference to energy intensity was found where the need for renewable was not mentioned	Cross	Y	
General	WPTO	Written	Formatting errors: end bullet points with periods (or not)		XX			Y	Proofed	Cross	Y	
General	WPTO	Written	Define all acronyms at first use		XX			Y	Also added multiple acronyms to the list in the front matter	Cross	Y	
Key Findings, Part IV	WPTO	Written	Estimates indicate that between 400-1000 GT C must be removed from the atmosphere and sequestered safely... Suggest including if this estimate incorporates a particular reduced carbon emission scenario into the model.		XX			Y	Added text indicating this range relies on a range of scenarios as in the citation given for Rogelj et al., 2018; CF also footnote 2.	Cross	Y	
Key Findings, Part IV	WPTO	Written	It’s not only public confidence in data, but in government support for manipulation/engineering of climate and ocean processes. Data provides a basis to advocate for CDR, but the public must also trust that the impact being made on our planet through CDR activities will not threaten their safety and is beneficial. I suggest adding something like: “protect the public’s confidence in Earth system data and NOAA/government decision-making/leadership.”		XX			Y	"Safe, sustainable, a fair" language added	Cross	Y	
Introduction	WPTO	Written	Remove “security” from “security threat multiplier”, to me this reads as redundant as the threat multiplier in question is related to national security anyway.		XX			Y	Removed redundant text	Cross	Y	
Part II: Overview, Comparing CDR Techniques	WPTO	Written	Remove “security” from “security threat multiplier”, to me this reads as redundant as the threat multiplier in question is related to national security anyway.		XX			Y	Removed redundant text	Cross	Y	
Part II: Overview, Comparing CDR Techniques	WPTO	Written	Scalability definition: The second half of this sentence is a bit confusing. Does the theoretical cap refer to the largest amount of carbon that can possibly be removed? If so, maybe clarify that “removal” refers to carbon removal; the way it is currently written makes it sound like the projects are being removed.		XX			Y	Text revised to increase clarity	Cross	Y	

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Part II: Overview, Comparing CDR Techniques	WPTO	Written	Delete (b)		XX			Y	Deleted	Cross	Y	
Table 1	WPTO	Written	BECCS should be defined		XX			Y	Defined	Cross, Battle	Y	
Breakout Box: Carbon budget	WPTO	Written	Typo; should this be "..may respire and be released.."?		XX			Y	Text revised to increase clarity	Cross	Y	
Direct Air Capture	WPTO	Written	Define "four dimensions		XX			Y	Spatial and 4 dimensions was redundant; removed reference to 4 dimensions and revised to read "spatiotemporal"	Cross	Y	
Breakout Box: The role of geologic carbon storage	WPTO	Written	BOEM is not part of USGS		XX			Y	Revised to indicate BOEM is part of DOI	Cross	Y	
Soil Carbon and Biospheric Approaches	WPTO	Written	define use of "carbon-14 of co2"		XX			Y	Revised	Sweeney	Y	
Macroalgal cultivation for carbon sequestration	WPTO	Written	Would be helpful to specify if this means 'the right conditions' that naturally occur in the environment (I.e., conditions that cause a large fraction of naturally occurring seaweed to sink to benthic sediments as DOC and POC) OR if this is intended to mean cultivation & sinking processes which are then met by the right benthic conditions for C storage, OR both		XX			Y	Removed	Cross	Y	
Marine Approaches introduction	WPTO	Written	Consider adding a point on the social dimension of needs for evaluation to the end of this sentence, e.g., "...testing for effectiveness, efficiency, ecological risk, and socioeconomic impact"		XX			Y	Added	Cross	Y	
Macroalgal cultivation - footnote 7	WPTO	Written	Add "in" between scales and Connecticut		XX			Y	Added	Cross	Y	
Figure 6 - caption	WPTO	Written	Remove note "Jordan to provide figure caption during review"		XX			Y	Removed	Cross	Y	
Ocean Alkalinity Enhancement	WPTO	Written	Define "MERL"		XX			Y	Defined	Carter	Y	
Figure 8	WPTO	Written	Suggestion to add another arrow indicating CO_2 absorption by the ocean, specifying increased CO_2 uptake after CO_2-stripped water is deposited back into ocean.		XX			Y	Added	Cross, Battle	Y	
Atmospheric Observing Networks	WPTO	Written	This introductory sentence feels a little more casual than the rest of the document. Suggest removing.		XX			Y	Removed	Cross	Y	
Earth System Modeling	WPTO	Written	First sentence "feels a bit long and wordy"		XX			Y	Revised	Cross	Y	
Process study modeling	WPTO	Written	scientific expertise, observing system capacity, and modeling infrastructure required		XX			Y	Revised	Cross	Y	
Collaborative Research and stakeholder engagement	WPTO	Written	Suggest "In the absence of a socio-economic..." rather than "absent a..."		XX			Y	REvised	Cross	Y	
Direct ocean capture	WPTO	Written	Consider including an example of a possible ecosystem impact to better illustrate the last point, e.g., "For example, acid waste from the bipolar membrane electrodialysis (BPMED) process must be properly disposed of to avoid environmental harm."		XX			Y	Text added	Cross	Y	
Collaborative Research and stakeholder engagement	WPTO	Written	Noting that including "societal perception" here seems to communicate that people have completely unwarranted negative perceptions of mCDR; given that we still need more data about mCDR consequences, it seems like "societal perception" here should be replaced with "uncertain socioeconomic and environmental impacts"		XX			Y	Changed as suggested	Cross	Y	
CDR Risks and cobenefits for marine ecosystems	EPA	Written	Page 48: Add "decision making /by regulatory entities such as EPA and USACE/"		XX			Y	Add text; relevant for partnerships box	Cross, Kitch	Y	
Marine Spatial Planning	EPA	Written	Page 55: regulatory processes would HELP identify		XX			Y	Text added	Cross	Y	
Marine Spatial Planning	EPA	Written	Page 55: applying these analyses /to support/ permitting and regulatory decision making /by appropriate regulatory entities./"		XX			Y	Text added	Cross	Y	
Wave 1 Example	EPA	Written	Page 61 "in the complex legal space of the EEZ..." and rest of bullet point: This statement about the London Protocol is incorrect and should be struck out.		XX			Y	Text removed	Cross	Y	
Wave 2 Activities	EPA	Written	Page 62 ""...atmospheric carbon observations and obtaining applicable permits from regulatory entities, as appropriate."		XX			Y	Text added	Cross	Y	
Coordinating research efforts at NOAA	EPA	Written	Page 64: regulatory agencies such as EPA and USACE should be identified as key partners in the federal CDR effort as they will be the decision-makers for permitting of proposed CDR field research projects and for determining when sufficient information is available to support the permitting of larger-scale CDR field research or deployment.		XX			Y	Correct text; important for partnerships section	Cross, Kitch	Y	
Essential program coordination activities	EPA	Written	Page 65: recommend including an acknowledgment of establishing strong working relationships with regulatory entities including EPA and USACE in this bullet. where DOE, USDA, NSF are also mentioned.		XX			Y	Correct text; important for partnerships section	Cross, Kitch	Y	
Key Findings	Ocean Conservancy	Written	Page 12, NOAA's role Part III: Strictly interpreted, NOAA's mandate does not cover manipulating the carbon cycle and climate system. One could argue that the 2nd sentence beginning "Accordingly" does not therefore follow. Perhaps rephrase this sentence to note that prior NOAA research has involved relatively small-scale application of several techniques that alter the carbon cycle and are proposed to change the climate system via CDR when operated at large scale for a long time.		XX			Y	Corrected text	Cross	Y	

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Key Findings	Ocean Conservancy	Written	Page 12, NOAA's Role Part III: Community as human communities or marine ecosystems or both?		XX			N	In this case, human communities-- but we feel this is implied by the text and did not make a revision.	Cross	Y	
Part I: Introduction	Ocean Conservancy	Written	Page 14: "Major" is Unnecessary word. Even the minor assessments (special reports) report on this. I see where you're going with the next sentences but I suggest changing "subsidiary reports" to "IPCC Special Reports"		XX			Y	Revised as suggested	Cross	Y	
Part I: Introduction	Ocean Conservancy	Written	Page 14: replace "build upon these to provide" with "provided		XX			Y	Revised as suggested	Cross	Y	
Part I: Introduction	Ocean Conservancy	Written	However, these gains can be masked by increased demand for energy-generating goods and services -- instead of generating, using?		XX			Y	Poor use of hyphen corrected	Cross	Y	
Part II: Overview of CDR Approaches	Ocean Conservancy	Written	Page 17: "enhanced natural processes and human-assisted processes" --this phrasing seems redundant		XX			Y	Removed sentence	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 17: "Annually" -- not every project will run on an annual timetable. you might want to rephrase this sentence to discuss temporal scalability (where you'd mention repeatability too) and areal scalability.		XX			Y	Removed use of "annual"	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 17: "proliferation" I'm not sure this is the right word. "Repeatability" may be more appropriate, but see note above about "annual"		XX			Y	Removed use of "proliferate"	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 17: "less desireable" this is a value judgement related to the underlying belief that all C removal must play by the same rules, i.e. something that can be monetized as a fixed asset. Consider unpacking this implicit concept or phrasing the sentence differently.		XX			Y	Removed value judgement	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 18: "and which may alter our understanding of this scalability" -- the construction of this sentence is a little off. Change to something like "(and additional research may...)"		XX			Y	Removed unclear text	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 18: "Accelerate" -- to assess and/or accelerate		XX			Y	Added	Cross	Y	
Table 1 caption	Ocean Conservancy	Written	What is the meaning when there are several shades in a cell?		XX			Y	Revised caption	Cross	Y	
Figure 2 caption	Ocean Conservancy	Written	Typically, "reservoirs" also refers to atmosphere, terrestrial biomass, etc. Maybe just note that the reservoirs relevant for this report are indicated in bold.		XX			Y	Correct text	Cross	Y	
Macroalgal cultivation	Ocean Conservancy	Written	Page 29: "viable food sources" being microalgae that didn't grow? Or assuming that all macroalgae is human-consumable? Revise to make this idea more clear.		XX			Y	Revised	Cross	Y	
Macroalgal cultivation	Ocean Conservancy	Written	Page 29: "restoration is often extremely resource intensive" -- maybe specify "per hectare" or whatever? The $/Gt figures I've seen listed associated with restoration are pretty cheap compared to other methods (see e.g. Figure 1 in this document)		XX			Y	Scaled back "extreme"	Cross	Y	
Marine ecosystem biomass	Ocean Conservancy	Written	Page 40: "Carcuses" should be cracasses		XX			Y	Correct text	Cross	Y	
Atmospheric Observing Networks	Ocean Conservancy	Written	This seems like an appropriate spot for mentioning collaborative research with other agencies (e.g., through USGCRP relationships or other)		XX			Y	Relevant for partnerships box	Sweeney, Kitch	Y	
Transformative opportunities in advanced monitoring / Ocean	Ocean Conservancy	Written	Would NIST also be an appropriate federal partner to name here?		XX			N	Relevant for partnerships box	Sutton, Kitch	Y	partnerships with NIST in terms of CRMs mentioned (Gabby)
Transformative opportunities in advanced monitoring / Atmosphere	Ocean Conservancy	Written	Would NASA's Earth Observing activities be an appropriate partner to name here as well?		XX			Y	Relevant for partnerships box	Sweeney, Kitch	Y	
Ecosystem and species-focused experimentation	Ocean Conservancy	Written	Maybe some words about partnering with regional efforts, e.g. marine mammal monitoring efforts, to look at the potential ecological outcomes for taxa that are not as easily modeled or experimented on.		XX			Y	Relevant for partnerships box	McElhany, Kitch	Y	Also added a sentence on regional partner collaboration to the ecosystem monitoring section.
Marine Spatial Planning	Ocean Conservancy	Written	Again here is a place where regional partnerships could be specifically called out.		XX			Y	Relevant for partnerships box	Kitch	Y	
Aquaculture (Research, development, and policy)	Ocean Conservancy	Written	(e.g., isotope analysis): "this seems like an odd place to make this note. relocate?		XX			Y	Revised text to clarify.	Hollarsmith	Y	
Key Findings	Ocean Conservancy	Written	Page 12, NOAA's Role Part III: suggest "stakeholder input mechanisms" because old inputs would not likely be relevant		XX			Y	Revised to reference decision support infrastructure	Cross	Y	
Figure 7	DIR	Written	Perhaps emphasize also the land-coastal ocean coupling and the potential for conducting enhanced weathering on land as a strategy to enhance alkalinity in coastal waters (see Renforth P, Campbell JS. 2021 The role of soils in the regulation of ocean acidification. Phil. Trans. R. Soc. B 376: 20200174. https://doi.org/10.1098/rstb.2020.0174).			XX		Y	See revised figure and section	Carter, Battle	Y	

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CDR Strategy Section	Reviewer Group	Comment Type	Comment	Classification				Action Y/N	What Action or why not	Assigned To	Resolved Y/N/NA	Notes
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General	DIR	Written	Somewhere in the document, transparency (which is mentioned a few times) and a clear code of conduct should be highlighted. Also perhaps mention that a best practice guide is already in progress (meeting in Monaco on January 2023 to define scope, assign tasks, etc organized by Oschlies, Bach and colleagues). It is anticipated that the guide will be published in the fall of 2023). Perhaps a section on strategies to ensure transparency and best practice should be included. With regards to the code of conduct, the Aspen's Energy & Environment Program, through a grant from the ClimateWorks Foundation, begun the process of developing a Code of Conduct for ocean CDR last year. I understand this work is primarily focused on research and pilot-scale projects (I think Aspen might be expanding the code of conduct to commercialization).			XX		Y	Code of Conduct breakout box in Part IV	Kitch	Y	Resolved in the partnerships breakout box -- very brief mention of existing efforts
General	DIR	Written	The document should emphasize the interactive process in CDR research strategies as the field is an emerging one.			XX		Y	Partnerships breakout box in Part III	Kitch	Y	
General	DIR	Written	Equity, societal impacts and social considerations are implicit in the document but rarely mentioned as well as education. A major barrier in the field is public perception largely due to complete lack of knowledge and understanding of climate intervention potential and risks. Outreach programs engaging various stakeholders, importantly state legislators, government decision makers and the public will require bodies like NOAA to recognize this need and implement pathways.			XX		Y	Expand stakeholder engagement discussion in Part III	Kitch	Y	
Breakout Box: Carbon Budget	DIR	Written	Page 22: Ocean's Role: perhaps the reciprocal exchange of CO_2 between atmosphere and ocean could be better explained. It is often unclear to scientists how oceans are likely to behave when atmospheric CO_2 decreases following implementation of measures to reduce CO_2. Essentially, how is ocean leakage of CO_2 prevented?			XX		N	Though "leakage" is not used, feedbacks are already described	Cross	Y	
marine Approaches	DIR	Written	First paragraph: I wonder if both weathering and electrochemically generated alkali should be under the same OAE approach.			XX		Y	See split Figure for OAE (7a and 7b)	Carter	Y	
Figure 6	DIR	Written	I think this and other figures depicting approaches/techniques could benefit from highlighting potential undesirable effects.			XX		Y	See new figure on potential ecosystem impacts and cobenefits	Battle, McElhaney	Y	
Figure 9	DIR	Written	Could ocean nutrient fertilization be applied to coastal systems to enhance productivity via pipes, for example?			XX		Y	Requested edits to figure to include a shoaling bathymetry on one side of the figure to show that this can be applied in the coastal region, not just open ocean. additional text in figure caption "Multiple methods of nutrient delivery to the ocean, such as passive technologies that reduce carbon emissions, should be evaluated."	Tedesco / Osborne	Y	
General	FECM	Written	Across the marine technologies, in particular, it would be nice to give light details on the tools NOAA has developed and is using to monitor CO_2 fluxes across the oceans (and links to any relevant project landing pages). A summary table presented somewhere in the document highlighting different detection tools and their accuracy, scale, and/or energy usage etc. could be a nice value-add.			XX		Y	More useful to link to a list of all the observing tech available to NOAA and the wider community (not just NOAA-developed tech).	Sutton	Y	Project landing pages were already provided in the Ocean Observing Networks section. Instead of duplicating efforts, we provided a new link in the Transformative Opportunities section to IOCCP's ocean carbon and biogeochemistry hardware directory. We also provide references to the tools NOAA has developed to monitor air-sea CO_2.
Syntehsized Research Strategy	FECM	Written	Suggested additions to "waves" (some of these may fit under existing bullets): Wave 1: fundamental materials development (including considerations for sustainable sourcing at large scales) and reactor design/reaction engineering, LCA&TEA, identification of important process parameters, sensor development for accurate CO_2 quantification			XX		Y	Added text in partnerships box	Kitch	Y	
Synthesized Research Strategy	FECM	Written	Suggested additions to "waves" (some of these may fit under existing bullets): Wave 2: transparent data and knowledge sharing, continued LCA and TEA, evaluation/comparison of monitoring methods, enhancement of CO_2 uptake models through field-scale data analysis			XX		Y	Added text in Wave 2	Cross	Y	
Synthesized Research STrategy	FECM	Written	Can more details about risk assessment be shared? What types of risk are meant and how will they be assessed?			XX		N	Out of scope	Cross	Y	
Synthesized Research Strategy	FECM	Written	Wave 3: Verification and validation of CDR, development of best practices documents and methodologies, development of robust models for analyzing permanence/additionality based on results from Waves 1 and 2			XX		Y	Added text in Wave 3	Cross	Y	
General	FECM	Written	Expanding on the role of NOAA in partnerships with DOE, particularly in regards to provide baselines and applicable background datasets for applied science R&D and CDR projects.			XX		Y	Parnterships breakout box	Kitch	Y	

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CDR Strategy Section	Reviewer Group	Comment Type	Comment	Classification				Action Y/N	What Action or why not	Assigned To	Resolved Y/N/NA	Notes
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General	FECM	Written	Monitoring, reporting, and verification is disaggregated throughout the strategy. It could be helpful to have to a consolidated section highlighting the difficulties of marine-based MRV, and the implications for financial carbon markets i.e. offsets and voluntary carbon credit programs.			XX		Y	Crediting is out of scope for this report. CF new breakout box on MRV	Cross	Y	
General	FECM	Written	A brief summary of ongoing/past projects and the main learnings for measuring carbon fluxes would be very helpful to include as well			XX		Y	A brief summary could go in the ocean observing section.	Sutton	Y	Added two sentences focusing on global ocean CO2 flux in the Ocean Observing Networks section.
Part II: Overview	FECM	Written	On pg. 17, other comparison metrics worth highlighting include: net negativity, additionality, SCI considerations, MRV (verifiability). May not be one of the 3 key metrics, but worth mentioning and then explaining why the first three were selected as "key"			XX		Y	See breakout box for MRV	Cross	Y	
Direct Air Capture	FECM	WRitten	On pg. 24, other DAC challenges include siting plant where environmental conditions favor the process and materials supply chains for these engineered sorbents/solvents. Important to highlight that MRV for DAC+storage is well established, compared to the other methods.			XX		Y	Added text to DAC section; Breakout box for MRV	Cross	Y	
Soil Carbon	FECM	Written	On pg. 27, it would be nice to include a link and brief summary (few sentences) of how the CarbonTracker product works (e.g., what kinds of data are being collected and what techniques are used to collect the data). This could be really insightful for sparking some collaborations. Also, few more sentences about the next steps related to this CarbonTracker.			XX		Y	Added	Sweeney	Y	
Soil Carbon	FECM	Written	P. 26 Although the explanation of atmospheric monitoring capabilities is both clear and promising, there may be interest in reading here about some MRV tools for ground-truthing the efficiency of soil-carbon approaches beyond the impact on carbon cycles, such as how you can dovetail the monitoring of soil health alongside carbon removal. For example, many people have concerns about enhanced weathering and biochar and potential adverse effects on soil toxicity. In other words, another sentence on the bottom-up approaches in addition to the top-down that are so well articulated.			XX		Y	Breakout box for MRV	Sweeney	Y	
Marine Approaches	FECM	Written	P. 28 On this page you define permanent as "(i.e., the next century and beyond)" – this might be good to succinctly include earlier when you discuss permanence as an important metric on page 17. Having this clearly defined as the minimum requirement for storage durability would provide better clarity for the reader's assessment of the many CDR approaches you then compare.			XX		Y	Added to earlier section	Cross	Y	
NOAA's Role	FECM	Written	On pg. 42, other things to highlight if applicable include history of community engagement work, dissemination of best practices and recommendations, technology commercialization, infrastructure development, lifecycle and technoeconomic assessment			XX		N	out of scope	Cross	NA	
Tech Dev / Oceans	FECM	Written	In the Transformative Opportunities for Advanced monitoring section – what specific type of sensors are needed and what modifications are desired? – this part is a little bit unclear.			XX		Y	Addressed in the new text in the Ocean portion of the Transformative Opportunities section.	Sutton	Y	
Stakeholder Engagement	FECM	Written	On pg. 57, notable existing or past collaborations can be highlighted (even bulleted form with links) to showcase how NOAA's efforts are coordinated with those of other stakeholders			XX		Y	Expand stakeholder engagement section	Kitch	Y	
Ocean Planning Section	FECM	Written	P. 54 It might be illustrative and compelling for this section to expand on the different dimensions of environmental justice (e.g. procedural, distributional, reparative) in relation to the mCDR techniques discussed. This could be as simple as underscoring how jobs creation is a form of distributive justice and "enhanced coastal community resilience" you mention is a form of reparative justice. Extending these key terms in the EJ community to examples you already have would serve to further align the science and social justice communities.			XX		Y	See research code of conduct breakout box	Kitch	Y	
Marine Ecosystem Monitoring	FECM	Written	On pg. 49, can more detail be provided about the specific parameters being measured/need to be considered to monitor ecological responses?			XX		Y	Added a paragraph about priority species for monitoring	McElhany	Y	
Transformative Opportunities: Ocean	NSF	Written	The section on ocean technology development (page 46) is surprisingly thin and certainly does not match the specificity of the following atmosphere section. This is not my area of expertise, but I feel it needs to be expanded. Give examples of what kinds of sensors are needed, how many, on what sorts of platforms, to what specific ends.			XX		Y	Expanded the Ocean portion of the Transformative Opportunities section.	Sutton	Y	
Part III generally	NSF	Written	Ecosystem section: perhaps "Marine Ecosystem Research: understanding risks and co benefits of CDR." The second paragraph begins "NOAA currently uses modeling, experiments, and monitoring to evaluate the consequences of CO2 emissions…." It might be good to structure the ensuing subsections in this order - currently the order is monitoring, modeling, experiments. A particular strength of this section, and specifically that on monitoring, is that it ties needed efforts to specific CDR strategies. I suggest doing more of this in the other sections of Part III. (The Earth System Modeling section is another good example.)			XX		Y	Edited structure accordingly	McElhany	Y	
Part III Generally	NSF	Written	One thing that is missing in Part III is what is needed to accomplish the things that you propose to "Expand/Start/Grow/Improve." Money, obviously, but a) how much, and b) is it for people, time, or things? If you are not supposed to talk about money in this white paper, then you can talk about people time and things.			XX		N	Out of Scope	Cross	Y	
Generally	NSF	Written	why you do not appear to use the term MRV or even the long form Measurement (Monitoring?), Reporting, and Verification more, not just here but elsewhere.			XX		Y	Add a breakout box for MRV to Part II	Cross	Y	

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CDR Strategy Section	Reviewer Group	Comment Type	Comment	Classification				Action Y/N	What Action or why not	Assigned To	Resolved Y/N/NA	Notes
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Generally	NSF	Written	The document ends rather abruptly, and I don't like ending on bullets. I think some sort of wrap up section is needed, and may well be underway by the time you read these comments.			XX		Y	Add a concluding statement	Kitch	Y	
Biological and Physical Carbon Pump Enhancement	NSF	Written	I feel very strongly that the biological and physical carbon pumps need to be separated. There is too much of a conflation of these processes in the biological oceanography community in particular, and it is on all of us to avoid perpetuating this.			XX		Y	Split them up. and added new heading and subheadings and additional text , including 2 new references with hyperlinks, in the first paragraph	Tedesco / Osborne	Y	
General	Ocean Conservancy	Written	The one area I feel needs improvement across the report is that each section could go farther in designating specifically what non-NOAA partnerships can be enhanced to support this work. The last section makes clear that NOAA views itself as one of many relevant groups on this topic, and that it intends to partner with other groups. However, each section could be more specific at mentioning either the types of examples of regional or federal partners. For instance, in the section discussing instrument development, it would seem natural to mention NIST as a potential partner. Likewise, for marine spatial planning, NOAA has already partnered with regional collaborations (e.g., state partnerships like MARCO) although those success stories are not mentioned. The calls for partnership and collaboration at the end would be stronger if there were more specifics throughout the white paper with example partnerships or potential partners mentioned, of course, noting that these are not guaranteed or even necessarily exhaustive, but indicative of the scope of partnership needed.			XX		Y	See partnerhips breakout box	Kitch	Y	
NOAA's Vision	Planetary	Written	Suggested actions: Open up NOAAs many ecosystems/sites to selected forms of mCDR testing, especially facilitating permitting of such activities, and if not funding and organizing such activities, at least provide the MRV and impacts assessment as suggested in the report. E.g. NOAA played an active role in experimentally researching the effects of CO2 addition on marine organisms and ecosystems. Why not conduct/support similar experiments with alkalinity addition to test the hypothesis that this will have, in contrast, beneficial effects? Ditto for other forms of mCDR? Such ideas are briefly alluded to on pg 50 and 51, but again a supporting role is emphasized, and there is no grand vision or organizing/hosting and supporting field R&D. I also sense the need for greater integration of ocean chemistry/physics with eco/bio in providing an integrated, full service platform for evaluation of mCDR field R&D at local/regional scales.			XX		N	Out of scope	Cross	NA	
NOAA's Vision	Planetary	Written	Rather than global scale measurement and modeling programs that NOAA is famous for, the initial requirement for mCDR will be at local/regional scales (pg 51-52). But aside from existing NOAA study sites, most current expertise here appears to reside in the academic and private sectors. Academic/private programs that are actually doing mCDR R&D at these scales will go to these (experienced) purveyors first, leaving NOAA with little to do (?)			XX		Y	See breakout box for partnerships in Part III	Kitch	Y	
Transformative Opportunities	Planetary	Written	Ditto for all-important AUV/ASVs and sensors (pg. 46). Private industry would appear the leaders in this field. Role for NOAA?			XX		Y	Weird comment. Expand tech section to highlight NOAA partnerships in tech development.	Sutton	Y	Public private partnerships were already referenced in this section, which detail the role for NOAA. Added references for NOAA-developed technology.
Part II: Overview of CDR Approaches	Planetary	Written	Pg. 12 "Negative emission strategies refer to a portfolio of techniques that are used to remove greenhouse gasses from the atmosphere and lock them away from the atmosphere." How about CDR strategies that remove CO2 from supersaturated reservoirs, thus reducing natural emissions? E.g. adding bio or abio CDR to ocean upwelling systems thus consuming excess CO2 there and reducing emission, but not necessarily to the point that air CO2 is consumed. Ditto for CDR in CO2 supersaturated soil systems, e.g. enhanced weathering.			XX		N	Out of scope	Cross	NA	
Breakout Box: Carbon Budget	Planetary	Written	pg. 22 "While the dissolved and inorganic carbon reservoirs (~150 Gt C) are larger, and accordingly could be a more efficient way of sequestering carbon from the atmosphere, sequestration is only half the problem: transport of sequestered carbon to the deep ocean, and ultimately into ocean sediments, where it cannot escape back into the atmosphere will ultimately determine the durability of any sequestered carbon pool." Unclear? There are >38,000 Gt C dissolved and inorganic carbon reservoirs in the ocean (Fig. 2). But how does this size make it more a efficient way of sequestering carbon? It is the longevity of the reservoir rather than the size that determines durability, irrespective of whether or not it gets to the deep ocean.			XX		N	See breakout box on geologic storage	Sweeney	Y	
Part II: Overview, Comparing CDR Techniques	WPTO	Written	Would love to see more on why additional risks to sustainable development are particularly relevant for land-based CDR			XX		Y	Reference IPCC Sustainable Development Goals	Kitch	Y	linked AR6 WGII report and added one additional sentence on pg. 17
Figure 4	WPTO	Written	The filter heating piece seem a bit disjointed from the rest of the figure. If I'm understanding this correctly, can arrows be added to clarify that the filters being heated/CO2 concentration is a step before transport/storage? Additionally, I think some clarification directly on the figure stating that the emitted CO2 is from truck fuel emissions and not direct loss/emission of the concentrated CO2 may be helpful (similar to the explanations in figure 5 of CO2 return to atmosphere			XX		Y	i would remove CO2 coming from truck. I would also simply have single box representing filter with high concentration of CO2 on one side and low concentration of CO2 on other side and concentrated CO2 stream being dumped below. // See revised figure	Sweeney, Battle	Y	

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Ocean Fertilization	WPTO	Written	Should this section also mention regulatory hurdles of ocean dumping? Or perhaps this text is more focused on the science of the processes, with the idea that regulations can be modified with updated scientific evidence?			XX		Y	Reference regulatory review paper	Tedesco / Osborne	Y	
Figure 8	WPTO	Written	The truck transporting extracted CO2 to market appears to be an underground storage bunker on first look. Would be quicker to understand if the truck was above ground level; could also benefit from a caption explaining CO2 is emitted from transportation fuel usage.			XX		Y	See revised figure.	Carter, Battle	Y	
Figure 9	WPTO	Written	Should the ship carrying nutrients also show emissions of CO2 like in other figures (for transportation), or is this not considered a net increase because the ships would already be in transit for other uses?			XX		Y	Requested figure edit to include CO2 emissions from ship	Tedesco / Osborne	Y	
Figure 10	WPTO	Written	The caption at the bottom says the process already occurs naturally, but this figure is for an engineered process, so it seems misleading. May want to specify that upwelling occurs naturally, and this process mimics/enhances it			XX		Y	Requested edit bottom of figure text from "process already occurs naturally" to "Enhances natural process; energy utilization and carbon outgassing important considerations"	Tedesco / Osborne	Y	
Ocean Planning	WPTO	Written	It feels a bit one-sided that there is only a potential positive socioeconomic impact example listed, and not also a potential negative impact example. Should either justify by saying at the time there are no known negative impacts (this sounds unlikely though) or could modify the last sentence with "...understand these co-benefits and other impacts"			XX		Y	Added	CBC Working Group	Y	
Marine Spatial Planning	WPTO	Written	Suggest including that co-location of mCDR in areas with sufficient renewable energy potential (wave, tide, solar, wind, ocean thermal, etc) may also be an important consideration for spatial planning			XX		Y	CF DAC section; see added sentence	Cross	Y	
			Page 15, middle of third paragraph: I would add a brief statement about the need for monitoring, reporting and verification schemes in place in parallel with technological advances. This is a major handicap in the field at present. This should be stated in addition to accountability metrics for carbon removal.			XX		N	this is implied by the existing text. CF also MRV breakout box	Cross	Y	
Part II: Comparing CDR Techniques	Ocean Conservancy	Written	Page 17: It seems appropriate to introduce the concept of additionality here as well. That is an overarching success metric even before scalability, durability, or cost come into it.			XX		Y	MRV section	Cross	Y	
Macroalgal cultivation	Ocean Conservancy	Written	Page 29: "Macroalgae harvested for consumption represents sequestration on the order of months to a few years," This phrase makes me think you're already thinking about this, but might it be worth spelling out that macroalgae culture might contribute to emissions reduction simply by virtue of providing feedstocks or raw materials that do not pretend to sequester much CO2, but prevent the need for fossil fuel-intensive alternatives? Not sure whether the scope of this document merits such a note or not.			XX		Y	Added text to summarize the comment.	Hollarsmith	Y	I tried to sumarize the comment as succinctly as possible.
Coastal Blue Carbon	Ocean Conservancy	Written	Page 38: "partnerships" With whom or what type of groups? I agree with this idea but would like to see a touch more detail.			XX		Y	Relevant for partnerships box	Cannizzo, Hutto, Kitch	Y	
Coastal Blue Carbon	Ocean Conservancy	Written	Page 38: "habitats" is there a partnership with other more "upland" agencies, e.g. USGS, that would be helpful to consider here?			XX		Y	Relevant for partnerships box	Cannizzo, Hutto, Kitch	Y	
Marine ecosystem biomass	Ocean Conservancy	Written	Page 40: "recent work indicates that livingbiomass may be a larger opportunity to aid in ocean carbon removal than previously thought" -- This seems like an overstatement of the evidence. Would suggest rephrasing to something more tempered like "recent work raises questions about whether living biomass can indeed aid in ocean carbon removal." Verification and additionality are nearly impossible to quantify for the examples given below, which are key concepts to confirm actual carbon removal.			XX		N	Disagree with comment	Canizzo, Hutto	NA	We disagree with the characterization of the comment. Previous work does suggest that the processes decribes may contribute to carbon removal at levals greater than preciously thought, as highlighted in the NASM report. While the reviewer is correct that full verification and additionality may be difficult, or even impossible, for some of the processes, the suggested language is vague, could suggest the opposite of its intent, and does not not address the concern of quantification. Further, while full quantification of the carbon removed may be difficult or impossible for some of the processes, it does not negate the recent work suggesting that carbon is removed by these processes. The prase "may be" was intentionally included to ensure that readers understood that this was not yet settled science.
Marine ecosystem biomass	Ocean Conservancy	Written	Page 41: "inclusion of carbon sequestration and storage as a key benefit" -- This seems to assume that marine life would undoubtedly represent additional C storage gains, which is not at all confirmed.			XX		Y	Changed "inclusion of" to "exploration of potential"	Canizzo, Hutto	Y	
Table 2	Ocean Conservancy	Written	is it worth calling out, here or somewhere else, NOAA's success in collaborating with other agencies which would necessarily be involved in CDR research and implementation also?			XX		Y	Relevant for partnerships box	Kitch	Y	

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Part III generally	Ocean Conservancy	Written	"Expand / start / grow / improve" -- I'm sure this Continue vs. "increase" framing is part of the required template, but here and throughout I find the 4 choices jarring and not all that clear. Starting something is operationally really different from expanding it. Either it's worth using more precision in what kind of "increase" is needed, or some framing needs to be provided somewhere to clarify you're making the difference between "keep things going (continue" and "increase things (second bullet)". If that's true, having a 3rd bullet of "enhance" here is also not quite a fit. Consider how to make these prescribed headers work best for you.			XX		Y	Resolved during proofing	Cross	Y	
Stakeholder engagement	Ocean Conservancy	Written	this is a place where developing partnerships with other agencies would be very advantageous			XX		Y	Relevant for partnerships box	Kitch	Y	
Table 1 and Figure 1	NSF	Written	I really appreciate you making the link available (p. 20) to the evolution of your efforts at presenting the information in Table 1 and Figure 1 (I only clicked the link below Figure 1, sorry if I missed something key in the link for the caption to Table 1). It's kind of a nightmare of a problem, isn't it. I really struggled with what's in the document, though, and I'm afraid your intended audience will, too. (By the way, I just realized I'm not entirely sure who your intended audience is!) I printed these two pages out and I think I spent as much time trying to digest them as I did the rest of the document. So, unfortunately, what's lacking in the current form(s) is some level of quick visual takeaway, or even clear visual guide as to what to focus on in order to get to a takeaway that takes longer. This is in contrast to the slide 8/9/10 version of the google doc, in which you can easily pick out "cheap and pretty much useless" from "cheap but potentially more useful (but uncertain!)" and "expensive but potentially really useful (but really uncertain)." My first suggestion in an effort to improve upon this is to consider the order in which the methods are presented. In the current iteration, not one of the columns in Table 1 runs from High to Low or vice versa. I suggest picking the one to which you most want to draw the reader's eye – perhaps "NOAA Potential Impact" – and try that, and then maybe a secondary sort. If you sorted (high to low) by NOAA Potential Impact and then by duration of storage, and then by scale potential, I feel like you'd draw the reader's attention straight to some things you want to emphasize. I suggest trying the same thing for Figure 1.			XX		Y	Added Figure 1b to the document	Cross, Battle	Y	
General	FECM	Written	There's been a shift away from the term of negative emissions technologies or strategies. Rather we tend to use carbon dioxide removal at tackle emissions from the accumulated pool in the atmosphere. We won't be tackling the legacy emissions until we achieve net-zero. The role of DAC and more broadly, CDR is counterbalancing sector emissions that we cannot avoid with tools today.				XX	N	Disagree	Cross	NA	
NOAA's Role	Planetary	Written	At the outset NOAA's measurement and modeling capabilities are emphasized and any R&D on actual CDR seems restricted to supporting roles (pg 43-44). The apparent assumption is that core mCDR R&D will be organized, lead and funded by other entities. Who then will be the prime agency for this R&D, given that NOAA is the only agency in the government with the required expertise and resources? If NOAA doesn't take the leadership in mCDR, what happens if no one steps forward and NOAA is left with nothing to measure and model? Just as DOE is the prime agency supporting DAC/CCS, and the USDA the lead agency for Land Bio approaches, so too must NOAA take a lead fed role in organizing and funding all appropriate forms of mCDR at this early stage. Such leadership is not foreign NOAA - they have been an advocate for Blue Carbon/Macrophye Sequestration, funding and supporting if not leading projects in this area, participating in high level policy statements (NASEM 2019) and coordinating national and international activities (pg. 39). This despite the very modest potential for BC to contribute to global CDR (pg. 37). If federal $$$ are to be spent on the broad possibilities for CDR and the massive potential for mCDR in particular to contribute to our dire, urgent CO2 problem then it requires a federal agency that takes a leadership role in finding and evaluating the best forms of mCDR and in requesting authority and support from Congress. Some fed agency needs to step up here or there could be little in the way of mCDR for NOAA to measure and model. Compare/contrast multi-multi $B direct support and advocacy for DAC/CCS R&D at DOE. What is the plan for getting even a fraction of that kind of support for mCDR?				XX	N	Out of scope: Congress makes this decision	Cross	NA	
Comparing CDR Techniques	Planetary	Written	pg 18 "Some methods of carbon removal that seem promising may be at an extremely early stage of development, meaning that much more research will be required before they can be successfully scaled (and which may alter our understanding of this scalability). We emphasize here that this is especially true for ocean-based CDR methods. Additional study by the entire research community is needed to accelerate technical readiness and help better articulate the risks associated with each method." Yes, but who will lead/manage and fund such an effort if NOAA's only role will be to "assess the duration, scalability, costs, risks, and co-benefits of the approach, or (b) improve the readiness of the approach by providing decision support tools…"				XX	N	Out of scope: Congress makes this decision	Cross	NA	
Ocean Alkalinity Enhancement	Planetary	Written	unclear how these efforts will be coordinated with the ongoing and planned R&D external to NOAA. Who is going to lead and coordinate the national OAE and larger mCDR effort, rather than just being another participant?				XX	N	Out of scope: Congress makes this decision	Cross	NA	
Collaborative research and stakeholder engagement	Planetary	Written	"Aligning NOAA's research capabilities with the evolving needs of stakeholders requires continual engagement, strong collaboration and partnerships to develop and deliver data and services in a way that stakeholders expect to consume them (Jones et al. 2021, NOAA Data Strategy)." Again, NOAA will play a supporting role, not a leadership role in (m)CDR?				XX	N	Out of scope: Congress makes this decision	Cross	NA	

Review Class Definitions:												
Complimenary	Supportive, endorses or agrees with Strategy, does not require revisions.											
Minor	Suggested addition(s) that clarifies key points, or correction/revision to factually incorrect material											
Substantive	Introduces new or expanded scope or content that may cause non-concurrence with current Strategy goals/objectives											
Critical	Contentious issue or topic that potentially conflicts with the purpose or objective of the Strategy											
CDR Strategy Section	Reviewer Group	Comment Type	Comment	Classification				Action Y/N	What Action or why not	Assigned To	Resolved Y/N/NA	Notes
				Complimentary	Minor	Substantive	Critical					
General	Planetary	Written	Bottom line: Great that NOAA is getting into the game here, but disappointing that a greater leadership role in mCDR is not taken. Unlike most other existential threats to humanity – defense, disease, famine, etc. where the US government takes an early, commanding leadership role in formulating, funding, researching and directing appropriate responses, there is so far no such advocate for mCDR in addressing the climate and ocean acidification crisis (with the possible (and curious) exception of NOAA's BC/macrophytes advocacy). Consequently, what action that has been taken on mCDR has largely been by the academic, private and philanthropic sectors, partially filling the void left by government inaction. My reading of this document suggests more of the same. What is the plan for bringing the US government into the mCDR effort in more than an underfunded, supporting role?				XX	N	Out of scope: Congress makes this decision	Cross	NA	
				11	91	57	6					
			NO	11	8	9	6	34				
			YES	0	83	48	0	131				