COASTAL COUPLING COMMUNITY OF PRACTICE

DISCUSSION DRAFT // **COASTAL COUPLING ROADMAP**

[TEMPORARY SECTION: ABOUT THIS ROADMAP]

About this Document

This Roadmap is being co-developed by the Coastal Coupling Community of Practice's (CC CoP) Executive Committee to guide the CC CoP's activities for the next 3 years. The Roadmap has two audiences:

> EXECUTIVE COMMITTEE • To lead and advise on the CC CoP's work.
> CC CoP • To contribute together to the outcomes.

Important note about document consistency: Because this document is based on the CC CoP charter (CC CoP 2019), it must remain consistent with the charter *or* charter changes must be proposed.

Timeline for the Coastal Coupling Roadmap

The following co-developing timeline may require additional revision and alignment cycles:

WHICH GROUP AND ACTIVITY?	BY WHEN?
Coordinator: Update CC CoP and invite community comments (2 weeks)	June 2024
Coordinator: Adjudicate comments for EC's review	June 2024
Executive Committee: Celebrate and execute	July 2024+

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01 EXECUTIVE SUMMARY

[Temporary: What are the takeaways? Why did we write this Roadmap? How is it socialized? What is the point?]

The Coastal Coupling Community of Practice (CC CoP) was founded in 2019 to advance predictive capabilities in the coastal zone (CC CoP 2019), a purpose that remains compelling. While the CC CoP has functioned effectively throughout the years as a mechanism for coordination and information-sharing, community members requested a CC CoP Roadmap that lays out the process for addressing: (1) Which models will, and will not, be one-way and two-way coupled, including the geographies and the timeline; (2) The process for making available a shared working environment or index of relevant repositories with co-located data and processing tools, ideally leveraging related Federal efforts; (3) Workforce development (CC CoP 2023: 5).

Based in the expertise of the CC CoP's Executive Committee, the following four initiatives will address the community's requests for information about models, shared working environments, and workforce development, while also addressing the missions of the CC CoP itself to couple models; provide actionable information; and accelerate national coverage (CC CoP 2019):

Initiative #1, Total Water Level: In which the CC CoP is contributing to ongoing total water level improvements based on: improved physics ; the addition of hyper-resolution (e.g., already planned for the National Water Model); improved understanding of geomorphic changes; other improvements proposed by the CC CoP Membership. The accountable working group is called the Total Water Level Working Group.

Initiative #2, Ecosystems and Water Quality: In which the CC CoP is contributing to ongoing ecosystem modeling (e.g., improved understanding of marsh migration and water quality issues) by contributing to reliable, physically based temperature and salinity models for inland and nearshore. The accountable working group is called the Ecosystems and Water Quality Working Group.

Initiative #3, Bathymetric Data: In which the CC CoP is contributing to, and advocating for, a complete national set of bathymetric data, including definitions, metadata, and data access (see also the CC CoP Annual Meeting Report 2023). Hydro flattened data, wherein water surfaces appear to represent traditional digital elevation models even though there is no underlying bathymetric data, will be replaced with complete data sets and cadenced updates. The accountable working group is called the Bathymetric Data Working Group.

Initiative #4, Communications, Education, and Training: In which the CC CoP is contributing to continuous communications, education, and training initiatives by sponsoring hack-a-thons, building modeling training kits into college curricula, and sharing content and inspiration with each other. The accountable working group is called the Communications, Education, and Training Working Group.

Co-developing and leading these inter-related initiatives is possible because of the deep expertise and commitment within the CC CoP:

CC CoP Community: The community itself is composed of nearly 500 people with expertise spanning science, modeling, forecasting, coastal and floodplain management, shipping management, and emergency management. The community is extraordinarily active: Around 60 people attend the various seminars and almost 200 people attended the last annual meeting.

CC CoP Executive Committee: The community is led by an Executive Committee (formerly called the Super Friends) who are accountable for establishing the direction for the CC CoP and ensuring progress toward the outcomes. Members of the Executive Committee, experts in coastal and estuarine modeling, represent a mix of public and private sector organizations.

CC CoP Coordinator: The community is supported by a NOAA-funded coordinator who ensures that the charter is fulfilled (CC CoP 2019); that this Roadmap is implemented; and that everyone in the community has the information they need to contribute the answers society needs. The Coordinator also shares information about current funding opportunities and, related, ensures that the priorities in this roadmap are included in upcoming funding opportunities.

The Roadmap is [will be] publicly available via the CC CoP's webpage (here) and is being [will be] implemented via a series of working groups.

02 A VIEW FROM 2027

[Temporary: What is the end state? What will we have achieved? What does it look like when riverine and ocean are fully coupled?]

The mission originally laid out by the CC CoP continues to be relevant and is the focus between now and 2027:

CC CoP Mission Area 1: "Coupling of models to better represent earth system processes across the coastal zone and provide improved predictions of quantities such as water levels, flow timing and duration, currents, sediment, water quality variables, geomorphic changes, etc."

CC CoP Mission Area 2: "Actionable information on these quantities provided to stakeholders in timely, accessible and user-friendly formats."

CC CoP Mission Area 3: "Accelerated national coverage of integrated water prediction capabilities through the adoption of community research and models that acknowledge stakeholder-driven requirements" (CC CoP 2019).

So, how does a Community of nearly 500 people address these mission areas using a roadmap for which the initiatives and milestones are nobody's direct responsibility? In short, by attuning everyone to opportunities for individual and organizational focus within their current work and as new work is envisioned. The general approach to addressing the Roadmap follows:

Information: Via information sharing and updates to learn from, and inspire, each other.

Coordination: Via coordinated activities between and among the various individuals and organizations accountable for this work, such as:
- Renewing focus within currently mandated, granted, or awarded work.
- Including these initiatives and activities in organizational funding opportunities.
- Developing professionals in the context of the various initiatives and milestones.
- Volunteering time and expertise to the various initiatives and milestones.

Execution / Evaluation: Via agile implementation focused on the initiatives and milestones and offering specific activities for groups to address an initiative or evaluate the progress so far.

Celebrate: Via continual assessments and acknowledgements that include, but are not limited to:
- Capturing and sharing lessons learned.
- Sharing credit and including attributions.
- Extending gratitude and celebrating.

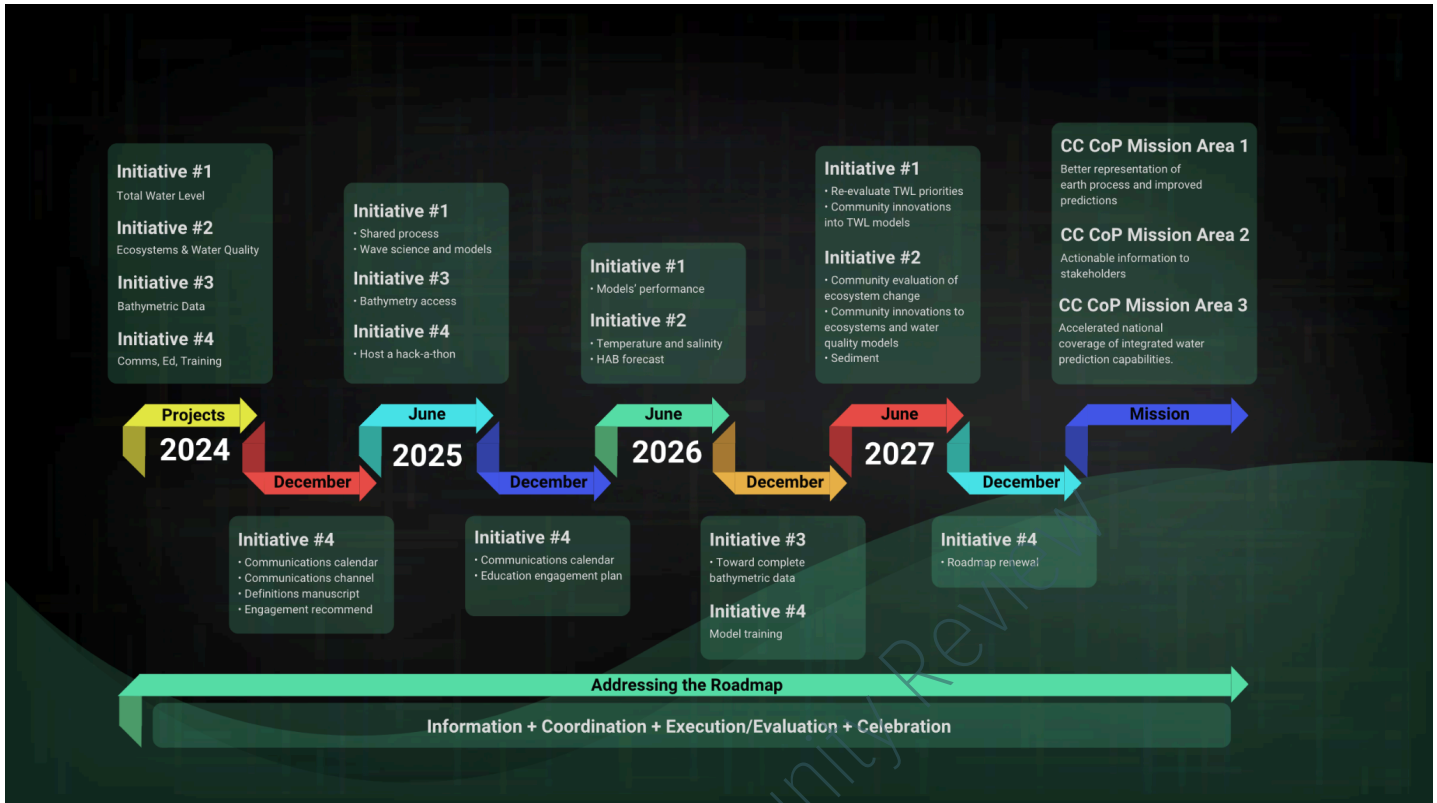Focused on this view from 2027, then, the following Roadmap lays out the four initiatives.

Image 1. Visualization of roadmap initiatives and milestones. Information = Information sharing and updates to learn from, and inspire, each other. Coordination = Coordinated activities between and among the various individuals and organizations accountable for this work. Execution/Evaluation = Agile implementation focused on the initiatives and milestones and offering specific activities for groups to address an initiative or evaluate the progress so far. Celebration = Via continual assessments and acknowledgements. Design source: Modified from Dark Green Modular Business Roadmap Brainstorm by Kazakov Vladimir on Canva.

03 A ROADMAP FOR SCIENCE, MODELING, AND ENGAGEMENT

[Temporary: Where are we focusing for science and modeling? How is that expressed in milestones? How will we test hypotheses? Find performance issues? Fix with science? How will we recognize that we're on the right track toward the milestones?]

Given the Charter and the view from 2027, the CC CoP must focus on four inter-related initiatives that simultaneously address both the problems faced by the community (Appendix B) and the CC CoP's mission areas (CC CoP 2019):

1. Initiative #1, Total Water Level
2. Initiative #2, Ecosystems and Water Quality
3. Initiative #3, Bathymetric Data
4. Initiative #4, Communications, Education, and Training.

The intention for each initiative is to begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities to address the CC CoP missions?

A note about specific models: While this Roadmap is agnostic as to which models will be incorporated into an initiative and when, some models are mentioned as starting points or to illustrate a point. Rather than specify which models will, and will not, be one-way and two-way coupled, including the geographies and the timeline, the Roadmap sets out an approach for any model to be coupled for any geography and on any timeframe. For each initiative, coupling (or other technology that creates the same effect) will be possible based on shared information about each model's specific one- and two-way coupling approach.

03.1 Initiative #1, Total Water Level

The big idea of Initiative #1, Total Water Level, is to contribute ongoing water level improvements toward improved predictions, localized features, and enhanced resolution. This includes improved physics (e.g., waves generally and wave run-up and overtopping); the addition of hyper-resolution (e.g., already planned for the National Water Model); improved understanding of geomorphic changes; and/or other improvements proposed by the CC CoP Membership. The accountable working group is called the Total Water Level Working Group (TWL WG), which may in turn establish Subworking Groups via scoping documents that include the purpose of the Subworking Group; criteria for satisfaction; deadlines for their deliverables; and lists of key resources (e.g., people, documents, baseline knowledge).

Reminder for Initiative #1, Total Water Level: The intention is to begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities to address the CC CoP missions?

INITIATIVE #1, TWL TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
By June 2025 • Shared process: Align on a shared process for improving the science, modeling, and coupling related to total water level	By June 2025, the Total Water Level Working Group (TWL WG) will: ☐ Select the metrics for measuring improvement ☐ Select an evaluation procedure ☐ Select test cases ☐ Recommend a process for validation/verification and/or benchmarking cases (i.e., evaluating to parameterizations or benchmarks) ☐ Consider how adaptive this approach is to new technologies, especially artificial intelligence (AI) and	Initially, the CC CoP Coordinator will: ☐ Invite two people to co-chair the TWL WG (at least one of the co-chairs must be a member of the Executive Committee) ☐ For at least the first two meetings, develop the agendas and schedule the pre-briefs and actual WG meeting ☐ Write the scoping document for the TWL WG to include the why, how, what, additional reference materials, etc. ☐ Begin by understanding the current state of progress

INITIATIVE #1, TWL TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
	machine learning (ML) ☐ Based on the above, recommend an integrated process for making available a shared working environment or index of relevant repositories with co-located data and processing, ideally leveraging related Federal efforts	domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities (including funding activities) to address the CC CoP missions? At least quarterly, the CC CoP Coordinator will: ☐ Consistent with the previous bullet, continue to learn more about what community members are doing in this space ☐ Document the process of addressing this shared process milestone ☐ Identify and include best practices ☐ Elicit and share information about current models related to the TWL WG. At a minimum, the table will include the model name, link to the main page, link to the repository(ies), contact, next planned updates (what and when), process for informing updates, process for one- or two-way coupling ☐ Publicly share all of this information, especially the process, for use in similar initiatives ☐ Better leveraging and sharing of funding opportunities
By June 2025 • Wave science and models: Improve the science and model coordination around wave physics to improve information and predictions related to coastal inundation and flooding Note: Different U.S. Federal	By June 2025, the TWL WG will: ☐ Improve the research on wave breaking dissipation and driving force term(s) ☐ Provide guidance for including wave information in models as an open boundary (e.g., in the Surge and Tide Operational Forecast System)	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this wave milestone ☐ Connect this group's work into related work

INITIATIVE #1, TWL TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
agencies have different definitions of total water level. For example, the United States Geological Survey (USGS) includes waves in total water level calculations to address setup and overtopping. The total water level definition will be addressed in Initiative #4, Communications, Education, and Training	and/or provide guidance about informing transition zone information based on the wave information at the shore ☐ Evaluate wave impacts on water levels in the transition zone (e.g., during hurricanes waves are likely to have a significant effect); could begin with comparisons to the National Water Model (NWM) during wave events), then pick up other effects on TWL such as sea ice	
By June 2026 • Models' performance: Evaluate models' performance in the transition zone and anywhere model outputs differ	By June 2026, the TWL WG will: ☐ In the transition zone (term to be defined by Initiative #4, Communications Education, and Training), and as requested, support the NWM in creating a retrospective simulation for total water level; then, evaluate the performance of the NWM in the transition zone compared to observations (e.g., use the Southeast Coastal Operational Forecast System as an example to see where skill is missing) ☐ Evaluate the findings from the Coastal Application Model Evaluation Team via the report provided to the developer: What explains the difference in model outputs? What is the best strategy for reconciling the issues (e.g., with improved techniques for incorporating vertical land motion, better information and processes for sea ice)?	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this evaluation milestone ☐ Connect this group's work into related work
By June 2027 • Re-evaluate TWL priorities: Re-evaluate TWL priorities per CC CoP Mission Area 1	By June 2027, the TWL WG will: ☐ Re-evaluate TWL priorities per Mission Area 1, "improved predictions of quantities such as water levels, flow timing and duration, currents,	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this re-evaluate TWL priorities

INITIATIVE #1, TWL TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
	sediment, water quality variables, geomorphic changes, etc." ([CC CoP 2019](#))	milestone ☐ Connect this group's work into related work
By June 2027 • Community innovations into TWL models: Incorporate (couple or equivalent) community innovations into relevant TWL models	By June 2027, the TWL WG will: ☐ Recommend the steps for community data observations and model code advancements to be incorporated into operations and upgraded into models ☐ Pick a pilot and use the pilot to establish the governance for community innovations, leveraging lessons learned from NOAA's Earth Prediction Innovation Center	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this community innovations milestone ☐ Connect this group's work into the community innovation milestone under the Ecosystems and Water Quality Working Group
Picturing Success: As the community address each of the milestones for the Total Water Quality Initiative, success is measured by the products and tools that are becoming available, especially: ☐ A manuscript, user cases, and catalog about the handshake among models. Begin with who is coupling what with the NWM, both how and when. Then, provide a NWM coupling guide for researchers and modelers. ☐ Repeat for the next model(s). ☐ An app, like the Weather App, that provides individually accessible information about total water levels and impacts for the individuals' area [see also Initiative #2, Ecosystems and Water Quality].		
Outcomes ([which match a subset of the problems in Appendix B](#)): The community knows how to contribute to ongoing improvements and understanding to various TWL models. The community knows how to 1-way or 2-way couple (or successor technology) to key coastal models. The community has a standardized approach for addressing the model evaluation process (metrics, techniques, etc.) with benchmark cases and best practice standards as a common starting place.		

Table 3.1. Total Water Level timing, milestones, implementation, monitoring, and evaluating, including the picture of our success and the big-picture outcomes (table inspired by the [Australian Academy of Science (2021)](#)).

03.2 Initiative #2, Ecosystems and Water Quality

The big idea of Initiative #2, Ecosystems and Water Quality, acknowledges the community's need for a reliable, physically based temperature and salinity model for inland and nearshore in relevant geographies. The community must be able to track water temperature and salinity from rivers through the estuarine zone to the coastal zone: While inland and coastal models are progressing well, significant attention is required for the transition zone (term to be defined in Initiative #4, Communications, Education, and Training) and the inland, coastal, and transition zone models must be inter-connected. The accountable working group is called the Ecosystems and Water Quality Working Group (EWQ WG), which may in turn establish Subworking Groups via scoping documents that include the purpose of the Subworking Group; criteria for satisfaction; deadlines for their deliverables; and lists of key resources (e.g., people, documents, baseline knowledge).

Reminder for Initiative #2, Ecosystems and Water Quality: The intention is to begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities to address the CC CoP missions?

INITIATIVE #2, ECOSYSTEMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
By June 2026 • Temperature and salinity: Pilot a physically based temperature and salinity model in a relevant geography (inland-estuary-coastal)	By June 2026, the Ecosystems and Water Quality Working Group (EWQ WG) will: ☐ Plan and pilot a physically based temperature and salinity model in a relevant geography (inland-estuary-coastal) at a relevant cadence ☐ Specify the plan for leveraging existing (or gathering new) datasets for a nationwide temperature and salinity by June 2026, June 2029 at the latest ☐ Identify the pathway for contributing this data to key models (likely beginning with the NWM)	Initially, the CC CoP Coordinator will: ☐ Invite two people to co-chair the TWL WG (at least one of the co-chairs must be a member of the Executive Committee) ☐ For at least the first two meetings, develop the agendas and schedule the pre-briefs and actual WG meeting ☐ Write the scoping document for the EWQ WG to include the why, how, what, additional reference materials, etc. ☐ Begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities (including funding activities) to address the CC CoP missions? At least quarterly, the CC CoP Coordinator will: ☐ Consistent with the previous bullet, continue to learn more about what community members are doing in this space ☐ Document the process of addressing this temperature and salinity milestone ☐ Identify and include best practices

INITIATIVE #2, ECOSYSTEMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
		☐ Elicit and share information about current models related to the EWQ WG. At a minimum, the table will include the model name, link to the main page, link to the repository(ies), contact, next planned updates (what and when), process for informing updates, process for one- or two-way coupling ☐ Publicly share all of this information, especially the process, for use in similar initiatives
By June 2026 • HAB forecast: Invite community feedback and/or inputs to the Harmful Algal Blooms forecast	By June 2026, the EWQ WG will: ☐ Ensure that the work in the other milestones leverages the existing HAB forecast work ☐ Invite contributions from the CC CoP to address improvement and innovation challenges	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this HAB forecast milestone ☐ Ensure that the work on each of the milestones in this Initiative remain consistent and coherent with the overall Initiative
By June 2027 • Community evaluation of ecosystem change: Pilot a community evaluation of how we're integrating ecosystem change	By June 2027, the EWQ WG will: ☐ Develop a validation process that considers mangroves, dunes, beaches (e.g., consider beginning with the Coastal and Ocean Modeling Testbed validation process and incorporating geomorphic change ☐ Develop the steps for getting the outputs from the temperature and salinity into specific models (EWQ WG to recommend at least 1) and then parameterized into specific models (EWQ WG to recommend at least 1) with upgraded topography and bathymetry	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the TWL WG is taking steps toward implementation of this ecosystem change milestone ☐ Ensure that the work on each of the milestones in this Initiative remain consistent and coherent with the overall Initiative
By June 2027 • Community innovations to ecosystems and water quality models:	By June 2027, the EWQ WG will: ☐ Review the literature and choose priorities (e.g.,	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the EWQ WG is

INITIATIVE #2, ECOSYSTEMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
Incorporate (couple or equivalent) community innovations into relevant ecosystems and water quality models	improved understanding of marsh migration or water quality issues, or other topics) ☐ Recommend the steps for community data observations and model code advancements to be incorporated into operations and upgraded into models ☐ Pick a pilot and use that pilot to establish the governance, leveraging lessons from NOAA's Earth Prediction Innovation Center	taking steps toward implementation of this community innovations milestone ☐ Connect this group's work into the community innovation milestone under the TWL WG
By June 2027 • Sediment: Specify the information needed to improve sediment predictions	By June 2027, the EWQ WG will: ☐ Specify the information needed for sediment, sediment concentration, and sediment transportation information needed (e.g., by building on the WRF-hydro work at Louisiana State University and choosing to make this a separate capability or add into NWM on 3.4 million river miles)	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the EWQ WG is taking steps toward implementation of this sediment milestone ☐ Connect this group's work into related work

Picturing Success: As the community address each of the milestones for the Ecosystems and Water Quality Initiative, success is measured by the products and tools that are becoming available, especially:

☐ A complete national data set of temperature and salinity in the transition zone ("transition zone" to be defined via Initiative #4, Communications, Education, and Training).

☐ A complete national information set of sediment dynamics and transport (fluvial, coastal sea).

☐ A calibrated, relevant simulation of temperature and salinity that incorporates geomorphic change.

☐ An evaluation process for upgraded code from the community, including more resolved or nested community models.

☐ A manuscript, user cases, and catalog about the handshake among the ecosystem and water models. Begin with the NWM.

☐ An app, like the Weather App, that provides individually accessible information about total water levels and impacts for the individuals' area [see also Initiative #1, Total Water Level].

Outcomes (which match a subset of the problems in Appendix B): The community knows how to 1-way or 2-way couple (or successor technology) to key coastal models. The community has a standardized approach for addressing the model evaluation process (metrics, techniques, etc.) with benchmark cases and best practice standards as a common starting place. The community understands and is addressing persistent challenges around ecosystems, ecology, biology. The community has a seamless set of temperature and salinity data from inland to coastal. The community has learned much more about marsh migration. The community has learned much more about the science related to salinity intrusion into agriculture, drinking water. And, the community has this information and data at timescales from weather

INITIATIVE #2, ECOSYSTEMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
to seasonal. The community knows more about pollution transport and residence time. The community knows more about sediment transfer, especially during extreme events.		

Table 3.2. Ecosystems and Water Quality timing, milestones, implementation, monitoring, and evaluating, including the picture of our success and the big-picture outcomes (table inspired by the Australian Academy of Science (2021)).

03.3 Initiative #3, Bathymetric Data

The big idea of Initiative #3, Bathymetric Data, is to foster the creation of, and then contribute to, a complete national set of bathymetric data. Hydro flattened data, wherein water surfaces appear to represent traditional digital elevation models even though there is no underlying bathymetric data, will be replaced with complete data sets and cadenced updates. The accountable working group is called the Bathymetric Data Working Group (BD WG), which may in turn establish Subworking Groups via scoping documents that include the purpose of the Subworking Group; criteria for satisfaction; deadlines for their deliverables; and lists of key resources (e.g., people, documents, baseline knowledge).

Reminder for Initiative #3, Bathymetric Data: The intention is to begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities to address the CC CoP missions?

INITIATIVE #3, BATHYMETRIC TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
By June 2025 • Bathymetry access: Identify the steps for improving access to existing bathymetry data	By June 2025, the Bathymetric Data Working Group (BD WG) will: ☐ Identify the steps for improving access to existing bathymetry data to include steps for adding features, making shape files easier to access, identifying research topics, filling in hydro flattened areas	Initially, the CC CoP Coordinator will: ☐ Invite two people to co-chair the BD WG (at least one of the co-chairs must be a member of the Executive Committee) ☐ For at least the first two meetings, develop the agendas and schedule the pre-briefs and actual WG meeting ☐ Write the scoping document for the BD WG to include the why, how, what, additional reference materials, etc. ☐ Begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the

INITIATIVE #3, BATHYMETRIC TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
		CC CoP community leverage and coordinate existing and emerging activities (including funding activities) to address the CC CoP missions? At least quarterly, the CC CoP Coordinator will: ☐ Consistent with the previous bullet, continue to learn more about what community members are doing in this space ☐ Document the process of addressing this bathymetry access milestone ☑ Identify and include best practices ☐ Elicit and share information about current bathymetry related to the BD WG. At a minimum, the table will include the bathymetry data set, link to the main page, contact, next planned updates (what and when), process for informing updates ☐ Publicly share all of this information, especially the process, for use in similar initiatives
By December 2026 • Toward complete bathymetry data: Progress toward complete bathymetry data	By December 2026, the BD WG will: ☐ Establish a way for community data/observations and advanced model cache (e.g., community upgrades) to come back to major bathymetry data sets ☐ Integrate meaningful community contributions into modeling suites (e.g., incorporate bathymetry sets from North Carolina research)	At least quarterly, the CC CoP Coordinator will: ☐ Ensure that the BD WG is taking steps toward implementation of this bathymetry data milestone ☐ Connect this group's work into related work
Picturing Our Success: As the community address each of the milestones for the Bathymetric Data Initiative, success is measured by the products and tools that are becoming available, especially: ☐ A community data portal for collecting, verifying, and validating bathymetry that adds a new layer for crowdsourcing into one of the existing nationally scalable systems (e.g., CoNED).		

INITIATIVE #3, BATHYMETRIC TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
☐ A complete set of bathymetric data.		
Outcomes (which match a subset of the problems in Appendix B): The community has a complete set of bathymetric data.		

Table 3.3. Bathymetric Data timing, milestones, implementation, monitoring, and evaluating, including the picture of our success and the big-picture outcomes (table inspired by the Australian Academy of Science (2021)).

03.4 Initiative #4, Communications, Education, and Training

The big idea of Initiative #4, Communications, Education, and Training, is to continuously link together the various initiatives while simultaneously surfacing new opportunities to collaborate and connect. The accountable working group is called the Communications, Education, and Training Working Group (CET WG), which may in turn establish Subworking Groups via scoping documents that include the purpose of the Subworking Group; criteria for satisfaction; deadlines for their deliverables; and lists of key resources (e.g., people, documents, baseline knowledge).

Reminder for Initiative #4, Communications, Education, and Training: The intention is to begin by understanding the current state of progress domestically and internationally around each milestone and, from there, figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities to address the CC CoP missions?

INITIATIVE #4, COMMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
By December 2024 • Communications calendar: With the CC CoP Coordinator, align on a communications calendar	By December 2024, the Communications, Education, and Training Working Group (CET WG) will: ☐ Work with the CC CoP Coordinator to update the communications calendar (e.g., at a minimum including which messages, to which groups, via which channels, on which cadence) ☐ Identify the cycle for inviting insights and information from the CC CoP	Initially, the CC CoP Coordinator will: ☐ Invite two people to co-chair the CET WG (at least one of the co-chairs must be a member of the Executive Committee or the CC CoP Coordinator) ☐ For at least the first two meetings, develop the agendas and schedule the pre-briefs and actual WG meeting ☐ Write the scoping document for the CET WG to include the why, how, what, additional reference materials, etc. ☐ Begin by understanding the current state of progress domestically and internationally around each milestone and, from there,

INITIATIVE #4, COMMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
		figure out where to contribute and improve: How might the CC CoP community leverage and coordinate existing and emerging activities (including funding activities)to address the CC CoP missions? At least quarterly, the CC CoP Coordinator will: ☐ Consistent with the previous bullet, continue to learn more about what community members are doing in this space ☐ Update the community on progress toward this roadmap and will include a list of related funding opportunities, whether open or upcoming
By December 2024 • Communications channel: In addition to email, choose to add another channel (e.g., LinkedIn group, GitHub board, or Slack channel)	By December 2024, the CET WG will: ☐ In addition to email, choose to add another channel (e.g., LinkedIn group, GitHub board, or Slack channel)	[as above]
By December 2024 • Definitions manuscript: With the CC CoP Coordinator, write the core definitions used within this community	By December 2024, the CET WG will: ☐ Write and submit for publication a manuscript for the core definitions used within this community to include, but not be limited to the following terms: total water level, one-way coupling, two-way coupling, forcings, dynamically linked models, transition zone (as amount of salinity and/or distance into the river)	[as above]
By December 2024 • Engagement recommendations: With the CC CoP Coordinator, recommend various experts for engagement in each initiative	By December 2024, the CET WG will: ☐ With the CC CoP Coordinator, recommend various experts for engagement in each initiative	[as above]
By June 2025 • Host a hack-a-thon: With the CC CoP	**By June 2025, the CET WG will:**	[as above]

INITIATIVE #4, COMMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
Coordinator, select and host a targeted topic that can be addressed in one to two weeks	☐ Host a hack-a-thon on a targeted topic that can be addressed in one to two weeks ☐ Include an update to the entire community about progress on the roadmap	
By December 2025 (and annually thereafter) • Communications calendar delivered for the year: With the CC CoP Coordinator, annually align on the new communications calendar and agilely adjust	By December 2025, the CET WG will: ☐ Work with the CC CoP Coordinator to deliver the already-planned messages and update the communications calendar (e.g., at a minimum including which messages, to which groups, via which channels, on which cadence)	[as above]
By December 2025 • Education engagement plan: Establish a plan for developing curricula around major coastal models and share with university coastal programs	By December 2025, the CET WG will: ☐ Establish a plan for developing curricula around major coastal models and share with university coastal programs ☐ Choose to begin with at least 3 models	[as above]
By December 2026 • Model training: Leverage other CC CoP activities as opportunities to incorporate model and tools development training	By December 2026, the CET WG will: ☐ Leverage other CC CoP activities as opportunities to incorporate model and tools development training	[as above]
By December 2027 • Roadmap renewal: Evaluate previous years' progress and launch next 3-year Roadmap	By December 2027, the CET WG will work with the CC CoP Executive Committee to: ☐ Evaluate previous years' progress and launch next 3-year Roadmap	[as above]
Picturing Our Success: As the community address each of the milestones for the Communications, Education, and Training Initiative, success is measured by the products and tools that are becoming available, especially: ☐ A community platform for communication (e.g., LinkedIn group, GitHub board, or Slack channel) with links to education and training materials for coastal and water models (moderated by members of the Executive Committee and their designees) ☐ A manuscript of definitions.		

INITIATIVE #4, COMMS TIMING AND MILESTONES	KEY STEPS AND LEADS FOR IMPLEMENTATION	KEY STEPS AND LEADS TO MONITOR AND EVALUATE
Outcomes (which match a subset of the problems in Appendix B): The community knows how and where to engage and contribute to coastal modeling and coupling. Related, the community has specific tasks to tackle. The community has a core suite of educational materials, courses, learning modules, student exchanges and related to modeling, science, tools, services, etc. The community knows which communities of practice are for what. All communities of practice are amplifying funding and collaboration opportunities on behalf of related communities. The community is improving the ways in which coastal information, predictions, and forecasts are packaged and disseminated.		

Table 3.4. Communications, Education, and Training timing, milestones, implementation, monitoring, and evaluating, including the picture of our success and the big-picture outcomes (table inspired by the Australian Academy of Science (2021)).

04 A QUICK-START GUIDE

[Temporary: How will we get started?]

Begin with the quick-start actions below to launch the four initiatives. Then, continue with enthusiasm.

WHICH ACTION?	BY WHOM?	BY WHEN?
04.1 Write one scoping document for each initiative to capture the additional technical details offered in the 2023 CC CoP Annual Meeting and the 2024 CC CoP Executive Committee Retreat	CC CoP Coordinator	May 31, 2024
04.2 Volunteer to chair one of the four initiatives	At least four Executive Committee Members	June 30, 2024
04.3 Invite someone to Co-chair your initiative	The four Executive Committee Members	June 30, 2024
04.4 Convene the first meetings for each of the four initiatives to include the following agenda, at a minimum [presumes 90 minutes]: ● [15 minutes, Information] Hello and introductions ● [15 minutes, Coordination] What's possible for the CC CoP as we succeed in our initiative? ● [15 minutes, Execution] Is there anything in our initiative that we could choose not to do? ● [30 minutes, Execution] For each of our upcoming milestones, who is interested in taking a lead? With which activities? How will others join you? ● [15 minutes, Celebration] Next actions and acknowledgements	CC CoP Coordinator, with Co-chairs for each of the initiatives	August 31, 2024
04.5 Lead the process for quarterly evaluations of the Roadmap (below)	CC CoP Coordinator	September 30, 2024

WHICH ACTION?	BY WHOM?	BY WHEN?
04.6 Convene the second meetings for each of the four initiatives to include the following agenda, at a minimum [presumes 90 minutes]: ● [15 minutes, Information] Hello and introductions ● [15 minutes, Coordination] ● What's possible for the CC CoP as we succeed in our initiative? ● [45 minutes, Execution] For each of our upcoming milestones, how are we progressing? With which activities? Where are we stuck or stopped? What else is needed? ● [15 minutes, Celebration] Next actions and acknowledgements	Co-chairs for each of the initiatives	October 31, 2024
04.7 Lead the process for quarterly evaluations of the Roadmap (below)	CC CoP Coordinator	December 31, 2024 and quarterly thereafter
04.8 If something is stuck or stopped, figure out which of the following four ingredients is missing: ● Information: Information sharing and updates to learn from, and inspire, each other. ● Coordination: Coordinated activities between and among the various individuals and organizations accountable for this work. ● Execution/Evaluation: Agile implementation focused on the initiatives and milestones and offering specific activities for groups to address an initiative or evaluate the progress so far. ● Celebration: Via continual assessments and acknowledgements.	CC CoP Coordinator	Ongoing

Table 4. Quick-Start Guide to Immediate Next Actions, including the accountable person and the deadline.

05 A PATH FOR AGILE EVALUATION AND REVISIONS

[Temporary: How often will we revisit the roadmap? How will revisions be made? How and when will those be shared with the full CC CoP?]

Once a quarter, the CC CoP Coordinator or their designee will invite members of the Executive Committee to review this document and propose deletions, revisions, and additions. All changes will be discussed in a full meeting of the Executive Committee; a revised version of this document that includes a revised version of Table 5 (above) will be publicly available within 15 business days of the meeting; and the version control table will be updated (see Appendix C).

06 CONCLUSION AND ACKNOWLEDGEMENTS

[Temporary: Takeaways? Calls to action with a quick-start guide? Acknowledgements?]

The opportunity to advance predictive capabilities in the coastal zone (CC CoP 2019) remains compelling. May this Roadmap be equally compelling, as there is much to accomplish over the next few years.

A special thanks for the phenomenal contributions from the CC CoP in the May 2023 annual meeting (CC CoP 2023) and from the Executive Committee members and other subject matter experts (pictured below) in the May 2024 retreat.

Image 2. Coastal Coupling Community of Practice Executive Committee and other subject matter experts (partial group) in front of a National Oceanic and Atmospheric Administration building and "The Hand." From left to right: Rebecca Atkins, John Warner, Cristina Urizar, Tracy Fanara, Courtney Barry, Trey Flowers, Saeed Moghimi, David Welch, Lucila Houttuijn Bloemendaal, Chris Massey, Rick Luettich, Dori Stiefel. Not pictured: Hamed Moftakhari, David Vallee, Pat Burke, Kara Doran, Maoyi Huang, Meg Palmsten, AJ Zhang. Photo credit: A kind stranger.

APPENDIX A. ALWAYS THINKING ABOUT DECISION MAKERS

Goal #4 of the CC CoP Charter calls for advancing science around modeling that will result in better products and services that meet the needs of the operational use community. Following are examples of those communities, expressed as personas and the lists of the questions they are trying to answer. Content was synthesized from listening sessions; user analyses; policy documents; and a CC COP Executive Committee Retreat (May 2024).

Category	Decision Maker Persona	Sample Decision Maker Questions
Scientists	Scientists are endeavoring to help society understand how humans are affecting and being affected by changes in the ocean. They use raw and processed data, model outputs, and/or open-source code to advance their research. Products they are currently using include those available via open dissemination programs (e.g., NOAA's Open Data Dissemination (NODD) Program). They need consistent access to consistent data, especially topography, bathymetry, and ocean observation data.	What is the process for handling raw and processed data, model outputs, and/or open-source code to open dissemination repositories? Will the products in open dissemination programs meet the future needs of technical users who are expecting artificial intelligence / machine learning (AI/ML) ready environmental data? What is missing now and in the future? How can the community establish a standardized modeling platform and dataset to serve as a benchmark for advancing compound flood modeling methodologies? How can we build a development environment that allows meaningful participation from multiple sectors of the community? As a scientist, how can I contribute my data to the effort? How can I pull data to use for my science and what is the quality of the data?

Category	Decision Maker Persona	Sample Decision Maker Questions
Modelers	Modelers are endeavoring to deliver accurate, reliable, and timely coastal predictions that inform a wide range of decision-support user needs across space and timescales. Products they are currently using include a variety of weather and climate models across a range of spatial and temporal resolutions. They need an integrated modeling approach that skillfully and appropriately represents complex riverine, estuarine, and coastal hydraulic processes.	Which models will, and will not, be one-way and two-way coupled, including the geographies and the timeline? How do I find out what process and structure a model is using for coupling? What are the standards for shared data? How might data and processing be co-located in the cloud? How can we improve data assimilation (DA) into our modeling; improving DA methods, increasing use of remotely sensed data to augment gaging networks, etc. How can we methodically tackle the challenges arising at the intersection of hydrologic and coastal hydrodynamics models, given that their disciplinary boundaries often hinder efficient handling of external fluxes? What are the best practices of engaging a community of modelers toward the same goal? How can we learn and leverage from each other?
Forecasters	Forecasters are endeavoring to improve the immediate and short-term (hours to days) weather forecasts using ocean data and information. Products they are currently using include weather forecast models (e.g., the European Center for Medium-Range Weather Forecasts (ECMWF) and the U.S.'s National Weather Service (NWS)) and bespoke products developed for specific Weather Forecast Offices. They need consistent national data and models in order to produce timely and accurate forecasts and warnings.	What is the probability of a heavy rainfall or runoff event? Of a hurricane and surge event? Of the coincidence/concurrence of these extremes? What impact will sea level changes have on storm surge extent, frequency, level? Where, when, how much, and for how long is sunny-day flooding expected? What impact will sea level change have on sunny-day flooding? How does the model typically perform in these types of events (i.e., confidence in the solution I'm seeing, model performance/evaluation etc.)? How well does the model capture extreme events? What would a joint heavy rainfall + storm surge event look like? What is the probability of such an event? What are the extents and impacts? What are the confidence levels of my forecast? What are the best methods for communicating forecasted flood risks without becoming the "boy who cried wolf"? What impact will human building of flood risk measures have on future forecasts and planning?

Category	Decision Maker Persona	Sample Decision Maker Questions
Coastal and Floodplain Managers	Coastal and floodplain managers are endeavoring to improve community resilience to changing ocean and climate conditions. They are constantly toggling back-and forth between short-term decisions (e.g., Should this beach be closed? Should this town be evacuated?) and long-term decisions (e.g., Where should this wastewater treatment plant be sited? Should this beach receive renourishment? How can the community's resilience to future flood disasters be enhanced?). Products they are currently using include the FEMA mobile app for short-term information and dashboards reflecting inundation scenarios regarding sunny day flooding, storm surge, or sea level rise for longer-term information. They need to understand which questions can be answered as well as where to find those answers and the decision support that accompanies those answers.	Which data/information/tools are available? Where can they be found? Is there a centralized site? Are they accessible and understandable for non-scientists? Are they relevant to local needs? How are those data/information/tools used? What types of education, training, and support are available to ensure proper usage? Where, when, how much, and for how long is sunny-day flooding expected? Where, when, how much, and for how long will coastal communities face inundation from sea-level rise and storm surge? Will hurricanes become more frequent and/or intense? Which building code alterations are necessary to make structures more resilient to flooding? Where should zoning law revisions be made to limit or forbid construction in areas at risk of flooding? How reliable/efficient our current metrics are for characterizing the elevated coastal sea level's associated risk/impacts? Should the beaches be renourished or dunes constructed to increase coastal resilience? What are the impacts of installing a green infrastructure project? Where, when, and for how long is a Harmful Algal Bloom (HAB) event expected? What decisions need to be made and by whom? What timescales need to be covered by information? What is the equivalent of the "weather app"? How long should I lease/mortgage a home? Questions about salt marshes/shore protection. Questions about evacuations/emergency routes/vehicles. Questions about datum updates/impacts to updates.

Draft for Community Review

Category	Decision Maker Persona	Sample Decision Maker Questions
Shipping Managers	Shipping managers and marine pilots are making complex, crucial decisions constantly in order to safely guide navigation at varying tidal stages while maximizing payload and monitoring under-keel clearance to avoid grounding. Products they are currently using include PORTS® as well as commercially available software packages that combine navigation with weather/tide/wave/wind information. They need simplified and easy to access display systems showing chart and coastal model products.	Are the shipping conditions (e.g., wind, wave, sea ice, fog, ocean currents) safe? When will the Arctic shipping lanes open? When and where will surface transportation systems be disrupted due to inundation? What is the forecast skill at X hours? Don't give me a 48-hour forecast unless the skill is as good as 12 hours. How good is your forecast for this month in order to execute plans? What is the air gap under bridges now? What will it be a week from now? What is the lowest possible stage in the next 14-28 days? Where do we need to mark navigable passes? Will water levels exceed X-level at Y-location? For example: We have a nuclear plant and need at least a week lead time to shut down. We need an accurate low water forecast 10-20 days out to set draft limits for navigation. When/will flows exceed rule limits for generation of diversions? How do I convert mean lower low water (MLLW) to the North American Vertical Datum of 1988 (NAVD8) elevation for X locations? What is the likelihood of saltwater intrusion this year? Do we need a plan now? Is there a chance of exceeding X water level? We need a 5-day lead time for operation of the gate structures for the flood protection system. What are the problem areas for dredging/sediment? How much water is available for diversions?
Emergency Managers	Emergency responders and/or managers are endeavoring to protect life and property by reducing or eliminating the adverse impacts of weather and climate extremes across timescales. That means emergency responders often need to know something on an hourly or daily basis (more like forecasters) whereas	What can be done to reduce or eliminate the adverse impacts of weather and climate extremes over the short and long term? How can communities be better equipped to withstand these impacts that they cannot avoid or lessen? Where should resources be pre-deployed for extreme events (e.g., hurricanes, tornadoes, floods)? How do we communicate risk to potentially impacted communities? Do you have a public relations partner/plan in place if needed?

Category	Decision Maker Persona	Sample Decision Maker Questions
	emergency managers are trying to pre-plan and understand trends (more like coastal state and/or local government officials). Products they are currently using include the FEMA mobile app for short-term information and dashboards reflecting inundation scenarios regarding sunny day flooding, storm surge, or sea level rise for pre-planning information. Expand successful pilot projects nationally while progressing toward consistent national data and models.	When and where should residents be evacuated in the face of extreme events? When will water levels subside so that we can commence recovery operations? Which areas are likely to become more, or less, at risk from extreme events and over what period of time? Which facilities should be upgraded or relocated in the face of changing conditions? Will the forecasts and data be available in an easily accessible format and in a single place for me during emergencies? Which areas need increased/additional observations and data to determine risk? Are there ways to improve the current products emergency managers are using now? Where do emergency responders go to get information for decision making? There are many sites (e.g., the FEMA app) but they might not be relevant at the local scale. Even worse for emergency managers is the number of sea level rise scenario tools. Which vehicle will I need for the forecasted water levels (e.g., 1', 3', 5', 9')?

APPENDIX B. THE PROBLEM SET

[Temporary: Which problems are in the way? Which problems are worthy of our expertise, experience, and attention?]

The following problem set was synthesized from listening sessions; user analyses; policy documents; the CC CoP Annual Meeting (CC CoP 2023); and a CC CoP Executive Committee Retreat (May 2024).

LIST OF PROBLEMS AROUND COASTAL COUPLING AND THE CC CoP Each problem affects all three CC CoP Mission Areas: Mission Area 1, Couple models Mission Area 2, Provide actionable information Mission Area 3, Accelerate national coverage Problems are ordered by the primary initiative(s) for addressing the problem (see the next columns)	ADDRESSED BY WHICH INITIATIVES(S) GREEN = PRIMARILY; GOLD = SECONDARILY #1 TWL, Total Water Level #2 ECOSYSTEMS, Ecosystems and Water Quality #3 BATHYMETRIC, Bathymetric Data #4 COMMS, Communications, Education, and Training			
	#1 TWL	**#2 ECO-SYSTEMS**	**#3 BATHY-METRIC**	**#4 COMMS**
TOTAL WATER LEVEL • The community would like to contribute to ongoing improvements and understanding in various TWL models yet does not know how to effectively engage	Green	Gold	Gold	Green
COUPLING • The community needs to know how to 1-way or 2-way couple (or successor technology) to key coastal models	Green	Green		Gold
MODEL EVALUATION • The community needs a standardized approach for addressing the model evaluation process (metrics, techniques, etc.) with benchmark cases and best practice standards as a common starting place	Green	Green	Gold	Gold
ECOSYSTEM • The community must understand and address persistent challenges around ecosystems, ecology, biology		Green		Gold
TEMPERATURE & SALINITY DATA • The community does not yet have a seamless set of temperature and salinity data from inland to coastal	Gold	Green	Gold	
MARSH MIGRATION • The community has much more to learn about marsh migration		Green		Gold
SALINITY INTRUSION • The community has much more to learn about the science related to salinity intrusion into agriculture, drinking water. And, the community needs this information and data at timescales from weather to seasonal	Gold	Green		Gold
POLLUTION TRANSPORT • The community needs to know more about pollution transport and residence time		Green		Gold
SEDIMENT TRANSFER • The community needs to know more about sediment transfer, especially during extreme events		Green		Gold
BATHYMETRIC DATA • The community does not yet have a complete set of bathymetric data	Gold	Gold	Green	
HOW TO CONTRIBUTE • As noted for TWL, it can be difficult in general for the community to know how and where to engage and contribute to coastal modeling and coupling	Gold	Gold	Gold	Green

LIST OF PROBLEMS AROUND COASTAL COUPLING AND THE CC CoP Each problem affects all three CC CoP Mission Areas: Mission Area 1, Couple models Mission Area 2, Provide actionable information Mission Area 3, Accelerate national coverage Problems are ordered by the primary initiative(s) for addressing the problem (see the next columns)	ADDRESSED BY WHICH INITIATIVES(S) GREEN = PRIMARILY; GOLD = SECONDARILY #1 TWL, Total Water Level #2 ECOSYSTEMS, Ecosystems and Water Quality #3 BATHYMETRIC, Bathymetric Data #4 COMMS, Communications, Education, and Training			
	#1 TWL	**#2 ECO-SYSTEMS**	**#3 BATHY-METRIC**	**#4 COMMS**
TRAINING • The community needs a core suite of educational materials, courses, learning modules, student exchanges related to modeling, science, tools, services, etc.	GOLD	GOLD	GOLD	GREEN
MANY COMMUNITIES OF PRACTICE • The community needs to know which communities of practice are for what. All communities of practice need to be amplifying funding and collaboration opportunities on behalf of each other				GREEN
SERVICE DELIVERY • The community seeks to improve the ways in which coastal information, predictions, and forecasts are packaged and disseminated	GOLD	GOLD	GOLD	GREEN

Table B. Science, Modeling, and Engagement problems to be addressed by the Coastal Coupling Community of Practice (Column 1), the primary initiatives to address that problem (e.g., the problem is a major focus of the initiative), and the secondary initiatives to address that problem (e.g., the problem is an incidental focus of the initiative) (Columns 2-4).

APPENDIX C. VERSION CONTROL TABLE (REVERSE CHRONOLOGICAL ORDER)

CHANGE	LEAD	DATE
Adjudicate comments and edits	Facilitation Team	May 31, 2024
Revise and comment	Executive Committee Members	May 24, 2024
Produce a discussion draft based on the Executive Committee Retreat (May 1-2, 2024)	CC CoP Coordinator	May 15, 2024