RMP Sediment Workgroup Meeting

May 19, 2026
9:00 AM – 11:30 AM

MEETING SUMMARY

Agenda

1. **Introduction & Meeting Overview**
2. **Discussion: Selecting Sediment Flux Modeling Location**

3a. Discussion: Presentations of Sediment Modeling Proposals

3b. Decision: Supporting the Sediment Modeling Special Study Proposals

4. **Report Out to Principal Investigators**

Attendees (Name, *Affiliation*)

Alex Braud, *SFEI*

Alex Snyder, *SFBRWQCB*

Alison Fisher, *SFPUC*

Allie King, *SFEI*

Amy Kleckner, *SFEI*

Andrew Stevens, *USGS*

Brenda Goeden, *BCDC*

Christina Toms, *SFBRWQCB*

Craig Jones, *Integral*

Dan Nowacki, USGS

David Halsing, *SBSPRP*

David Hart, *USGS*

David Peterson, *SFEI*

David Schoellhamer, *USGS (retired), Technical Advisor*

Emma Sevier, *SFEI*

Galen Egan, *Princeton*

Jessie Lacy, *USGS*

Jeremy Lowe, *SFEI*

Judy Nam, SCVWD

Kara Scheu, *Integral*

Karen Thorne, *UC Davis*

Kyle Stark, *SFEI*

Lester McKee, *SFEI*

Lyndsey Tu, *EPA*

Makena Wong, *BCDC*

Mariya Qadri, *USACE*

Melissa Foley, *SFEI*

Michelle Azurin, *SFEI*

Oliver Fringer, *Stanford*

Pat Wiberg, *UVA Professor (retired), Technical Advisor*

Rachel Allen, *SFEI*

Sam McWilliams, *Integral*

Scott Dusterhoff, *SFEI*

Sydney Quan, *UCLA*

Tom Mumley, *RMP Steering Committee Chair*

Xavier Fernandez, *SFBRWQCB*

1. Introduction & Meeting Overview

Scott Dusterhoff welcomed attendees to the 2026 San Francisco Bay Regional Monitoring Program (RMP) Sediment Workgroup (SedWG or WG) August meeting and stated the primary goals of the meeting to:

- Provide feedback on a sediment flux modeling location
- Discuss the Phase 1 and Phase 2 modeling proposals

Scott began by reviewing the meeting agenda. He then provided background information for the two main agenda items - Discussion & Selection of a Second Sediment Flux Modeling Location and Presentation & Discussion of Phase 1 and Phase 2 Modeling Proposals. He reminded the attendees that Oliver Fringer received funding in 2025 to model fine sediment flux at Dumbarton Bridge and a second location that would be selected with SedWG input. The discussion of the second cross-section began at the May 2026 SedWG and would be completed at this meeting. He then reminded the attendees that Oliver, Rachel Allen, Allie King, and Jessie Lacy completed the Sediment Modeling Study Plan in early 2026, which includes six phases over nine years with a total budget of approximately $7M. At the March 2026 meeting, the SedWG asked for Phase 1 and Phase 2 proposals from Oliver and Galen Egan. At the May 2026 meeting, the SedWG was informed of the discussion to fund modeling outside the regular workgroup process, with the proposal discussion postponed. At this meeting, the SedWG will discuss the Phase 1 and Phase 2 proposals and assess stakeholder support.

Scott provided an update on ongoing and upcoming workgroup activities including the development of the MQ 1&2 workplan, the update to MQ 3-5 Sediment Monitoring & Modeling Workplan, the 2027 Sediment Summit (likely a 2-day event in February to better coordinate monitoring and modeling with RMP funding to inform management; with a program in development), El Nino event monitoring, and the addition of workgroup advisors.

Scott additionally informed the workgroup that Dave Schoellhamer is ending his tenure with the RMP and this will be his final meeting. Dave will be sharing an address at the RMP meeting in October so there will be an opportunity for future celebration. Dave shared his gratitude to the workgroup over the past 8 years and excitement for future workgroup efforts.

2. Discussion: Selecting Sediment Flux Modeling Location

Oliver Fringer led a discussion on the selection of a second cross-section to model fine sediment flux (in addition to the Dumbarton Bridge) within his 2026 Special Study titled, “A detailed analysis and understanding of fine sediment flux and development of a GitHub, community-based DFlow-FM sediment transport modeling platform for San Francisco Bay.” This discussion was a continuation of the discussion started at the May 2026 meeting.

Oliver reviewed the objectives for the project’s two tasks:

- Task 1: Develop a community-based sediment transport model of SF Bay hosted on GitHub
- Task 2: Study the physics governing the suspended sediment flux (SSF) at the Dumbarton and a second site (TBD) in SF Bay

Oliver shared the motivation for studying SSF as it is a single metric which captures important sediment transport processes. Estimates of SSF can indicate the potential for marshes to keep pace with sea-level rise, inform sediment supply for salt pond restoration projects in the lower South Bay, and be useful for computing average erosion and deposition in subembayments. Additionally, SSF can be used to quantify seasonal trends, assess the impacts of physical processes on sediment transport, and to validate models.

Oliver stated that few modeling studies have quantified the physical drivers of the SSF in estuaries such as SF Bay. This is largely because SSF is difficult to measure and few studies have quantitatively compared observed and 3D-modeled cumulative flux over a water year. Project research questions include:

- How can we accurately relate high-frequency point measurements to infrequent cross-sectional averages (i.e., the index method of Livsey et al. 2019)?
- What is the impact of the cross-sectional variability on the flux?
- What instrument locations give the most accurate measure of the flux?
- What is the uncertainty in computing the flux with instruments?

Oliver described that the relationship of point measurements to depth-averaged values is sensitive to the depth of measurement and to the Rouse number. He described the variety of physical processes which dictate sediment flux including tidal residuals, wind-driven circulation, spring-neap variability, baroclinic circulation, channel shoal exchange processes, particle size distribution erosion and flocculation, wind-wave resuspension, and contributions from local streams.

Oliver further described methods by Dyer et al. (1974) to estimate different components of the flux, including the mean Stokes drift and dispersive flux. Sediment flux at the Dumbarton Bridge cross section has been extensively studied with observations (Shellenbarger et al. 2013; Livsey et al. 2019, 2020) and limited modeling (Bever and MacWilliams 2013; White 2019; Van Gijzen 2020), making it an appropriate location for more detailed modeling. Previous studies showed that the flux is predominantly landward (south into Lower South Bay), though modeling studies have not focused on understanding the governing physical processes. This new study provides an opportunity to build on past conceptual frameworks to examine factors that may affect the flux such as baroclinic exchange during wet years which may induce a northward sediment flux.

Oliver then facilitated a discussion as to other appropriate transects for monitoring. At each site, Oliver evaluated the presence of a continuous monitoring station, previous literature, and key issues for modeling. The cross-section locations being considered are:

> **Mallard Island:** At Mallard Island, there is a continuous monitoring station and previous literature indicates that sediment delivery is strongly event-driven. Overall, Oliver indicated that this site is not a good candidate because the proposed model does not include the Delta.
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> **Carquinez Bridge/Benicia Bridge:** This location has continuous monitoring stations at Carquinez and Benicia. Previous literature provides estimates of advective, dispersive, and Stokes drift fluxes over low and high flow conditions. Key issues for modeling include that the modeled flux depends largely on the estimate of inflows from the Delta.
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> **Golden Gate Bridge:** This location doesn't have a continuous monitoring station though the Alcatraz site could be used as a surrogate. Previous monitoring and modeling studies show that transect data over one or two tidal cycles is not enough to validate the flux. Key issues for modeling include that the flux is largely due to remote rather than local sources and the lack of continuous monitoring to inform the 3D model.
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> **Richmond/San Rafael Bridge, Bay Bridge, San Mateo Bridge:** Oliver provided a combined evaluation for the three sites noting all have continuous monitoring stations with the exception of the Bay Bridge where Pier 17 can be used as a surrogate. With respect to existing literature, many previous studies compute the SSF at these transects to estimate sediment budgets, although they do not validate the flux or perform a detailed analysis (e.g., Anchor QEA, L.L.C. 2021, Van Gijzen 2020). Key issues for modeling include difficulty in validating a 3D model due to lack of cross-sectional measurements, wide cross sections, interesting physics associated with lateral variability, and point measurements less representative of cross-sectional variability.

Oliver then presented a summary slide with priorities for modeling listed as: 1) Golden Gate, 2) Carquinez Bridge/Benicia Bridge, 3) and Richmond/San Rafael Bridge, Bay Bridge, San Mateo Bridge, with Mallard Island crossed out from the list. He opened the floor for questions and discussion.

Questions & Discussion:
Pat Wiberg led the discussion saying that the Carquinez Bridge/Benicia Bridge would help constrain the overall sediment budget for the entire system. She asked if sediment fluxes at this site would be more important than the Golden Gate.

Oliver stated that the Carquinez Bridge/Benicia Bridge is an important cross section as it provides insight as to how much sediment from the Delta makes it into San Pablo Bay. Though the Golden Gate is an important control as to how much sediment may be leaving the Central Bay, the Carquinez Bridge/Benicia Bridge can inform how much sediment from the Delta circulates through other subembayments, perhaps making it more important than the Golden Gate from a total sediment budget perspective.

Dave Schoellhamer added to the conversation that he and Lester McKee have conducted a total Bay budget and the Golden Gate is a large uncertainty within this. He stated that from a bay-wide budgeting point of view, the Golden Gate would be the holy grail. The site has been well-studied by Mark Stacey and John Largier and it would be an excellent test of the model to verify baroclinic circulation at this site. Dave added that this section would have the highest risk vs. reward as it's a difficult cross section and an important control.

Tom Mumley confirmed the sites were listed in order of the modeling team's preference with the Golden Gate listed first. He further stated that all cross sections are important and will eventually be addressed. This study is a proof of concept which will be iterated and refined through subsequent improvements. Tom stated his reservation with the Golden Gate related to possible complications as opposed to a simpler cross section such as Carquinez and the importance of considering "doability" within the selected section. Tom further identified the monitoring workplan at the Golden Gate and the importance of strategizing timing between these two efforts.

Oliver clarified that the Golden Gate is ranked first because it's important and there is a great opportunity to calculate dispersive, Stokes drift, and advective fluxes. He noted that the model wouldn't be as well validated at this location due to the lower amount of observational data available.

Tom added that there is a benefit of modeling to inform new observations as monitoring at the Golden Gate likely won't happen until 2028. The modeling work can focus the observation work.

Oliver clarified that Tom was referring to Dan Nowacki and David Hart's RMP-funded Golden Gate flux monitoring study. Scott stated that the plan will be developed in 2026-2027 with monitoring occurring in 2028. Andrew Stevens added on behalf of Dan Nowacki that pilot measurements are occurring this year related to the Golden Gate Monitoring and Modeling Workplan.

Craig Jones agreed with Dave that the Golden Gate is the holy grail but also the most difficult cross section to model. He stated the uncertainty related to sediment flux in the Central Bay with a need to understand how much is exchanged at the Golden Gate vs the South Bay. Craig added that the Delta may be a less important source of sediment and the importance of identifying tidal pumping covariates in addition to advective flux.

Oliver asked how modelers would view a 3-D modeling study which captured different flux components if it was not well validated. Carquinez is well validated whereas the Golden Gate would be more of a leap-of-faith. Despite the lack of validation at the Golden Gate, there is still an opportunity to validate the model with stations throughout the Bay as has been done in the past by Michael MacWilliams.

Jessie Lacy clarified with Oliver that the modeling was intended to estimate physical processes during a constrained period as opposed to a long-term flux. Oliver confirmed this. Based on this, Jessie encouraged selecting a site with better validation data (e.g., the Carquinez Bridge/Benicia Bridge). At the Golden Gate, the processes which are most important vary dramatically between wet and dry years. What would be possible at the Golden Gate with this study would be short descriptions of processes where data is available. There would be an opportunity to validate where data was already collected and identify the important fluxes over different conditions over different water years. The processes will be quite different between Carquinez and Dumbarton and it would be nice to use two studies with a similar amount of data.

Lester added the Maureen Downing-Kunz paper to the list of relevant literature. He urged the importance of evaluating sand as well as mud. SFEI's Nutrient Management Strategy team will deploy a moored sensor at the Golden Gate and this modeling study could influence that station's placement. At Benicia, the SedWG is still waiting for the publication of David Hart's work which could be a resource to build from. There was a presentation on this at the March 2025 workgroup which would be useful to add to the literature review. Lester expressed his interest in selecting both the Carquinez and Golden Gate cross sections, agreeing with Tom that it's just a matter of prioritizing.

Rachel added a question as to the difficulty in getting the models up and running so that the Bay and ocean fluxes could be trusted. She posed to the group, would it be better to pursue a site with better data to initialize the model and better data to validate (e.g., Carquinez)?

Oliver affirmed this point, adding the importance to confirm the accuracy of Delta inflows. The Golden Gate relies on getting the sediment flux accurate everywhere else. Within the Golden Gate, there could be an option to show that the advective flux is much greater than the dispersive flux under certain conditions. It would be difficult to get the tidal variability of suspended sediment accurate at the Golden Gate as opposed to Dumbarton and Carquinez.

> *Jessie added (in chat): There's an interesting modeling paper about SSF at Carquinez by Elmilady and Van der Wegen.*

> *Andrew added (in chat): I wouldn't trust the Golden Gate results without good validation data. Vote for a site with better constrained data*

Scott summarized the pros and cons for both sites and asked for a decision. He agreed with Tom and Lester to prioritize the sites and asked the SedWG to determine which site should be completed first.

Oliver proposed the idea that the team work on the model calibration. If the calibration shows that the model can reproduce conditions at Alcatraz, the Golden Gate could be selected as the cross section. If the calibration is not accurate, the team could pursue Carquinez as the selected cross section. The team will likely pursue Carquinez given the difficulty of modeling the Golden Gate.

Scott asked if there were any objections. There were no objections and Scott asked about the timeline as to selecting the second cross section.

Oliver stated that by the March SedWG meeting the team would have a sense as to the second cross section based upon validation at Dumbarton.

> *Andrew added (in chat): Problem is very small differences in flow residual/SSC could lead to getting the flux completely wrong.*

> *Dan added (in chat): To the extent that our intended Golden Gate pilot survey this winter and complete study can help, we can coordinate with Oliver in terms of measurement strategy*

> *Andrew added (in chat): If a special study is funded to investigate flux through Golden Gate, we should definitely include a modeling component.*

Xavier added that it may be important to model the Carquinez Strait first and asked Oliver to develop a Special Study Proposal for the following year for whatever cross section between the Golden Gate and Carquinez is not modeled this year.

Jessie added that the first iteration will provide insight as to how effective the model is. Based on these results, it may be more important to invest in model improvements as opposed to additional cross sections.

Oliver stated the purpose here is to improve the tidal variability based on phases 1 and 2 of the model. He stated his confidence in pursuing the Golden Gate after multiple phases of the modeling study.

3a. Discussion: Presentations of Sediment Modeling Proposals

Oliver Fringer and Galen Egan presented jointly on the Sediment Modeling Study Plan Phase 1 and Phase 2 proposals. Oliver provided a high level overview of the sediment transport modeling study plan consisting of six phases, focusing the presentations today on the first two phases.

Oliver provided a brief overview of the suspended sediment advection and diffusion equations describing well-characterized parameters including horizontal transport and vertical turbulent mixing in response to tides, waves, and baroclinic circulation, in addition to parameters which still need better characterization like erosion and settling.

He provided context as to the fixed size class sediment transport models of SF Bay. Models can reasonably predict low-frequency variability of the suspended sediment concentration (SSC) but generally underpredict peaks in tidally-driven or wave-driven SSC. Often, the size classes (and hence settling velocities) are tuned to match observations of SSC which can account for errors in other parameters. Additionally, many models use fixed bed properties that are either tuned or based on core samples.

Within the current state of the art models, UnTRIM and Sedimorph, major simplifications include a discrete set of sediment classes with constant sediment parameters, the inability to capture aggregation and breakup of sediment particles, and the simple treatment of bay floor erosion. Effects of these simplifications include decreased peak SSC during energetic periods because flocs do not disaggregate and resuspend more easily, underestimation of sediment flux from channels and onto mudflats, and increased SSC at the start of spring tides owing to a lack of consolidation during the preceding neap tide.

Proposed work to remedy this includes modeling cohesive sediment transport using FLOCMOD to simulate aggregation and breakup of multiple cohesive sediment size classes which requires many size classes and additional parameters. The team additionally proposes using the Sanford (2008) model to represent consolidation and swelling of bed in response to erosion/deposition.

Galen provided background on data assimilation which is defined as a set of methods for combining numerical model output, observations, and uncertainties to better estimate modeled quantities and unknown input parameters. This process can be used to infer the many parameters associated with FLOCMOD.

Galen further explained that data assimilation methods ensure that modelers arrive at a unique solution. Updates are automatic and optimal and provide a better method to compare parameter estimates against representative sites through time and space. Data assimilation represents an improvement over subjective tuning procedures which can make it difficult to compare calibrated parameter values between study sites.

Galen described two data assimilation methods:

1. **Adjoint methods** where model uncertainty is prescribed in advance, with updates based on an iterative cost function minimization. This approach has a high upfront implementation cost which requires hand-coding derivatives of the numerical model and all parameterizations.
2. **Ensemble methods** including the Ensemble Kalman Filter (EnKF) where model uncertainty is calculated on the fly from an ensemble of simulations (i.e., Monte Carlo approach). Ensemble methods may be easier to implement, but have a high ongoing computational cost.

Given this background, Phases 1 and 2 of the sediment modeling study plan intend to develop and validate data-assimilative numerical models for cohesive sediment transport in SF Bay. Galen presented the Phase 1 proposal below.

1. **Phase 1: Data-assimilative 1D vertical modeling of cohesive sediment flocculation and bed dynamics (Egan). Budget: $498,269**

The goal of this proposal is to implement a data-assimilative 1D Vertical (1DV) numerical sediment transport model, validated against existing SF Bay observations. The tasks include:

Task 1: Curate and QA/QC existing SF Bay Datasets (07/2027)
Key datasets include water level, tidal velocity, wave height, salinity, temperature, and SSC spanning a range of environments including channels, flats, and marsh fringes. The deliverable for this task (July 2027) includes datasets hosted in an open-source repository which can be used to validate the 1DV and 3D model.

Task 2: Develop non-assimilative 1DV model code (02/2028)
Parameterizations for the 1DV model include flocculation using FLOCMOD which models exchange of particles among size classes by shear- and collision-driven aggregation and breakup. For bed evolution and erosion, a model would be used to capture the evolution of particle size distribution, bulk density, critical shear stress over multiple bed layers as a function of time and bioturbation. The complex dynamics of flocculation and bed evolution require many parameters to specify necessitating data assimilation. The 1D model would assume horizontal homogeneity but use the same equations and parameterizations of the 3D model. The deliverable here would be source code hosted on Github.

Task 3: Report + publication on model development and validation (07/2028)
The deliverable for Task 3 (July 2028) consists of a technical report and submitted journal publication detailing the development of the 1DV model. This report will allow for validation and comparison against multiple field datasets alongside a discussion of conditions that the 1DV model struggles to resolve.

Task 4: Add data assimilation to 1DV model (02/2029)
The primary research effort within this task is to implement and test adjoint and Ensemble Kalman Filter data assimilation approaches to compare upfront and ongoing complexity in terms of code maintenance and computational costs. The final implementation will enable objective, data-driven parameter estimation with the deliverable (Feb 2029) as the source code hosted on Github.

Task 5: Report + publication on DA methods and validation (07/2029)
The deliverable for this task (July 2029) includes a technical report and submitted journal publication describing the development and testing of the data assimilation system and comparison of the two data assimilation methods.

Task 6: Report + publication comparing assimilation-informed model parameters across time and study sites (12/2029)
The deliverable for this task (Dec 2029) is a technical report and submitted journal publication comparing the predictive skill of the assimilative versus non-assimilative 1DV model over various time scales, the optimal input parameter values at each of the study sites, and the relationships between parameter values and resulting suspended sediment concentration and particle size distributions across study sites.

Galen then presented the budget and timeline for all Tasks in phase 1 where the majority of the budget would support a postdoctoral scholar for 3 years who could be co-advised by Galen Egan for 1 month/year and Rachel Allen for 2 weeks/year.

Questions & Discussion:
Dave stated his concern with the advective term in 1DV models. He stated a typical scenario with an accelerating ebb tide and increasing bed shear stress leading to sediment laden waters. He asked how the modeling team would separate out the advective term in this scenario or decide to exclude these conditions because the advective term is so large given the 1D approach. He asked if the data assimilation methods could tease out the advective term.

Galen added that the modeling team expects the advective term to be very important. There could be locations where currents are not as strong, where gradients in SSC may not be as steep. By selecting different sites to validate the model, the modeling team can make educated guesses about where the advective term is most important. Within the 1D model, the advective term can also be estimated as a residual. The horizontal velocity is still an input in the model, it's just not measured as a gradient. Galen further added, if the modeling team observes differences in sediment concentration which can't be explained by the 1D model, these differences can be identified as the advective term.

Dave cautioned that the advective term is a weakness of this model and to keep this in mind when interpreting results. The strength is a better understanding of the vertical terms.

Pat commented that sediment bed properties should be included on the list of minimum observations for the study sites to better understand the connection between the bed and the water column. She then asked, to what degree will the modeling team harmonize or ensure similar values for similar focus sites?

Galen stated that the team plans to apply a similar parameterization method to fit values across different sites. There are different techniques to make sure the solutions are stable and unique (e.g., regularization terms). Galen confirmed that it's important to make sure parameters pass the "smell-test" and make sense with respect to real-world values.

Pat asked if the modeling team would do this as part of data assimilation. Galen described his intention to calibrate each site independently first and hypothesized a more consistent outcome with the data assimilation method than with parameterization done by an individual.

Tom clarified starting logistics assuming funding is received and asked if a post-doc was identified or if there would need to be a search.

Galen identified the need to initiate a search for a post-doc via Princeton. There is a post-doc in mind currently working with Mark Stacey who has addressed similar problems. Tom clarified that contracting could happen in tandem with post-doc recruitment.

> *Andrew added (in chat): I am not convinced that much more simple transport formulations (such that exist in Delft3D currently) will not serve to calculate SSC and flux in the Bay to inform management questions this group considers. I worry a bit about creating an ever more complicated model framework that very few will be able to understand and use. In this project, I would recommend comparing your results to more simple formulations to see what is gained by the additional complexity.*

2. Phase 2: Development of a 3D, data-assimilative cohesive sediment transport model for San Francisco Bay (Fringer). Budget: $878,009 [packet pg. 13-24]

Oliver stated the overarching goal of Phase 2 is to develop a 3D sediment transport model that accurately simulates cohesive sediment transport processes in SF Bay consisting of fixed size classes (Tasks 1-2), cohesive modeling (Tasks 3-5), and data assimilation (Tasks 6-9). Each task is described in detail below.

Task 1: Software to compute offline sediment transport (04/2027)
Task 1 consists of Oliver's ongoing RMP-funded project which involves replacing Delwaq with a more efficient in-house sediment transport model. The deliverable for this task (April 2027) consists of an offline sediment transport modeling software with a fixed size class approach.

Task 2: Calibrated offline sediment transport model (07/2027)
Task 2 involves using data from Phase 1 to calibrate the offline 3D sediment transport model. The deliverable, a calibrated offline sediment transport model is expected in July 2027.

Task 3: Software to compute sediment transport with the FLOCMOD approach (02/2028)
Task 3 involves adding FLOCMOD and cohesive bed routines to the offline sediment transport code. This will incorporate variable size classes and flocculation/breakup routines as well as cohesive bed properties and involves close coordination with Galen Egan and Rachel Allen to ensure the same parameterizations are applied as in the 1DV model. The deliverable for this task is (Feb 2028) the calibrated FLOCMOD and cohesive bed source code hosted on github.

Task 4: Calibrated FLOCMOD software with traditional tuning approach (07/2028)
Task 4 includes calibrating FLOCMOD and cohesive routines using traditional calibration methods (i.e. not data assimilative) using curated data from Galen Egan and Rachel Allen established in Phase 1. The model will use parameters suggested from Galen Egan and Rachel Allen and previous studies (e.g. flocculation/breakup rates, bed properties) to produce the deliverable (July 2028) of a calibrated FLOCMOD and cohesive bed source code hosted on github.

Task 5: Technical report and peer-reviewed publication (07/2028)
The deliverable for this task (July 2028) is a technical report/paper on FLOCMOD and cohesive sediment transport modeling in SF Bay which discusses the offline sediment transport model, compares FLOCMOD and cohesive bed parameters to those based on fixed size class approach, and discusses the advantages and disadvantages when compared to the traditional, fixed size class approach.

Task 6: Data assimilation with fixed size classes (12/2029)
Task 6 relies on ideas and methods from Phase 1 to focus on assimilation methods with simplified fixed size class approaches. This would be a primary research effort to develop and test data assimilation techniques including the 3D Ensemble Kalman Filter and adjoint codes in the offline sediment transport model and to compare the efficiency of both methods for a simplified fixed size class approach. The deliverable (December 2029) for this task is the data assimilation code hosted on github.

Task 7: Technical report and peer-reviewed publication (12/2029)
The deliverable (December 2029) for this task is a technical report and paper outlining data assimilation applied to SF Bay sediment transport modeling. This will focus on implementation and comparison of data assimilation techniques (adjoint vs Ensemble Kalman Filter), comparing parameters derived from data assimilation to an ad-hoc tuning approach, and comparing the accuracy of the data assimilation approach to traditional ad-hoc tuning approaches.

Task 8: Data assimilation with FLOCMOD (12/2030)
Task 8 is a primary research effort with the data assimilation applied to cohesive sediment transport modeling from Task 4, employing assimilation techniques developed during Task 6. The deliverable (December 2030) includes data assimilation codes applied to cohesive sediment transport hosted on github.

Task 9: Technical report and peer-reviewed publication (12/2030)
The final culminating deliverable for this effort (December 2030) is a technical report and paper on cohesive sediment transport modeling in SF Bay with data assimilation. This paper would compare to three approaches including ad-hoc tuning with fixed size classes, ad-hoc tuning with cohesive sediment transport physics, and data assimilation with fixed size classes. The study will provide an opportunity to determine to what extent parameters obtained from 1DV modeling can be applied to 3D models.

Oliver then reviewed the 4-year timeline with a majority of the budget used to support a full-time postdoctoral scholar.

Questions:
Pat noted in the conceptual diagrams that there are no arrows going from the offline model back into the hydrodynamic model. She asked what, if any, feedback exists between the two models.

Oliver stated the feedback between the hydrodynamic model and the sediment model is very weak based on the assumption that the channel bed will not change over short (~1-year) modeling timescales. The other possible feedback is sediment induced stratification. Studies have shown this could be important in some places though the modelers hope to initially not incorporate this feedback mechanism. If this feedback is deemed critical, it can be included in the model. The 1D, offline model will be much more efficient and easier to work with. It's possible to couple the models though not preferred.

Dave stated that there's a lot of effort being put into the data assimilation. He asked, how is it not duplicative to do the data assimilation for 1D and 3D?

Oliver stated that it would be ideal if the results from the 1D and 3D models were duplicative but unlikely based on horizontal advection. It's a primary objective of this study to determine this. If the parameters are the same, there is an opportunity to collect more data, if they do agree, the team can create a framework for understanding why.

Christina Toms asked if stakeholders sought a better understanding of the flux and parameters like erodibility, flocculation, and settling, what modeling would need to be repeated to understand these parameters at another location since this is focused on Dumbarton?

Oliver stated that this study is bay-wide and the team will focus on getting SSC to match the observed concentrations at all of these sites using as many datasets as possible from Phase 1. The modeling team will validate the 3D model and show that it produces SSC at all the continuous monitoring stations in order to predict the flux anywhere. This will be better than the ad hoc approach, the question is how much work will it take to be better.

Brenda Goeden noticed in Oliver's study table that sediment transport within channels and to marsh edges was identified. Brenda relayed her experience that North Bay and Central Bay channels have a lot of sand and finer sediment is more on the outside. She recognized the team's work on fine grained sediment and flux and asked as the modelers look at channels and flocs how do the different pieces fit together.

Oliver stated that the Sherwood model has a module which differentiates between sand and flocs allowing for bulk resuspension (flocs) based on stress or resuspension of individual grains (sand). This effort can capture fine sand resuspension but will not focus on bedload transport of sand.

Tom asked once again about the availability of a post-doc and how the effort will account for integration with other modeling efforts including modeling associated with strategic placement and modeling led by Integral for bay-wide sediment transport. He asked how the SedWG makes sure this investment is optimized.

Oliver doesn't yet have a candidate yet but could likely find one in a 3-month timeframe. He and Galen have already met informally with other modelers to formulate an approach and anticipates this coordination will be ongoing. Oliver has discussed incorporating these models into D-Flow and has a scheduled meeting to continue this discussion and further integration with Deltares modeling. Results will continue to be published as part of the GitHub community-based model.

> *Lester added (in chat): Oliver and Galen, you did not mention literature review. My guess is we aren't the only group trying to improve model parameterization for bed–water column fluxes and mass exchange across particle sizes over relevant timescales. Could we learn from similar ongoing research at Delft University (Rhine River Delta / North Sea) or institutions in the Shanghai area or those studying that Delta? Could these hubs be great hunting grounds to identify a Postdoc candidate and further build academic collaborations with the RMP?*

3b. Decision: Supporting the Sediment Modeling Proposals

During this agenda item stakeholders within the SedWG indicated their support for the sediment modeling proposals based upon the following questions and the Principal Investigators for study proposals left the room. RMP Stakeholders provided feedback within this closed-door session and SFEI staff provided input and information as needed.

4. Report Out to Principal Investigators

Lester added when Galen and Oliver rejoined the meeting following the closed door session to please engage with SFEI staff and leverage available datasets to inform the modeling studies.

Xavier Fernandez summarized the discussion and reported the results of the closed-door session to the larger group. Xavier stated overall high support for the two phases of the project from stakeholders and brought forth the question of the model complexity and whether more simple approaches could suffice. He relayed the importance of coordinating with other modeling teams (e.g. Integral), discussions of TAC oversight, and the use of existing SFEI datasets. Based upon the high support expressed, funding for these proposals will be discussed at the Steering Committee Monday August 24th.

Oliver asked if TAC oversight and/or Steering Committee oversight should be explicitly addressed within the proposals. Xavier added that it would be a good idea to mention the need for this and Tom clarified that the larger group as opposed to the PIs may be responsible for formulating the governance and oversight process for this effort.

Galen followed up on Lester’s point about coordinating the collection and curation of SFEI datasets and stated his excitement to collaborate. Lester encouraged the team to reach out to RMP staff. Oliver clarified that the budget didn’t need to be updated to account for this and Scott and Xavier agreed.

Tom added that Xavier and Tom will take responsibility for this item at the 8/24 Steering Committee meeting. The two remaining next steps are finalizing funding availability and timing. Conceptually, these proposals are a go - now it’s on to the logistics. Tom encouraged the team to initiate the process pending logistics. It’s unlikely this proposal will be funded via a lump sum but can hopefully be addressed in a phased approach. The meeting was adjourned at 12:40 pm