Modernizing PMP
DRAFT Partnership Engagement Strategy
Updated: December 2025

1. Purpose and Vision

The National Oceanic and Atmospheric Administration (NOAA) is undertaking the modernization of Probable Maximum Precipitation (PMP) guidance to enhance national resilience against extreme hydrometeorological events. The Bipartisan Infrastructure Law/Infrastructure Investment and Jobs Act (BIL/IIJA), signed into law in 2021, along with the PRECIP Act, passed in 2022, directed NOAA to modernize PMP estimates. PMP estimates have remained relatively static over the past several decades. The PRECIP Act specifically calls for a PMP estimate modernization effort to bring estimates more in line with a changing climate. This effort recognizes the importance of engaging with a range of partners to ensure scientific rigor, relevance to stakeholders, and practical implementation with widespread adoption.

The partnership engagement strategy aims to:

1. Foster collaboration with stakeholders across federal, state, tribal, academic, private, and community sectors.
2. Collaborate with the user community to leverage commercial sector best practices and incorporate expertise into PMP development.
3. Build long-term capacity for updating PMP methods, models, and datasets.
4. Facilitate the adoption and implementation of modernized PMP guidance across sectors.

2. Background and Context

This strategy builds on the National Academies of Science, Engineering, and Medicine study committee report "Modernizing Probable Maximum Precipitation Estimation" released in 2024, which itself synthesizes many lessons learned from PMP science improvements over the past several decades. In the report, the study committee identified 13 specific recommendations related to this project and described a recommended approach for modernizing PMP guidance.

Study Recommendations

The study committee made 13 recommendations, outlined below, to modernize PMP. These recommendations are divided into three categories:

- **Foundational (5-1, 5-2, 5-3, and 5-4):** These recommendations guide the overall approach to PMP modernization, and focus on improving the definition, engaging users, and updating guidance.
- **Near-Term (5-5, 5-6, 5-7, 5-8, and 5-9):** These recommendations identify near-term ways to improve PMP estimates while a long-term, model-based approach is being developed.

- **Long-Term (5-10, 5-11, 5-12, and 5-13):** These recommendations inform how NOAA should pursue a long-term, model-based approach to PMP estimation.

#	Title	Description
Foundational Elements		
5-1	Pursue a phased approach to modernizing PMP estimation	This recommendation outlines the strategy itself (a phased approach), rather than being a specific short-term or long-term technical task (see next section). This approach should prioritize transparency, objectivity, accessibility, and reproducibility.
5-2	Engagement with scientific and practitioner communities	This recommendation emphasizes continuous collaboration and engagement, which is a process that runs throughout all phases of modernization, rather than being confined to a specific short or long-term technical implementation.
5-3	Revise the definition of PMP	This recommendation focuses on changing the fundamental definition of Probable Maximum Precipitation, which is a foundational shift that underpins both short-term enhancements and the long-term model-based approach.
5-4	Develop guidance for AEPs used for PMP	This recommendation involves developing national guidance for defining the AEPs for PMP, a crucial aspect of the new PMP definition and risk-informed decision-making. It's a guiding principle rather than a specific short-term or long-term technical implementation.
Near-Term Enhancements (1-5 years)		
Storm Catalog Data		
5-5	Share and improve existing storm catalog	The U.S. Army Corps of Engineers (USACE) should make its existing storm catalog publicly available. NOAA should facilitate the digitization and enhancement of this catalog to include gridded rainfall fields and moisture data for each event. NOAA should also help develop an expanded storm catalog with high-resolution radar rainfall fields and surface rainfall measurements to improve near-term PMP estimation.
5-6	Develop procedures for surface rainfall measurements	NOAA should develop and standardize procedures for obtaining and validating surface rainfall measurements for PMP studies. This includes using both conventional and nonconventional sources, like bucket surveys and dense gauge networks (e.g., CoCoRaHS), to ensure high-quality data, especially for extreme events.
Reconstruction of Rainfall Fields for Key Events in the Historical Storm Catalog Using Model Simulations		
5-7	Reconstruct	NOAA should facilitate model simulations of historical storm events.

#	Title	Description
	recent historical storm events	These simulations would be used to (1) add to the expanded storm catalog, (2) improve scientific understanding of PMP-magnitude storms and their precipitation distributions, and (3) contribute to the Model Evaluation Project.
Methods: Storm Types, Storm Transposition, Maximization and Transposition Factors, Envelopment		
5-8	Provide scientific guidance on near-term improvements	NOAA should include a summary of scientific principles in its national guidance for near-term PMP estimation. Enhancements to storm transposition, moisture maximization, and transposition factors, especially those involving subjective decisions, should be based on recent scientific advancements.
5-9	Incorporate adjustment factors	NOAA should adopt adjustment factors for current approaches to modeling PMP. These factors should be based on the model-based scaling relationship between extreme precipitation and temperature.
Long-Term Recommendations (5-10 years)		
5-10	Conduct model-based PMP estimation	NOAA should adopt a model-based approach to PMP estimation that aligns with the revised PMP definition. This involves using multi-model large ensemble simulations at kilometer-scale or finer resolution to construct the probability distribution of precipitation for PMP estimation under various climate conditions.
5-11	Conduct statistical analysis to develop estimates	NOAA should use statistical methods to estimate PMP (along with its associated uncertainty). This estimation should define PMP as the precipitation depth that corresponds to an extremely low annual exceedance probability, derived from the model-simulated precipitation distribution, with a particular focus on extreme value analysis based on threshold exceedance levels.
5-12	Model Evaluation Project	NOAA should initiate a Model Evaluation Project (MEP). The purpose of this project is to assess the skill of models, identify their strengths and limitations relevant to PMP estimation in current and future climates, and ensure they are "fit for purpose." This is crucial for building community confidence in using these models for PMP estimation.
5-13	Share high-resolution model fields	NOAA should facilitate access to high-resolution model fields from its simulations. Making these fields available will increase the value and applicability of the simulations for a wide range of hydrologic and broader climatological uses.

Phased Development Approach

In addition to the recommendations above, the committee provided a proposed approach (recommendation 5-1) to modernizing PMP, as shown below. NOAA's PMP development team is currently working on an implementation plan that will catalog its approach to implementing the committee's recommendations. In addition, the PMP development team will consult with the National Weather Service Office of Water Prediction on findings and lessons learned during the recent precipitation frequency update, Atlas 15.
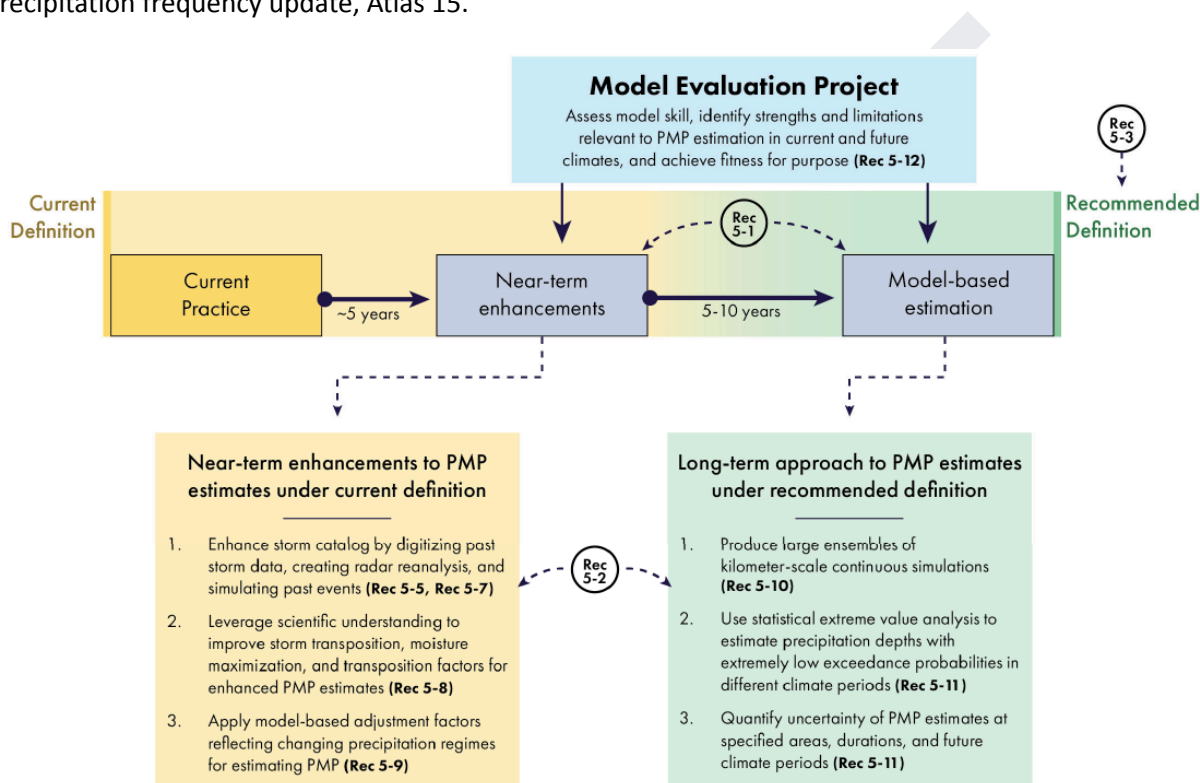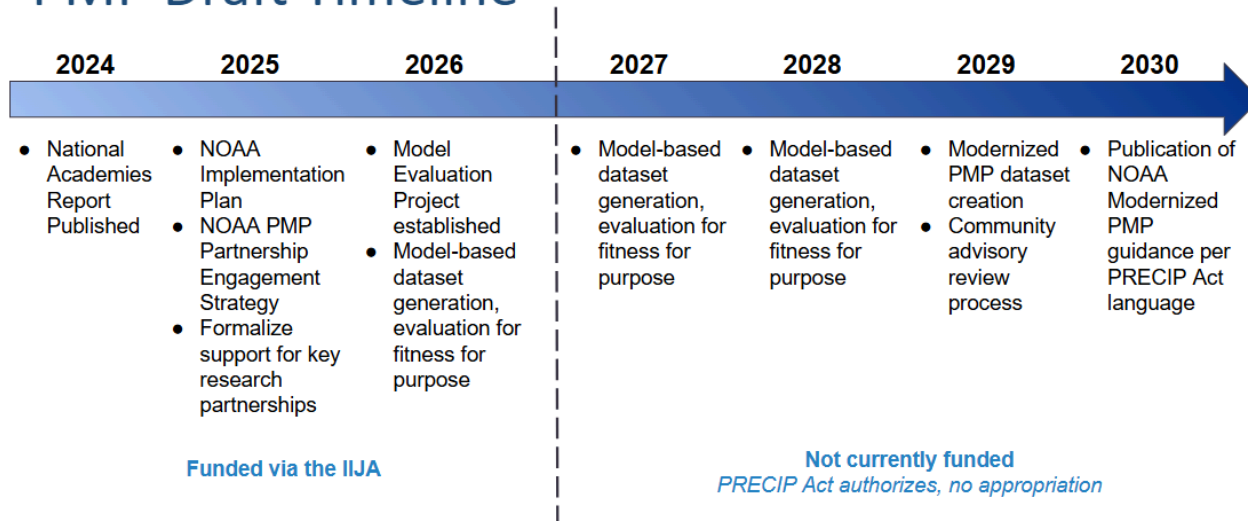

FIGURE S-1 Overview of modernized PMP estimation.

Funding for the modernization of PMP is included in the BIL/IIJA, but after those funds expire in September 2026, the project will need a new funding source. The following figure provides a brief overview of the timeline of PMP development, aligned to this funding threshold.

PMP Draft Timeline

2024	2025	2026	2027	2028	2029	2030
• National Academies Report Published	• NOAA Implementation Plan • NOAA PMP Partnership Engagement Strategy • Formalize support for key research partnerships	• Model Evaluation Project established • Model-based dataset generation, evaluation for fitness for purpose	• Model-based dataset generation, evaluation for fitness for purpose	• Model-based dataset generation, evaluation for fitness for purpose	• Modernized PMP dataset creation • Community advisory review process	• Publication of NOAA Modernized PMP guidance per PRECIP Act language

Funded via the IIJA

Not currently funded
PRECIP Act authorizes, no appropriation

3. Guiding Principles

The modernization of PMP will be guided by the following principles:

- **Co-Development and Collaboration:** Engage a broad range of voices and perspectives from users across the country to inform development and collaborate with private industry.
- **Transparency:** Communicate processes, decisions, and data openly with partners.
- **Scientific Integrity:** Ensure engagement supports the advancement of rigorous, peer-reviewed methods and data. Emphasis reporting on objectivity and reproducibility of findings to users.
- **Utility:** Prioritize outputs that are actionable, scalable, and beneficial to end users.
- **Reciprocity:** Create mutually beneficial relationships that support NOAA's mission and partner objectives.

Credibility, integrity, and collaboration are foundational to the success of this project. As such, the development team will pursue an engagement approach that incorporates best practices in building trust and credibility with stakeholder communities. One recent study identified "ten simple rules" to foster effective scientific collaboration (Sahneh, F., et. al., 2021):

- **Develop Reflexive Habits.** This involves exploring one discipline through the lens of another, bringing together experts in various fields to share knowledge and expertise and improve the overall product.
- **Communicate the Project Management Plan Early and Often.** This focuses on ensuring the entire stakeholder team understands project goals and are aligned on achieving those goals. This also helps define roles and responsibilities.
- **Speak the Same Language.** This encourages curiosity through participants asking questions, others explaining in a non-judgmental way, and seeking to use plain, non-technical language where possible.

- **Design the Project so Everybody Benefits.** This highlights that projects need to serve the needs of different stakeholders (e.g., not prioritizing one discipline or sector over another), particularly crossing the threshold of scientific and technical users.
- **Fail Early and Often.** This emphasizes the iterative nature of these projects, and the need for participants to be comfortable making mistakes, going in the wrong direction, and learning from those errors. Failing quickly empowers creativity and produces better results.
- **Share Collaboration Tools.** This focuses on ensuring there are set ways that collaborators can access information and highlights the need for a single, authoritative source of information.
- **Manage Data.** This discusses the need for a shared approach to metadata, data quality and organization, and data access. The project data management plan should adhere to FAIR (Findable, Accessible, Interoperable, and Reusable) data principles.
- **Write Code Others Can Understand.** This highlights that data scientists on the project should develop code that aligns to best practices and is workable, readable, and executable. This also supports credibility by enabling the code to be widely shared and used.
- **Observe Ethical Hygiene.** This emphasizes that researchers need to pursue their work ethically; this supports the overall credibility and reproducibility of foundational toolsets.
- **Document Collaboration.** This discusses the importance of documentation of both technical and non-technical processes so others can learn from this approach and it is preserved for future use.

The following graphic (from Sahneh, F., et. al., 2021) captures how these rules work together.
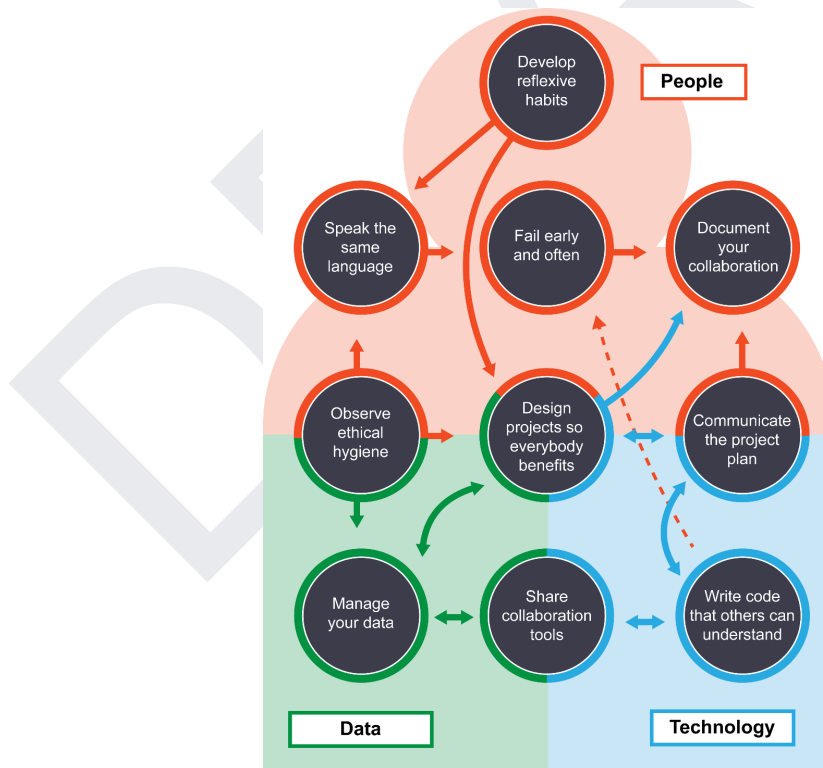
In the PMP modernization project, these principles will be applied as described in the following table.

Rule	Incorporation into PMP Project
Develop Reflexive Habits	This project is designed from the ground up to bring together technical experts across multiple disciplines, along with users, to communicate and collaborate.
Communicate the Project Management Plan Early and Often	The project management plan will be socialized among internal and external stakeholders for review, feedback, and concurrence. The PMP project team will provide monthly internal updates and biannual (at least) external updates to the community.
Speak the Same Language	For each of the recurring working groups identified in Section 5 of this plan, the PMP team will develop a charter that guides effective communication and collaboration, including through standardizing language. The PMP project team will also prioritize communicating in a clear and non-technical way, to the extent doing so does not alter the intent of discussion.
Design the Project so Everybody Benefits	This is a cornerstone of the PMP project. The engagement approach highlights the ways the project team will partner with applied, less technical users along with policymakers and regulators to collect input, share information, and help facilitate mutual benefit throughout the project.
Fail Early and Often	This project will require scientific curiosity, experimentation, and failure; the science is cutting edge, the statistical applications are new, and the models are still being developed. The project team will work closely with leadership to communicate project workstreams and any failures therein.
Share Collaboration Tools	The PMP website will serve as the authoritative source of public information. For collaborators, NOAA may set up a google drive or other shared platform to share information and serve as an authoritative clearinghouse.
Manage Data	As with "Speak the Same Language" the project team will develop guidance and expectations around data management, metadata, and organization to ensure all users are operating with the same playbook.
Write Code Others Can Understand	The project team will place a premium on developing both code and scientific breakthroughs that are transparent, replicable, and clearly documented to facilitate future improvement and research.
Observe Ethical Hygiene	In addition to documenting ethical agreements in team charters, the project team will follow all applicable NOAA and scientific guidance on incorporating ethics into this project.
Document Collaboration	The project team will create documentation for decisions, methodologies, development, and other key elements to facilitate transparency.

4. Key Partner Categories and Roles

PMP has long been a collaborative product across federal agencies and users. This section captures the major types of partners and stakeholders, an initial understanding of the value they bring to the modernization of PMP, and example organizations who could be engaged in each segment. Users are divided into six groups:

- **Technical Collaborators** - Specialists in a variety of technical disciplines who can advance the technical understanding of PMP.
  - PMP needs individuals with expertise in statistics (particularly extreme value analysis), high performance computing, numerical weather prediction models, climatological software engineering, GIS, artificial intelligence, and machine learning.
- **Scientific Experts** - Experts in a variety of scientific disciplines who can advance the scientific understanding of PMP.
  - PMP needs individuals with expertise in hydrometeorology, hydrology, hydraulic engineering, atmospheric and climate science, and radar meteorology.
- **Applied Users** - Individuals who use PMP in their work and who are the primary target audience of the new product.
- **Policymakers and Regulators** - Organizations who provide governance (e.g., laws, regulations) about how and when PMP needs to be used in facility design and operation.
- **Industry Groups** - Groups that represent groups of users (primarily from the dam and nuclear industries) and offer user guidance on applying toolsets.
- **International Partners** - Stakeholders from outside the U.S. who have expertise in the development or application of PMP in their countries.

The following table discusses these groups in more detail.

User Group	Role(s)	Example Organizations
Technical Collaborators	• Provide technical expertise to inform method development • Provide peer review of technical methodology • Participate in model validation and testing	Academic institutions, NOAA, USACE, private sector developers
Scientific Experts	• Provide scientific expertise to inform method development • Provide peer review of scientific methodology • Participate in scientific validation and testing	Academic institutions, NOAA, USACE, private sector developers
Users	• Share experience using PMP and describe needs • Contribute to use cases and case studies • Participate in user testing	Insurers and reinsurers, engineers, dam owners and operators, nuclear owners and operators, state dam safety programs,

User Group	Role(s)	Example Organizations
	• Provide feedback on definition and general improvements	Federal Energy Regulatory Commission (FERC), Nuclear Regulatory Commission (NRC), Natural Resources Conservation Service (NRCS)
Policymakers and Regulators	• Update and align laws and regulations about how and when PMP should be applied • Provide feedback on definition and general improvements • Share information with user community	USACE, Federal Emergency Management Agency (FEMA), U.S. Geological Survey (USGS), Department of Energy (DOE), FERC, NRC, state and local governments
Industry Groups and Professional Societies	• Develop and update guidance and guidelines for applied users • Share information with user base • Provide feedback on methodology and definition	Association of State Dam Safety Officials (ASDSO), U.S. Society on Dams (USSD), Association of State Floodplain Managers (ASFPM), American Society of Civil Engineers (ASCE), U.S. Nuclear Industry Council (USNIC), Nuclear Energy Institute (NEI)
International Partners	• Participate in methodological benchmarking • Share data and best practices • Provide insights from climate modeling	World Meteorological Organization, United Kingdom Environment Agency, International Atomic Energy Agency
General Public	• Raise awareness of safety measures related to critical infrastructure. • Educate individuals on extreme precipitation. • Share information related to community impacts of extreme precipitation.	N/A

5. Engagement Phases and Activities

Just as the development of PMP is phased, so too is user engagement. This is necessary because of the longevity of the PMP modernization project and the goal of building a broader user community and capacity around PMP. The engagement phases, described below, build on one another to grow trust with the user community, provide updates on methods and the product, and encourage user readiness and uptake.

Activity	Description	Frequency	Target User Group(s)
Phase 1 - Discovery and Relationship Building (Year 1)			
Map stakeholders and existing PMP developers and users	• Develop comprehensive list of key users and organizations to engage through the development process • Identify existing relationships and begin discussions to identify representatives and mechanisms for engagement with users • Share engagement and partnership plan to build buy-in and solicit feedback	One time	• All
Host a kickoff webinar	• Hold a webinar announcing the plan to modernize PMP; walk users through the implementation plan and partnership and engagement strategy • Share quick wins and progress to-date, along with opportunities for users to get involved in the process • Post the webinar and related materials on the PMP website for future reference	One time	• All
Convene a technical and scientific working group	• Establish a technical and scientific working group to discuss and provide input on the scientific and technical challenges related to modernizing PMP • Meetings will be actively facilitated, two-way discussions focused on key topics (e.g., redefining PMP) • Participants will be expected to complete light pre-work to come prepared to participate in discussion around key challenges the project team is facing	Quarterly, or more frequently if needed on specific topics	• Technical collaborators • Scientific experts • Users
Host listening sessions	• Host a series of listening sessions focused on key sectors and types of users (e.g., four total: two focused on practitioners, two focused on regulators and policymakers, divided by application)	One time series (four total recommended)	• Technical collaborators • Scientific experts • Policymakers and regulators • Users

Activity	Description	Frequency	Target User Group(s)
	• Listening sessions will present attendees with NOAA's plan to modernize PMP and a set of key questions to solicit input • Participants will share their needs and priorities around the modernization of PMP; outputs will inform development approach		
Distribute user survey	• Develop a survey to validate user needs with the broader community • Distribute the survey through industry groups and other major stakeholders to provide users with an opportunity to share input • Use results from survey to inform development approach, methodology, and updates to the PMP definition	One time	• Technical collaborators • Scientific experts • Users • Policymakers and regulators • Industry groups
Begin developing regional and sectoral case studies	• Identify two-to-four projects/communities across the country to participate in case studies, sharing how they use PMP in critical infrastructure projects and the challenges they face • Begin conducting interviews to build case study materials • Case studies will ultimately serve to demonstrate the benefits of modernizing PMP and validate the use-cases for PMP	Ongoing with two-to-four projects; multiple interviews per project	• Users
Phase 2 - Co-Development of Methodology and Definition (Years 1-3)			
Collaboratively design updated PMP methodology	• Through the technical and scientific working group, develop appropriate sub-committees to work on developing specific aspects of the PMP methodology • Meetings will be actively facilitated, two-way discussions focused on specific topics; each sub-committee will set	To be determined by each subcommittee;	• Technical collaborators • Scientific experts

Activity	Description	Frequency	Target User Group(s)
	their own meeting cadence and approach based on project need • Participants will be expected to complete pre-work to come prepared to participate in discussion on key topics	at least quarterly	
Work with partners to collect data, review methods, and test models	• As identified by the technical and scientific working group, there will be opportunities to solicit the broader community for assistance on key milestones • This may take place through regular project updates and newsletters, or may be posted as a call to action on the PMP website • Though more ad hoc, this provides an important opportunity for additional participation and validation of activities	Based on key milestones	• Technical collaborators • Scientific experts • Industry groups • International partners
Facilitate public comment	• Craft public comment questions to elicit targeted feedback (in addition to general comments) on specific elements of the methodology • Upon the publication of the methodology, work with industry groups and stakeholders engaged to-date to share the public comment period and encourage participation • Analyze public comment inputs and identify trends; develop responses to comments	One time, upon publication of methodology	• Technical collaborators • Scientific experts • Users • Policymakers and regulators • Industry groups
Facilitate targeted working groups	• Establish two additional working groups that will meet quarterly; a policy and regulatory working group, and an applications working group • The policy and regulatory working group will provide a venue for federal and state policymakers and regulators to discuss the necessary legal changes and processes to	Quarterly, or more frequently if needed, per working group	• Users • Policymakers and regulators • Industry groups

Activity	Description	Frequency	Target User Group(s)
	incorporate modernized PMP ● The applications working group will provide an option for applied users and industry groups to participate in regular user testing and input sessions on specific elements of PMP development, infusing user needs and advocacy		
Host webinars at key milestones	● At key milestones in the development process, host 1-2 hour webinars that share updates and innovations ● Webinars will provide an opportunity for the community to ask questions, and could incorporate interactive polling to gather targeted input ● Recordings can be posted on the PMP website and used as a record of development, in addition to documentation	Based on key milestones	● All
Complete series of regional and sectoral case studies	● Complete case study interviews and develop accompanying documentation and website content ● Identify key use cases that need to be incorporated into development ● Explore sharing early prototypes with case study participants to demonstrate how improvements in PMP serve users	Ongoing until case studies are complete	● Users
Phase 3 - User Readiness and Implementation (Years 4-5)			
Conduct user testing	● Hold user testing sessions at multiple points in the development process to explore the user experience, data format, usability, and other key elements ● User testing can begin with the applications working group (described above) but should expand to include other industry users ● User testing reports will inform future development of the	One time series, recommend at least five to seven tests (multiple users at each test)	● Users

Activity	Description	Frequency	Target User Group(s)
	product and refinement of the user interface		
Develop public education materials	• Through case studies and working group discussions, identify concepts that are most confusing and require clarification for users • Develop materials that explain key scientific concepts in the modernization of PMP for the average person • Post materials on the PMP website and share widely with industry groups and policymakers	One time, iterative updates	• Users • Policymakers and regulators • Industry groups • General public
Develop training and user readiness materials	• Through case studies, user testing, and working group discussion, identify the user training and readiness materials most helpful to the community (beyond required documentation) • Develop training and other user readiness materials to facilitate capacity-building in users • Post materials on the PMP website and share widely with industry groups and policymakers	One time, iterative updates	• Users • Policymakers and regulators • Industry groups
Host targeted release webinars	• Upon the release of the product (preliminary or final), host a webinar that explains the changes and how users can apply the product • Collaborate with major industry groups and working group participants to do follow-up presentations and discussions on the product • [If release is phased, like Atlas 15] conduct targeted user engagement across the country to collect input on the user interface and product prior to finalization	One time series, exact number to be determined	• All
Support implementation	• With target projects (either those in case studies or others), partner to facilitate the application of PMP and	One time, exact number of pilot	• Users • Policymakers and regulators

Activity	Description	Frequency	Target User Group(s)
through pilot projects and technical assistance	document results; capture these outputs by sharing use cases and other materials on the PMP website • Provide technical assistance and technical assistance tools to industry groups (e.g., ASDSO, ASCE) to empower users • Work with regulators and policymakers to phase in new guidance for the user community	projects to be determined	• Industry groups
Phase 4 - Sustained Collaboration (Ongoing)			
Establish long-term feedback and update mechanisms for the PMP product	• Post a product survey easily accessible on the PMP site to solicit ongoing input and feedback from users • Catalog feedback from users for future product updates • Share feedback regularly in a PMP community of practice (below)	Ongoing	• All
Lead a PMP Community of Practice to encourage ongoing innovation	• Hold regular, semi-annual meetings to discuss applications of PMP, advancements in science and technical capabilities, and feedback obtained from users • Engage with stakeholders at relevant group meetings with an established cadence (AMS, AGU, ASCE, USSD meetings) • Bring in applied users, policymakers, and scientific and technical experts to showcase their projects • Foster discussion and collaboration across experts in the field	Semi-annual	• Technical collaborators • Scientific experts • Users • Policymakers and regulators • Industry groups

6. Metrics of Success

While the final key performance indicators (KPIs) for this project will be captured in the implementation plan, there are some metrics that are unique to user engagement. Some KPIs that align to multiple objectives may be repeated. These KPIs have not been validated and mapped to specific data sources.

Objective	KPIs
Engage users across the federal, state, tribal, academic, private, and community sectors.	• Total number of users engaged • Type of users engaged (by sector) • Number of engagement activities held
Collaborate with users throughout the development process.	• Number of engagement activities held • Pieces of user feedback shared with developers • Number of community updates shared
Leverage commercial sector best practices and expertise in product development.	• Number of commercial or private sector users engaged in development • Number of peer-reviewed publications and methodological endorsements • Feedback from commercial user groups
Develop a product that is useful, usable, and used.	• Overall stakeholder satisfaction and feedback on product utility • Number of user needs translated to final product requirements • Results of usability testing
Build community awareness of PMP updates and implementation.	• Number of engagement activities held • Quantity of feedback from practical users • Metrics on newsletter updates and website visits
Facilitate adoption of modernized PMP across sectors.	• Uptake of modernized PMP guidance in policy and planning • Timing of when industry guidelines are updated and released • Community uptake of training materials
Build long-term capacity for updating PMP.	• Number of peer-reviewed publications and methodological endorsements • Number of scientific and technical users engaged • Number of conference presentations.
Improve the resilience of critical infrastructure across the nation.	• Evidence of improvements to risk planning in critical infrastructure sectors • Positive feedback from industry groups and users • Impacts of extreme precipitation events on facilities incorporating modernized PMP

7. Risk Management and Adaptation

There are risks inherent in any stakeholder engagement and partnership approach. The following table is not a complete list of risks; rather, it identifies some of the common risks that emerge in these types of activities and captures some potential mitigation approaches. The PMP development team will maintain an overall risk register, which may draw on the below.

Risk	Probability	Impact	Mitigation Approach
Difficulty identifying users to engage.	Low	Medium	Work closely with a subset of super-users who have already indicated high levels of interest to identify target organizations and individuals for outreach.
Limited engagement from the user community.	Medium	High	Implement multiple mechanisms for feedback; collaborate with national industry organizations to identify opportunities to collect input.
Difficulty reaching users at the right level of expertise	Medium	Medium	Collaborate with identified stakeholders and super-users to identify the right mix of users; hold brief pre-meetings with new user groups to identify their typology and identify the appropriate representative.
Failing to incorporate user input into product development	Low	High	Hold regular check-ins with the product development team to share findings; identify the best strategy and timing to incorporate user input into development.
Improper management of personally identifiable information (PII)	Low	Medium	Follow all applicable NOAA guidelines and procedures to protect PII; ensure all staff are trained on PII protocols.
Recruiting and retaining qualified user engagement experts	Medium	Medium	Collaborate closely with scientific and technical experts in the private sector to supplement expertise.
Securing funding for user engagement activities	High	High	Collaborate closely with office leadership to identify and advocate for funding needs; develop light-lift engagement strategies as backup.

Continuous Improvement

Finally, any effective engagement project benefits from interaction with users and a commitment to continuous improvement. This project will implement the following strategies to improve over time:

- Review project activities on a regular cadence and identify efficiencies and opportunities for improvement.
  - Rapid response convenings can be held for finalizing urgent decision-making or disputes.
- Bring users in throughout the development process, tracing user needs to technical requirements and final release.
- Conduct regular retrospectives after engagement phases to identify lessons learned and adjustments.
- Share regular updates with the user community and solicit input and feedback.