DEPARTMENT OF THE ARMY EC 1105-2-412
U.S. Army Corps of Engineers
CECW-CP Washington, D.C. 20314-1000

Engineer Circular
No. 1105-2-412 30 Dec 2009

EXPIRES 30 DEC 2010
Planning
ASSURING QUALITY OF PLANNING MODELS

1. Purpose. This circular establishes the process and the requirements for assuring the quality of planning models.

2. Applicability. This circular applies to all USACE elements, Major Subordinate Commands (MSCs), and district commands having Civil Works responsibility. This guidance applies to planning models as defined in Paragraph 5 of this Circular.

3. References:

a. Engineer Regulation 1105-2-100, Planning Guidance Notebook, April 2000.
b. Report of the Planning Models Improvement Task Force, September 2003
c. The Information Quality Act, Public Law No. 106-554
d. Office of Management and Budget, Final Information Quality Bulletin for Peer Review, Federal Register Vol. 70, No. 10, January 14 2005, pp 2664-2677
e. Engineering and Construction Bulletin 2007-6: Model Certification Issues for Engineering Software in Planning Studies

4. Background.

a. The Corps of Engineers Planning Models Improvement Program (PMIP) was established in 2003 to assess the state of planning models in the Corps and to make recommendations to assure that high quality methods and tools are available to enable informed decisions on investments in the Nation's water resources infrastructure and natural environment. The main objective of the PMIP is to carry out "a process to review, improve and validate analytical tools and models for U.S. Army Corps of Engineers (USACE) Civil Works business programs". In carrying out this initiative, a PMIP Task Force was established to examine planning model issues, assess the state of planning models in the Corps, and develop recommendations on improvements to planning models and related analytical tools. The PMIP Task Force collected the views of Corps leaders and recognized technical experts, and conducted investigations and numerous discussions and debates on issues related to planning models. It identified an array of model-related problems, conducted a survey of planning models, prepared papers on model-related issues, analyzed numerous options for addressing these issues, formulated recommendations, and wrote a final report that is the basis for the development of this

Circular. The Task Force considered ongoing Corps initiatives to address planning capability, and built upon these where possible.

b. The process of assuring quality and effectiveness in planning models will be based on a few simple but fundamental principles:

- Confidence and transparency in models are of the utmost importance
- Models and methods should keep current with advancements in knowledge, technology and Corps policy
- Model documentation must be clear and thorough - agency and external review panels must have enough information to understand the model, its intended usage, and its limitations
- Practicality is necessary in data requirements as well as ease of use
- Flexibility in models is needed for a wide range of applications
- No more "home grown" models – models must be developed in collaboration with the Planning Community of Practice, not in isolation
- Success will be:
  - Complete toolbox of models
  - Trained users
  - Corporate process to keep models current
  - Appropriate, timely and cost-effective analysis to support decision making

5. Definitions:

a. Planning models - For the purposes of this Circular, planning models are defined as any models and analytical tools that planners use to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision-making. It includes all models used for planning, regardless of their scope or source, as specified in the following sub-paragraphs. This EC does not cover engineering models used in planning which will be certified under a separate process. Planning models are categorized according to their origins, as follows.

1) Corporate models – developed by Corps laboratories/Field Operating Agencies (FOAs) which have nationwide applicability (HEC-FDA, IWR-PLANNING SUITE, BEACH-FX, etc.)

2) Regional/local models – typically developed by district offices to addressa particular local project/problem, and could have broader regional applicability. This category includes all spreadsheets and software applications developed by analysts for planning purposes as well as specific applications of commercially developed software (e.g., @RISK based applications).

3) Commercial off-the-shelf (COTS) models – developed by private industry that may have applicability to Corps planning.

4) Models developed by others– developed by other Federal agencies, non-Federal government entities (states, counties, etc.), Non-Governmental Organizations (NGOs) or academic institutions that may have applicability to Corps planning.

b. Certified model. A planning model that has been reviewed and certified by the appropriate Planning Center of Expertise (PCX) and Headquarters (HQ) in accordance with the rules and procedures specified in this Circular. Model certification is a corporate determination that the model is a technically and theoretically sound and functional tool that can be applied during the planning process by knowledgeable and trained staff for purposes consistent with the model's purposes and limitations. Only models developed by the Corps of Engineers will be certified.

c. Approved model. A planning model that has been reviewed and approved by the appropriate PCX and HQ in accordance with the rules and procedures specified in this Circular. Models will be considered for approval (rather than certification) if they have been developed by an entity outside the Corps. Models will also be considered for approval in cases where a model has been developed by the Corps and is viewed by the vertical team (including the District, MSC, PCX, and HQ) as single-use or study-specific (which will include many ecosystem output models). Model approval is a corporate determination that the model is a technically and theoretically sound and functional tool that can be applied during the planning process by knowledgeable and trained staff for purposes consistent with the model's purposes and limitations.

d. Planning Centers of Expertise (PCXs). The PCXs were established in 2003 to enhance the Corps planning capability for inland navigation, deep-draft navigation, ecosystem restoration, hurricane and storm damage reduction, flood damage reduction and water reallocation. The PCXs are part of a national initiative to improve the quality and effectiveness of the Corps water resources planning program. The PCXs will be responsible for the implementation of the certification and approval assessment processes stated in this EC

e. Proponents. Model certification proponents are any districts, MSCs, Corps laboratories, model developers or Headquarters that identify a need for and request certification

f. Model Certification Headquarters (HQ) Panel. The Planning Community of Practice (CoP) and CECW-P will establish and select members for a Model Certification HQ Panel to serve in a deliberative role to support the Planning CoP in its decisions associated with model certification. The panel will be headed by a senior member of the Planning CoP and will consist of representatives from CECW-P (including the Office of Water Project Review), CECW-E, the Institute for Water Resources, and other offices as appropriate. The panel will be selected to represent disciplines including engineering,

plan formulation, economics, and ecosystem restoration. CECW-P, in consultation with the panel, will make the final decision on all model certification and approval actions.

g. Peer Support. A means of assisting in the development of new models, or revision of existing certified models, that consists of ongoing involvement of expertise from inside and outside of the Corps and other technical/administrative support as appropriate.

6. Policy. Use of certified or approved models for all planning activities is mandatory. This policy is applicable to all planning models currently in use, models under development and new models. District commanders are responsible for delivering high quality, objective, defensible, and consistent planning products. Development of these products requires the appropriate use of tested and defensible models. National certification and approval of planning models results in significant efficiencies in the conduct of planning studies and enhances the capability to produce high quality products. The appropriate PCX will be responsible for implementing the model certification/approval process. The goal of certification/approval is to ensure that Corps planning products are theoretically sound, compliant with Corps policy, computationally accurate, and based on reasonable assumptions regarding the availability of data. The use of a certified/approved model does not constitute technical review of the planning product. The selection and application of the model and the input data is still the responsibility of the users and is subject to Agency Technical Review and Independent External Peer Review (where applicable). Once a model is certified/approved, the PCXs will be responsible for assuring that model documentation and training on the use of the model are available (either from the PCX or the model developers), and for coordinating with model developers to keep the model to reflect current procedures and policies.

7. Criteria for Model Certification. Technical soundness is the primary criterion on which model certification/approval decisions will be based. Technical soundness reflects the ability of the model to represent or simulate the processes and/or functions it is intended to represent. The performance metrics for this criterion are related to theory and computational correctness. In terms of the theory, the certified model should: 1) be based on validated and accepted “state of the art” theory; 2) be consistent with Corps policies and requirements; 3) properly incorporate the conceptual theory into the software code; and, 4) clearly define the assumptions, sensitivities, uncertainties, and known limitations inherent in the model. In terms of computational correctness, the certified/approved model should: 1) be free of computational errors and employ proper numerical/mathematical methods to estimate functions and processes represented; and, 2) adequately characterize, estimate and forecast the actual parameters it is intended to represent. A certified/approved model will stand the test of technical soundness and theory, computational correctness and usability These criteria are discussed in more detail in Section 3a of Appendix A,

8. Certification/Approval Process.

a. As soon as a model need is identified, the proponents in coordination with the applicable PCXs will determine whether a model exists for their specific needs. If there

is an existing model that meets the needs and requirements of the proponents and it had been previously certified, use of the model will be approved for the planning effort. PCXs, upon request, can recommend sources of training and technical support. If the existing model is not certified, the process described in Exhibit 1 will be used for certification. If no model is available to meet the needs and requirements, the proponents will decide whether to develop a new model (in-house or through a Corps laboratory), to modify an existing model or to purchase a commercial application. In these cases, the process to certify these models is described in paragraph 9 of this EC. Figure 1 summarizes the model certification process for existing or revised models. Figure 1 includes an approximate timeline for each step, which will likely vary with each application depending on model complexity, the extent of comments received during the process, PCX schedules, and other variables.

b. Each certification/approval action will require a customized certification plan akin to a PMP, both for billing purposes and for defining the scope of review. The certification plan should fulfill Steps 1-4 from the process described in Exhibit 1, as well as provide a cost estimate to the proponent. The PCX will submit each certification plan to CECW-P for approval (Step 5) prior to initiating the review.

c. Model Certification: For models developed by the Corps that are anticipated to be applied on a regular basis or in multiple settings, the PCX will implement the process to certify these models.

d. Model Approval (models developed by non-Corps entities): For models developed by entities outside the Corps, the PCX will implement the process to approve the use of these models based on an assessment of the documentation provided by the proponent that demonstrates the model satisfies the certification criteria (Appendix A).

e. Model Approval (single use): For single-use or study specific models developed by the Corps, the PCX will implement the model approval process through technical review rather than through a separate model certification process. This means that technical review will necessarily be intensive since the basic requirements of the Certification Protocols (Appendix A) requiring documentation of technical and system quality must still be met.

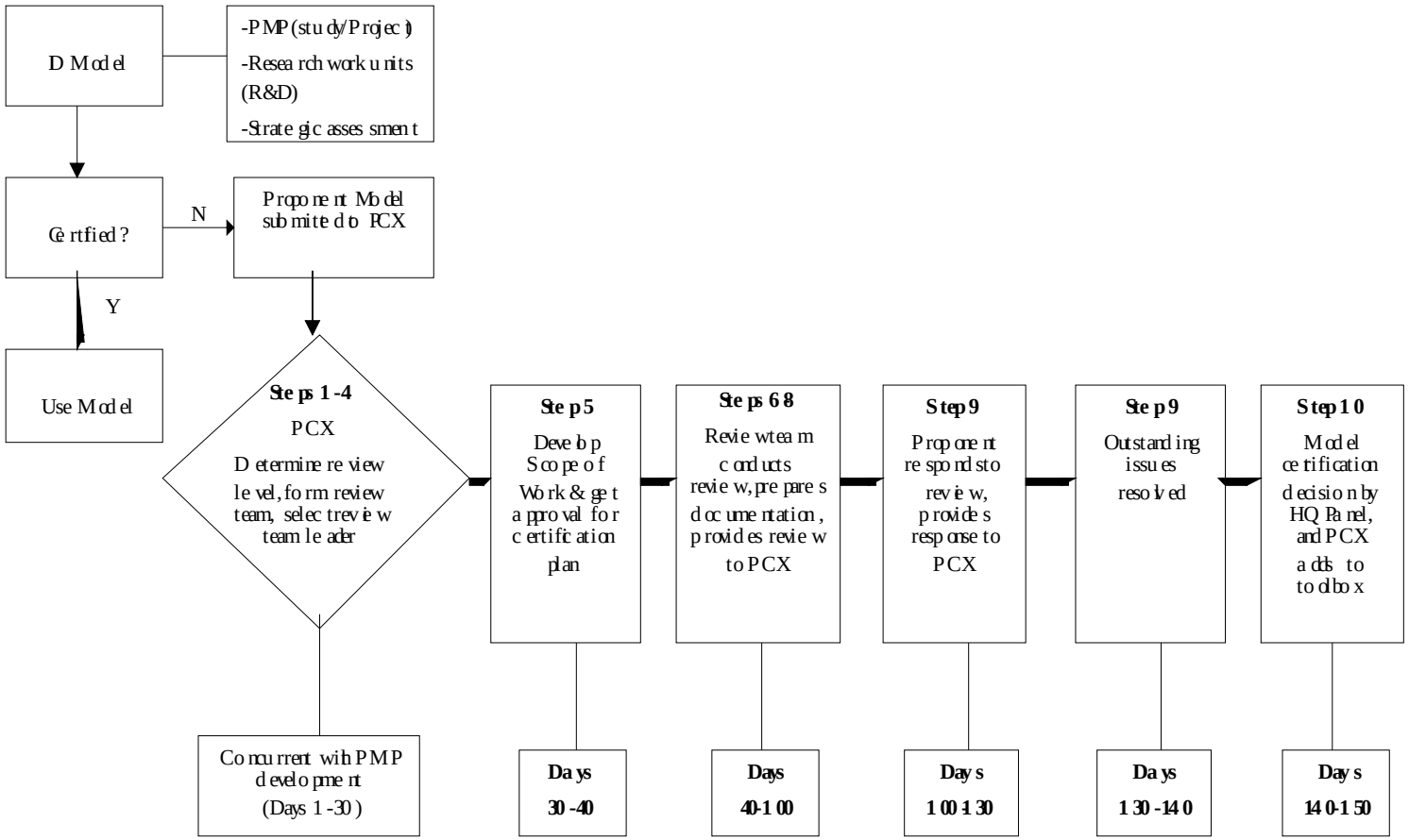
Exhibit 1 Certification/Approval Process for Existing (or Revised) Models	
Step 1	Proponent identifies model to be used for a national, regional, or local application and the PCX determines the need for certification or approval.
Step 2	Proponent submits model and documentation to the appropriate PCX.
Step 3	The PCX utilizes the following criteria to determine the appropriate level of review. The PCX has final approval on the level of review. **Level 1** review is for highly complex models used in decision-making

Exhibit 1 Certification/Approval Process for Existing (or Revised) Models	
	where there could be a high risk of making an incorrect investment decision (e.g., not justified, not optimal, etc.) that could result in major negative impacts. **Level 2** review is for models of lesser complexity than Level 1 models with lower risks of making an incorrect investment decision that could result in minimum impacts. **Level 3** review is for routine and non-complex models that have a minor impact on project decision-making **Level 4** review is for current frequently used models that were developed by Corps Districts, Corps Labs/FOAs and other agencies and contractors that have withstood historical informal reviews. The capabilities and limitations of these models are generally well understood. The review of frequently used existing products will include examination of the individual product's review documentation to determine if the product warrants certification without a level 1 or 2 review.
Step 4	The PCX establishes a review team, identifies team members, identifies the team leader, and defines the anticipated charge and scope of review. The review charge and scope should guide the product reviewers and direct them to key issues, assumptions, routines, and aspects for review. A team selected from the roster of qualified reviewers maintained by the appropriate PCX, including external and internal reviewers, will conduct Level 1 and Level 2 reviews. Level 3 and Level 4 reviews may be conducted by Corps internal experts, but the review team, as deemed appropriate by the PCX, could include external individuals as well. Protocol and procedures for the model review process will be specified in the PCX standard operating procedures (SOP) and will reflect prevailing industry practices.
Step 5	The PCX develops a certification plan to include the information from Steps 1-4, defining the scope of review. The Certification Plan (and accompanying model documentation materials) is submitted to CECW-P for approval. Written approval from CECW-P must be received by the PCX prior to proceeding with the certification review.
Step 6	Once the PCX has received approval to proceed, the PCX will hold an initial meeting to begin the certification process to assure that all participants understand the nature of the effort, as well as to discuss any particular technical or administrative issues that will be important in the review. The meeting (which can be held by teleconference) will include representatives of the PCX, the model proponent and the review team. CECW-P will be notified of the meeting and invited to

Exhibit 1 Certification/Approval Process for Existing (or Revised) Models	
	attend.
Step 7	In fulfilling its role, the review team will provide to the PCX a consolidated documentation of review comments and recommendations. The review should adhere to the review charge and scope provided by the PCX. The PCX will strive for consensus, but one or more reviewers may not concur with the views of the majority. Matters of disagreement should be addressed forthrightly in the report. As a final recourse, a reviewer may choose to prepare a brief dissent describing the issues of contention and the arguments in support of the minority view. To encourage reviewers to express their views freely, the review comments are treated as panel responses and are given to proponents with identifiers removed.
Step 8	Review comments are provided to the PCX within 90 days after submittal of the model for review to the review team. (Ninety days is the estimated maximum time for review of models in Level 1. For models in other categories, the review time will be adjusted accordingly, and is expected to be less than 90 days.) The PCX then assesses whether the review team fulfilled the charge and scope provided. When the PCX determines that the review charge and scope have been met, the comments are provided to the proponent for review and response, and a checkpoint meeting is scheduled to discuss the review comments and issues for response. The checkpoint meeting will be held with the same parties as the initial meeting in Step 6, above.
Step 9	Feedback from the proponent, within 30 days after receipt of the comments, is transferred through the PCX back to the review team until all comments are either resolved or all parties reach an agreement on outstanding issues. The PCX will strive to resolve all comments, but not all comments may be resolved. CECW-P in consultation with the HQ Model Certification Panel, the proponent and the PCX will have the final decision on comment resolution and product certification. The final decision on model certification should be made within 90 days after initial submittal of review comments to the proponent. (In cases where substantial revisions are made to the model, this time period may be longer.)
Step 10	The PCX will furnish Headquarters Planning Community of Practice Leader the documentation of the review, model documentation, and a recommendation for or against certification. CECW-P, in consultation with the Model Certification HQ Panel, will make the determination to certify or not certify the model. Upon certification, CECW-P will issue a certification memorandum and instruct the PCX to add the model to the National toolbox of certified models.

Figure 1

Existing Models Certification



9. Development and Certification of New Models. New models will continue to be required, particularly in business programs that lack corporate or commercial models. No new model development should commence without engaging the appropriate PCX. The process described in the following sub-paragraphs applies for new models developed for Corps use.

Comment [s1]: Need to include certification plan here too, since exhibit 1 is for existing models.

a. Upon recognition that a new model is needed to address an immediate or emerging Corps need, the proponent shall contact the appropriate PCX to initiate a peer support process for the modeling development effort.

b. The PCX will provide peer support for new modeling efforts. The purpose of peer support is to provide proponents with early and ongoing advice, assistance, and review from experts during the development and initial application of models. Peer support could be provided from the PCXs, HQ, MSCs, districts, IWR, ERDC, and non-Corps entities. The process will emphasize model development and model review to ensure that upon completion of the model, the development and peer review process utilized will lead to product certification. The PCX will provide or identify a source of experts to provide peer support to develop a new model or modify an existing model as required. The PCXs will identify and involve appropriate experts from academia, industry and other agencies as needed. Protocols and procedures for model development and review process will be specified in the PCX SOP (for the new model to be developed) and will reflect prevailing industry practices.

c. Models currently under development will be considered as new models under this EC. Proponents should immediately contact the PCXs to initiate the model certification process in accordance with the procedures specified herein.

d. Proposed revisions of existing certified models will also follow the peer support process described herein.

10. Roles of PCXs. The PCXs are responsible for the implementation of the certification process as defined in this EC. Specifically, the PCXs are responsible for developing and maintaining a PMP, as defined in paragraph 14a of this Circular; for implementation of the certification process; for developing and maintaining an inventory of models to be considered for certification and identifying appropriate level of certification; for identifying models to be eliminated from use; for setting priorities for certification; for establishing and maintaining rosters of qualified individuals, both external and internal to the Corps, to serve as model reviewers; for developing the review charge and scope for each model; and, for developing a cost estimate for certification. The PCXs will incorporate certified models in the National toolbox. The PCXs will produce an annual audit of processes, activities and accomplishments of the model certification activities.

11. Models associated with business programs for which there are no designated PCX. For models associated with business programs for which there is no officially designed PCX, such as recreation, the proponents should contact CECW-CP for additional information on how to proceed for model certification.

12. PMIP Administration:

a. ToolboxTthe PCXs in coordination with CECW-CP will be the lead organizations for creating and maintaining a corporate toolbox of certified planning models. CECW-CP and the PCXs will define the information required for the toolbox of certified models. The toolbox will be maintained at a site accessible to all Corps planners for ready reference. Single-use or study specific models will not be included in the toolbox.

13. Funding mechanisms. Funding for model certification will be secured from various sources depending on the model category. For corporate models with National applicability, Headquarters will finance the costs associated with certification. For models that have specific study/local applicability, the costs of certification will be covered by the specific study or studies. The cost of certification will be considered when developing the PMP for a particular study, if the use of a model that requires certification is planned. For models of regional application, the MSCs could consider sharing the costs of certification among the districts that would use the model. Financing required for the administration of the PMIP by each PCX, other than the costs associated with model certification, will be included in the annual budget request for each PCX.

Comment [s2]: add review plans here?

14. Implementation:

a. Project Management Plan (PMP). Each PCX will develop a PMP for implementation of the requirements of this EC in coordination with other PCXs.

b. Training. PCXs will assure that training is provided on the use of certified models, either directly by the PCX or in association with the model developers such as ERDC, IWR or IWR-HEC

c. Communication. The PCXs will coordinate with the Planning Community of Practice to facilitate communication among model users, promote the toolbox, the training opportunities available, corporate models in development and future direction of the model development activities.

e. The requirements stated in this Circular are effectively immediately For new models under development or ongoing revisions to existing models, proponents should contact the PCXs immediately to initiate the certification/approval process.

FOR THE COMMANDER:

Appendix

Colonel,
Corps of Engineers
Executive Director of Civil Works