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Outline for a Bulletin on Engineering During the Planning Process for Water Resources Projects

Committee F: Engineering Activities in the Planning Process for Water Resource Projects

Foreward

Acknowledgement

Summary

The Planning Process is the decision process by which decisions for new and major modifications to existing water resource infrastructure projects are conceptualized and the feasibility justified. This bulletin applies primarily to dams, levees, and other water resource projects that deliver benefits in flood protection, hydropower, navigation, water supply, recreation, and environmental enhancement. Such projects are governed in part by regional governance, laws, and cultures and in part by the best practices in planning studies for water resource projects, the focus of this bulletin.

1. Introduction.

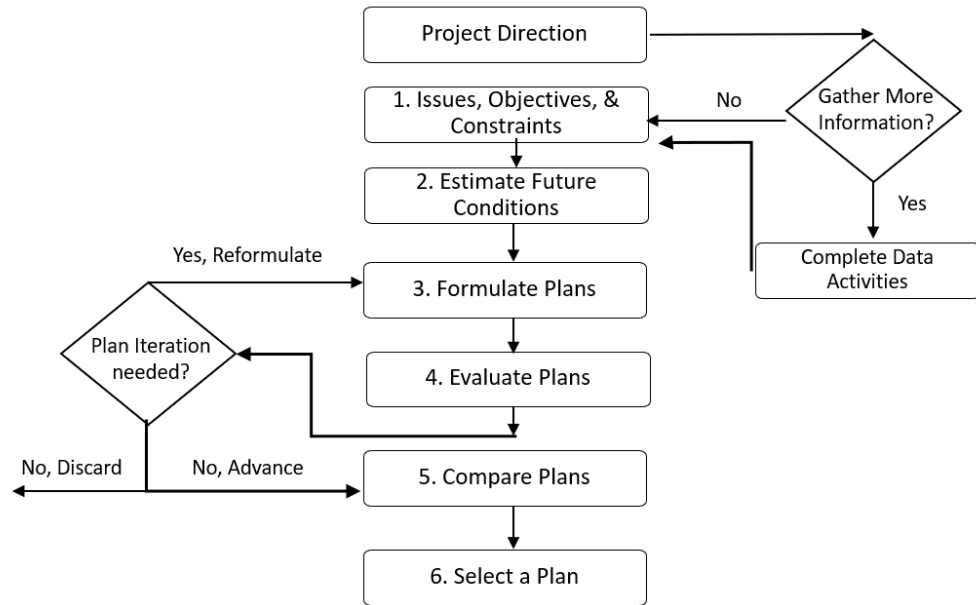
- a. Purpose of This Bulletin. The purpose of this document is to delineate a draft version of a decision-making process that can be implemented to achieve a common set of water resource principles and objectives. After the draft process is completed, an after-action review will be used to update the draft guidance with lessons learned.
- b. Background. The risk informed water resources planning process is a structured approach to problem solving which provides a rational framework for decision making. These frameworks can help answer basic questions such as: (1) should a new dam be constructed, and if so, how and where?; (2) what is the most cost effective way to improve the safety of an existing levee system? ; and (3) what is the most equitable way to consider multiple objectives and constraints in infrastructure decision-making? The framework consists of a six-step planning process used in water resource development studies to support investment in infrastructure. It applies equally to new infrastructure or major modifications (investments) to existing infrastructure. It is a process similar to that used in many business sectors in the United States.
- c. Why is Water Resource Planning for the Future So Critical? Water resource projects of the last century were planned within the context of the ethics and principles of the day, often around a central project purpose or benefit stream. With average age of dams worldwide exceeding 60 years of age, we are living with infrastructure planned for the ethics of generations ago. Today we understand that the numerous cross-cutting issues facing society, some of them as existential threats, and the place of infrastructure

systems within societies require a broader, more inclusive, and more long-term approach to how they are planned. Cross-cutting issues of today are those global concerns that span all elements of society including climate change, carbon emissions, the water crisis, land development, environmental collapse, river basin and sedimentation management, equity with indigenous peoples, and risk informed decision making – which is also part of the solution. Therefore, it is critical that we plan today's water resource projects for the uncertainty that the generations after us will face.

- d. Roles within the Planning Process. The water resource planning process demands multiple roles within the engineering and science community as input to what typically are management and/or political decision-makers.

2. Overview of Planning for Water Resource Projects

- a. Project Initiation or Pre-Feasibility Studies. A prefeasibility study is the business case that includes an evaluation of the technical feasibility, financial feasibility, market feasibility (or market fit), and operational feasibility of a potential water resources project.
- b. Decision-Making Principles Within Water Resource Planning. Because water resource projects must end with defensible and credible decisions, they should start with a common foundation of principles and objectives which guide the process. Principles are the enduring values that an organization embraces and reflects what is most important. Objectives are those specific and measurable goals that organizations establish to address water resources challenges and opportunities.
- c. Summary of the Planning Process. The risk informed planning process for water resource infrastructure follows six defined steps, some of which are conducted in iterations to refine and optimize risk reduction alternatives. It utilizes risk analysis as the primary basis for evaluating, comparing, and selecting an alternative to implement. The process is preceded by the quantitative assessment of risk. The process is conceptualized in the following diagram.



- d. Planning Studies Within the Larger Project Lifecycle. Planning studies inform the major investment decisions of water resource projects that encompass the commissioning, the rehabilitation, and the decommissioning phases of infrastructure.

3. Cross-Cutting Issues to Consider for Water Resource Planning for A Better Future

- a. Sustainable Development Goals
- b. Climate Change and Carbon Emissions
- c. Risk Informed Decision-Making
- d. Environmental Concerns and Objectives
- e. River Basins and Systems, Including Sedimentation
- f. Societal and Cultural Values

4. Planning – An Outline of the Process and Where Engineering Fits In

- a. Pre-requisites for Planning a Water Resources Project. Studies require the following activities to be determined prior to beginning:
 - i. Existing condition risk assessment. Existing condition risk assessments are typically a quantitative risk assessment (QRA) but may utilize SQRA results for

projects without loss of life or projects with well-defined risks driven by single potential failure modes. Failure modes to consider in formulation would include those at or above the societal and individual risk lines, those within an order magnitude or more of risk guidelines, and failure modes which you don't want to remain post construction.

- ii. Another pre-requisite for a Planning Study are the outcomes from the Owner's decision meeting on the specific project in question. Such outcomes typically confirm the risk classification, accept the findings of the risk analysis and the justification for action, and direct the implementation of a Planning study including any additional information needing to be collected or activities it deems necessary.
 - iii. A recognition and coordination of the activities which are to be conducted parallel to and integrated with the Planning Study are important and should be planned, to include: (1) environmental activities and documentation; (2) real estate assessments; and (3) independent reviews.
- b. Identifying the Issues, Objectives, and Constraints for the Project. The proper identification of issues, objectives, and constraints in clearly written, concise statements are the foundation for scoping of risk informed planning studies. Issue statements identify the problems to be addressed and include those failure modes and key damage states identified in the project justification. Objectives are the statements of desired results of the planning study and thus shape the risk reduction alternatives considered in the study. Although objectives are both numerically and narratively applied, it is important that the multi-criteria evaluations and comparisons be conducted based on their relative benefits, impacts, and tradeoffs, and not a weighted numerical modeling approach. Constraints are legal, policy, and resource considerations which restrict the planning alternatives and are unique to each project. As such, avoidance of constraints is an objective of the study.
 - c. Forecasting the Future Without a Water Resources Project. The future without action is an estimation of the risk most likely to exist during the period of analysis of the Planning Study if the Owner does not take action to reduce risks, and considers what others would do absent the project to address the risk. It differs from the risk assessment of the existing condition in that it looks to the future conditions within the study period.
 - d. Formulating Alternative Plans. Plans must be formulated to identify specific ways to deal with the issues identified and address the objectives within the constraints of the Study. A risk management plan consists of series of structural and non-structural risk reduction measures formulated for each of the identified issues or risk driving potential failure modes. As such, risk management measures are the building blocks of alternatives.

- e. Evaluating Alternative Plans. In this major step, each Alternative Risk Management Plan is assessed against the Future Without Action Plan for the purpose of reducing the number of plans.
- f. Comparing Alternative Plans. In this step, the remaining Alternative Risk Management Plans are compared against each other with emphasis on the effects the plans have on the required comparison metrics, including cost effectiveness. Beneficial and adverse effects of each plan should be compared and documented in a narrative. The output of the Comparison step is a ranking of plans and a tentatively recommended plan.
- g. Recommending a Selected Plan. This step is business sensitive and is therefore led by a representative of the owner with input from the Comparison plan ranking.

5. Current Applications

6. Glossary

7. References

Appendix A: List of Case Studies