Focusing on Practical Approaches to Water Management Under Climate Change Uncertainty.

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ABSTRACT:

Water resources management is in a lengthy and difficult transition phase in attempting to accommodate the large uncertainties associated with climate change. Water is the principal medium through which most of the projected impacts of global warming will be felt and ameliorated – reflected through changes in, and requirements for improved management of aquatic ecosystems which supply such basic societal services as hydroelectric power, municipal and industrial water supply, agricultural irrigation, commercial navigation and water based recreation, as well as indirect uses such as nutrient recycling, climate regulation and flood and drought mitigation. There has been a significant amount of research and many studies addressed to overcoming the challenges of a variable and changing climate. However, many of the standard water management practices, based on assumptions of a stationary climate and variability, can be effectively extended to accommodate some aspects of climate uncertainty. Adaptations of various strategies developed by the water management profession to cope with contemporary uncertainties and climate variability can also be effectively employed during this transition period, as a new family of hydrological tools and better climate change models are developed.

There are a large number of requirements for better, if not new information needs which require an emphasis on an improved understanding of non-stationary hydroclimatic concepts, with the associated development of a new family of hydrologic analytical methods for risk and uncertainty analysis. This must be coupled with substantial improvements in climate models, especially regional circulation models that can provide more reliable 30-, 60- and 90-day forecasts. These initiatives would considerably improve water management capabilities in dealing with extreme climate impacts (especially floods and droughts).

Adaptive management and the ‘precautionary principle’, as practiced by water managers, are key concepts that are central to the management of the vast network of existing water infrastructure, including ecosystem infrastructure. The same principles hold for the large proportion of water management demands subject to rainfed agriculture. The keystone of adaptive management is
much improved meteorological and hydrologic data networks. Better adaptation to flood and
drought and contingency preparedness and recovery operations is essential, for these are the
leading edge of any adaptive management strategy that is inherently geared to dealing with
uncertainty of climate variability and change, and inherently dependent on better forecasting and
real-time data collection and analysis. Improvements in seasonal and intra-annual forecasts
would offer the greatest positive changes to a broad array of water management functions –
especially for agricultural irrigation, which uses approximately 80% of the freshwater resources
of the globe, together with rainfed agriculture, and is essential to sustaining most economies of
the developing world.

The design of new water infrastructure initiatives presents the biggest challenge in the current
circumstances, i.e. the transition period, as the life of a typical project is usually 50 years or
more, and encompasses the period when climate change impacts are expected to become more
severe. Standard hydrologic methods (surface water and groundwater) are still useful, though
carefully selected climate scenarios can be applied to test the robustness of the performance of
various alternative designs to determine the ‘best’ (most risk-cost effective) design. However,
economic decision criteria and evaluation practices would need to be revised in conjunction with
the changes in hydrologic analyses. For example, the choice of the discount rate in any economic
and financial analysis, whether it be internal rate of return or classical benefit-cost analysis is the
single most important determinant of the economic/financial viability of a water project. Where
ecosystem-based measures have been introduced to better manage water resources, the impacts
of climate change on these measures must also be considered.