Ten Challenges on Technical Policies for Rivers and Coasts which Need to be Addressed in the Near Future

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With a backdrop of changes in both the natural and social environment including frequent flood damage due to climate change, imminent large-scale earthquakes, a decreasing population and declining birthrate as well as an aging population, it is more and more urgent to promote technical research and development to support policy deployment based on a philosophy of integrated river basin water management including river basin disaster resilience. As of February 2025, I present the following 10 major challenges in river and coast fields which need to be addressed in the near future. The NILIM's River department has been working on policies in close coordination and role distribution with related institutions such as Water Management and Land Conservation Bureau of MLIT, Public Works Research Institution, NILIM's Sabo Department.

1. Establishment of a river channel design method that integrates water management and the environment

We aim to achieve river management, improving the safety of water management, preserving and creating a rich river environment and ensuring efficient maintenance and management by establishing a river channel design method integrating water management and the environment. To accomplish that we are comprehensively studying, designing and constructing methods and construction goals for river channels at each river from such multi-dimensional viewpoints as water management and the environment. Moreover, we take into consideration water utilization, maintenance and management.

Photo: Hydraulic model experiment to understand polarization process of river channel

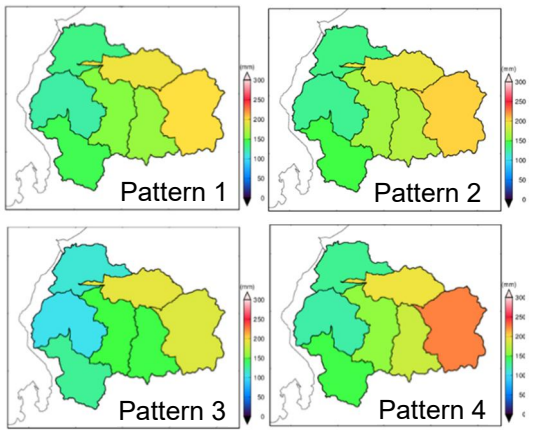
2. Improvement of prediction accuracy for sediment movement and sediment management technologies by understanding sediment dynamics

Working beyond project barriers among Sabo projects, dam projects, river projects and coast projects having sediment management issues, we aim to solve sediment issues in each field and to maintain sustainable quicksand by working on understanding sediment dynamics and efficient and effective sediment management measures with quicksand.

3. Clarification of next development reflecting the impact of climate change on basic policies

We seek to clarify the next development in river, Sabo and water resources fields including a review of river maintenance basic policies and maintenance plans utilizing the current precipitation change ratio by visualizing the impact of climate change using new climate prediction data and by studying preparation method for water management plans.

Figure-1 Examples of auto-detection of future and typical spatial rainfall distribution from large-scale ensemble climate prediction data

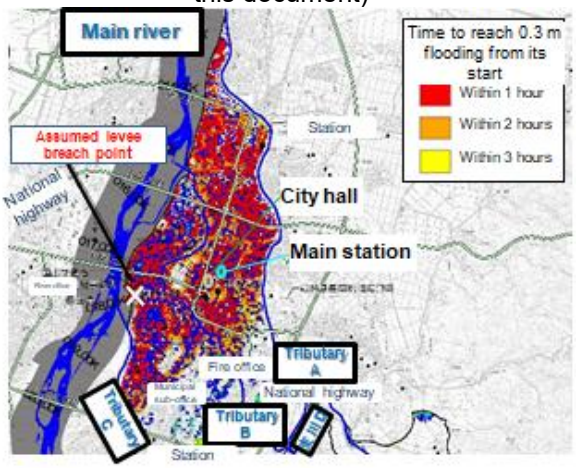


4. Visualization of change in flood risk for inland and river waters by selecting countermeasures taken for river basin water management

We aim to establish a method to confirm that the countermeasures including measures to mitigate disasters are optimal along the entire river basin and to establish countermeasures against such a risk taking into account that there will be certain areas where the situation locally deteriorates beyond the current status (organizing approaches).

Figure-2 One example of hazard index map by flooding scenario (refer to pages 54 and 55 of

this document)



5. Development of methods to improve effectiveness of evacuation activities by understanding flooding situations

We aim to ensure more accurate and more prompt disaster responses (including facility operations and drainage works by MLIT) by the Japanese government and local governments and to establish a society where companies and residents can take appropriate actions that include evacuation, making their own judgement by making it possible to predict and detect the possibility of floods and flood locations. Also to make real time reporting of flood situation (the range of flooding, flooding depth, etc.) and to make extended predictions in the future.

6. Dam's positioning taking into consideration increased external force due to climate change

For the safety and the function of dams and related facilities, we aim to propose devised works through systematic designing to reasonably secure required capability based on appropriate prediction and evaluation of the impact of an increase in external forces due to climate change.

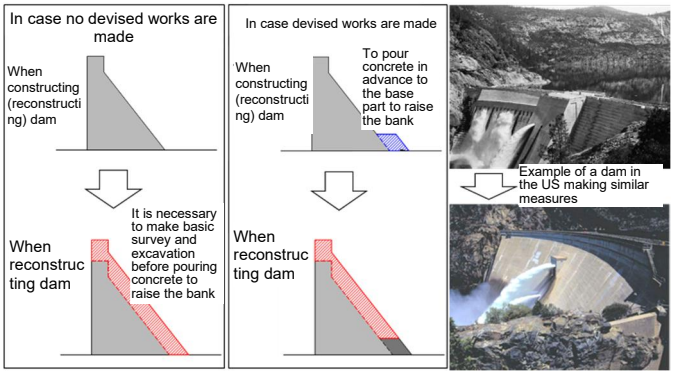


Figure-3 Devised works of dam body design preparing for future reform
(One example of bank raising-up)

7. Development of damage estimate technologies for landslides and floods

We aim to show estimates of flood damage areas taking into consideration such impacts as the potential closure of bridges caused by sediment and driftwood in areas having a propensity for landslides and floods, and to promote hardware measures such as disaster prevention in advance.

8. Quality improvement for high tide prediction

For "new climate information to prevent high tide disasters" considering waves washing up on the shore, we aim to establish a system and structure to publicly announce such information under cooperation among related institutions covering all the coastlines in Japan, by utilizing " wave height prediction" and "real time observation technologies for overtopping waves", etc. which are being newly developed, in addition to the current tide and wave prediction.

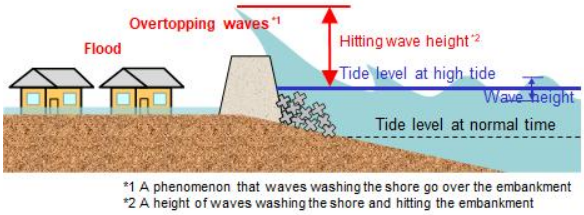


Figure-4 Flooding image after waves overtop the shore embankment

9. Study of river management methods considering the dynamism of flow volume and sediment flow

We aim to establish a society that achieves nature positivity along the entire river basin having a river as a core axis, in an attempt to harmonize a rich river environment with water management and water utilization. To accomplish this we need to secure river functions such as changes in flow volume and quicksand volume, which are important factors for a river environment.

10. Quality improvement for cost-benefit calculation method of water management projects

We aim to ensure flood risk evaluation, which is closer to the actual situation by improving the quality of cost-benefit calculation method for water management projects.

In the earthquake and the heavy rain that occurred in Noto Peninsula in 2024, it was made clear that we needed damage mitigation measures considering a series of disasters occurring within short intervals of each other . It is necessary to promote research and development for the above-mentioned challenges, trying to take initiative to utilize rapidly evolving digital technologies while flexibly responding to technology development and implementation needs.