

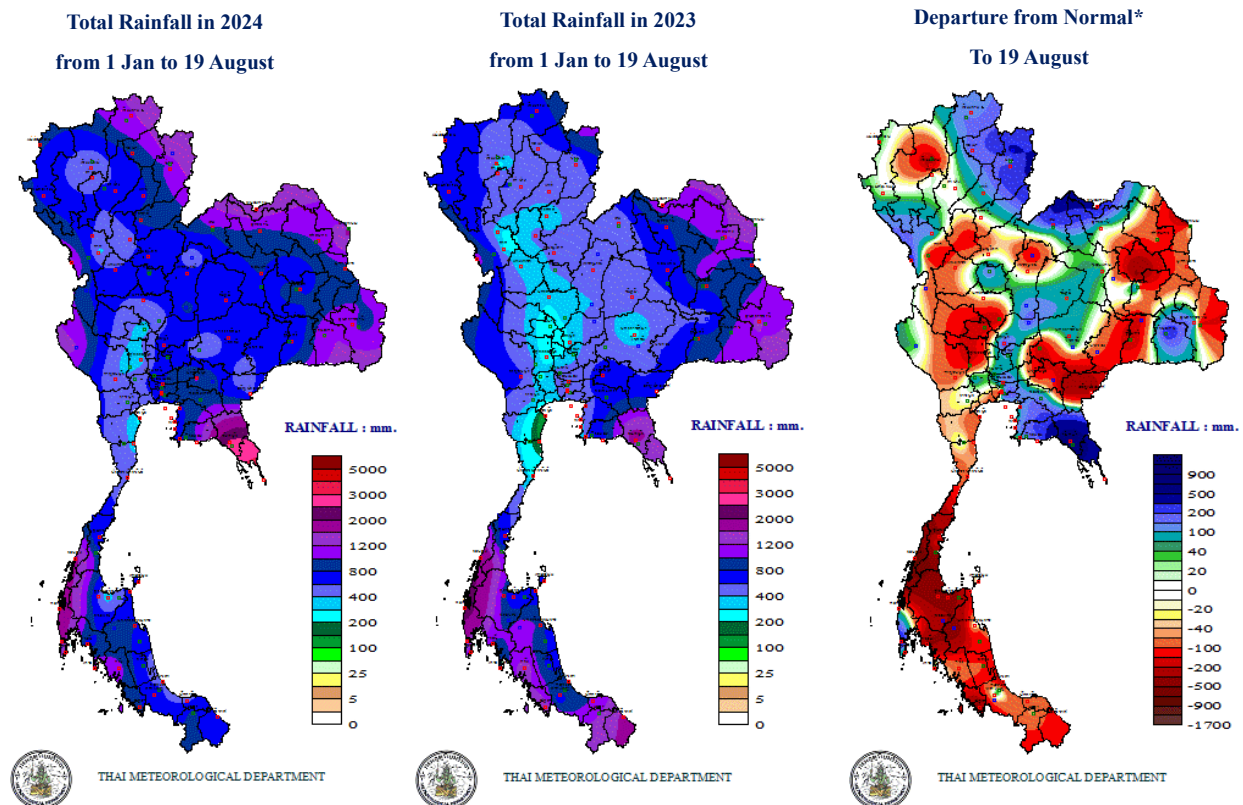
InterRisk Thailand Flood Report <2024 No.02>

Thailand Flood Risk Situation on August 2024

[Summary]

- Three months have passed since the start of the rainy season on May 21, and from now until October, rainfall will peak in many areas of Thailand. As the rainy season began, rainfall has increased significantly nationwide, and the concerns about drought that had continued since last year have been almostly resolved.
- The global climate state is currently transitioning from El Niño to neutral, and TMD and NOAA are predicting the occurrence of La Niña in the second half of this year, and the impact on rainfall in Thailand will be closely watched.
- The rain is notably high in the northeast near Mekong River and in the east near Chantaburi and Trat Provinces. From August, rain will increase and tropical storms could pass by which could cause heavy rain further leads to flash flood. The total rainfall in Thailand from August to October is expected 5 percent higher than normal. Until the end of the rainy season, it is important to prepare for flooding near rivers and drainage channels and in low-lying areas.
- There are flood situations reported in Nakhon Ratchasima, Prachinburi, Nakhon Nayok, Chantaburi, and Trat.

Precipitation



The accumulated rainfall amount of this year (until 19 August) is notably higher than last year, especially in the central, northeastern, and northern regions, whereas the rain is slightly lower than last year in the southern region. Comparing to the normal rainfall value, the accumulated rainfall amount is mainly higher than normal in the central region, and partially in the northern and northeastern regions.

* Normal value is the average rainfall amount within the period of the last 30 years.

3-Month Forecast (August-October)

According to the 3-month forecast released by the Thai Meteorological Department (TMD) at the end of July 2024, the total rainfall in Thailand from August to October is expected 5 percent higher than normal. The approximated rainfall amount in each region are as follows:

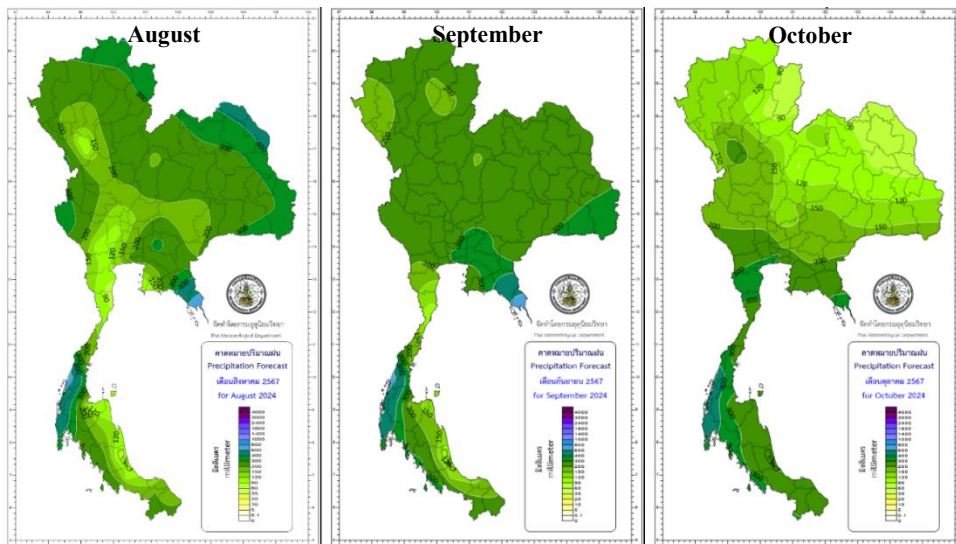
North	550-650 mm (normal 577 mm)
Northeast	600-700 mm (normal 636 mm)
Central	550-650 mm (normal 571 mm)
Bangkok and surroundings	800-900 mm (normal 782 mm)
East	850-950 mm (normal 856 mm)
South (East Side)	500-600 mm (normal 531 mm)
South (West Side)	1,200-1,300 mm (normal 1,217 mm)



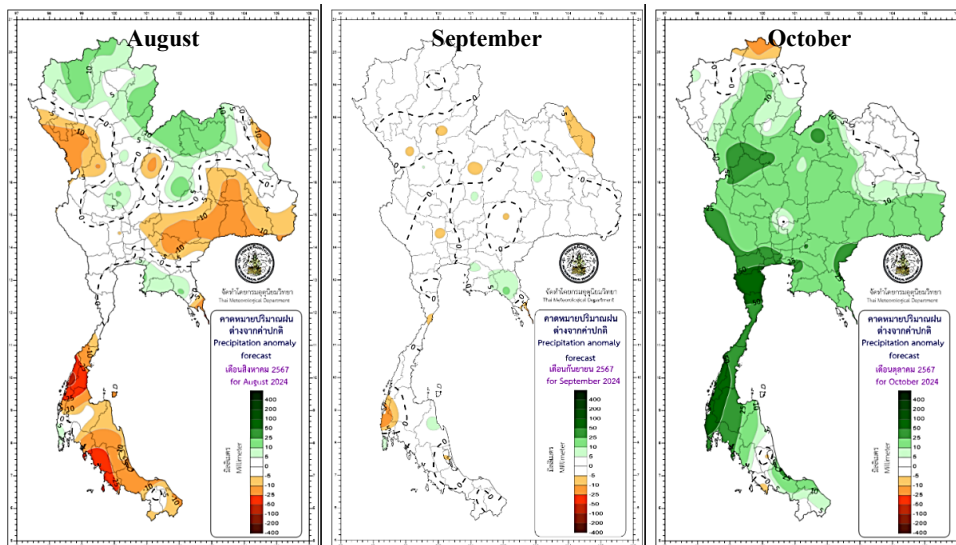
Regional division of Thailand by TMD

TMD predicts slightly above-normal rainfall in the northern and eastern parts of the country in August, and above-normal rainfall over a wide area in October. And rainfall will increase and tropical storms could pass until September by which could cause heavy rain further leads to flash flood. The expected rainfall and rainfall amount comparing to normal of each region in August to October is shown in the below figures.

Expected Rainfall



Expected Rainfall Comparing to Normal

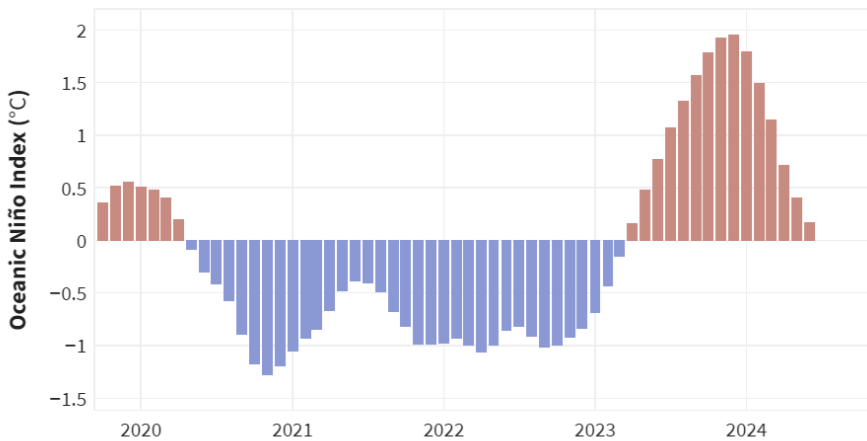


(Source: TMD, released on 30 July 2024)

Prediction of the start of La Niña and its impact to Thailand

El Nino and La Nina are global climate phenomena caused by fluctuations in ocean surface temperatures in the equatorial Pacific. TMD has shown the study of monthly rainfall and temperature during 1951-2000 (50 years). The result shows that the rain is higher than normal in most La Nina years, specifically in summer and winter periods. However, it is also found that La Nina has more effect on temperature than rain.

The National Oceanic and Atmospheric Administration (NOAA) measures the Oceanic Niño Index (ONI), an index of the occurrence of El Niño/La Niña, from the ocean surface temperature in a specific area. Periods when the ONI is 0.5 or higher are defined as El Nino, and periods when it is -0.5 or lower are defined as La Nina. The trend of ONI since 2020 is shown in the figure below:



Remark

El Nino: A warming of the ocean surface, or above-average sea surface temperatures, in the Central and Eastern tropical Pacific Ocean. In El Nino year, the Western Pacific, including Australia and Asia will be hot and dry.

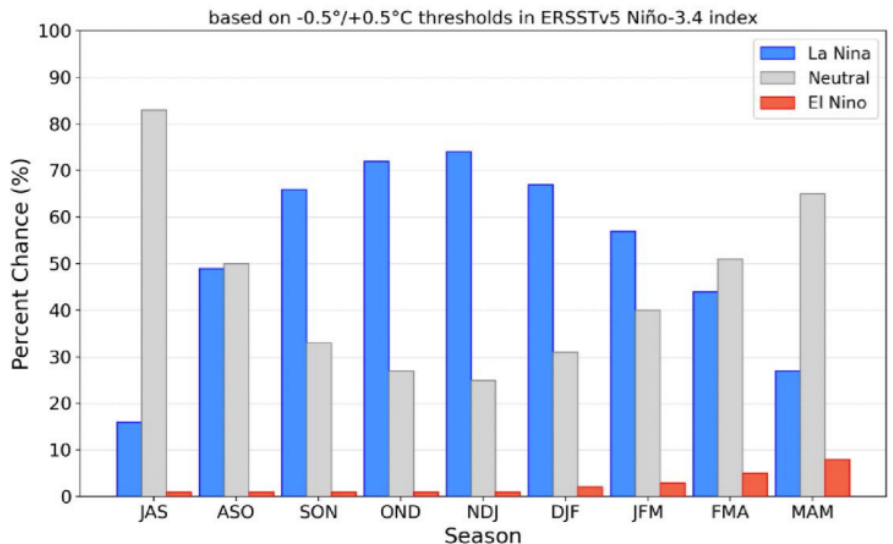
La Nina: The periodic cooling of ocean surface temperatures in the central and east-central equatorial Pacific. In La Nina year, the Western Pacific, including Australia and Asia will be cool and wet.

(Source: Climate.gov, NOAA, confirmed on 20 August 2024)

Most recently, El Nino occurred from mid-2023 to early 2024, but ONI is currently on a downward trend and is neutral in mid-2024. NOAA predicts a high probability of La Nina occurring in the second half of this year and continuing at least until the end of the year. Meteorological agencies in Thailand (TMD), Japan (Japan Meteorological Agency), Australia (BOM), and other countries have also announced forecasts of similar trends.

NOAA's latest forecast indicates that there is an 80% or higher probability of climate neutrality in July-September, and a 50% or higher probability of a La Niña occurring in the following 6 months.

Official NOAA CPC ENSO Probabilities (issued August 2024)



Monthly probability* of El Nino/La Nina from July-September 2024

*Calculated from the difference of 3-month ocean temperature normal value

(Source: Climate Prediction Center, NOAA, updated on 8 August 2024)

Preparations by government for the predicted rainy peak season

The Thai Meteorological Department (TMD) has expected La Nina to begin during July-September and continues until during December 2024 to February 2025. As a result, rain will increase in the second half of the year and temperature will be lower in winter comparing to last year. Comparing to last year, the rain is expected to be higher in July and August, lower in September and November, and similar in October and December.

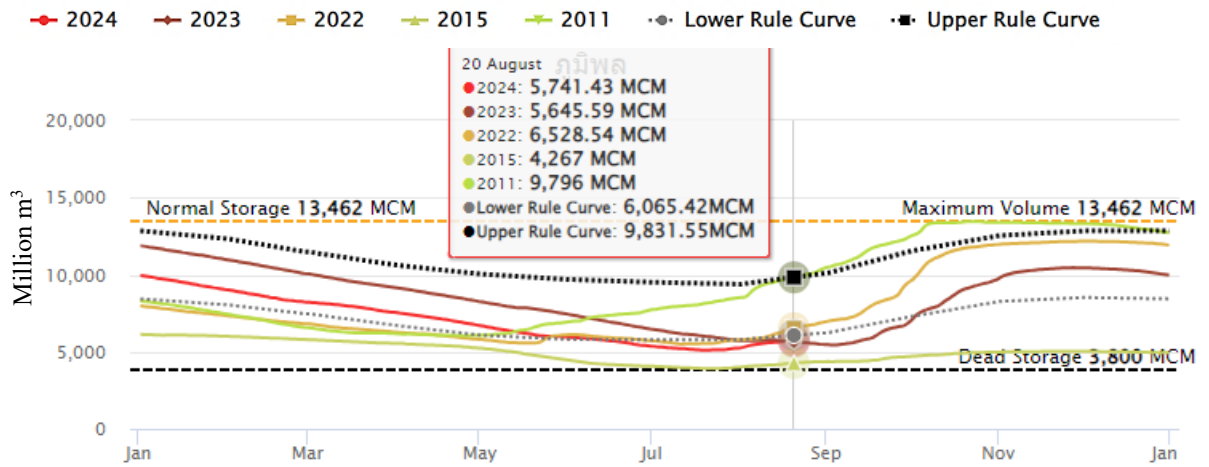
The Office of the National Water Resource (ONWR), accompanied with other related organizations have begun to drive all 10 rainy season countermeasures (mentioned in the our previous news article issued in May 2024), together with forecasting the rainfall quantity, climate condition, and tropical storms to ensure that the 2011 flood situation will not recur.

Due to a possible approaching of monsoon troughs in August and September, the rainfall amount is expected to be 20 percent higher than normal in the Chao Phraya River Basin, especially in the lower section that flow and level of the related rivers and canals could become concerning. The rainfall condition could affect historic sites, industrial estates, and agricultural areas. Therefore, ONWR is the main in charge for monitoring and managing the situations. 4 monitoring points of the Chao Phraya Basin are designated at Station Y.4 in Sukhothai, Station C.2 in Nakhonsawan, Station C.13 at Chao Phraya Dam, C29A in Ayutthaya Province.

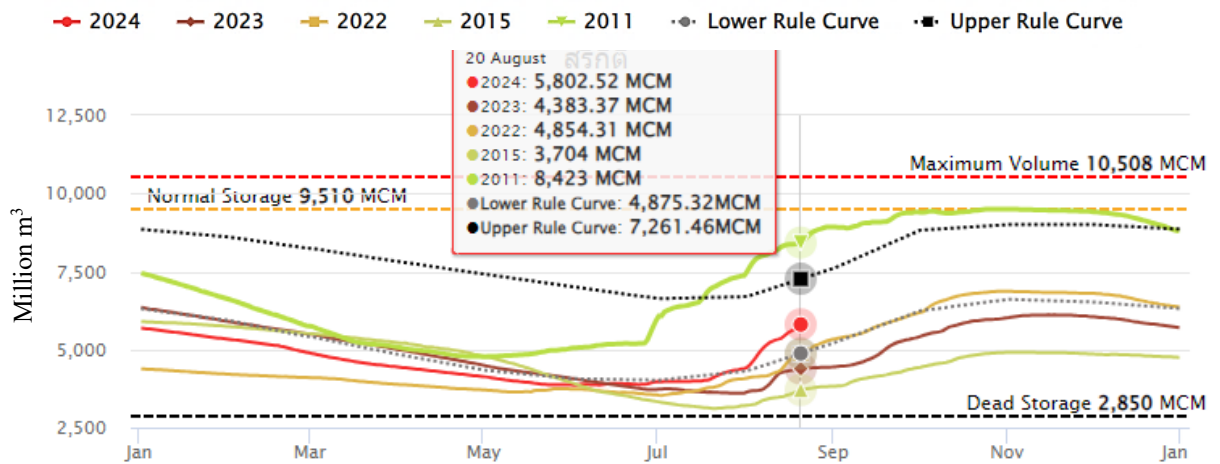
For the industrial estate protection measures and response plans, the Industrial Estate Authority of Thailand (IAET) has planned the active protection measures in terms of infrastructure improvement, drainage system improvement and provisional catchment area arrangement, and emergency flood measures drill to maintain operations and mitigate damage. The 24-hour situation monitoring is in charge by the Environmental Monitoring and Control Center. The industrial estates are separated into 2 groups which are 15 industrial estates that are completely governed by IEAT and 53 industrial estates that are co-governed with private sectors. The IEAT can fully focus on the first group. The IEAT also updates the flood protection in Bangpoo Industrial Estate as of 2023, the additional drainage systems have been constructed by the installation of the smart water management and supervisory control and data acquisition (SCADA) which are able to real-time monitor and analyze the situation to reduce the water discharge to community and instead mainly drain the water to canals connected to the sea, together with sealing the weak points at the earth dikes. The SCADA system should be installed at all industrial estates but due to limited budget, the industrial estates that have risk are first chosen to install.

Dam storage level (Bhumibol dam, Sirikit dam)

Storage level Bhumibol Dam : 38% (20 July 2024) → 43% (20 August 2024)



Storage level Sirikit Dam : 43% (20 July 2024) → 61% (20 August 2024)

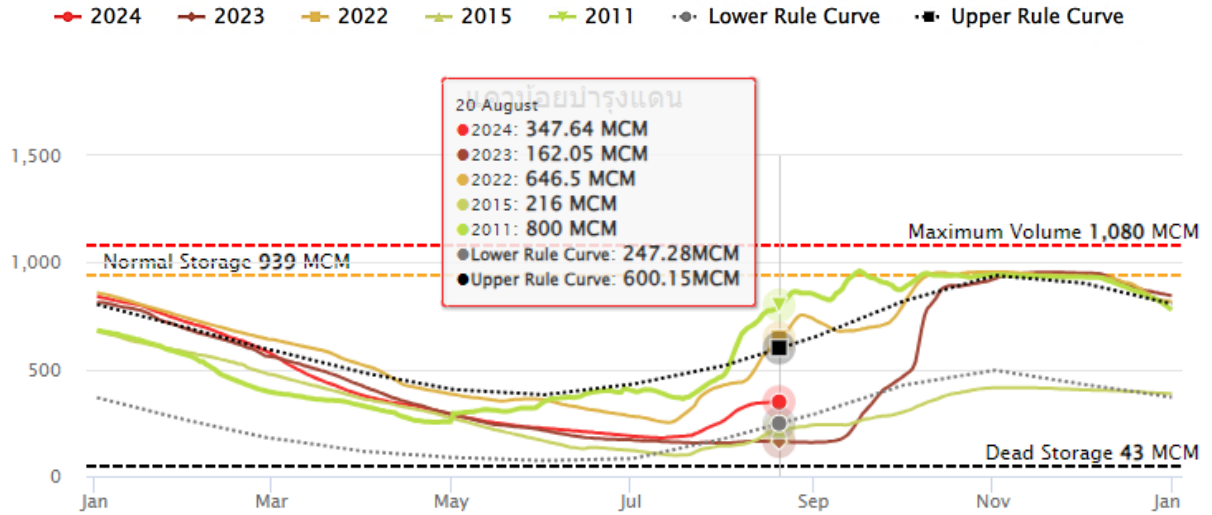


(Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

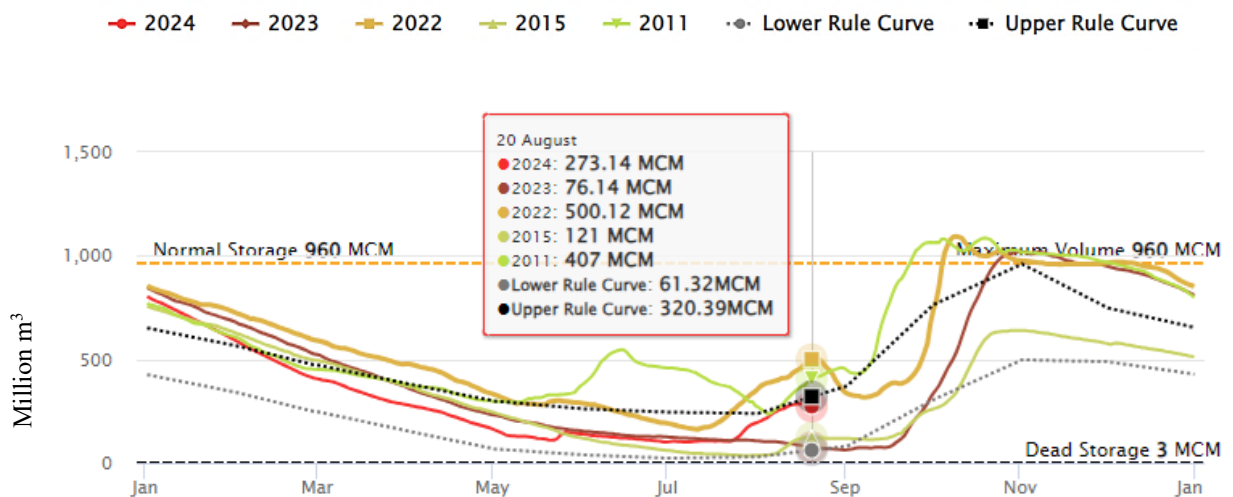
The storage levels of both Sirikit Dam and Bhumibol Dam are currently in a slightly increasing trend. The storage levels of both dams are still lower than the “lower rule curve” which could imply the preparation of the incoming heavy rain season. Only Sirikit Dam began to have an obvious increasing trend from August, higher than 2022 but lower than 2011.

Dam storage level (Kwaenoi dam, Pasak dam)

Storage level Kwaenoi Dam : 20% (20 July 2024) → 37% (20 August 2024)



Storage level Pasak Dam : 11% (20 July 2024) → 28% (20 August 2024)



(Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

The storage levels of both Kwaenoi and Pasak dams are increasing. The trends of both dams are changing to abrupt increasing. The current storage level of Pasak Dam is close to 2011, whereas the storage level of Kwaenoi Dam is still lower than 2011 and 2022. Historical trends show that water levels at both dams increase significantly from September to October, so a further increase in water storage is expected towards the end of the rainy season.

The upper Chao Phraya river flow

The parts of upper Yom River are currently at Critical level, with high flow rates. There is no concern about flooding in other areas. The water flowing down to the Lower Chao Phraya via the Chao Phraya Dam significantly increased comparing to May.

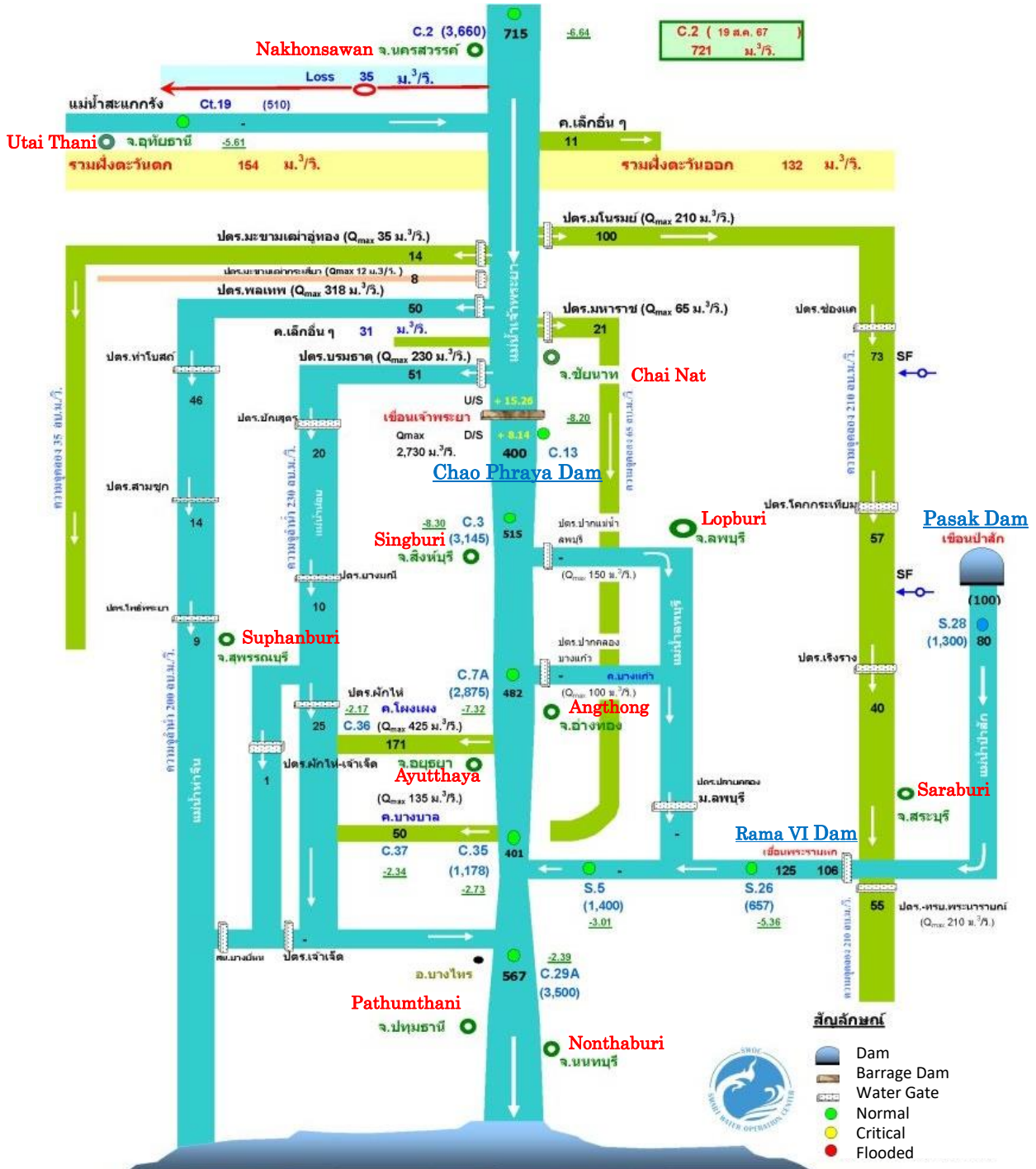


Note: - Numbers in bracket indicate the flow rate of water in m³/sec.
 - Numbers with underline indicate higher (+) or lower (-) of water level than the river bank in meters.
 - Water levels U/S and D/S are in meters.

Water Situation in the upper Chao Phraya River on 20 August 2024
 (Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

The lower Chao Phraya river flow

There is no notable change in the Lower Chao Phraya River which is also still low. There are no notable flood events.



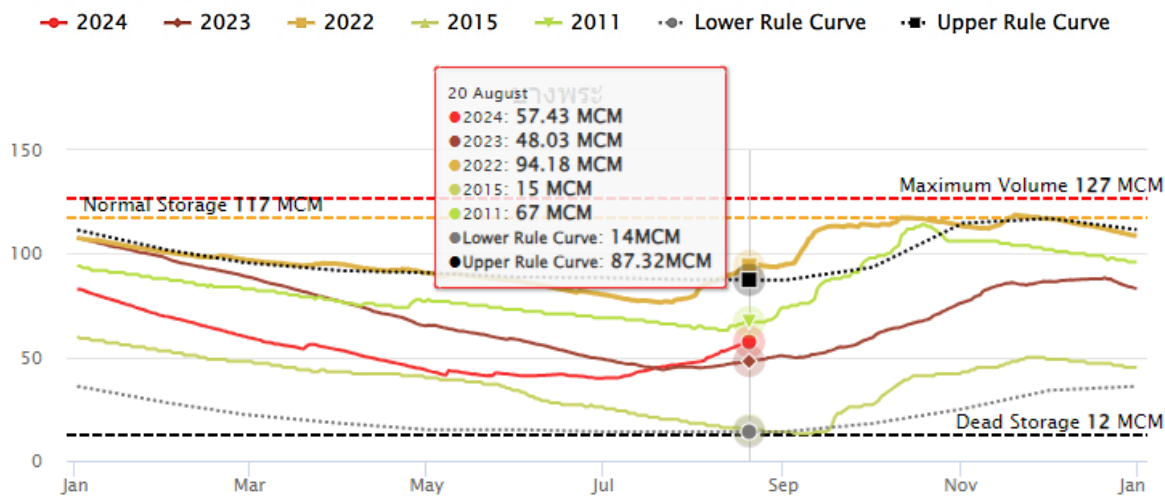
Note: - Numbers in black indicate the flow rate of water in m³/sec.
 - Numbers in bracket the flow rate of water in m³/day.
 - Numbers with underline indicate higher (+) or lower (-) of water level than the river bank in meters.

Water Situation in the lower Chao Phraya River on 20 August 2024

(Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

Reservoir storage level in eastern region (Chonburi province)

Storage level Bang Phra reservoir : 39% (20 July 2024) → 49% (20 August 2024)



Storage level Nong Kho reservoir : 40% (20 July 2024) → 48% (20 August 2024)

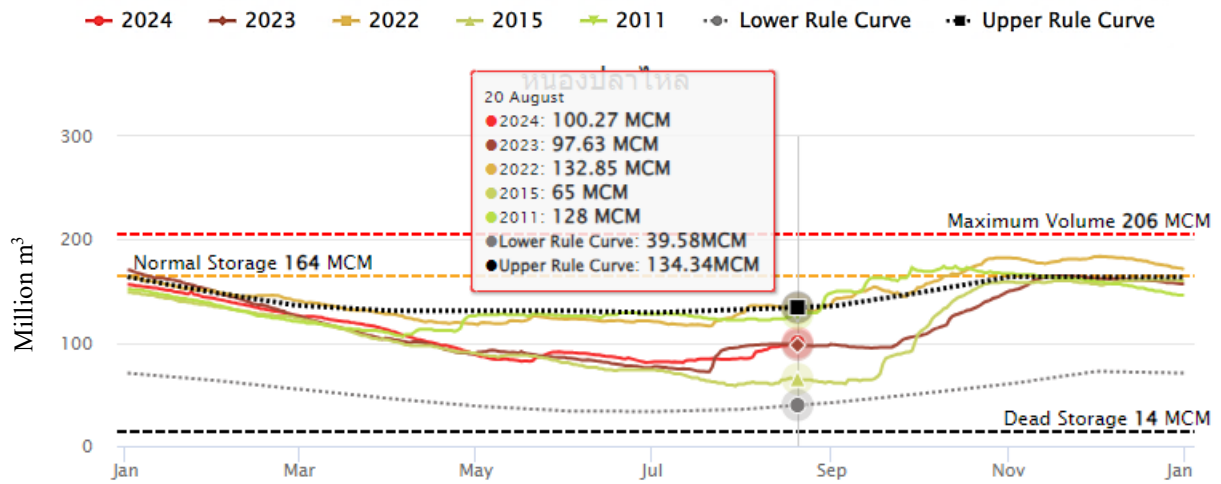


(Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

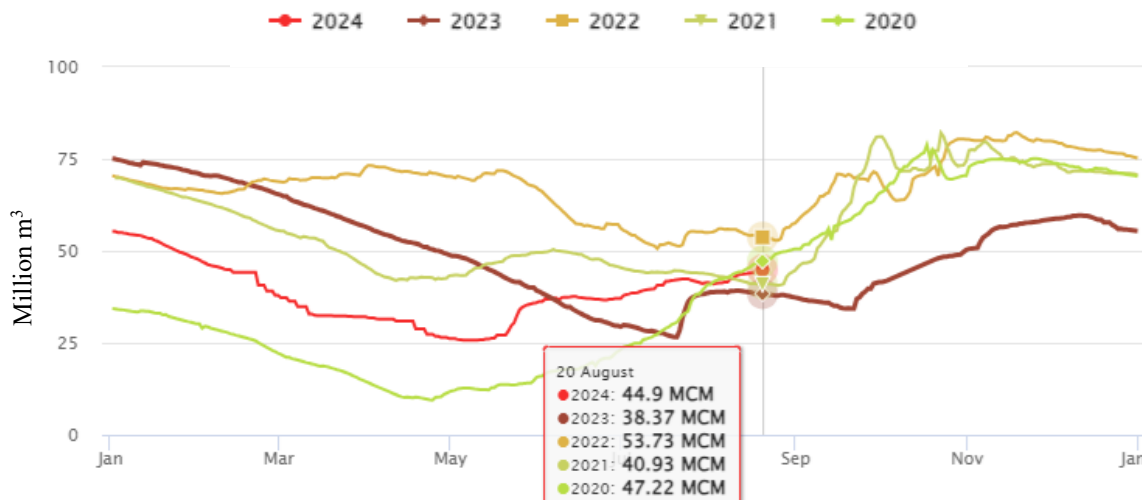
The main reservoirs in Chonburi province have continued to show an increase in storage volume due to increased rainfall since the start of the rainy season. Bang Phra's storage level is higher than the same period in 2015 and 2023, and Nong Kho's storage volume is trending towards its lowest level since 2020. Historical trends show that both reservoirs have seen a large increase in storage volume from September to October, so a further increase in storage rate is expected towards the end of the rainy season.

Reservoir storage level in eastern region (Rayong province)

Storage level Nong Pla Lai reservoir : 51% (20 July 2024) → 61% (20 August 2024)



Storage level Dok Krai reservoir : 59% (20 July 2024) → 63% (20 August 2024)



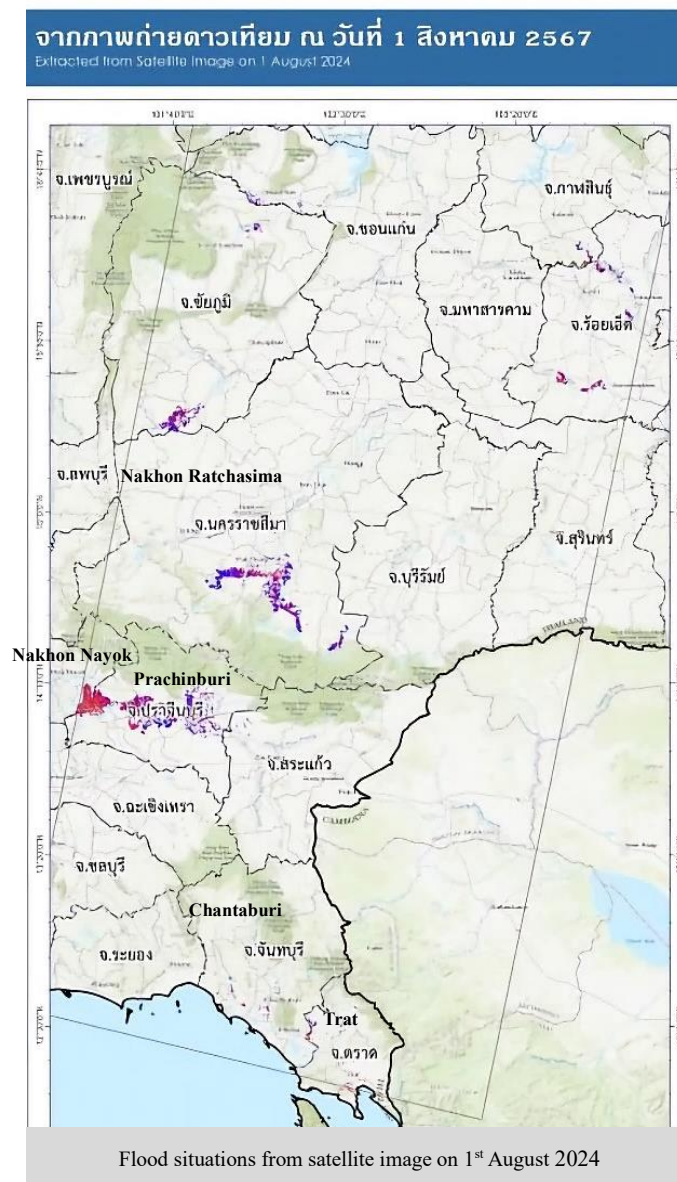
(Source: National Hydroinformatics Data Center, confirmed on 20 August 2024)

The water levels of the main reservoirs in Rayong Province continued to decline until around mid-May and were at their lowest levels since 2021. However, since the start of the rainy season, the water levels have continued to increase due to increased rainfall. Nong Pla Lai is trending towards a similar water storage level to 2023, and Dok Krai is trending towards a water storage level higher than 2021 and 2023. Based on past trends, a further increase in water storage is expected from September to October.

Flood situations in the eastern region in August

There was the flash flood in Nakhon Ratchasima and Prachinburi from Khao Yai National Park at beginning August. Later, the flood situation is notable in Muang District in Nakhon Nayok Province as there were damages occurred to the residential and business areas (resorts at the rear of the dam) during the night of August 4th. The resort owner perceived that the cause of flash flood was the excessive water release from Khundan Prakarnchon Reservoir which thereafter, the official has accepted that the cause was from a broken water gate. In addition, as there has been heavy rain in the upper part of Nakhon Nayok Province which the water in the main water channels flowed into Ong Karak District leading to floods in the residential areas and several agricultural areas. In order to mitigate the situations, the navy was requested to implement 30 water thrusting boats at Ong Karak District to push the water to the Gulf of Thailand.

There are ongoing flood situations as of August 1st in the eastern region as shown in the figure from GISTDA. The flooded areas in the east (Prachinburi, Nakhon Nayok Chantaburi, Trat) and northeast (Nakhon Ratchasima) are highlighted in the map. No reports about flooding in the industrial estates around Prachinburi have been found.



(Source: GISTDA)

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Information on flood risk consulting menu from InterRisk Asia Thailand

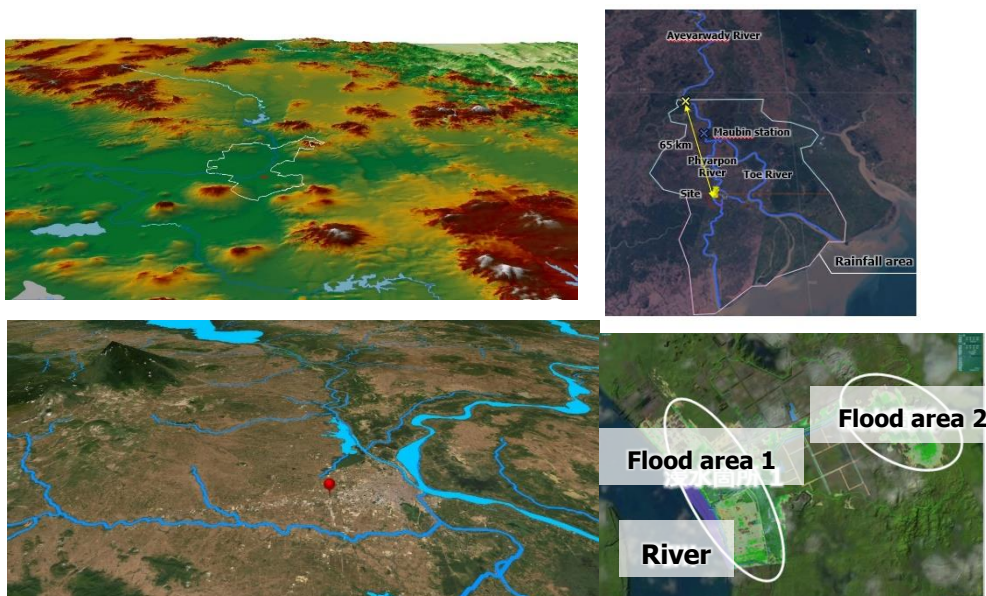
- InterRisk Asia Thailand offers various risk management menus such as flood risk assessment and on-site investigation, flood simulation, and BCP support for private companies in Southeast Asia.
- We can flexibly respond to consultations regarding flood risk, such as identifying flood risks at multiple locations, investigating the actual flood risk at individual locations, supporting the consideration of flood prevention measures, and evaluating the impact of flood risk due to climate change.



Flood Risk Assessment |

Estimation of both river flood and inland flood risks at customer's premises by using topographic data, flood history, and hazard map accompanied with the flood countermeasures.

✓ Flood Risk Survey	On-site survey is conducted to evaluate flood risk based on topographical data, past inundation history, and flood hazard accompanied with the flood countermeasures in the premises. Furthermore, opinion and recommendations provided by the surveyors are included in the report to reduce flood risk.
✓ Flood Risk Assessment	Flood risk is evaluated based on the public information to assess the elevation profile of the river, site, and surroundings, hazard map (with 100 year and 500 year-return period), and historical map.
✓ Flood Analysis by using ArcGIS	Flood hazard is estimated by using ArcGIS software to create the flood hazard map. 2D and 3D topographic images and animation are available to understand overall flood risk easily.
✓ Flood Simulation	Flood simulations using high-precision topographic maps are provided (Mesh size: 1m x 1m) to simulate the river flood and/or inland flood scenarios. The expected inundation depth regarding return period (e.g. 100 year, 200 year, 500 year) on the premises will be shown on the simulation.
✓ Flood BCP	Flood BCP service is an establishment and enhancement of effective business continuity plan (BCP) so that the supply of important products and services can be continued and to minimize the property damage during flood incident.
✓ Flood BCP Training	The flood BCP training service will give the basic knowledge of the flood BCP awareness which is suitable for the management and all employees.
✓ Flood Risk News	Flood risk news in Thailand are published once or twice a month. (Rainy season only: from May to November). The up-to-date situation on dams and river will be reported.
✓ Flood Risk Survey by Drone	Drones are utilized to survey the areas where the river flood has occurred and flood risk is increasing.



(Output image of flood analysis and simulation)