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2010 International Training Workshop on Natural Disaster Reduction

Impact and Recovery of Flood Disaster Induced by Typhoon Morakot

Water Resources Agency

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經濟部水利署 WATER RESOURCES AGENCY

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I、 Flood Disasters Induced by Morakot

- Large Scale Inundation Problem
- Hydraulic Structures Damage Problem
- Serious River & Reservoir Sedimentation Problem
- Response & Pre-Warning Capacity Problem

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Large Scale Inundation Problem

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Hydraulic Structures Damage Problem

- More than 122.8 km WRA built and 119.5 county built River, Drainage system and Coastal Dikes were damaged during Morakot.

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Some Dikes were broken by Tree Debris

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Dike Damages (built by WRA)

Type	Length of Dike Damage (m)
River Dike	116,152
Drainage System	865
Coastal Dike	5,810
合　計	122,827

Inundation Area

River	Inundation area	River	Inundation Area
Tachia Creek	0.15	Choshui Creek	0.01
Pachang Creek	11.50	Potzu Creek	15.58
Tsengwen Creek	62.00	Yenshui Creek	14.40
Kaoping Creek	3.80	Linpien Creek	21.10
Taimarli Creek	4.50	-	-
Total		133.04 km²	

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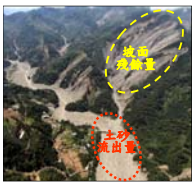
Serious River & Reservoir Sedimentation Problem

- More than 394.92 Km² hill collapse or land slide during Morakot
- The Land collapse produced 1.2 billion m³ sediment. Only 0.4 billion m³ was taken with flood, 0.8 billion m³ sediment was still accumulated on hill slope.



Total Vol. of sediment 1.2 billion
- 坡面殘餘量 0.8 billion
- 土砂流出量 0.4 billion
  - 中上游土砂量 0.15 billion
  - 中下游土砂量 0.25 billion

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Hill Collapse, Land slide, Debris flow and Natural reservoir always induce casualties

莫拉克風災共計發現18處新的堰塞湖

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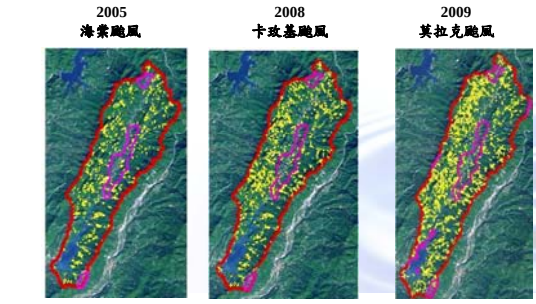
Hill Collapse in Catchment

Nan-Hua Reservoir



	2005 海棠颱風	2008 卡玫基颱風	2009 莫拉克颱風
Collapse Sites	752	1035	1592
Area	3.67 Km²	5.59 Km²	810 Km²

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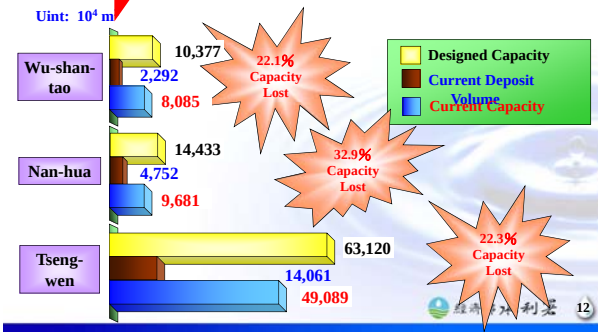
Deposit suddenly Increase in Reservoirs

After Morakot

91.62 million m³ deposit was measured in Tseng-Wen Reservoir, 17.06 million m³ in Nan-Hua Reservoir.



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River Bed Raised and Main-stream Channel Changed

旗山溪錫安山河段

那瑪夏野溪

Response & Pre-Warning Capacity Problem

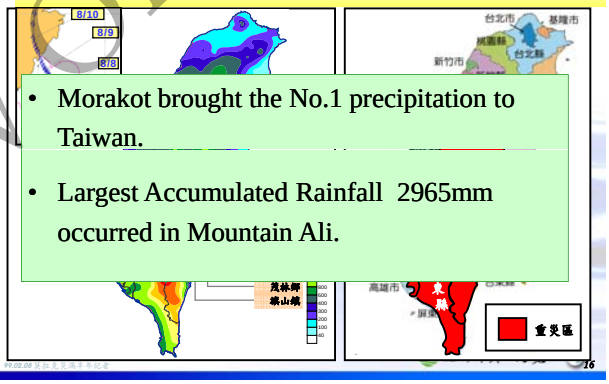
- **Manpower shortage**: Training is not professional and time is not enough. No powerful tools for pre-warning and no S.O.P. for evacuation operation.
- **Information and Communication Capacity is invalid during Large-scale Typhoon.**
- **Without Assistance of Private and Volunteer, Disaster status cannot be controlled quickly and cause mismanaged and improperly rescue.**

II、 Policy Enhancement after Morakot

Flood Management Issues after Morakot

- Long-Duration, High-Intensity and Large-region Rainfall will happen more frequently
- Compound Disaster requires new mitigation management mechanism
- Pre-Warning and Evacuation Operation should be enhanced
- Private disaster mitigation resources and Volunteer should involve properly

Morakot teached us a lesson
Disaster always knocks at a door when we slacking



- Morakot brought the No.1 precipitation to Taiwan.
- Largest Accumulated Rainfall 2965mm occurred in Mountain Ali.

Key Flood Mitigation Operations in 2010

Issue	Key Operation
Serious Sedimentation	Accelerate Scouring
Hydraulic Structures Damage	Speed recovery project
Large Scale Inundation	Upgrade Preparedness

III、 Progress of Morakot Disaster Recovery

Accelerate Scouring

Aim：**Scouring 65 million m³ before June 30th 2010**

Current Achievement：58.75 million m³ has been removed

Rate of advance 90.4%

	River Scouring (45 million m³)		Reservoir Scouring & River Sedimentation (10 million m³)	Upstream creeks scouring (10 million m³)	Total
	WRA (25)	Local Authorities (20)			
Current Aim	19.13	14.52	461.2	819.5	46.46
Status	25.09 (100.4%)	1688.5 (81.9%)	766.2 (76.6%)	961.4 (96.1%)	58.75 (90.4%)

5, May

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Scouring Operation in Kaoping Creek

Speed recovery project

1. 98.8% projects of WRA have been contracted.
2. 70.9% projects of Local Authorities have been contracted.
3. 95% of projects are expected to be finished before 31, Dec. 2010.

	Budget (billion)	Total projects Number	Projects have been contracted	Projects were already finished	Projects will be finished before 30, June
WRA	8.3	257	256 (99%)	43 (16.7%)	73 (28.5%)
Local Authorities	4.8	790	560 (70.9%)	94 (11.9%)	101 (12.8%)

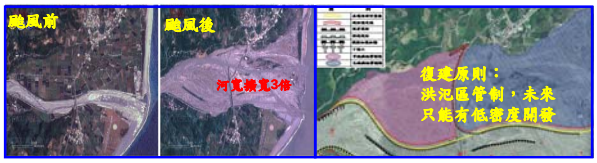
25, April

KaoPing Creek Recovery Projects

- 63 emergency projects(9.3 km long) has been done in one week after Morakot Typhoon.
- 118 emergency recovery projects (43 km long) has been finished in 3 months after Morakot Typhoon.
- 257 (123km long) recovery projects all have been contracted and progress on schedule.

TaiMarLi Creek Recovery Project

- TaiMarLi Creek is a so unsatble creek, she changes its width and main-stream channel for many times.
- Recovery project after Morakot Typhoon will consider enlarge the width of creek instead of reconstruct a new dike on old site.



Upgrade Preparedness

Aim： Staff training should done before 1, May.
All Local Authorities Staff also be trained.

- Ministry of Interior and WRA Required all local authorities doing large-scale exercises for flood mitigation and evacuation during April.
- More than 30 training workshops have been done for WRA staff, Local Authorities staff, Industrial Parks and other authorities.

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Rechecking Flood Mitigation Resources

Aim： **100% O.K. for portable Pump**


抽水機檢查

- Rechecking **636 Large Portable Pumps, 98% O.K. currently.**
- **Rechecking 1/3 of Small Portable Pumps 99% O.K. currently.**


大型移動式抽水機


中型移動式抽水機


小型移動式抽水機

- River bureaus of WRA have prepared more than 100 thousand concrete blocks, 48 thousand sand bags etc. for supporting local authorities' need.
- **WRA asked local authorities to prepare their own flood mitigation resources. There are 8660 concrete blocks and 149 thousand sand bags have been prepared.**
- WRA has rechecked the safety of **5073 hydraulic facilities.**


太空袋


砂包


防汛塊

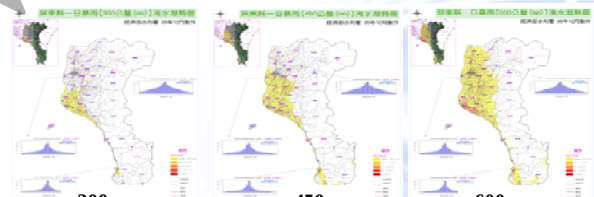
Flood mitgation resources Preparedness of Local Authorities

Local Authorities	No. of Concrete block	No. WRA suggested
基隆市政府	126	500
台北市政府	50	500
台北縣政府	638	2000
桃園縣政府	**1058**	**1000**
苗栗縣政府	40	1000
台中市政府	207	500
台中縣政府	200	1000
彰化縣政府	120	2000
屏東縣政府	676	2000
宜蘭縣政府	**1402**	**1000**
花蓮縣政府	797	2000
台東縣政府	**2269**	**2000**
澎湖縣政府	772	1000

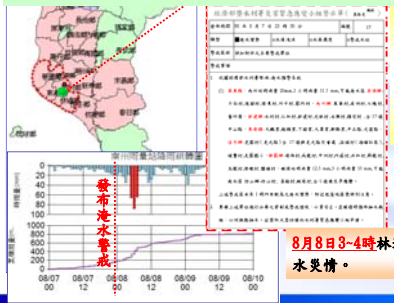
Local Authorities	No. of Concrete block	No. WRA suggested
新竹市政府	0	500
新竹縣政府	0	1000
南投縣政府	0	2000
雲林縣政府	0	2000
嘉義市政府	0	500
嘉義縣政府	0	1000
台南市政府	200	500
台南縣政府	0	2000
高雄市政府	0	500
高雄縣政府	0	1000

Upgrade Pre-Warning Capacity

- **WRA owns 2 Pre-Warning System**
- **The first Pre-Warning system Combine pre-simulated inundation potential May(Hazard May) and Rainfall estimation from CWB**



- **The second Pre-Warning System catch the information from current precipitation and then estimates what places will inundate in the following 2~3 hours.**



98年8月7日23時50分南州兩量站達警戒值，水利署「防災資訊服務網」發布新園鄉、東港鎮、林邊鄉、佳冬鄉、南州鄉及莿頂鄉等六鄉鎮淹水警戒資訊。

8月8日3~4時林邊鄉等六鄉鎮陸續傳出淹水災情。

Pre-Warning Messages will send to

- Central Disaster Mitigation Management Center
- Central Weather Bureau
- Local Authorities (Fax)
- Mayor of Townships (Cell Phone Messages)

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