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USING MAJOR WATER SUPPLY DAMS FOR FLOOD MITIGATION AND THE POTENTIAL IMPACTS DOWNSTREAM

Overview

1. What is a dam?
2. Dams and flood mitigation
3. Flood risk management
4. Adapting water supply dams for flood mitigation.
5. How do you decide if it is worth it?
6. Who pays for it?

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What is a dam?

A dam is built to control and store water. Dams are made from earth, rocks or concrete and are usually constructed on rivers to store the water in a reservoir (ANCOLD, 2012)

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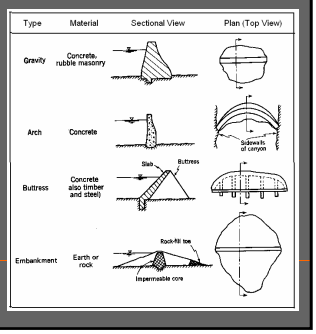
Dam Construction Types

Various dam types exist to suit the desired function and the site specifics of their location. The major dam types include:

- Concrete Gravity dams
- Concrete Arch dams
- Buttress dams
- Embankment dams – earth and/or rockfill.



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What are dam used for?

Dams are built for various purposes to suit community needs including:

- water supply
- irrigation
- flood control
- hydro-electricity
- environmental controls (e.g. mine tailings dams)

(NSW DSC, 2011)

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When is a dam described as major or large?

A major dam is:

- 15 m high
- 10 m to 15 m high and
  - greater than 500 m length
  - storage capacity over 1 million cubic metres
  - or a spillway capacity of over 2000m^3/s

(ANCOLD, 2012).

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Dams and flood mitigation

From a flood mitigation perspective there are three types of dams:

1. Water supply dam – incidental flood mitigation
2. Water supply and flood mitigation dam – dual function
3. Water supply dam modified to also provide flood mitigation


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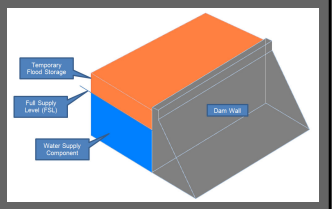
Dams and flood mitigation

The amount of flood mitigation a dam provides depends on a number of factors including:

- Current water level in the dam
- Capacity above full supply level
- Operating rules
- Size of flood
- Catchment size
- Spillway configuration

(VICSES, 2013)



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Water supply dams - objectives

Many water supply dams are managed to meet the following objectives, in priority order:

- Protect the structural integrity and safety of the dam
- Maximise water availability
- Limit flood damage downstream

(MDBA, 2013)


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Oaky River Dam – after construction in 1950s (pre-failure)

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Oaky River Dam - post-failure, February 2013

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Oaky River Dam - post-failure, February 2013

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Why worry about flood risk?

Munich RE 2013, global economic losses from flooding exceeded $19 billion in 2012

Flooding in central Europe (2013)

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Flood risk management process

Floodplain risk management process (FDM, 2005):

1. Data collection – existing and additional information
2. Flood study – to define nature and extent of the problem
3. Floodplain risk management study – assess options
4. Floodplain risk management plan – preferred options exhibited to the community
5. Plan implementation – structural and non-structural measures.

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Flood mitigation options

The purpose of flood mitigation is to decrease or eliminate the impact of floods on society and the environment (BTRE, 2002). Flood mitigation strategies typically involve a combination of structural and non-structural measures:

Structural Measures

- dams/reservoirs
- levees
- detention basins
- floodgates
- diversion channels

Non-structural measures

- land zoning and building regulations
- response modifications (education programs, emergency planning and weather warning systems)

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Structural measures - dams

Case Study - Wivenhoe Dam and Somerset Dam in Queensland

- Water supply and flood mitigation

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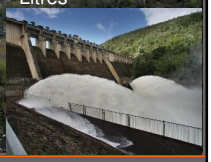
Case Study – Wivenhoe Dam and Somerset Dam

Constructed to provide both urban water supply and flood mitigation.

Combined:
Full Supply volume is 1.4 Million Mega Litres
Flood mitigation of 2.6 Million Mega Litres



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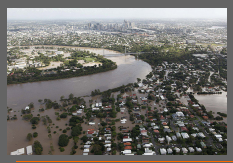
2011 Brisbane floods

Ongoing review to provide improved outcomes



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Adapting an existing water supply dam for flood mitigation

There are numerous methods to adapt a water supply dam for flood mitigation, with the most common being:

- **Pre-releases** well in advance of a flood event and/or **alternate gate operational rules** during flooding events
- **Permanent lowering** of the full supply level (FSL)
- **Physical modification** of the dam to provide additional temporary storage

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Pre-releases and alternate gate operation

Pre-releases: releasing water prior to the 'wet season' or well before an expected flood event to create airspace within the dam to 'absorb' the first of the floodwaters

Alternate gate operation: when a dam fitted with gates is operated in sequence to reduce peak flooding downstream

- Highly dependent on rainfall predictions
- Can reduce evacuation times downstream
- Loss of water supply
- Generally only reduces impact of small floods
- Can create issues with dam safety

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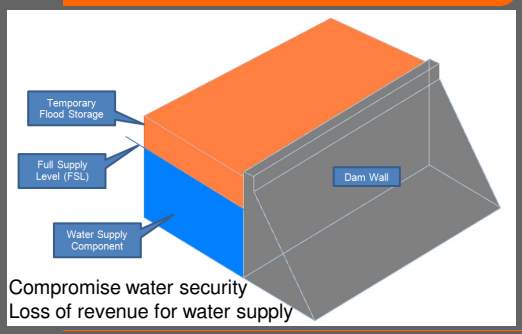
Permanent lowering of the Full Supply Level



Compromise water security
Loss of revenue for water supply

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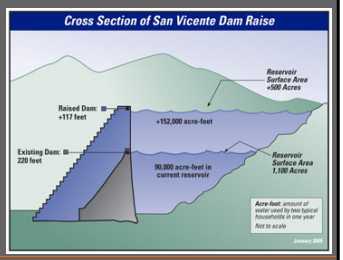
Physical modification of the dam

Usually by raising the dam wall in combination with high level spillways to create additional temporary flood storage

- substantial flood mitigation benefits
- high capital costs
- complex, operational dam, environmental, dam safety



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How do you decide if it is worth it?

Modifying a water supply dam for flood mitigation. Assessment process:

1. Assess and cost options
2. Model the dam and assess downstream consequences
3. Select the most cost effective and beneficial solution
4. Design works which provide greatest value-benefit
5. During construction: water supply, water quality, flood security

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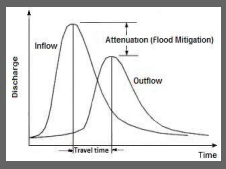
How do you decide if it is worth it?

The effectiveness of flood mitigation schemes is usually evaluated:

- reduction in peak dam outflows compared to the peak flood inflows for a range of flood events
- impacts downstream of the dam
- the reduction in the downstream water levels achieved is critical



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Who pays for it?

Someone has to pay so who gets the most benefit

- Local Councils
- Dam owners
- Insurance industry
- Developers
- State or Federal Government

Community ultimately pays for it, it is just how wide the payment is distributed and who can afford it.

Who pays if the work is not done and the flood causes damages?

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Maintaining risk reduction

How do we ensure that flood risk reduction is maintained into the future if such a project was undertaken?

- Pressure from developers for removal of land use restriction
- Government planning

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Summary

- Some water supply dams, if adapted, can provide significant flood mitigation benefits
- Modifying an existing water supply dam for flood mitigation can be complex and very expensive
- Finding funding sources for such projects
- The community pays either way – either by paying for the works to mitigate floods or via the damages after the flood

It is a matter of risk management

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Questions?

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