The Hills Shire Local Emergency Management Committee

EMERGENCY RISK MANAGEMENT STUDY

March 2015
**TABLE OF CONTENTS**

1) EXECUTIVE SUMMARY .......................................................... 1
2) SUMMARY OF PROCESS .......................................................... 2
   Risk Management Process .......................................................... 2
3) CONTEXT ................................................................................... 3
4) OBJECTIVE ............................................................................... 4
5) SCOPE ....................................................................................... 4
6) THE HILLS SHIRE LOCAL AREA ............................................. 5
   Map 1: The Hills Shire Local Government Area ......................... 5
7) ADMINISTRATION ...................................................................... 6
   7.1. DELIVERABLES ................................................................. 6
   7.2. DOCUMENTATION ............................................................ 6
   7.3. RESOURCES ......................................................................... 6
   7.4. TIMELINES ........................................................................... 6
   7.5. POLICY BASE ....................................................................... 6
8) LOCAL AREA PROFILE ............................................................ 6
   8.1. TOPOGRAPHY AND GEOLOGY .............................................. 8
   8.2. CLIMATE ............................................................................. 9
   8.3. CLIMATE CHANGE IMPACTS .............................................. 10
   8.4. LAND USE ........................................................................... 13
   8.5. INDUSTRY ................................................................ .......... 14
   8.6. TRANSPORT ROUTES .......................................................... 14
   8.7. WATERWAYS ....................................................................... 15
   8.8. WATER STORAGE AREAS ................................................... 16
THE COMMUNITY ............................................................................... 17
   8.9. POPULATION SIZE ............................................................... 19
   8.10. POPULATION PROJECTIONS & FUTURE GROWTH .......... 19
   8.11. AGE PROFILE ..................................................................... 20
   8.12. FAMILY TYPE .................................................................... 21
   8.13. COUNTRY OF BIRTH ......................................................... 22
   8.14. ABORIGINALITY .................................................................. 22
9) SIGNIFICANT HAZARDS IN THE HILLS SHIRE LGA ...22
   9.1. BUSH FIRE ........................................................................... 22
   9.2. HISTORY OF FLOODING & POTENTIAL THREAT ............. 26
   9.3. LANDSLIP ........................................................................... 29
   9.4. BUILDING COLLAPSE .......................................................... 30
   9.5. EARTHQUAKE ...................................................................... 30
9.6. DAM FAILURE ................................................................. 31  
9.7. ANIMAL OR PLANT DISEASE ............................................ 31  
9.8. STORMS ......................................................................... 31  
9.9. LOCAL INFRASTRUCTURE FAILURE ................................. 36  
9.10. COMMUNICABLE DISEASES - HUMAN ......................... 36  

10) RISK ANALYSIS & EVALUATION ...................................... 36  
10.1. RISK EVALUATION CRITERIA ......................................... 37  
10.2. METHODOLOGY – CONSEQUENCE ................................. 37  
10.3. METHODOLOGY – LIKELIHOOD ...................................... 38  

11) REFERENCES .................................................................... 39  

12) APPENDICES ..................................................................... I  
12.1. APPENDIX 1 - RISK ASSESSMENT ................................. I  

DRAFT DECEMBER 2014
1) EXECUTIVE SUMMARY

The Emergency Risk Management (ERM) Study is a process undertaken by a sub-committee of The Hills Shire Local Emergency Management Committee (LEMC). The sub-committee included representatives of:

- The Hills Shire Council
- NSW Police Force;
- Fire & Rescue NSW;
- NSW Rural Fire Service;
- NSW State Emergency Service
- NSW Ambulance
- NSW Health (Western Sydney Local Health District)
- Department of Primary Industries

The North West Metropolitan Region Emergency Management Officer (REMO) facilitated the process.


These publications highlight the importance of continual monitoring and review of any study. Consequently there is no concluding date of this Study as it is designed to be a fluid document to adapt to changing circumstances and situations that impact on local emergency management.

Considerable information was drawn from a variety of sources during the development of the Study including:

- 2006 Baulkham Hills Shire Emergency Risk Management Study;
- Council’s adopted Local Strategy, Residential Direction and Waterways Direction;
- The Hills Shire Plan;
- Bureau of Meteorology;
- relevant Council and emergency service databases.

The list of both natural and non-natural hazards that could potentially impact on The Hills Shire is extensive. However the sub-committee considered that many of these hazards e.g. earthquake, major aviation incident, Hazmat would be a Regional if not State issue. It is understood that representatives of the State Emergency Management Committee (SEMC) have advised that they will be forthcoming with a list of those hazards that are being assessed on a State or Regional basis.

Throughout the ERM process there has been a considerable amount of information and knowledge developed of hazards and potential hazards in the Shire.
The Study has been useful in providing a closer examination of the hazards identified in the current Local Disaster Plan (April 2011). Although no additional hazards have been identified, it has been acknowledged that major infrastructure, commercial and residential development projects such as the North West Rail Link, NorthConnex and the Castle Towers redevelopment could increase the likelihood and consequences of an emergency requiring a coordinated response.

2) SUMMARY OF PROCESS

- Form Emergency Risk Management sub-committee

  The Hills Shire Emergency Risk Management sub-committee was formed at The Hills Shire LEMC meeting of 10th November 2014.

- Inaugural sub-committee meeting of 25th November 2014 defined project context and scope.

- Ongoing discussions between members of the sub-committee to develop the Risk Management Plan prior to submission to the Local Emergency Management Committee for endorsement.

- Review of the Emergency Management Plan as required

Further Work

- Commencement of Identification of Risks, Risk Analysis and Evaluation

- Risk treatments

- Recommendations

The process outlined in this document will be based on the Australia/New Zealand Risk Management Standard 31000 and normal management practices.

The aim of the process is to identify and evaluate risks with potential to require a significant and co-ordinated multi-agency response.

Risk Management Process

The process by which emergency risk management is undertaken is taken from AS/NZ ISO 31000 Risk Management.

The following figure (adapted from Figure 1, National Emergency Risk Assessment Guideline 2010) outlines the steps involved in the process.
3) CONTEXT

Key Stakeholders

The Hills Shire Council  
NSW Police Force  
Fire & Rescue NSW  
NSW Rural Fire Service  
NSW Ambulance  
NSW State Emergency Service  
NSW Health (Western Sydney Local Health District)  
Department of Primary Industries  
Roads and Maritime Services  
Transurban (M2, M7 and proposed NorthConnex)  
Transport for NSW (North West Rail Link)  
NSW Crown Lands  
NSW State Forests  
NSW National Parks and Wildlife Service
Sub-Committee

The Hills Shire Council
NSW Police Force
Fire & Rescue NSW
NSW Rural Fire Service
NSW State Emergency Service
NSW Ambulance
NSW Health (Western Sydney Local Health District)
Department of Primary Industries
North West Metropolitan Region Emergency Management Officer (facilitator)

Management Arrangements

Documentation will address the following:

- Objectives
- Scope
- Study Area
- Administration
- Deliverables
- Documentation
- Resources
- Timelines

4) OBJECTIVE

To identify, analyse and evaluate risks with potential to require a significant and coordinated multi agency response within the area defined by The Hills Shire LEMC.

5) SCOPE

The Study will only consider hazards and risks which may result in an emergency as defined in the SERM Act.

“Emergency” means an actual or imminent occurrence (such as fire, flood, storm, earthquake, explosion, accident, epidemic or warlike action) which:

(a) Endangers, or threatens to endanger, the safety or health of persons or animals in the State, or
(b) Destroys or damages, or threatens to destroy or damage, property in the State;

being an emergency which requires a significant and co-ordinated response.
For the purposes of the definition of emergency, property in the State includes any part of the environment of the State. Accordingly, a reference in this Act to:

(a) threats or danger to property includes a reference to threats or danger to the environment, and the protection of property includes a reference to the protection of the environment.”

Treatment strategies will remain, wherever possible, the responsibility of the agency/s identified in the NSW State Emergency Management Plan.

6) THE HILLS SHIRE LOCAL AREA

The assessment of natural hazards and risks was undertaken within the Shire, which constitutes the Local Emergency Management Committee’s area.

Map 1: The Hills Shire Local Government Area (LGA)
7) ADMINISTRATION

The Hills Shire LEMC Chair will be responsible for administrative arrangements for the sub-committee. This will encompass preparation of minutes and any necessary correspondence/reports of that committee.

7.1. DELIVERABLES

Ongoing reports to LEMC.

7.2. DOCUMENTATION

The Hills Shire Council LEMC representative will be responsible for documentation of the ERM Study and will also be responsible for preparing reports to the LEMC.

7.3. RESOURCES

No special resources required at this stage.

7.4. TIMELINES

This project has no set timeframes; however, it has been prepared in a fashion that allows for a sub-committee to progress at its own speed, based on the availability of information and research and participants' workloads.

The sub-committee will identify tasks requiring action outside of meetings. These tasks will be undertaken by identified committee members and completed within agreed timeframes.

7.5. POLICY BASE

Legislation

- State Emergency & Rescue Management Act 1989 as amended
- see Section 60KA & Section 62 of State Emergency & Rescue Management Act - re legal protection
- Local Government Act 1993

Policy

- State Emergency Management Committee
- Region Emergency Management Committee
- Local Emergency Management Committee

8) LOCAL AREA PROFILE

The Hills Shire is located in the north-western outskirts of Sydney approximately 30 km from the Sydney CBD. The Shire covers an area of 401 sq. km stretching from the suburb of Oatlands in the south to Wisemans Ferry in the north. Approximately
65% of the area is rural in character with the urban residential areas being concentrated in the southern part of the Shire.

The Shire is surrounded by the LGAs of Parramatta (south), Blacktown (south west), Hawkesbury (west), Gosford (north) and Hornsby (east). It is generally bounded by the Hawkesbury River (north and west), Old Northern Road, Castle Hill Road, Pennant Hills Road, Windsor Road, Old Windsor Road and Boundary Road. The Shire is made up of 29 suburbs and localities and is divided into four electoral Wards. A number of the suburbs cross over into adjoining LGAs.

The suburbs/localities are:

- Annangrove
- Bella Vista
- Castle Hill
- Glenhaven
- Kenthurst
- Maraylya
- Nelson
- North Rocks
- Sackville North
- Winston Hills
- Baulkham Hills
- Box Hill
- Cattai
- Glenorie
- Leets Vale
- Maroota
- Northmead
- Oatlands
- South Maroota
- Wisemans Ferry
- Beaumont Hills
- Carlingford
- Dural
- Kellyville
- Lower Portland
- Middle Dural
- North Parramatta
- Rouse Hill
- West Pennant Hills

The northern and western boundaries of the Shire are largely set by the Hawkesbury River.

The northern part of the Shire is heavily vegetated with typically large amounts of dry
sclerophyll forests, some wet sclerophyll forests and remnant areas of pastoral land, grasslands and some open woodlands.

Topographically, the southern areas are characterised by the flatter areas and ridge/gully country, with the northern areas having much less flatter areas with more rugged ridge/gully country.

8.1. TOPOGRAPHY AND GEOLOGY

The Shire is located within two bioregional provinces, Sydney Plains and Sydney Hills. The Sydney Plains province covers the Cumberland Plain and occurs in the west of the Shire, whilst the Sydney Hills province includes the Hornsby Plateau and occurs in the north and east of the Shire.

Elevation within the Shire ranges from sea level at Wisemans Ferry to 239 metres at Maroota Trig Station. Much of the land within the Hornsby Plateau is underlain by Hawkesbury sandstone. The land of higher elevation around Dural, Glenhaven, Castle Hill and West Pennant Hills has a layer of Wianamatta shale over the sandstone. In the south-west, Wianamatta shale is on the lower plains and hills of the Cumberland Plain.

Alluvial deposits are found along the Hawkesbury River floodplain and in the flatter valleys along tributaries of the Hawkesbury (O'Hara's Creek, Blue Gum Creek, Cattai Creek, Caddies Creek, Little Cattai Creek) where swamps form the more extensive alluvial deposits.

A number of soil landscapes occur within the Shire. Soil landscapes associated with Hawkesbury sandstone include Hawkesbury, Falconbridge, Gymea and Lucas Heights soil landscapes. Small areas of Oxford Falls soil landscape occur in Baulkham Hills and toward Winston Hills where flatter valleys occur and in the head waters of Little Cattai Creek and at Maroota.

Higher elevations of Wianamatta shale have the Glenorie soil landscape present. The steep sheltered slopes of West Pennant Hills soil landscape can be observed at West Pennant Hills and Castle Hill, while Picton soil landscape is found at Winston Hills through to Baulkham Hills associated with the steeper slopes, and Wianamatta shale.

On the Cumberland Plain, Blacktown soil landscape is associated with Wianamatta shale geology. Luddenham soil landscape also associated with Wianamatta Group sediments, is found along the ridges and rolling hills of Winston Hills and Baulkham Hills extending west to Marayong in Blacktown.

Some igneous intrusions exist within the area at Dural and Maroota providing rich biodiversity around these areas.

Woodlands soil landscape is found on broad benches and drainage lines on beds of the Mittagong formation, such as along the middle reaches of Little Cattai Creek. The South Creek soil landscape is associated with Quaternary alluvial deposits in the floodplains of Caddies Creek, Smalls Creek and Killarney Chain of Ponds at Box Hill. The Freemans Reach soil landscape is also associated with Quaternary alluvial
deposits. This soil landscape is found along the floodplain of the Hawkesbury River and tributaries with occurrences including Broadwater Swamp, Doyles Swamp and Lambs Creek.

As the two bio-regions of the Cumberland Plain and the Hornsby Plateau meet within the Shire, the large transition areas between the two provide for the richest biodiversity within a local government area of the Sydney basin.

8.2. CLIMATE

The Shire is entirely within a temperate climate zone which results in the climate being generally mild and mostly free from extremes of heat and cold.

The chart below shows the average monthly temperature for all years of data since 1881, as recorded at the University of Western Sydney at Richmond.

![Temperature Chart]

The graph bellows shows the average rainfall by month from 1981 to 2010, as recorded at the University of Western Sydney at Richmond.
8.3. CLIMATE CHANGE IMPACTS

According to the NSW Department of Environment and Heritage’s ‘NSW Climate Impact Profile’, the natural, social, and economic systems of New South Wales are all likely to be affected by the unavoidable impacts of climate change.

The expected climatic changes for the Sydney/Central Coast region are:

**Temperatures are virtually certain to rise**
The mean daily maximum and minimum temperature are virtually certain to increase in all seasons. The magnitude of projected increases ranges from 1.5–3°C.

**Rainfall is likely to increase in all seasons except winter**
Summer rainfall is likely to increase substantially across the region, with smaller increases likely in autumn and spring. Winter rainfall is likely to decrease moderately across much of the region. However, changes in weather patterns that cannot be resolved by the climate models mean that rainfall in coastal regions is difficult to simulate.

**Increased evaporation is likely in spring and summer**
Evaporation is likely to increase moderately in spring and summer. There is no clear pattern in projections for autumn and winter.

**The impact of the El Niño–Southern Oscillation (ENSO) is likely to become more extreme**
Our current understanding of how climate change may influence major drivers of climate variability such as the ENSO phenomenon is limited. However,
current scientific literature indicates that the pattern of climate variability associated with ENSO will continue under enhanced greenhouse conditions. This assessment assumes that the ENSO phenomenon will continue to drive climatic variability across NSW. It is noted, however, that ENSO is a weaker influence on annual average rainfall in coastal areas than in inland areas.

This assessment assumes that ENSO years will continue to be drier than average but also become hotter, leading to more extreme impacts. La Nina years are likely to continue to be wetter than average but will also become warmer. In El Nino events, water stress is likely to be more intense because of higher temperatures.

The table below provides a summary of the temperature and rainfall changes in the Sydney/Central Coast region.

<table>
<thead>
<tr>
<th>Season</th>
<th>Minimum temperatures</th>
<th>Maximum temperatures</th>
<th>Precipitation</th>
<th>Evaporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>2.0–3.0°C warmer</td>
<td>2.0–3.0°C warmer</td>
<td>10–20% increase</td>
<td>10–20% increase</td>
</tr>
<tr>
<td>Summer</td>
<td>1.5–3.0°C warmer</td>
<td>1.5–2.0°C warmer</td>
<td>20–50% increase</td>
<td>10–20% increase</td>
</tr>
<tr>
<td>Autumn</td>
<td>1.5–3.0°C warmer</td>
<td>1.5–3.0°C warmer</td>
<td>No significant change</td>
<td>No clear pattern</td>
</tr>
<tr>
<td>Winter</td>
<td>1.5–3.0°C warmer</td>
<td>2.0–3.0°C warmer</td>
<td>10–20% decrease</td>
<td>No clear pattern</td>
</tr>
</tbody>
</table>

The expected physical responses to climate change in the region are:

**Sea level is virtually certain to rise**
Sea levels are expected to rise increasing coastal erosion and flooding that will affect beaches and estuaries.

**Increased evaporation is likely to lead to drier conditions in spring**
As a result of increased temperatures and evaporation, soil conditions in spring are likely to be slightly drier.

**A minor increase in annual average run-off is projected; summer run-off is very likely to increase substantially**
Some redistribution of run-off across the seasons is likely, with increases in summer and autumn and decreases in winter and spring. A substantial increase in summer run-off is very likely throughout the region. A minor decrease in average annual run-off average annual run-off is about as likely as not.
Short-term hydrological droughts are projected to become more severe, while medium and long-term droughts are projected to become less severe

Estimates of the change in total run-off during short-term drought periods range from 20% drier to 25% wetter compared to historical conditions. The corresponding estimates for medium to long-term drought periods range from 10% drier to 20% wetter. The average of the four modelled results indicates that short-duration droughts are likely to become more severe, and medium to long-term droughts are about as likely as not to be slightly less severe.

Flooding behaviour is likely to change

The combination of rising sea levels and catchment-driven flooding is likely to increase flood frequency, height and extent in the lower portions of coastal floodplains. Increases in the intensity of flood-producing rainfall events are likely to change flood behaviour, but catchment conditions at the time of each rainfall event (soil moisture conditions and levels in major water storages) will affect the degree of the change.

Fire regimes are likely to change, but changes to fuel availability are uncertain

Higher temperatures and changes to rainfall patterns will more likely than not lead to increased fire frequency, but the return period of fires is considered likely to remain within the current domain of acceptable fire intervals of 10–30 years towards the year 2050. Peak fire dangers in the region are currently reached in spring through to early summer and no major change is expected over most of the region. However, intensification of fire danger levels within the existing season is projected.

The fire season will more likely than not be longer, extending into late winter and lengthening into late summer. Very high to extreme fire danger days are projected to increase by 10–50% and the conditions conducive to large and intense fires (such as prolonged drought, low humidity, number of days with high temperature and high wind speeds) will more likely than not increase.

Future change in fuel availability is the least certain of all the factors that drive fire. Projected decreases in available moisture will possibly reduce fuel availability; however, projections of fuel availability are presently regarded as highly speculative.

Other expected climate related impacts in the region are:

- Energy demand for cooling in summer will increase markedly. Buildings, roads and other infrastructure assets will deteriorate more quickly, increasing life-cycle costs and maintenance requirements.

- The incidence of more extreme and longer lasting heatwaves is likely to result in an increase in heat related deaths, and hospital admissions for heat stress and heat related illness. Higher temperatures may also contribute to the spread of vector-borne viruses and water-borne and food-borne diseases.
- Sydney’s mains water supply will come under increasing stress as population growth and environmental flow requirements increase the demand for water, whilst reduced annual rainfalls and increased evaporation will mean less runoff into rivers and storage areas. Water restrictions could possibly become semi-permanent, with the use of potable water prohibited for irrigating playing fields and gardens.

- Small urban streams will likely become ephemeral, while urban wetlands will dry out or suffer serious water quality problems from weed or algae. Aquatic weeds in the Hawkesbury River will require increasing effort and resources to control.

- Droughts are likely to become more frequent and severe as the century advances.

- Food will become much more expensive and limited as Australia’s major food producing regions suffer from increasing water shortages.

- Increases in short-duration extreme rainfall events are likely to result in more frequent and severe flooding in smaller urban streams and surcharge of sewerage and drainage systems causing both water quality and quantity problems.

- Possible increases in storm severity will place additional demands on emergency services, and increase insurance premiums. Power blackouts will happen more often when transmission lines are damaged.

8.4. LAND USE

The Hills Local Environmental Plan (LEP) 2012 (as amended) is the principal planning instrument affecting land use within the Shire. The plan, although prepared by Council, was vetted by the NSW State Government to ensure consistency with the Environmental Planning and Assessment Act 1979 and State Environmental Planning Policies before being gazetted by the Minister.

The purpose of the LEP is to define what purpose land may be used for. The LEP consists of a written statement and a number of maps.

The written LEP statement includes the legal definitions of a wide range of land use activities and land use tables divided into different zones to describe what uses are permissible, or prohibited under the given zones. The plan also contains a number of special provisions to address such issues as heritage conservation, subdivision and land acquisition. The zoning map then depicts graphically the application of the various zones to specific areas of land.

In general terms, the LEP is used by Council to determine if a land use or activity is permissible on any given property. The LEP expresses Council’s broad land use strategy for the Shire.
State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (the Codes SEPP) specifies exempt and complying development under that Policy. The Codes SEPP has state-wide application and commenced on 27 February 2009.

Details on all land use zonings, including maps and permissible activities, are available on Council’s website at www.thehills.nsw.gov.au.

8.5. INDUSTRY

The Shire contains a wide variety of industry types ranging from light industry and warehousing to agricultural industries such as wholesale nurseries and market gardens.

There are five main industrial areas within the Shire located at Castle Hill, Northmead, North Rocks, Rouse Hill and Winston Hills. They range in size with the largest at Castle Hill containing approximately 850 premises to Winston Hills which contains 10 premises. In addition, the industrial zone at Rouse Hill is relatively undeveloped at this time but is likely to provide for industry growth into the future. All of these areas are zoned for light industry and there are no areas within the Shire zoned for heavy industry.

Agricultural industries are scattered throughout much of the Shire’s rural land. However with urban expansion to the north-west, it is gradually shrinking to the northern areas of the Shire.

8.6. TRANSPORT ROUTES

The Shire is serviced by the M2, M7, Old Windsor Road, Windsor Road and numerous other arterial, sub arterial and local road links. Construction of the NorthConnex project, an underground road tunnel linking the M2 at West Pennant Hills and the M1 at Wahroonga, is planned to commence in early 2015.

In the northern part of the Shire there are only two arterial roads running north/south - Wisemans Ferry Road along the western part of the Shire, and Old Northern Road along the eastern part. From north of Castle Hill, Old Northern Road also largely forms the boundary between The Hills Shire and Hornsby Shire LGAs.

There are only four east/west roads in the middle to northern area of the Shire being Pitt Town Road, Cattai Ridge Road, Cliftonville Road and Sackville Ferry Road.

At present public transport within the Shire is mainly limited to bus services on various routes that serve the main residential and commercial areas. However regional bus services also provide access to major centres including Parramatta, Hornsby, Macquarie Park, North Sydney, Blacktown and the City.

The North West T-Way provides bus services between the Rouse Hill Regional Centre and Parramatta. The T-Way includes a dedicated bus only roadway running adjacent to Old Windsor Road and Windsor Road from Rouse Hill to Northmead before heading to Westmead Hospital and then on to Parramatta.
A very limited rail service is provided from Carlingford connecting to the main western line (T1) at Clyde. Carlingford station is currently the only railway station located within the Shire.

The North West Rail Link, a metro style heavy rail line, is currently under construction and planned to be completed in 2019. It will initially provide a shuttle service between Cudjegong Road (within the Blacktown City LGA) and Chatswood via the existing Epping to Chatswood rail line. A total of six stations will be located on the rail link within the Shire including Rouse Hill, Kellyville, Bella Vista, Norwest, Showground and Castle Hill. Planning is currently underway to extend the rail link from Chatswood to the Sydney CBD through a second harbour crossing before connecting to the current Bankstown (T3) line.

The NSW State Government recently announced plans for the Parramatta Light Rail project with four corridors listed for detailed studies. Two of those corridors that could provide services within the Shire include Parramatta to Macquarie Park via Carlingford and Parramatta to Castle Hill via Old Northern Road.

8.7. WATERWAYS

The Shire straddles the catchments of the Hawkesbury River to the north and west and the Upper Parramatta River to the south. The northern rural areas of the Shire drain to the Hawkesbury River, while the southern urban areas of the Shire predominantly drain to the Parramatta River and ultimately Sydney Harbour.

Flooding on Cattai Creek

The Shire has 39 major sub-catchments, being drained by over 900 kilometres of natural and constructed waterways in varying condition, from near pristine to severely degraded.
8.8. WATER STORAGE AREAS

There are currently nine stormwater detention basins located within the Shire that have been identified as ‘Prescribed Dams’ under the provisions of the Dam Safety Act 1978. Only four of those prescribed dams are under Council’s ownership and control.

The table below sets out the location and ownership of these ‘Prescribed Dams’.

<table>
<thead>
<tr>
<th>Description</th>
<th>Location</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loyalty Road Dam</td>
<td>Excelsior Reserve off Loyalty Road, North Rocks</td>
<td>Greater Sydney Local Land Services</td>
</tr>
<tr>
<td>Gooden Reserve Flood Detention Basin</td>
<td>Gooden Reserve, Gooden Drive Baulkham Hills</td>
<td>The Hills Shire Council</td>
</tr>
<tr>
<td>Sierra Place Reserve Flood Detention Basin</td>
<td>Sierra Place, Baulkham Hills</td>
<td>The Hills Shire Council</td>
</tr>
<tr>
<td>Muirfield Golf Course Flood Detention Basin</td>
<td>Perry Street, North Rocks</td>
<td>The Hills Shire Council</td>
</tr>
</tbody>
</table>
In addition Council has 18 other flood detention basins that although not designated as ‘Prescribed Dams’, are inspected on a frequency of up to six months as part of a risk management program. The table below sets out the name and location of these flood detention basins:

<table>
<thead>
<tr>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernie Mullane Sports Complex</td>
<td>Marella Avenue, Kellyville</td>
</tr>
<tr>
<td>Francesco Reserve</td>
<td>Francesco Crescent, Bella Vista</td>
</tr>
<tr>
<td>Bella Vista Village Green</td>
<td>Bella Vista Drive, Bella Vista</td>
</tr>
<tr>
<td>Charles McLaughlin Reserve</td>
<td>Crestwood Drive, Baulkham Hills</td>
</tr>
<tr>
<td>Henry Curtis Reserve</td>
<td>Glenrofe Avenue, West Pennant Hills</td>
</tr>
<tr>
<td>Lyndhurst Court Reserve</td>
<td>Avonleigh Way, West Pennant Hills</td>
</tr>
<tr>
<td>Gilbert Road Reserve Flood</td>
<td>Gilbert Road, Glenhaven</td>
</tr>
<tr>
<td>Kingussie Avenue Reserve</td>
<td>Kingussie Avenue, Castle Hill</td>
</tr>
<tr>
<td>Fairmont Avenue Reserve</td>
<td>Fairmont Avenue, Baulkham Hills</td>
</tr>
<tr>
<td>Bron Close</td>
<td>Bron Close, West Pennant Hills</td>
</tr>
<tr>
<td>Cedar Grove</td>
<td>Marriot Grove, Castle Hill</td>
</tr>
<tr>
<td>William Harvey Reserve</td>
<td>Greensborough Avenue, Rouse Hill</td>
</tr>
<tr>
<td>Glenwood Way Reserve</td>
<td>Crane Road, Castle Hill</td>
</tr>
<tr>
<td>George Thornton Reserve</td>
<td>View Street, West Pennant Hills</td>
</tr>
<tr>
<td>Brighton Drive Reserve</td>
<td>Brighton Drive, Bella Vista</td>
</tr>
<tr>
<td>Darcey Road Reserve</td>
<td>Darcey Road, Castle Hill</td>
</tr>
<tr>
<td>Castle Hill Heritage Park Reserve</td>
<td>Gilbert Road, Castle Hill</td>
</tr>
<tr>
<td>Green Road Reserve</td>
<td>Green Road, Kellyville</td>
</tr>
</tbody>
</table>

There are currently six locations within the Shire where there are water storage reservoirs operated by Sydney Water. They are at:

- Rutland Avenue, Baulkham Hills
- Glen Road, Castle Hill
- Marie Street, Castle Hill
- Myee Crescent, Baulkham Hills
- Westwood Way, Bella Vista
- Wrights Road, Castle Hill

There are also a number of relatively large bodies of water that are publicly accessible at the following locations.

- Brighton Drive, Bella Vista (Norwest Association)
Location plan of ‘Prescribed Dams’
• Edgewater Drive, Bella Vista (Norwest Association)
• Solent Circuit, Bella Vista (Norwest Association)
• Sanctuary Drive, Beaumont Hills (Sydney Water)
• Turkeys Nest Reserve, Tamborine Drive, Beaumont Hills (The Hills Shire Council)
• Caddies Boulevarde, Rouse Hill (Lend Lease GPT)
• Mindaribba Avenue, Rouse Hill (Sydney Water)

These bodies of water are primarily provided for recreational, landscape and water quality improvement purposes.

THE COMMUNITY

8.9. POPULATION SIZE

The population of the Shire was estimated by the Australian Bureau of Statistics to be approximately 183,500 in 2013. This represented an average annual increase in population over the previous 10 year period of approximately 3,440.

The Shire is still experiencing a period of rapid growth towards an expected total population of 248,900 by 2031.

8.10. POPULATION PROJECTIONS & FUTURE GROWTH

Details of the forecast growth in the population, number of households and average household size are included in the graph below. The Shire’s projected population of 248,900 by 2031 represents an increase of 37% over the current population.

This rapid growth is due to new land releases in the Balmoral Road and North Kellyville areas, and the Box Hill precinct within the North West Growth Centre, as well as a number of potential urban activation precincts within existing urban residential areas. The existing urban areas of the Shire are also experiencing growth as medium and high density developments replace single stand-alone houses.
### 8.11. AGE PROFILE

#### Age structure - service age groups

<table>
<thead>
<tr>
<th>The Hills Shire - Total persons (Usual residence)</th>
<th>2011</th>
<th>2006</th>
<th>Change 2006 to 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service age group (years)</td>
<td>Number</td>
<td>%</td>
<td>Greater Sydney %</td>
</tr>
<tr>
<td>Babies and pre-schoolers (0 to 4)</td>
<td>11,192</td>
<td>6.6</td>
<td>6.8</td>
</tr>
<tr>
<td>Primary schoolers (5 to 11)</td>
<td>17,493</td>
<td>10.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Secondary schoolers (12 to 17)</td>
<td>15,392</td>
<td>9.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Tertiary education and independence (18 to 24)</td>
<td>15,705</td>
<td>9.2</td>
<td>9.5</td>
</tr>
<tr>
<td>Young workforce (25 to 34)</td>
<td>17,909</td>
<td>10.5</td>
<td>15.4</td>
</tr>
<tr>
<td>Parents and homebuilders (35 to 49)</td>
<td>38,875</td>
<td>22.9</td>
<td>21.9</td>
</tr>
<tr>
<td>Older workers and pre-retirees (50 to 59)</td>
<td>23,301</td>
<td>13.7</td>
<td>12.2</td>
</tr>
<tr>
<td>Empty nesters and retirees (60 to 69)</td>
<td>18,010</td>
<td>10.6</td>
<td>9.0</td>
</tr>
<tr>
<td>Seniors (70 to 84)</td>
<td>10,129</td>
<td>6.0</td>
<td>7.2</td>
</tr>
<tr>
<td>Elderly aged (85 and over)</td>
<td>1,867</td>
<td>1.1</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Total population</strong></td>
<td>169,873</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

#### Forecast age structure - 5 year age groups 2011 to 2026

<table>
<thead>
<tr>
<th>The Hills Shire - Total persons</th>
<th>2011</th>
<th>2026</th>
<th>2031</th>
<th>Change between 2011 and 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (years)</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>0 to 4</td>
<td>11,537</td>
<td>6.5</td>
<td>14,302</td>
<td>6.3</td>
</tr>
<tr>
<td>5 to 9</td>
<td>12,405</td>
<td>7.0</td>
<td>14,895</td>
<td>6.6</td>
</tr>
<tr>
<td>10 to 14</td>
<td>12,773</td>
<td>7.2</td>
<td>15,347</td>
<td>6.8</td>
</tr>
<tr>
<td>15 to 19</td>
<td>13,034</td>
<td>7.4</td>
<td>15,476</td>
<td>6.9</td>
</tr>
<tr>
<td>20 to 24</td>
<td>12,082</td>
<td>6.8</td>
<td>14,224</td>
<td>6.3</td>
</tr>
<tr>
<td>25 to 29</td>
<td>9,397</td>
<td>5.3</td>
<td>13,337</td>
<td>5.9</td>
</tr>
<tr>
<td>30 to 34</td>
<td>10,316</td>
<td>5.8</td>
<td>15,029</td>
<td>6.7</td>
</tr>
<tr>
<td>35 to 39</td>
<td>13,181</td>
<td>7.5</td>
<td>16,617</td>
<td>7.4</td>
</tr>
<tr>
<td>40 to 44</td>
<td>13,667</td>
<td>7.7</td>
<td>16,903</td>
<td>7.5</td>
</tr>
<tr>
<td>45 to 49</td>
<td>13,309</td>
<td>7.5</td>
<td>16,180</td>
<td>7.2</td>
</tr>
<tr>
<td>50 to 54</td>
<td>12,649</td>
<td>7.2</td>
<td>15,659</td>
<td>6.9</td>
</tr>
<tr>
<td>55 to 59</td>
<td>11,456</td>
<td>6.5</td>
<td>13,891</td>
<td>6.2</td>
</tr>
</tbody>
</table>
8.12. FAMILY TYPE

### Household type

<table>
<thead>
<tr>
<th>The Hills Shire</th>
<th>2011</th>
<th>Greater Sydney %</th>
<th>2006</th>
<th>Greater Sydney %</th>
<th>Change 2006 to 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Couples with children</td>
<td>27,719</td>
<td>50.9</td>
<td>34.8</td>
<td>26,247</td>
<td>51.3</td>
</tr>
<tr>
<td>Couples without children</td>
<td>13,091</td>
<td>24.0</td>
<td>22.6</td>
<td>12,237</td>
<td>23.9</td>
</tr>
<tr>
<td>One parent families</td>
<td>4,746</td>
<td>8.7</td>
<td>10.8</td>
<td>4,270</td>
<td>8.3</td>
</tr>
<tr>
<td>Other families</td>
<td>457</td>
<td>0.8</td>
<td>1.4</td>
<td>424</td>
<td>0.8</td>
</tr>
<tr>
<td>Group household</td>
<td>873</td>
<td>1.6</td>
<td>4.1</td>
<td>899</td>
<td>1.8</td>
</tr>
<tr>
<td>Lone person</td>
<td>6,410</td>
<td>11.8</td>
<td>21.5</td>
<td>5,747</td>
<td>11.2</td>
</tr>
<tr>
<td>Other not classifiable household</td>
<td>979</td>
<td>1.8</td>
<td>4.1</td>
<td>1,102</td>
<td>2.2</td>
</tr>
<tr>
<td>Visitor only households</td>
<td>223</td>
<td>0.4</td>
<td>0.9</td>
<td>214</td>
<td>0.4</td>
</tr>
<tr>
<td>Total households</td>
<td>54,498</td>
<td>100.0</td>
<td>100.0</td>
<td>51,140</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Forecast household types

<table>
<thead>
<tr>
<th>The Hills Shire</th>
<th>2011</th>
<th>2026</th>
<th>2031</th>
<th>Change between 2011 and 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Couple families with dependents</td>
<td>27,369</td>
<td>48.2</td>
<td>33,940</td>
<td>44.9</td>
</tr>
<tr>
<td>Couples without dependents</td>
<td>16,853</td>
<td>29.7</td>
<td>23,137</td>
<td>30.6</td>
</tr>
<tr>
<td>Group households</td>
<td>1,363</td>
<td>2.4</td>
<td>1,765</td>
<td>2.3</td>
</tr>
<tr>
<td>Lone person households</td>
<td>5,677</td>
<td>10.0</td>
<td>9,309</td>
<td>12.3</td>
</tr>
<tr>
<td>One parent family</td>
<td>4,597</td>
<td>8.1</td>
<td>6,124</td>
<td>8.1</td>
</tr>
<tr>
<td>Other families</td>
<td>946</td>
<td>1.7</td>
<td>1,282</td>
<td>1.7</td>
</tr>
</tbody>
</table>
8.13. COUNTRY OF BIRTH

![Country of Birth Chart]

8.14. ABORIGINALITY

<table>
<thead>
<tr>
<th>Culture and ethnicity</th>
<th>The Hills Shire</th>
<th>2011</th>
<th>2006</th>
<th>Change 2006 to 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>Number</td>
<td>%</td>
<td>Greater Sydney</td>
<td>Number</td>
</tr>
<tr>
<td>Aboriginal and Torres Strait Islander population</td>
<td>634</td>
<td>0.4</td>
<td>1.2</td>
<td>427</td>
</tr>
</tbody>
</table>

9) SIGNIFICANT HAZARDS IN THE HILLS SHIRE LGA

Based on the collective knowledge and experience of the members of the LEMC, the following natural hazards currently pose the greatest risk to the Shire community:

- Bushfires
- Floods
- Storms

However other natural and man-made hazards such as landslip, a major structure collapse or a plant or animal disease also have the potential to impact on the community. However the level of risk is likely to be somewhat lower than the above mentioned natural hazards.

9.1. BUSH FIRE

From historical information, major bushfires in the Shire generally occur on a hot, dry day with strong gusty winds blowing from the north to the northwest. Often this wind
will change later in the day to a southwest direction, sometimes bringing a cool southerly change.

Some areas that once contained significant tracts of bushland and allowed large uncontrolled bushfires, have now been broken up by residential development thereby reducing the physical area available to bushfires, e.g. West Pennant Hills, Glenhaven, Castle Hill, Kellyville and Rouse Hill. However remnant areas, particularly within the gully systems, continue to pose high risks to adjoining properties at the bushland interface.

The Shire experiences on average more than 100 bush fires per year of which six on average can be considered as significant.

As with many other LGAs, most fires are caused by arson, lightning strikes or private landowners illegally burning rubbish or not seeking the necessary approvals to undertake hazard reduction burns within their property.

Major fires that have occurred in the Shire were in 1939, 1975, 1981, 1991, 1994 and 2002. Details of those fires are as follows:

**1939**  
Box Hill, Annangrove, Kenthurst, Glenhaven, Kellyville, Middle Dural and Rouse Hill

Little recorded information about this fire is available and any details have been passed on by word of mouth from people who were around at the time. This fire burnt through areas where today considerable development has changed the landscape, the area now consisting of mainly two hectare private holdings.

It is believed that the fire started in Vineyard and during that day burnt through large areas of bush and grassland through Oakville, Box Hill, Nelson, Rouse Hill and Annangrove touching Kenthurst, Kellyville and Middle Dural. Asset losses from the fire are unknown.

Whilst some areas of Box Hill, Nelson and Rouse Hill today may be considered as low risk, the remainder with large areas of remnant bushland, particularly in the gullies, will always pose a major threat to the ever-increasing population of the area.

**1975**  
Australia Day 26th January - Hillside, Glenorie, Kenthurst, Annangrove, Glenhaven, Kellyville and Castle Hill

The first fire was reported at around 0900 hours at the south-western end of Glenhaven Road with the cause thought to be an escape from a rubbish fire. Strong north-westerly winds had been blowing from early in the morning and this fire was driven into the Cattai Creek Gully. Being inaccessible, the fire could not be contained and at around 1030 hours it crossed the creek and driven by the wind, exploded through the southern part of this gully and the surrounding area of Kellyville toward
Castle Hill. At around midday through to the early afternoon the winds changed from the west to south west, which then pushed this fire back along the northern side of the gully and the properties off Glenhaven Road. It then crossed Glenhaven Road into the gully to the north, thus impacting on properties in Glenhaven and Annangrove Roads. This fire ended up in the residential outskirts of Castle Hill and properties along Old Northern Road through to Round Corner Dural.

The second fire was reported at the western end of Shoplands Road, Annangrove at approximately 1130 hours and was thought to have been caused by arcing power lines. Under the influence of the strong winds, this fire raced along the bushland both in the Cattai and Blue Gum gullies on both sides of Shoplands Road to Annangrove Road. The fire continued along the Blue Gum Creek and part crossed to the southern side of Annangrove Road and ran through the Cattai Creek gully eventually joining with the Glenhaven fire towards Sagars Road, Dural. The other part with the variation in wind direction to the west/south west continued through the Blue Gum gully impacting on the length of Annangrove Road and Pitt Town Road to the north ending up in the Kenthurst Village area and along Kenthurst Road,

The third fire started approximately 5km west of Cattai Ridge Road along Halcrows Road at Hillside at about midday. Again, the cause was unknown.

This fire ran along the southern side of Halcrows Road, eventually crossing into the Fern Creek gully and then Kellys Creek gully impacting on Cattai Ridge Road and ending up in the outskirts of Glenorie.

The run of all three fires was contained by a major thunderstorm, which hit the area in the afternoon. However not before some 10 homes and countless other assets were destroyed or damaged throughout these areas.

1981 August 1981 – Maroota, Maroota South, Glenorie and Hillside

This fire started at around 1300 hours on Wisemans Ferry Road near Kearney’s Road at South Maroota and was thought to have been caused by a resident burning rubbish. Under the influence of strong westerly winds, the fire raced through the dense bushland between Kearney and Paulls Roads, which is totally inaccessible crossing Kearney to Floyds Roads then and eventually spotted across Little Cattai Creek into the Maroota State Forest area to the east.

During the afternoon, the fire spread through this area impacting along Old Northern Road around Forest Glen by 1700 hours. Moderating weather conditions enabled the run of the fire to be held on Old Northern Road. However major works during the night and next day
were required both along Old Northern Road and Wisemans Ferry Roads to contain the fire. Losses from this fire were minimal.

1991  
16th October 1991 – Kenthurst, Middle Dural, Hillside and Glenorie

This fire was reported at or about 1056 hours on Wednesday, 16 October 1991 on Pitt Town Road, Kenthurst approximately 1km west of Lang Road.

Under the influence of strong north-westerly winds, the fire crossed Pitt Town Road into the Scaly Bark Creek gully impacting on properties along Pitt Town Road and Orana Road. With a change in winds, to the west-southwest, the fire expanded and raced in a north-easterly direction towards Hillside and Glenorie.

Unfortunately this fire resulted in the loss of two lives and the destruction of seven homes.

(Details outlined in the report “Report on Kenthurst Fire – 16th and 17th October, 1991 prepared by John Hojel, Fire Control Officer, Baulkham Hills Shire Council (Section 41F Appointee))

1994  
23rd September 1994 – Lower Portland and Maroota South

This fire was reported during the mid-afternoon in the area known as Dargle Swamp, approximately 1km east of River Road at Dargle (cause unknown). Under the influence of strong westerly winds, the fire headed in an easterly direction impacting on properties along Cliftonville Road and Sackville Ferry Road. On the basis of forecast weather the next day, a declaration was made under Section 41F of the Bush Fires Act. Improving weather conditions in the evening enabled containment strategies to hold the fire along these roads and Wisemans Ferry Road.

Aerial seeding of the unburnt areas early in the next morning prevented any further run of the fire. Containment lines held. Mopping up continued for a further two days.

Approximately 300 hectares of bushland was involved and asset losses were minimal.

2002  
December 2002 – Majority of northern area of the Shire from Maraylya/Kenthurst to Wisemans Ferry etc.

The day of the 4th December 2002 saw a continuation of the hot and dry conditions which were being experienced, with a weather forecast for Richmond of 35C, humidity 11%, winds from the west 33-50km/hr and the FDI extreme. A state-wide total fire ban was in place.
At around 1445 hours a report of a fire was received at the Control Centre from the local Brigade Captain at South Maroota thought to be in the Broadwater/Chilvers Lane area.

This fire took hold rapidly and headed quickly toward Hillside and Old Northern Road (Chilvers Fire).

At around 1515 hours another report was received at the Control Centre from the Sydney Communications Centre (NSWFB) of a fire in River Road at Lower Portland. This fire travelled along grassland adjacent to the river and then crossed River Road into heavy bushland (Cornelia Fire).

At around 1625 hours a further fire was reported to the Control Centre in an area east of Boundary Road near Red Gables and Maguires Roads. This fire spread quickly through grassland and headed toward Pitt Town Road and into heavy bushland (Red Gables Fire).

As these fires progressed, encompassing both Baulkham Hills (now The Hills) and Hornsby Shires, the fires joined and the whole were finally named ‘The Baulkham Hills Complex’.


9.2. HISTORY OF FLOODING & POTENTIAL THREAT

Introduction

The most severe threat of flooding within the Shire is from the Hawkesbury River along the Shire’s northern boundary where small areas of floodplain land exist. Because this reach is estuarine, marine influences can be important in determining the characteristics and severity of flooding

The Hawkesbury River System

The Hawkesbury River catchment is one of the largest on the coast of New South Wales, with a total area of 22,000 square kilometres stretching south beyond Goulburn and west to the Great Dividing Range. About 18,500 square kilometres of this catchment is upstream of Wisemans Ferry.

The major tributaries are the Mulwaree, Wollondilly, Nattai, Wingecarribee, Kowmung, Coxs, Warragamba, Grose, Colo and MacDonald Rivers and South, Eastern, Webbs and Mangrove Creeks. The upper and middle sections of the Hawkesbury River basin house a number of significant water storage dams, the largest of which is Warragamba Dam which controls 41% of the total catchment. Most of the catchment, especially the western and northern portions, is made up of steep, rugged, forested country.
The significant sources of flooding in the Shire are the main arm of the Hawkesbury River, which flows through Sackville, and the Colo and MacDonald Rivers, which together drain the northernmost portion of the total Hawkesbury River catchment. Along with Webbs Creek, these three streams join just upstream of Wisemans Ferry.

Large flood flows on the Hawkesbury and Colo Rivers, reaching Wisemans Ferry simultaneously and in conjunction with an oceanic storm surge, would represent a severe flood threat. Flood flows from Wisemans Ferry downstream can be of high velocity, though this would be less true if raised ocean levels and large waves retarded flood drainage.

A factor which acts to mitigate the severity of flooding on the lower Hawkesbury River is the existence of a major constriction, the Sackville Gorge, between Ebenezer and Wisemans Ferry. As a result very large floods are ponded in the Windsor-Richmond area and can escape only slowly to the lower river via a long and narrow waterway.

**Weather Systems and Flooding**

Flooding on the lower Hawkesbury River can occur at any time of year. Summer is normally the wettest part of the year, but some of the worst floods seen on the river, including the record flood of 1867, occurred during the winter months. Many parts of the Hawkesbury catchment have received 175mm or more of rain in a 24-hour period and some have recorded falls of over 250mm in such a period.

The most common flood-producing mechanisms on the Hawkesbury River system are East Coast low pressure systems. Such systems appear on weather maps as depressions located off the New South Wales coast, usually in the cooler months and usually moving slowly southward. They can develop in other seasons, however, and can move in a northerly direction or remain stationary for several hours (or in some cases a small number of days).

The most severe floods experienced on the Hawkesbury River have resulted from East Coast low pressure systems. Among these was the flood of record in June 1867. More recently, flooding in June 1964, March 1978, August 1986 and August 1990 resulted from similar weather systems.

East Coast low pressure systems can also generate oceanic storm surge conditions and large waves can occur as a result of associated gale-force and storm-force winds. Such conditions may lead to incursions of sea water onto land that is usually not flooded and to the retarding of flood flows from the Hawkesbury River. The larger floods that have occurred on the Hawkesbury River have often been accompanied by storm surges of 0.1m - 0.3m in Broken Bay. These effects are most apparent if storm surge conditions occur during times of spring or extreme high tides.

Less commonly, flooding could also occur as a result of monsoonal troughs stretching from northern Australia or from the southward passage of ex-tropical cyclones originating in the Coral Sea. Both these mechanisms are associated with the summer and early autumn seasons; in February 1990, rain from an ex-tropical cyclone (Nancy) caused a rise on the Hawkesbury River. In the winter months, the
passage of series of cold fronts moving across the Hawkesbury catchment could also produce flooding.

Flash flooding from the passage of thunderstorms can also occur, especially in the warmer months. Such flooding can cause small creeks and artificial drains to surcharge but thunderstorm activity does not cause flooding on the Hawkesbury River or its larger tributaries.

Flood History

Floods have been quite frequent along the lower Hawkesbury River. The following table indicates the heights reached at four different locations in some of the most serious events recorded. It is noteworthy that the Hawkesbury, the Colo and the MacDonald Rivers have made very different contributions in individual events. The 1867 flood was probably largely generated over the main stem of the river upstream of Sackville and over the Grose River catchment, with no great contribution from the Colo River or the MacDonald River. This appears also to have been the case in 1961 and 1990. The 1978 flood, however, resulted mostly from a comparatively rare large event on the Colo River with significant contributions from the Hawkesbury and the MacDonald rivers. This was also the pattern in 1964 and in the lesser event of 1988.

<table>
<thead>
<tr>
<th>Month, Year</th>
<th>Windsor</th>
<th>Sackville</th>
<th>Colo River</th>
<th>MacDonald River</th>
<th>Wisemans Ferry (Webbs Creek)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 1867</td>
<td>19.6</td>
<td>16.1</td>
<td>NA</td>
<td>NA</td>
<td>6.0</td>
</tr>
<tr>
<td>June 1949</td>
<td>12.1</td>
<td>8.4</td>
<td>17.4</td>
<td>8.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Nov 1961</td>
<td>15.0</td>
<td>10.4</td>
<td>9.3</td>
<td>3.8</td>
<td>3.2</td>
</tr>
<tr>
<td>June 1964</td>
<td>14.6</td>
<td>11.0</td>
<td>14.6</td>
<td>11.2</td>
<td>4.2</td>
</tr>
<tr>
<td>March 1978</td>
<td>14.5</td>
<td>10.7</td>
<td>20.7</td>
<td>10.4</td>
<td>4.8</td>
</tr>
<tr>
<td>July 1988</td>
<td>11.0</td>
<td>NA</td>
<td>17.5</td>
<td>7.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Aug 1990</td>
<td>15.3</td>
<td>10.0</td>
<td>NA</td>
<td>NA</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Many more floods than these have occurred on the lower Hawkesbury River. Flooding was experienced in 1933, 1934, 1938, 1942, 1947, 1949, 1952, 1956, 1975, 1986 and 1992, at least, in addition to the dates cited in the table above. Not all of these were serious floods at Windsor.

Design Flood Levels

Design flood levels are as shown in the table below in AEP (Annual Exceedance Probability) and ARI (Average Recurrence Interval (in years)) terms. Note that the AEP is a measure of the probability of occurrence of a flood of a particular level: a 1% flood has, each and every year, a 1% chance of being experienced at a specified location. At Wisemans Ferry there is a 1% chance each year of a flood reaching or exceeding 6.7 metres AHD at the Webbs Creek gauge and a 20% chance of a flood reaching or exceeding 3.2 metres.

These two levels can be expected (on average) to be experienced about once every 100 years and once every five years respectively. Note, however, that this does not mean that such floods will occur exactly once in the specified period: there are
numerous recorded cases in New South Wales of floods of low AEP levels occurring two or three times in quick succession at a particular location. Equally, very long periods may elapse between occurrences of particular levels of flooding. An indication of this is that the 20% AEP (5-year ARI) flood level at Wisemans Ferry has not been reached or surpassed for more than 10 years.

<table>
<thead>
<tr>
<th>Location</th>
<th>20% AEP (5-year ARI)</th>
<th>5% AEP (20-year ARI)</th>
<th>2% AEP (50-year ARI)</th>
<th>1% AEP (100-year ARI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wisemans Ferry (Webbs Creek)</td>
<td>3.2</td>
<td>4.4</td>
<td>5.6</td>
<td>6.7</td>
</tr>
<tr>
<td>Gunderman</td>
<td>2.4</td>
<td>3.3</td>
<td>4.3</td>
<td>5.2</td>
</tr>
<tr>
<td>Spencer</td>
<td>1.7</td>
<td>1.9</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Brooklyn</td>
<td>1.5</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
</tr>
</tbody>
</table>

### 9.3. LANDSLIP

A small amount of land within the Shire has been identified as a landslide risk. These areas are mainly located on the southern side of the Castle Hill Road ridgeline and the western side of the Old Northern Road ridgeline between Castle Hill Road and an area north of Old Castle Hill Road.

Full details of the areas identified are provided in The Hills Local Environment plan 2012.

Isolated rock falls and land slips have been experienced in other areas of the Shire such as at various locations along River Road. These incidents generally occur following periods of heavy rain and can result in short term road closures.
9.4. BUILDING COLLAPSE

There are a number of significant buildings in The Hills Shire that would, in the event of a building collapse, have an impact on the surrounding area and the local community. These buildings are primarily located within the Norwest Business Park as well as the various commercial and industrial areas such as Castle Hill, Baulkham Hills, North Rocks and Rouse Hill.

Planning is also well underway for the construction of multi-storey, high density residential apartment buildings in the area of Carlingford in the vicinity of the Carlingford Railway station, as well as around a number of the station precincts on the North West Rail link project.

9.5. EARTHQUAKE

The Sydney basin encloses a significant proportion of the Australian population with the 1989 Newcastle earthquake demonstrating that the basin is not immune from the impact of even relatively modest earthquakes.

The most significant geological formation that increases Sydney’s risk of a large earthquake is the Lapstone Structural Complex (LSC) which comprises a series of north-trending faults and monoclinal flexures forming the eastern margin of the Blue Mountains Plateau.

The LSC is 100km to 150km in length, from the Colo River in the north to the area near Bargo in the south, and has caused rocks on the western side to rise gradually over 500m relative to those on the east.
It would be reasonable to assume that a significant earthquake involving the LSC would not be restricted to The Hills Shire but would affect most of the Sydney Basin. Therefore it is considered appropriate that further investigation into the likelihood and impact of earthquakes in the Sydney Basin should be undertaken at a higher level.

9.6. DAM FAILURE

As indicated previously in Section 8.8, there are currently nine stormwater detention basins located within the Shire that have been identified as ‘Prescribed Dams’ under the provisions of the Dam Safety Act 1978. Only four of those prescribed dams are under Council’s ownership and control. None of these basins are permanently filled with water.

The failure of any one of these prescribed dams during a major rainfall event could result in serious damage to property and infrastructure and threaten the safety of residents and employees living or working downstream.

Although there are numerous other detention basins and dams in both residential and rural areas of the Shire in public and private ownership, these are not known to have the potential to represent a hazard in respect of emergency management.

9.7. ANIMAL OR PLANT DISEASE

Given the presence of various agricultural related businesses and hobby farms in the rural areas of the Shire, the impact of an outbreak of a significant plant or animal disease could be considerable.

However the presence of animals, fruit trees and vegetable gardens in urban areas must also be accounted for when estimating the potential impact of any significant outbreak of a plant or animal disease.

The sub-committee considered that further investigation into the likelihood and impact of animal or plant disease should be undertaken at a higher level through the Department of Primary Industries.

In 1998 an outbreak of Newcastle Disease occurred in two commercial poultry flocks in western Sydney. One of those flocks was located at Glenorie. The emergency was managed at a State Level through the Department of Primary Industries although the LEMC and Council provided some assistance with the coordination of resources including the supply of earthmoving equipment to assist with the burial of euthanased birds.

9.8. STORMS

Severe storms can occur anywhere in Australia and do so more frequently than any other major hazard. In terms of property damage, storms cause greater losses to the community than any other single hazard with the exception of floods.
Different types of storm activity may occur either separately or in association with each other. The following types of storms are identified in the State Storm Plan:-

- Thunderstorms
- Tornadoes
- Tropical and ex-Tropical Cyclones
- Mid-Latitude Low-Pressure System (including East Coast Lows)
- Low Pressure Troughs
- Cold Fronts and Southerly Busters
- Cold Outbreaks

The Shire has been heavily or partially affected by the following storms since 1989 (source Bureau of Meteorology):-

18/3/90  The Western Sydney Hailstorm

This severe thunderstorm struck Sydney at 4.00pm on the afternoon of Sunday, 18th March. Heavy falls of hail occurred over a large area, with high winds. Many trees were toppled, bringing down power and telephone lines. Some hailstones with diameters of 8cm were recorded.

Large parts of Sydney were affected on both sides of the harbour, the most serious damage occurring in the Auburn and Bankstown areas. Thousands of houses sustained broken windows and damage to roofs, mostly because of hail. There were whole streets in which every house suffered damage.

More than 60 people had to be evacuated from their houses until they could be made safe to live in. A further 85 were evacuated from a Bass Hill nursing home which had been damaged.

As a result of the storm the State Emergency Service (SES) was deluged with more than 3,500 calls for help in the first two days after the storm. SES units were brought in to respond from parts of Sydney which were little affected and from the Newcastle, Illawarra, Central West and Queanbeyan-Cooma areas.

SES volunteers, along with other emergency services and Army personnel, spent thousands of man hours placing tarpaulins over damaged roofs and heavy-duty plastic over broken windows and removing fallen trees from houses and streets. Over the first few days assistance was provided to some 2,000 homes.

Because of the large number of damaged houses and the run on building supplies which developed, tradespeople were unable to complete the permanent repairs quickly. A wet and windy autumn led to many tarpaulins and plastic sheets ripping off, and water entered some houses repeatedly. A near-continuous SES involvement was maintained for two weeks after the storm.
The damage bill, in terms of insurance payouts, was $384M in 1998 dollar terms, and the total economic cost was estimated at $550M.

21/1/91 The Northern Sydney Hail/Wind/Rain storm

This storm, a super cell thunderstorm, struck between 3.00pm and 5.00pm, crossing northern Sydney in a SW-NE direction. Wind gusts up to 230km/h were experienced, along with hailstones up to 7cm in diameter (tennis-ball sized) and very heavy rain. Some areas received more than 35mm of rain in six minutes and more than 60mm in half an hour.

Areas of most severe damage stretched from the Warrawee-Turrramurra area to Duffy's Forest, with significant damage occurring to property in the Ku-ring-gai, Hornsby, Warringah, The Hills, Blacktown, Gosford and Fairfield Council areas. Access to and within the affected area was greatly restricted because of fallen trees and downed power poles. About 164,000 customers lost power.

More than 7,000 houses were damaged, 20 of them so badly that they had to be demolished. About 200 public buildings (including schools) were also damaged. Damage to Telstra lines and property amounted to over $1M and to Sydney Water property about $1.2M.

The Hornsby and Ku-ring-gai State Emergency Service organisations received approximately 12,000 requests for assistance. More than 60 SES units were employed in the response, some of them coming from country areas of the State. Major operational support was also given by the Police, NSW Fire Brigades, the Bush Fire Brigades, the Roads and Traffic Authority, the Water Board, local councils, Telecom, electricity authorities, Public Works, the Department of Family and Community Services and the Army.

A total of 126,000 person hours were worked in the first two weeks after the storm in response and clean-up work. Vast quantities of vegetative material were deposited at tips in the northern Sydney area, 60,000 truckloads being needed to remove it. The removal of rubbish and the repair of infrastructure took about four months to complete.

The insurance payout on the storm was $226M in 1998 dollar terms and the total economic cost was about $670M.

14/4/99 The Eastern and Southern Sydney Hailstorm

This storm was a very intense and unusually long-lived super cell thunderstorm. It formed at about 4.25pm near Berry and tracked through the Kiama, Albion Park and Shellharbour areas where it deposited hail in large quantities. It then moved offshore before crossing the coast again near Helensburgh at about 7.00pm.
Thereafter it headed north across the Sutherland Shire, Botany Bay (including Kingsford Smith airport) and the eastern suburbs of Sydney.

The main areas of damage were the Lilli Pilli and Caringbah areas of the Sutherland Shire and St Peters, Erskineville, Botany, Eastlakes, Rosebery, Kensington, Redfern, Randwick, Darlinghurst and Paddington. These areas were struck between 7.30pm and 8.15pm. The storm then crossed the harbour, doing further damage in the northern beachside suburbs before moving out to sea in the vicinity of Gosford at 9.45pm. Some damage occurred as far north as Wyong.

This was principally a hail event though wind gusts of up to about 80km/h were recorded. Individual hailstones of at least 9cm diameter (soft-ball sized) were confirmed as having fallen.

In the first two days after the storm, some 10,000 calls for assistance were received but the number had escalated to 25,000 after three weeks. Other damage, not reported by residents and owners of damaged non-residential buildings, was picked up by emergency service crews by doorknocks which contacted more than 100,000 dwellings.

More than 20,000 buildings were damaged, most of them suffering holed or cracked roofing tiles. Slate and fibro cement roofs also fared badly, unlike corrugated iron roofing materials. Many ceilings were also damaged, and household effects and furnishings were waterlogged as a result. Some 44,000 cars were damaged along with 3,000 commercial and industrial premises and various facilities and aeroplanes at the airport. Public facilities damaged included 60 schools and the offices of South Sydney Council.

The areas of most concentrated damage were Rosebery and Kensington where there were whole streets in which every house suffered severe roof damage. Many of the inner-city buildings affected were multi-storey structures.

The biggest storm damage operation ever conducted in Sydney was mounted. During the four weeks after the storm there were at times more than 3,000 emergency workers deployed from the SES, the NSW Fire Brigades, the Rural Fire Service, the Army, the Volunteer Rescue Association and the National Parks and Wildlife Service. SES crews from Victoria, Queensland, South Australia and ACT joined the response.

A major problem was caused as a result of strong winds and heavy rain in three separate weather events in the month after the storm. Winds measured at up to 110km/h ripped off many of the tarpaulins which had been placed over damaged roofs. Emergency crews had to return to some houses on several occasions to replace and re-tie tarpaulins.
The scale of the repair task was massive and the permanent repairing of roofs took months to complete. The total insurance payout, a year after the storm, was estimated at $1.7 billion, the highest ever for a natural disaster in Australian history. The total economic damage was of the order of $2.2 billion.

3/11/2000 Western Sydney Thunderstorm

A large thunderstorm moved over western Sydney producing hailstones the size of tennis balls and three separate tornado stacks. This supercell thunderstorm was well captured by advanced radar systems on trial at the time as part of a World Meteorological Organisation sponsored Forecast Demonstration Project.

16/2/2002 Supercell Storm Over Western Sydney

Western parts of Sydney suffered again when a supercell thunderstorm moved across the region bringing damaging winds, heavy rain and up to 5cm hailstones. The SES received over 8,000 requests for assistance.

25/10/2003 Thunderstorm Over Western Sydney and Lower Blue Mountains

Thunderstorms occurred with hail of up to 5cm size stripped trees and gardens, injured livestock and damaged cars and solar hot water systems. Reports were received of flash flooding and hail covering the ground. One man was killed by a falling tree in the Blue Mountains during the thunderstorm. At Berowra, 75mm of rain was recorded in 60 minutes.

5/9/2014 Father’s Day Hailstorm

This storm affected most of Sydney from Blacktown to the coast, north to Hornsby and south to Bankstown. Hail covered the ground to a depth of 5cm causing traffic chaos and local flooding.

26/2/2006 Thunderstorms and Flash Flooding in the Sydney - Wollongong Area

Thunderstorms caused flash flooding in parts of Sydney and Wollongong areas during the evening. A woman was swept to her death near Berry to the south of Wollongong after attempting to drive across a flooded causeway. On the Illawarra coast significant rainfall totals were Reverces (113mm), Wonhawilli (110mm), Dombarton Loop (108mm) and Wattamolla (97mm).

In Sydney, very heavy rain caused flash flooding in Penrith, Glenmore Park, St Marys and Northmead. Roads were closed and cars were stranded. Glenmore Park recorded 94mm of rain in three hours, Horsley Park 48.8mm in 60 minutes, Homebush 24.2mm in 30 minutes.
and Turramurra 40mm in 30 minutes. Avalon on the northern beaches recorded 101mm in about two hours.

9/12/2007  Severe Storm with Giant Hail Hits NW Sydney

A severe thunderstorm crossed Sydney’s western and northern suburbs around 4.00pm producing many reports of golf ball to tennis ball size hail in suburbs stretching from Blacktown to Wahroonga. The largest confirmed hail size was 7cm at Blacktown and 6cm at Wahroonga with an unconfirmed report of 11cm hail at Cherrybrook. The damage bill exceeded $200 million dollars with more than 6,000 calls for assistance received by the SES. The supercell is probably the most significant single thunderstorm event to impact on Sydney since the infamous hailstorm that struck the eastern suburbs in April 1999. This storm and associated cells also affected the NSW Central Coast and Newcastle, producing very heavy rain, hail and squally winds.

9.9. LOCAL INFRASTRUCTURE FAILURE

The various public utilities that provide services across the Shire have an excellent record of maintaining supply to residential and commercial customers. Nevertheless, interruptions can occur due to bushfire, flood and storm damage, motor vehicle accidents, equipment breakdowns and ‘accidental’ damage resulting from excavation or construction work by third parties.

Any significant emergency incident affecting public utility infrastructure, including major transmission systems that may traverse the Shire, requiring a multi-agency response would be managed at a State or Regional level through the emergency plans developed by the responsible agency.

9.10. COMMUNICABLE DISEASES - HUMAN

NSW Health is the combat agency in the event of a pandemic.

A human influenza pandemic plan has been developed by NSW Health and identifies the emergency management arrangements required to respond to such an event.

10) RISK ANALYSIS & EVALUATION

Risk Assessment Matrix

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Insignificant</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Catastrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost Certain</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Likely</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Possible</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>Extreme</td>
</tr>
</tbody>
</table>
10.1. RISK EVALUATION CRITERIA

- Any reasonably preventable accident/incident resulting in loss of life is unacceptable.
- Any reasonably preventable accident/incident resulting in serious injury is unacceptable.
- Any reasonably preventable matter that will affect the health and wellbeing of a community is unacceptable.
- Any reasonably preventable activity or incident that will have a medium- to long-term or permanent effect on the environment is unacceptable.
- Any reasonably preventable activity or incident that will have a long-term or permanent effect on the cultural assets and values of a community is unacceptable.
- Any reasonably preventable activity or incident that will seriously disrupt normal business activity is unacceptable.
- Any reasonably preventable activity or incident that will seriously disrupt community lifelines or services is unacceptable.

10.2. METHODOLOGY – CONSEQUENCE

<table>
<thead>
<tr>
<th>DESCRIPTOR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignificant</td>
<td>No injuries or fatalities. No displacement of people or displacement of only a small number of people for short duration. Little or no personal support required (support not monetary or material). Inconsequential or no damage. Little or no disruption to community. No measurable impact on environment. Little or no financial loss.</td>
</tr>
<tr>
<td>Minor</td>
<td>Small number of injuries but no fatalities. First aid treatment required. Some displacement of people (less than 24 hours). Some personal support required. Some damage. Some disruption (less than 24 hours). Small impact on environment with no lasting effects. Some financial loss.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Medical treatment required but no fatalities. Some hospitalisation. Localised displacement of people who return within 24 hours. Personal support satisfied through local arrangements. Localised damage that is rectified by routine arrangements. Normal community functioning with some inconvenience. Some impact on environment with no long-term effect or small impact on environment with long-term effect. Significant financial loss.</td>
</tr>
</tbody>
</table>
### 10.3. METHODOLOGY – LIKELIHOOD

<table>
<thead>
<tr>
<th>RATING</th>
<th>DESCRIPTION &amp; INDICATIVE PROBABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost certain</td>
<td>is expected to occur in most circumstances; and/or high level of recorded incidents; and/or strong anecdotal evidence; and/or a strong likelihood the event will recur; and/or great opportunity, reason, or means to occur; may occur once every year or more</td>
</tr>
<tr>
<td>Likely</td>
<td>will probably occur in most circumstances; and/or regular recorded incidents and strong anecdotal evidence; and/or considerable opportunity, reason or means to occur; may occur once every five years</td>
</tr>
<tr>
<td>Possible</td>
<td>might occur at some time; and/or few, infrequent, random recorded incidents or little anecdotal evidence; and/or very few incidents in associated or comparable organisations, facilities or communities; and/or some opportunity, reason or means to occur; may occur once every 20 years</td>
</tr>
<tr>
<td>Unlikely</td>
<td>is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or no recent incidents in associated organisations, facilities or communities; and/or little opportunity, reason or means to occur; may occur once every 100 years</td>
</tr>
<tr>
<td>Rare</td>
<td>may occur only in exceptional circumstances; may occur once every 500 or more years</td>
</tr>
</tbody>
</table>

11) REFERENCES

- ABS Regional Population Growth
- ABS Census Data - Local Regional and NSW
- ABS 2011 Census Data – General
- The Hills Shire Council – Community Profile
- Emergency Risk Management Applications Guide – Emergency Management Australia
- North West Metropolitan Emergency Management District Displan (2011)
- The Hills Shire Displan (2011)
- Penrith LEMC ‘Emergency Risk Management Study’ (2014)
- NSW Department of Environment and Heritage’s ‘NSW Climate Impact Profile’
- Aviation Emergency Sub-Plan (2010)
- NSW Flood Sub-Plan (2008)
- Hawkesbury Nepean Flood Emergency Sub-Plan (2014)
- The Hills Shire Local Flood Plan (2010)
- Heatwave Sub-Plan (2011)
- Human Influenza Pandemic Plan (2010)
- Major Structure Collapse Sub-Plan (2011)
- Storm Sub-Plan (2013)
- Tsunami Emergency Sub-Plan (2008)
### 12) APPENDICES

#### 12.1. APPENDIX 1 - RISK ASSESSMENT

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Definition</th>
<th>Likelihood Rating</th>
<th>Consequence Rating</th>
<th>Risk Level</th>
<th>Treatment/ Treatment Option</th>
<th>Priority</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biosecurity (Animal and Plant)</td>
<td>An agriculture/ horticulture incident that results, or has potential to result, in the spread of a communicable disease or infestation.</td>
<td>Possible</td>
<td>Moderate</td>
<td>High</td>
<td>DPI will determine response with appropriate quarantine and treatment measures</td>
<td>High</td>
<td>Refer to Biosecurity (Animal and Plant) Emergency Sub-Plan</td>
</tr>
<tr>
<td>Bridge Closure</td>
<td>Failure of a major bridge structure with or without warning owing to structural failure or as a result of external/ internal events or other hazards/ incidents.</td>
<td>Unlikely</td>
<td>Major</td>
<td>High</td>
<td>Regular inspections of bridge structures are the responsibility of the bridge owner</td>
<td>Medium</td>
<td>The majority of major transport bridges in the Shire are the responsibility of RMS and/or M2/M7 Motorway operators. Council managed bridges are on roads with lower traffic volumes. Viable alternate routes are generally available</td>
</tr>
<tr>
<td>Building Collapse</td>
<td>Collapse of building owing to structural failure or impact from external/ internal event or other hazards /incidents.</td>
<td>Unlikely</td>
<td>Major</td>
<td>High</td>
<td>Building Code of Australia and Major Structural Collapse Sub-Plan</td>
<td>Low</td>
<td>Some high rise commercial buildings are located in the Norwest Business Park. High rise residential apartment buildings (greater than four storeys) are under construction or planned for a number of target sites including the Carlingford precinct and Baulkham Hills Town Centre, as well as in the vicinity of future railway stations on the North West Rail Link project.</td>
</tr>
<tr>
<td>Hazard</td>
<td>Definition</td>
<td>Likelihood Rating</td>
<td>Consequence Rating</td>
<td>Risk Level</td>
<td>Treatment/Treatment Option</td>
<td>Priority</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Communicable Disease - (Human/Animal)</td>
<td>Pandemic illness that affects, or has potential to affect, large portions of the human or animal population</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Ministry of Health and/or DPI will determine response with appropriate quarantine and treatment measures</td>
<td>Medium</td>
<td>Considered to be outside the scope of responsibility of the LEMC. Department of Health is the primary response agency. State and Commonwealth response plans have been prepared</td>
</tr>
<tr>
<td>Dam Failure</td>
<td>A dam is compromised that results in localised or widespread flooding.</td>
<td>Unlikely</td>
<td>Major</td>
<td>High</td>
<td>Regular inspection of dam walls by dam owner. For Prescribed Dams, ongoing compliance with requirements of Dam Safety Committee</td>
<td>Medium</td>
<td>All Prescribed Dams are detention basins that generally contain no water except during major storm events. Failure of dam walls during such an event would threaten the safety of residents, businesses and properties immediately downstream</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Earthquake of significant strength that results in localised or widespread damage.</td>
<td>Rare</td>
<td>Catastrophic</td>
<td>High</td>
<td>Building Code of Australia and Major Structural Collapse Sub-Plan</td>
<td>Low</td>
<td>A major earthquake is considered to be outside the scope of responsibility of the LEMC. State response plan has been prepared</td>
</tr>
<tr>
<td>Fire (Bush or Grass)</td>
<td>Major fires in areas of bush or grasslands.</td>
<td>Likely</td>
<td>Major</td>
<td>Extreme</td>
<td>Refer to The Hills Bush Fire Management Committee ‘Bush Fire Risk Management Plan’ and Operations Plan</td>
<td>High</td>
<td>Refer to The Hills Bush Fire Management Committee ‘Bush Fire Risk Management Plan’ and Operations Plan</td>
</tr>
<tr>
<td>Fire (Industrial)</td>
<td>Serious industrial fire in office complexes and/or warehouses within industrial estates.</td>
<td>Possible</td>
<td>Moderate</td>
<td>High</td>
<td>Building Code of Australia, pre-incident planning by relevant fire authority and fire safety inspections by regulatory authorities</td>
<td>Medium</td>
<td>Response will be coordinated by relevant fire authority with assistance if required from other agencies</td>
</tr>
<tr>
<td>Hazard</td>
<td>Definition</td>
<td>Likelihood Rating</td>
<td>Consequence Rating</td>
<td>Risk Level</td>
<td>Treatment/ Treatment Option</td>
<td>Priority</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fire (Commercial)</td>
<td>Serious commercial fires in shopping centres, aged persons units, nursing homes and hospitals.</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Building Code of Australia, pre-incident planning by relevant fire authority and fire safety inspections by regulatory authorities</td>
<td>Medium</td>
<td>Response will be coordinated by relevant fire authority with assistance if required from other agencies</td>
</tr>
<tr>
<td>Fire (Residential)</td>
<td>Serious residential fire in medium/high rise apartments.</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Building Code of Australia, pre-incident planning by relevant fire authority and fire safety inspections by regulatory authorities</td>
<td>Medium</td>
<td>Response will be coordinated by relevant fire authority with assistance if required from other agencies</td>
</tr>
<tr>
<td>Flood (Flash)</td>
<td>Heavy rainfall causes excessive localised flooding with minimal warning time</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Regular monitoring by Council staff to ensure drainage systems are operational. Council has a program to upgrade drainage systems on a priority basis where flash flooding is known to occur</td>
<td>Medium</td>
<td>Response will be coordinated by local SES with assistance if required from other agencies</td>
</tr>
<tr>
<td>Flood (Riverine)</td>
<td>River flows exceed the capacity of normal river systems resulting in flood waters escaping and inundating river plains</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>NSW State Flood Plan, Hawkesbury Nepean Flood Emergency Sub-Plan and The Hills Shire Local Flood Plan</td>
<td>High</td>
<td>Response coordinated by SES at regional and local level or possibly even State level for an extreme event</td>
</tr>
<tr>
<td>Hazardous Release</td>
<td>Hazardous material released as a result of an incident or accident.</td>
<td>Unlikely</td>
<td>Moderate</td>
<td>Moderate</td>
<td>State Hazardous Materials and CBR Sub-Plan, Building Code of Australia,</td>
<td>Low</td>
<td>Primary responsibility for response lies with relevant fire authority with assistance if required from other agencies</td>
</tr>
<tr>
<td>Hazard</td>
<td>Definition</td>
<td>Likelihood Rating</td>
<td>Consequence Rating</td>
<td>Risk Level</td>
<td>Treatment/Treatment Option</td>
<td>Priority</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Landslip</td>
<td>Landslip/landslide resulting in localised or widespread damage.</td>
<td>Unlikely</td>
<td>Major</td>
<td>High</td>
<td>LEP identifies known areas of landslip risk supplemented by DCP controls and Section, 149 Certificate notifications. Council has also appointed an independent panel of experts to assist with DA assessment in known landslip areas</td>
<td>Medium</td>
<td>Primary responsibility for response lies with LEOCON with assistance from other agencies</td>
</tr>
<tr>
<td>Storm</td>
<td>Severe storm with accompanying lightning, hail, wind, and/or rain that causes severe damage and/or localised flooding. (includes tornado)</td>
<td>Likely</td>
<td>Moderate</td>
<td>High</td>
<td>Building Code of Australia, Australian Standards, community awareness programs such as ‘Stormsafe’</td>
<td>High</td>
<td>Emergency response to storms managed by SES at a local level with assistance from other agencies. Response could escalate to Regional or even State level depending on severity and geographical extent of storm in accordance with State Storm Plan</td>
</tr>
<tr>
<td>Transport Emergency (Air)</td>
<td>Aircraft crashes in LGA resulting in large number of fatalities, injuries and/or damage to property.</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Extreme</td>
<td>State Aviation Emergency Sub – Plan details arrangements for the control and coordination of the response to an aviation emergency. Guidance also provided in booklet jointly prepared by ATSB and DDAAFS title ‘Civil and Military Aircraft Accident Procedures for Police Officers and</td>
<td>Low</td>
<td>Considered to be outside the scope of the LEMC. REMC or SEMC more likely to respond to a major event. The State Aviation Emergency Sub-Plan will determine response in conjunction with Air Transport Safety Board (ATSB) and the Directorate of Defence Aviation and Air Force Safety (DDAAFS).</td>
</tr>
<tr>
<td>Hazard</td>
<td>Definition</td>
<td>Likelihood Rating</td>
<td>Consequence Rating</td>
<td>Risk Level</td>
<td>Treatment/ Treatment Option</td>
<td>Priority</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Transport Emergency (Road)</td>
<td>A major vehicle accident that disrupts one or more major transport routes that can result in risk to people trapped in traffic jams, restrict supply routes and/or protracted loss of access to or from the area.</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Emergency Services Personnel.</td>
<td>Low</td>
<td>Major road transport incident not likely to constitute an emergency requiring involvement from LEMC. Overall impact on road and public transport network resulting from major incidents will be managed by the Transport Management Centre with assistance from other agencies including emergency services.</td>
</tr>
<tr>
<td>Transport Emergency (Sea)</td>
<td>A major accident that results in environmental damage and major recovery operation</td>
<td>Unlikely</td>
<td>Major</td>
<td>High</td>
<td>Commercial passenger vessels undergo regular inspection by accredited marine surveyor and are licensed</td>
<td>Low</td>
<td>Could occur as a result of an incident with one of the four vehicular ferries operating within the Shire along the Hawkesbury River. Unlikely to be a matter for LEMC</td>
</tr>
<tr>
<td>Tsunami</td>
<td>A tsunami wave of magnitude that presents a risk to land and marine elements.</td>
<td>Rare</td>
<td>Moderate</td>
<td>Moderate</td>
<td>State Tsunami Emergency Sub-Plan</td>
<td>Low</td>
<td>Unlikely to cause any significant direct damage within The Hills Shire although river front properties and businesses along lower reaches of Hawkesbury River could experience some impacts</td>
</tr>
<tr>
<td>Utilities Failure</td>
<td>Major failure of essential utility for unreasonable periods of time as a result of a natural or event.</td>
<td>Possible</td>
<td>Major</td>
<td>Extreme</td>
<td>Gas Supply Distribution Supporting Plan, Energy and Utilities Supporting Plan (including Wires)</td>
<td>Low</td>
<td>Primary responsibility for response rests with relevant utility authority or service provider. Very unlikely to be a matter for LEMC unless effects are widespread and long term</td>
</tr>
</tbody>
</table>
## Hazard Definition

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Definition</th>
<th>Likelihood Rating</th>
<th>Consequence Rating</th>
<th>Risk Level</th>
<th>Treatment/Treatment Option</th>
<th>Priority</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heatwave</td>
<td>A set of meteorological conditions that is described by the Bureau of Meteorology as a Heatwave which may affect a part or the whole of the state. Generally this is a sequence of three days of abnormally hot conditions. (Source: NSW State Heatwave Sub-Plan)</td>
<td>Almost Certain</td>
<td>Major</td>
<td>Extreme</td>
<td>Down Sub-Plan), Telecommunication Services Supporting Plan</td>
<td>Medium</td>
<td>Primary responsibility for coordination of response rests with SEOCON and DEOCON with assistance from other functional areas and agencies</td>
</tr>
</tbody>
</table>

The following hazards have been considered and determined to be no risk within the area of this study:

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avalanche</td>
<td>Mass of ice and snow falling suddenly down a mountain slope and often taking with it earth, rocks and rubble of every description</td>
</tr>
<tr>
<td>Underground Mine accident</td>
<td>Incident occurring in an active mine resulting from an explosion, fire, collapse or chemical release resulting in injury or death</td>
</tr>
<tr>
<td>Space debris</td>
<td>Re-entry of debris from space causing injury, death and damage on impact with the earth’s surface</td>
</tr>
<tr>
<td>Coastal erosion</td>
<td>Coastal erosion is a process that occurs through the actions of currents and waves along coastlines that results in the loss of sediment</td>
</tr>
</tbody>
</table>