

Working from the same page

consistent messages for CDEM

PART B: Hazard-specific information



Beach Road, Whangarei, 2007

Coastal-storm inundation

- ▶ **Learn about your community's risks from hazards created by coastal storm inundation.**
- ▶ **Contact your regional council to find out if you live in an area prone to coastal storm inundation.**
- ▶ **Visit the National Institute of Atmospheric Research (NIWA) website www.niwa.co.nz, and the MetService website www.metservice.co.nz, to find out about risks from storm surge.**

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CORE ACTION MESSAGES IN THIS CHAPTER (p6)

- ▶ **Determine your risk.**
- ▶ **Get your household ready.**
- ▶ **Make an evacuation plan.**
- ▶ **Keep an 'in case of coastal storm inundation' to-do list.**

For general readiness, every household should create and practice a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take coastal-storm inundation specific precautions and plan for and practice what to do if a coastal storm occurs.

Please note: Core Action Messages should be read in conjunction with the rest of the text in this chapter.

Awareness messages

Is coastal-storm inundation an issue in New Zealand?

Coastal inundation can cause substantial damage to public and private property including the contents of flooded buildings and can cause breakdown of transport and communications. Coastal inundation can be a threat to the safety of inhabitants of low-lying coastal areas. Some areas of New Zealand have in the past been affected by coastal inundation, including (but not limited to) Whangarei Harbour, Hauraki/Thames, Whitianga, East Clive to Clifton, and parts of South Canterbury and Southland.

A high proportion of New Zealand's urban development has occurred in coastal areas. Some of this development has been located in areas that are vulnerable to coastal hazards such as coastal inundation and also coastal erosion. In recent years, coastal development and the growth of associated infrastructure has intensified, and property values have increased enormously. As development and property values in coastal margins increase, the potential impacts and consequences of coastal inundation hazards also increase. Climate change will increase the exposure to coastal inundation in many areas of New Zealand, including many areas that do not currently have a history of inundation.

What causes coastal inundation?

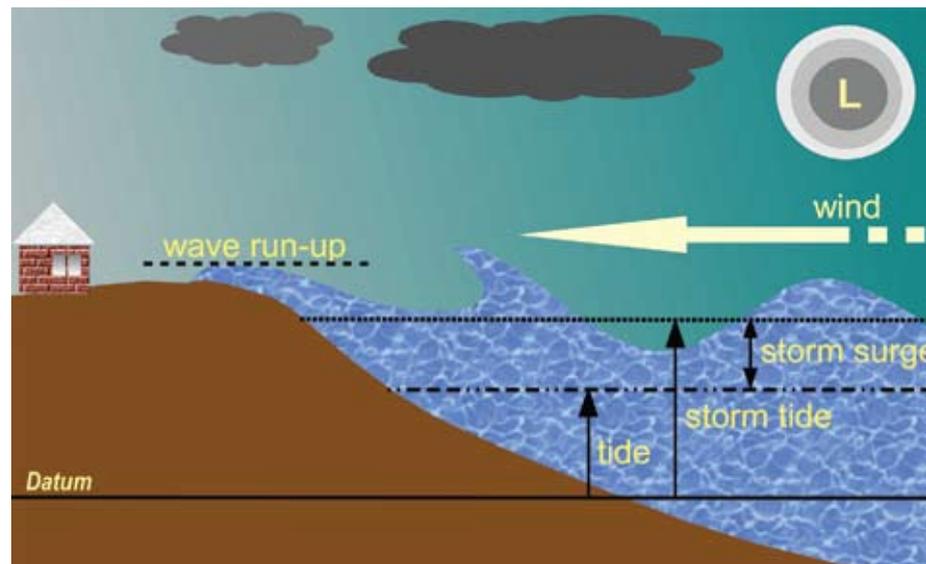


Fig. 1: Components that combine to produce elevated storm-tide levels and wave run-up leading to coastal storm inundation (NIWA, 2008)

Coastal inundation is the flooding of coastal lands by raised ocean waters and can be compounded by flooding in adjacent lowland rivers. Most coastal inundation problems have arisen from coastal development located in low-lying coastal areas, or areas located too close to the shoreline to accommodate existing natural changes in shoreline position.

Coastal inundation is an acute natural event arising from extreme weather events (storms), where normally dry, but low-lying coastal land is flooded occasionally. Coastal inundation can also be caused by a tsunami (**See** Tsunami). Storm-related coastal inundation is typically caused by a combination of factors that include high tides combining with:

- Storm surge – the temporary (hours to a few days) increase in ocean level over and above the predicted tide height due to a combination of low barometric pressure and strong onshore or adverse alongshore winds¹;
- Wave set-up landward of the surf zone and wave run-up over the upper beach which can overtop low coastal barriers;
- Elevated water levels from any accompanying rainfall causing river floods or flashfloods

The first two processes are illustrated by the schematic in Fig. 1 on the previous page.

During storm events, the likelihood and magnitude of coastal inundation is highly dependent on the particular occurrence or timing of high tides and their relative height, storm surge and accompanying wave/swell conditions.

Storm surges in New Zealand can be relatively modest compared to the tidal range of water level (which is completely independent of meteorological conditions). Extreme wave conditions may not always coincide with the peak in storm-tide levels. In some cases, extreme waves (particularly long-period swell) can arrive from a storm centre located well offshore with little storm surge occurring locally, yet still cause overtopping.

Despite our modest storm surge heights up to possibly 1 m (compared with several metres in some parts of the world), New Zealand has many low lying coastal areas (relative to present mean sea level) that are exposed to potential coastal inundation. These include wetland and other fringe areas of coastal lagoons, estuaries and rivers, and the areas behind beach and dune systems or protected by coastal stopbanks.

The extent and magnitude of inundation also depends locally on how storm tide and wave conditions actually overtops and inundates an area. This depends on the physical characteristics and topography of the upper parts of the beach or estuarine shoreline and immediate coastal hinterland. In particular, public accessways (walkways, boat ramps, roads) and low points in the ridge-line along coastal barriers or dunes are prime candidates for inundation pathways.

1 Besides direct onshore winds, alongshore winds (blowing parallel to the coast) can also cause set-up in sea level when they blow in a direction over the sea where the land is to the left, e.g. south-westerly on east coast of South Island or north-easterly on west coast of South Island.

What sorts of impacts should we watch for?

Some of the impacts that will occur during or after a coastal inundation event (in addition to generic flooding impacts) are:

- Extensive and possible long-lasting ponding of seawater behind coastal barriers, seawalls or dunes with difficulties providing drainage to the sea for gravity systems which can be exacerbated by backwater effects or closure of stormwater flap gates from high storm-tide levels;
- High velocities along inundation pathways where wave run-up and run-down occurs ("green water"), which can cause damage or scour to the foundations of buildings and infrastructure and pose a safety risk to people (even with shallow water depths);
- Potential safety issues with substantial volumes of wave splash and wind-driven saltwater spray, e.g. pedestrian safety, impaired vision for drivers, safety of vehicles on coastal roads;
- Damage and possible breaches or failures of coastal-defence structures, stopbanks or revetments;
- Potential damage to shoreline structures and facilities, e.g. marinas, jetty structures, boat ramps, boat sheds, car parks, surf-club property, toilet and bather changing buildings;
- Potential for strong outrush velocities and associated scour where inundation waters find exit points along the coast, e.g. creeks, stormwater drains, low accessways;
- Higher chance of electric shocks from downed power lines or damaged underground cables due to the higher conductivity of saltwater;
- Marine sand/gravel and debris deposits on land. (Note: During the clean-up, sand/gravel should be returned, where possible, to the coastal sedimentary system it came from rather than a landfill);
- Salt damage to assets containing exposed metal, particularly vehicles and internal house fixtures;
- Long-lasting salt damage to flooded pastures (can be up to a year before recovery of grasses) that will affect primary productivity;

How will climate change affect coastal inundation?

Climate change will exacerbate existing coastal inundation problems and start to cause problems in many other lower-lying areas previously not impacted as sea levels continue to rise and storm intensity increases. Impacts on New Zealand's coastal margins due to sea-level rise, modification of estuary/harbour tides and climate change impacts on storms, waves, river floods and sediment supply to the coast will lead to more extensive and frequent coastal inundation. This may also be compounded by coincident river flooding and generally higher ground-water levels resulting in increased drainage problems in adjacent low-lying areas.

CORE ACTION MESSAGES

- ▶ **Determine your risk.**
- ▶ **Get your household ready.**
- ▶ **Make an evacuation plan.**
- ▶ **Keep an 'in case of coastal storm inundation' to-do list.**

For general readiness, every household should create and practice a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take coastal storm inundation specific precautions and plan for and practice what to do if the storm inundation happens.

Reducing the risk and planning pays off

The reality of having your home or business inundated is difficult to understand unless you have been through the experience – you can face months away from home while it is repaired. Coastal inundation can also mean the prospect of losing your possessions (including additional saltwater damage) as well as an immense amount of disruption to normal life. The emotional impact can be equally devastating. Coping with the unfamiliar tasks of sorting out the restoration of your home whilst living in temporary accommodation, plus worrying about the possible impact on house prices and the risk of future flooding, all add to the stress of the situation. Having your home or business inundated is a devastating experience, but the distress and disruption can be limited if you are prepared. Having a plan can help – knowing who is going to do what and where to turn for help can really calm the crisis.

Regardless of how coastal inundation occurs, the rule for being safe is simple: head for higher ground and stay away from the shoreline. Even a shallow depth of moving water produces more force than most people imagine. Winds and waves also have enough force to destroy properties and infrastructure or wash away buildings and even roads. You can protect yourself best by being prepared and having time to act. You can protect your home best by taking measures to reduce potential inundation damage (called mitigation).

What is the best source of information in a flood situation?

Radio or television stations can be good sources of information in a severe situation for official weather and weather-related bulletins. MetService is responsible for releasing weather warnings in New Zealand. They will issue a Severe Weather Warning whenever there is an expectation that the following weather condition will occur within the next 24 hours:

Widespread severe gales with a minimum mean speed of 90 km/hr or frequent gusts exceeding 110 km/hr. “Widespread” means over an area of 1000 square kilometres or more [MetService, 2008].

MetService will issue a Severe Weather Watch whenever there is an expectation

that conditions may deteriorate to the thresholds specified for the issue of a Severe Weather Warning, i.e:

After the next 24 hours but within 48–72 hours, or if there is a high level of uncertainty within the next 24 hours.

In addition, there is a Severe Weather Outlook, with the aim to provide a “heads up” of potential severe weather events in the day three to day six period. Since tides have a major influence whether a storm surge becomes a threat or not, a wind forecast alone would not provide the necessary information.

There are two useful web resources for tide predictions:

www.hydro.linz.govt.nz/tides/majports/index.asp

(tide predictions at standard and secondary ports for the following 12 months);

www.niwa.co.nz/our-services/online-services/tides

(open-coast tide predictions at any location around New Zealand out to 2019).

There are also coastal water-level stations around New Zealand that provide near real-time or recent measurements and are operated by regional councils, some territorial authorities and NIWA. Some of the web links to these monitoring stations are listed under Useful Links.

How can I protect myself during coastal inundation?

Before inundation

1. If you are building in a coastal area, ask your local and regional council about the likelihood of coastal inundation including the effects of climate change and the history of coastal flooding in the region. You may choose to exceed council consent requirements by further elevating and reinforcing your house or critical buildings.
2. If you own a property, check whether it is above or below the projected storm-tide water level and learn about the history of coastal inundation for your region.
3. Promote effective and wise land use planning within your coastal community.
4. Find out from your local emergency management office if you live in a coastal inundation-prone area.
5. Check with the local civil defence emergency management office if there is a community evacuation plan. If yes, plan and practice an evacuation route. This plan should show you the safest routes away from the coast to high ground or evacuation centres. All members of the household should know where to meet each other, where to evacuate to, and what route(s) to take if they have to leave. Making plans well in advance will help you avoid last-minute confusion.

6. If you live in an area prone to coastal inundation you may need to abandon your house and look after yourself. Keep the following survival supplies:
 - Torch and extra batteries
 - Portable battery-operated radio and extra batteries
 - First aid kit and manual
 - Water (three litres per person per day)
 - Food (canned, dried, non-perishable)
 - Nonelectric can opener
 - Essential medicines
 - Cash and credit cards
 - Sturdy shoes
 - Blankets and warm clothing;
 - Alternative cooking method (BBQ or gas cooker)
 - Pet supplies
 - Baby supplies
 - Disposable cleaning cloths, such as “baby wipes” for the whole family to use in case bathing facilities are not available
 - Personal hygiene supplies, such as soap, toothpaste, sanitary napkins, etc.

Make a list of any additional vital items you will need should you be flooded – some warm clothes, essential toiletries, any medication etc. In the same way as expectant mothers are encouraged to ‘pack a bag’ ready for going into hospital, consider packing an ‘go bag’; include a torch and a battery operated radio.

7. Make sure that all family members know how to respond during a storm surge.
8. Teach children how and when to call 111 and which radio station gives emergency information.
9. Make a list of useful telephone numbers – insurance, gas, electric, local authority, essential farming contacts, local Rural Support Trust, landlord if applicable and keep it in a safe place – preferably upstairs.
10. Make sure you and your family members know how to switch off gas, electric and water supplies at the mains – even in the dark.
11. Keep insurance policies, documents, and other valuables in a safe-deposit box. You may need quick, easy access to these documents. Keep them in a safe place less likely to be damaged during a flood.
12. If farming, develop a livestock plan which includes identifying areas likely to be free from inundation, making prior arrangements with neighbours etc. Responsibility for livestock rests with the owner.
13. Prepare a separate pet plan, most public shelters do not accept pets.

14. Contact your local civil defence emergency management office for more information on mitigation options to further reduce potential coastal-inundation damage. Your local emergency management office may be able to provide additional resources and information on ways to reduce potential damage.

Evacuation preparedness

Before an imminent/during a storm-tide event:

15. Prepare your home prior to leaving by boarding up doors and windows, securing or moving indoors all yard objects, and turning off all utilities.
16. Turn off utility services if told to do so by authorities. Authorities may ask you to turn off water, electricity or gas supplies to prevent damage to your home or within the community.
17. Unplug small appliances. Small appliances may be affected by electrical power surges. Unplugging them reduces potential damage.
18. Move valuable household possessions to the upper floors or to safe ground if time permits. Raising this equipment will prevent damage. An undamaged water cylinder may be your best source of fresh water after a flood.
19. Minimise the distance you must travel to reach a safe location; the further you drive the higher the likelihood of encountering traffic congestion and other problems on the roadways.
20. Select the nearest possible evacuation destination, preferably within your local area, and map out your route. Do not get on the road without a planned route, or a place to go.
21. Choose the home of the closest friend or relative outside a designated evacuation zone and discuss your plan with them. You may also choose a hotel/motel outside of the vulnerable area.
22. If neither of these options is available, consider the closest possible evacuation centre, preferably within your local area.
23. Use the evacuation routes designated by authorities and, if possible, become familiar with your route by driving it before an evacuation order is issued.
24. Contact your local civil defence emergency management office to register or get information regarding anyone in your household whom may require special assistance in order to evacuate.
25. Before leaving the area, fill your car with fuel and withdraw extra money from the ATM.
26. Take all prescription medicines and special medical items, such as glasses and nappies.
27. If your family evacuation plan includes a caravan, boat or trailer, leave early. Do not wait until the evacuation order or exodus is well underway to start your trip.
28. If you live in an evacuation zone and are ordered to evacuate by local emergency management officials, do so as quickly as possible. Do not wait or delay your departure, to do so will only increase your chances of being stuck in traffic, or even worse, not being able to get out at all.

29. Expect traffic congestion and delays during evacuations. Expect and plan for significantly longer travel times to reach your family's intended destination.
30. Find and listen to a radio station broadcasting civil defence messages. Ensure you have a portable battery-operated radio in case of power failure or if you need to evacuate.
31. Be ready to act quickly. Coastal inundation can happen relatively quickly and the warning time may be short. Be ready to act immediately and keep your previously assembled Getaway Kit near. Having supplies ready will save time.
32. Follow the instructions and advice of civil defence emergency management authorities. Local authorities are the most informed about affected areas and the most knowledgeable about areas you should avoid.
33. Consider a precautionary evacuation of livestock. Waiting until the last minute could be fatal for them and dangerous for you. Where possible, move livestock to higher ground.
34. Take your pets with you if you evacuate. Leaving them may endanger you, your pets, and emergency responders.

After inundation/ returning home

35. Dangers do not end when the water begins to recede. Continue to listen to radio or television stations and don't return home until authorities indicate it is safe to do so. There may be flood-related hazards within your community, which you could hear about from radio or television broadcasts.
36. Get medical care at the nearest hospital or clinic, if necessary. Contaminated water can cause infection. Severe injuries will require medical attention.
37. Help people who require special assistance – infants, elderly people, those without transportation, families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
38. Stay away from damaged areas. Your presence might hamper rescue and other emergency operations, and put you at further risk from the residual effects of floods, such as contaminated water, crumbled roads, landslides, mudflows, and other hazards.
39. Wear long pants, a long-sleeved shirt, and sturdy shoes. The most common injury following an inundation disaster is cut feet.

Health hygiene and clean up

40. Check for sewage and water pipe damage. If you suspect sewage pipes are damaged avoid using the toilets and call a plumber. If water pipes are damaged, contact the council's water-services section or utility company and avoid using the water from the tap. Contamination of drinking water by sewage can cause dangerous and contagious disease.
41. Throw away food and drinking water that has come in contact with floodwater, including canned goods. It is impossible to know if containers were damaged and the seals compromised. Food contaminated by floodwater can cause severe infections.

42. Discard wooden spoons, plastic utensils, and baby bottle teats and dummies if they have been covered by floodwater. There is no way to safely clean them.
43. Disinfect metal pans and utensils by boiling them in clean or properly treated water.
44. Avoid drinking or preparing food with tap water until you are certain it is not contaminated. If water is of questionable purity, boil the water or add bleach to it. Wells inundated by floodwater should be pumped out and the water tested for purity before drinking. If in doubt, call your local public health authority. Ill health effects often occur when people drink water contaminated with bacteria and germs.
45. You can clean and disinfect your property using ordinary household products.
46. A garden hose is useful for washing down to clean silt, salt deposits and fine debris. Do not use high-pressure hoses as they blast contaminated matter into the air.
47. Flood water can make the air in your home unhealthy. This is because when things get wet for more than two days they usually get mouldy. There may also be germs and bugs in your home after a flood. Hence, it is important to clean and dry your house and everything in it.
48. If you are drying your property naturally, keep doors and windows open as much as possible. If using dehumidifiers, close external doors and windows.
49. Mould may be more likely to make some people with asthma, allergies, or other breathing problems sick. Talk to your doctor or another medical professional if you have questions about cleaning or working in a home that has been flooded.
50. If there is a large amount of mould, you may want to hire professional help to clean up the mould.
51. Fix any leaking pipes and other water problems and then dry things, or the mould will grow again.
52. When cleaning protect yourself by wearing a certified respirator, goggles, gloves, long pants, long-sleeved shirt, and boots or work shoes.
53. Throw away anything that was wet with flood water and can't be cleaned.
54. If you use a generator because of a power outage, use it OUTSIDE and far away from buildings. Do not use portable generators inside your house or garage. Do not put portable generators on balconies or near doors, vents, or windows. Do not use portable generators near where you or your children are sleeping.
55. All farm buildings and facilities will need thorough cleaning – especially if they are used for livestock.

Building and utility safety

56. If entering buildings, use extreme caution.
57. Wear sturdy shoes and use a battery-powered torch when examining buildings.
58. Stay out of any building if water remains around the building. Floodwater often undermines foundations, causing sinking. Floors can crack or break and buildings can collapse.
59. Avoid entering any building (home, business, or other) before local officials have said it is safe to do so. Buildings may have hidden damage that makes them unsafe. Gas leaks or damage to electric lines or water lines can create additional problems.
60. Report broken utility lines to the appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury. Watch for chemical spills.
61. Examine walls, floors, doors, and windows to make sure that the building is not in danger of collapsing.
62. Watch for loose plaster and ceilings that could fall.
63. Look for fire hazards and inspect utilities in a damaged house
64. Check for gas leaks – if you smell gas or hear blowing or hissing noise, open a window and quickly leave the building. Turn off the gas at the outside main valve if you can and call the gas company from a neighbor's home. If you turn off the gas for any reason, it must be turned back on by a professional.
65. Look for electrical system damage – if you see sparks or broken or frayed wires, or if you smell hot insulation, turn off the electricity at the main fuse box or circuit breaker. If you have to step in water to get to the fuse box or circuit breaker, call an electrician for advice.
66. Look before you step: after inundation, the ground and floors are covered with debris including broken bottles and nails. Floors and stairs that have been covered with mud can be very slippery.
67. Inspect foundations for cracks or other damage. Cracks and damage to a foundation can render a building uninhabitable.
68. Pump out flooded basements gradually (about one-third of the water per day) to avoid structural damage. If the water is pumped out completely in a short period of time, pressure from water-saturated soil on the outside could cause basement walls to collapse.
69. Only pump out water when flood levels outside your property start to be lower than inside. This reduces the risk of structural damage.
70. Shovel mud away evenly from both sides of a wall. This stops pressure building up on one side.
71. Service damaged septic tanks, manholes, pits, and leaching systems as soon as possible. Damaged sewage systems are health hazards.

Insurance

If your property sustains any damage or was inundated:

72. Ring your insurer as soon as possible. In almost all cases the insurance company will send an insurance assessor to look at your property. They will confirm what repairs and replacements are needed and covered by your policy. EQC covers land damage.
73. Always make your own record of flood damage
74. Use a permanent ink pen to mark on the wall the maximum height of the flood water. Do this in every room affected by flooding.
75. Photograph or video record your damaged property.
76. List the damage to your property and belongings.
77. If your insurance policy covers you for loss of perishable goods, make a list of all the foods you throw away. Include any food touched by flood water and anything in your fridge or freezer ruined by loss of power.

Ask the insurance company:

78. How long it will be before the assessor visits.
79. If you are to clean your property or if they will get a company to do it for you.
80. If they will provide you with temporary accommodation. This could be a nearby motel, bed and breakfast, a static caravan or a rented house.

Things to help with your insurance claim:

81. Confirm the insurance company will pay for any service or equipment you need.
82. Make a note of all telephone calls. Record the date, name and what was agreed.
83. Keep copies of all letters, emails and faxes you send and receive.
84. Keep receipts.
85. Don't throw anything away until told (except ruined food).
86. Depending on your policy, the insurance company may only offer to clean and repair something, not replace it.
87. If you rent your property, contact your landlord and your contents insurance company as soon as possible.
88. If you do not have insurance, your local council should be able to provide information on hardship grants or charities that may be able to help you.

Recovery

Following an inundation, there are a whole range of measures that can be taken to reduce the impact of the next inundation should it happen and now is the time to think about these. Before you start making changes get advice from a specialist. Making flood-resistant alterations to your home may cost more than just restoring it to its previous state, but it is money well spent especially if your property is at high risk of flooding again. In future coastal-inundation events these measures can speed up the drying out time and get you back home quicker. They will also reduce the cost of future repairs.

89. Lay ceramic tiles on your ground floor (avoiding the use of particle board flooring) and use rugs instead of fitted carpets. Rugs can be moved and will suffer less damage in a flood than a fitted carpet.
90. Replace chipboard or particle-board kitchen and bathroom units with plastic or solid wood. Or raise cupboards up on supports so that water can flow beneath them.
91. Fit water resistant door and window frames.
92. Install non-return valves in drainage pipes to prevent sewage backing up into the house or critical buildings.
93. Replace usual plaster with a more water resistant version such as lime plaster or cement render.
94. Always use waterproof sealant on external walls and water resistant paint on internal walls.
95. Raise the height of electrical sockets to at least 1.5 metres above ground floor level.
96. Position any main parts of a heating or ventilation system upstairs or raised well above the ground floor.
97. Take good care of yourself. Recovering from inundation is a big job. It is tough on both the body and the spirit. The effects a disaster has on you and your family may last a long time. Learn how to recognize and care for anxiety, stress, and fatigue.

Coastal-storm inundation general information

Media and community education ideas

98. Ask your local newspaper or radio or television station to:
 - Do a series on the dangers of coastal-storm inundation.
 - Do a story featuring interviews with local officials about land use management and building codes in coastal floodplains.
 - Highlight the importance of staying informed about local weather conditions.
 - Run public service ads about how to protect lives and property in a storm surge.
99. Help the reporters to localise the information by providing them with the local emergency telephone numbers and hospitals. Also provide the business telephone numbers for the local emergency management office.
100. Work with officials of the local fire, police, and emergency medical services departments; utilities; hospitals; and civil defence emergency management office to prepare and disseminate guidelines for people with mobility impairments about what to do if they have to evacuate.
101. Periodically inform your community of local public warning systems. Explain the different warning stages.
102. Help hospitals and other operations that are critically affected by power failures to obtain auxiliary power supplies.
103. Contact your emergency management office for information on local warning systems. Advanced warning provided by early detection is critical to saving lives. Automatic flood detection systems are available commercially for storm surge prone communities.
104. Publish emergency evacuation routes for areas prone to coastal inundation.

Fiction and facts

Fiction: Coastal inundation in low-lying areas only happens when a deep depression passes over the area.

Facts: In New Zealand, when large high tides or “king tides” occur, then only a small-to-moderate storm surge is required to flood some areas, and that could be caused just by strong winds and ocean swell.

Fiction: A storm surge is the same as a tsunami.

Facts: Storm surges are caused by weather systems, such as low pressure system raising the height of the water higher than ordinary sea level, while tsunami are created when a body of water is displaced by a submarine or coastal earthquakes, an underwater landslides or underwater volcanic eruptions. Therefore they have different characteristics and damage potential.

Fiction: The height of the storm surge depends only on wind.

Facts: There are various factors that determine how high a storm surge can get: the local topography – bays, headlands and offshore islands can funnel and amplify the storm surge. The shape of the sea floor – the surge builds up more strongly if the slope of the sea bed at the coast is shallow.

Useful links

Coastal inundation preparedness

- www.getthru.govt.nz
- www.epa.qld.gov.au/ecoaccess/coastal_development/assessment_of_development_on_coastal_land/coastal_hazards__storm_tide_inundation/
- www.ew.govt.nz/enviroinfo/hazards/naturalhazards/coastal/flooding.htm/
- www.hurricanetrack.com/ncstormsurge/prpmit.html/
- www.coastalhazards.info/~webdev/tsunami/taxonomy/term/53/
- www.sdr.gov/185820_Coastal_FINAL.pdf
- www.maf.govt.nz/mafnet/rural-nz/adverse-events/

Insurance

- www.ami.co.nz/products/contents/
- www.state.co.nz/
- www.equ.govt.nz
- www.tower.co.nz/Web_Home.asp
- www.vero.co.nz/
- www.icnz.org.nz/

Coastal inundation general

- www.niwa.co.nz/our-services/online-services/tides
- www.niwa.co.nz/news-and-publications/publications/all/wa/15-3/coastal
- www.environment.gov.au/coasts/publications/nswmanual/appendixc6.html/
- www.magazine.noaa.gov/stories/mag178.htm/
- www.rural-support.org.nz/
- www.maf.govt.nz/mafnet/rural-nz/adverse-events/

Weather and wave forecasts

- www.metservice.co.nz/default/index.php?alias=weatherwarnings
- www.metservice.co.nz/default/index.php?alias=mapsandobservations
- www.niwa.co.nz/our-services/online-services/forecast

Tide predictions

- www.hydro.linz.govt.nz/tides/majports/index.asp
- www.niwa.co.nz/our-services/online-services/sea-levels

Storm-tide and wave monitoring

- www.niwascience.co.nz/services/free/sealevels
- www.mulgor.co.nz/MarsPt/
- www.envbop.govt.nz/MonitoredSites/cgi-bin/hydwebserver.cgi/catchments/details?catchment=23
- www.envbop.govt.nz/MonitoredSites/cgi-bin/hydwebserver.cgi/sites/details?site=241&treecatchment=23
- http://map.es.govt.nz/RiverRainfall/measurements.aspx?measurement=River%20Level&layer=River_Level&sm=l_b
- www.gw.govt.nz/section763.cfm
- www.es.govt.nz/river-rainfall/www.portotago.co.nz/12/2.html
- www.porttaranaki.co.nz/Port/Weather.htm
- www.ecan.govt.nz/Our+Environment/Coast/Wave-buoy/

Coastal-storm inundation general information

Useful numbers

Your important emergency household plan telephone numbers. Fill this out and keep this leaflet with your flood kit.

Contact	Details
Local authority emergency helpline	
Insurance company 24-hour	
Insurance number and policy number	
Local radio station (Frequency)	
School	
Family and neighbours	
Bank phone number and details	
Work phone numbers	
Medical Center/GP	
Local police station	
Vet/kennel/cattery	
Local hotel or B&B	
Gas supplier and meter number	
Electricity supplier and meter number	
Water supplier and meter number	
Electrician	
Plumber	
Builder	