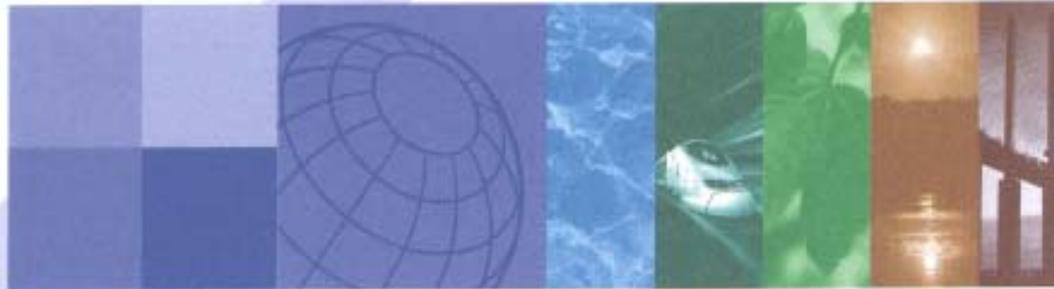


Environment Agency
Coastal Adaptation Project:
Review of international best practice

November 2008



Halcrow Group Ltd.

Halcrow

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Environment Agency

Coastal Adaptation Project: Review of international best practice

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Approved by
1	0	Draft Report	1 October 2008	Adam Hosking
1	1	Final Report	24 November 2008	Adam Hosking

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Contents

Executive Summary	1
1 Introduction	3
1.1 <i>Scope of Work</i>	3
1.2 <i>Background</i>	3
1.3 <i>Outline Approach</i>	3
1.4 <i>Document Format</i>	4
2 Adaptation Practices: United States of America	6
2.1 <i>Administrative Background</i>	6
2.2 <i>Overall Policy and Funding</i>	6
2.3 <i>Scale of Problem</i>	7
2.4 <i>Political Drivers for Intervention</i>	7
2.5 <i>Approaches</i>	8
2.6 <i>Barriers to Implementation</i>	8
2.7 <i>Case Histories</i>	9
2.8 <i>Summary</i>	10
2.9 <i>Sources Used</i>	11
3 Adaptation Practices: France	12
3.1 <i>Administrative Background</i>	12
3.2 <i>Overall Policy and Funding</i>	12
3.3 <i>Scale of Problem</i>	13
3.4 <i>Political Drivers for Intervention</i>	13
3.5 <i>Approaches</i>	15
3.6 <i>Barriers to Implementation</i>	18
3.7 <i>Case Histories</i>	18
3.8 <i>Summary</i>	19
3.9 <i>Sources Used</i>	19
4 Adaptation Practices: the Netherlands	20
4.1 <i>Administrative Background</i>	20
4.2 <i>Overall Policy and Funding</i>	20
4.3 <i>Scale of Problem</i>	21
4.4 <i>Political Drivers for Intervention</i>	21
4.5 <i>Approaches</i>	21
4.6 <i>Barriers to Implementation</i>	22
4.7 <i>Case Histories</i>	23
4.8 <i>Summary</i>	23
4.9 <i>Sources Used</i>	24
5 Adaptation Practices: New South Wales, Australia	25
5.1 <i>Administrative Background</i>	25
5.2 <i>Overall Policy and Funding</i>	25
5.3 <i>Scale of Problem</i>	26
5.4 <i>Political Drivers for Intervention</i>	26

5.5	<i>Approaches</i>	27
5.6	<i>Barriers to Implementation</i>	29
5.7	<i>Case Histories</i>	30
5.8	<i>Summary</i>	31
5.9	<i>Sources Used</i>	31
6	Adaptation Practices: other countries	32
6.1	<i>New Zealand</i>	32
6.2	<i>Belgium</i>	35
6.3	<i>Germany</i>	35
7	Conclusions and Recommendations	37
7.1	<i>Conclusions</i>	37
7.2	<i>Summary of Findings</i>	38
7.3	<i>Recommendations</i>	39

Executive Summary

In order to help progress sustainable planning on the coast, approaches to helping individuals and communities adapt to change are being developed through the coastal adaptation project, being led by Defra. The project aims to assess the scale and effect of the issues and develop a broad portfolio of options for addressing them. To help inform the development of the adaptation measures a desk-based review of practices in other countries has been undertaken, drawing upon first hand experience, discussions with contacts and document searches.

Following this review, the USA, France, the Netherlands and Australia were identified as having the most relevant practices to consider for applicability to the UK. The following summarise the findings.

United States of America

Within the USA there are a wide range of coastal adaptation approaches that have been applied, but none that is universally used as the best means to manage long term erosion and flooding risks. The mix of Federal, State and Local agencies involved in coastal management, makes for a complex management system. The Hazard Mitigation Grant Program represents a framework that may be worth investigating further for potential application in the UK. The existence of a structured program that facilitates a review of the sustainability of properties/communities in the wake of significant flooding could provide a mechanism to instigate the relocation of high risk areas. In the UK, this would need to work closely with the insurance industry and local authorities.

France

The Law Barnier, and Barnier Fund, represents a national level initiative to provide a means to assist landowners in areas at high risk of flooding or erosion. Through this process the State provides a mechanism for relocating properties in instances where the risk is considered worthy of intervention and the cost of relocation is lower than that of preventative measures. This is a statutory process, but requires landowner consent and is not mandatory. As with any such mechanism, the potential for application in the UK will in part relate to funding mechanisms. The Law Barnier is funded through a surcharge on property insurance premiums with additional funds being provided by national government if required. This essentially represents a dedicated tax for property purchases.

The Netherlands

The Netherlands has necessarily developed a highly engineered approach to coastal risk management given the threat that coastal flooding presents. The very high safety standards embedded in law have led to the development of highly advanced risk management engineering techniques and structures, but until recently have largely removed consideration of other flood management techniques, as residual flooding risk was not considered. Today there is some consideration of differential levels of flood risk and appropriate land use in higher risk areas; however, systems to remove properties from high risk areas are not common place. Under a new national strategy, some existing dike systems will be relocated and properties placed at high risk will be purchased as part of the scheme cost. However, elsewhere where land owners make decisions to develop in high risk areas they will not be provided protection by government.

Australia (New South Wales)

The coastal adaptation approaches being applied in New South Wales provide a number of mechanisms to deal with coastal flooding and erosion risks. The 'voluntary purchase' process provides an approach that enables existing properties to be removed from high risk areas. However, the approach appears to be applied (funded) differently by different authorities. Its application is largely driven by amenity and access requirements, rather than solely for the good of the landowner in question. The flexibility of the concept makes it worthy of more detailed review for application in the UK. Review of different Australian examples is likely to demonstrate a number of different drivers and funding mechanisms. Further to the purchase process, the approaches to preventing new development in risk areas warrant further review for potential applicability in the UK. Amongst these approaches is

the systematic use of ‘planned retreat’ to allow time-limited development on the coast, providing a mechanism for risk informed decisions which should be readily implementable in the UK.

Conclusions

Almost all countries, for which coastal management information was reviewed, had some level of risk awareness which was translated into ordinances for appropriate development within hazard areas. The level of sophistication and robustness of these planning ordinances varies, but all are intended to avoid locating long-term developments in areas where they will become exposed to unacceptable levels of risk during their planned life.

However, based on this review it is reasonable to conclude that the long-term strategic planning process applied on the UK coast through Shoreline Management Plans creates a unique risk awareness situation. Through this process, the long-term flood and erosion risks to properties are clearly identified and consequently they can impact property values, etc long before the risk may be expected to occur. Further these risks are consistently and systematically identified for the entire coast of England and Wales.

In the other countries reviewed, the adaptation approaches identified are largely driven by reaction to either a natural disaster or an identified near-term risk. In these situations, property relocation is often borne as part of the project cost. Hence these approaches are very site specific and considered on a project by project basis.

Recommendations

No approaches that provide a ready solution for the programmatic adaptation necessary in the UK have been identified. However, there are a number of approaches that warrant some further review for their potential to offer benefits in the UK. It is recommended that the following be considered further:

- Voluntary purchase of ‘at risk’ properties, enabling existing properties to be removed from high risk coastal areas (based on Australian practice).
- Development of a program to promote/enable the purchase of damaged properties following a major flood/erosion event (similar to US HGMP).
- Systematic use of ‘planned retreat’ to allow time-limited development on the coast providing a mechanism for risk informed decisions (based on Australian practice).
- Requirement for local planning authorities to systematically adopt restrictive zoning policies for coastal erosion (such as in Australia and French Risk Prevention Plans).
- Acquisition and lease back of coastal lands at risk. Under such schemes, local government acquires land at risk and leases it to existing or future users for a specified period of time, after which the land reverts to public ownership (based on Australian practice).
- Voluntary purchase and resale for development. Under such schemes, the resale of land at risk might be dependent on its use for purposes compatible with the governing hazards (based on Australian practice).
- Special rates levied on existing development at risk to offset the cost of necessary protective works (based on Australian practice).

1 Introduction

1.1 *Scope of Work*

This is a desktop review of coastal flood and erosion adaptation policies and practices outside the UK. This Project accompanies other ongoing assessments into how the UK Government might respond to climatic changes on the coast and on inland flooding.

Full details of the range of ongoing initiatives can be found on the Defra website at:

<http://www.defra.gov.uk/enviro/fcd/adaptationandresilience/default.htm>

1.2 *Background*

In order to help progress sustainable planning on the coast, approaches to helping individuals and communities adapt to change are being developed through a project being led by Defra. The coastal adaptation project aims to assess the scale and effect of the issues and develop a broad portfolio of options for addressing them. Key to this is identifying the scale of the problem and considering what interventions might help communities to adapt to both flooding and erosion risk on the coastline. The project is looking at three main areas:

- planning
- community engagement
- properties and infrastructure at risk.

As far as possible it is drawing on work that has already been done in the past but it is also important that new ideas are fed into the process.

To help inform the development of the adaptation measures a review of practice in other countries has been undertaken. This project involved a desktop search and review of the approach in several other countries based upon first hand experience, discussions with contacts and document searches.

1.3 *Outline Approach*

This task was principally undertaken as a desk study, through review of reports, data and information available over the internet, journals and other media.

Research for the study focused on those countries where the nature of coastal risks was considered to be somewhat similar to those experienced in the UK, in terms of the nature of the coastal hazards and/or the development of the coastal zone. The final list of countries reviewed in this report results from both the applicability of the approaches reviewed and the availability of information upon which to undertake the review.

The steps followed in undertaking this review were as follows:

1. Data search using internet, library and journal resources to extent of data availability on coastal risk adaptive strategies. This will

look specifically for information on the above named countries and also provide a broader search for information for other countries that may be relevant.

2. Undertake initial data review to establish: a) extent of data availability for each country; and b) relevance to UK issues. (Supplemented by informal discussions with attendees at ICCE 08.)
3. Liaise with Environment Agency project Manager to agree final list of countries to be reported in the review, also the reporting themes (based upon data availability).
4. Develop full draft report with information for each review country providing relevant details as described above. The report will also make preliminary recommendations of those international practices that would appear to have most relevance to the UK and may warrant further investigation.
5. Draft report to be produced and submitted to Environment Agency Project Manager.
6. Review of draft by Environment Agency Project Manager, and feedback to Halcrow.
7. Incorporate comments into draft, and deliver Final Report.

1.4

Document Format

The following chapters of this report present the information for those countries where coastal risks can be considered somewhat similar to those in the UK, where adaptation policies are in place which may hold some relevance for the UK, and where substantial information is available on those policies and practices. The countries covered by individual chapters are: the USA, France, Netherlands and Australia. For each of these countries the following information is provided:

- administrative background
- overall policy and funding
- scale of problem – numbers of properties at risk, for example
- set out political drivers in the cases of any intervention, e.g. social, environmental or institutional, and funding source e.g. regional or national.
- adaptation approaches used
- barriers to implementation
- case histories

A further chapter provides a summary of information found for other countries for which information was identified which either presents other approaches for consideration or provides for a broader perspective on international coastal risk management approaches.

The final Chapter then presents a brief overview of the findings of the review and makes some recommendations for approaches that may be appropriate for further consideration in the UK.

2

Adaptation Practices: United States of America

2.1

Administrative Background

Coastal flood and erosion risk management is undertaken through a combination of Federal, State and local inputs in the United States. At each level of government there are different criteria for the economic and technical analyses of flood and coast protection works. Projects are usually promoted on a cost sharing basis, with a local ‘sponsor’ (the local authority) identifying and promoting a project need and the State or Federal government providing a grant for some portion of the costs. The project development process, funding levels and funding sources vary between agencies and sponsors.

In relation to adaptive practices, these approaches are more usually driven through disaster management agencies, led at the national level by the Federal Emergency Management Agency (FEMA).

2.2

Overall Policy and Funding

In 1974, the Disaster Relief Act was established for the United States authorising and implementing Presidential Disaster Declarations. 14 years later, Congress passed into law the Stafford Act, amending the Disaster Relief Act and creating the current system for disaster declaration and disaster relief. The United States’ strategy for disaster assistance is stated within the Robert T. Stafford Disaster Relief and Emergency Assistance Act that was passed that year. This act states the statutory rights, roles and responsibilities of the President of the United States in declaring natural disasters and FEMA’s responsibility in providing and organising assistance from 28 federal agencies and non-governmental organisations. “The Federal Emergency Management Agency coordinates the federal government’s role in preparing for, preventing, mitigating the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror” (FEMA).

The three most commonly discussed FEMA disaster mitigation programs, funded through the U.S. Department of Homeland Security to which FEMA belongs, include: the Hazard Mitigation Program, the Pre-Disaster Mitigation Program, and FEMA’s Flood Mitigation Assistance.

The Hazard Mitigation Grant Program provides grant money to States and local governments in order to reduce the risk to life and property from future natural disasters during disaster recovery. This funding allows for the completion of mitigation projects and although funding is provided as needed following a major natural disaster, the Federal government has eligibility requirements that must be met; all projects “must provide a long-term solution to a specific risk” (FEMA). Each State or local government is responsible for the selection of projects to be completed and grant applications are required in order to obtain funding. Pre-Disaster Mitigation and Flood Mitigation Assistance, all focused on reducing risk to life and property, function similarly to the Hazard Mitigation Program.

FEMA is also responsible for a different type of assistance than that mentioned above, in particular the National Flood Insurance Program. The US passed a National Flood Insurance Act in 1968 which established the National Flood Insurance Program (NFIP). The NFIP Regulations provide for coastal erosion through the designation of 'E Zones', areas of special flood-related erosion hazards. At direction of US Congress in the National Flood Insurance Reform Act of 1994, FEMA looked at implementing coastal and riverine erosion hazards as part of the NFIP. The E Zones were intended to require:

- communities to take erosion into account in land management and use
- setbacks for all new development in order to create a safety buffer.
- to reserve erosion prone areas for open space and
- adoption of preventative measures for E-zones that include relocation of threatened developments, relocation of structures in the path of flood-related erosion and community acquisition of flood-related erosion prone properties.

However, it appears that no 'E Zones' have ever been designated, and consequently no community land use management measures have been required. It is likely that the failure of this initiative is based on FEMA not having the legal authority or funding to map erosion zones, as undertaking erosion mapping for the entire US (coastal and fluvial), would be a massive undertaking.

2.3

Scale of Problem

Coastal counties have become the most rapidly growing areas in the nation. Within the United States, "23 of the 25 most densely populated U.S. counties are coastal," averaging 300 people per square mile (NOAA). Between 1980 and 2003, the total coastal population increased 28 percent. According to the statistical information obtained, it was anticipated to increase another 4 percent by 2008.

The vulnerability of certain sections of this coastal population have been clearly highlighted in recent years with extensive hurricane damages to the Atlantic and Gulf coasts of Florida in 2004, Hurricanes Katrina and Rita impacting the central Gulf coast in 2005, Hurricane Ike recently impacting Texas. Also, Hurricanes Hanna and Kyle have recently impacted the Atlantic coast. The low relief of large portions of the US coastal margins combines with this tropical storm threat to produce very high risks in many coastal areas.

Through the NFIP the mapping of flood risks is well established, however statistics on the numbers of properties at risk from coastal flooding are not readily available. Similarly, there are no national assessments of the number of properties at risk from coastal erosion.

2.4

Political Drivers for Intervention

Property owners make decisions to live in areas that are "at-risk" in regards to a number of different disasters including coastal erosion, flooding, fire, etc. These owners are allowed to develop without consideration of the likelihood of loss of life or damage/loss of property. Local zoning and permitting authorities often allow for this development,

which becomes “economically and politically rational and fiscally sound” (Hartwig). Development is not discouraged due to the creation of jobs, stimulation of commercial development leading to development of infrastructure, and stimulation of the economy both on a regional and national level. All of these factors together begin to contribute overall to the nation as local, state and federal representation within each sector of government increases. On the State level, voters are unlikely to reappoint a representative that does not truly “represent” them, for that would prevent future election which begins to influence decision making as a whole. This trend continues upward until the Federal level is achieved. As unwise growth occurs within disaster prone areas, it becomes acceptable due to the vast amount of federal aid available and the tax burden is largely supported by those outside of the at-risk area. On the Presidential level, it becomes a matter of favourability and future election outcomes as to whether or not this disaster aid is provided, meaning more times in not that aid is distributed as needed.

2.5

Approaches

2.5.1

New Developments

In order to minimise and reduce risks to proposed/planned new developments, a number of approaches have been used throughout the United States. These include: land use controls such as zoning ordinances including the concepts of Smart Growth and Urban Growth Boundaries, transfer or purchase of development rights, subdivision ordinances, building ordinances, and building setback; expenditure limitations; public notification; and risk-based taxation.

The case histories in section 2.7 provide more details of a number of these approaches.

2.5.2

Existing Developments

In order to minimise and reduce risks to existing developments, a number of approaches have been used throughout the United States. These include: relocation; building ordinances including elevation and flood-proofing; and land and property acquisition. Many counties and States have obtained Hazard Mitigation funding and Pre-Disaster Mitigation funding in order to assist with the cost of these different approaches. Although not considered risk reducing, flood insurance and property insurance are also considered necessary investments for properties located within high risk areas in order to compensate for loss.

2.6

Barriers to Implementation

Within the United States, there are numerous barriers to implementation that exist when at-risk property is concerned. Implementation of property purchase schemes is accomplished at the State or County level, with no compulsory purchase powers, making implementation reliant on a voluntary process. As of yet, the U.S. has not passed a Federal law prohibiting development of any at-risk area, leaving the responsibility for implementation at the local and land-owner level. Each State is allowed to decide for itself which if any measures will be enforced making it inconsistent across the country.

Numerous states throughout the U.S. are currently in the process of creating or implementing plans to buffer at-risk areas or prohibit

development in these areas. In order for this to occur, planning decisions must be made in regards to properties already in existence within these buffer zones as well as future development and take into account private landowners in these areas.

2.7

Case Histories

The following case histories are provided for adaptation practices throughout the United States.

- Louisiana developed a Comprehensive Plan for Coastal Protection and Restoration. This plan called for the restoration of important coastal areas as well as protection for coastal areas at risk. Also included, were the concepts of Smart Growth, buffer zones, strict enforcement of the National Flood Insurance building codes and regulations, hazard mitigation plans, evacuation route planning, and relocation of properties. Currently, Louisiana is also participating in the HMGP following Hurricanes Katrina and Rita. Numerous properties have been elevated as well as flood proofed and acquisitions have also occurred.
- The Texas Open Beaches Act of 1959, is intended to provide for free public access to the open beach by prohibiting construction in the intertidal area. A key feature of this legislation is that the intertidal area has a rolling definition, i.e. as the coast retreats so the 'no development' area retreats. Under this law, there have been many instances where, following storm induced erosion, properties have ended up in the intertidal zone. These houses can be seized/condemned by the State. In the past a fund has provided up to \$50,000 for such properties, but the present status of such funds is unknown. This is a very topical issue given the recent erosion induced by Hurricane Ike, which has placed many properties in the intertidal area.
- In 1998, Humboldt County, California, through funding from HMGP and through the California Governor's Office of Emergency Services, purchased 17 residential properties in the Big Lagoon landslide area that had been threatened by erosion as a consequence of the El Nino storms. All structures present on the properties were demolished and the land will remain as open-space.
- East Grand Forks, Minnesota, and Grand Forks, North Dakota, were devastated in the spring of 1997 after a catastrophic flooding event from the Red River of the North. A \$409 million dollar effort was undertaken, by the US Army Corps of Engineers, to construct flood barriers, remove hundreds of structures from the floodplain, create additional flood storage space, and in addition add green space to be enjoyed by both towns. Several neighbourhoods that were among the lowest elevations were acquired by the towns and the residents were relocated to higher ground. These neighbourhoods included Lincoln Park and Sherlock Park which were converted to recreational areas including walking/biking trails, pedestrian bridges, as well as picnic and parking facilities. The relocations were paid for as part of the project costs.

- In 1977, Maryland introduced and enforced the concept of Smart Growth. This concept consisted of more compact growth patterns, development through infill, pedestrian friendly and transit oriented development, as well as reuse of sites previously not developed. Under the Maryland Smart Growth Initiative, state agencies would no longer provide funding for areas outside of the preferred growth areas.
- In Oregon, Urban Growth Boundaries are currently used in land use planning. This concept calls for growth to occur only within these boundaries, to strengthen the existing cities and developments, and contiguous to existing development. This concept discourages growth in risk areas including coastal areas or flood prone areas.
- Virginia Beach, Virginia, has enforced the “Green Line” concept. This so called line sets the limit as to where development can and cannot occur. Development is encouraged to the North of the line through redevelopment, infill, and investment in existing neighbourhoods. South of the line, agricultural land and environmentally sensitive coastal land is restricted through zoning ordinances and purchase of development rights from landowners.
- In 1999, Palm Beach, Florida, developed and adopted the Managed Growth Tier System. Under this system, there are 5 distinct tiers assigned to land within the county. These tiers are: Urban/Suburban, Exurban, Rural, Agricultural Reserve, and Glades. Development guidelines are enforced at different levels for each tier. For example, development within Rural and Exurban tiers may occur, but at low densities, while development in Agricultural Reserves and Glades is prohibited. Other land use planning tools are also used within this tier system including purchase of development rights, land acquisition, and subdivision ordinances.
- Nantucket, an island off of the coast of Massachusetts, in 2001 developed a comprehensive plan for planning on the island. This plan called for acquiring the island’s shoreline for public ownership and established a “Greenbelt Overlay Zoning District” to separate the countryside from the developed areas of the island. Zoning ordinances are enforced throughout the island.

2.8

Summary

Within the USA there are a wide range of coastal adaptation approaches that have been applied, but none that is universally used as the best means to manage long term erosion and flooding risks. The mix of Federal, State and Local agencies involved in coastal management, makes for a complex management system. Further, the prominence of private land-owner rights plays an important role in the ability of agencies to proactively manage high risk areas, resulting in the reactive approach whereby intervention/support is largely left until after the flooding event.

The Hazard Mitigation Grant Program does represent a framework that may be worth investigating further for potential application in the UK. The existence of a structured program that facilitates a review of the

sustainability of properties/communities in the wake of significant flooding could provide a mechanism to instigate the relocation of high risk areas. In the UK, this would need to work closely with the insurance industry and local authorities. Funding of such a program would be a key question to be resolved.

2.9

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3

Adaptation Practices: France

3.1

Administrative Background

The framework to deal with coastal hazards is administered by a number of ministries within the French National Government, within which there are a number of lead National Government Departments:

- **Risk and planning issues** - Regional Management for Industry, Research and the Environment within the Ministry of Industry (DRIRE);
- **Scientific studies of hazards** - the Regional Management for the Environment within the Ministry of the Environment (DIREN) and Departmental Management for Equipment (DDE).
- **Coastal and geotechnical issues** - Regional Management for Equipment (DRE).

These establishments are supported by scientific institutions including Institut français de recherche pour l'exploitation de la mer (IFREMER), BRGM (French geological organisation) and universities and colleges who commission and undertake research.

3.2

Overall Policy and Funding

In France, coastal erosion is identified as a natural disaster in accordance with the 1982 Environment Act. Under the Code of Development and Town Planning (1986 Coastal Act ('loi littoral'), Public Safety Act and the 'loi Barnier').

The local Commune has an obligation to consider the potential of any natural risks when planning land occupancy and defining town planning zones. The Commune can be held responsible if a potential risk was ignored when redrafting the Plan of Ground Occupation (Plan d'Occupation des Sols, POS) or if planning permission has been given without due regard to the potential risks (although consideration is given as to the degree of public knowledge on the existence of a potential risk at the time the planning permission was granted). In areas prone to instability problems POS support the local plans.

The Law Barnier (No. 95-101, 2 February 1995) created the "fond de prevention des risques naturels majeurs " (FPRNM). Amongst other actions (see Section 3.5.1 below) and the law authorises the expropriation and compensation by the Government of properties threatened by natural risks considered to pose a risk to life, when remedial works are too expensive to undertake. This Law covers both flooding and erosion amongst other natural hazards.

The compensation is funded by a State Surcharge of 12% on all property insurance premiums in France that is taken for the "CatNat warranty" (Natural Catastrophe Warranty). From this 12% surcharge, the FPRNM takes 4%, which is used for implementation of the Law Barnier.

A Risk Prevention Plan (under the Law Barnier) determines where a natural risk is foreseeable and forms an annex to the POS; it can also prohibit construction and other activities within a particular zone because it will be exposed to a risk, or could exacerbate the risk. Remedial measures are allowed, provided they do not exceed 10% of the total value of the asset.

Public authorities have no obligation to carry out or finance coastal defence work. They must however, ensure that adequate maintenance of coastal defence structures takes place.

Legislation is in force through the publication of Risk Prevention Plans and Particular Plans for Intervention (PPIs) - Law 95- 101 (2/2/95). Refer to Section 3.5, which describes how this law is implemented.

Very recently (10th November 2008) the 'Loi Barnier' was replaced by the 'code de l'environnement'. This has not significantly altered the risk management system, but has reinforced, and somewhat clarified, the system. It is understood that the system continues to be referred to as the 'Loi Barnier'.

3.3

Scale of Problem

The French Metropolitan coastal areas - over 5500 km long - are zones of conflict in terms of interest and use between the environmental conservationists and the planners. The French coasts are distinguished by a wide diversity of habitats and a great disparity in planning from the highly urbanised Mediterranean coasts of Provence to the natural coasts of the Landes (Atlantic) with 260 km beaches (Richard and Dauvin, 1996).

No information on the numbers of properties or population sited within France's coastal risk areas was identified.

3.4

Political Drivers for Intervention

French regulations share the responsibility of flood prevention among four key players (CEPRI, 2008):

- The State
- Town Mayors
- People living along rivers
- Owners

The State is responsible for defining the town planning regulations in the flood areas. For each State Department, there is a Prefect. The mission of the Département Prefect is to supervise the maintenance of public order and safety of both people and property, on the scale of the département.

The Prefect prepares and implements the flood prevention plans (PPR). He orders the PPR following a public inquiry and submits it to the approval of the town councillors in the territory on which it must be applied. The Prefect also legally defines the consultation methods relating to the drafting of this plan.

The Prefect of each département must produce a risks document "available for consultation". To do this, he must draw up the DDRM (Département Report of Major Risks), which describes the risks, town by

town, their predictable consequences as well as the prevention protection and safeguard measures planned in the Département to reduce their effects. The State has an obligation to inform Mayors of the risks present locally, and the Prefect is responsible for sending the Mayor the DDRM, with the maps of the existing risk as well as the flood prevention plan if it exists.

In the event of a flood exceeding the boundaries of a single town, the Department Prefect is also the Director of Emergency Operations. The Prefect orders the Plan d'Organisation des Secours Départemental (ORSEC) (Emergency organisation plan), as well as the Plans de Secours Spécialisés (PSS) - (special emergency assistance plans) (i.e. floods).

The State is also responsible for the Water Regulations. In this regard, the State must ensure the safety of flood protection dikes, whether they belong to it or not. To fulfil this responsibility, the State must carry out a national listing of dikes concerning public safety and impose upon their owners specific orders (diagnosis, check-up visits, and work).

The **town mayor** is responsible for maintaining order and safety in the town area. The mayor works under enforcement power which includes [article L 2212-2 of the Code général des collectivités territoriales](#) (Territorial Authorities General Code).

On provision of information from the State, the Mayor is responsible for informing his citizens of the risk of flood. This done by:

- The Document d'Information et de Communication sur les Risques Majeurs (DICRIM) - (Information document on major risks),
- By making Atlases of flood areas and the Natural Foreseeable Risks Prevention Plan "available for consultation", when they exist,
- Communicating the risks of flooding (at least every two years if the town is covered by a flood prevention plan) to the public,
- Affixing flood marks in flood areas. (Law No.2003-699 dated 30 July 2003, Law No.2004-811 dated 11 August 2004 and Article L 125-2 and L 563 of the Code de l'Environnement (Environment Code) and Article R 125-9 and R 125-27 of the Code de l'Environnement (Environment Code) and Decree No.2005-233 dated 14 March 2005.
- The prevention of flood risk and the bursting of dikes "by suitable precautionary means" (via the above).
- The prevention of the bursting of dikes obligation implies that the Mayor must remind owners of non-maintained (and potentially dangerous) dikes of their obligation to ensure the safety of these works.

The Mayor is also responsible for land occupancy in the territory of his town and therefore the risks created by the constructions he authorises. Building permits must comply with the Flood Prevention Plan, if there is one on the town territory ([Decree No. 95-1089 dated 5 October 1995 amended](#)).

On his own initiative, the mayor and the town councillors may undertake other flood prevention steps in the territory of the town, and in particular actions towards the reduction of the vulnerability of property located in flood areas.

During an emergency/ post-emergency management, the Mayor becomes the "Director of Emergency Operations" in his territory. The Mayor must draw up the Plan Communal de Sauvegarde (Local Protection Plan), which he must organise.

Owners of both built and unbuilt properties located in the areas covered by a risk prevention plan, must append a "risk status" to the contract as well as the list of the damage the property has suffered. Article R 125-23 and R 125-27 of the Code de l'Environnement (Environment Code).

Owners and managers of campsites and caravan parks located in an area subject to a natural risk (in particular flooding), must implement certain information, warning and evacuation measures in order to ensure the safety of the occupants. These measures are laid down by the relevant town planning authority. Article R 125-15 and R 125-22 of the Code de l'Environnement (Environment Code).

The owners of dikes and water resources developments are responsible for the maintenance and safety of their structures. Their civil liability may be incurred in the case of damage to a third party, for fault, negligence or carelessness, even where there is no fault (Articles 1382 to 1384 of the Code Civil (common law)).

3.5

Approaches

3.5.1

PPR and Preventative Measures

The overarching source of funding for the development of measures to prevent and reduce the vulnerability of people and properties to natural risks is the Law Barnier (refer to previous Section 3.2.1).

The Barnier fund can be used to finance two elements with regard to flood prevention; the sequencing of which is presented in Figure 3.1 below.

1. Preventative expropriation; and
2. Preventative measures.

Key to the preventative approach is the production of a Risk Prevention Plan (PPR), which determines the areas where a natural risk is foreseeable. It is intended that the PPR allows action to be taken in advance by the proprietor and the local authority.

Urban expansion is restricted to the vicinity of existing developments and within urban areas, a coastal strip extending 100 m from the landward limit of the shore is declared "la bande littorale non constructible" in which most construction is prohibited.

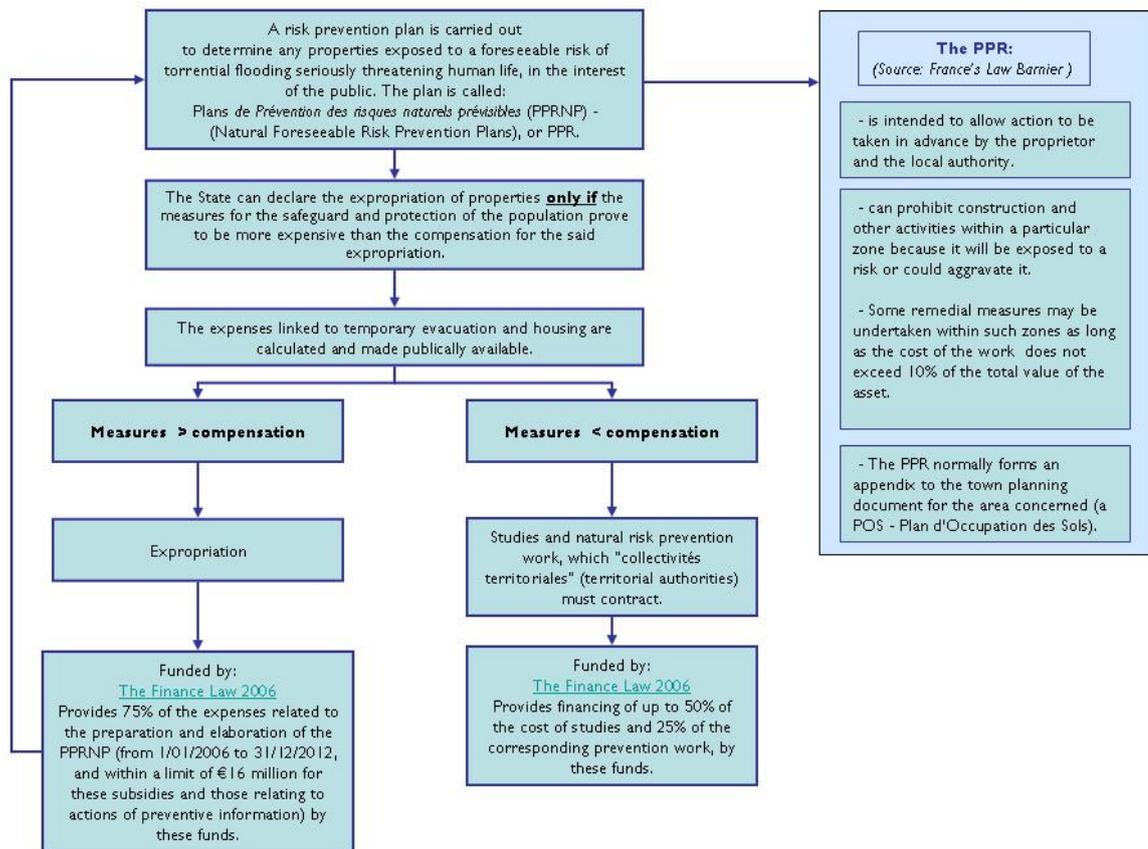


Figure 3.1: Flood risk adaption, France. (Source of information: CEPRI, 2008).

[The Finance Law of 2006](#) (i.e. taxes, products and incomes assigned to the state) makes provision for the financing of 75% of expenses related to the issuing of preventive information on major risks, by the Barnier fund.

The Law Barnier effectively provides a guarantee of protection from natural risks for all properties provided that the owner has property insurance. By making sure that all properties have insurance, this system helps the government ensure that enough money is available in case of an emergency.

In those circumstances where an individual wishes to purchase a property in a high risk area, in order to obtain insurance and participate in this process, they must pay for any work required for that property to be considered safe to use. However, through restrictions imposed by the PPR, no construction will be allowed in unsafe areas.

The main goal of the process is to maintain the safety of people and/or their properties. However, risk to life is only one of the ten situations in which the funds are used, as below.

- Purchase of property where there is a risk to human life.
- Purchase of property where more than 50% of the property suffered damage from a hazard occurring.
- Short term evacuation where a risk is anticipated to occur.

- To get prepared and put together a preventive plan (PPR) where risks might occur.
- Inform the public to the risks they might encounter.
- Inform the public about the Law *Barnier* and *Barnier Fund*.
- Engineering work to reduce risks to an individual property.
- Engineering work as recommended in a PPR.
- Engineering work to reduce risks to a group of properties or local area (collectivity).

The FPRNM will cover the total amount needed (value without the risk) minus any money provided by the insurance to compensate any damage to the property (where property damage is driving the purchase).

3.5.2

New Developments

The Centre Europeen de Prevention du Risque d'Inondation (CEPRI, 2008) has developed a plan to prevent new development along the coast in 'at risk' areas.

The plan, referred to as the 'Plan de prevention des risques d'inondation (PPR) – (Flood Prevention Plan)' is the State's main statutory tool with regard to flood prevention (Articles L 562 of the code de l'Environnement (Environment Code) and Decree No. 95-1089 dated 5 October 1995).

In some urban areas there are also separate plans for industrial risks, called *Plans de Prevention des Risques Technologiques (PPRT)*.

The purpose of the plan is to control construction in areas exposed to flood risk, in order to avoid risk to human life, damage to properties and businesses and to preserve the floodwater expansion areas as much as possible.

The risk plan divides the area into three planning zones, determined according to a reference flood, which is the largest known flood, or the hundred-year flood, if this is higher (*Source: CEPRI, 2008 and French-property.com*):

- Red Zone – Dangerous areas (areas directly exposed to risk), where, as a general rule, all construction or new installations are prohibited. No planning permission permitted.
- Blue Zone –Precautionary areas (areas that are not directly exposed to risks, but in which construction may aggravate existing risks or give rise to new ones. Planning permission is subject to conditions.
- White Zone – Planning permission subject to local planning regulations.

French-property.com report that official estimates suggest that less than 5% of the country is likely to be designated a red zone, with the remainder merely subject to stronger planning regulation. However, in some areas of the country, prone to greater natural risks, this percentage will be higher.

Example of PPR (flood prevention plan) zoning (CEPRI, 2008)
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The PPR has a procedure, which defines the prevention, protection and mitigation measures that should be applied in each of these areas (in the form of banning or orders).

The PPR can recommend or even oblige developments to use sites that preceded the plan that is to say to existing constructions, facilities or agricultural land, in dangerous or precautionary areas. The cost of these developments must not, however, exceed 10% of the value of the property.

As much as is necessary, the PPR can recommend measures whose purpose is to allow water to drain freely and for the preservation, restoration or expansion of flood plains.

The PPR can also recommend risk prevention work to private individuals. It can even define regulations relating to public networks and infrastructures, to make evacuation or the arrival of emergency services easier in a flood situation.

Some measures can be made compulsory within a five year period, depending on the nature and intensity of the risk. This may be reduced in the event of an emergency. Failing to comply within the recommended period, the Prefect can, following non-response to formal notice, order these measures to be carried out at the owner's, manager's or user's cost.

3.5.3

Existing Developments

As described above (3.5.1), existing developments in high hazard areas can be purchased under the Law Barnier where agreement can be met with the owner and a purchase price lower than the cost of providing protection is agreed.

Prospective buyers will normally be informed of the risk status of any property, as a report on natural or 'technological' risks forms part of the statutory survey reports that an owner is required to produce as part of the sale process. Thus the transfer of ownership of 'at risk' properties is done in full knowledge of the risks.

If a property is destroyed or heavily damaged by flood or fire, there is no guarantee that the owner would be able to obtain planning consent to rebuild it. This provides a further mechanism to avoid increasing overall risks levels.

3.6

Barriers to Implementation

With legislative powers for property purchase, and funding to cover the market value of properties, it is only reluctance of landowners to leave their home that presents a barrier to the removal of 'at risk' properties under the Law Barnier. However, the approach is used in areas identified as having a serious threat to human life, and as such it is not applied in areas where there is a longer term risk, or the hazard is more gradual.

3.7

Case Histories

The approach of putting remedial measures into place as per the RPP described in Section 3.5.1 and 3.5.2 has been used to move inhabitants from 17 residential properties at Criel-sur-Mer, with the property price

paid at the risk-free market value. These properties were considered to be at an unacceptable level of risk from erosion of adjacent coastal cliffs.

3.8

Summary

The Law Barnier, and Barnier Fund, represents a national level initiative to provide a means to assist landowners in areas at high risk of flooding or erosion. The exact mechanisms for implementation of the program (i.e. what constitutes an unacceptable level of risk) are not clear to this review; however the principles are apparent. Through this process the State provides a mechanism for relocating properties in instances where the risk is considered worthy of intervention and the cost of relocation is lower than that of preventative measures. This is a statutory process, but requires landowner consent and is not mandatory.

As with any such mechanism, the potential for application in the UK will in part relate to funding mechanisms. The Law Barnier is funded through a surcharge on property insurance premiums with additional funds being provided by national government if required. This essentially represents a dedicated tax for property purchases. If applied in the UK, this would be a departure from current risk management approaches, and would probably be met with resistance by those that consider themselves unlikely to benefit (i.e. those not directly at risk), but it is a mechanism that should be reviewed for applicability in the UK

3.9

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4

Adaptation Practices: the Netherlands

4.1

Administrative Background

The main national administrative bodies dealing with coastal hazards are: the Ministry of Transport, Public Works and Water Management, the Ministry of Housing, Spatial Planning and the Environment, the Ministry of Agriculture, Nature Management and Fisheries, and the Ministry of Economic Affairs.

The Rijkswaterstaat Rijksinstituut voor Kust en Zee (RIKZ ~ National Institute for Coastal and Marine Management) is one of the six specialist services of the Directorate General of Public Works and Water Management. RIKZ is the main supplier of knowledge related to coastal hazards, particularly sustainable use of coasts and seas and protection of the land against tidal flooding.

4.2

Overall Policy and Funding

The Dutch approach to coastal flood and erosion risk is dominated by a generic protection policy, given the fact that 60% of the country is below sea level. A major flood would disrupt society as a whole; therefore the precautionary principle lies at the heart of Dutch policy.

For flood risk management this means that there is a statutory system of safety standards that apply to the system of dike rings (embedded in the Flood Defence Act of 1996). Every 5 years the flood defences are evaluated and necessary improvements planned. For coastal erosion management the generic policy is 'hold the line'. This is done with hard structures where needed, but preferably with sand nourishments where possible. Currently, 12 million cubic meters of sand is nourished annually to maintain the Dutch coastline at its 1990 position (a legal requirement).

In the past years there has been a policy review of all options available in the 'safety chain' (or risk management cycle). Additionally, a government committee (the Delta committee) has recently advised the Dutch government on how to adapt to climate change from the perspective of flood management (see www.deltacommissie.com/en/advies). One of the findings is that flood protection remains the most important pillar of coastal (flood risk) management policy. In fact, a seaward policy option is proposed by increasing the sand nourishment volumes over the decades to come.

In the Netherlands there is extensive discussion of coastal resilience and climate adaptation approaches. 'Coastal defence zone' concepts involving the creation of discrete flood areas and appropriate land uses in higher risk areas, as developed in project Comcoast (www.comcoast.org), and unbreakable dikes (deltadikes) are drawing much attention. Also, the organisation of flood crisis management is currently being improved (www.platformoverstromingen.nl).

High safety standards for flood defences have led to a lesser need to embed flood risks in Dutch spatial planning, with the exception of areas that are not protected by dikes or dunes, such as near river beds or coastal frontages. For the latter two, planning policy exists that strongly discourages new developments.

The funding of flood protection works, such as beach nourishment, dike rings, etc comes from National government. This also extends to works to strengthen any flood defences, as necessary to provide the necessary standard of protection. Local water boards fund maintenance works to structures through water board taxes.

4.3

Scale of Problem

Some 60% of the Netherlands is at or below sea level, home to around 9 million people, making tidal flood protection an absolute necessity for the economic and societal well-being of the entire nation. With a continuous line of flood protection structures and dunes protecting the country from tidal and fluvial flooding, the vast majority of the country is afforded protection.

It is estimated that approximately 15,000 people (number of houses not identified) live in properties seaward of the coastal protection dykes.

4.4

Political Drivers for Intervention

The political drivers for government intervention in flood risk management are self evident in the Netherlands, given that the majority of the country is below sea level, any failure or weakness in the nations flood protection system has the potential to result in national scale economic and social impacts.

4.5

Approaches

4.5.1

New Developments

The Netherlands have well established safety standards which define the standard of protection afforded to all areas vulnerable to flooding risks. This protection is afforded by various structures along river channels and the open coast. There is strict regulation of development outside of these structural defences (i.e. within river flood plains or on the open coast). Any development proposals are assessed for potential impacts on the flood water carrying capacity of the area (i.e. potential negative impacts on the effectiveness of the flood protection system) or on the operation of natural processes. If no detrimental impacts are identified then the development may be permitted but with recognition that no flood protection will be provided by government. The local authorities have decision making powers on these planning determinations, however they follow national guidance on appropriate coastal uses.

Within the protection systems, land use planning is also undertaken, however flooding risks are not a major driver as this is considered to be adequately dealt with through the structural flood protection measures.

Through the system of statutory safety standards and requirement to hold the 1990 position of the coast, there is no option for coastal managed retreat. Consequently, within the Netherlands there will not normally arise any situation where development is located in areas at risk greater than the prescribed safety standard. The only situations where this may occur are either where new development takes place outside the protection system in which case the developer is aware that no protection will be afforded, or in certain circumstances where river dykes are realigned in order to increase flood water capacity, resulting in properties being outside the new realigned defences.

As part of the recent government 'Room for the River' programme (www.ruimtevoorderivier.nl) there have been a number of instances where river dikes have been realigned in order to improve the flood protection system. Such realignments are planned and implemented on a project by project basis, based upon technical, environmental and economic considerations of flood protection. Where it is determined that realignment is technically preferred then the cost of 'removing' those properties that will be exposed to an unacceptable level of risk is considered part of the option costs, as are any other mitigation actions for properties that are not removed. The need to remove properties, or undertake other mitigatory actions is determined on a site by site basis, based on the residual flood risk levels and the property use. As for any other flood protection projects, the funding comes from central government.

Once the final alignment of a new river dike has been determined through the design process (and the property cost taken into account in project costing), the approach to purchase and removal of the properties is as follows.

- The property owner is offered the current market value (protected from flooding) for the property. This is undertaken by central government. The owner can approach the State to offer the property for purchase if they wish to expedite the process.
- If the owner does not agree to early purchase offers, then government has the authority to force the owner to sell (compulsory purchase) if removal of the property will delay project construction.
- Once purchased, the property can be sold on by the government, however no compensation for flooding will be received by the new owner (i.e. it should be utilised for a flood-proof use).
- Some towns may also offer some relocation assistance to owners who have to move, but this is entirely at the town's discretion and not part of the national government cost.

4.6

Barriers to Implementation

The situation in the Netherlands is such that adaptive approaches, particularly those dealing with high levels of risk to existing developments, are really not a strong feature of the risk management

framework. Consequently the main barrier to adaptive approaches is the nation's statutory requirement for structural protection to be afforded to flood risk areas.

Where a need to relocate properties arises from the realignment of flood defences, central government funds are available to make the purchase, and compulsory purchase powers enable the project to proceed in the situation where owners are not willing to move.

4.7

Case Histories

Dike realignment is considered to be one of the most drastic flood management options available in the Netherlands, nevertheless, through the 'Room for Rivers' programme a number of these projects have been undertaken. The following four realignments involving property removal are reported (www.ruimtevoorderivier.nl).

- Nijmegen: here realignment of the river dike will result in a number of existing houses effectively ending up on an island. As part of the project a bridge will be built to these properties. Additionally 50 properties will be removed, bought from the owners by the state. The town will provide some help the owners to find new accommodation
- Cortenoever: here the realignment will require the removal of 20 properties and several farms.
- Voorster Klei: similarly here 10 properties and some farms will be removed.
- Westenholte: at this location just 1 property will need to be removed

These dike realignments are just one of a number of interventions being undertaken on Dutch rivers as part of this programme. Other approaches include:

- New high water channel
- Removing obstacles – lowering dykes, quays
- Deepening the flood plain between the summer & winter dykes (uiterwaarden)
- Deepening the main channel

4.8

Summary

The Netherlands has necessarily developed a highly engineered approach to coastal risk management given the threat that coastal flooding presents. The very high safety standards embedded in law have led to the development of highly advanced risk management engineering techniques and structures, but until recently have largely removed consideration of other flood management techniques, as residual flooding risk was not considered.

Today there is some consideration of differential levels of flood risk and appropriate land use in higher risk areas, however systems to remove

properties from high risk areas are not common place. Under a new national strategy, some existing dike systems will be relocated and properties placed at high risk will be purchased as part of the scheme cost. However, elsewhere where land owners make decisions to develop in high risk areas they will not be provided protection by government.

The developing land planning guidance should be reviewed for applicability to the UK and comparison to PPS25, however the legally mandated flood protection levels for the majority of the Netherlands makes their wider flood management system less relevant for application in the UK.

4.9

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5 Adaptation Practices: New South Wales, Australia

5.1 *Administrative Background*

Management of the Australian coastal zone varies regionally, with the management policies and practices primarily led by State (or Territory) agencies. These regional governments provide the policy and legislative frameworks for the activities of local authorities, who are largely responsible for on the ground activities. Specific approaches vary between States, however the overall framework is broadly consistent around the country.

Based upon the review of information available, it appears that the State of New South Wales has a comprehensive approach to coastal management comparable to any of the other States, hence this review will focus on practices in New South Wales (NSW).

5.2 *Overall Policy and Funding*

Hanslow and Howard (2005) provide a good summary of the policy framework for coastal erosion management in NSW:

“Local councils, as the local land managers, are responsible for much of the day-to-day management of the NSW coastal zone. This includes local environmental planning and development approval under the Environmental Planning and Assessment Act (1979), the preparation of coastal zone management plans under the Coastal Protection Act (1979), as well as the management of community land including most beaches under the Local Government Act (1993).

In managing the coast, councils are guided principally by the Coastal Policy 1997 (NSW Government 1997) and the Coastline Management Manual (1990). The Coastal Policy 1997 promotes better management of the coastal zone of New South Wales through the application of ecologically sustainable development (ESD) principles. The policy aims to facilitate the development of the coastal zone in a way, which protects and conserves its values. This includes recognising and accommodating natural process and protecting beach amenity and public access.”

The NSW Coastline Management Manual (1990) states that State Government will make financial assistance available to local councils under the Coastline Hazard Program. The level of assistance is 50% of the cost of projects and works. Projects which are eligible for assistance fall into the following categories:

- studies to investigate the type, nature and magnitude of coastline hazards;
- preparation of management plans within the context of social, economic, ecological, land capability etc. issues;

- works and measures which put into effect plans of management (these may include structural works, dune management measures, or the voluntary purchase of property). The total amount eligible for assistance will include the cost of any necessary design, environmental assessment and supervision of construction; and
- works to maintain and improve the recreational amenity of the State's beaches.

Government assistance is not available for works made necessary by any new development. Under these circumstances the developer and/or the consent authority are responsible for the cost of any hazard management measures.

With this 50% State government funding it is required for the local authority to provide matched funds for any projects or works.

5.3

Scale of Problem

Specific details of numbers of properties or population at direct flooding or erosion risk are not defined. However, more than 80% of the population of NSW lives and works along the coast. Hence coastal hazard management is a high priority for State and local government.

5.4

Political Drivers for Intervention

In June 1988 the NSW Government adopted a Coastline Hazard Policy which sets the context for its ongoing adaptation policies. The preamble to the policy is as follows.

“The coastline of NSW is under constant attack from the natural forces of the wind and waves. Consequently, much development is under threat from the hazards of erosion and recession of the coastline, and from inundation by the ocean.

In many places, beaches are receding at a significant rate, with implications both for existing development and for the siting of future development. Recession of the coastline may also result in the loss, not only of beaches but of public reserves and facilities along with a uniquely Australian landscape.

The situation is being exacerbated by the "greenhouse" effect...

Construction of protective works is not necessarily the solution to coastal hazards, as in many cases these can cause loss of the beach amenity, and can have adverse impacts on other parts of the coastline. The answer, where existing development is at risk, lies in an understanding of the forces at work and the application of management measures appropriate to the situation. Elsewhere, pre-planning should aim at ensuring that any development will be compatible with the degree of hazard.

The Government is concerned that much coastline development has in the past occurred in ignorance of, or without regard to, its potential for damage or inundation by storm seas, or the less obvious, but

inevitable effects of coastline recession. The Government therefore desires that the coastline be managed in an integrated fashion so that its natural and man-made values will be conserved for posterity, but with regard to the legitimate needs of society to enjoy, occupy and use coastal areas.”

The primary objective of the Coastline Hazard Policy is to reduce the impact of coastal hazards on individual owners and occupiers, and to reduce private and public losses resulting from natural coastal forces. Consequently, it is the policy of the NSW Government that:

- the impact of coastal forces on existing developed areas shall be reduced by works and measures and by the purchase of property on a voluntary basis, where appropriate;
- the potential for coastal damage in respect of any proposed coastline development shall be contained by the application of effective planning and development controls by local councils; and
- a merit approach to all development and building decisions which takes account of social, economic and ecological as well as oceanic process considerations, shall be followed by local councils and developers.

This policy clearly sets a standard whereby State government undertakes to provide hazard protection across the coastal zone. This is achieved with the match funding identified in section 5.2.

With respect to the process of ‘voluntary purchase’ (described below), it would appear that a driver for the use of this approach is maintenance of the recreational amenity and free access to public beaches. Removal of structures to avoid visual impacts and provide for access and amenity areas is certainly a factor in property purchases.

5.5

Approaches

5.5.1

New Developments

The 1990 Coastline Management manual sets out a number of risk management tools that may be adopted for the NSW coast. Those options that are principally aimed at reducing risks to new developments are described below.

Buffer Zones: “The concept of a buffer zone is based on the philosophy that the coastal processes should be accommodated rather than prevented. The most basic form of accommodation is to avoid siting structures within areas affected by the various hazards. This requires the reservation or zoning of an appropriately managed area between the beach and development within which natural fluctuations can be accommodated. An appropriate buffer zone allows both for maintenance of natural beach amenity and also for the impact of natural processes without the demands on the public purse for protection of structures.

The width of a buffer zone should take into account of the natural foredune, and a buffer zone is most effective when it is sufficiently wide

to allow for both the present fluctuations of the beach position with erosion and build-up, as well as likely future fluctuations.”

Restrictive Zoning: “Provisions can include: requirements for development consent to be obtained to allow special conditions to be applied; establishment of building setback lines; limits on the number, size, scale and design of structures; etc.

“In certain circumstances, a council may wish to impose a freeze on all beachfront development until more information is available. In such cases, a coastal engineer’s report may be required for all building applications for additions to existing buildings or for the redevelopment of areas at risk.”

Planned Retreat: “Coastal land can be planned to permit development that has a limited life and this approach allows use and occupation of the coastal site until coastline hazards threaten or damage property. This permits a flexible approach in the future if hazards become more severe, for example in response to climate change, or in cases where there is moderate to high coastal recession.

At the time a development is approved, a specified period can be identified before consent lapses. Alternatively, approval may specify that consent only remains valid while a beach erosion scarp does not encroach within a set distance from a development. At this stage, consent lapses and the structure must be moved back, relocated or demolished, as specified by the consenting Council.”

Building Setback: “Buildings can be restricted to areas on the landward side of properties in order to maintain their distance from potentially eroding dunes and bluffs. They can similarly be restricted to areas landward of setback lines established in planning instruments.

When consent for redevelopment is sought, building setbacks from original positions may also be achieved, to reduce the potential for hazard damage.”

Building Types: “The scale and bulk of buildings may be limited by development control conditions to maintain the damage potential of hazards at low levels, as well as for planning purposes such as avoiding overshadowing of beaches.”

Flood Mitigation: “Flood mitigation measures include minimum floor levels, the use of suitable building materials and flood proofing.”

Foundation Design: “Appropriate foundation design for all types of coastline development is a fundamental means of limiting damage to buildings and structures. On sandy beaches subject to erosion/recession, this may involve the use of piles of a specified length to ensure that the building remains standing if the sand beneath it is eroded away. Where recession is high this represents only an interim solution as piled structures on the beach are not socially acceptable. On a coastal bluff subject to slumping, it may involve drainage control works.”

Relocatable Buildings: “Requirements can be applied for buildings to be relocatable. This can facilitate a temporary occupation of a beachfront site and allow for hazards to be avoided by movement of the structure to landward when appropriate.”

Existing Developments

The main approach that is recommended for managing risk to existing developments is **Voluntary Purchase**.

“Both the State and some Local Government bodies have adopted schemes to bring certain coastal properties, threatened by hazards, into public ownership. Following purchase, structures are usually removed and dune management techniques implemented to provide a stable coastal reserve at the site.

Voluntary purchase is also used as a means of removing anomalous developments from a rezoned area. Such zoning will often relate to amenity or environmental quality of the site.

This approach is more commonly used in floodplain management. The Australian floodplain management best practice principles and guidelines (SCARM, 2000) states that “in certain high hazard areas of the floodplain it may be impractical or uneconomic to mitigate flood hazard to existing properties. Under those circumstances it may be appropriate to cease occupation of such properties in order to free both residents and potential rescuers from the hazard of future floods. Properties can be bought and buildings removed or demolished as part of a floodplain management plan. Property should be purchased at an equitable price and only when voluntarily offered. Such areas should be rezoned to a flood-compatible use, such as recreation or parkland.”

As a ‘voluntary’ process, neither the State nor Local government have powers to compulsorily purchase properties. The price of the property will be set based upon the appraised ‘market value’ and negotiations with the local authority. The local authority remit will vary locally. As an example, the Warringah Council (NSW) property acquisition policy states that “where the Council has formally resolved to purchase a property, the General Manager has discretion to offer the vendor (if necessary) up to ten per cent (10%) above the independent valuation of the property obtained prior to negotiations commencing, and to finalise the purchase.”

Other financial schemes, recognised in the NSW Coastline Management Manual, include the following.

- Acquisition and lease back of coastal lands at risk. Under such schemes, local government acquires land at risk and leases it to existing or future users for a specified period of time, after which the land reverts to public ownership...
- Voluntary purchase and resale for development. Under such schemes, the resale of land at risk might be dependent on its use for purposes compatible with the governing hazards; and
- Special rates levied on existing development at risk to offset the cost of necessary protective works.”

5.6

Barriers to Implementation

There is little discussion related to details of the implementation of the voluntary purchase option for coastal risk management in NSW.

However, there are references to the availability of funds being a limiting factor in its application.

Clearly a major barrier is the 'voluntary' status of this process. With local authorities potentially able to offer purchase prices in excess of the property valuation, this will provide greater motivation for house owners to accept the proposal. However, with finite funding there will clearly need to be choices made and this process does not guarantee all at risk property owners will have their property purchased.

5.7

Case Histories

5.7.1

Planned Retreat

Byron Shire Council has recently adopted planned retreat as a means of managing their receding coastline. The Byron Shire Development Control Plan recognises three recession/erosion "lines" for planning purposes: an "immediate impact line", a "50 year erosion line" and a "100 year erosion line". These lines were identified in a coastal process study...

1. Between the beach escarpment and the "immediate impact line", generally no new buildings or works are preferred. Community buildings not requiring a major extension of services may be allowed. Such buildings must be easily removable.
2. Between the "immediate impact line" and the "50 year erosion line", development will be considered on the understanding that any consent granted will be subject to the proviso that, when the erosion escarpment comes to within 50m of any building, the development consent will then cease. The owner will then be responsible for the removal of any or all buildings from the site, or, if possible, to a location on the site further than 50m from the erosion escarpment.
3. Similar controls apply to the area between the "50 year" and "100 year" erosion lines. The option of demolition as the means of removal is available for all buildings.

By this approach, Byron Shire facilitates a planned retreat from a receding coastline whilst encouraging responsible use of hazardous coastal areas at minimum future cost to council.

5.7.2

Voluntary Purchase

The Collaroy Narrabeen Coastline Management Plan is designed to ensure more careful development in future, balance the rights of beach users and property owners and address the problems already caused to the sensitive coastal region. Under the Plan, the coastline has been divided into five separate precincts, with different management options for each.

The middle and southernmost sections of the beach have been identified as the most vulnerable to coastal hazards. In drawing up the Plan, Council worked closely with the Warringah Coastal Management Committee, comprising representatives from resident's groups, sporting associations and State Government. Strong differences of opinion emerged, all of which were given careful consideration by Council.

To help address the problems, a special levy is to be applied to beachfront property owners. A voluntary buy back scheme by Council will also enable the return of vulnerable areas to public open space. Regular beach nourishment or sand replacement will continue.

Under the Plan's proposals all new developments must be located further west, away from wave impact lines. Enhancement and extension work of the seawall is also to be investigated.

As Warringah plays host to a number of major national and international surf related sports events and attracts large numbers of day trippers, it is essential to the local economy as well as the environment that this management plan is workable and successful.

Voluntary purchase has been a recognised coastal risk management approach in Warringah for many years. Since 1950, Warringah Shire Council has purchased over 30 residential properties in hazardous areas of the coast

5.8

Summary

The coastal adaptation approaches being applied in New South Wales provide a number of mechanisms to deal with coastal flooding and erosion risks. The 'voluntary purchase' process provides an approach that enables existing properties to be removed from high risk areas. However, the approach appears to be applied (funded) differently by different authorities. Its application is largely driven by amenity and access requirements, rather than solely for the good of the landowner in question. The flexibility of the concept makes it worthy of more detailed review for application in the UK. Review of different Australian examples is likely to demonstrate a number of different drivers and funding mechanisms.

Further to the purchase process, the approaches to preventing new development in risk areas warrant further review for potential applicability in the UK. The systematic use of 'planned retreat' to allow time-limited develop on the coast provides a mechanism for risk informed decisions, which should be readily implementable in the UK.

5.9

Sources Used

Hanslow, DJ and Howard, M (2005), *Emergency Management of Coastal Erosion in NSW*.

<http://www.ses.nsw.gov.au/multiattachments/3722/DocumentName/CoastalErosionHanslowHoward2005.pdf>

New South Wales Government (1990) *New South Wales Coastline Management Manual*

<http://www.environment.gov.au/coasts/publications/nswmanual/section1.html#problem>

SCARM (2000) *Floodplain management in Australia: best practice principles and guidelines*. SCARM Report 73. CSIRO Publishing, Australia.

6

Adaptation Practices: other countries

This chapter provides an overview of the coastal risk management framework and any adaptation practices adopted in a number of countries other than those reviewed in the preceding four chapters. This is by no means exhaustive, but provides some further perspectives on coastal risk management, illustrating the range of approaches adopted internationally.

It is notable that a number of European coastal zone management studies have included reviews of coastal management practices in different countries. These reviews have not been reproduced here, but the reader is referred to the following resources for details of other European countries (although they are not reported here as they do not specifically offer any additional insight for the UK process).

EU LIFE Environment Project 2003-2006 'RESPONSE': LIFE 03 ENV/UK/000611

A review of legislation, policy and good practice for managing natural hazards (coastal erosion, instability and flooding) within coastal zones (2006).

http://www.coastalwight.gov.uk/RESPONSE_webpages/r_e_practical_application.htm

Safecoast, EU INTERREG IIIB North Sea Region Programme

Safecoast (2008), Coastal Flood Risk and Trends for the Future in the North Sea Region, Synthesis Report. Safecoast project team. The Hague, pp. 136.

<http://www.safecoast.org/index.php>

The remainder of this chapter is subdivided into the Countries for which information is presented. New Zealand text provides information on property purchase options for that country, and brief Belgian and German reviews identify why those countries are not considering adaptive options at this time.

6.1

New Zealand

A recent New Zealand Ministry of Environment (2008) guidance document for coastal hazard management provides a review of managed retreat as a tool for the New Zealand coastline which will necessarily become prevalent in the future. The following text box provides extracts from that report.

Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand (2008):

“Given the level of existing coastal development in coastal margins around New Zealand, the use of planned or managed retreat will need to become a fundamental and commonly applied risk-reduction measure within the next few decades. The alternative would be a considerable increase in the scale of hard coastal protection works that are installed.

Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand (2008):

This may be an appropriate long-term strategy in certain (exceptional) circumstances, but such an approach does not fit comfortably with the values and principles of sustainably managing coastal margins: it would impact significantly on beaches, and on natural character, amenity and public access values.

‘Managed retreat’ is defined as any strategic decision to withdraw, relocate or abandon private or public assets that are at risk of being impacted by coastal hazards. At present, relocation of properties tends to occur on a case-by-case, occasional basis, with no council having yet developed a district or region-wide strategic approach to reducing coastal hazard risk this way.

The various scales of managed retreat include:

- micro-retreat, where the elevation of the building floor is raised, for example, by elevating a building on piles (suitable only for inundation-related hazards)
- relocation within a property boundary
- relocation to another site
- large-scale relocation of settlements and infrastructure.

It is suggested that the most likely methods for implementing managed retreat would be a mix of some or all of the following:

- district and regional plan rules that relate to managing existing use rights and limiting or controlling the construction of protection works
- property title covenants, to prevent undesirable activities such as construction of coastal defences. Covenants may also specify where and when retreat and/or relocation is required
- financial instruments or assistance measures including:
 - purchase of property
 - subsidies for relocation
 - taxation of risk or adverse effects
 - pre-paid community relocation fund
 - transferable development rights
- relocation of infrastructure out of hazard areas
- insurance incentives or disincentives.

Financial mechanisms are likely to play a key role, but their use to date in reducing coastal hazard risk has tended to be on a case-by-case basis by councils and other agencies. If financial mechanisms are to be incorporated more fully into activities to avoid and reduce coastal hazard risk, decision tools such as cost–benefit analyses will need to be part of option appraisal processes (and include more research into aspects such

Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand (2008):

as non-market valuation).

For managed retreat to be implemented, Turbott and Stewart (2006) suggest that regulation must also include two key elements: 1) prohibiting hard protection works in the coastal marine area and adjacent land, and 2) specifying control of land-use rights for both new and existing buildings plus the trigger levels that would require relocation. Despite Turbott's and Stewart's work, significant barriers remain to managed retreat becoming a strategic and more commonly applied mechanism.

These barriers include:

- public perception, existing use rights (see next section), financial issues, and the relative involvement of central government, and regional / district councils in applying and managing retreat
- the sporadic use of more robust decision-making tools, particularly cost-benefit analysis incorporating non-market valuations
- the lack of clear processes relating to transition mechanisms and timeframes for staging a strategic approach to managed retreat.”

This document references the fact that property purchase has been previously used in New Zealand as a mechanism to deal with coastal risks, but on an *ad hoc* basis.

The property purchase option has been systematically reviewed against economic, environmental and social criteria within a recent coastal erosion scheme appraisal for Cooks Beach, New Zealand (2008). This study was reviewing options for management of an eroding beach frontage backed by development.

The review estimates that up to 60 structures are at short/medium term risk with no intervention, with over 100 properties threatened by the turn of the next century. The analysis included a range of structural and beach nourishment based options, together with an option to purchase 25 of the most at risk properties and rezone the area for open space. However, with the cost of property purchases, the removal option is by far the most costly of all those considered. It is also unpopular with those property owners who would be affected. Hence it scores poorly on social and economic criteria. Only when a very high value is placed on the benefit of open space does it come close to ranking alongside the other options. This illustrates that whilst this is being seriously considered as an option, unless property have to be removed it is unlikely to be implemented.

Information sources used

Ministry for the Environment 2008. Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand. 2nd edition. Revised by Ramsay, D, and Bell, R. (NIWA). Prepared for Ministry for the Environment. viii+127 p.

Beca Carter Hollings & Ferner Ltd. (2008) Cooks Beach Coastal Erosion Management Strategy. Report for Environment Waikato, Hamilton East,

New Zealand. Produced in association with Thames Coromandel District Council. August 2008.

6.2

Belgium

The Belgian coastline is 67 km long consisting mostly of a sandy coast with sea walls in front of the cities and dunes in between. Around 400,000 people live in the flood prone area. More than half of the coastline is eroding, which is managed by sand nourishments near the coastal cities. These nourishments are the main technical measures to strengthen the coast against flooding.

The federal government is responsible for national contingency planning. The Flemish government (Flemish region) is responsible for maintaining the coastal defence and has defined the minimum safety level of the coastal defence at once in 1000 year. However, the safety standard is not implemented in any law or decree.

To obtain the required safety level along the entire coast, the safety level is increased step by step every year with nourishments. For several years no new sea walls have been built, because these hard safety measures are considered to detrimentally impact the dynamics of the coastline whereas soft measures, like nourishments, work with natural processes.

Defence strategies such as managed retreat, hold the line and seaward extension are regarded as an option for mid-term and long-term strategy. Whereas the current policy is based on a holding-the-line approach, retreat is a reasonable option in broad dune areas and to increase the biodiversity.

The Belgian government is currently producing a Master Plan to define the approach to delivering 1,000 year standard of protection for the coast. The current hold the line approach means that there is no consideration of adaptive approaches, however it is recognised that in the long term more adaptive approaches may be required.

Information sources used:

Personal communication with Tina Mertens, Project Engineer; Flemish Ministry of Transport and Public Works - The Agency for Maritime and Coastal Services - Coastal Division, Vrijhavenstraat 3B-8400 Oostende Belgium

Mertens, T., Trouw, K., Bluekens, K., De Nocker, L., Couderé, K., Sauwer, C., De Smedt, P., Lewis, C., Verwaest, T., (2008), SAFECoast: INTEGRATED MASTER PLAN FOR FLANDERS FUTURE COASTAL SAFETY, Coastal Division of the Flemish Community, Belgium

6.3

Germany

In Germany coastal protection is managed by the single provinces.

Coastal management strategies are prepared by the provinces which are intended to be reviewed every ten years. To date there has been no examples of properties being bought or relocated for the purpose of risk management.

The land use planning is undertaken through a tiered approach with Federal, State and local authorities all involved. In the Schleswig-Holstein province (the most northern province, surrounded by baltic sea, north sea and Denmark) it is recommended that there be a 200m buffer along the coast within which there should be no infrastructure. Although it is understood that this ordinance can be disregarded in instances where the demand for development is considered too high for the coastal strip to remain unused.

Information source used:

Personal communication with Arfat Hinrichsen of the Planning Department of the Coastal, Marine and National-park Authority of Schleswig-Holstein Province, Germany.

7

Conclusions and Recommendations

7.1

Conclusions

Almost all countries for which coastal management information was found had some level of risk awareness which was translated in ordinances for appropriate development within hazard areas. The level of sophistication and robustness of these planning ordinances varies, but all are intended to avoid locating long-term developments in areas where they will become exposed to unacceptable levels of risk during their planned life.

Some countries refer to climate change in terms of its potential to increase risks at the coast, but it is not generally presented as a driver for changing the way the coast is managed (the main exception being Australia where climate change has been an identified issue for many years and is presented as a driver for adaptation). Where climate change is referenced it tends to be presented as a justification for bolstering structures to hold the existing line of defence.

However, in the UK adaptive approaches to management of coastal risks are, to some greater or lesser extent, motivated by the understanding of potential future impacts of climate change on coastal hazards. Taking this long-term view, in the UK, has resulted in the early identification of numerous areas where structural risk protection will be impractical at some point in the future, hence exposing land and properties to increasing risk.

The UK's long-term coastal risk strategic planning process (SMPs and Strategies), together with the ongoing National Coastal Erosion Risk mapping project, makes the UK somewhat unique in terms of risk awareness for those located in the coastal zone. Whilst this is clearly a very positive (intended) outcome of the strategic planning process, it does lead to negative impacts on those for whom the long-term picture is one of increasing risks. Having these 100 year risk management plans adopted by local government creates a demand for mitigation actions where risks will increase as a consequence of the adopted policies. However, the 'permissive powers' under which UK agencies undertake coastal risk management works do not impose any duty for mitigation.

This 'permissive' situation is similar to some other countries, e.g. France, where there is no legal requirement for flood or erosion protection. However, in France, the operation of the Law Barnier is such that government effectively takes on responsibility to remove people and property from areas where hazards are determined to pose a serious threat to life. The operation of the US Hazard Mitigation Grant Program is similar; in so much as it is driven by the avoidance of unacceptable risks to life, and the economic desire to avoid the high costs of disaster recovery.

These risks are different in nature to the risks often considered in the UK when property purchase and similar options are discussed, whereby the threat is often a longer-term one, where the landowner is primarily driven by the financial impacts of losing (or devaluing) his asset. This is often the

case in areas where there is a gradual coastal erosion presenting future instability risks. Again, the exception here is the Australian ‘voluntary purchase’ process, where property removal is less ‘disaster’ driven.

The review has not identified any practices that could be considered a mechanism to share the risk management burden with existing land owners. In the examples identified, government agencies have usually sought to purchase ‘at risk’ properties at their full market value, effectively absolving the owner of responsibility for the risk their property is exposed to. The only example where landowners took on part of the cost is the application of the US HMGP at Humboldt County, California (Section 2.7) where the government only paid 75% of the appraised property value.

Based on this review it is reasonable to conclude that the long-term strategic planning process applied on the UK coast through SMPs (and national flood and erosion mapping) creates a unique risk awareness situation. Through this process, the long-term flood and erosion risks to properties are clearly identified and consequently they can impact property values, etc long before the risk may be expected to occur. Further, these risks are consistently and systematically identified for the entire coast of England and Wales.

In the other countries reviewed, the adaptation approaches identified are largely driven by reaction to either a natural disaster or an identified near-term risk. In these situations, property relocation is often borne as part of the project cost. Hence these approaches are very site specific and considered on a project by project basis.

No approaches that provide a ready solution for the programmatic adaptation necessary in the UK have been identified.

7.2

Summary of Findings

Table 7.1 provides a high level overview of the coastal risk management framework and approaches adopted in the four main countries reviewed.

Country	USA	France	Netherlands	Australia
Legislative framework	Federal, State and Local statutes	National and Local processes	National legislation	National and State/Territory statutes
Administration	Permissive Powers	Permissive Powers	Permissive Powers	Permissive Powers
Implementation	Local 'Sponsors, Federal/ State inputs	Local	National and Local	State/Territory and Local
Funding	Federal, State and local	National and local	National	State/Territory and Local
Adaptive Processes: existing development	Post disaster removal	High risk property purchase	Limited, part of project implementation	Voluntary purchase
Adaptive Processes: new development	Some zoning ordinances	Risk prevention plans to guide development	Land use planning approaches evolving	Various land planning/zoning approaches applied.
Application of property removal approaches	Limited, increasing through recent major hurricane disasters	Limited evidence of application	As part of current project proposals.	Some examples with varied drivers.

Table 7.1: Summary Comparison of Approaches.

7.3

Recommendations

7.3.1

New Developments

The international examples of coastal area zoning, development restrictions, etc intended to prevent the further (inappropriate) development of coastal hazard areas, provide some interesting approaches that should be considered for wider application in the UK.

While PPS25 provides a national level framework for the review of development proposals in the context of flooding risks, the guidance for coastal erosion is less well developed and implemented. It is recommended that the ongoing review of PPG20 should consider a requirement for local planning authorities to systematically adopt zoning policies for coastal erosion. This is currently undertaken by many local authorities, but the erosion timescales considered and the restrictions placed on land use vary greatly. The institution of a national policy, and guidance, would benefit this situation.

7.3.2

Existing Developments

It appears that there is no one approach developed and applied internationally which will provide a tailor made solution to the flood and erosion risk management issues faced in some areas of the UK coast.

The Australian ‘Voluntary Purchase’ process appears to be that which is most aligned to the situation in the UK. This process warrants further consideration and review regarding details of its motivations, funding and operation. Its voluntary status would probably make it more straightforward to adopt legislatively. However, it is noted that this process is limited by funding availability, which is often cited as the main reason why such approaches are not systematically used in the UK, where available funding is directed to protection assets *in situ*.

With regard to funding, the surcharge on property insurance premiums used to fund the French ‘Law Barnier’, should be considered further. Similarly levy’s or surcharges on other premiums or taxes may provide a mechanism to generate revenue to provide funds that could be directed towards the removal of vulnerable assets.

Other mechanisms (identified in Section 5.5.2) that could be considered further include:

- Acquisition and lease back of coastal lands at risk. Under such schemes, local government acquires land at risk and leases it to existing or future users for a specified period of time, after which the land reverts to public ownership.
- Voluntary purchase and resale for development. Under such schemes, the resale of land at risk might be dependent on its use for purposes compatible with the governing hazards; and
- Special rates levied on existing development at risk to offset the cost of necessary protective works.