

8th European Real Estate Society Conference

Alicante, Spain 27th – 29th June 2001

The Long Term Impact of Flooding on Residential Property Values

Chris Eves, University Western Sydney, School of Construction, Property & Planning. Locked Bag 1797 Penrith South DC NSW 1797, Australia

Phone: 61 2 98524219

Fax: 61 2 98524185

Email: a.eves@uws.edu.au

Key Words

Residential Property, Housing, floods, valuation, property returns.

Abstract

Current planning schemes in Australia identify areas that are potentially flood liable. This identification of flood liable land is based on flood height levels over time. Throughout New South Wales this measure of flood affectation is determined by three classifications. These classifications also influence the development of residential property within these flood areas.

Prospective purchasers are advised of this flood zoning when a full title search is carried out. However, as these properties are often located on the flood plain, and not within sight of the river, flooding can appear visually remote to the uninformed buyer.

This study will analyse residential house sales in flood prone areas and compare price movements of these houses to similar houses in immediate adjoining areas that are not affected by flooding.

The analysis will cover the period of 1984 to 2000. This period includes the last major floods in Sydney during 1990. This study period will determine what impact a major flood has on residential housing prices and whether this effect is on-going or decreases the longer the area is flood free.

Introduction

Any major town or city located in a river valley can be subject to varying degrees of flooding. In many cases the risk of flooding can be reduced by the construction of flood mitigation works, such as levee banks and spillways. However, despite these works flood prone areas cannot be guaranteed to be flood free in the future.

In Australia planning authorities have surveyed and mapped all flood prone areas. From these maps they have been able to identify all land that is flood liable as well as providing an indication of how often such land will be affected by flooding. Flood affectation has been classified into four categories ranging from flood free to possible flood inundation once every 5 years.

General flood information is available to all participants in the property market and is used as the basis for building approvals, property valuations, property insurance and property finance. However, the degree of flooding that affects individual properties is only made available if the interested party expressly requests such information.

Previous studies by Fibbens (1992), Bialaszewski (1990) and Guttery, Poe and Sirmans (1997) have determined that property that is either flood affected or on wetlands have a reduced value compared to similar properties without these detriments.

Although the detrimental aspects of flooding are documented in relation to the variation in price based on a flood liable and a flood free property of similar location and characteristics, there has been limited research in the Sydney basin area in relation to the price variation and investment return over an extended time period.

This study has been undertaken to:

- ?? determine the performance of flood effected properties in comparison to similar nearby residential properties that are not flood liable;
- ?? establish if the difference in values between flood liable residential property and flood free residential property is constant, or decreases as the time period from the last known flood increases.

Residential Flood Zones

Sydney, like most cities that have developed in a major river valley, has certain areas that have been built upon despite the fact that they are subject to flooding. The relatively small annual rainfall of the Sydney region, combined with an even rainfall distribution and a large network of water storage dams to assist with flood mitigation, actually limits the number of floods that have occurred. In the past twenty years there have been only 26 floods in the Sydney area, with only eight of these floods causing serious residential property damage (Bureau of Meteorology, 2000).

Despite the relative infrequent occurrence flooding in Sydney the damage caused by over floor flooding can be significant both in relation to property damage and service disruption.

To minimise the flood damage to property restrictions have been placed on the type and scope of real estate development that can take place on flood liable land.

Both State and Local Government Authorities have adopted a four type rating system for property within flood prone areas. These classifications are:

1. Very flood liable, possible flooding every 0 to 5 years;
2. Moderately flood liable, with possible flooding every 5 to 20 years;
3. Marginally flood liable, possible flooding every 20 to 100 years;
4. Flood free, outside inundation levels of a 100 year flood.

All the above classifications for property in flood areas are based on the land being covered by rising flood waters. This does not always result in actual flood waters entering or covering the floor of the improvements. Residential building design and land works can increase the actual building floor level height above the various flood level classifications, which in turn can lessen the impact and severity of flooding.

Influence of Flooding on Property

Flood water has been defined as either over land flooding or over floor flooding.

Over land flooding is defined as water covering the actual land, gardens and sheds but not actually entering and covering the floor of the main property (residential, commercial or industrial). Over land flooding can result in some isolation due to restricted vehicular access to the property and in some cases the disruption of services. Some minor infrastructure such as roads, sheds, garages and landscaping can also be damaged but actual property loss is limited.

However, over floor flooding is more severe, with the actual property being inundated with floodwater. As well as the problems associated with over land flooding there will be a greater chance of actual property structural damage including wall linings and electrical wiring. In cases where regular flood inundation occurs permanent structural damage of walls and foundations can occur. In addition to the structural damage over floor flooding can also result in the substantial loss of personalty, such as equipment, floor-coverings, furniture and soft furnishings.

As stated by Lambley and Cordery (1991) the property that is subject to over floor flooding can result in the overcapitalisation of the property due to the requirement to restore the property after flooding has occurred. Lambley and Cordery (1991) also considered that not rectifying the damage from flooding may minimise the problem of overcapitalisation but would result in the loss of property value due to the neglected state of the building and overall structural depreciation.

The infrequent nature of severe flooding in the Sydney basin may have a different influence on residential property values compared to areas where the flooding is more frequent and severe.

One of the major aspects of infrequent flooding is that the actual problems associated with flooding are only apparent during and immediately after a flood. At all other times these problems are not visible and in fact can be a positive factor in relation to property values. The residential property may have severe problems during a period of flooding but offers aesthetic water views and close proximity to water sports at all other times. As previously stated there have been 23 significant floods in the Sydney region over the past 17 years. If the average flood covers a period of 4 days, then the percentage of time these flood-affected properties have been inundated over the past 17 years is only 1.5%.

In some cases the actual nature of low lying flood prone land in the Sydney area is that certain land can be flood liable and actually not be in close proximity to or in visual contact to the river system that causes the flooding. Despite being advised of potential flooding by the relevant Local Government Authorities during the property search process buyers could discount the impact of flooding when there has been an extended periods of average to lower rainfall and no visible or recent evidence of flooding.

According to Fibbens (1992) and Guttery et al (1997) flood prone properties and properties in wetlands are not considered as attractive as other residential property and this results in a lower price or value. On this basis the greatest impact on value or price would be immediately after a severe over floor flood where both disruption and property damage occur. As residential land is also a scarce resource in the Sydney basin large tracts of flood liable open space can appear wasted by an uninformed public.

Identification of Flood Liable Property

Each Local Government Area in New South Wales, which has areas that are liable to flooding have access to flood maps that indicate which land is subject to the various classifications of flooding. These maps are available for public inspection, but only on request. An uninformed purchaser may be told that the property is subject to flooding and can still be unaware of the severity of that flooding.

The flood liability of property is also reported by Local Government Authorities under Section 149 of the Environmental Planning and Assessment Act (1979). As part of the purchase and conveyancing process property buyers obtain a section 149 certificate to determine the allowable uses of the property being purchased. If a property is flood liable, this information will be included in the section 149 certificate, however it is again stressed that the level of affectation is not always stated.

Therefore, the prudent purchaser is fully aware of the fact that the property being purchased is flood liable and factors this detrimental aspect of the property into the purchase decision; a similar level of awareness may not be available to the imprudent buyer.

A property's possible flood liability also has implications in relation to property finance and property insurance.

In Australia it is not possible to insure a property for flood damage. The effects of flooding and the subsequent restoration costs cannot be covered by insurance, but must be considered as a long-term cost by the purchaser. This disadvantage is limited to some extent by the advance flood warnings that are issued to flood liable property owners allowing personal property to be removed.

Lending institutions will not finance properties that are subject to severe flooding. Finance is generally not available to residential properties where the building floor level is below the 1 in 100 year flood level (subject to over floor flooding) identified by the Local Government Authority.

On this basis the detrimental effects of flood liable property is not only restricted to actual physical and property damage but also reduced financing and insurance opportunities that should also influence value.

Study Area

The study has initially been restricted to a small residential area in the southwest suburbs of Sydney. The study covers streets in the suburbs of Canley Vale, Carramar and Lansvale. All these suburbs are in the Local Government Area of Fairfield, which is classified as a lower to middle income socio-economic area. The properties in the study are all residential properties comprising a mix of both single freestanding residential houses and low-rise multi-residential unit complexes. All flood liable properties are predominantly subject to over land flooding with very few properties actually subject to over floor flooding. On inspection of the study area, it was noted that a majority of free standing single residential dwellings in the flood liable areas had been elevated to lift the habitable floor level of the property above the designated 1 in 100 year flood level. In such cases the flooding would be classified as over land flooding only.

These suburbs are conveniently located with good access to all forms of transport and services; therefore the potential flood liability is the only major limiting property factor for this particular residential market.

All the streets in the study are subject to flooding from the Georges River river system.

Research Methodology

After identifying the areas in these three suburbs that were subject to varying degrees of flooding, a physical inspection was carried out to determine the type and level of development in the flood liable areas. As the study is focussing on residential price movement, all streets with any form of development other than residential were not included in the analysis.

The physical inspection of the study area identified 22 streets that were flood liable and developed with single residential or low-rise multi-residential unit complexes. Having identified these 22 streets they were matched with 22 adjoining streets that were just outside the flood liable areas but virtually identical for all other factors that influence residential housing prices. Properties in the flood free streets were also a mix of single freestanding residential houses and low-rise residential unit complexes.

As this particular area of Sydney is considered to be a lower socio-economic area, the actual residential properties are more uniform compared to higher priced suburbs of Sydney. House construction is predominately timber framed and accommodation is either two or three bedrooms. Redevelopment in this particular area is not new single residential dwellings but medium density home units. Due to this the actual residential housing markets are very similar, with price variation appearing to be influenced more by condition and inclusions rather than by construction or size.

Having identified the 44 residential streets all residential sales transactions were collected for the period 1984 to 2000 from a commercial electronic data base (R. P. Data Pty Ltd). All sales were sorted on both an annual and a quarterly basis. At this point there is insufficient sales data to carry out a quarterly analysis but this will be carried out when the study areas are expanded.

Total transactions for the study period were 1994 sales, with the majority of sales occurring in the period from 1990 to 2000.

Data was also obtained from the Bureau of Meteorology- Flood Warning Centre, which provided peak river heights for the Georges River for the period 1875 to 2000. From the peak river heights it was possible to determine which river peaks resulted in both over land and over floor flooding. Rainfall and peak river heights are represented in Figures 1 and 2 (attached).

Sales data was analysed on an annual basis to determine the average annual sale prices for both the flood free and the flood liable properties. These results were compared to determine annual trends, average annual price movements and the average annual return and risk for both the property classifications. Results were then compared to the average annual rainfall and peak river height data to determine any correlation between flood occurrence, sales volume and price movement.

Research Analysis

Over the study period there have been 28 occasions when the Georges River has flooded. These flood peaks have ranged from 0.89 metres to 4.6 metres, as evidenced in Figure 2 (attached). However, following discussions with the Hydrology Department of the Bureau of Meteorology, only those flood height peaks greater than 4 metres were considered to be serious over floor floods. All other flood peaks were

considered to be over land floods. The highest flood peaks have also coincided with the years of highest annual rainfall (refer to Figure 1). However, high rainfall is not always an accurate indicator of flooding potential.

There is a definite price differential between similar type properties that are flood free compared to the same type of properties that are flood liable. From Table 1 it can be seen that the price differential is not uniform but varies on an annual basis. The greatest price difference between the two groups was during the period 1988-1991. During the period from April 1989 to June 1991 there were seven occasions when there was flooding on the Georges River in the study area location. Serious over floor flooding occurred on two of these occasions with over land flooding on the other five occasions. However, it appears that the price differential tends to decrease as the occurrence of both over land and over floor flooding decreases, this is evidenced by the decreased price differentials during the periods 1984 to 1988 and 1995 to 2000.

Table 1 Data Summary 1984-2000

Year	Sales-Flood free	Sales-Flood liable	Average Annual Sale Price-Flood Free (\$)	Average Annual Sale Price-Flood Liable (\$)	Annual Price Difference Flood free-liable
1984	31	18	61056	55160	5896
1985	26	31	67628	60954	6674
1986	29	23	76187	71958	4229
1987	38	32	75878	69317	6561
1988	59	54	96353	82048	14305
1989	34	52	128449	103441	25008
1990	29	46	111715	97931	13784
1991	102	88	115369	97423	16946
1992	86	84	118097	105106	12991
1993	102	77	120875	114326	6549
1994	103	86	130673	118657	12016
1995	87	73	127864	119461	8403
1996	75	56	129960	123554	6406
1997	73	58	129120	119506	9614
1998	88	64	131554	124611	6993
1999	63	44	138326	131095	7231
2000	42	41	141694	133261	8433
Total	1067	923			

Figure 3 (attached) shows the price trend of the flood free and flood liable residential property over the period 1984 to 2000. Basically the price of residential properties in the two areas has followed very similar price trends during this period. Both property types had significant increases in price from the period 1986 to early 1990 with a peak in values in late 1989 followed by a fall in prices in later 1990. It also appears that any negative market factors have a greater impact on flood liable property, as shown by the price trend for the two property types for the period 1988-1993. Overall both

property types followed the general trend for the Sydney residential property market for the period 1984 to 2000.

Figure 4 (attached) also shows that the actual percentage fall in value from 1989 to 1990 were very similar for both property classifications despite the fact that there were also four periods of flooding (one over floor flood) during 1990. Based on this data it appears that a general property recession will have a similar impact over all property classifications.

Following the stock market crash in October 1987 there was a considerable shift of assets from the equity market into the residential property market. During the three years from 1987 and 1989 the price of flood free residential property in the study area increased from \$75,878 to \$128,449 (69%). At the same time there was also an increase in the price of flood liable residential property but this increase was only 49.28%.

In relation to annual percentage price movement both flood free and flood liable residential property in the study area had the highest annual increase in 1989, which was followed by the greatest decrease in percentage price movement in the next year (refer to Figure 4).

The actual annual percentage price changes are significantly different, indicating that the detrimental nature of flood liable land is not constant but will vary depending on other economic factors, prevailing weather conditions and actual flood frequency. The analysis shows that there have been years where the price of flood liable land actually increases at a greater rate than the flood free property. Figure 3 shows that this greater increase occurs after a significant drop in prices following a flood period, such as the rapid increase in the price of residential land in 1989 and 1991/92 following the significant floods of 1988 and 1990.

Figure 5 (attached) represents the average annual price of residential property as an index based on the price level as at 1984. This index also shows that the changes in the value of flood free and flood liable residential land is not consistent over time and can vary significantly on an annual basis. Both classes of residential property increased in price at similar levels until 1986, when the period of substantial serious flooding commenced. During the period 1986 to 1992 non flood residential property prices in the study area increased at a greater rate than the flood liable property. However, since 1993 the index shows that the flood liable property has performed better to the point where both property types have a similar performance index level in 2000.

The average annual return for the two residential classifications are very similar with the flood free land showing an average annual return (nominal) of 5.9 %. The nominal average annual return (nominal) for flood liable land is 6.0%. It was expected that the analysis would show a significantly higher return for the flood liable land due to the added risk associated with ownership of this property type.

Table 2 shows that the average annual nominal return for residential property in the Fairfield Local Government Area was 7.1 %, with a volatility of 8.58%. These results

are considered to be limited, as they have been calculated from the New South Wales Valuer General's residential price index. This index is based on the estimated annual price variation on a benchmark property rather than an analysis of all market sales transactions. Further research will be carried out to analyse all residential sales for the period 1984 to 2000 to accurately assess the variation in residential prices and returns for this control group.

Although there appears to be limited variation between the long-term nominal return of residential property in flood free areas and those areas immediately adjoining, there is a considerable variation in both the percentage and actual price differences on an annual basis. Figure 6 (attached) indicates that the difference in price for flood free and flood effected residential property was relatively minor in the period 1984 to 1987 but increased significantly from a low of \$4,229 (5.9%) in 1986 to a peak difference of \$25,008 (22.4) in 1991, this compares to an average annual price difference of \$10,120.. This trend for an increasing difference in prices of flood free property relative to flood effected property was greatest during the period 1987 to 1991, where there were 11 floods recorded. Floods in this 5 year period represents 48% of floods in the total period of the 15 year study.

Since the peak difference in prices in 1991 the difference in the price of flood free property relative to flood-affected property has been decreasing. During this same period there has not been an over floor flood and two periods where any flooding has caused inconvenience to property.

Table 2 Residential Property Returns (1984-2000)

	Flood Free (Study Area)	Flood Liable (Study Area)	Fairfield LGA
Average Annual Return %	5.9	6.0	7.1
Volatility %	11.12	8.81	8.58

Research Conclusions

This research confirms the results of earlier studies that flood liable property has less value compared to similar property that is not flood liable. However, this analysis over a 17 year period suggests that the price difference between flood liable and flood free land is not a constant percentage , but varies from year to year. The difference in the price of residential property in a flood free area compared to a flood liable area is greatest following a period of over floor flooding and tends to reduce when there has been no recorded flooding or where any flooding is minimal or over land only.

The actual risk of ownership for the two residential property types is very similar and the actual long term average annual return is also very similar. This suggests that once the initial purchase discount is applied to the property the owners of the two properties will receive similar levels of capital appreciation over time. However, the owner of flood liable residential property can suffer short-term reductions in capital

appreciation compared to flood free property, when there is a succession of floods over consecutive years, as demonstrated in the analysis for the period 1988 to 1991.

In periods of very strong property markets, such as the situation in Sydney during 1988, the percentage increases in property prices are very similar for both flood liable and flood free residential property. This suggests that in periods of strong buyer demand and limited supply the market does not consider flood affectation to be a major investment consideration, even if flooding has occurred in that year.

A similar situation exists in relation to periods of property recessions. In 1990, following the property boom of the late 1980s, both flood liable and flood free residential property in the study area suffered a similar overall percentage drop in prices. This suggests that in the case of residential property a major factor influencing the market will have a similar impact on all property in the area and not only affect residential property that is considered to have a some form of detriment. The detrimental factor will have more impact on the subject property in average to good market conditions.

The study also shows that following a period of both decreasing property prices and only small annual increases in property prices the price difference between flood liable and flood free land will decrease, provided there are no further incidences of over floor flooding.

References

Bialaszewski, D., 1990. *Adjusting Comparable Sales for Floodplain Location; the case of Homeworld, Alabama*. The Appraisal Journal, January 1990.

Fibbens, M., 1992. *Effect of Flooding on Residential Property Values*. UWS-H, Property Research Centre Report.

Guttery, R., Poe, S. L., Sirmans, C. F., 1998. The Impact of Compliance with Federal Wetlands Regulations on Housing Prices. Unpublished Conference Paper. 14th American real Estate Conference, Monterey California, April 15-18 1998.

Lambley, D. B, Cordery, I., 1991. *Effect of Floods on the Housing Market in Sydney*. Conference Proceedings, International Hydrology and Water Symposium, Perth Western Australia, October 1991.

Owens, R., Roberts, J., 1991. *Adjusting Flood Plain Properties*. The Appraisal Journal, April 1991.

Valuer General's Department, 1982, *New South Wales Real Estate Market*. NSW Government Information Service, Sydney.

Valuer General's Department, 1984, *New South Wales Real Estate Market*. NSW Government Information Service, Sydney.

Valuer General's Department, 1988, *New South Wales Real Estate Market*. NSW Government Information Service, Sydney.

Valuer General's Department, 1992, *New South Wales Real Estate Market*. NSW Government Information Service, Sydney.

Valuer General's Department, 1996, *New South Wales Real Estate Market*. NSW Government Information Service, Sydney.

Figure 1. Average Annual Rainfall (mm) and Rainy Days-Sydney (1980-2000)

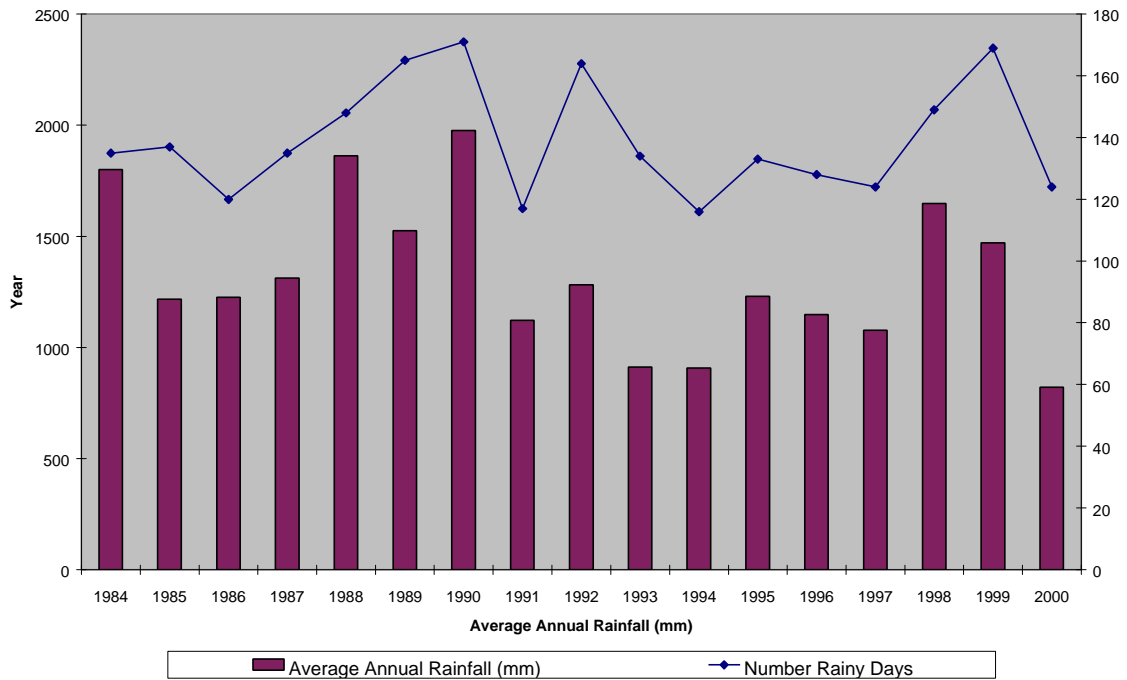


Figure 2. Annual Rainfall (mm)/Georges River-Peak River Heights (m) 1978-2000

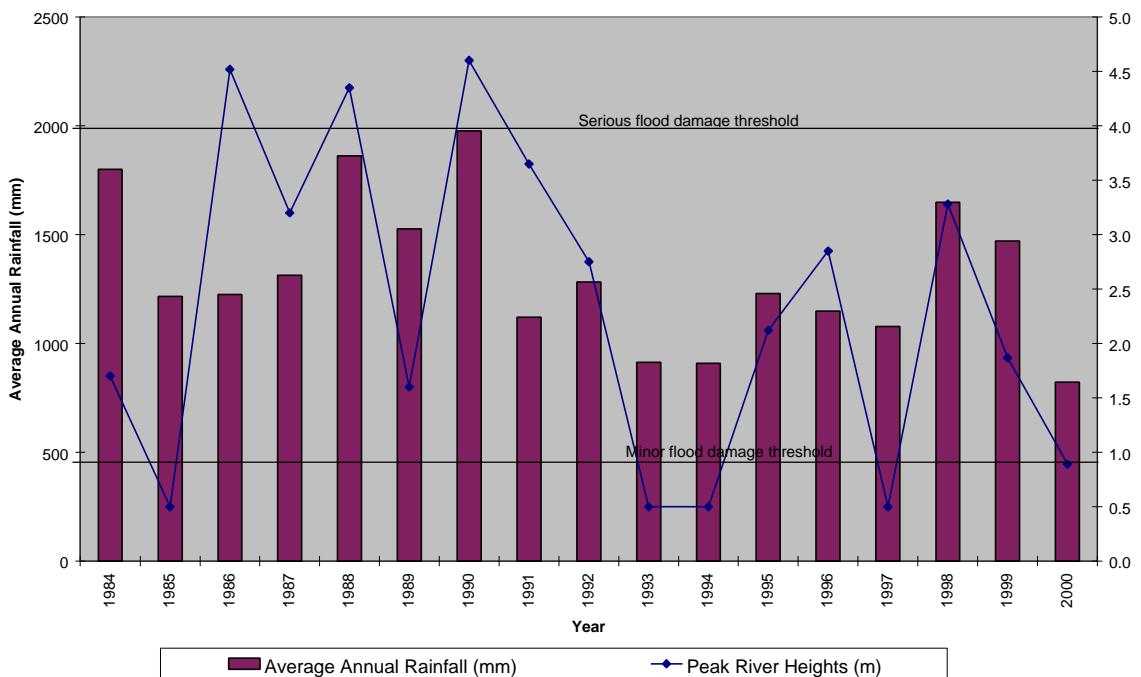


Figure 3 Average Annual Residential Prices (\$) 1984-2000

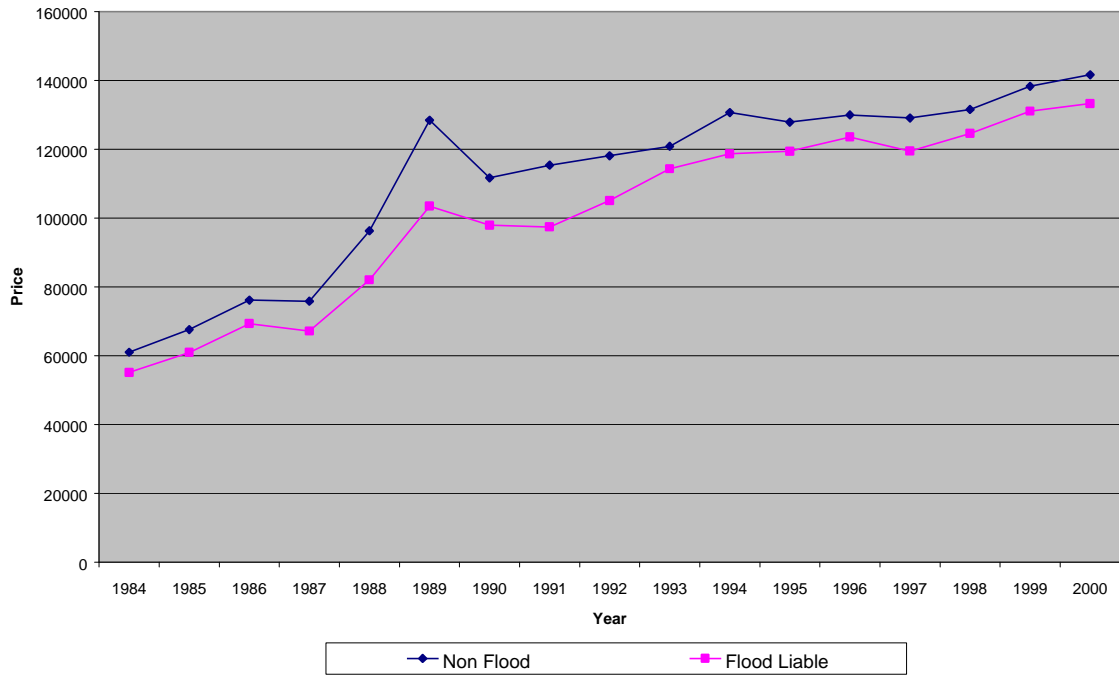


Figure 4 Average Annual Residential Price Movement (%) 1984-1998

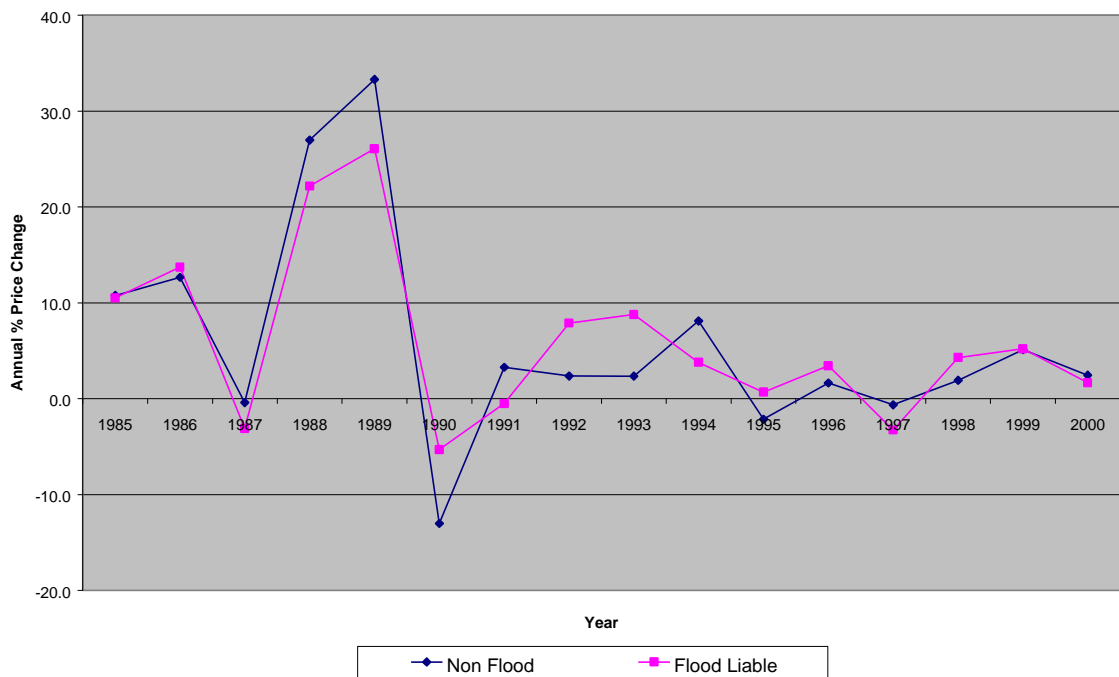


Figure 5 Residential Price Index (1984-2000)

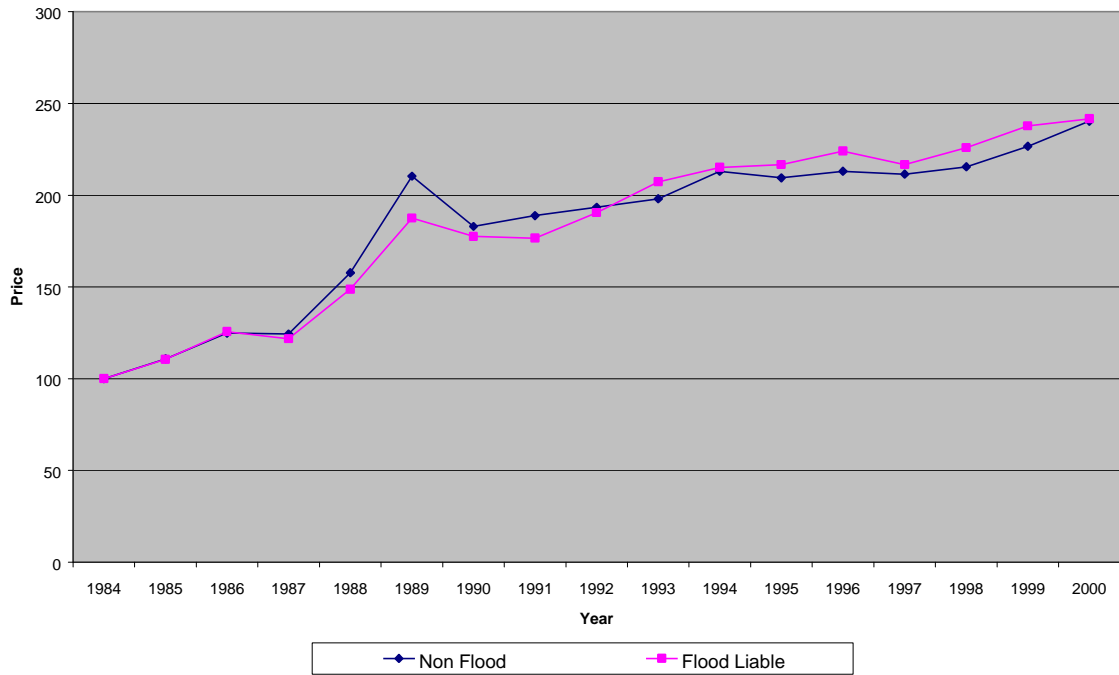


Figure 6: Annual Price Difference (\$) - Flood Free Relative to Flood Effected Property

