

APPENDIX J

Community Based Flood Insurance Program

White Paper

Examining an Alternative to the National Flood Insurance Program

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1.0 Introduction

The National Flood Insurance Program, crafted with the best of intentions, is negatively impacting the Delta Legacy Communities, making them less flood resilient, not more.

The high price of flood insurance prompts many households to forgo flood insurance. If households do purchase flood insurance, it is unlikely they will receive adequate reimbursement to fully recover. The NFIP mandated building restrictions make it hard to invest in building improvements. Overall, the program is stifling the economic vitality of the region.

The Delta Legacy Communities of Sacramento County including the City of Isleton are underinsured, both individually and collectively. The levees protecting the Legacy Communities within Sacramento County are considered fragile (Semonite 2018). If a levee were to fail, it could quickly inundate the entire community to depths as high as 15 feet. Further, a single island failure could domino into a multi-island failure (Semonite 2018). There are slightly more than 1,800 structures in the Legacy Communities. In 2019, there were only slightly more than 1,000 NFIP policies. Without insurance, the only recourse is often a federal loan to be repaid with interest.

Even with an NFIP policy, policyholders may not be fully covered. A National Flood Insurance Program (“NFIP”) insurance policy does not cover the full replacement value, living expenses while the home is being rebuilt, or septic system repairs (FEMA 2021a). An NFIP policy for single-family residential structures is capped at a total loss value of \$350,000, with a maximum of \$250,000 for structure damage/replacement and \$100,000 for structure contents (FEMA 2021a). Policies have a 30-day waiting period before coverage takes effect (FEMA 2021a). After the disaster, it may be months before the policyholder receives their first payment (Kimbrow 2021).

Figure 1.1 shows the claim history for the Delta Legacy Communities in Sacramento County. Figure 1.1 A shows the total number of residential building claims paid. It shows the impact of the 1986, 1996, 2005, 2016 flood events. Figure 1.1 B shows total amount of the claims paid. It shows that investments from the past twenty years have reduced the flood losses. Figure 1.1 C shows median claims payment adjusted to 2020

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dollars. It shows that the median claims payment in 2020 dollars was less than \$20,000.

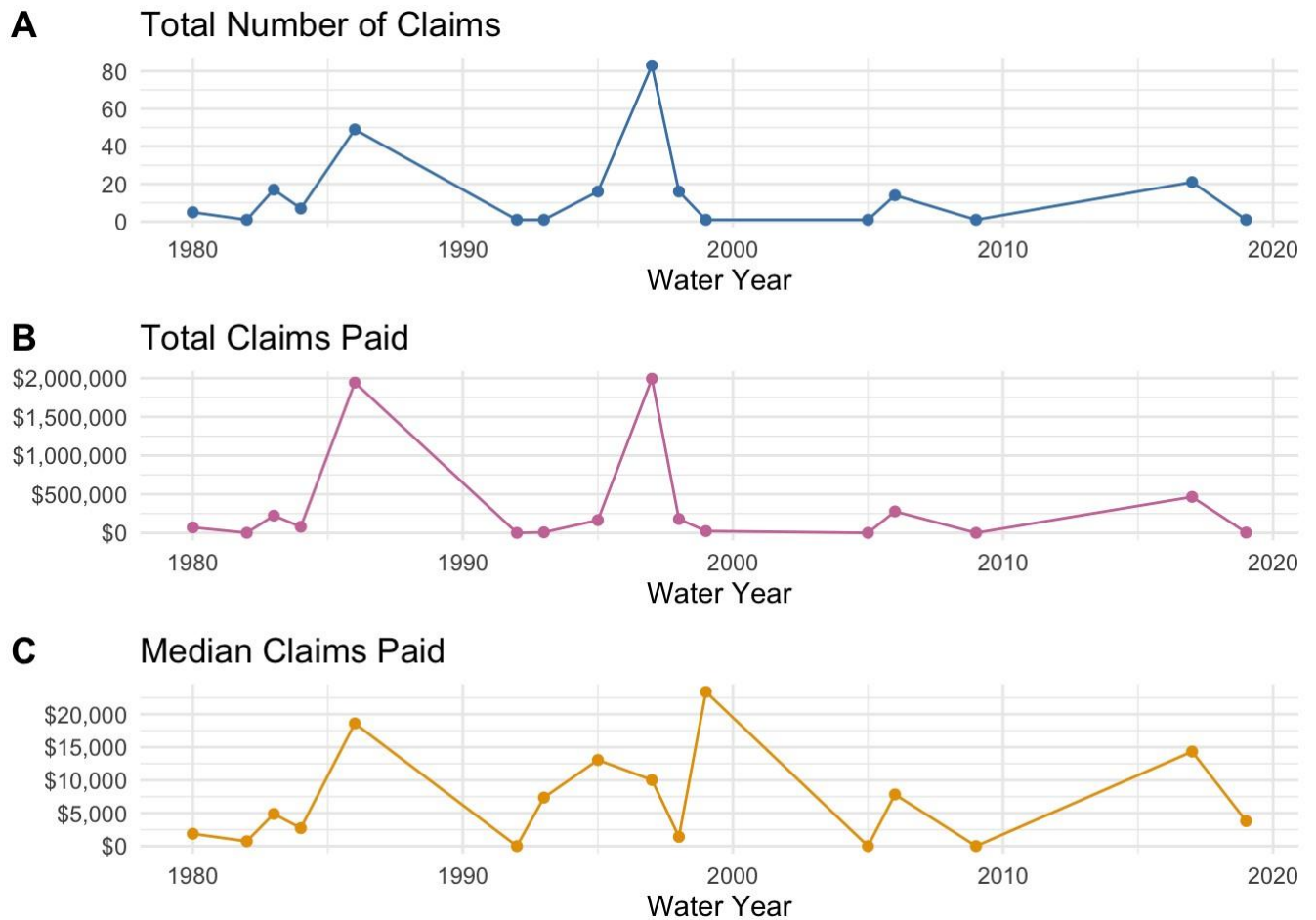


Figure 1.1: Annual residential building claims payments in 2020 dollars, total residential, and median residential building payments by year for the Sacramento Delta Legacy Communities. Source: FEMA Open Source Data

The insurance gap is widening. Figure 1.2, below, is created from FEMA’s open-source data base. It shows the change in NFIP residential policies over time. Figure 1.2 A shows the change in the annual number of NFIP policies purchased each year. In 2010 and 2012 FEMA issued new Flood Insurance Rate Maps (FIRMs) placing several communities in the Special Flood Hazard Area(SFHA) for the first time. Sacramento County hosted several community outreach meetings encouraging people to buy flood insurance so that their flood insurance rate would be “Grandfathered” at the lower rate.

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Figure 1.2 A shows that a significant number of people followed this advice. During this period the number of households with insurance increased from 795 NFIP policies in 2011 to 945 NFIP policies in 2012. Following a trend seen in other parts of the State where policyholders retain their policies for four years, the number of policies remains stable for four years before declining.

The first Flood Insurance Rate Map (FIRM) for Sacramento County was issued in March 1979. Owners of single-family residences built before 1979 have enjoyed a subsidized flood insurance rate, known as a pre-FIRM rate. In 2012, NFIP reforms removed the pre-FIRM subsidy and set into motion significant rate increases. In 2014, after a backlash from homeowners who saw rates increase by as much as 25%, Congress passed the Homeowner's Flood Insurance Affordability Act of 2014 (HFIAA). Under HFIAA, rates were projected to increase but at a slower rate. Figure 1.2 C shows that median policy price increased from a low of around \$500 in 2012 to over \$900 at the end of 2019. Comparing Figure 1.2 A to Figure 1.2 C shows that as rates increased, the number of policies purchased annually decreased. Figure 1.2 B shows that although the number of policies decreased, the total annual premium paid continued to increase.

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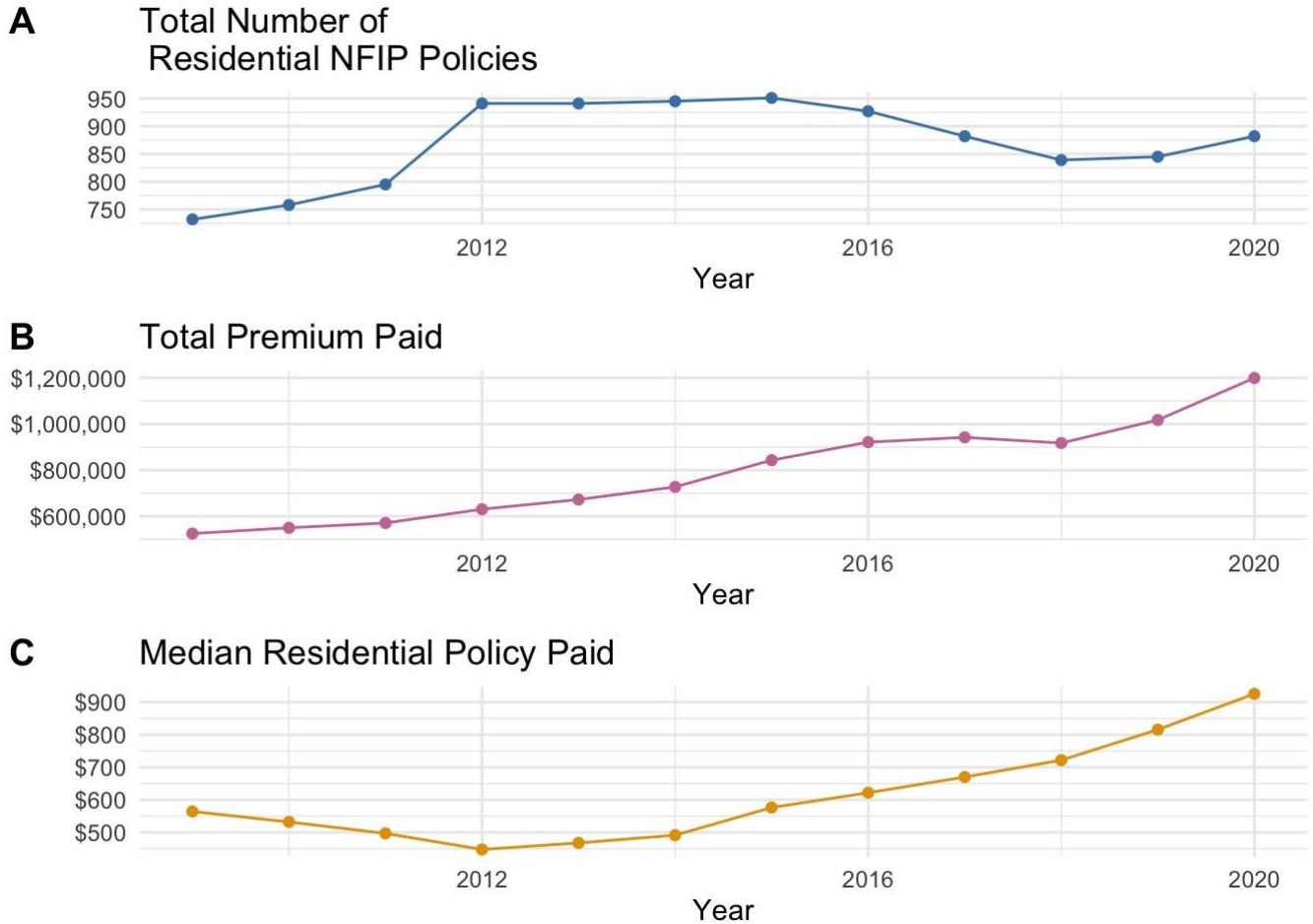


Figure 1.2: Annual residential policy take-up rate, total premiums paid, and median premium payments by year for the Sacramento County Delta Legacy Communities. Source: FEMA Open Source Data

The NFIP pricing structure resulted in some homeowners paying too much and others paying too little. In 2019, the lowest annual flood insurance premium for residential structures in the Sacramento County Delta Legacy Communities was \$235, and the largest premium was \$6,645. Thus, homes with similar risks paid inordinately different amounts. Risk Rating 2.0 dubbed “Equity in Action,” seeks to fix this inequity (Maurstad 2027). Unfortunately, the inability of FEMA to modify existing regulations and the inability of Congress to enact meaningful reform prevents Risk Rating 2.0 from living up to its full potential. The NFIP will always be hard to change due in part to the sheer magnitude of the program. With more than 5.1 million NFIP policies in force (2021), providing \$1.25 trillion of content and building coverage, the NFIP is the largest, single-

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line insurance carrier in the world (Maurstad 2027). Virtually every community in the U.S. has adopted some form of NFIP regulation (Maurstad 2027).

Risk Rating 2.0, introduced in October 2021, builds on the experience gained from contracting with the reinsurance markets. Risk Rating 2.0 fundamentally changes how FEMA prices NFIP policies (Maurstad 2027). It is the first major change in how it prices policies since the program was enacted in 1968. NFIP policies will no longer be priced based on an “in-out” Flood Insurance Rate Map (FIRM). Additionally, the pre-and post-FIRM subsidies will be phased out. Policies are instead to be priced based on the location-specific estimated flood risk. The location-specific flood risk will be determined by an ensemble of catastrophe models along with other factors such as the location near a potential flooding source, a river, stream, lake, or coastal proximity. The different elements that go into the premium price are shown in the figure below. For the first time, this provides private firms with a benchmark against which they can measure their risk pricing.



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The problem with Risk Rating 2.0 is that it does not remove all of the cross-subsidies. Although the subsidies will be phased out over time, the subsidy for the pre-firm and newly mapped areas remain (FEMA 2021b). In addition, the number of properties eligible for the Community Rating System (CRS) discount will increase as the CRS discount is now applicable to areas outside of the SFHA. And while this is seen as a benefit, it results in small communities like the City of Isleton subsidizing the premiums for their neighbors in the unincorporated Sacramento County.

Risk Rating 2.0 retains a number of fees and surcharges. All policies are charged an 18 percent Reserve Fund Assessment. Primary residents are charged a \$25 HIFAA surcharge. Non-primary residents are charged a \$250 HIFAA surcharge. And all non-condominium policies are charged a \$47 Federal Policy Fee (FEMA 2021b).

The NFIP pricing structure also adversely impacts low-income rental properties that are not owner-occupied. Roughly half of all policies written within the Sacramento County Delta Legacy Communities were rental properties. When these policyholders renewed their policies in 2020, they saw an average premium increase of about 24 percent, an increase which was inevitably passed along to the renter occupants. Figure 1.3 A-C below, created from the NFIP open-source data set, shows the change in premiums for the non-owner-occupied properties in the Sacramento County Delta Legacy Communities. It shows that since 2012 the median policy price has increased from less than \$500 to more than \$900. As noted above, under Risk Rating 2.0, property owners may see a reduction in premiums. However, these rental properties are charged \$225 more than their owner-occupied homes. Notable, many rental properties in the Sacramento County Delta Legacy Communities do not have a mortgage and do not have NFIP coverage. The NFIP has a “contents only” coverage, but it is not strongly promoted, and few renters choose to purchase it.

The following presents an overview of the historical NFIP policy pricing and take-up rates, it covers a review of the historical claims data for the Sacramento County Legacy Communities. This provides background information for a discussion regarding a hypothetical new arrangement for flood insurance. This proposal considers how a community-based insurance program might be crafted to better meet the needs of the

Legacy Communities. It is intended to inspire conversations that examine the details more thoughtfully. More work will be needed to make this change a reality.

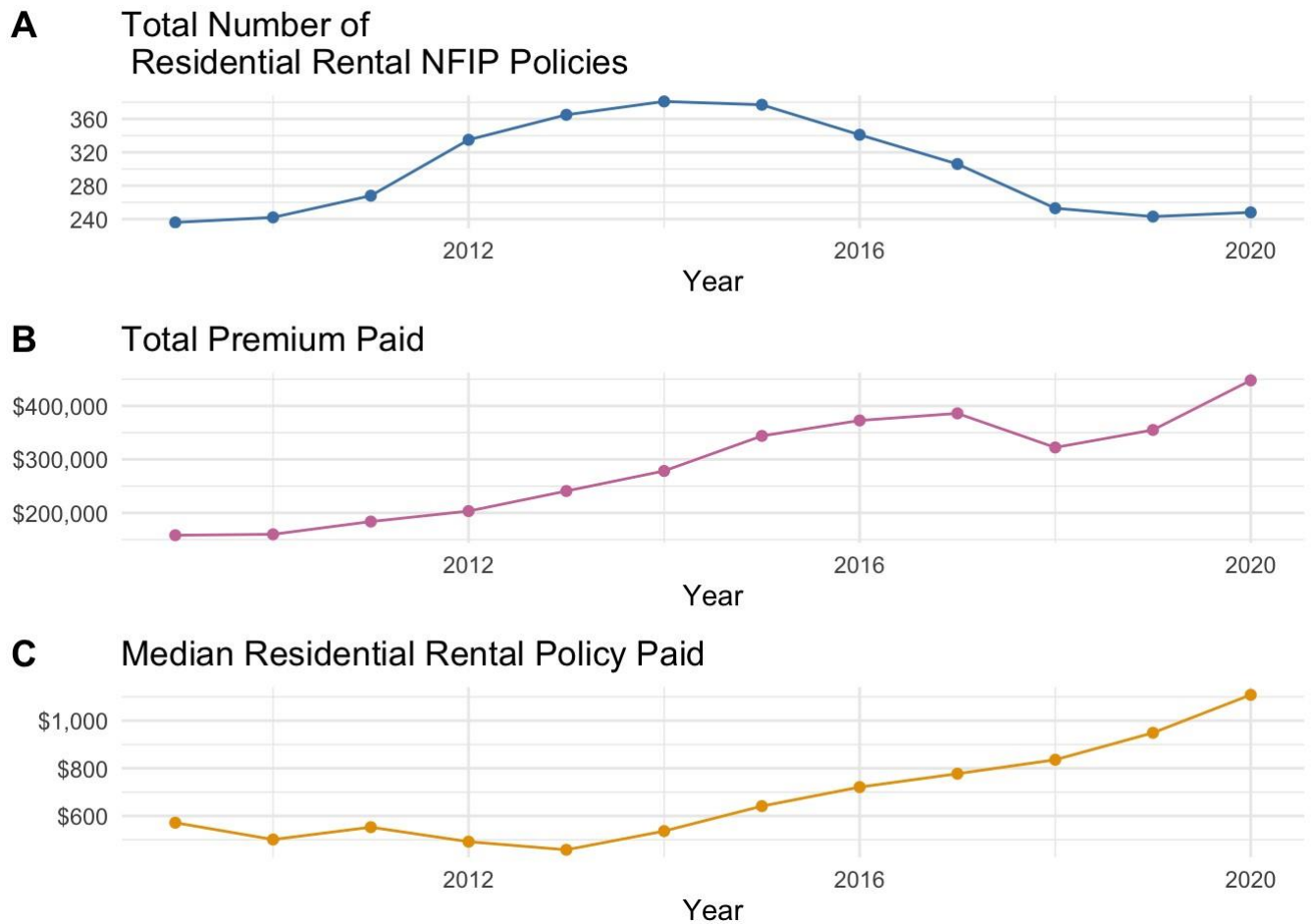


Figure 1.3: Annual residential rental policy take-up rate, total premiums paid, and median rental premium payments by year for the Sacramento County Delta Legacy Communities. Source: FEMA Open Source Data

2.0 NFIP Evaluation

2.1 Policy Summary

The NFIP has been the predominant supplier of flood insurance in the US for over fifty years. By looking at the details of NFIP policies purchased within the Sacramento

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County Delta Legacy Communities, we can establish a benchmark in which improvements such as Risk Rating 2.0 or community-based alternatives may be judged. We can also gain insight into the challenges likely to be encountered in enacting a change. This section examines and evaluates the NFIP purchases within the Sacramento County Delta Legacy Communities in 2019. The year 2019 was chosen because it reflects the price increases mandated by HIFAA yet is not affected by changes due to COVID. The following 2019 policy analysis is based on NFIP open source policy data downloaded from the FEMA Open Source website. The FEMA NFIP open source policy data is aggregated at the zip code level, which roughly aligns with the boundaries for the Sacramento County Legacy Community Flood Mitigation Study areas.

For over fifty years, NFIP policies were not rated based on actuarial flood risk. NFIP policies were instead rated based on a dizzying array of policy decisions that are difficult to explain and complicated to implement. On October 1, 2021, this changed. The NFIP transitioned to a new rating method entitled Risk Rating 2.0. This rating method is actuarial based but retains several non-actuarial discounts. For the residents of the Legacy Communities, this change will have mixed results. Risk Rating 2.0 will phase out pre-FIRM and Newly Mapped discounts increasing some premiums. However, it will consider the protection provided by unaccredited levees, which should result in a decrease in premiums for those paying the full premium rate. The rate will be automatically calculated on a structure-by-structure basis using FEMA software, reducing the chance of rating error. Over one-third of the policies located within the Sacramento County Legacy Communities were thought to be miss-rated.

The NFIP rating process consists of establishing the premium based on factors such as grandfathering or the age of the structure (pre-FIRM). The NFIP Community Rating System (CRS) discount is then applied to the computed premium. After the CRS discount is applied, certain federally mandated fees are then added to the premium cost. The total amount paid by the homeowner is listed in the NFIP database as the policy cost. In the tables and charts below, *Premium* refers to the amount that includes the CRS discount but not the additional fees. *Policy Cost* refers to the total amount paid

by the policyholder and reflects both the *Premium* and the additional fees. The cost of fees and other charges not related to the actuarial premium cost is the difference between the *Total Premium* and the *Total Policy Cost* (\$345,000). The average additional fee per policy is \$323.

Table 2.1 below shows the summary NFIP policy data for the Delta Legacy Communities. In 2019, slightly more than \$1 million in premiums was collected from 1,068 policies with a total insured building value of \$207M. Sacramento County is a CRS Class 2 , and thus, some NFIP policyholders receive as much as a 40 percent discount on premiums. With the Newly Mapped and CRS discounts, the median premium was \$530. What is important to note from this table is that while there are slightly more than 1,800 structures in the Sacramento County Delta Legacy Community Zip code areas, there are only 1,068 policies.

Table 2.1: Summary of 2019 NFIP policy data for the Delta Legacy Communities (Source: FEMA Open Source Data)

Total Premium	No. Policies	Median Price	Total Building Coverage
\$1,062,921	1069	\$530	\$207,927,600

2.2 Policies by CRS Code

FEMA created the CRS in 1990 to bolster the performance of the NFIP. The CRS is a voluntary program designed to reduce flood damage to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management (Cunniff 2018a). It encourages communities to take floodplain management actions that exceed the minimum NFIP standards. Communities are assigned a “class” based on the number of CRS activity credits earned, ranging from 9 (entry level) to 1 (highest). In return, NFIP policyholders in participating communities receive a discount on their flood insurance premiums. The greater the participation, the greater the discount. Thus, the CRS links community-level flood mitigation to household-level NFIP participation. Implementing the flood mitigation activities requires a financial commitment on the part of the community (Brody et al. 2009). So it is not surprising that CRS communities with more significant tax revenues

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undertake more CRS mitigation activities (Landry and Li 2012). We see this with the comparison of Sacramento County to the City of Isleton. The poor community of Isleton does not participate in the CRS program, while the wealthier Sacramento County is a CRS Class 2, the only county in the nation with this high rating. As a CRS Class 2 residents in the unincorporated area received a 40 percent discount for Special Flood Hazard Area (SFHA) (100-yr) policies and a 10 percent discount for Non-SFHA policies. Under Risk Rating 2.0, all residents in the unincorporated area will receive a 40 percent discount.

The CRS program is intended to be revenue-neutral. Thus, communities like Isleton subsidize wealthier communities like Sacramento County. For this reason, the CRS is increasingly viewed with criticism (Cunniff 2018b). Frimpong and others (2020) find that participation in the CRS program does lead to an increase in NFIP take-up rates. However, the consensus from a body of experts convened in 2017 suggests that more evidence is needed to demonstrate definitively the costs and cost-effectiveness of the CRS in lowering risk, reducing damages, and providing other community-wide benefits (Cunniff 2018b).

Not all policies received the CRS discount. There were 44 policies in the unincorporated Sacramento County that were incorrectly rated and did not receive the benefit of the Class 2 rating. Class 6 communities receive only a 20 percent discount for SFHA policies and a 10 percent discount for Non-SFHA policies. Class 7 communities receive only a 15 percent discount for SFHA policies and a 5 percent discount for Non-SFHA policies. Class 8 communities receive only a 10 percent discount for SFHA policies and a 5 percent discount for Non-SFHA policies (FEMA, n.d.).

Table 2.2 shows that slightly more than 80 percent of the policies written in the Sacramento County Delta Legacy Communities received the CRS class 2 discount. The maximum premium of \$23,527 would have been 40 percent higher if the discount was not in place. It also shows that 129 NFIP purchasers paid a median premium of \$1,887, demonstrating that Isleton residents subsidize the premiums for the 897 policyholders who enjoyed the CRS discount. This type of cross-subsidization is generally frowned upon by insurance regulators.

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Table 2.2: Summary of 2019 NFIP policy data showing the impact of the CRS discounts on premium prices

CRS	No. Policies	Median Premium	Maximum Premium	Total Premium	Total Policy Cost	TIV
2	897	\$530	\$23,527	\$738,346	\$1,007,852	\$230,431,600
6	1	\$421	\$421	\$421	\$534	\$350,000
7	41	\$593	\$5,345	\$42,686	\$59,141	\$6,705,200
8	1	\$2,001	\$2,001	\$2,001	\$2,376	\$246,000
	129	\$1,887	\$7,255	\$279,467	\$339,152	\$28,129,400
Total	1069			\$1,062,921	\$1,409,055	\$265,862,200

Table 2.3 shows the summary data for the non-CRS participating community of Isleton. Because Isleton does not participate in the CRS program, homeowners are not eligible to receive a CRS discount. However, the data shows that roughly one-third of the residents received the CRS class 2 discount. If the policies were rated appropriately, purchasers would have paid as much as \$2,689 more for the same policy. Risk Rating 2.0 eliminates the opportunity for brokers to miss-rate policies. It will be interesting to see how buying habits change when the miss-rated discount is removed.

Table 2.3: Comparison of the 2019 NFIP Policies by CRS for the Community of Isleton

CRS	No. Policies	Median Premium	Maximum Premium	Total Premium	Total Policy Cost	TIV
2	216	\$748	\$6,707	\$211,080	\$280,089	\$38,163,900
	123	\$1,889	\$6,645	\$268,593	\$325,297	\$26,445,400
Total	339			\$479,673	\$605,386	\$64,609,300

2.3 Policies by rating method

Before Risk Rating 2.0, NFIP policies were rated in many ways. Table 2.4 shows the different ways that policies were rated. Twenty-three policies are incorrectly receiving a preferred risk policy. This policy is only available to homes outside the SFHA, and since

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there are no areas outside the SFHA we know this rating is incorrect. Significantly, 490 policies rated as *newly mapped* enjoy a discount that is being phased out. Likewise, 45 *pre-FRIM* policies enjoy a rating that is also being phased out. The FEMA open source data identifies 490 policies rated using method R, which are policies written in areas protected by a Provisionally Accredited Levee (PAL) such as in the RD 554 portion of East Walnut Grove. At some point, FEMA will reassess this area. When they do, the levees are likely to de-accredited changing the rating. However, under Risk Rating 2.0, the levee certification is only one factor considered in the overall rating.

The Total Insured Value (TIV) represents the TIV for both building and contents. The NFIP database does not break out the premium between building and contents, so there is no way to know how much of the premium is associated with the building and how much is associated with the contents.

The sum of the total premiums compared to the sum of the total policy cost shows that Delta Legacy policy holders paid over \$300,000 in fees and added charges in 2019. It also shows that the total insured value was over \$265 M. Comparing the sum of the total policy cost to the TIV finds that the median policy cost per hundred dollars of insured value was \$1.91. This cost per hundred dollars of insured value is useful for comparing alternatives.

Table 2.4: Summary of 2019 NFIP premiums by rating method

Rating Method	No. Policies	Median Policy Cost	Maximum Premium	Total Premium	Total Policy Cost	TIV
Regular	513	\$995	\$23,527	\$698,820	\$899,418	\$90,083,300
PRP	23	\$374	\$2,399	\$14,792	\$20,636	\$8,318,000
Pre-Firm	45	\$272	\$1,486	\$15,421	\$26,050	\$9,236,900
Newly Mapped	490	\$515	\$4,028	\$309,230	\$438,723	\$157,574,000
Total	1071			\$1,038,263	\$1,384,827	\$265,212,200

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Figure 2.1 below, shows the distribution of policies by payment amount. The first chart (A) shows the distribution of premium amounts for all policies written in Delta Legacy communities. It shows that the vast majority of the policies are written in the \$500 range. Private flood insurance is reportedly being offered by a Lloyd’s of London carrier for about \$1500 per policy. The second chart (B) is the distribution of policies less than \$1500. Further highlighting the fact that the majority of the policies were written for about \$500. The third chart (C) is the distribution of policies greater than \$1500. This chart shows the most likely opportunity for community-based flood insurance to compete.

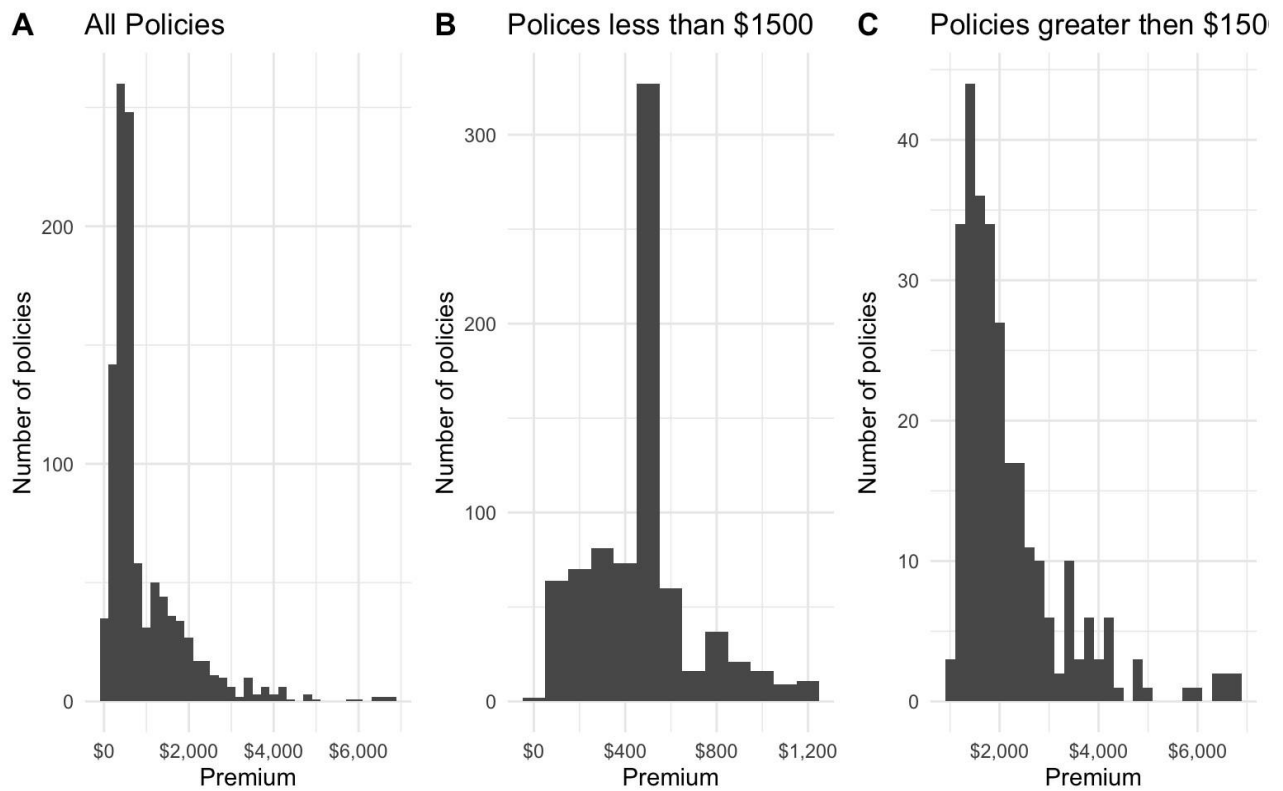


Figure 2.1: Distribution of 2019 Residential Premiums for the Sacramento County Legacy Communities. Source: FEMA Open Source Data

In 2019, there was one policy written for more than \$20,000. Figure 2.2 shows the box plot distribution for the policies written in the Delta Legacy Communities with this one policy removed. When that policy is removed, it shows that with the exception of Isleton, 75% of the policies are less than \$1000. The top of the box shows that 75 percent of the policies were less than the value shown. The heavy horizontal line shows

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that 50 percent of the policies are less than the value shown. The bottom of the box shows that 25 percent of the policies are less than the value shown. This chart shows that 50 percent of the Isleton policyholders pay more than 75 percent of the policyholders in the unincorporated area of Sacramento. It shows that the residents of Walnut Grove (East) have greatly benefited from the Provisionally Accredited Levee (PAL) status.

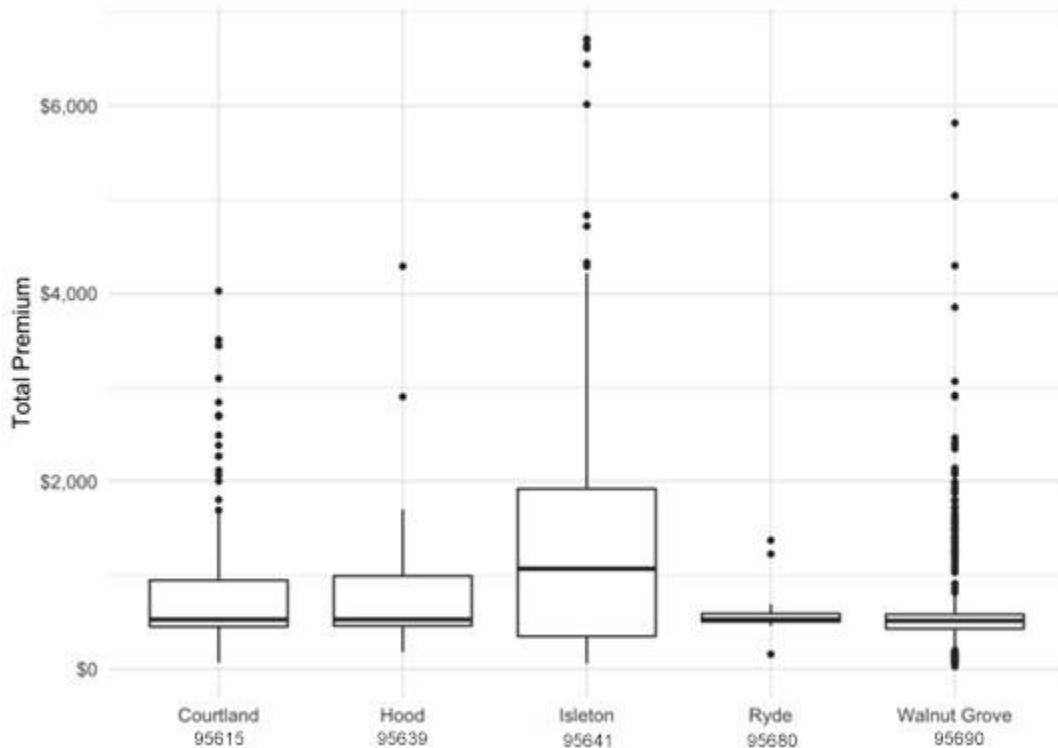


Figure 2.2: Box plot showing the distribution of 2019 Premiums by zip code with outlier removed.

Table 2.5 provides additional detail on the policies that in 2019 were not rated correctly. The term *Premium* is used to identify the premium amount on which the CRS discount is calculated. The term *Policy Cost* is the cost calculated by adding together calculated premium, reserve fund assessment, federal policy fee, and HFIAA surcharge.

Table 2.5: Non-CRS 2 Rated Policies

CRS	Rate Method	Count	Median Premium	Maximum Premium	Total Premium	Over Charge Amount
6	PRP	1	\$421	\$421	\$421	\$0
7	Regular	30	\$1,000	\$4,296	\$35,484	\$10,436
7	Pre-Firm	5	\$353	\$355	\$1,652	\$92
7	Newly Mapped	7	\$530	\$1,395	\$5,238	\$291
8	Regular	2	\$1,846	\$2,001	\$3,693	\$1,231

The estimated amount that homeowners were overcharged in 2019 is estimated to be in excess of \$12,000.

2.4 Policies by ownership or rental

Table 2.6 compares the rental policies to the owner-occupied policies. The following presents a breakdown of owner-occupied versus rental policies. This shows that there are roughly 600 owner-occupied policies and 450 rental policies. This is interesting to note when considering a community-based insurance policy. It suggests that a low-cost renter’s policy may be attractive. It also shows that if a Proposition 218 fee is to be collected as part of a community-based insurance program, outreach will have to include mailers and consider the needs of the non-voting rental community. This table also highlights one of the fallacies of the NFIP. The NFIP assumes that once homeowners learn of their flood risk, they will encourage their community to take action to mitigate the risk. It ignores the current economic reality that many homes are held as rental properties with the landlords residing outside of the local area. As the NFIP premium is a deductible cost that can be passed on to renters, they have little incentive to encourage change.

Table 2.6: Summary of 2019 Policies by Owner Occupied versus Rental

CRS	Count	Median Premium	Maximum Premium	Total Premium	Total Policy Cost
Rental	482	\$528	\$23,527	\$533,885	\$757,355
Residence	589	\$528	\$4,105	\$504,378	\$627,472
	1071			\$1,038,263	\$1,384,827

2.5 Policies by residential or commercial

Table 2.7 shows the breakdown of residential versus commercial policies. This shows that there were 1046 owner occupied policies and 25 commercial policies.

Table 2.7: Policies by Residential and Small Business

Small Business	Count	Median Premium	Maximum Premium	Total Premium	Total Policy Cost
Residential	1046	\$528	\$23,527	\$1,007,479	\$1,341,926
Small Business	25	\$306	\$6,711	\$30,784	\$42,901
	1071			\$1,038,263	\$1,384,827

2.6 Policies by agricultural versus nonagricultural

Table 2.8 presents a breakdown of the agricultural versus non-agricultural policies. This shows that of the 1068 policies only 17 were on agricultural buildings.

Table 2.8: Policies by Agricultural Building versus Non-Agricultural Building.

Ag Bldg	Count	Median Premium	Maximum Premium	Total Premium	Total Policy Cost
Not Ag Building	1054	\$528	\$23,527	\$1,033,382	\$1,374,115
Ag Building	17	\$112	\$1,175	\$4,881	\$10,712
	1071			\$1,038,263	\$1,384,827

2.7 Polices from 2018 Reinsurance Data

In 2018, FEMA compiled policy data to share with reinsurance bidders. Table 2.9 shows 2018 reinsurance data for this area. The source of the data is FEMA Open Source Data. This table presents an opportunity to view the building and contents data separately.

Table 2.9: 2018 Reinsurance Data

ZIP	Building TIV 2018	Contents TIV 2018	Total TIV 2018	TIV 2019
95615	\$43,665,010	\$5,260,488	\$49,423,300	\$55,797,600
95641	\$64,461,333	\$2,851,177	\$63,200,800	\$65,562,600
95690	\$117,643,283	\$12,944,176	\$132,827,200	\$129,486,400
Total	\$225,769,626	\$21,055,841	\$245,451,300	\$250,846,600

2.8 How much would be saved by having the \$10k deductible?

Table 2.10 shows that Legacy Community policyholders could save over \$123,000 if they were able to accept a \$10,000 deductible. This suggests that the State or Sacramento County could make flood insurance more affordable by simply guaranteeing the deductible for all homeowners in the Legacy Communities.

Table 2.10: Premium Savings with a \$10 K Deductible

Total Premium	Total w/o Deductible	Total with \$10K Deductible	Total Savings
\$509,419	\$989,624	\$385,953	\$123,466

3.0 Claims Data

3.1 Introduction

What is the flood risk for the Legacy Communities? Given the amount of money invested in Delta research and in Central Valley modeling, it is remarkable that there is

no clear answer to this question. It highlights the problem with the current flood management system. The Sacramento County Legacy Communities are protected on one side by State Plan of Flood Control (SPFC) levees which are managed by the Department of Water Resources (DWR). Heavily influenced by Corps of Engineers methods, DWR has adopted one view of the flood risk (Davis and Bardini 2017). The Delta Stewardship Council, with their directive to advance the state's coequal goals for the Delta – a more reliable statewide water supply and a healthy and protected ecosystem presents a completely different view of the flood risk (Rudnick 2022). Academics have yet another view (Hopf 2011; ISB 2017; Madani and Lund 2012). Each largely ignore the human ecosystem, and conflict not only with each other, but with the shared experiences of residents within the Delta. Adding to the mix are antiquated FEMA maps that drive land use decisions and stifle economic growth.

Insurance has an opportunity to bring all these conflicting views into focus. One of the guiding principles of natural disaster insurance is that premiums should be based on risk (Kunreuther and Michel-Kerjan 2013). In order for that to occur, the risk and associated uncertainties must be accurately quantified. One of the major costs of insurance is the cost associated with uncertainty. It is in the best interest of insurers to understand all the sources of uncertainty, evaluate the underlying drivers, and assess the potential consequences in an unbiased manner. In short, insurers take an eyes wide open view of both the risk and opportunities associated with floods.

3.2 FEMA Claims Data

The FEMA open source claims data provides a history of the NFIP claims filed since 1980. By examining the claims data, Table 3.1 shows the NFIP Claims data adjusted for inflation to 2020 dollars. Since 1980 there have been a total of 235 claims filed for properties in the Sacramento County Legacy Communities. Median building claim paid for Ryde, Walnut Grove, and Locke during the 40-year period between 1980 and 2020 was \$7,540,707. The two claims in the community of Ryde were more than twice the amount paid for claims in Walnut Grove, and four times the amount paid for homes in Isleton.

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3.1 No. Claims by Zip Code since 1980 (Inflation Adjusted)					
Zip Claims	No.	Median Building Claim	Total Building Claim	Total Contents Claim	Total Claim
95641 Isleton	99	\$6,338	\$2,155,415	\$782,355	\$2,937,770
95680 Ryde	2	\$41,908	\$83,815	\$51,547	\$135,363
95690 Walnut Grove	134	\$12,543	\$3,193,924	\$1,273,651	\$4,467,575
Total	235		\$5,433,155	\$2,107,553	\$7,540,707

Source: FEMA Open Source Data

Figure 3.1 shows the number of claims by year adjusted for inflation to 2020. This chart shows that there are many years without a flood loss which is consistent with the findings of Corringham et al. (2019). The figure shows that the area suffered the greatest losses in 1986 and 1997. In February 1986, a series of Pineapple Express events caused high flood flows in the Consumnes and Mokelumne watersheds. During the 1986 event, houseboats at Wimpy's Marina broke loose because of high flows in the Mokelumne River and lodged against the bridge at Wimpy's. As a result a surge of water flowed around the North Fork of the Mokelumne overtopping and flooding Tyler Island (RD 563). In addition Dead Horse Island, McCormack Williamson, New Hope Tract and Glanville flooded because of the volume of water coming from the Consumnes/Mokelumne watershed area.

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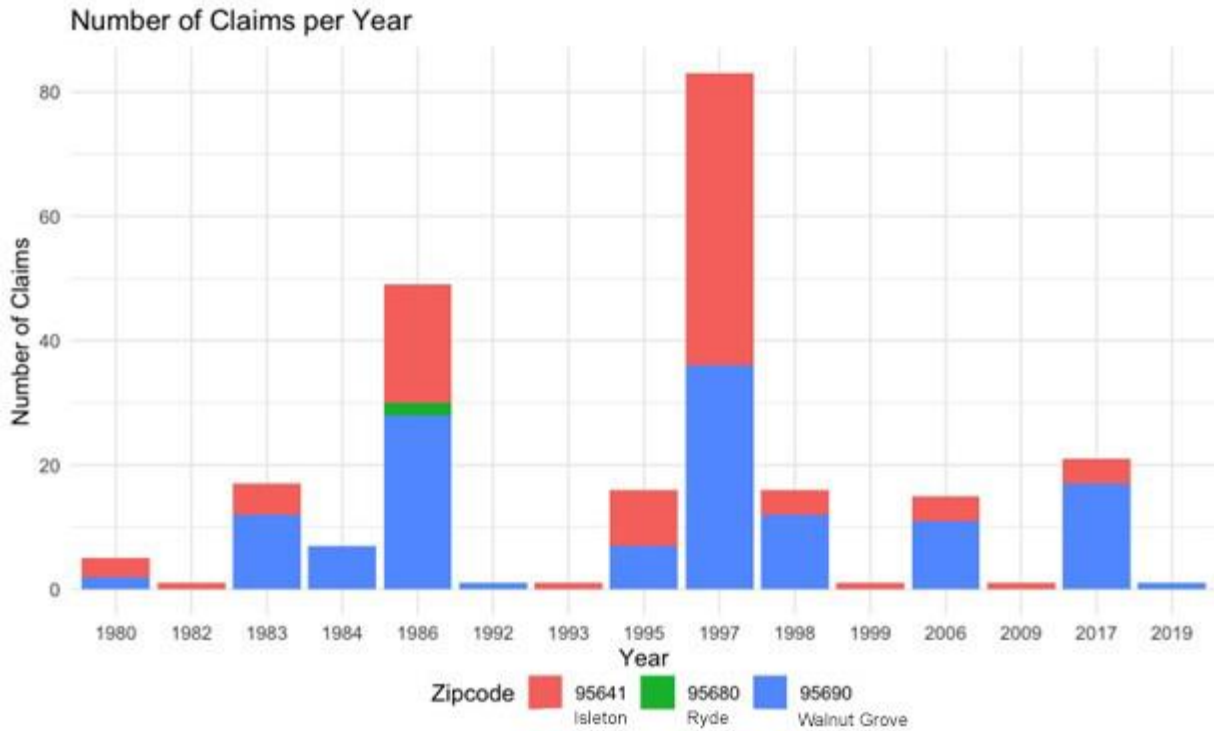


Figure 3.1: Number of NFIP claims per year. Source: FEMA Open Source Data

Figure 3.2 shows the corresponding total claim amounts. It shows that in 1986 the majority of the damages were attributed to the Walnut Grove & Locke (ZIP code of 95690), followed by Isleton (ZIP Code 95641) and to a much lesser degree in Ryde (ZIP code 95680). In the 1997 flood the majority of the damages were attributed to the Isleton Zip code of 95641. In 2017, the losses were limited to low-lying areas within Walnut Grove/Locke followed by Isleton. Significantly, this figure shows the value of investments that were made during the 1996–2017-time frame. Both 2006 and 2017 were years with heavy precipitation. Twenty seventeen was the year of the Oroville Dam failure where the flows in the Sacramento River were categorized as 100-year flows. Yet, both the number of claims and the total amount of the damages were significantly less than either the 1986 or 1997 events.

This also shows the need to review the current flood management practices in the Central Valley. The Central Valley Flood Protection Plan (CVFPP) focuses attention and resources on the State Plan of Flood Control levees. This focus disregards the fact that the Sacramento River is not the only source of flooding for most of the Sacramento

County Legacy Communities. It also disregards the fact that flood losses are often caused by pluvial flooding in addition to fluvial flooding.

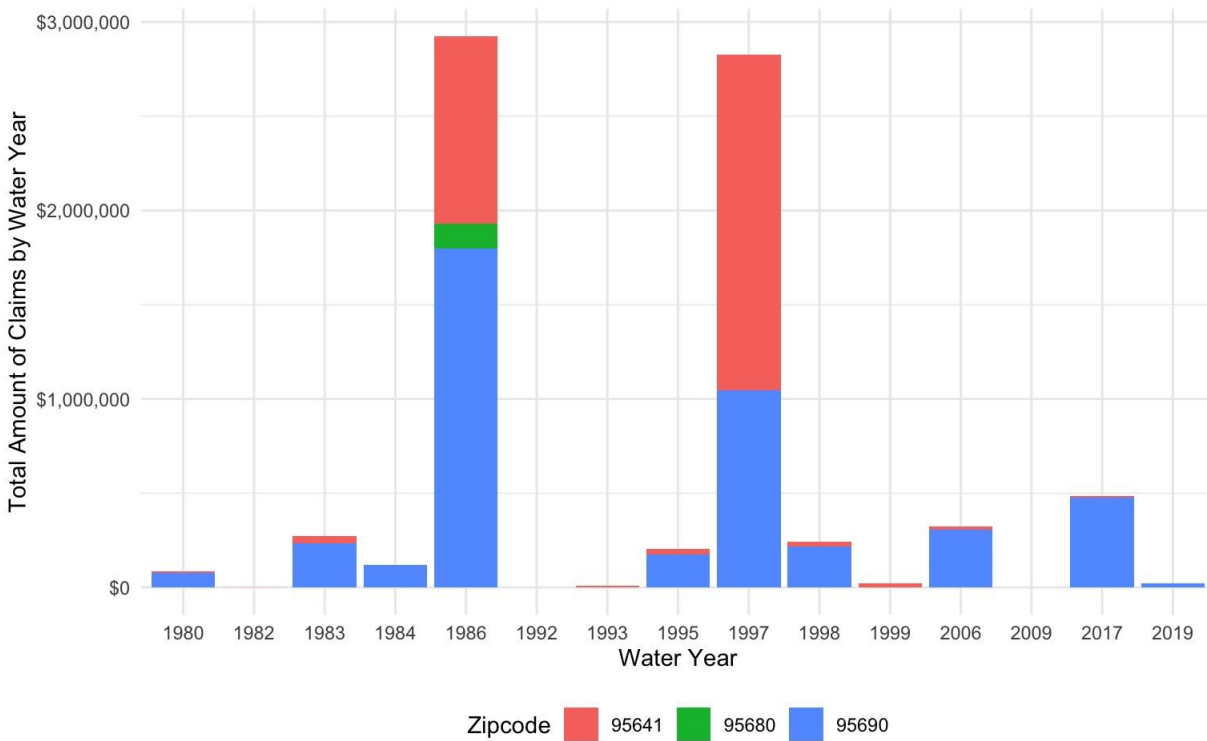


Figure 3.2: Distribution of total claims payments per year adjusted to 2020 dollars. Source: FEMA Open Source Data

3.3 Would a \$100,000 policy be attractive?

Research into the insurability of low probability catastrophic risks finds that when considering both the buyers’ willingness to pay and the sellers’ costs, under certain conditions the optimal coverage for a \$200,000 loss with a 1-percent-annual-chance of occurring is between \$24,920 and \$97,274 (Louaas and Picard 2021). In Figure 3.3, the median claims payment is shown by the dark solid line. The top of the box shows the value at which 75 percent of the claims are less than the amount listed. The box plot shows that 75 percent of all claims adjusted to 2020 dollars were less than \$40,000. This suggests that a \$100,000 policy would be attractive to both the purchasers and insurers.

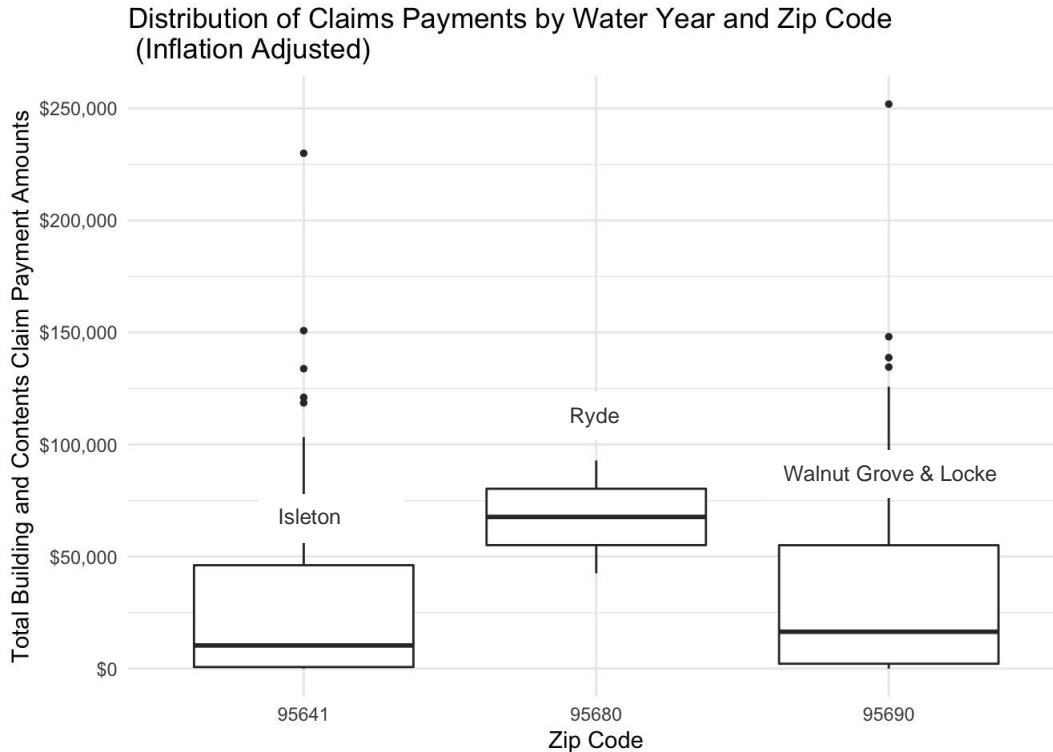


Figure 3.3 Distribution of Claims by Zip Code

The NFIP provides a discount of up to 45% for purchasers who are able to accept a \$10,000 deductible. Many lenders who enforce the mandatory flood insurance purchase requirements require homeowners to carry a \$2,000 deductible. One way to provide a subsidy to low-income households could include a community-based program that covers the first \$10,000. This would serve two functions. It would encourage communities to address the more frequent fluvial flooding events and it would provide an opportunity to reduce insurance costs for all community members.

Solution: Community Based Flood Insurance

What is Community Based Flood Insurance?

Community Based Insurance has the potential to serve the community better than either the NFIP or private flood insurance. Community based flood insurance (CBI) is a single policy, purchased by a local governmental or quasi-governmental body, which covers a group of designated properties (Kousky and Shabman, 2015). It simplifies the

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process of setting the premium, greatly reducing the cost of settling claims, which provides administrative savings that can then be shared with property owners and/or used to fund flood risk reduction mitigation measures. It provides an opportunity to manage the flood risk collaboratively which reduces uncertainty. Uncertainty pricing is one of the biggest components of premium pricing.

The increase in interest in private flood insurance brings with it an increased interest in CBI. The idea of CBI has been around for a long time, but until now technological, regulatory, governmental, and administrative challenges have prevented it from being implemented. As noted, many of these potential obstacles have been overcome or changed and today there is growing interest. The concept of CBI is a building block in The Congressional Action Platform for a Clean Energy Economy and a Healthy, Resilient, and Just America (Castor, 2020). Support for community-based flood insurance is included within the draft language for the reauthorization of the National Flood Insurance Program. The legislation, if passed, would call for FEMA to initiate a pilot within 180 days of passage of the bill.

CBI is part of a broader Community Based Disaster Risk Management (CBDRM) approach to disaster risk management. CBDRM is an approach that supports local grassroots community disaster risk management. It is an approach strived for in FEMA's Whole Community philosophy (Agency, 2011). It is widely promoted by countries that share the same low-income challenges as residents within the Delta Legacy Communities (Paripurno and Jannah, 2011; Mysiak et al., 2016).

In this approach, the community plays an active role in the self-interpretation of hazards and disaster risk, and in the reduction, monitoring, and evaluation of their own performance in disaster risk reduction. Key to the successful implementation of a CBDRM program is the optimal mobilization of resources that the community has and has control over (Paripurno and Jannah, 2011). This is why the idea of CBI is attractive. It gives the community ownership of their flood risk; and, importantly, the assets that come with it. The community ceases to be viewed as hapless victims and are instead viewed as empowered citizens.

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A CBI program presents an opportunity to align public agency staff, engineers and private insurance around a unified goal of managing flood risk—providing the opportunity to both reduce flood insurance and fund mitigation measures (Kousky and Shabman, 2015). CBI is a risk transfer program developed in collaboration between engineers, insurance professionals, investors, and media professionals. It has the potential to:

- Allow insurance companies to take advantage of the detailed flood risk information developed by engineers, thus reducing costs;
- Compile detailed risk information for the graduated pricing of risk;
- Provide the specific form of coverage desired by the citizens;
- Implement quantifiable mitigation measures;
- Permit the community to accept some degree of risk, passing the savings on to their citizens;
- Roll program savings into mitigation measures or provide the local cash match for grant funding;
- Support an open and informed decision-making process;
- Reduce uncertainties associated with risk, which is one of the largest components of the risk premium; and
- Reduce longstanding environmental justice inequities.

What is a GHAD?

Geologic Hazard Abatement Districts (GHADs) are uniquely poised to fill the role of a CBI provider. California has a unique government entity called a GHAD that is particularly suited to handle the responsibilities of a CBI. A GHAD, much like a homeowner's association (HOA), is a public agency formed by a community to provide a management structure and funding source to protect the community from landslides,

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erosion, liquefaction, flooding, and other hazards. GHADs are state-level agencies with powers to provide prevention, rapid response, and funding to address hazardous geologic conditions. Although formed by a local agency, a GHAD is a political subdivision of the state and is not an agent or instrument of a local agency. They were established by the California Legislature to allow local communities to develop a self-funding mechanism to mitigate the damaging effects of large-scale hazards such as landslides, earth movement, erosion and other similar hazards.

GHADs were created in California in 1979 by the Beverly Act to enable local residents to collectively mitigate geological hazards which pose a threat to their properties and their associated improvements. Statutes pertaining to GHADs are presented in California Public Resources Code Division 17. GHADs are designed to handle long-term abatement and maintenance of real property potentially threatened by geologic hazards.

When established, a GHAD is an independent political subdivision of the State governed by a locally elected Board. However, it is not an agency or instrument of a local agency, and therefore is not subjected to control by a local agency. It is granted similar authority as other local agencies, including:

- Taxing and/or assessment ability
- Bonding ability
- Certain legal immunity
- Can sue and/or be sued
- May exercise eminent domain

A GHAD is intended to address the prevention, mitigation, abatement, and control of geologic hazards on designated land within its boundaries. Further, as a prudent landowner, a GHAD is able to acquire, construct, operate, manage, or maintain improvements on any land it specifically owns. There are no limits or requirements pertaining to size, number of units, or contiguous boundaries (i.e., a GHAD may contain

numerous non-contiguous parcels, and may be developed for one or a handful of separate Delta Legacy Communities).

Why is a GHAD an attractive partner for insurers?

There are several features of a GHAD that makes it an attractive partner for insurers. First, unlike other government entities, such as city councils or flood control districts, the single focus of the GHAD is to mitigate the damaging effects of large-scale natural hazards. The GHAD boundaries are flexible and do not need to be contiguous. Depending on the desire of the community, the boundaries can be drawn to spread the risk widely, they may be drawn in such a way that only those property owners most concerned about their flood risk participate or they may be drawn to in such a way as to exclude economically uninsurable risk areas. The board of the GHAD can be comprised of property owners who are concerned about their risk and seek to take pro-active measures as opposed to city council members who may have other priorities. From the insurers perspective, it provides a single point of contact for the purchase of policies and administration of claims. The aggregation of the risk reduces the uncertainty associated with individual policies. Uncertainty is a key component in insurance pricing. Lastly, it provides a government structure that supports a partnership between the insurer and the community around a common goal of reducing flood risk.

Significantly, it also reduces the volatility associated with types of policies. The premium would be paid from property tax revenue guaranteed by the county in which the GHAD was formed. Because the premiums would come from ongoing tax revenue, the aggregated risk would be spread across time. Thus, a large loss early in the program would be recouped over time. Additionally, GHAD could self-insure certain layers of risk, minimizing both the moral hazard and the volatility associated with an aggregated loss. The GHAD could also receive state and federal grant funding to support ongoing community-specific structural-based flood management actions (including but not limited to levee repairs/improvements) and non-structural measures that could include flood-fight berms, ring levee systems, and enhanced community-specific flood emergency response programs.

How might a GHAD based flood insurance program work?

It is envisioned that flood insurance would be provided by the GHAD in a three tiered program. Tier 1 - the Good Samaritan Tier would provide of a modest amount of recovery cash immediately after the disaster to everyone in the community. Tier 2 — the Insurance Tier would provide a base level of insurance to everyone who sought to purchase it. Tier 3 — the Concierge Tier would consist of a policy providing other coverages as the community requested. The GHAD would purchase a single policy and distribute it to the community. The GHAD would be the policy holder and issue certificates to individual parcels.

Tier 1 - The Good Samaritan Tier

Tier 1 is intended to provide a small amount of immediate *ex ante* funds (as much as \$10,000) to every policy holder who experiences a flood loss. The reason for this tier is four-fold.

This tier recognizes that low-income households become even more vulnerable during and after disasters. A 2018 study conducted by FEMA's Individual and Community Preparedness Division found most respondents said they would not have enough money to cover a \$500 emergency expense (NAC, 2019). When families lack savings or property insurance, there is no mechanism to fill the financial gap after a flood. A U.S. Department of Housing and Urban Development (HUD) study found that households with flood insurance were 37% more likely to have rebuilt after Hurricane Katrina. For this reason, flood insurance plays an important role in post-flood disaster recovery. The immediate *ex ante* flood recovery funds could be utilized by the policyholders to cover temporary re-location living expenses or pay for immediate remediation repairs over and above the structure damage or content damage claims that are paid with a conventional NFIP policy.

This tier also recognizes that people have different perceptions of risk and different resources to purchase flood insurance. Many people are risk seeking and will not

purchase flood insurance for any reason. Many people may not know that they have a flood risk, and if they do, they may be overwhelmed by other activities that drive them to “back burner” the purchase of flood insurance. Lastly, this tier provides an incentive for the community to manage the more frequent smaller flood events.

Tier 2 - The Insurance Tier

A study examining flood insurance claims in the US by Kousky and Michel-Kerjan (Kousky and Michel-Kerjan, 2017) finds that there are a number of factors that go into a household’s decision to purchase flood insurance. They find that most homeowners want to see some return on their premium payment, and they want to collect as much as possible on their policy should they suffer a loss. In other words, they do not want to pay for a \$250,000 policy if the most they will ever collect is \$100,000. Research also suggests that most people disregard the possibility of a catastrophe. They suggest that a policy low deductible low-loss level policy would be attractive.

The global insurance firm has expressed interest in providing a flood insurance policy that would provide \$100,000 in building coverage and \$20,000 in contents coverage with a \$10,000 deductible for around \$500.

Tier 3 – Concierge Tier

The same study of claims in the US mentioned earlier by Kousky, and Michel-Kerjan (Kousky and Michel-Kerjan, 2017) suggests that coverage for the rare or insurance terms --tail losses only would be attractive. Some individuals might prefer to self-insure for the more frequent and modest losses but purchase a policy to cover catastrophic damage. Such a “tail insurance policy” would be cheaper than a more comprehensive coverage and thus, it is likely to be much more affordable.

Another reason for breaking out the policies into three tiers is that it allows the high tier to be managed separately. Rare, large events are simultaneously more difficult to evaluate statistically and may result in aggregated claims that threaten the solvency of any program. We see this with Hurricane Katrina. The sum of all insurance claims paid

out by the NFIP was more significant than the same of all payments made by the program before 2005 (Kousky and Michel-Kerjan, 2017). The issue of how to pay off this debt is an issue of contention almost twenty years later.

This level of loss might be financed with a security such as a catastrophe bond. However, unlike the federal government, private reinsurers pay a cost for this capital. Alternatively, a state or local entity would need to pay a cost for capital, however, they enjoy the benefits of a tax-exempt status that makes lending more attractive. Thus, they may be in a better position to accept this layer of risk.

How would claims be handled?

It is envisioned that the Tier 1 payments and potentially the Tier 2 would be handled as a parametric insurance policy. Traditional insurance is indemnity based. Coverage is based on the policy terms and conditions such as deductibles, exclusions, limits and sub-limits. Claims are paid when losses exceed the retention held by the insured. In contrast, parametric insurance losses are covered by predefined payments made when a predefined trigger is established. Parametric insurance is increasingly viewed as a viable alternative to traditional claims-based insurance. Many industries such as manufacturing, hotel/hospitality, real estate, construction projects, public entities, energy, and utilities purchase parametric insurance. After the 2017 hurricane season industry reported a massive rise in parametric hurricane inquiries (<https://riskandinsurance.com/8-questions-for-robert-nusslein/>). There is interest in parametric insurance for things beyond weather such as reduced tax revenue for a municipality operating a port that has reduced cargo traffic.

What are the characteristics of parametric insurance?

Unlike a traditional NFIP flood insurance program, parametric insurance pays a predetermined amount when an event exceeds a pre-determined index (trigger). An index is an objective measure (e.g. rainfall, river gage height, wind speed) that is highly correlated to the variable of interest (e.g. flood depth, flood loss). In the case of the Sacramento County Delta Legacy Communities, the triggering event could be a levee

failure, the water surface elevation in the Lower Sacramento River at specific locations exceeding a predetermined Flood Warning or Flood Stage height, or an Atmospheric River event of a certain magnitude. An index must have the following properties:

- observable and easily measured.
- objective
- independently verifiable
- transparent
- reported in a timely manner
- consistent over time
- experienced over a wide area.

Challenges with implementing a parametric insurance program center around agreeing on the payout and on the triggering event and addressing basis risk. Basis risk is the difference between an insured's policies and the parametric insurance recovery. Basis risk is present in traditional insurance policies as well in the form of deductibles or retentions, exclusions, sub-limits, and unresponsive cover, such as business interruption losses that must result from physical damage to insured assets not just from the event. Third-generation parametric structures allow for more flexibility by creating "either/or" triggers - a design-driven by the convergence of multiple factors.

What are the benefits of parametric insurance?

The most significant and impactful benefit is the speed of the payment. With a parametric insurance program, payments can be made almost immediately. Increasingly advances in technologies such a blockchain hold the potential to provide an almost instantaneous transfer of funds. The financial liquidity available from a parametric insurance policy can reduce some of the indirect effects of damage, such as human suffering, loss of livelihoods. Prompt payouts facilitate more rapid reconstruction. Actions that help communities and households recover more quickly, reduce the long-term consequences that accompany disasters.

Parametric insurance can also be used to fill in coverage gaps left by traditional policies. For example, parametric insurance can provide business interruption

insurance even though the business is not directly impacted by the event. Further, payouts can be applied however the insured chooses, covering direct and indirect loss and any expenses associated with the event. In the case of the Delta Legacy Communities, a parametric policy could be purchased to cover flood fight activities.

Another benefit is that payments are known in advance.

The standard NFIP policy excludes coverage for mold damage due to the policy holder's failure to inspect and maintain property after flood waters recede. Because a parametric policy does not require damage inspectors, the prompt payments provide funding for the immediate mitigation of mold.

While the NFIP provides coverage for the clean-up of pollutants, it does not provide coverage for testing or monitoring. This is something that could be economically conducted by the community or GHAD.

What would be the typical annual insurance premium(s) for a three-tiered CBI policy for single-family residences in a Delta Legacy Community?

Acknowledging that the Tier 1 and Tier 2 premiums and payments would likely be handled as a parametric insurance policy, and Tier 3 would provide for additional catastrophic losses. The following range of premiums are anticipated for each of the three Tiers.

Tier 1 – The Good Samaritan Tier

Tier 1 would be the minimum coverage that would be provided to all homeowners/renters living within the GHAD, preferably the entire populated center of the Delta Legacy Community. The policy holders of this tier would be entitled to a claim of up to \$10,000 to use at their own discretion anytime the Sacramento River (and/or other distributary sloughs) reached flood stage at a pre-determination level; and/or there were evacuation measures or flood-fight activities occurring within the larger Reclamation District(s) where the Delta Legacy Community resides.

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This premium amount would not include an added benefit assessment amount that is envisioned to accrue local cost-share amounts and long-term financing for flood community-specific risk reduction structural-based management actions coupled with non-structural measures that may be identified in the Delta Legacy Community SCFRRP feasibility studies completed in 2021.

This tier would likely need to be funded from sources outside of the Legacy Communities. It would recognize that the low-income residents within the Legacy Communities are already overburdened by other costs. The payment for this tier might come from the State or County General Fund. It might also come from FEMA. This payment is similar to that provided by the FEMA Individual Assistance program. Unfortunately, payments from the FEMA IA program are seldom asked for in California and often take months to receive. The FEMA IA program could be a source of funding, but it would require a change to the Safford Act. This tier would also recognize that over the years the County has invested in 100-year protection for other parts of the County. Providing a parametric payment would compensate for the County's inability to provide 100-year protection to the residents within the Legacy Communities. Because it is unlikely that more than one community will fail at a time, the largest sum that the County would likely have to pay is about \$2,500,000.

Tier 2 – The Insurance Tier

This Tier recognizes that households are unable or unwilling to spend much more than 1 percent of their income on flood insurance. This means that for flood insurance to be attractive, it must be offered in the \$500 to \$800 range. Conversations with international insurance firms suggest that a policy providing \$100,000 building and \$20,000 in contents coverage with a \$10,000 deductible could be provided for \$400 to \$700. In this scenario, an additional \$100 to \$200 could be charged to each policy. This extra amount could be accumulated and would be a source of funding to help pursue other larger grants.

In this scenario, everyone might be required to purchase flood insurance. Alternatively, those who chose not to buy flood insurance might be assessed a fee of \$100 to \$500.

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All fees would be subject to a Proposition 218 vote. Thus, an arrangement acceptable to a majority of the voters would need to be determined. Teasing out an arrangement that is not only acceptable, but that is supported by a majority of the voting residents will take a concerted effort. As finding an alternative to the NFIP is a goal specifically called for in both the 2020 Governor's Water Portfolio and in the 2017 Central Valley Flood Protection Plan, the County or the State might consider investing in outreach and surveys to determine the wishes of the community.

Tier 3 – The Concierge Tier

Individuals who participate in a Health Maintenance Organization insurance plan are often provided the opportunity to pay extra to receive more specialized treatment. The term used to describe this extra insurance is “concierge insurance”. Similarly, this tier would be a concierge insurance that would provide extra insurance above the basic plan. This level of insurance might provide for coverages that meet the \$250,000 as might be required by lenders. It might also cover items not covered by NFIP policies such as housing relocation during reconstruction or debris removal. The cost of this additional tier would vary widely given the type of coverage provided. However, given the fact that the lower more frequent losses are covered in other tiers, it would not be unreasonable to assume that insurance in this tier might be obtained for around \$1.50 per hundred dollars of insured value.

This tier might also be viewed as a catastrophe tier. In the past, through the Stafford Act, FEMA has provided Individual Assistance to homeowners and Public Assistance to communities. Recent increases in the minimum loss thresholds make it unlikely that FEMA assistance under the Stafford Act will be available to the Legacy Communities. Recognizing the impact of this change, the State may choose to fill the gap by purchasing Catastrophe Insurance. This is an increasingly attractive option and is used by cities like New Orleans and New York City.

References

- Brody, Samuel D, Sammy Zahran, Wesley E Highfield, Sarah P Bernhardt, and Arnold Vedlitz. 2009. "Policy Learning for Flood Mitigation: A Longitudinal Assessment of the Community Rating System in Florida." *Risk Analysis: An International Journal* 29 (6): 912929.
- Cunniff, Shannon E. 2018a. "Improving FEMA's Community Rating System to Encourage Investment in Coastal Natural Infrastructure to Reduce Storm Damages." *Shore & Beach* 86 (2): 2732.
- Federal Emergency Management Agency. A whole community approach to emergency management: Principles, themes, and pathways for action, 2011. URL https://www.fema.gov/sites/default/files/2020-07/fema_whole-community_120211.pdf.
- Federal Emergency Management Agency(FEMA) n.d. "Flood Insurance Manual, Effective October 1, 2018 | Fema.gov." *Flood Insurance Manual, Effective October 1, 2018*. <https://www.fema.gov/medialibrary/assets/documents/171681#>.
- Frimpong, Eugene, Daniel R Petrolia, Ardian Harri, and John H Cartwright. 2020. "Flood Insurance and Claims: The Impact of the Community Rating System." *Applied Economic Perspectives and Policy* 42 (2): 245262.
- Rep. Kathy Castor. Solving the climate crisis: The congressional action plan for a clean energy economy and a healthy, resilient and just America. Technical report, 116th Congress, Washington, D.C., June 2020. URL <file:///Users/kathyschaefer/Downloads/Climate%20Crisis%20Action%20Plan.pdf>.
- Carolyn Kousky and Erwann Michel-Kerjan. Examining flood insurance claims in the United States: Six Key Findings. *Journal of Risk and Insurance*, 84(3):819–850, 2017.
- Carolyn Kousky and Lenard Shabman. A Proposed Design for Community Flood Insurance, 2015.
- Carolyn Kousky, Howard Kunreuther, Brett Lingle, and Leonard Shabman. The emerging private residential flood insurance market in the United States. *Wharton Risk Management and Decision Processes Center*, 2018.
- Landry, Craig E, and Jingyuan Li. 2012. "Participation in the Community Rating System of NFIP: Empirical Analysis of North Carolina Counties." *Natural Hazards Review* 13 (3): 205220.
- David Maurstad. Reauthorization of the national flood insurance program, part ii, June 2027. Statement of Before the Committee on Banking Housing, and Urban Affairs, United States Senate, Washington, D.C.
- Jaroslav Mysiak, Swenja Surminski, Annegret Thieken, Reinhard Mechler, and Jeroen

Appendix J Examining an Alternative to the National Flood Insurance Program

- Aerts. Brief communication: Sendai framework for disaster risk reduction—success or warning sign for Paris? *Natural Hazards and Earth System Sciences*, 16(10): 2189–2193, 2016.
- NAC. National Advisory Council report the FEMA Administrator. Technical Report, National Advisory Council, Washington, D.C., November 2019.
- Eko Teguh Paripurno and Ninil Miftahul Jannah. Community based disaster risk management (CBDRM) guidelines. Technical Report, Masyarakat Penanggulangan Bencana Indonesia, Indonesia, 2011.
- John Rollins. Wading into the private flood insurance market. Technical Report, Milliman, 2019. URL <https://www.milliman.com/-/media/milliman/importedfiles/ektron/wading-private-flood-insurance.ashx>.
- WSIA. Surplus lines flood insurance market data and statistics. Technical Report, Wholesale Specialty Insurance Association, 2017.
- WSIA. Surplus lines flood insurance market data and statistics. Technical Report, Wholesale Specialty Insurance Association, Kansas City, Missouri, 2019. URL <https://www.wsia.org/docs/PDF/Legislative/SurplusLinesMarketDataandStatistics2-28-19.pdf>.
- FEMA. 2021a. “Flood Insurance Manual: October 2021 Risk Rating 2.0: Equity in Action Edition.” Washington, D.C.
- . 2021b. “Flood Insurance Manual: October 2021 Risk Rating 2.0: Equity in Action Edition.” Washington, D.C.
- Kimbrow, Rachel. 2021. *In Too Deep: Class and Mothering in a Flooded Community*. Univ of California Press.
- Maurstad, D. 2027. “Reauthorization of the National Flood Insurance Program, Part II,” June.
- Semonite, Todd T. 2018. “Delta Islands and Levees Feasibility Report, California,” December. <https://www.spk.usace.army.mil/Missions/Civil-Works/Sacramento-San-Joaquin-Delta/>.
- Corringham, Thomas W, F Martin Ralph, Alexander Gershunov, Daniel R Cayan, and Cary A Talbot. 2019. “Atmospheric Rivers Drive Flood Damages in the Western United States.” *Science Advances* 5 (12): eaax4631.
- Davis, G., and G. B. Bardini. 2017. “Central Valley Flood Protection Plan 2017 Update.” Sacramento, CA.
- Hopf, Frank. 2011. “Levee Failures in the Sacramento-San Joaquin River Delta: Characteristics and Perspectives.” PhD thesis.
- ISB. 2017. “Review of Research on the Sacramento-San Joaquin Delta as an Evolving Place.” Sacramento, CA.
- Kunreuther, Howard, and Erwann Michel-Kerjan. 2013. “Managing Catastrophic Risks Through Redesigned Insurance: Challenges and Opportunities.” In, 517546. Springer.

Appendix J Examining an Alternative to the National Flood Insurance Program

Louaas, Alexis, and Pierre Picard. 2021. "Optimal Insurance Coverage of Low-Probability Catastrophic Risks." *The Geneva Risk and Insurance Review* 46 (1): 6188.

Madani, Kaveh, and Jay R Lund. 2012. "California's Sacramento San Joaquin Delta Conflict: From Cooperation to Chicken." *Journal of Water Resources Planning and Management* 138 (2): 9099. Rudnick, Jessica. 2022. "Understanding People in the Face of Rapid Environmental Change." <https://deltacouncil.ca.gov/blogs/understanding-people-in-the-face-of-rapid-environmentalchange>.