MILL VALLEY

STAFF MEMORANDUM

TO: Mayor and City Council

FROM: Patrick Kelly, Director of Planning and Building

SUBJECT: Soft Story Program

DATE: May 6, 2022

Approved for Forwarding:

Alan E. Piombo, Jr., City Manager

Work is underway on a "Soft Story retrofit program", which involves an inventory of soft, weak, or open front structures and regulations requiring safety upgrades, retrofits to the "soft story". The objective is to protect existing housing stock in the community in compliance with Housing Element policies. Staff has retained the services of David Bonowitz, Structural Engineer, to assist with the work program. Mr. Bonowitz has experience working on soft story building ordinances in several Bay Area cities.

The work program is provided as Attachment A. Task 1, preliminary inventory of potential soft story buildings in Mill Valley, has been drafted (refer to Attachment B). Staff and Mr. Bonowitz will be attending the Council Retreat to provide an update on the soft story work program and respond to questions. The presentation will provide background information, summarize the work program, and draft memo on the inventory of soft story buildings / units and discuss next steps.

Attachments:

A) Soft Story Work Program
B) Draft memo, Mill Valley "Soft Story" study, Task 1: Inventory

ITEM 2B

ATTACHMENT "A"

SOFT STORY RETROFIT PROGRAM
SCOPE OF SERVICES

Phase or Task Note: Each Phase or Task is contingent on findings and conclusions from preceding work. Scope of subsequent tasks may be adjusted in accordance with Exhibit "B" paragraph 4.	**Expected End Date**
1. Inventory Assumptions: • City to provide County assessor data for all residential properties, in spreadsheet format. • City to provide supplemental data as needed to address related questions not covered by assessor's data. • City to consider Council resolution protecting inventory data as sensitive, interim, and temporary, not for public distribution. • Further inventory based on online imagery only; therefore limited by visibility in wooded or obscured locations. Deliverables: • Revised spreadsheet with parcel-level details for 3-unit and larger residential buildings. • Summary memo with building counts by key subgroups and summary of options for Planning phase.	April 30, 2022
2. Planning Assumptions: • City staff to provide input on preferred policy options, including broad mitigation goals, based on Inventory memo. • City to provide supplemental data as needed to address related questions not covered by assessor's data. Deliverables: • Summary memo discussing Inventory findings in the context of preferred policy options and other identified issues.	May 15, 2022
3. Engineering Assumptions: • City will take advantage of existing precedents from other jurisdictions to the extent feasible, with no new model building or BCA studies. Deliverables: • Summary memo of recommended mitigation program type, mitigation objectives, and technical criteria.	May 31, 2022

ATTACHMENT A

ATTACHMENT B

MEMORANDUM

TO: Patrick Kelly, City of Mill Valley
FROM: David Bonowitz
DATE: April 29, 2022
SUBJECT: Mill Valley "Soft Story" study, Task 1: Inventory

This memo summarizes my analysis of the Mill Valley housing stock with attention to buildings expected to have woodframe target stories (WFTS), also commonly referred to as "soft story" buildings.[1] I have not performed any structural analysis to confirm or quantify the risk associated with any building's WFTS condition. In fact, identifying a building as having a WFTS, whether for inventory purposes or in the screening phase of a mitigation program, is not the same as confirming a seismic deficiency by analysis.

HOUSING STOCK BREAKDOWN

Table 1 describes the Mill Valley housing stock by building size and WFTS status. Figure 1 illustrates certain conditions discussed in this memo, with and without WFTS conditions.

Table 1. Breakdown of Mill Valley's residential buildings by size and expected WFTS status

Building Size (Units)	All Residential Buildings		Pre-1983 Residential Buildings w/ Wood Frame Target Story			
			Minimum estimate		Maximum estimate	
	Buildings	Units	Buildings	Units	Buildings	Units
1	3625	3625	Not reviewed in detail		Not reviewed in detail	
2[a]	560	1120				
3	45	135	13	39	28	84
4	78	312	10	40	35	140
5	22	110	7	35	11	55
6	35	210	11	66	18	108
7	3	21	0	0	1	7
8	16	128	4	32	9	72
9 – 12	26	266	7	71	16	155
13 – 20	7	110	0	0	5	80
21 – 30	19	469	0	0	2	52
31+	0	0	0	0	0	0
All	**4436**	**6506**	See text for discussion of 1- and 2-unit dwellings			
% of All	100%	100%				
3+ Units	**251**	**1761**	**52**	**283**	**125**	**753**
% of All	5.7%	27%	1.1%	4.3%	2.8%	12%
% of 3+	100%	100%	21%	16%	50%	43%
5+ Units	**128**	**1314**	**29**	**204**	**62**	**529**
% of All	2.9%	20%	0.6%	3.1%	1.4%	8.1%
% of 5+	100%	100%	23%	16%	48%	40%

[a] The 2-unit counts assume each 2-unit parcel in the source data has a single 2-unit building. It is likely that some of the 2-unit parcels actually comprise two separate 1-unit buildings.

[1] As an engineering term, *soft story* refers to a type of structural irregularity; it is not limited to wood structures or to residential buildings. Outside of engineering, the public, the media, and several California jurisdictions have used the term to mean a woodframe multi-unit residential building suspected of having certain collapse-prone seismic deficiencies. As a non-technical shorthand, the term's meaning varies, since different jurisdictions include different buildings in their programs, making distinctions by age, number of stories, and number of residential units. To avoid confusion, this memo generally uses the term *woodframe target story* (WFTS) to indicate the condition of interest.

ATTACHMENT B

Notes on Table 1:

- The estimates of WFTS status are based on my observations of publicly available online imagery. A description of how the database was produced is provided at the end of this memo.

- The difference between the minimum and maximum estimates is due to unclear online images. As shown, the maximum estimate is roughly 2.6 times the minimum estimate. This ratio is more than double that of other cities where I have developed similar inventories using similar techniques. The difference is due to less complete "streetview" coverage in Mill Valley, combined with Mill Valley's more common hillside conditions, narrow streets, and heavily wooded residential streets. Figure 2 shows examples of suspected WFTS conditions counted only in the maximum estimate.

- The WFTS counts in Table 1 include only buildings built before 1983 to approximate the scope of a typical retrofit program. Typical programs exempt younger buildings by setting a cutoff date around 1980 based on the city's history of building code adoption and other precedents. The implications of setting different cutoff dates are discussed with Table 3 below.
    - In addition to the counts given in Table 1, Mill Valley has between 15 and 27 multi-unit buildings built after 1982 with similar WFTS conditions. Nearly all are townhouse or condominium structures in large developments from the 1980s.

- The WFTS counts in Table 1 do not include 5 buildings (33 units) believed to have concrete masonry unit (CMU) walls in the critical story. Of these, only 2 (9 units) were built before 1983. While not necessarily "earthquake safe," buildings with CMU walls are expected to be less collapse-prone than WFTS buildings of similar size. If retrofitted, they would require different structural systems and design criteria and are therefore excluded from typical retrofit programs. The fact that Mill Valley appears to have only a handful of these buildings means that exempting them from a possible mitigation program will not raise some of the questions expected in other cities where this building type is more common.

Table 1 shows that Mill Valley's WFTS buildings with five or more units comprise 3 to 8 percent of the City's total housing stock. If the 3- and 4-unit buildings are included, the WFTS cohort represents between 4 and 12 percent of the City's housing. (As noted above, this difference between the minimum and maximum estimates is unusually large.) The vast majority of Mill Valley's housing – over 70 percent of units, and over 90 percent of individual buildings – is in one- and two-unit dwellings; potential seismic deficiencies in these dwellings are discussed in a separate section below.

Considering the 27 percent of Mill Valley housing in multi-unit buildings, Table 2 shows the breakdown between the WFTS cohort and other structure types. Though not analyzed here, non-WFTS buildings can also pose seismic risks. Even new residential buildings, while earthquake-safe, can pose reoccupancy and recovery risks, especially to vulnerable tenants.

Table 2. Breakdown of Mill Valley's multi-unit residential buildings by structure type

	Buildings with 3-4 units		Buildings with 5 or more units	
Structure type	Buildings	Units	Buildings	Units
All multi-unit buildings	123	447	128	1314
Pre-1983 WFTS (max estimate)	63	224 (50%)	62	529 (40%)
Pre-1983 woodframe, non-WFTS	23	86 (19%)	21	165 (13%)
Pre-1983 wood + CMU first story	1	3	1	6
Pre-1983 other[a]	2	8	18	417 (32%)
Post-1982 woodframe	18	71 (16%)	5	42
Post-1982 other[b]	4	14	3	40

[a] One unreinforced masonry (URM) structure, and 19 with unknown structural systems.

[b] Two concrete podium structures (woodframe upper stories), and five with unknown structural systems.

Table 2 shows that WFTS buildings might account for about half of the City's multi-unit housing – as much as 50 percent in the smaller buildings, and 40 percent in the larger ones. The smaller non-WFTS buildings are also mostly woodframe, either of the same age or newer than the WFTS cohort. Among the larger buildings, the structural system of many non-WFTS buildings is not obvious from online imagery; the majority of these 18 buildings are on the campus of The Redwoods and provide assisted living and affordable housing for seniors, discussed further below.

Table 3 shows that a large majority of Mill Valley's WFTS buildings were built between 1950 and 1982. Among the larger buildings, the portion from that era exceeds 90 percent. This is not unexpected, as other small and mid-size Bay Area cities have similar development histories. San Francisco and Oakland, by contrast, have many more buildings from the 1920s boom. The younger building stock in Mill Valley can be advantageous to a retrofit program, as the younger buildings are more likely to have documentation and to lack certain features that increase risk or complicate retrofit, such as heavy plaster finishes or deteriorated framing and foundations.

Table 3. Pre-1983 WFTS buildings (maximum estimate) by era of construction

	WFTS buildings with 3-4 units		WFTS buildings with 5 or more units	
Era of construction[a]	Buildings	Units	Buildings	Units
All WFTS buildings	63	224	62	529
Pre-1920	10	32	3	23
1920-1950	9	31	1	11
1950-1977	40	148 (66%)	45	325 (61%)
1978-1982	4	13	13[b]	170 (32%)

[a] Source data on the year of original construction is incomplete. For 34 of the 125 buildings shown, I estimated the era of construction based on architectural style, assigning all 34 to pre-1978 eras (25 of 34 to 1950-1977).

[b] These 13 buildings are all from two large developments, one constructed in 1979, and one in 1981.

Table 3 also shows a substantial number of suspected WFTS buildings from the five-year period 1978-1982. This is important because "soft story" retrofit programs typically draw an exemption line somewhere in this period. *California Health and Safety Code* Section 19161, which encourages local jurisdictions to develop such programs, sets the date at January 1, 1978, but it makes more sense to draw the line based on each city's history of development and building code adoption, and different California cities have, accordingly, set different cut-off dates.

In other cities, the number of possible WFTS buildings within a year or two of the exemption date is small, so the effect of the choice on the overall effectiveness of a citywide program is small as well. In Mill Valley, however, Table 3 shows that selecting a different exemption date, even within this narrow

range, can significantly change the scope and effectiveness of the program. As Mill Valley moves forward, it will be useful to review the code provisions the City applied to projects in design or construction around this time. That said, it should not be necessary to make a definitive judgment about any of these borderline cases in advance. Even if the City sets a later date, thereby including more buildings in a mitigation program, the owner of any subject building may still demonstrate compliance by evaluation, if in fact no retrofit is needed.

Comparison with other Bay Area cities

As noted, Mill Valley's WFTS buildings with five or more units comprise 3 to 8 percent of the city's total housing stock, between 4 and 12 percent if the smaller multi-unit buildings are included. Overall, as shown in Table 4, these numbers are on par with other Bay Area cities, but only if a substantial number of buildings currently counted as *possibly* WFTS turn out to be *actually* WFTS. If the true count is closer to the minimum estimate in Table 1, Mill Valley's WFTS cohort is smaller than that of any of the other Bay Area cities listed.

Table 4. WFTS portion of total housing stock in Bay Area cities

City	Portion represented by WFTS buildings with 3+ units	Portion represented by WFTS buildings with 5+ units
Mill Valley	4.3% to 12%	3.1% to 8.1%
Bay Area City[a]	10% to 12%	5.1% to 5.6%
Albany	8.4% to 11%	4.0% to 6.3%
Berkeley	not reported	6%
Palo Alto	not reported	10%
Mountain View	16%	14%
San Francisco	not reported	14%
Oakland	not reported	15%

[a] The city is not identified because the cited inventory data is not yet public. The same unidentified city is considered in Table 5 as well.

Further comparison with two Bay Area cities offers additional context, as shown in Table 5. Mill Valley is both smaller and less densely populated than either of the other two cities in the table. This is consistent with Mill Valley's very high proportion of single-family and duplex housing (73% compared with Albany's 54%). In concept, since higher density is reflected in taller buildings and in-building parking, one might expect Mill Valley to have a smaller portion of its housing in WFTS buildings, but whether that hypothesis is supported by Table 5 will depend on whether Mill Valley's actual WFTS count is closer to the minimum or maximum estimate from Table 1.

Table 5. Demographics and WFTS housing in three Bay Area cities

Building size	Mill Valley	Bay Area City[a]	Albany
Population	14,300	25,400	19,800
Population density	3800 / sq. mile	6900 / sq. mile	12,000 / sq. mile
Total housing units	6506	11,245	8006
Residents per unit	2.2	2.3	2.5
WFTS: 1-2 units	33% + (about 2300 units; see derivation below)	28% (about 3200 units)	19% (about 1500 units)
WFTS: 3-4 units	1.2% to 3.4%	5.1% to 5.9%	4.4% to 4.9%
WFTS: 5+ units	3.1% to 8.1%	5.1% to 5.6%	4.0% to 6.3%

[a] The city is not identified because the cited inventory data is not yet public. The same unidentified city is considered in Table 4 as well.

CONFIGURATION & WFTS SUBTYPES

Mitigation programs are most efficient where a large cohort of similar buildings can all use a common retrofit solution. Similarity within the cohort clarifies and focuses policy development, simplifies implementation for the City, and benefits building owners by creating a market with knowledgeable engineers and builders who can move efficiently from project to project. Mill Valley does not appear to have a characteristic WFTS building type. As shown in Table 6 and as discussed below, however, the City does have a larger than normal share of certain building subtypes, including hillside conditions and townhouse-style developments. A selection of Mill Valley buildings illustrating some of the issues discussed in this and following section is given in Figure 1.

Table 6. Subtypes of the Pre-1983 WFTS cohort

	WFTS maximum estimate 3-4 units		WFTS maximum estimate 5+ units	
Building or WFTS subtype	Buildings	Units	Buildings	Units
All WFTS buildings	63	224	62	529
Buildings w/ parking WFTS	12	45 (20%)	17	172 (33%)
Buildings w/ occupied WFTS	9	29 (13%)	18	145 (27%)
4-story buildings	2	8	7	62
3-story buildings	18	69 (31%)	39	348 (66%)
2-story buildings	41	141 (63%)	16	119 (23%)
1-story over cripple wall	2	6	0	0
2+ stories over cripple wall only	22	78 (35%)	10	87
Hillside crawl space	21	78 (35%)	17	125 (24%)
Townhouse buildings	8	30	8	49
End bay parking only	1	3	2	17

Buildings with occupied units in the WFTS

For buildings with an equal probability of collapse, those with an occupied first story pose higher safety risks than those whose first story contains only parking and other incidental uses (lobby, storage, laundry). A mitigation program might choose to prioritize these higher-risk buildings. In Mill Valley, the portion of the WFTS cohort with occupied first stories is significant, but not especially large. What is perhaps more interesting is that the balance of the cohort – the portion that does *not* have an occupied WFTS – is not always a building with ground floor parking. Rather, the balance is mostly made up by buildings with unoccupied cripple wall and hillside conditions, discussed below.

Building height

For buildings of the same footprint, taller buildings have more mass and therefore generally pose a higher risk (in addition to having more units at risk). Since the retrofit solution is often nearly the same for buildings of 2, 3, or 4 stories, the cost per residential unit is less, and the benefit greater, for the taller buildings. For these reasons, some mitigation programs exempt 2-story buildings. Mill Valley's WFTS cohort is generally split between 2- and 3-story buildings. (About a quarter of the 3-story buildings, however, are actually 2-stories over a hillside crawl space tall enough to count as a story by code.) In general, given the large number of cripple wall, hillside, and unknown conditions in the data, I do not see a clear reason to exempt the shorter buildings at this time.

Unbraced cripple walls

The term "soft story" is often associated with a visibly open wall line – a line of garage doors or shop windows – in the building's first full story above grade. But unbraced woodframe "cripple walls" around a crawl space can be just as collapse-prone. While unbraced cripple walls are commonly associated with single-family dwellings, Table 6 shows they are also present in 35% of Mill Valley's 3- and 4-unit, 2-

story and taller WFTS buildings. Cripple walls are rarer in the larger buildings, which tend to have different deficiencies. Due to its greater mass, a two-story cripple wall building generally poses a higher collapse risk than a one-story building.

Cripple wall buildings are generally less life-threatening than a full-height WFTS because the collapse-prone crawl space is unoccupied. Still, cripple wall collapse is often irreparable, and severe damage would represent at least a loss of housing. While these multi-unit cripple wall buildings should probably be included in a possible WFTS retrofit program, they do present a different set of issues and might need separate (but fairly straightforward) retrofit design criteria that account for complicated construction access and quality control in semi-confined spaces.

Hillside buildings

The relatively large number of hillside WFTS buildings distinguishes Mill Valley from other Bay Area cities with "soft story" programs. A WFTS condition on the downhill end of a steeply sloped lot can be especially vulnerable. Even though the critical portion is typically an unoccupied crawl space, the nature of the site means that collapse is life-threatening for the entire building. A mitigation program for collapse-prone housing in Mill Valley would certainly want to include these hillside buildings. However, the most common "soft story" retrofit approaches can be complicated by wall height anomalies and foundation deficiencies common in older hillside structures. When it adopts engineering criteria for a mitigation program, the City might want to develop supplemental provisions for hillside conditions to ensure completeness and consistency.

Townhouse buildings

Mill Valley appears to have at least 65 townhouse buildings containing over 300 units, significantly more than other Bay Area cities with WFTS programs. About a fourth of these – the 16 buildings shown in Table 6 – appear to present WFTS conditions; they represent a small but significant portion of the Mill Valley WFTS cohort. (Townhouses are also frequently associated with condominium ownership, discussed below.)

A townhouse building is a specific type of multi-unit structure in which each distinct unit runs from the foundation to the roof and is attached to other units only along common side walls. From a structural perspective, a townhouse structure with a WFTS (for example, due to a line of garage doors along the front side; see Figure 1d) is little different from a similarly-sized apartment building, but the nature of the required separation between units might complicate some typical retrofit details. As Mill Valley's program develops, it might prove useful to study the 1970s and 1980s townhouse types prevalent in the City in terms of the fire separation between units, whether they have single or double-stud walls, and any complications posed by multiple out-of-plane offsets, a common architectural feature.

End bay parking

Ground floor parking under one end of a long building, which I call "end bay parking," can look like a vulnerable WFTS condition from the street but is often less risky. These buildings are common in other Bay Area cities, so they are worth tracking in inventories, but as shown in Table 6, Mill Valley has practically none of them. This is related to the prevalence of hilly conditions and curvy streets, which do not allow for deep lots, and to the City's low density, which allows more buildings with parking and driveways along the side of the building, not just at the street end.

Extensive, multi-purpose deck and carport

Though not specifically tracked or shown in Table 6, I noticed a significant number of Mill Valley buildings where parking spaces are provided outside the main building footprint, but under an attached, occupiable deck, sometimes furnished as an outdoor room. Figure 1c shows an example. As with any attached substructure, if the mass is high and the connections and bracing are inadequate, the substructure will be vulnerable to collapse in an earthquake. Some may consider this acceptable damage, or at least not concerning enough to justify mandatory mitigation, since the damage is rarely life-threatening, probably

does not impede use of the building as basic shelter, and is relatively easy to remove, repair, or replace. Where the substructure is used as both a carport and a deck, however, collapse might threaten safety more than an unoccupied carport, and it might be more costly and disruptive than a typical lightweight deck. (And with condominium ownership, discussed below, repair might be excessively delayed for procedural reasons.)

Even so, these multi-purpose substructures are not counted as WFTS buildings because the collapse-prone condition remains outside the footprint of the main residential structure. It would be unusual to include them in a "soft story" mitigation program, but the City might separately want to develop standard retrofit details that owners can apply voluntarily.

Previous retrofits

I have not reviewed permit records to identify any WFTS buildings that might have already been improved by retrofit. In my review of online images, I did identify three buildings that appear to have visible retrofit elements. Because the number is small and the retrofit design is unknown, all three buildings are counted here within the WFTS maximum estimate. While a mitigation program will have to account for previous retrofits, there is no reason to think that past retrofit work significantly affects any of the overall findings presented here.

USE & OWNERSHIP SUBTYPES

Residential subtypes based on usage and ownership are often of interest as earthquake risk reduction policy is considered. Table 7, based on partial or preliminary data, shows the relationship between the City's suspected WFTS buildings and particular uses of interest. With additional data, the City might choose to study any of these or other issues further.

Table 7. Portion of certain uses in pre-1983 WFTS buildings

	All buildings		Pre-1983 WFTS, 3+ units maximum estimate	
Use or ownership subtype	Buildings	Units	Buildings	Units
Multi-family housing	251	1761	125	753
Mixed-use buildings	4	28	1	11
Rental housing	Not studied		Not studied	
Condominium buildings [a]	124 (max)	773 (max)	33 (max)	250 (max)
Senior housing or assisted living [b]	14	326	0	0
Affordable or supportive housing [b, c]	17	141	11	75
Hotels and motels	Not studied		Not studied	

[a] The condomininm counts are based on source data records with Use Code 14: Single Family Attached. The Marin County Assessor assigns this use code to condominiums, co-ops, townhouses, and attached units in planned unit developments (PUD), so the numbers shown are not strictly for condominiums. See text for additional discussion.

[b] Sixty units of affordable senior housing at The Redwoods are included with the Senior housing.

[c] Includes only facilities dedicated to low income or otherwise qualified tenants. Does not include market housing where rental rates happen to be low.

Multi-family housing

Multi-family, or multi-unit, housing is of special interest where a City is interested in developing with higher density, especially with transit-oriented or mixed-use projects. (Multi-unit housing is also commonly associated with rental housing and affordable housing, discussed below.) Table 2 provided a breakdown of Mill Valley's multi-unit housing stock by structure type, comparing the WFTS cohort to other subtypes. As shown in Tables 1 and 2, while the City's WFTS buildings account for only 4 to 12 percent of the City's total housing units, they represent much larger portions – as much as 43 percent with

the maximum estimate – of the City's multi-unit housing. Thus, to the extent that multi-unit housing is a subtype of interest, it makes sense to protect this large portion of the existing stock by mitigation.

Mixed-use buildings

Where the critical story is occupied as a commercial space, retrofit can be complicated by business disruption and other owner-tenant issues. According to the source data, however, Mill Valley has only four buildings with more than two residential units over a ground floor mercantile or business occupancy.[2] Only one of those, a 3-story pre-1950 building on Throckmorton Avenue, appears to have a WFTS condition.

In addition to the four buildings counted in Table 7, the inventory of multi-unit buildings also identified four commercial buildings with just one or two housing units in upper stories over a commercial ground story. The source data includes about 50 other parcels, each with one or two housing units (about 60 total), in areas with commercial zoning. It is possible that these are also mixed-use buildings, and some might have WFTS conditions, but they have not been studied as part of the current inventory effort. Current Bay Area WFTS mitigation programs would all exempt such cases because of the low unit counts, but Los Angeles' program might include them.

Rental housing

Rental housing is of interest to policy makers to the extent that rentals are regulated differently and are related to housing affordability. It can also be of interest to seismic mitigation planning because a retrofit program will need to account for owner-tenant relations and cost-sharing. The data reviewed so far does not include an overlay with rental status. Rental housing is commonly associated with multi-unit housing, so the data presented above for multi-unit housing might be usable as a first approximation of the City's rental housing, but the two groups are not identical.

Condominium buildings

Condominium buildings, which are typically owner-occupied, can present fewer owner-tenant obstacles than rental housing. Because they are not income-generating, however, costs cannot be shared with tenants over time, and individual condo owners might have difficulty complying with a retrofit mandate. In addition, it is widely believed that condominium buildings rarely undertake voluntary improvements because it is harder to generate consensus for a voluntary expenditure within the group of owners. Some of these issues have received attention recently because they might have affected decision-making before the collapse of Champlain Towers South in Surfside, Florida. That said, California has relatively thorough requirements for condominium owners. In addition, San Francisco also has a substantial number of condominium and tenants-in-common buildings, and I am not aware of any evidence that they disproportionally failed to comply with the mandatory "soft story" retrofit program there.

As noted at Table 7, the current count of Mill Valley condominiums includes co-ops, townhouses, and attached units in PUDs, all of which are coded the same way by the county assessor. While these ownership types are different in some ways from condominiums, they often have the same mix of individual ownership of units and joint responsibility for the whole structure, so they present similar opportunities and obstacles with respect to retrofit. These issues might become important in Mill Valley, which has a high proportion of condominium units compared with other Bay Area cities with "soft story" programs. The 773 identified units represent more than 40 percent of the City's multi-unit housing and 12 percent of housing overall. Of these, only about a third (250 units) appear to be in buildings with WFTS conditions, but because of joint responsibility, any requirements imposed on this subset might also affect the owners of non-WFTS buildings within the same development.

[2] Institutional occupancy, such as assisted living or nursing home facilities, is covered below, in the section on senior housing.

Senior housing or assisted living

Senior housing, especially if it involves medical care or other assistive services, might be considered a higher retrofit priority because the tenants are more vulnerable, have special needs, and would be harder to relocate if a property is damaged. In particular, if built new, these facilities would be subject to special design requirements for Institutional Occupancy (Group I-1, Condition 2). In Mill Valley, the inventory identified 14 buildings that provide these services (all but one at The Redwoods facility), and none of these appears to have a WFTS condition. As noted above, however, non-WFTS buildings can also pose seismic risks. Even new residential buildings, while earthquake-safe, can pose reoccupancy and recovery risks, especially to vulnerable tenants.

Affordable housing

Affordable (or supportive, below market rate, or low income) housing might be prioritized in a mitigation program because, like senior housing, satisfactory alternatives are not easily found should the tenants need to relocate because of earthquake damage. Also, developing new affordable housing is a priority in many cities' general plans. In Mill Valley, the inventory identified 17 buildings (141 units), at four different developments, designated as affordable or supportive housing. About half of the units are in buildings that appear to present WFTS conditions. Further development of a WFTS mitigation program should give attention to how the costs for these buildings will be shared between owners, agency funders, and the low-income tenants. That said, all 11 of the possibly WFTS buildings are in one development, so direct negotiation or coordination with that owner might be a fruitful alternative.

Hotels and motels

Hotels and motels are of interest because they are sometimes repurposed as shelters, interim housing, or worker housing during post-earthquake recovery. In cities with large tourism industries, their performance can also affect economic recovery. Most WFTS mitigation programs include hotels and motels. Evolving policies on vacation rentals, time-shares, and short-term rentals pose related issues regarding post-earthquake housing. For this inventory, hotels and motels were not explicitly tracked. For future reference, however, it is perhaps noteworthy that the source data received from the county assessor is inconsistent in how it includes these uses.

ONE- AND TWO-UNIT DWELLINGS

As noted in Table 1, I have not made a detailed review of Mill Valley's roughly 4700 housing units in one- or two-unit dwellings. These single-family residences and duplexes represent at least 94 percent of the City's residential buildings and 73 percent of the total housing units.

These smaller buildings – conventionally framed houses, typically – can present WFTS risks due to unbraced cripple walls, "room over garage" (ROG) conditions, or hillside conditions.[3] The first two types are less likely to pose safety risks, but the damage can still be severe enough to render the dwelling uninhabitable, posing an economic and recovery risk. Vulnerable hillside dwellings can pose risk in all categories – safety, economy, reoccupancy, and recovery. Even so, 1- and 2-unit dwellings are typically excluded from WFTS mitigation programs, mostly because of the lower safety risk, but sometimes because they are assumed to be owner-occupied, with the owner assumed to be more capable of a voluntary retrofit without policy intervention. Both of these assumptions can be false, however: some portion of single-family homes in Mill Valley are surely rentals, there is no guarantee that homeowners are motivated to retrofit, and the aggregate effects of damage to small buildings can still be large in terms of community resilience. Mill Valley might be interested in studying any or all of those issues. For now, we are interested in these dwellings mostly to provide a broader context for understanding the WFTS risk posed by the larger buildings.

[3] The discussion here is focused on dwelling structures, i.e. all-residential buildings with one or two units, which are almost entirely conventional woodframe "house" construction. Mixed-use buildings with one or two units, which can be in any structure type, are discussed briefly above.

As shown in Table 1, Mill Valley has 4185 buildings with one or two residential units. Of these, most were coded as single family residential or duplex parcels in the source data, but 425 were identified through the multi-unit inventory.[4] Taking the era of original construction as a proxy for structure type and potential deficiency:[5]

- 621 dwellings (737 units) appear to have been built before the 1920s Bay Area building boom. These older structures almost certainly have unbraced woodframe cripple walls.

- About 70 percent of these dwellings – 2925 buildings with 3232 units – appear to have been built between 1920 and 1977 (roughly half before 1950 and half after). Some portion of these certainly have cripple walls, hillside, room-over-garage (ROG), split level, or other seismic vulnerabilities.

- The remaining 545 buildings with age data were built after 1977 and probably do not have unbraced cripple walls. Some portion, however, almost certainly have ROG, split level, or hillside vulnerabilities.

For many locales, a reasonable first order approximation of seismic risk might be made by assuming all of the first group, half of the second group, and none of the third group have a significant deficiency. Prorating to account for the small number of buildings that lack age data, this yields a sum of about 2300 at-risk units, or about a third of Mill Valley's overall housing stock.

However, because of the prevalence of hillside conditions in Mill Valley, I do not consider this a reliable estimate. To improve it would require a building-specific review of a representative sample, which could be complicated by Mill Valley's topography and limited online imagery, as discussed above. If the City were to do this additional study, I would recommend supplementing assessor's data with building permit data to attempt to quantify the age and extent of prior voluntary retrofits.

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[4] County assessor's records are on a parcel basis. Thus, in the source data for this inventory, multiple buildings on the same parcel are grouped together, with the unit count given as the total for all buildings. The record for a 4-unit parcel, for example, might represent a single building or a combination of single- and multi-unit buildings. The inventory process described in this memo resolved the source data into one building per record. In doing so, it identified additional one- and two-unit buildings. However, that resolution considered only parcels coded as 3 or more units, so as noted at Table 1, it is likely that some of the 560 buildings shown as duplexes are actually two single-family houses on the same lot. That distinction is ignored in the discussion here. See the text below on Producing the Database for more discussion of the source data and inventory process.

[5] The source data provides a year of original construction for most buildings. Together with my building-specific review of the multi-unit parcels, I estimated the era of construction for all but 94 of the 4185 dwellings. The source data also gives an "Effective Year" that suggests a substantial addition or renovation, presumably for tax assessment purposes. For about 1000 buildings, the Effective Year is at least 40 years later than the year of original construction; for about 500 buildings, the difference is more than 60 years. But the data itself gives no indication as to whether the presumed renovation work included any seismic or structural improvements.

Figure 1. Illustrative multi-unit residential buildings in Mill Valley
(Image source: Google maps.)

1a. 2-story, 12-unit. No WFTS; first and second story units align. All parking is outside the building.

1b. 3-story, 4-unit. WFTS: Long side open, to accommodate ground story parking.

1c. 3-story, 6-unit townhouse. No WFTS. Parking under deck looks like "long side open" WFTS but is outside the building and is structurally similar to an attached carport.

1d. 2-story, 4-unit townhouse. WFTS: Long side open to accommodate ground story parking.

1e. 3-story, 5-unit. WFTS: Hillside cripple wall. Tall crawl space under first floor to accommodate hillside site (note vent openings in wall).

1f. 2-story, 5-unit townhouse. WFTS: Hillside cripple wall. Tall crawl space under first floor to accommodate hillside site

Figure 2. WFTS buildings with obscured conditions counted in the maximum estimate only
(Image source: Google maps.)

2a. 2-story, 3-unit, sloped site. WFTS: Cripple wall assumed based on age of building and elevation of first floor relative to grade.

2b. 3-story, 4-unit, hillside site. WFTS: Hillside cripple wall assumed based on age of building and partial height retaining wall at right side.

2c. 3(?)-story, 6-unit, hillside site not visible from street. WFTS: Hillside cripple wall assumed based on similar buildings.

2d. 3-story, 4-unit building on rear of lot. WFTS: Open first story assumed based on partial visibility from street.

PRODUCING THE DATABASE

The primary source for all of the building and unit counts discussed in this memo was a flatfile database of 2021 Marin County Assessor's parcel records received from the City on January 31, 2022:

- MillValleyParceclZone_January 2021.xlsx [sic]: 46 fields, 5709 records

To supplement the data, I found online a one-page listing of the Marin County Assessor's Use Codes and their descriptions:

- https://www.marincounty.org/~/media/files/departments/ar/assessor/use-code-list.pdf

From the parcel records, I corrected some misaligned data, removed extraneous fields (especially those with owners' personal information), and reformatted the file. I then split the file into two for improved workability: one for dwellings, based on Use Code 10-13, and one for multi-unit parcels.

Working with the 1770 records of multi-unit parcels, I then took the following main steps to resolve common discrepancies and prepare the file for building-specific review. (All substantive changes to the source data are recorded on the file's Data History page.)

- Resolved 851 condominium parcel records (Use Code 14), leaving one building per record.
- Reviewed and deleted extraneous records with no relevant data.
- Added field labels for the building attributes of interest.
- Made a parcel-specific visual review of each record showing 3 or more "Living Units."
    - For parcels with multiple buildings, added records to maintain "one building per record."
    - For each building, added building specific data based on judgment.
        - In many cases, the source data and online imagery was supplemented with data and images from online real estate listings or the building's own website.
    - Reviewed and confirmed or corrected all records shown with 0 units due to tax exempt status and those with 0 units in areas with multi-unit residential zoning. As discussed above regarding mixed-use buildings, I did not do a detailed review of the 0-unit parcels in areas zoned for commercial use. It is possible, but unlikely, that these parcels contain a relatively small number of additional housing units not yet considered.
- Upon completion, moved 452 records for 1- and 2-unit buildings to the dwelling file.

In the dwelling file:

- Added, deleted, and reformatted the file to match the multi-unit file.
- Added 452 records for 1- and 2-unit buildings from the multi-unit file.
- Added information on era of construction.

With the main phase of multi-unit data entry complete, this memo is based on the following two files:

- Mill Valley Multiunit Inventory 220426.xlsx: 251 records, 28 fields
- Mill Valley Dwelling Inventory 220426.xlsx: 4390 records, 29 fields

The Multi-unit Inventory now contains building-specific information for each of 251 buildings in the following fields added to the source data:

- Era of construction, to bin the vetted "year built" data into groups
- Stories above grade, confirming or correcting the provided values
- Basement type, including crawl spaces and other foundation conditions
- Ground floor use(s), including residential, parking, storage, business, mercantile, etc.
- Upper floor uses(s), typically residential only
- Structure type, meaning the assumed structural material of the building's seismic force-resisting system, typically wood
- WFTS?, taking entries of Y, N, and U(nknown)
- Target type, including Long Side Open (LSO), Short Side Open (SSO), End bay parking, Open story, Cripple wall, Room over garage (ROG), and combinations
- Slope, to indicate the site grading as Flat, Sloped, Hillside, or Graded
- Plan shape, of the building, including Rect(angular), L, C, U, O, etc.
- Vertical irregularities in upper stories, including setbacks and split levels.

Certain database cells are color coded:

- Yellow
    - Estimated data, especially where no data was provided
    - Questionable or missing data in source records
- Light green
    - Questionable or missing data confirmed or sourced
    - Supplemental data or records added.

Phase or Task Note: Each Phase or Task is contingent on findings and conclusions from preceding work. Scope of subsequent tasks may be adjusted in accordance with Exhibit "B" paragraph 4.	**Expected End Date**
4. Cost-Sharing Assumptions: • City to provide background information and arrange a meeting with City staff regarding current rent adjustment policy. • City will rely on available data from other sources, with no new cost estimates or survey. • No new grant application. Deliverables: • Summary memo of expected compliance costs and cost-sharing policy options.	June 15, 2022
5. Legislation Assumptions: • City will take advantage of existing precedents from other jurisdictions to the extent feasible. Deliverables: • Presentations at one Council study session, one outreach meeting with stakeholders (to be arranged by City), and one Council hearing. • Council memo compiling and summarizing the background from previous phases. • Draft ordinance codifying the selected policy approach and program type.	July 31, 2022, subject to adjustment to suit Council schedule
6. Implementation Assumptions: • City will take advantage of existing precedents from other jurisdictions to the extent feasible. • City is responsible for actual implementation. • Work to be done during interim period between final approval of the Legislation and the effective date of the ordinance. Deliverables: • One presentation to stakeholders and project participants (to be arranged by City). • Compliance forms to match the requirements cited in the Legislation. • Technical bulletin providing interpretations of the broad engineering criteria cited in the Legislation.	September 30, 2022, subject to adjustment to suit the ordinance effective date