CITY AND BOROUGH OF JUNEAU
ALASKA'S CAPITAL CITY
COMMUNITY DEVELOPMENT

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155 S. Seward Street • Juneau, AK 99801

March 6, 2023

MEMO

To: **Mandy Cole, Chair Planning Commission Committee of the Whole**

CC: **Rorie Watt, City Manager**

From: **Jill Maclean, Director, AICP**

RE: **Severe Avalanche and Severe Landslide Area Maps and Draft Ordinance**

Background
The Planning Commission Committee of the Whole (COW) has been asked to review and provide guidance on draft ordinance language and a set of avalanche and landslide area maps that would replace the adopted 1987 maps for downtown Juneau that were created in the 1970's.

The public process leading to this draft ordinance and maps has been extensive. In 2018, CBJ received a FEMA grant to hire a contractor, Tetra Tech, Inc. to conduct a hazard assessment that included technical memos and the creation of new maps. Throughout the assessment, public outreach, public comment, and numerous discussions have been held at Planning Commission and Assembly meetings. This information is available on the CDD Landslide and Avalanche Assessment webpage.

Included in your packet is a memo from the most recent Assembly meeting on the topic at the November 7, 2022 Assembly Committee of the Whole Meeting.

Recommendation
Staff recommends the COW make a motion to forward the Severe Avalanche and Severe Landslide Area Maps and draft Ordinance to the full Planning Commission for a public hearing to take public testimony and make a recommendation to the Assembly.

Attachments
Attachment A Severe Avalanche and Severe Landslide Area Draft Ordinance
Attachment B Severe Avalanche and Severe Landslide Area Maps
Attachment C City Manager Hazard Mapping Memo November 2022

Presented by: The Manager
Presented: 2023
Drafted by:

ORDINANCE OF THE CITY AND BOROUGH OF JUNEAU, ALASKA

Serial No. 2023 XX

An Ordinance Amending the code related to avalanche and landslide areas and replacing the avalanche and landslide areas maps

WHEREAS, and…

Commented [JM1]: To be added at time of finalizing draft ordinance

Reminder to check "and" and "or" throughout before final draft

BE IT ENACTED BY THE ASSEMBLY OF THE CITY AND BOROUGH OF JUNEAU, ALASKA:

Section 1. Classification. This ordinance is of a general and permanent nature and shall become a part of the City and Borough of Juneau Municipal Code.

Section 2. Amendment of Section. CBJC49.70.300 **Avalanche and landslide areas** is amended to read:

(a) *Generally*.

(1) Development in mapped avalanche and landslide areas shall minimize the risk of loss of life or property due to landslides and avalanches.

(2) Boundaries of severe avalanche areas will be as shown on the avalanche area maps dated April 27, 2022, as the same may be amended from time to time by the assembly by ordinance.

Commented [JM2]: Confirm date prior to final ordinance if revised

(3) Boundaries of severe landslide areas will be as shown on the landslide area map dated April 27, 2022, as the same may be amended from time to time by the assembly by ordinance.

Commented [JM3]: Confirm date prior to final ordinance if revised

(b) *Severe avalanche areas*

(1) Notwithstanding any other provision, subdivision other than a boundary line relocation, a lot line adjustment, or a lot consolidation, or development greater than a single-family dwelling within severe avalanche areas shall require a conditional use permit.

(2) Notwithstanding any other provision, development greater than a single-family dwelling, within the severe avalanche areas shall require a conditional use permit with site specific engineering for the following: peak drainage, special foundation or high back wall engineering, and debris flow diversion mechanisms. Attached and detached accessory dwelling units are considered development greater than a single-family dwelling, and do not count toward density.

(3) No subdivision shall be approved that creates a lot lacking a sufficient buildable site outside a severe avalanche area without the need for a variance, unless it is a platted as a Public Use Lot (49.15.422).

(3) Owners shall provide written notice to potential buyers or renters that the property is located in a severe avalanche area prior to sale or rental of the property.

(4) If a developer disagrees with the boundaries shown on the severe avalanche map, the developer may seek departmental relocation of the boundaries by submitting site specific study prepared by a civil engineer licensed in the State of Alaska or a licensed geotechnical engineer. Such studies shall include detailed analyses of topography, vegetation, potential snow accumulation, and other factors. The results should indicate actual hazard area boundaries and potential debris flow direction, time, distance and mass. If, in the opinion of the Director of Engineering & Public Works, the studies

Commented [JM4]: Do we want to add "with current errors and omissions liability insurance"

Likely approx. $1M; if yes, contact CBJ Risk Mngt - standard policy

clearly establish that the map boundaries are inaccurate and the proposed development is outside a severe avalanche area, the department shall proceed accordingly.

(5) The commission may require mitigating measures certified as effective by a civil engineer licensed in the State of Alaska or a licensed geotechnical engineer for development in severe avalanche areas. Such measures may include dissipating structures or dams, special structural engineering, or other techniques designed for the site. Mitigating measures may also include reduction in the proposed density, occupancy, or development.

(c) *Severe landslide areas*.

(1) Notwithstanding any other provision, no subdivision other than a boundary line relocation, a lot line adjustment, or a lot consolidation, shall be approved in a severe landslide area. Applications for all other subdivision types shall not be accepted for filing or shall be rejected by the director.

(2) Notwithstanding any other provision, no development or any part of a development, which is within a severe landslide areas shall, by the addition of bedrooms or accessory dwelling units, conversions of buildings, or otherwise increase the density of the lot or occupancy of the building; provided, that a single-family dwelling may be constructed on a vacant lot. Accessory dwelling units are not permissible on a lot in a severe landslide area.

(3) Notwithstanding any other provision, development greater than a single-family dwelling within the severe landslide areas shall require a conditional use permit with site specific engineering for the following: peak drainage, special foundation or high back wall

engineering, and debris flow diversion mechanisms. Attached and detached accessory dwelling units are considered development greater than a single-family dwelling, and do not count toward density.

(4) Owners and developers shall provide written notice to potential buyers or renters that the property is located in a severe landslide area.

(d) *Warning and disclaimer of liability.* Avalanches and landslides may occur outside hazard areas in excess of engineering expectations. The location and severity of the event may be increased by manmade or natural causes. This article does not imply that land outside of designated hazard areas, or uses permitted within such areas, will be free from danger or damage. This article shall not create liability on the part of the City and Borough of Juneau or any officer or employee thereof for any damages that result from reliance of this article or any administrative decision lawfully made under this article.

Section 4. Amendment of Section. CBJC 19.04.R301.9 Geophysical hazards is amended to read:

"*301.9 Geophysical hazards.* In Moderate and Severe geophysical hazard zones as shown in "Geophysical Hazards Investigation, Juneau, Alaska" dated 10/72 and on the "Severe Avalanche and Landslide Area Maps", ~~both adopted by ordinance serial no. 87-49,~~ adopted _____ _____ 2023 or when the building official determines that development is proposed in an area similar in nature to those studied in the above referenced documents, and is located outside of the study area, an engineered structural analysis shall be submitted with the permit application. The building official may waive this requirement upon presentation of more specific studies stamped by a civil engineer licensed in the State of Alaska or a licensed

geotechnical engineer showing the proposed site is not likely to be affected by geophysical hazards."

Section 5. Amendment of Section. Hillside Development CBJ 49.70.210(a)(4) is amended to read:

Any hazard area identified on the avalanche and landslide area maps dated ~~September 9, 1987,~~ April 27, 2022 ~~consisting of sheets 1—8~~, as the same may be amended from time to time by the assembly by ordinance or any other areas determined to be susceptible to geophysical hazards.

Commented [JM5]: Confirm date prior to final draft

Section 6. Effective Date. This ordinance shall be effective 30 days after its adoption.

Adopted this _____ day of _____, 2023.

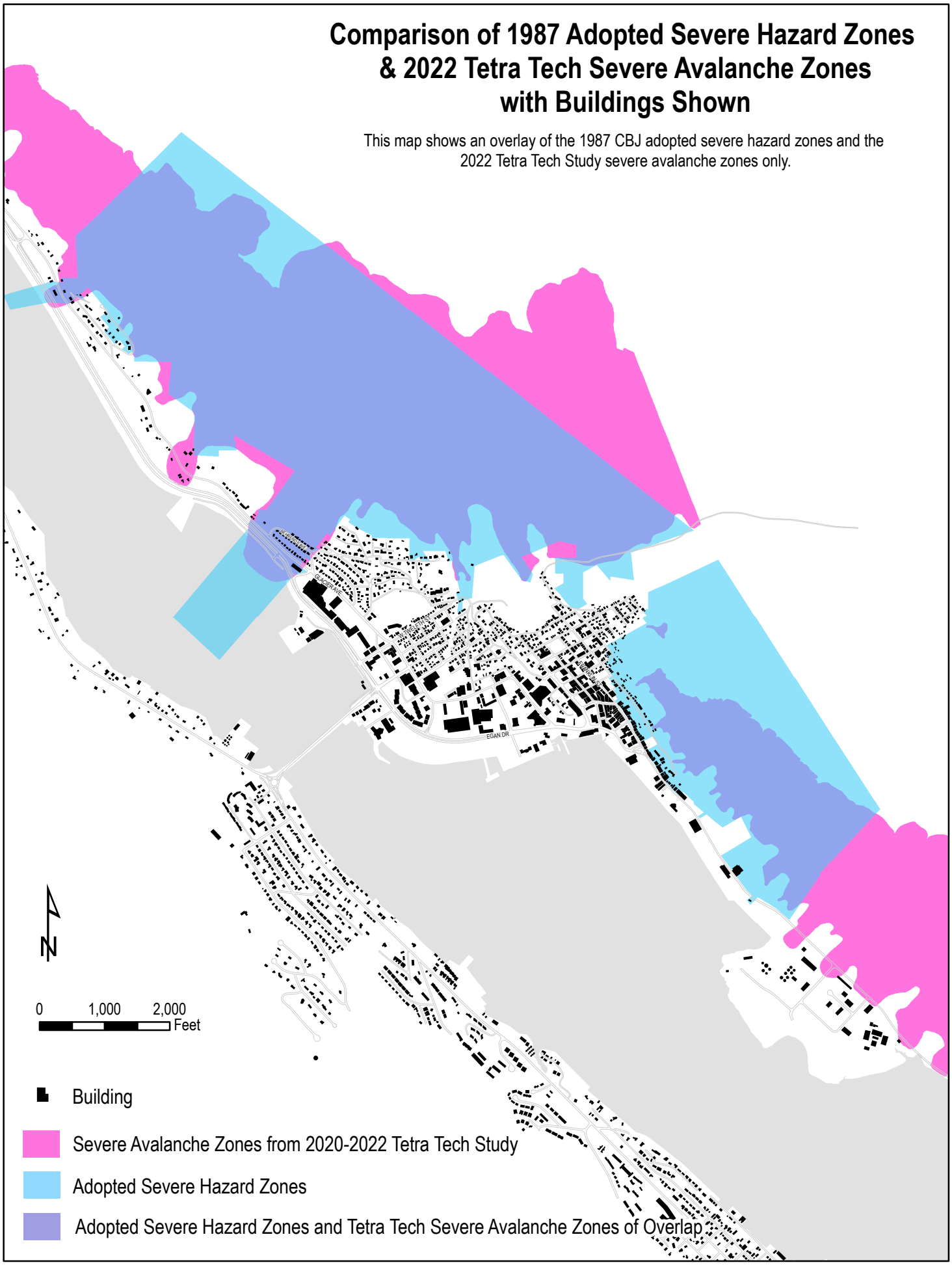
_____
Beth A. Weldon, Mayor

Attest:

_____
Elizabeth J. McEwen, Municipal Clerk

Comparison of 1987 Adopted Severe Hazard Zones & 2022 Tetra Tech Severe Avalanche Zones with Buildings Shown

This map shows an overlay of the 1987 CBJ adopted severe hazard zones and the 2022 Tetra Tech Study severe avalanche zones only.

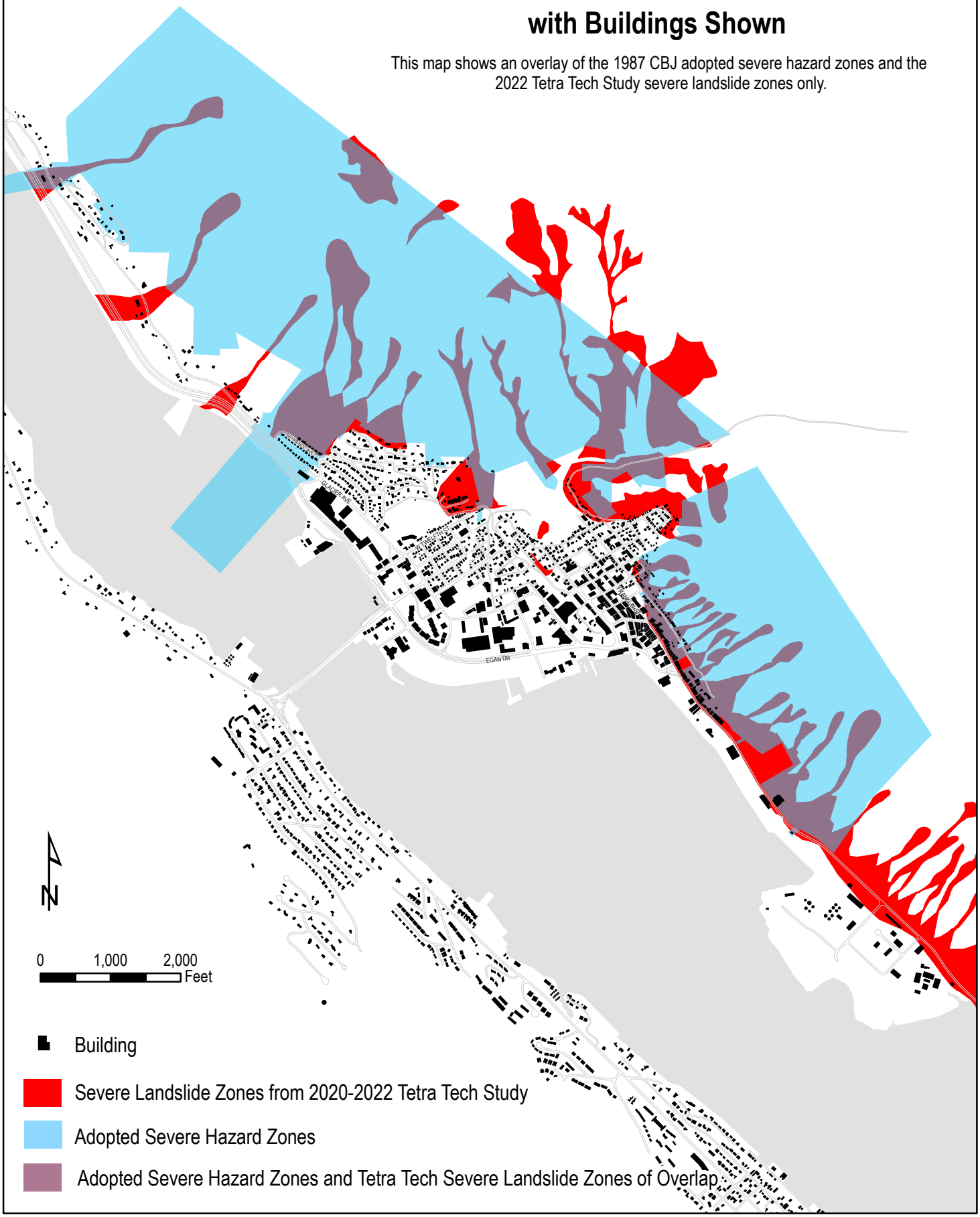


ArcMap source: P:\quinn\Projects\CDD\Hazard Assessment Project\affected_props_analysis4.mxd

Map 3: Severe avalanche with buildings

Comparison of 1987 Adopted Severe Hazard Zones & 2022 Tetra Tech Severe Landslide Zones with Buildings Shown

This map shows an overlay of the 1987 CBJ adopted severe hazard zones and the 2022 Tetra Tech Study severe landslide zones only.



ArcMap source: P:\quinn\Projects\CDD\Hazard Assessment Project\affected_props_analysis4.mxd

Map 5: Severe landslide with buildings

ASSEMBLY COMMITTEE OF THE WHOLE AGENDA

November 07, 2022 at 6:00 PM

Assembly Chambers/Zoom Webinar/YouTube Livestream

Assembly Committee of the Whole Worksession (No Public Testimony Taken)
Immediately following the Special Assembly Meeting 2022-25
https://juneau.zoom.us/j/95424544691 or call 1-253-215-8782 Webinar ID: 954 2454 4691

A. CALL TO ORDER

B. LAND ACKNOWLEDGEMENT

C. ROLL CALL

D. APPROVAL OF AGENDA

E. AGENDA TOPICS

1. **Huna Totem Subport Dock Update**
2. **Ordinance 2022-21** An Ordinance Related to Property Tax Appeals and Codifying the Board of Equalization Rules of Procedure.

   This ordinance would amend the Juneau Board of Equalization's rules of procedure, which govern property tax appeals. The substance of this ordinance comes from three sources: the Anchorage Board of Equalization rules, the existing Juneau Board of Equalization rules, and changes to state law since the existing Juneau property tax appeal code was adopted in the 1970s.

   The Juneau Board of Equalization reviewed this ordinance on September 20, 2022. The Assembly Committee of the Whole reviewed this ordinance on September 26, 2022.
3. **Hazard Mapping**
4. **Parks and Recreation Board Consolidation**

F. STAFF REPORTS

G. SUPPLEMENTAL MATERIALS

5. **RED FOLDER: Huna Totem Presentation - Additional Slide #21**
6. **RED FOLDER-November 4, 2022 Juneau Chamber of Commerce Letter re: Board of Equalization Rules**
7. **RED FOLDER: Additional Slides Hazard Mapping**

H. ADJOURNMENT

ADA accommodations available upon request: Please contact the Clerk's office 36 hours prior to any meeting so arrangements can be made for closed captioning or sign language interpreter services depending on the meeting format. The Clerk's office telephone number is 586-5278, TDD 586-5351, e-mail: city.clerk@juneau.org.

CITY AND BOROUGH OF JUNEAU

Engineering and Public Works Department

155 South Seward Street

Juneau, Alaska 99801

Telephone: 586-0800 Facsimile: 586- 4565

MEMORANDUM

DATE: **November 4, 2022**

TO: **Deputy Mayor Gladziszewski**

FROM: **Katie Koester, Engineering and Public Works Director**

SUBJECT: **Gastineau Avenue Event Summary**

The purpose of this memo is to provide the Assembly with a summary of the response to the Gastineau Avenue event on September 26, 2022, including context on the nature of the event and contributing factors. The memo and associated images were compiled from the field observations, notes, and narratives of Mitch McDonald, Engineering Geologist with Alaska Department of Transportation and Public Facilities, Mort Larsen with Landslide Hazards Program Manager with the Division of Geological and Geophysical Surveys, Richard Cartesen with University of Alaska and Aaron Brakel with Southeast Alaska Conservation Council. Immense gratitude for their personal and professional contributions.

Event Response

9.26.22: At 6:10PM on Monday, September 26th a channelized landslide consisting predominantly of tree debris on Gastineau Avenue damaged three homes, took out power to downtown Juneau and cut off road access. Capital City Fire and Rescue (CCFR) responded, evacuating homes in the immediate area. Engineering and Public Works Streets responded and blocked off the street. Due to poor lighting and heavy rain, site safety could not be adequately addressed that evening. CBJ did not stand up a shelter, but did provide sheltering for impacted property owners at a downtown hotel.

9.27.22: CBJ was fortunate to have the assistance of state geologists to assess the site the following morning. Together with CCFR staff and Juneau Mountain Rescue, they assessed the slide and identified several hazard trees that had to be removed upslope before crews could safely begin working in the area. CBJ contracted with Admiralty Construction to remove debris on Gastineau Ave. with oversight from CBJ Streets and Engineering to ensure the structural stability of the debris pile as pieces were removed.

9.28.22: Debris was cleared from the CBJ right-of-way and Gastineau Avenue was opened back up to traffic.

Drone footage from Pat Dryer, ADOT

Nature of the Event

Geologists have identified this event as a shallow channelized landslide that scoured down to bedrock. This slide originated at approximately 600 feet and traveled down the mountainside, leaving a roughly 30 foot wide U-shaped channel that scoured relatively shallow surface soils until water exposed the underlying bedrock channel. It is not known if the slide was initiated by a tree toppling in the high gale force winds or if water erosion initiated the event by undercutting root systems.

While the debris pile at the toe of the slope consisted of some saturated silty soil and bedrock fragments, large woody debris (alder and spruce) was the dominant feature. Out of the 15 truckloads of woody debris hauled from the area to clear Gastineau Ave., there was soil debris reported in only one of the truckloads. The water flowing through the debris pile had very low turbidity, suggesting very little soil was associated with the event. Damage to the structures (3) and vehicles (2) appears to have been caused by a single large spruce tree, 3-4 feet in diameter. Observations from Discovery Southeast date this tree to 1770.

Contributing Factors

The terrain in this area is extremely steep with a thin layer of soil and organic materials over the bedrock. This creates a shallow root system for the alder and spruce trees that dominate the slope. By September 26, 2022, Juneau had experienced just shy of twice the average September rainfall (According to the Juneau Airport weather station, average rainfall in September is 6.7 inches and rainfall on 9.26.22 had already reached 11.61 inches.). Notably, rainfall had been particularly intense over the six days preceding the event. In addition to the rainfall that contributed to this event, Juneau has been experiencing an increasing amount of heavy rainfall over the past several decades. The scatterplot below tracks the number of days per year, since 1944, where we have seen more than 1 inch of rain at the Juneau Airport. A clear upward trend is noted. A rapid shift in the direction of the wind recorded at the Mount Roberts Tram Terminal weather station could have also contributed to the event.

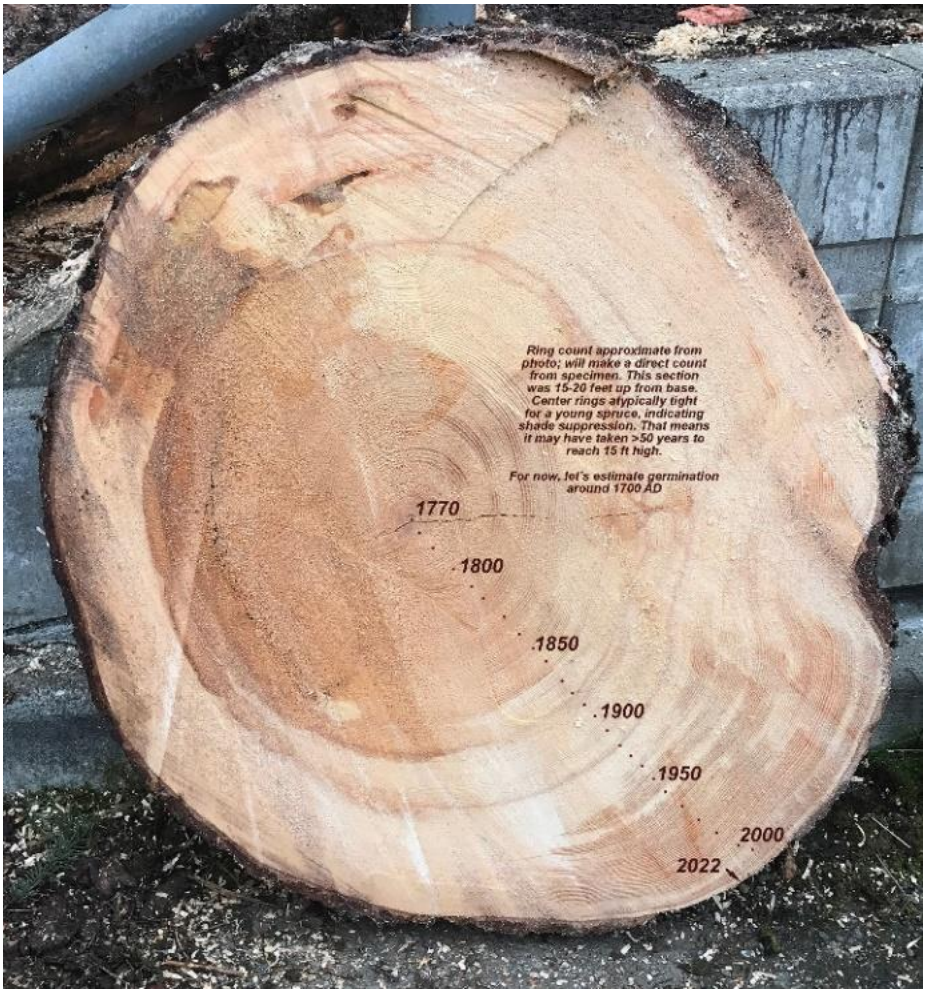
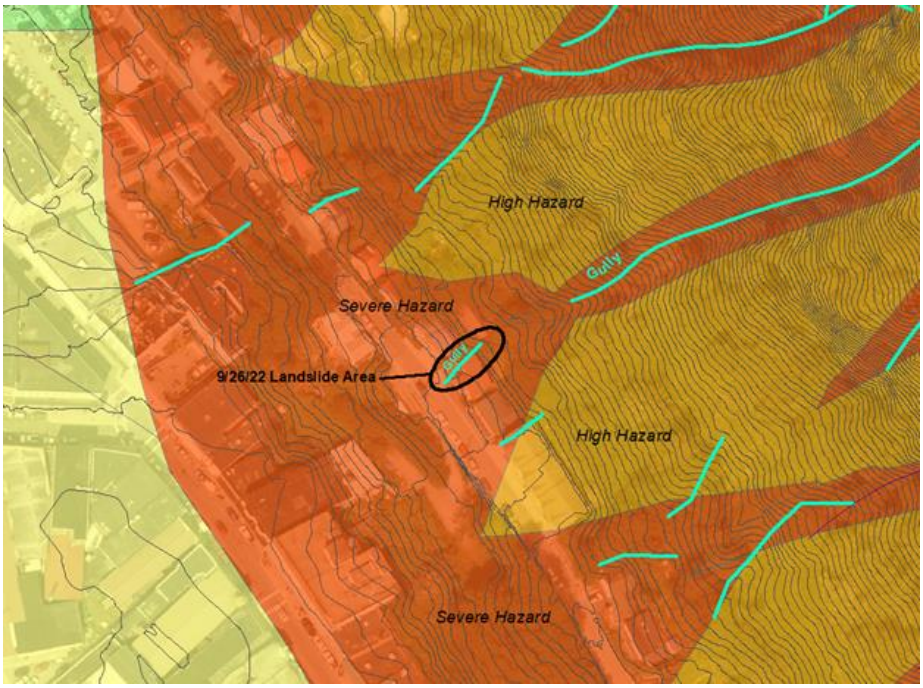


Photo Credit: Richard Carstensen, University of Alaska and Discovery Southeast and Aaron Brakel, Southeast Alaska Conservation Council

Graphic and data credit: Juneau National Weather Service, NOAA



Graphic from Community Development Department

City and Borough of Juneau
City & Borough Manager's Office
155 South Seward Street
Juneau, Alaska 99801
Telephone: 586-5240| Facsimile: 586-5385

TO: Deputy Mayor Gladziszewski and Assembly Committee of the Whole

FROM: Rorie Watt, City Manager DATE: November 3, 2022

RE: Hazard Mapping Update/Recommendation

From a municipal policy perspective, hazard mapping is very complicated. While we all acknowledge that the existing mapping and code is weak and antiquated, several attempts to update the code and maps have failed. In order to effect an update to the code, the Assembly should be prepared to spend quality time on the topic. While draft recommendations are included in this memo, no action is requested tonight. I suggest that the Assembly digest the information in this memo, read a lot of the companion information and take the topic up again at the 11/28 Committee of the Whole.

Changes to hazard maps and implementing code will be codified in Title 49 and all changes to this chapter are required by code to go to the Planning Commission for work, public input and recommendation. Any direction the Assembly gives will be a point of departure for staff to begin that work with the Commission.

As this is an enormous topic, I have included quite a few endnotes to help frame the topic.

Many documents (including the new maps) are available on the Community Development Department webpage under special projects, linked here:

https://juneau.org/community-development/special-projects/landslide-avalanche-assessment

The existing adopted hazard maps from 1987 are antiquated and the companion Code (49.70.300) does not accommodate the necessary subtly to allow for best answers for development in or near hazard areas. Existing Mapping and Code generally guides and limits development as follows:

Purpose - Minimize the risk of loss of life or property due to landslides and avalanches

Mapping - Two zones: Moderate and Severe (same categories for both avalanche and landslide)
Restrictions
- *every action except a single family home requires a Conditional Use Permit*
- *developer may change map boundaries with engineering analysis*
- *Planning Commission may require mitigating measures*
- *severe areas may not increase density or construct more than a single family home*

The new mapping has more hazard categories (and we have not developed companion code):

Mapping Categories-
Landslide - Four zones: Moderate, High, Severe, Severe w/ Bedrock failure
Avalanche - Two zones: Moderate, Severe
- *Estimated impact pressure threshold differentiating the zones*
- *Impact pressure can be used to inform building requirements*

Uncomplicated policy implementations are at the ends of the spectrum – either doing nothing, or outright prohibiting development is the least complex. Anything decision in between is significantly more complex. Partially limiting property owners from developing requires very careful rationale to allow justifications to

limit development rights – in situations that are all subtly different. New companion code could accommodate existing building renovation/expansion proposals while also regulating vacant land. This is made more complicated by disclaimers in the study that indicate that the maps are not to be used for site specific decisions. At a high cost, the consultant has indicated that additional site specific analysis could cost between $250K and $1M per hazard path.

Because landslide mapping can never be perfect, and if development is to be restricted, I recommend that the code should continue to allow property owners an avenue to change map boundaries. There is a less strong case that we should allow changes to avalanche mapping. The avalanche mapping has been historically consistent, yet allowing an avenue for change/updating does seem reasonable. I have to admit to having mixed feelings about this recommendation.

Landslides are more complicated than avalanches (or flood plains) from a policy perspective, they are less predictable and can take more forms than avalanches. We can (and do) measure and analyze snow packs and make risk predictions throughout the winter and an occupant that is in danger of an avalanche could temporarily vacate a structure. Similarly, a person can also vacate a structure during a high water event when flooding is predicted or when it is occurring.

Landslides can occur in several forms – large mass wasting events (1921, 1936), episodic gully washers and September's large tree event are examples. Unlike avalanches, landslides are not at all easy to predict. Some communities have adopted slope or weather and soil monitoring approaches, but those do not seem like obviously good strategies for Juneau. Monitoring would not have predicted the tree event of 9/26/22 or the episodic gully washing events that occur from time to time in the main drainage channels (organic debris builds up over time, high rainfall events trigger relatively minor and localized slide events, scouring the drainage channels to bedrock). Peak hour rainfall monitoring may be a better landslide risk indicator (but is unlikely to be a flawless metric).

Code Purpose Draft Recommendation:
The existing purpose statement in 49.70.300 appears to be appropriate. Minimizing loss of life and property is appropriate. Unfortunately, eliminating loss of life and property is not possible. I recommend that we maintain this same purpose.

Avalanches:
The new and existing avalanche maps are similar, and the existing code appears to strike a reasonable balance between information, restriction and prohibition. The maps are clear and believable to the public (avalanche activity has been observed in our lifetimes and in documented memory), and enforce an uncomplicated restriction (nothing greater than a single family home in a severe avalanche hazard area). The draft report also recommends tangible mitigating standards, namely construction that has to resist a certain force.

> ***Avalanche Mapping & Code Draft Recommendation:***
> I recommend that the Assembly request a draft Ordinance that would adopt the new avalanche maps and contain companion legislation that mirror's the current code. The information on the estimated impact pressure should be included as an advisory note in the draft legislation. The Draft would be sent to the Commission for review.

Landslides:
Landslides have been reported in recent years in several other Southeast communities, some with fatal results. People should reasonably ask – does Juneau face similar risks? Are our citizens at risk of fatality if development or occupancy proceeds in our hazard zones or in other areas of Juneau? The answers to these questions will be necessarily dissatisfying – we can't perfectly know. We can predict and estimate, but we can't know the real actuarial risk. We can, however, make reasonable decisions based on the available information that we have.

In comparison to the adopted maps, the new mapping is more assertive in where it shows landslide zones. Whether the Assembly buys into this newly shown increased risk is uncertain. Whether the Assembly feels that restricting development is sound public policy is also uncertain. In weighing the consideration of the TGH project or the pre-development loan to the Gastineau Lodges project, both the Planning Commission and the Assembly seem inclined to support development projects and to let private applicants sort out the complicated details of hazard zone development.

Landslide Mapping & Code Recommendation:

I recommend that we adopt the maps as the best updated mapping available and develop a draft Ordinance for Commission review that would propose to regulate development as follows:

No restrictions in Low, Moderate or High Hazard Areas
Single Family Residency permissible in Severe Hazard Areas
Development Density Greater than Single Family Requires a Conditional Use Permit, with the developer proposing special engineering for the following:
Peak Drainage
Special Foundation and/or High back wall Engineering
Debris Flow diversion mechanisms
Possible Adjustments to Map Boundaries
Additionally, the developer/owner should be required to notify hazard details to renters
Consider requiring property sellers to disclose hazard designation to potential buyers

Endnotes:

Skagway:
In the last year, the White Pass cruise ship dock has been damaged by rock landslides and private consultants have been assessing the situation. The geological composition of that cliff side is different than downtown Juneau. The exposed slope in Skagway shows fractured and over steepened cliff bands; unconsolidated boulders are poised for descent some 950' down to their cruise ship dock. It is not immediately analogous to our situation and the immediate and severe nature of the risk is evident to a lay person. Skagway is considering some expensive short term measures than are not at all likely to make the north cruise dock safe for use.

Haines:
The tragic Haines slide of 12/2/2020 occurred on a forested slope, gentler in grade than Mount Roberts. It actually looks more similar to other Juneau slopes (including Douglas Island) than it does to our downtown hazard areas. It is a good reminder that any mountainous slope can be unstable. Soil depths to bedrock appear to be much greater than those on Mount Roberts which resulted in the availability of much more soils debris for the landslide.

Sitka:
Sitka experienced a fatal landslide on 8/18/2015**.** Sitka's soil strata is very different than much of southeast, a layer of tephra soils (explosively erupted ash from the Mount Edgecumbe Volcano) underlay surface soils in the region. These soils have different soil mechanics resulting in different slope stability considerations. Soil depths to bedrock appears to be greater than those found on Mount Roberts. With Federal NSF funding, the non-profit Sitka Science Center maintains a Sitka landslide risk dashboard. I do not believe that the City and Borough of Sitka endorses this website's risk analysis. An interesting link to a video about correlation between rainfall and landslide risk is also available (time stamp at about 18:30 for discussion on correlation of peak rainfall and risk elevation). The problem with this approach is that people interested in understanding risk may get a false sense of security – landslides can and will occur outside of peak rainfall events.

Juneau/Mount Roberts:
Juneau had two large slide events on Mount Roberts in the earlier part of the 20th century. Both slides appear connected to the AJ Mine's rail road development and its practice of side dumping rock on the steep slopes above town for the construction of a rail road that ran side hill above town. Informing slope stability, the historic mill site ruins appear unchanged since they were constructed some 100 years ago. Several mine penetrations readily offer inspection of Mount Robert's bed rock which appears to be very stable. These mine tunnels provide limited but very valuable geotechnical information.

CBJ has cleaned up several smaller mudslides on Gastineau Avenue in the last 20 years. Several drai channels have been episodically active and we should expect them to continue to be periodically active. When these channels have scouring events, the underlying bedrock is typically exposed and appears to be stable.

CBJ's significantly reconstructed Gastineau Avenue in 2001. Those project improvements are mitigating factors for slope hazard analyses for properties that are downhill of the road. Substantial geotechnical engineering including soil stabilization, retaining walls (including anchoring) and water management improvements were constructed as part of that project.

Soil depths in the drainage channels on Mount Roberts are observable in many locations and are shallow, resulting the availability of less soil debris for landslide events.

Climate Change:
As measured at the Juneau Airport, Juneau has seen a rough doubling in the last 20 years of days with more than one inch of rain from the historical averages. From 1944 – 1990 we had an average of about 5-8 days per year with greater than one inch of rain and from 2000-2020 about 10-15 days per year. There are many ways to measure climate changes (this one comes with a warning about a smallish sample size) but peak rainfall events appear to be increasing - which is very consistent with many climate change predictions.

Private Updating of Hazard Maps:
Given the nature of our hazard maps (a broad overview, not property specific) it makes sense to allow applicants and property owners a process to update mapping. In theory this sounds reasonable, but in practice it is actually quite challenging for several reasons. First, private applicants don't have large financial resources that will likely result in more detail than CBJ's FEMA funded mapping effort. Second, private engineers and geologists who have expertise in hazard zones have little to gain by participating in individual site selections on reduced budgets. The liability is simply too great and the applicant's ability to pay for a detailed analysis is very limited. Private engineers with economic resources to protect are going to be naturally conservative.

In making the decision on whether to allow a path for property owners to update the hazard maps, the Assembly has to balance several issues. First, global hazard mapping is an effort to broadly help the community, while the ability to adjust maps would allow individual owners to represent their financial interests, the interests of specific properties. Second, it is unlikely that private proposals to update will have similar mapping quality than the new maps.

Statistics & Probability:
Any policies about hazard zone regulation are inextricably bound to the likelihood that events occur within a named period of years. The avalanche efforts are tied to a 30 year concept that is derived from climate and event data. Flood mapping is typically tied to 100 or 30 year event probabilities. Like avalanche risk analysis, flood mapping is heavily reliant on measurable rainfall data, topography and records of historical events. Landslide or mass wasting probability is much more difficult to predict. The new landslide mapping is not linked to event probabilities. Some discussion of probability was included in the draft report and deleted by the consultant in the final report; the consultant was unwilling to tie their work to event probability estimates.

There are about 30 mapped severe landslide hazard chutes between about 2nd Street and the Little Rock Dump. The consultant has generally mapped the severe hazard exposure areas to the waterside of Franklin Street/Thane Road. When discussing probability of new code restrictions, I suggested to the Assembly that we not try to regulate hazards that are not predicted to occur within a 50 year time frame, the Assembly preferred a more conservative approach of not regulating events that are not predicted to occur within a 100 year timeframe.

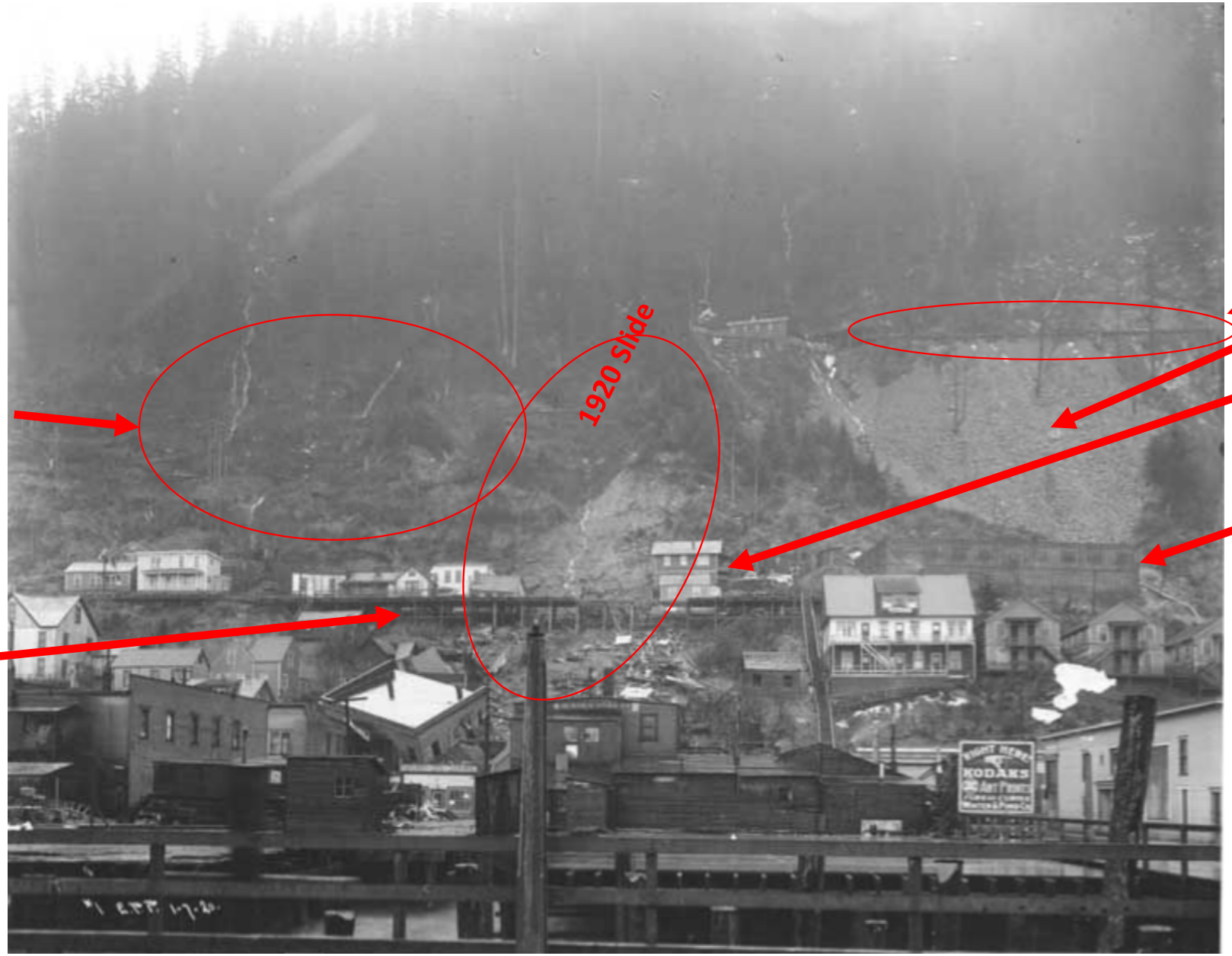
Doing the Math:
Statistically, a landslide path with a 100 year event probability has a 63% chance of occurring in any given 100 year period (or a 37% chance of NOT occurring). We have 30 mapped landslide paths and more than 100 years of data and two mine railroad related events that caused debris flows to reach South Franklin. The chance of All of these mapped paths having a 100 year event probability and ALL NOT having a non-made made debris slide reach South Franklin in ANY of these paths in a 100 year period is something like one millionth of a percent.

The simple math tells us that these mapped severe areas are not all likely to reach South Franklin Street as shown on the maps. Is it possible? Yes, of course. But it is more likely to be on some multi-100 year likelihood. Maybe we'll be unlucky enough to see a 500 or 1,000 year event in our lifetimes, but most probably not.

Downed Trees:
Geologists consider the September event that damaged homes on Gastineau Avenue to be a landslide event. Another perspective is that the event very well may have been initiated by high winds which blew down a 300+

year old tree and it was this tree and associated woody debris that caused damage to the homes. Th distinction is likely significant for homeowners and their insurance companies. While there was rainfall and soil erosion, the causative factor in the home damage was from trees that fell and mobilized at high velocity down the hillside.

To my knowledge, we do not have historical knowledge of events like this one. There are many downed and dead trees on the hillside, yet they have not mobilized in storm events. Notably, AEL&P performs maintenance on the power line corridor that is above the roads. They cut down and trim trees that are potentially hazardous to the aerial power lines. These downed trees are in the power line corridor, slowly decomposing. It seems very strange and unusual to have 300ish year old tree fall and take a 600-700 toboggan ride, root wad first. Speaking for myself, it had not occurred to me that it would be possible, I would have assumed that falling trees would get hung up on other trees.



Attachment C- City Manager Hazard Mapping Memo November 2022

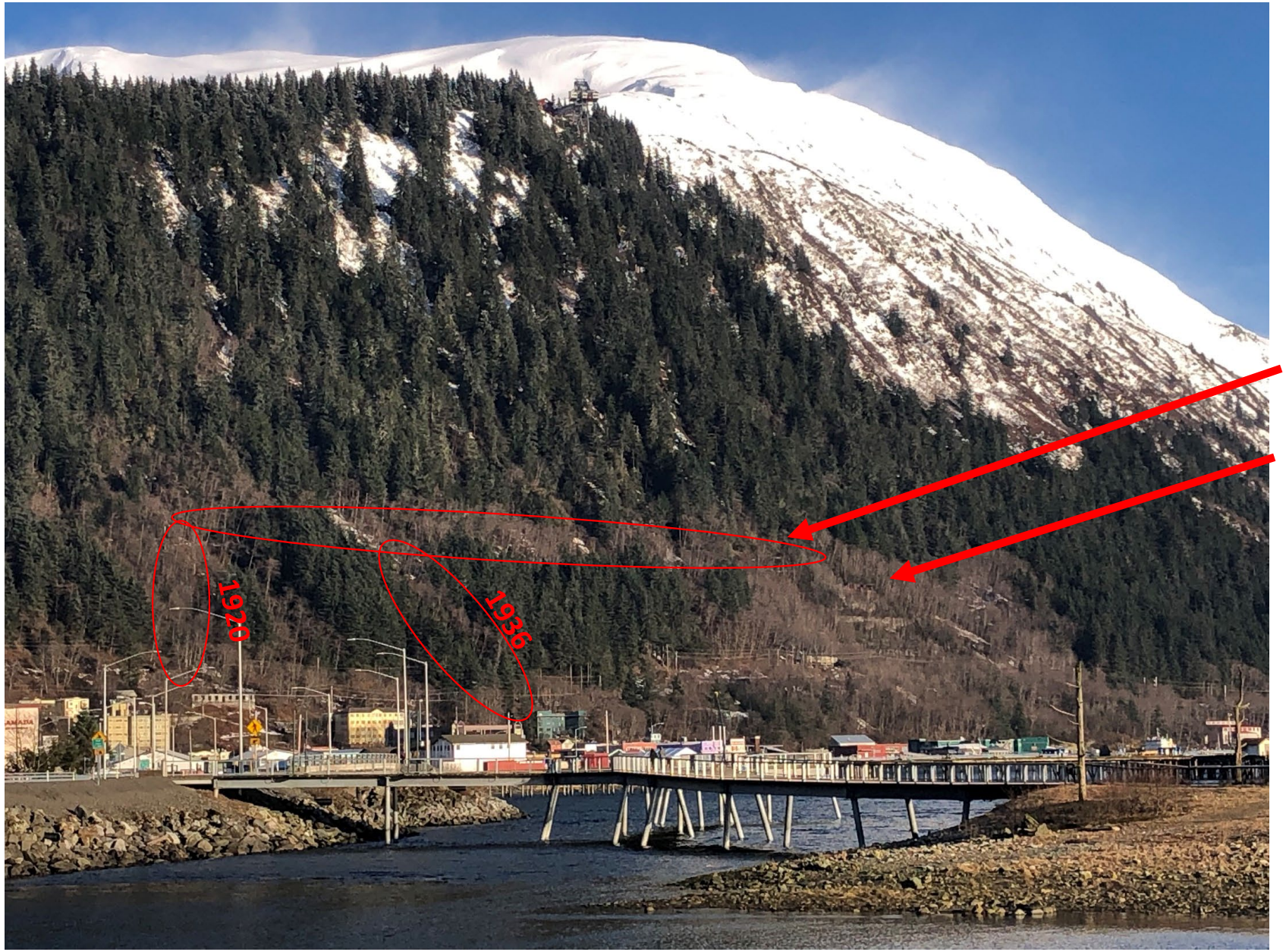
Alaska State Library - Historical Collections

265 & 269 Gas Ave.

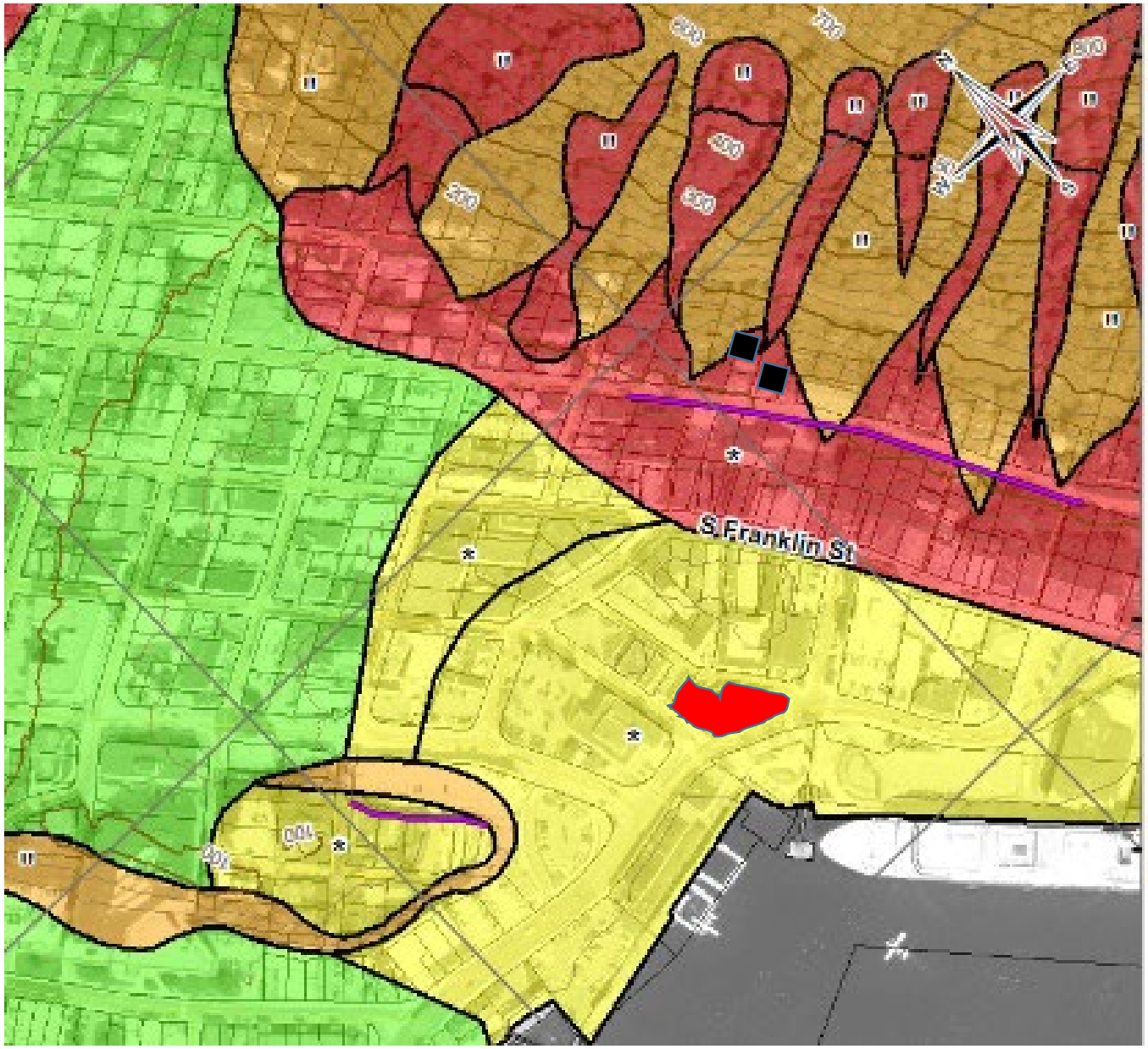
Historic Foundation

Significant drainage & retaining walls by CBJ ~2005

Attachment C- City Manager Hazard Mapping Memo November 2022



Attachment C- City Manager Hazard Mapping Memo November 2022



Location of Interest

Study Area

Deep-Seated Bedrock Slide

Engineered Slope[1]

Landslide Hazard

(For Hazard Designation Definitions Refer to Table 1.4 and the Glossary of Terms in the Report)

Low

Moderate

High

Severe

Severe if Deep-Seated Bedrock Slide Fails

" Initiation Zone

* Runout Zone

+ Potential Initiation Zone for Deep-Seated Bedrock Slide

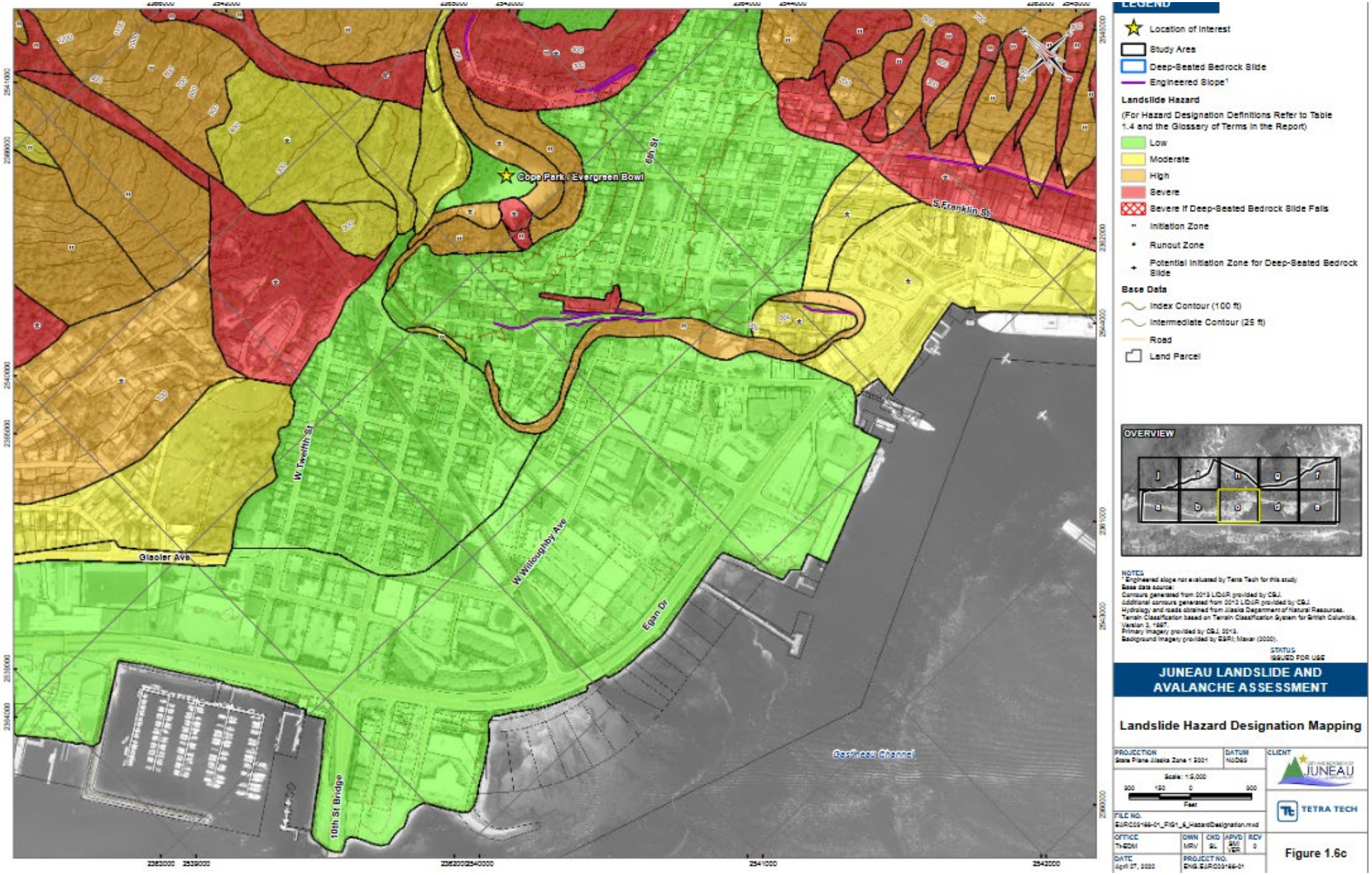
Base Data

Index Contour (100 ft)

Intermediate Contour (25 ft)

Road

Land Parcel


Cope Park / Evergreen Bowl
6th St
S Franklin St
W Twelfth St
Glacier Ave
W Willoughby Ave
Egan Dr
Gastineau Channel
10th St Bridge
LEGEND
Location of Interest
Study Area
Deep-Seated Bedrock Slide
Engineered Slope*
Landslide Hazard
(For Hazard Designation Definitions Refer to Table 1.4 and the Glossary of Terms in the Report)
Low
Moderate
High
Severe
Severe if Deep-Seated Bedrock Slide Fails
Initiation Zone
Runout Zone
Potential Initiation Zone for Deep-Seated Bedrock Slide
Base Data
Index Contour (100 ft)
Intermediate Contour (25 ft)
Road
Land Parcel
OVERVIEW
NOTES
* Engineered slope not evaluated by Terra Tech for this study
Base data source:
Contours generated from 2013 LiDAR provided by CBJ.
Additional contours generated from 2013 LiDAR provided by CBJ.
Hydrology and roads obtained from Alaska Department of Natural Resources.
Terrain Classification based on Terrain Classification System for British Columbia, Version 2, 1997.
Primary Imagery provided by CBJ, 2013.
Background Imagery provided by ESRI, Maxar (2020).
STATUS
ISSUED FOR USE
JUNEAU LANDSLIDE AND AVALANCHE ASSESSMENT
Landslide Hazard Designation Mapping
PROJECTION
State Plane Alaska Zone 1 5001
DATUM
NAD83
Scale: 1:5,000
Feet
CLIENT
JUNEAU
TETRA TECH
FILE NO.
OFFICE
DWN
CKD
APVD
REV
DATE
PROJECT NO.
Figure 1.6c