Attachment H

NW Geologic PLLC

March 27, 2024
Report No.: 24-013

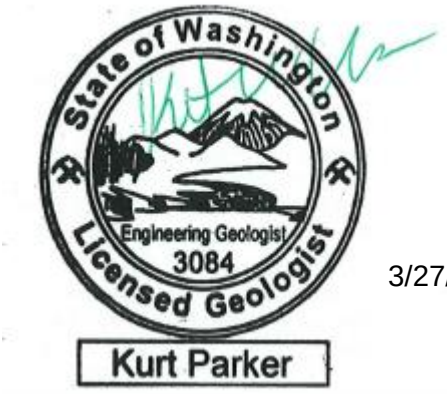
Michael Brennan
2530 Jaeger Street
Bellingham, WA 98225

RE: Coal Mine Hazard Report for 2530 Jaeger Street, Bellingham, Washington
Parcel No.: 380224230126

Dear Mr. Brennan:

NW Geologic, PLLC (NW Geo) thanks you for the opportunity, and respectfully submits the following coal mine hazard report for the proposed detached accessory dwelling unit (DADU) to be located at the above parcel. Should you have any further questions regarding the information contained within this document, or if we may be of service in other regards, please contact the undersigned.

Respectfully Submitted,



3/27/2024

Kurt Parker, Owner
Licensed Engineering Geologist
NW Geologic, PLLC
Ferndale, WA

SCOPE OF SERVICES

The purpose of this report is to address the current City of Bellingham Municipal Code (BMC) 16.55.410-16.55.460 for Mine Hazard Areas for the purpose of permitting approval. Mine hazard areas are those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings. Specific areas of known and suspected historical mining activity and hazards include areas depicted as coal mine hazard areas within the *Geologic Hazards* Map Folio, Bellingham, Washington, 1991, Bellingham *City IQ* data and historical reports by other parties.

PROJECT DESCRIPTION

It is our understanding that the client intends to construct a two-story, approximately 864 square foot (SF) detached accessory dwelling unit on the property at 2530 Jaeger Street in Bellingham, Washington. An existing, single-story 624 SF garage located on the east side of the property will be improved for the new DADU structure. We presume a geohazard evaluation of the subject property is required because of the square footage proposed for the new development, or because of the proximity to areas of greater subsidence potential. The project site falls within an area considered to present a low potential for subsidence due to the subsurface presence of the historic Bellingham Coal Mine. Based on the client provided plans dated March 22, 2024, we anticipate the structure will utilize the existing garage foundation and slab on grade, with upward wood framing, therefore loading should be lightweight.

Areas depicted as coal mine hazards were identified within the City of Bellingham *Geologic Hazards* Map Folio, Bellingham, Washington, 1991 (Updated 2022). The Bellingham Coal Mine is known to underlie the of much of the Birchwood Neighborhood, parts of the Columbia Neighborhood and vicinity. Mine locations have been identified in detail through the *Bellingham Abandoned Mine Lane Survey* by Tetra Tech, Inc. (1984), *The Bellingham Coal Mine* map (2007), and via the City of Bellingham *City IQ* website. It is our understanding that mine related subsidence has not been documented within the subject property.

SITE CONDITIONS

This section includes a description of the general surface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on the results and review of available information, site reconnaissance, and previous experience in the project vicinity. NW Geologic visited the site on March 26, 2024, to perform the field investigation. Photographs of the site conditions are included at the end of this report.

The roughly square shaped subject property encompasses approximately 0.23-acres at the southeast intersection of Jaeger Street and West North Street in the Columbia Neighborhood. It is generally surrounded by parcels containing single-family residences in all directions. The subject parcel currently supports a roughly 1,686 SF,1.5 story single-family residence, detached garage, gravel driveway and associated infrastructure. *City IQ* records indicate the residence and garage were built in 1904.

The subject property is mostly surfaced with grasses, sparse mature trees and landscape plantings. No surface water was observed during the site visit.

The subject site and vicinity are relatively level with minimal vertical relief across the property overall. Based on our field observations, there is no evidence that would indicate coal mine related subsidence has occurred in the area. Signs of subsidence could include voids, cracks, very loose soils, sinkholes, shafts or topographic depressions.

Additionally, no evidence of significant foundation cracking, settlement or other signs of building or soil displacement were observed at the project site or vicinity. The property owner reported no concerns over the last 30 years with settlement at the property or within the immediate vicinity due to coal mine related hazards.

GEOLOGIC CONDITIONS

General geologic conditions at the project site were reviewed according to the *Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington* (Lapen, 2000). According to the referenced map, the geologic unit underlying the project site consists of Glacial Outwash from the Sumas Stade of the Fraser Glaciation (Unit Qgo_s). This unit overlies the Chuckanut Formation, a sedimentary bedrock unit which contains the coal seams of interest to the former mining activities.

Lapen describes the Glacial Outwash from the Sumas Stade of the Frasier Glaciation as a former outwash plain that is underlain by cobble and boulder gravel near the Canadian border and grades to sand to the southwest. The geologic unit contains a series of former meltwater channels produced by continental glacial retreat. The unit is well sorted and stratified and ranges in thickness from 3 to 280 meters.

The Chuckanut Formation is a sedimentary bedrock unit that typically consists of sandstone, conglomerate, mudstone, and minor coal. These sedimentary rocks originated as soil deposits from a dynamic river basin system that existed in the region during the Eocene, approximately 34 to 56 million years ago. The alluvial sediments have since been lithified, undergone uplift, deformation, and erosion and now comprise some of the foothills around the Bellingham area.

MINE HISTORY

From 1888 to 1891, the Bellingham Bay Improvement Company purchased 880 acres of land north of Squalicum Creek and began prospecting the area. Production of coal from the Bellingham Coal Mine began in 1918, with the mine entrance located approximately 1,200 feet northeast of the Northwest Avenue and Birchwood Avenue intersections. The mine extended to the southwest toward Marine Drive and reached a maximum depth of approximately 1,100 feet. The coal seam thickness averaged between 12 and 14 feet of which 8 to 9 feet were mined. Approximately 5.3 million tons of coal was removed during the operation of the mine. The mine was closed in 1955 due to economic conditions. The entrances were sealed, and the mine was allowed to flood to the current groundwater level.

According to the *Bellingham Abandoned Mine Survey Report* (Tetra Tech, 1984), subsidence confirmed to be related to the Bellingham Mine is only well documented within one location. In 1930, a roughly 320 foot by 325-foot area centered near the intersection of East Maplewood Avenue and Walnut Street began to display evidence of coal mine related subsidence. Specific evidence consisted of tension cracks and pavement problems. Five residential lots were affected; however, the details were not well documented. Although several other instances of subsidence were investigated as part of the referenced survey report, it was determined that the other instances of settlement were the result of other causes and were not attributable to coal mine related subsidence.

We are unaware of any other evidence of coal mine subsidence within the vicinity of the project site.

CONCLUSIONS AND RECOMMENDATIONS

According to the referenced BMC Chapter 16.55 for Critical Areas, geologically hazardous areas include *areas susceptible to erosion, landslide, rock fall, subsidence, earthquake, or other geological events that pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard.* Aside from the coal mine hazards, discussed below, no other geologically hazardous areas, based on Bellingham Municipal Code definitions, were identified at the project site.

According to BMC section 16.55.420(D), *mine hazard areas are those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings*.

NW Geologic reviewed the 1984 *Bellingham Abandoned Mine Land Survey* report by Tetra Tech, the 2007 *Bellingham Coal Mine: Plan Layout and Depth Profile* map, and the City of Bellingham GIS geodatabase information representing the mine extents and hazards as outlined in the Tetra Tech report. According to these documents, the primary hazard at the subject site is the potential for subsidence due to the failure of mine pillars which would cause roof collapse. It is our understanding that there are no known adits or airshafts underlying the subject property.

Tetra Tech performed a mathematical analysis of the mine pillar stability for the Bellingham Coal Mine using conservative strength parameters. They used this analysis, combined with other qualitative findings in the survey, to produce hazard classification maps addressing possible pillar stability and potential for subsidence. Tetra Tech generally considers the pillars in the mine to be over-designed. However, they are only certain of pillar stability in the shallower mine areas in the northeast because the pillar conditions there were well documented prior to the closure of the mine.

According to the Tetra Tech hazard classification maps, the subject property is in an area considered to have a "low potential for subsidence", due to the location within an area of pillar stability. While the true degree of stability of the pillars in this area is uncertain, the mathematical analysis by Tetra Tech indicated that even the smallest, weakest pillars of the mine are theoretically able to remain stable down to about 790 feet below ground surface. At the subject property, the Bellingham Coal Mine workings are located approximately 630 to 640 feet below ground surface. Below the estimated depth of stability, any unstable pillars are assumed to have already failed in the time since the mine was decommissioned. Furthermore, Tetra Tech suggests that pillar failure would likely only cause subsidence at surface level if two or more pillars in an area were to yield.

Based on the information presented in this report, it is our opinion that the likelihood of mine related failure or collapse below the subject property impacting the existing ground surface is low. If a tunnel or shaft were to collapse within the vicinity of the project site, the chance of subsidence propagating more than 600 feet to the surface would be low.

We confirm that the Bellingham Coal Mine is mapped at depth under the subject property. However, there are no entries, portals or shafts of any type within a reasonable proximity to the subject site. The new DADU development is not anticipated to impact the Bellingham Coal Mine, nor would a collapse of supporting elements of the mine affect the project site. There are no known sinkholes, significant surface depressions, trough subsidence features, coal mine spoil piles, and other mine-related surface features within proximity of the parcel. There are no known locations of any prior site improvements that have been carried out to mitigate abandoned coal mine features within a reasonable distance of the property.

In conclusion, it is our opinion that the proposed construction is feasible and that the risk of ground subsidence due to coal mine related hazards is low. With the potential for subsidence classified as low, we are not recommending any additional mitigations for design and construction of the DADU. The guidelines for new building engineering found within the International Building Code and International Residential Code contain safeguards for structural design. We recommend the design engineer follow the parameters found within the current IBC/IRC when designing the new accessory dwelling unit.

REFERENCES

City of Bellingham. 1991. *Geologic Hazard Areas Map Folio*, Bellingham, Washington. City of Bellingham. Updated 2022.

City of Bellingham. *City IQ.* Online GIS mapping service. Retrieved March 2024 from https://maps.cob.org/services/maps/online-mapping.

City of Bellingham. GIS Data Center. Retrieved March 2024 from https://cob.org/services/maps/gis.

City of Bellingham. 2007. *The Bellingham Coal Mine: Plan Layout and Depth Profile.* Retrieved March 2024 from https://cob.org/documents/gis/maps/CoalMine.pdf.

Lapen, Thomas, J., 2000. *Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington*. Washington Division of Geology and Earth Resources. Open File Report 2000-5, scale 1:100,000.

Tetra Tech Inc., 1984. *Bellingham Abandoned Mine Land Survey* in U.S. Department of Interior Office of Surface Mining Report TC-3920. Tetra Tech Inc., Englewood, Colorado.

Washington Geologic Information Portal. Retrieved March 2024 from https://geologyportal.dnr.wa.gov/.

Washington Lidar Portal. Retrieved March 2024 from http://lidarportal.dnr.wa.gov/.

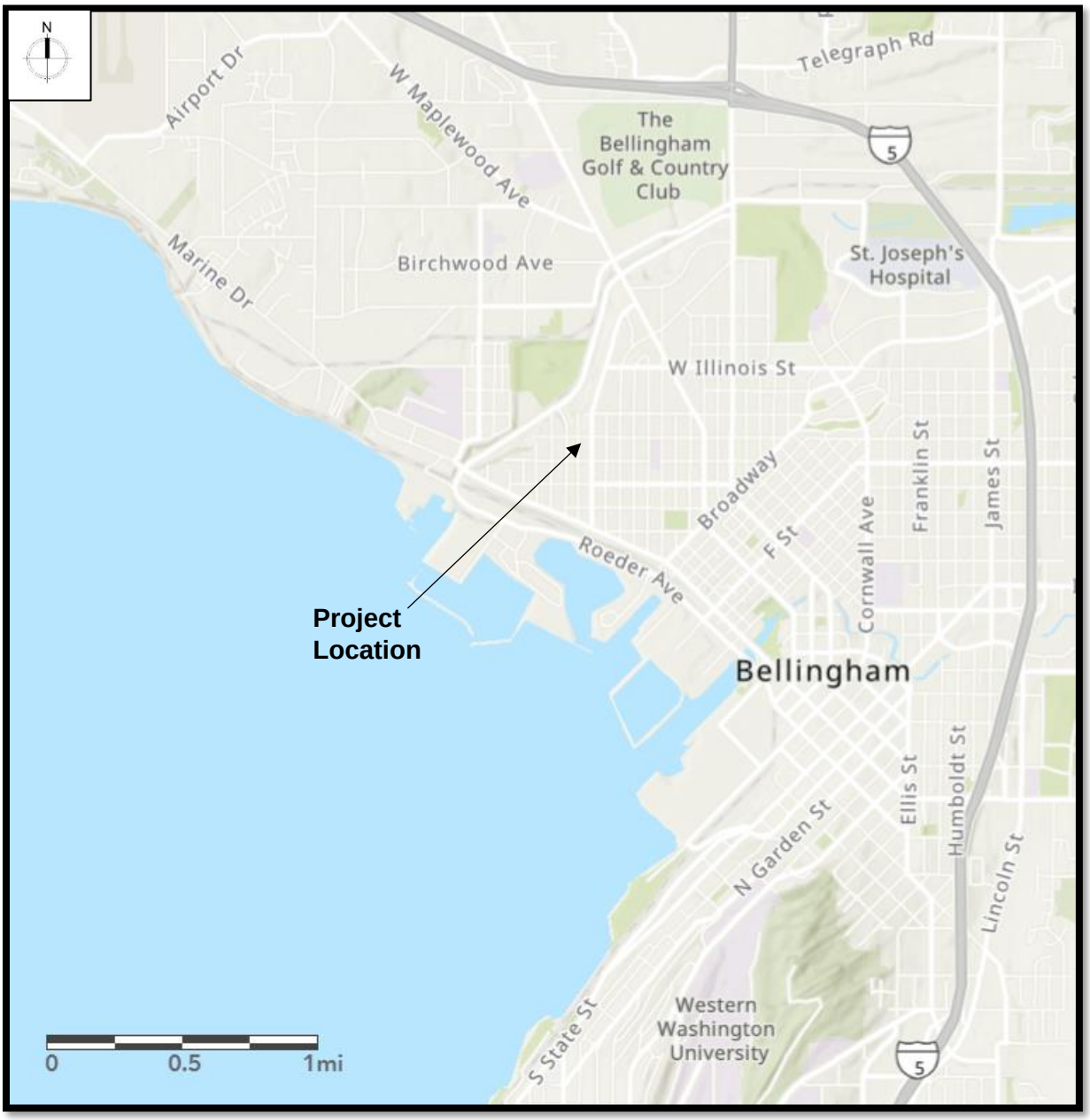


Figure 1: Vicinity Map showing the general project location within the City of Bellingham. Image acquired from *ArcGIS*, 2024.

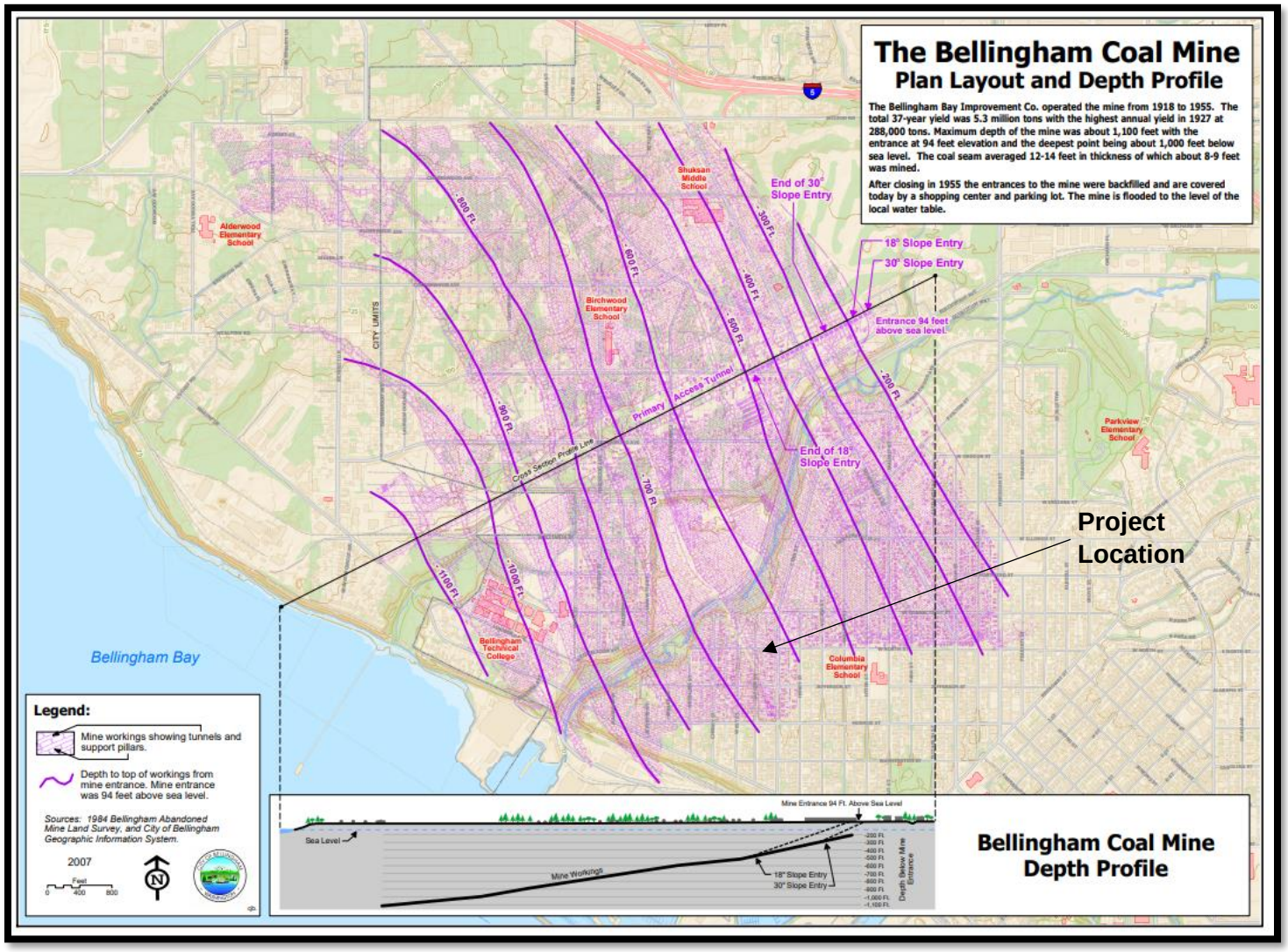


Figure 2: The Bellingham Coal Mine map showing the general project location within the City of Bellingham. Image acquired from City of Bellingham, 2024.

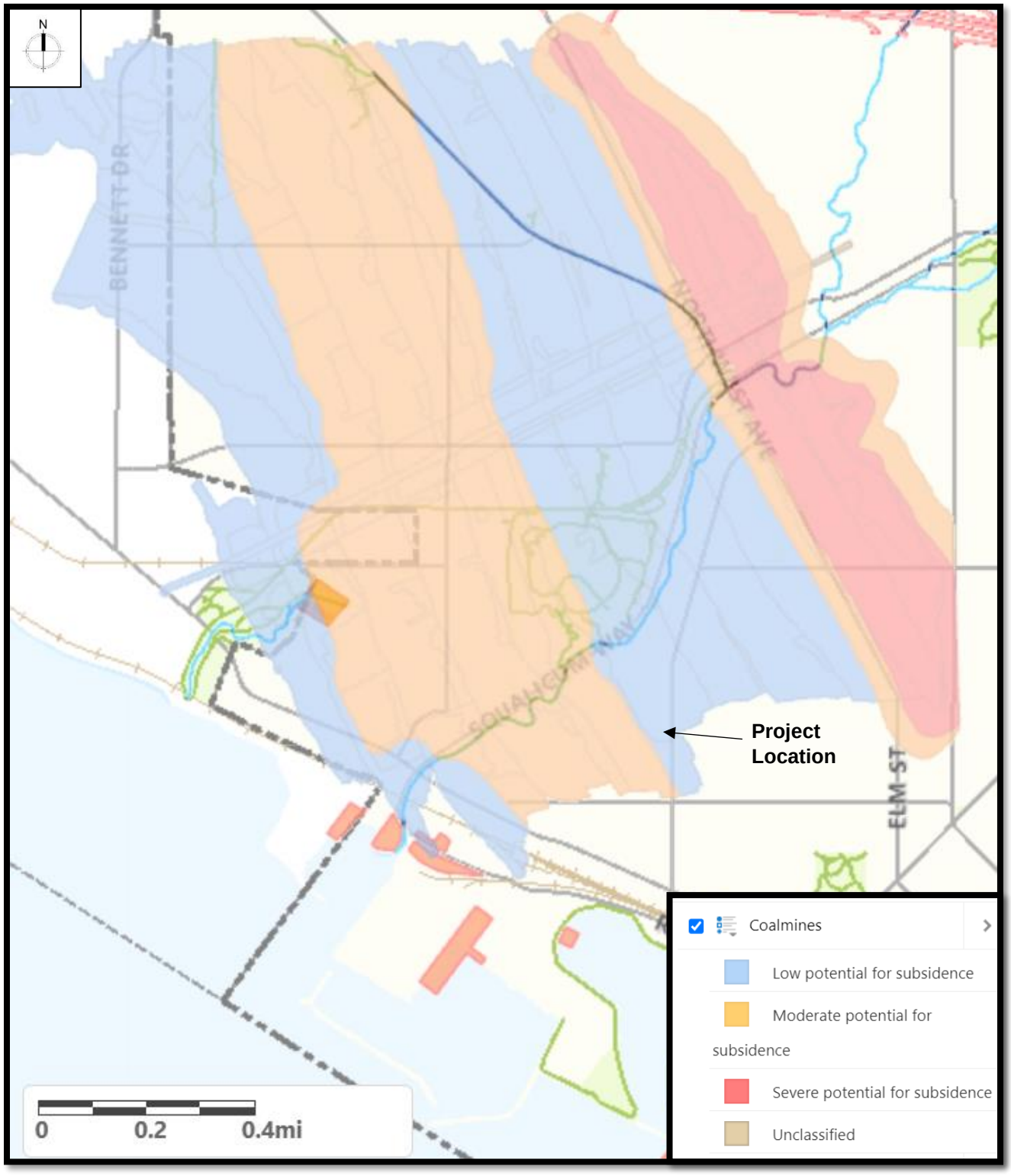


Figure 3: A portion of the Bellingham *City IQ* map showing the general project location and coal mine stability classifications. Image acquired from City of Bellingham *City IQ*, 2024.

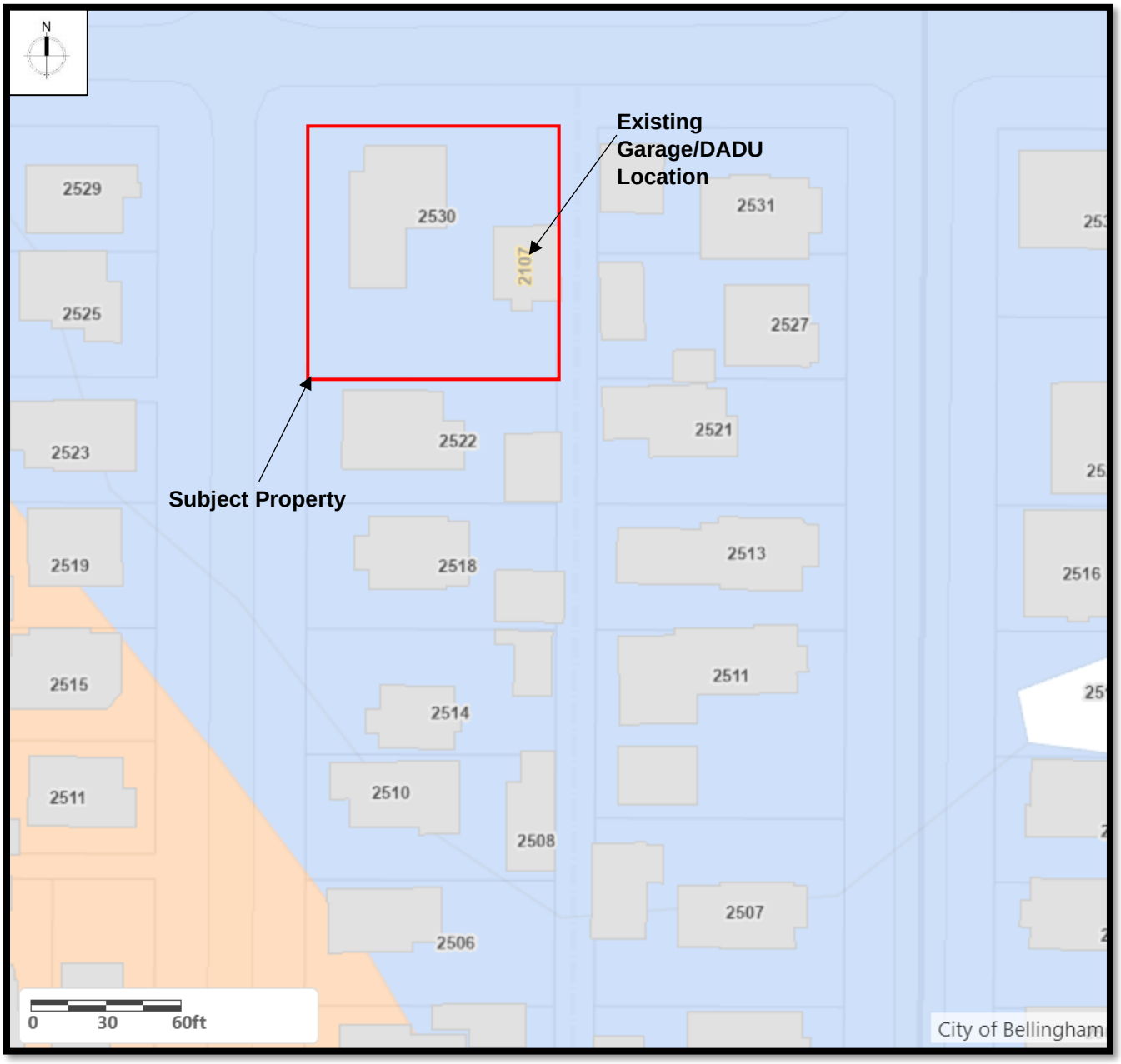


Figure 4: The Bellingham *City IQ* map showing the property at 2530 Jaeger Street within a low potential for subsidence classification. Image acquired from City of Bellingham, 2024.

Image 1: Existing conditions at 2530 Jaeger Street with the residence (left) and garage (right). Facing north on March 26, 2024.

Image 2: Project site conditions at 2530 Jaeger Street with the existing garage in center. Facing east on March 26, 2024.