

ORDINANCE 24- 06

AN ORDINANCE AMENDING TITLE 12. LAND USE,
MAKING CHANGES RELATED TO GEOLOGIC HAZARDS

1 WHEREAS, the City Council of the City of North Logan, Utah, adopted and passed the Code of Revised
2 Ordinances of the City of North Logan on March 16, 1989, which Code was published and effective on
3 March 20, 1989; and

4
5 WHEREAS, said Code included Title 12 which is the City's Land Use Ordinance; and

6
7 WHEREAS the City Council and the City's Planning and Zoning Commission have determined there is need
8 and good cause to amend the City's Land Use Ordinance to modify the regulations regarding geologic
9 hazards.

10
11 NOW, THEREFORE, pursuant to Section 12A-301 of Title 12 of North Logan City code and Section 10-9a-
12 205 of the Utah Code, and after ten (10) days' notice and a public hearing held November 7, 2024 by the
13 Planning Commission as required, the City Council of the City of North Logan, Utah hereby adopts, passes
14 and publishes the following:

15
16 **AN ORDINANCE AMENDING TITLE 12. LAND USE,**
17 **MAKING CHANGES RELATED TO GEOLOGIC HAZARDS**

18
19 BE IT ORDAINED by the City Council of the City of North Logan, Utah as follows (highlighted portions
20 added, crossed through portions deleted):

21
22 **SECTION I:** Amend TITLE 12 LAND USE, modifying 12A-200 Definitions.

23
24 **12A-200 Definitions**

25 For the purpose of this ordinance, certain words and terms are defined as follows: (Words used in the
26 present tense include the future: words in the singular number include the plural and the plural the
27 singular; words not included herein but defined in the Uniform Building Code shall be construed as defined
28 herein.) Listed references to the Utah Code within definitions are for reference only. Definitions are not
29 necessarily always the same between the North Logan Code and the Utah Code.

30 ...

31 8. Acreage, Non-Buildable. The phrase "non-buildable acreage," means the area within a project that
32 has extraordinary circumstances that under existing city, state, or federal laws render development
33 on it ~~infeasible very unlikely~~. The applicant bears the burden to prove an area does not meet this
34 definition. This term shall be considered synonymous with "non-buildable areas."

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38 **SECTION II:** Amend TITLE 12C LAND USE – ZONING, modifying 12C-1003 Area, Width, And Yard
39 Regulations.

40 **12C-1003 Area, Width, And Yard Regulations**

		Setbacks						
					Side Setbacks			
Zone		Min Res. Lot Size Standard Sub-division	Width	Front	One Side Minimum	Minimum Sum of Both Sides	Side Set-Back On Side Adjoining a Street	Rear
Agriculture	A-10	10 Acres	250'	30'	12'	24'	20'	30'
	A-20	20 Acres	250'	30'	12'	24'	20'	30'
Residential Estate	RE-1	1 Acre	100' Note # 10	30'	15' Note # 10	35' Note # 10	20' Note # 10	30'
	RE-2	2 Acres	100' Note # 10	30'	15' Note # 10	35' Note # 10	20' Note # 10	30'
	RE-5	5 Acres	100' Note # 10	30'	15' Note # 10	35' Note # 10	20' Note # 10	30'

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Single-Family Residential	R-1-10	10,000 sf	80' (60') Note # 10	25'	10' (8') Note # 10	24' (18') Note # 10	20' Note # 10	25'
	R-1-12	12,000 sf	90' (80') Note # 10	25'	10' Note # 10	25' (24') Note # 10	20' Note # 10	30'
	R-1-15	15,000 sf	95' (80') Note # 10	25'	10' Note # 10	25' (24') Note # 10	20' Note # 10	30'
	R-1-20	20,000 sf	100' (80') Note # 10	25'	10' Note # 10	25' (24') Note # 10	20' Note # 10	30'
	R-1-30	30,000 sf	100' (90') Note # 10	25'	10' Note # 10	25' Note # 10	20' Note # 10	30'
	One and Two Family Residential	R-2-12	12,000 sf	95'	30'	10'	25'	20'
R-2-12		15,000 sf	100'	40'	10'	25'	20'	30'

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Multiple Family Residential	RM – Single Family Res.	10,000 sf	80'	30'	10'	25'	20'	30'
	RM – SFR Zero lot line	6,000 sf	60'	30'	0'	14'	20'	30'
	RM – Two Family Res.	12,000 sf	95'	30'	10'	25'	20'	30'
	RM – Three Family Res.	14,000 sf	100'	30'	10'	25'	20'	30'
	RM – Four Family Res.	16,000 sf	100'	30'	10'	25'	20'	30'
	RM – Other	Note #2	Note #2	30'	10'	25'	20'	30'
Residential Business – (Residential and Non-Residential Uses)		Note #4	Note #4	Note #4	Note #4	Note #4	20'	Note #4
Mixed Use	Single Family Residential	12,000 sf	90'	30'	10'	25'	20'	30'

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(MX-G or MX-CC)	Other Permitted or Conditional Uses	No. Min.	No. Min.	Note #9	20'	40'	20'	Note #3
	Mixed Uses	Note #8	Note #8	Note #8	Note #8	Note #8	Note #8	Note #8
Professional (PR)		No. Min.	No. Min.	Note #9	Note #3			Note #3
Community Commercial (CC)		No. Min.	No. Min.	Note #9	Note #3			Note #3
Hospital (HOSP)		No. Min.	No. Min.	50'	Note #7	Note #7	Note #7	Note #7
General Commercial (CG)		No. Min.	No. Min.	Note #9	Note #3	Note #3	Note #3	Note #3
Recreation/School (R/S)		N/A	No. Min.	50'	Note #3	Note #3	Note #3	Note #3
Manufacturing, Commercial (MC)	Heavy	No. Min.	No. Min.	30'	Note #5			Note #5
High Tech., Manufacturing, and Research (M2)		Note #6	Note #6	Note #6	Note #6	Note #6	Note #6	Note #6

41 Note, the second number, in parenthesis, is the width/set-back requirement when using methods two or
42 three for subdivision development.

43 Note #1 - (Applies throughout) For use of a lot for group dwellings, multiple family dwelling, or other
44 conditional uses as specified in this ordinance, the lot area and width of the particular property would
45 have to be approved by the proper municipal authorities before such uses could be allowed.

46 Note #2 - As Determined by the City Council following a review by the Planning Commission.

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47 Note #3 - Ten feet minimum side/rear setback is required where the side or rear yard abuts an agricultural
48 or residential zone, or where the yard abuts a current residential use. Twenty feet minimum is required
49 where the side yard is adjacent to a street. Any applicable modifying regulations may also require side
50 setbacks. No minimum side/rear setback is required when abutting other commercial zones. An
51 exception may be granted by the City Council to allow for not less than a ten-foot (10') side yard where
52 said side yard is adjacent to a street if it can be shown that at least one hundred (100) feet of minimum
53 sight distance will be maintained past any structure(s) on the property and between intersecting right-of-
54 way lines (or a line twenty-five feet (25') from the center line in the case of an intersecting private
55 driveway or alley) for any intersecting roadways, streets, alleys, or driveways.

56 Note #4 - Minimum set backs, lot width and size of lots in this zone are to conform to the adjacent zone.
57 If the property has more than one adjacent zone the Planning and Zoning Commission will determine the
58 applicable area, width, and yard regulations based on the lot's adjacent zones.

59 Note #5 - None, except that for any parcel in the MC zone having a lot line in common with a lot in an
60 adjoining zone or lying across the street or alley from such adjoining zone, the side and rear yards
61 prescribed for such adjoining zone shall be maintained in the MC zone.

62 Note #6 - The minimum lot size; lot width; front, rear and side yard requirements for the M-2 Zone
63 accepted and approved by the city are the same standards as set forth in the "Declaration of Covenants,
64 Conditions and Restrictions of the Utah State University Research and Technology Park" as filed with the
65 Cache County Recorder 26 October, 1987.

66 Note #7 - All buildings shall maintain a minimum side and rear setback of forty feet from other properties.
67 For each foot by which the main hospital building exceeds thirty-five feet in height, the requirement for
68 side yards shall be increased by one additional foot on each side of the building.

69 Note #8 - Other than single-family residence, setbacks, lot sizes including lot widths for uses designated
70 by "M" in the zoning matrix for both Mixed Use Zones are established by the Mixed Use Development
71 Plan as reviewed by the Planning Commission and approved of the City Council (See Sections 12C-1050
72 through 12C-1057.)

73 Note #9 - Any parcel with frontage on Main Street shall have a minimum front setback of twenty five (25)
74 feet measured from the back of curb. All other parcels have a minimum front setback of ten (10) feet
75 measured from the back of curb of the designed future right of way.

76 **Note 10 - Any lots created within a Geologic Hazard Area with primarily northern or southern facing street**
77 **frontage, and lot widths running primarily east to west, shall have a minimum lot width of not less than**
78 **130 feet. The building envelope of these lots shall allow for a side yard setback of not less than 25 feet on**
79 **each side yard. Lots with this configuration that also have a side yard adjacent to a street shall have a**
80 **minimum side yard setback of 25 feet on the non-street-adjacent side yard, and a minimum street-**
81 **adjacent side yard setback of 30 feet.**

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84 **SECTION III:** Amend TITLE 12D LAND USE – SUBDIVISIONS, various sections as outlined below.

85 **12D-105 Definitions**

86A. The following definitions shall apply to this chapter. Any definitions not listed herein shall be as defined
87 in the City's Design Standards Technical Manual or the City's Land Use Ordinance.

88 ...

89 59. Non-Buildable Areas. "Non-Buildable Areas" are areas designated on a subdivision plat in which
90 construction is prohibited. Areas may be designated as non-buildable due to but not limited to steep
91 slopes (as further defined as "Steep Slope Areas"), soils types, natural drainage corridors, canal
92 channels, wetlands, or other constraints which create potential hazards to life, limb, or property. Any
93 specific prohibitions in addition to prohibiting construction within a non-buildable area should be
94 clearly specified on a plat or other appropriate document.

95 ...

96 81. Steep Slope Area. An area of steep slope is defined as such that when the highest points of any
97 measured slope line for points within the area have a 25~~30~~% or steeper slope. Such slopes are
98 measured by the steepest slope downhill from such points and measuring the slope from those points
99 over a horizontal distance of sixty feet (60').

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102 **12D-117 Development Regulations**

103 A. All subdivisions within the City shall comply with the City's General Plan. The following items,
104 without limitation, shall be addressed on all land applications required by this chapter to assure
105 compliance with the City's General Plan and the purposes of this chapter:

- 106 1. The effect of the proposed development on the lands on which the development is
107 proposed to be located;
- 108 2. The relationship of the development to, and the effect of the development on:
- 109 a. Vegetation;
- 110 b. Gateways to the City, its trails and parks;
- 111 c. Geologic hazards or potential geologic hazards;
- 112 d. Loss of wetlands;
- 113 e. Natural floodplain, drainage systems, and canals;
- 114 f. Soil erosion;
- 115 g. Steep slopes;

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- 116 h. Unstable Soils;
- 117 i. Urban interface with the Mount Naomi Wilderness / Wasatch National Forest
- 118 including the subdivision's potential for increasing the potential fire hazard in any
- 119 interface with the wilderness area and/or the national forest;
- 120 j. Utility corridors;
- 121 k. Water conservation;
- 122 l. Water recharge areas;
- 123 m. Wildlife corridors; and
- 124 n. Public trails corridors, both planned and existing.
- 125 3. The effect of the proposed development on other adjacent, surrounding or nearby lands;
- 126 4. The effect of the proposed development on the overall future development of the City;
- 127 5. The identification of all existing trails through or adjacent to the property to be
- 128 developed, and all trails shown as proposed or existing in the City's General Plan;
- 129 6. Identification of all non-developable land within or adjacent to the area proposed for
- 130 development;
- 131 7. The data and conclusions in all applicable reports concerning any of the foregoing issues;
- 132 and
- 133 8. All applicable legal or regulatory requirements bearing on any of the foregoing.
- 134 B. The following studies, reports, and plans shall be required on all developments, except as
- 135 provided for in sections: 12D-403, 404, and 405 or unless otherwise determined by the Land Use
- 136 Authority through pre-application meetings or Concept Plan review and approval.
- 137 1. Soils Report. A soils report shall be prepared by a qualified soils engineer, licensed in the
- 138 State of Utah and shall contain at least the following information:
- 139 a. A slope analysis with a contour map accurately depicting no less than five foot (5)
- 140 contour intervals. Slope classifications shall be identified on a map in percentage
- 141 of gradients in the following categories:
- 142 (1) Class 1 Areas of Non-Steep slopes - less than 25~~30~~%
- 143 (2) Class 2 Areas of Steep slopes - 25~~30~~% or greater
- 144 Percentages shall be calculated as prescribed by the definition for "steep
- 145 slopes". If the subdivision contains any areas of steep slopes, the person
- 146 or firm preparing the soils report shall identify the Class 2 areas (areas
- 147 with 25~~30~~% slope or more). These areas shall be designated as "non-
- 148 buildable areas". ~~If, in the opinion of the soils engineer, any Class 2 areas~~
- 149 ~~should not be designated as non-buildable areas, the report should~~
- 150 ~~include reasons why an exception should be considered by the Land Use~~
- 151 ~~Authority to not designate such Class 2 slopes as "non-buildable".~~

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- 152 b. A soils type and soils rating analysis including accepted soils engineering tests to
153 determine bearing capacity, settlement and/or slope failure potential, and
154 shrink/swell potential of the proposed site. There shall be a minimum of one (1)
155 test performed for each soil type classified in the Natural Resources Conservation
156 Service’s Soil Survey and additional tests as prescribed or required by the City
157 Engineer. If the subdivision contains any soils rated as “Very Limited”, the soils
158 analysis shall include a soils hazard mitigation plan for the proposed subdivision’s
159 infrastructure. In such case(s) the final subdivision plat shall also put owners on
160 notice that building on these soils will require on-site investigation and lot-
161 specific soils hazard mitigation plans.
- 162 c. An estimate of the normal highest elevation of the season high-water table based
163 on a pizometer-tube test and the locations of swamps, seeps, or springs with the
164 reasons for the occurrence of these underground water sources.
- 165 d. Locations of classified wetlands.
- 166 e. A written statement by the person or firm preparing the soils report, identifying
167 any other means proposed to minimize hazards to life, property, and adverse
168 effects on the safety, use or stability of public rights-of-way or drainage channels,
169 and adverse impacts on the natural environment.
- 170 f. A set of two (2) maps of the subdivision identifying 1) the soils types (RFG2m,
171 RhB for example) and 2) the soil rating using “dwellings with basements” as the
172 criteria from the Natural Resources Conservation Service’s Soil Survey. The soil’s
173 rating for the area of the subdivision shall be identified on a map showing the
174 soil rating from the following categories:

- 175
- 176 Very Limited – Shown in Red
177 Somewhat limited – Shown in Yellow
178 Not Limited – Shown in Green
179 Not Rated – Shown in Grey

- 180 2. ~~Geologic Hazard Investigation Geology Report. A geology report shall be prepared by a~~
181 ~~person or firm qualified by training and experience to have expert knowledge of the~~
182 ~~subject and licensed in the State of Utah. The report shall include mapping of geologic~~
183 ~~hazards or potential geologic hazards and must identify the author and date of the data~~
184 ~~upon which the report is based. The report must include an analysis of the geologic~~
185 ~~conditions, conclusions regarding the effect of geologic conditions on the development,~~
186 ~~and recommendations covering the adequacy of sites to be developed within a~~
187 ~~recognized Geologic standard. It shall also include a written statement identifying the~~
188 ~~means proposed to minimize hazards to life or property, adverse effects on the safety,~~

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189 use or stability of public rights-of-way or drainage channels, and adverse impacts on the
190 natural environment. A Geologic Hazard Investigation and subsequent report shall be
191 required for all subdivisions located entirely or partially within a Geologic Hazard Area per
192 the requirements detailed within NLMC Section 12F "Land Use - Geologic Hazard
193 Mitigation". The DRC, Planning Commission, or City Council may, at their discretion,
194 require that a Geologic Hazard Investigation and report be provided for any subdivision
195 that may have suspected, yet unmapped, geologic hazards within the area/s of the
196 development.

197 3. Grading and Drainage Plan. A grading and drainage plan shall be prepared by a
198 professional engineer licensed in the State of Utah. The plan shall include at least the
199 following:

- 200 a. A map of the entire site with existing and proposed contours using a minimum
201 five foot (5) contour interval or at the same scale as will be utilized on subsequent
202 plats.
- 203 b. Proposed plans and locations of all surface and subsurface drainage devices,
204 walls, dams, sediment basins, storage reservoirs and other protective devices to
205 be constructed to control storm water runoff and soil erosion.
- 206 c. A plan showing temporary erosion control measures and storm water control
207 during construction.
- 208 d. A written statement by the person or firm preparing the report, identifying any
209 grading and drainage problems of the proposed development and further stating
210 an opinion as to the ability of the proposed plan to mitigate or eliminate such
211 problems in such a manner as to prevent hazards to life or property, and adverse
212 effects on the safety, use or stability of public rights-of-way or drainage channels,
213 and adverse impacts on the natural environment within an acceptable standard.
- 214 e. The Grading and Drainage Plan may need to be developed based on
215 recommendations derived from a Geologic Hazards Investigation.

216 4. Water Conservation Plan. The water conservation plan shall assess if the land currently or
217 has historically had irrigation rights. If the land being developed has currently or
218 historically had irrigation rights, the water conservation plan shall contain an assessment
219 and recommendations for development of a secondary water system, including sizes and
220 locations of all existing and proposed lines and valves, and shall include approval from the
221 irrigation and canal companies for the area if applicable. See Chapter 12I, Dedication of
222 Water System Shares or Water Rights for required water share dedication. If the land
223 being developed does not currently have and has not historically had irrigation rights, the
224 water conservation plan shall contain an assessment of the potential outside culinary

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- 225 water use for the subdivision and recommendations for lot size, landscaping and irrigation
226 practices to minimize culinary water use and shall require the following:
- 227 a. As a core requirement of a water conservation plan, the following maximum lawn
228 or turf shall be allowed on residential lots:
- 229 (1) The area within the public right-of-way between the curb and gutter and
230 the sidewalk, otherwise known as the park strip, shall not be landscaped
231 with lawn or turf.
- 232 (2) Lawn or turf areas shall not be less than eight feet wide at their narrowest
233 point.
- 234 (3) Lawn or turf areas shall not exceed fifty percent (50%) of the total
235 landscaped area for front and side yards. Lawn or turf limitations do not
236 apply to small residential lots with less than two hundred and fifty square
237 feet (250 sq. ft.) of landscaped area.
- 238 b. As a core requirement of a water conservation plan, the following maximum lawn
239 or turf shall be allowed on commercial, industrial, institutional-residential, and
240 non-residential lots:
- 241 (1) The area within the public right-of-way between the curb and gutter of
242 the sidewalk, otherwise known as the park strip, shall not be landscaped
243 with lawn or turf.
- 244 (2) Lawn or turf areas shall not be less than eight feet (8') wide at their
245 narrowest point.
- 246 (3) Lawn or turf areas shall not exceed fifty percent (50%) of the total
247 landscaped area for front and side yards. Lawn or turf limitations do not
248 apply to small residential lots with less than two hundred and fifty square
249 feet (250 sq. ft.) of landscaped area .
- 250 c. Water Rates. All new developments post December 2021, without access to
251 secondary irrigation rights shall be subject to separate Water Usage Fee Tiers as
252 found in the City's Master Fee Schedule. These separate Water Usage Fee Tiers
253 shall be referenced and noted on the final subdivision plat.
- 254 d. Exterior water use shall only be permitted from the months of May through
255 September.
- 256 e. If determined by the City's Water Model that exterior water use will create a
257 demand that cannot be met, exterior water use may be restricted further to zero
258 exterior water use if necessary.
- 259 f. Non-Buildable Areas and/or Common Space Vegetation Plan. A vegetation plan
260 shall be developed for all non-buildable areas or common spaces within a
261 proposed subdivision and a report shall be prepared by a person or firm qualified

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- 262 by training and experience to have expert knowledge of the subject, duly licensed
263 in the State of Utah and shall include the following:
- 264 (1) A plan of the proposed re-vegetation of the site, including top soil
265 requirements, detailing existing vegetation to be preserved, new
266 vegetation to be planted and any modifications to existing vegetation.
 - 267 (2) A plan for the preservation of existing vegetation during construction.
 - 268 (3) A vegetation maintenance and weed control program, including initial
269 and continuing maintenance as necessary.
 - 270 (4) Xeriscaping and water management requirements for areas not serviced
271 by secondary water systems.
 - 272 (5) A written statement by the person or firm preparing the report
273 identifying any vegetation problems and further stating an opinion as to
274 the ability of the proposed plan to mitigate or eliminate such problems in
275 such a manner as to prevent hazard to life or property, adverse effects
276 on the safety, use or stability of public rights-of-way or drainage channels,
277 and adverse impacts on the natural environment within an acceptable
278 standard.
- 279 5. Traffic Report. In the case of any proposed subdivision, a traffic report is required unless
280 when determined unnecessary during the Pre-Application Meeting or review of the
281 Concept Plan. This report should describe the traffic impacts that will be created by the
282 project including but not limited to peak period trip generation rates, impacts on turning
283 movements and road segment level of service, proposals to mitigate the impacts,
284 justification for the proposed numbers of parking spaces, and/or a parking phasing plan
285 when required.
- 286 6. Fire Protection Plan. A fire protection plan shall be required for any subdivision that has
287 the potential to increase the hazards for fires especially as that hazard relates to the
288 interface with the Mount Naomi Wilderness Area and/or the Wasatch National Forest.
289 The fire protection plan shall include at minimum the plans for any needed firebreaks and
290 planned fire-wise construction and/or landscaping for the proposed subdivision.
- 291 7. Street Lighting Plan. A street lighting plan shall be required to identify the location of the
292 existing and proposed electrical services for street lighting and the existing and proposed
293 street light locations to be installed as part of the subdivision improvements and shall be
294 in accordance with the City's Design Standards Technical Manual; and
- 295 8. Other Reports and Plans. Other reports and plans may be prepared by the developer as
296 determined to be necessary or appropriate during the Pre-Application Meeting Review or
297 review of the Concept Plan. Such other reports and plans include, but may not be limited to:
298 to:
- 299 a. Groundwater protection;

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- 300 b. Adequacy or availability of public safety services;
- 301 c. Erosion control or any other physical or environmental matters;
- 302 d. Landscape maintenance; or
- 303 e. Wildlife habitat preservation.
- 304 9. The text of any ancillary agreement proposed by the applicant. Ancillary agreements
- 305 would normally include but are not limited to:
- 306 a. A development agreement including a schedule for constructing improvements
- 307 in the event that all improvements will not be completed prior to issuing building
- 308 permits;
- 309 b. An agreement for the distribution of water rights as part of a water conservation
- 310 plan.
- 311 c. An agreement on any special considerations that impact the development to be
- 312 agreed upon by the applicant/developer and the City.
- 313 d. An agreement providing for the application of the initial seal coat on all asphalt
- 314 surfaces in the subdivision.
- 315 e. In the event that a waiver or modification is granted by the Land Use Authority
- 316 per section 12D-403 for any of the reports or studies required by this section, the
- 317 applicant shall provide as a minimum, a written statement stating the reasons the
- 318 reports or studies were waived or modified. The statement shall be provided with
- 319 the applicant's development plan application.

- 320 C. Non-Buildable Areas. No homes, buildings, or other structures, streets, or alleys shall be erected
- 321 or built on areas designated and platted as "Non-Buildable"; except for those required for public
- 322 improvements and facilities such as: power poles, pump houses, reservoirs, regulator stations,
- 323 etc., or those drives required for access to such public improvements and facilities. Non-Buildable
- 324 areas shall be designated on the Preliminary and Final Subdivision Plat by shading and shall have
- 325 a designation of "No-Build" shown on the plat. The areas with the following characteristics ~~shall~~
- 326 ~~should be considered for designation~~ **labeled** as Non-Buildable Areas:
- 327 1. Areas of Steep Slopes as defined in section 12D-103 of this ordinance;
- 328 2. Areas with soils with "very limited" soils rating;
- 329 3. Natural drainage corridors, canal channels, and wetlands;
- 330 4. Any areas identified by the required studies as potentially hazardous to life, limb, or
- 331 property; and
- 332 5. Fire breaks.

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335 **12D-118 Subdivision Plat; Required Notations**

336 A proposed subdivision plat shall include the following notations. Additional notes may be required based
337 on unique circumstances found applicable to the subdivision:

338 A. All subdivisions serviced by secondary water: "Culinary water shall only be used for indoor
339 purposes. Only secondary water shall be used for outdoor irrigation purposes."

340 B. Maximum lawn or turf in residential areas:

341 1. The area within the public right-of-way between the curb and gutter and the sidewalk,
342 otherwise known as the park strip, shall not be landscaped with lawn or turf.

343 2. Lawn or turf areas shall not be less than eight feet wide at their narrowest point.

344 3. Lawn or turf areas shall not exceed fifty percent (50%) of the total landscaped area for
345 front and side yards. Lawn or turf limitations do not apply to small residential lots with
346 less than two hundred fifty square feet (250 sq. ft.) of landscaped area.

347 C. Maximum lawn or turf in commercial-industrial and institutional-residential and non-residential
348 areas:

349 1. Within common area or open space landscapes, lawn or turf areas shall not exceed
350 twenty percent (20%) of the total landscaped area outside of active recreational areas.

351 2. Lawn or turf areas shall not be less than eight feet (8') wide at their narrowest point.

352 3. The area within the public right-of-way between the curb and gutter and the sidewalk,
353 otherwise known as the park strip, shall not be landscaped with lawn or turf.

354 D. All subdivisions located partially or entirely within a Geologic Hazards Area shall contain the
355 following notations:

356 1. "This subdivision is located partially or entirely within a known Geologic Hazard Area. A
357 Geologic Hazards Investigation was performed and a subsequent report was drafted prior
358 to the platting of this subdivision. A copy of this report is on file with North Logan City and
359 can be obtained upon request."

360 2. All lots within this subdivision require a site-specific geologic hazard investigation to be
361 performed prior to the issuance of any building permits. Site-specific structural and
362 landscaping designs, are required to be professionally developed pursuant to the
363 recommendations and findings identified within the lot's site-specific geologic hazards
364 investigation.

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ORDINANCE 24- 06

AN ORDINANCE AMENDING TITLE 12. LAND USE,
MAKING CHANGES RELATED TO GEOLOGIC HAZARDS

367 **12D-401 Pre-Application Meeting Required; Determination By DRC If Concept Plan Required**

368 A. Pre-application Meeting Required. Before submitting a subdivision application to the City for
369 review, applicant(s) shall attend a pre-application meeting with the DRC to discuss development
370 plans on an informal basis.

371 1. The DRC may choose to waive the requirement of a pre-application meeting or
372 subsequent concept plan review at the applicant's request.

373 2. **With exception to developments partially or entirely within a Geologic Hazards Area**, if
374 the proposed development is a residential single family, two family, or townhome
375 development, applicant(s) shall not be required to attend a pre-application meeting.
376 However, an applicant(s) may request a pre-application meeting and/or concept plan
377 review to be conducted by the City pursuant to §10-9a-604.1 of Utah State Code (as
378 amended). The applicant(s) request shall be submitted to the City along with any
379 applicable applications or materials that are ordinarily required by this chapter along with
380 any applicable fees as outlined in the City's fee schedule.

381 3. The DRC may provide any helpful suggestions or cautions, including relevant
382 specifications and regulations, to help the applicant understand what must be done to
383 have the subdivision application accepted by the Land Use Authority.

384 4. The DRC shall determine whether the proposed subdivision requires the submission of a
385 concept plan.

386 B. The applicant must be the property owner, or an official representative of the property owner
387 and shall provide the City with complete and accurate information about the size and scope of
388 the proposed project.

389 ...

390

391 **SECTION IV:** Amend TITLE 12 LAND USE, adding 12F Land Use - Geologic Hazard Mitigation.

392

393 **12F Land Use - Geologic Hazard Mitigation**

394

395 **12F-100 – Purpose**

396

397 **The purpose of this geologic hazard ordinance is to promote and protect the health, safety, and welfare**
398 **of the citizens of North Logan, protect the infrastructure and financial health of North Logan, and**
399 **minimize adverse effects of geologic hazards to public health, safety, and property by encouraging wise**
400 **land use and development.**

401

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402 **12F-200 – Definitions**

403

404 As used in this geologic hazard ordinance, the following terms have the following meanings:

405

406 1. **ACCEPTABLE AND REASONABLE RISK:** No loss or significant injury to occupants, no release of
407 hazardous or toxic substances, and minimal structural damage to buildings or infrastructure
408 during a hazard event allowing occupants egress outside.

409

410 2. **ACCESSORY BUILDING:** Any structure not designed for human occupancy, which may include
411 tool or storage sheds, gazebos, and swimming pools. Accessory dwelling units and 228 Utah
412 Geological Survey businesses located in accessory buildings must comply with all requirements
413 as buildings designed for human occupancy.

414

415 3. **ACTIVITY CLASS OF FAULTS:** The activity level of a fault is based on the latest Western States
416 Seismic Policy Council (WSSPC) policy recommendation defining surface faulting
417 (<https://www.wsspc.org/public-policy/adopted-recommendations/>). WSSPC Policy
418 Recommendation 18-3 states that based on the time of most recent movement: latest
419 Pleistocene- Holocene faults are defined as movement in the past 15,000 years, late Quaternary
420 faults are defined as movement in the past 130,000 years, and Quaternary faults are defined as
421 movement in the past 2,600,000 years. **ALLUVIAL FAN:** A fan shaped deposit where a fast-
422 flowing stream flattens, slows, and spreads, typically at the exit of a canyon onto a flatter plain.

423

424 4. **AVALANCHE:** A large mass of predominantly snow and ice, but may also include a mixture of
425 soil, rock, and/or organic debris that falls, slides, and/or flows rapidly downslope under the
426 force of gravity.

427

428 5. **BUILDABLE AREA:** Based on an accepted geologic hazard investigation report, the portion of a
429 site not impacted by geologic hazards, or the portion of a site where it is concluded the
430 identified geologic hazards can be mitigated to an acceptable and reasonable risk, and where
431 structures may be safely located. Buildable areas must be clearly marked on approved site plans
432 and/or final approved plats, as appropriate.

433

434 6. **CITY COUNCIL:** The city council of North Logan.

435

436 7. **CRITICAL FACILITIES:** Essential, hazardous, special occupancy, and all Risk Categories III and IV
437 structures, as defined in the statewide adopted International Building Code (IBC), and lifelines,
438 such as major utility, transportation, communication facilities, and their connections to critical
439 facilities.

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8. DEBRIS FLOW: A slurry of rock, soil, organic material, and water transported in an extremely fast and destructive manner that flows down channels and onto and across alluvial fans; includes a continuum of sedimentation events and processes, including debris flows, debris floods, mudflows, sheet flooding, and alluvial fan flooding.
9. DEVELOPMENT: All critical facilities, subdivisions, single-family dwellings, duplexes, and multi-family dwellings, commercial and industrial buildings; also includes additions to or intensification of existing buildings, storage facilities, pipelines and utility conveyances, and other land uses.
10. ENGINEERING GEOLOGIST: A Utah-licensed Professional Geologist, who, through education, training, and experience, practices in the field of engineering geology and geologic hazards meeting the requirements of Section 1.6.
11. ENGINEERING GEOLOGY: Geologic work that is relevant to engineering and environmental concerns, and the health, safety, and welfare of the public. Engineering geology is the application of geological data, principles, and interpretation affecting the planning, design, construction, and maintenance of engineered works, land use planning, and groundwater issues.
12. ESSENTIAL FACILITY: Buildings and other structures intended to remain operational in the event of an adverse geologic event, including all structures with an occupancy greater than 1000 shall also be considered IBC Risk Category III when not meeting the criteria for IBC Risk Category IV; and IBC Risk Category IV buildings and other structures are designated as essential (critical) facilities.
13. FAULT: A fracture in the Earth's crust forming a boundary between rock and/or soil masses that have moved relative to each other, due to tectonic forces. When the fracture extends to the Earth's surface, it is known as surface fault rupture, or a fault trace.
14. FAULT SCARP: A steep slope or cliff formed by movement along a fault.
15. FAULT SETBACK: A specified distance on either side of a fault within which structures for human occupancy or critical facilities and their structural supports are not permitted.
16. FAULT TRACE: The intersection of a fault plane with the ground surface, often present as a fault scarp, or detected as a lineament on aerial photographs or other imagery.

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- 478 17. **FAULT ZONE:** A corridor of variable width along one or more fault traces, within which ground
479 deformation has occurred as a result of fault movement.
480
- 481 18. **GEOLOGIC HAZARD:** A geologic condition that presents a risk to life, of substantial loss of real
482 property, or of substantial damage to real property (Utah Code 17-27a-103[19]:
483 <https://le.utah.gov/xcode/Title17/Chapter27A/17-27a-S103.html>) and includes, but not limited
484 to surface fault rupture, steep slopes, natural drainage areas, liquefaction, landslides, slope
485 stability, debris flows, rockfalls, avalanches, radon gas, and other hazards.
486
- 487 19. **GEOLOGIC HAZARD STUDY AREA:** A potentially hazardous area as defined in Section 12F-400 of
488 this ordinance within which geologic hazard investigations are required prior to development.
489
- 490 20. **GEOTECHNICAL ENGINEER:** A Utah-licensed Professional Engineer who, through education,
491 training, and experience, is competent in the field of geotechnical or geological engineering
492 meeting the requirements of Section 12F-600.
493
- 494 21. **GEOTECHNICAL ENGINEERING:** The investigation and engineering evaluation of earth materials,
495 including soil, Appendix E | Guidelines for investigating geologic hazards and preparing
496 engineering-geology reports, second edition 229 rock, and manmade materials and their
497 interaction with earth retention systems, foundations, and other civil engineering works. The
498 practice involves the fields of soil and rock mechanics and the earth sciences, and requires the
499 knowledge of engineering laws, formulas, construction techniques, and performance evaluation.
500
- 501 22. **GOVERNING BODY:** The City Council, or a designee of the Council.
502
- 503 23. **HAZARDOUS FAULT:** A fault with movement in the past 2,600,000 years (Quaternary).
504
- 505 24. **INFRASTRUCTURE:** Those improvements which are required to be installed and guaranteed in
506 conjunction with an approved subdivision or other land use approval. Infrastructure may be
507 public or private, on site or off site, depending on development design, and may include streets,
508 curb, gutter, sidewalk, water and sanitary sewer lines, storm sewers, flood control facilities, and
509 other similar facilities.
510
- 511 25. **INTERNATIONAL BUILDING CODE (IBC):** The latest, statewide adopted International Code Council
512 International Building Code (Utah Code Title 15A, <https://le.utah.gov/xcode/Title15A/15A.html>).
513 An online version of the 2018 IBC is available at <https://codes.iccsafe.org/content/IBC2018> and
514 the 2018 International Residential Code (IRC) is available at
515 <https://codes.iccsafe.org/content/IRC2018>.

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26. **LANDSLIDE:** The downslope movement of a mass of soil, surficial deposits, and/or bedrock, including a continuum of processes between landslides, earth flows, debris flows, debris avalanches, and rockfalls.

27. **LEGAL LOT OF RECORD:** A parcel of land which meets all zoning requirements to be eligible for the development of a dwelling, habitable structure, or other facility or structure, pursuant to all North Logan requirements.

28. **LIQUEFACTION:** A sudden, large decrease in shear strength of a saturated, cohesionless soil (generally sand and silt) caused by a collapse of soil structure and temporary increase in pore water pressure during earthquake ground shaking. May lead to ground failure, including lateral spreads and flow-type landslides.

29. **NON-BUILDABLE AREA:** That portion of a site which a geologic hazard investigation report has concluded is impacted by geologic hazards that present an unreasonable and unacceptable risk, and where the siting of habitable structures, accessory structures which house an accessory dwelling unit or business, or critical facilities, are not permitted.

30. **ROCKFALL:** A rock or mass of rock, newly detached from a cliff or other steep slope which moves downslope by falling, rolling, toppling, and/or bouncing; includes rockslides, rockfall avalanches, and talus.

31. **SETBACK:** An area subject to risk from a geologic hazard within which habitable structures or critical facilities and their supports are not permitted.

32. **SLOPE STABILITY:** The resistance of a natural or constructed slope to failure by landsliding and assessed under both static and dynamic (earthquake-induced) conditions.

33. **SNOW AVALANCHE:** See definition of Avalanche.

34. **STRUCTURE DESIGNED FOR HUMAN OCCUPANCY:** Any residential dwelling or any other structure used or intended for supporting or sheltering any use or occupancy by humans or businesses, includes all Risk Category II structures as defined in the currently adopted International Building Code, but does not include an accessory building that houses no accessory dwelling unit or business.

35. **TALUS:** Rock fragments lying at the base of a cliff or a very steep rocky slope.

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12F-300 – Applicability

The regulations contained in this ordinance shall apply to all lands under the jurisdiction of North Logan. Every legal lot of record, lot in a proposed land subdivision, and parcel within a Geologic Hazard Study Area as defined by this ordinance must have a safe buildable area for the intended use. Each buildable area must also have access from the nearest existing public or private street which is free of unreasonable and unacceptable geologic hazards. Any geologic hazards must be identified in order to provide a safe buildable area with acceptable and reasonable access prior to approval of a final plat. Any identified geologic hazards must be adequately mitigated prior to issuance of a building permit.

Detached accessory buildings that are under 200 sq. ft. in area and that are not designed for human occupancy are not required to comply with the provisions of this ordinance. In addition, the remodeling of existing structures designed for human occupancy may occur without compliance with this ordinance, if no expansion of the existing structure footprint, foundation, and no structure use change is proposed. Complete or substantial demolition and replacement of structures shall comply with this ordinance.

As defined in the statewide adopted 2018 International Building Code (IBC), Table 1604.5, North Logan considers IBC Risk Category III buildings and other structures to represent a substantial hazard to human life in the event of failure, except that any structure with an occupancy greater than 1000 shall also be considered IBC Risk Category III when not meeting the criteria for IBC Risk Category IV; and IBC Risk Category IV buildings and other structures are designated as essential (critical) facilities. Each of these building types shall be required to comply with the provisions of this ordinance.

12F-400 – Geologic Hazard Study Areas

A. Geologic Hazard Study Areas in North Logan are defined as, but are not necessarily limited to:

1. Designated Special Study Areas by the Utah Department of Natural Resources, Utah Geological Survey (UGS, <https://geology.utah.gov>), including those areas designated per Utah Code 79-3-202(f) around hazardous faults and are in the Utah Quaternary Fault and Fold Database (<https://geology.utah.gov/apps/qfaults/>); and
2. Surface-fault-rupture hazard areas; and
3. Landslide hazard areas; and
4. Liquefaction hazard areas; and

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5. Debris flow hazard areas; and

6. Rockfall hazard areas; and

7. Land subsidence and earth fissure hazard areas; and

8. Radon gas hazard areas; and

9. Problem soil and rock hazard areas; and

10. Snow avalanche hazard areas; and

11. Geologic-based flood hazard areas; and

12. Other areas where the topography; geology, including soils and bedrock conditions, either on the subject property or adjacent indicate the presence of geologic hazards, other previously identified geologic hazards; and environmentally sensitive areas that North Logan finds to be of significance to the health, safety, and welfare of the citizens of North Logan; and

13. Site-specific surface-fault-rupture investigations are required for all critical facilities and structures for human occupancy (International Building Code [IBC] Risk Category II, III, and IV) along latest Pleistocene- Holocene faults and for critical facilities (IBC Risk Category IV) along late Quaternary and Quaternary faults. For noncritical facilities for human occupancy (IBC Risk Category II and III) along late Quaternary and Quaternary faults, investigations are recommended, but not required. See the UGS Utah Quaternary Fault and Fold Database (<https://geology.utah.gov/apps/qfaults>) to locate Quaternary age faults within North Logan and to determine their activity class.

B. The applicant's professional consultants will find geologic information available from the UGS and other sources useful in planning site development, preparing for the scoping meeting, and in performing geologic hazard investigations and subsequent analysis. Available UGS information includes:

1. Geologic maps (<https://geology.utah.gov/apps/intgeomap/>)

2. Geologic hazard maps and data (<https://geology.utah.gov/hazards/info/maps/>)

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3. Aerial photographs (<https://geology.utah.gov/resources/data-databases/aerial-photographs/>)

4. Prior geologic and geotechnical reports (<https://geodata.geology.utah.gov/>)

5. Other information (<https://geology.utah.gov/>)

6. Lidar elevation data are available at <https://gis.utah.gov/data/elevation-and-terrain/> and <https://opentopography.org>.

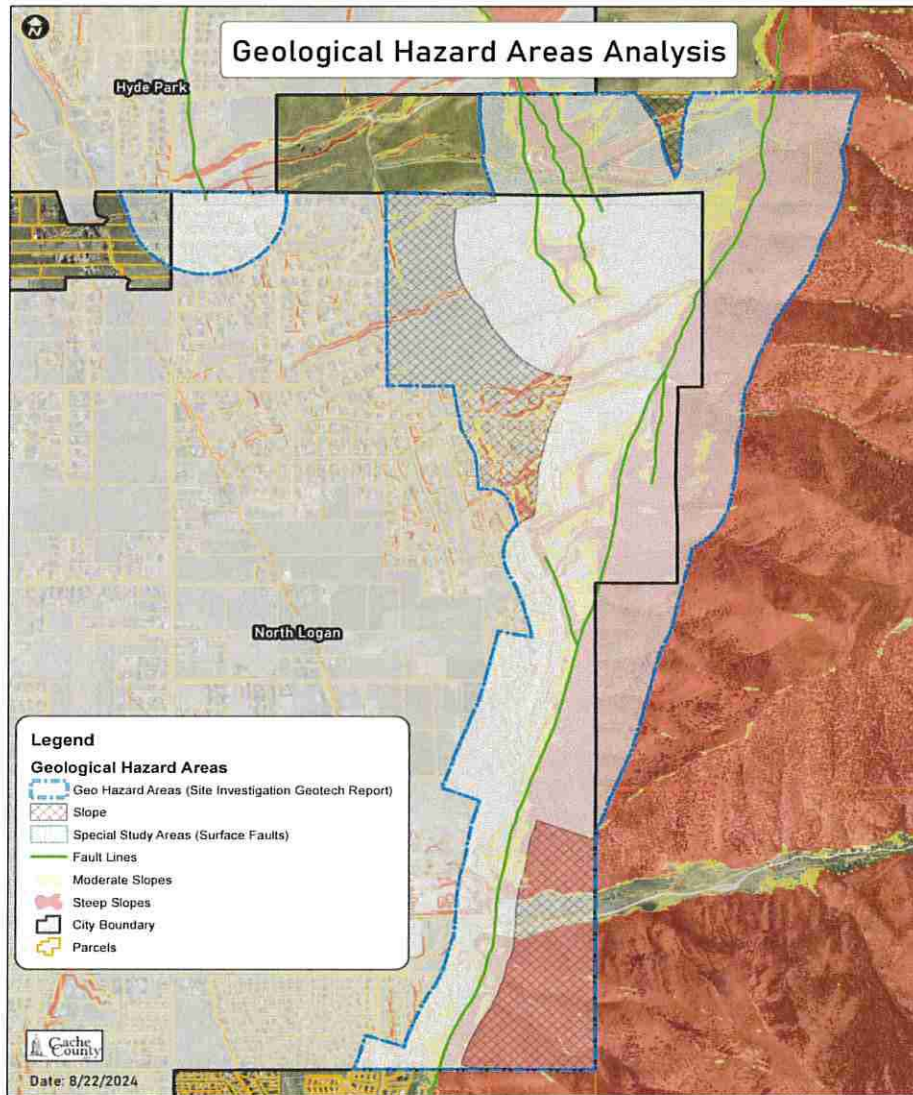
In areas where UGS geologic hazard maps are not available and where geologic maps are used to define Geologic Hazard Study Areas, note that geologic hazard maps are based on significant other data sources beyond geologic maps and that not all of a geologic unit may be prone to geologic hazard(s).

C. **Figure 1** has been generated as a reference map to facilitate quick identification of areas within North Logan that are located within known geologic hazard areas or Special Study Areas. Please note that **Figure 1** is provided as a quick reference guide and does not represent all of the potential geologic hazards that may exist on a particular piece of property. Geologic Hazard Investigations and reports are required for any development located within the mapped Geologic Hazard Areas as identified in **Figure 1**. Any lot or parcel in North Logan that is located outside of the Geologic Hazard Areas depicted in **Figure 1** may also be required to perform a Geologic Hazard Investigation if the property is found to contain, or is suspected to contain, any of the geologic hazards listed in subsection 12F-400(A) above.

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Figure 1: Known Geological Hazard Areas in North Logan



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659

12F-500 – Geologic Hazard Investigations and Reports Required for Development

661

Any applicant requesting land-use approvals for property located within the mapped Geologic Hazard Study Area, shall submit to North Logan an unlocked PDF digital copy of a site-specific geologic hazard investigation report that specifically relates to the geologic hazards present on and adjacent to the subject site.

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667 For the purposes of this subsection, "land use approvals" shall mean a building permit request on a lot
668 or parcel, whether existing or newly subdivided; evaluating and approving a subdivision concept plan,
669 preliminary plat, or final plat; any conditional use permit which requires site plan approval; or exploring,
670 evaluating, or establishing locations for permanent improvements.

671

672 **12F-600 – Minimum Investigator Professional Qualifications**

673

674 Geologic hazard investigations often involve both engineering geology and geotechnical engineering.
675 Engineering geology investigations shall be performed under the direct supervision of a Utah-licensed
676 Professional Geologist specializing in engineering geology. Geotechnical engineering investigations shall
677 be performed under the direct supervision of a Utah-licensed Professional Engineer specializing in
678 geotechnical engineering. Licenses may be verified with the Utah Division of Occupational &
679 Professional Licensing (<https://secure.utah.gov/llv/search/index.html>).

680

681 Engineering geology and the evaluation of geologic hazards is a specialized discipline within the practice
682 of geology requiring the technical expertise and knowledge of techniques not commonly used in other
683 geologic investigations. Therefore, geologic hazard investigations involving engineering geology and
684 geologic hazard investigations shall be conducted, signed, and sealed by a Utah-licensed Professional
685 Geologist specializing in engineering geology and geologic hazards. Proof of qualifications shall be
686 provided to North Logan upon request.

687

688 The minimum qualifications required by North Logan for an Engineering Geologist, include:

689

690 A. An undergraduate or graduate degree in geology, engineering geology, or geological
691 engineering, or closely related field, from an accredited college or university; and

692

693 B. Five full-time years of experience in a responsible position in the field of engineering geology
694 and geologic hazards in Utah, and experience demonstrating the geologist's knowledge and
695 application of appropriate techniques in geologic hazard investigations; and

696

697 C. An active Utah Professional Geologist license in good standing.

698

699 Evaluation and mitigation of geologic hazards often require contributions from a qualified Geotechnical
700 Engineer, particularly in the design of mitigation measures. Geotechnical engineering is a specialized
701 discipline within the practice of civil engineering requiring the technical expertise and knowledge of
702 techniques not commonly used in civil engineering. Therefore, geologic hazard investigations that
703 include engineering design and related tasks shall be conducted, signed, and sealed by a Utah-licensed

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704 Professional Engineer, specializing in geotechnical engineering and geologic hazards. Proof of
705 qualifications shall be provided to North Logan upon request.

706

707 The minimum qualifications required by North Logan for a Geotechnical Engineer, include:

708

709 A. A graduate degree in civil or geological engineering, with an emphasis in geotechnical
710 engineering; or a B.S. degree in civil or geological engineering with 12 semester hours of post
711 B.S. credit in geotechnical engineering, or course content closely related to evaluation of
712 geologic hazards, from an ABET accredited college or university program; and

713

714 B. Five full-time years of experience in a responsible position in the field of geotechnical
715 engineering and geologic hazards in Utah, or in a state with similar geologic hazards and
716 regulatory environment, and experience demonstrating the engineer's knowledge and
717 application of appropriate techniques in geologic hazard investigations; and

718

719 C. An active Utah Professional Engineer license in good standing.

720

721 **12F-700 – Activities to be Performed Prior to Subdivision or Site Plan Design**

722

723 This section shall apply to any geologic hazard investigation for the purpose of determining the
724 feasibility of land-use approval for a concept plan, preliminary plat, or final plat; or any conditional use
725 permit which requires site plan approval; or for the purpose of exploring, evaluating, or establishing
726 locations for permanent improvements. A geologic hazard report shall be submitted to North Logan as
727 part of a complete land use application, pursuant to the requirements of this ordinance, for any
728 proposed development either partially or entirely within a Geologic Hazard Study Area.

729

730 A. Prior to a land use application, the applicant shall schedule a scoping meeting with North Logan
731 to evaluate the Engineering Geologist's and Geotechnical Engineer's investigative approach and
732 work plan. The investigation approach shall allow for flexibility due to unexpected site
733 conditions. Field findings may require modifications to the work plan. At this meeting, the
734 applicant shall present a work plan that includes the locations of anticipated geologic hazards
735 and proposed subsurface exploratory excavations, such as test pits, trenches, borings, and cone
736 penetrometer test (CPT) soundings, which meet the minimum acceptable regional standards of
737 practice, this ordinance, and includes:

738

739 1. A property location map; and

740

741 2. A geologic map; and

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3. A topographic map with contours; and

4. A slope map or lidar imagery, if available; and

5. A map showing the location of the proposed development, including structures, roads, depths of basements and foundations, etc.; locations of proposed subsurface exploration, such as trenches, borings, test pits, etc.; with a description of the proposed development; and

6. A map showing the slope stability analysis cross section locations, if existing landslides are present on or near the proposed site and/or slope instability is anticipated.

B. North Logan will arrange for a Utah-licensed Professional Geologist, specializing in engineering geology, to attend the scoping meeting on behalf of the City at the applicant's expense. North Logan's geologist will provide verbal feedback to the applicant and their consultants regarding their proposed work plan and the requirements of this article. Reimbursement to the City for the direct costs of any outsourced staff shall be paid by the applicant prior to the acceptance of a subdivision or site plan application; and

C. As required by this code and except as otherwise noted herein, no person shall commence or perform any land disturbance, grading, excavation, relocation of earth, or any other land disturbance activity, without first obtaining an excavation or grading permit. Application for an excavation or grading permit shall be filed with North Logan on forms furnished by the City for such purposes only after a scoping meeting has taken place; and

D. The applicant shall specify a primary contact responsible for coordination with North Logan during the land disturbance activities.

12F-800 – Building Permit Issuance - Site-Specific Requirements and Application Review Procedures

A. The following submittal items are required for the issuance a building permit for a new or replacement structure that is either over 200 sq. ft., designed for human occupancy, or is an addition to a structure designed for human occupancy on any lots or parcels, whether existing or newly subdivided, located within Geologic Hazard Study Areas:

1. A lot or parcel's site-specific geologic hazards investigation report.

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780 2. A professionally-developed and stamped final site plan and civil plan set, drawn to scale,
781 containing the following items:

782
783 a. Calculated cut and fill schedule.

784
785 (1) Maximum cuts into native hillsides shall be limited to no more than 5-
786 feet when within 10-feet of a living space, and no more than twelve-feet
787 when immediately adjacent to non-living space.

788
789 b. Final grading plan.

790
791 (1) The final grading plan shall depict the placement of any proposed
792 structures. The plan shall depict both the site's native and final
793 contours. Final grade contours shall be coordinated around any
794 proposed structure's footprint and elevations. All contours shall be
795 depicted with no more than a one-foot separation.

796
797 (2) The final grading plan shall identify how the lot or parcel will retain and
798 discharge its on-site stormwater. Stormwater shall not be released onto
799 adjacent properties without a coordinated discharge design.

800
801 (3) The final grading plan shall incorporate a retaining wall plan for any
802 proposed retaining wall/s needed on the property to achieve the final
803 grading plan. This retaining wall plan shall be developed and stamped by
804 a licensed civil engineer and shall follow any recommendations of the
805 site-specific geologic hazards investigation report.

806
807 (A) The maximum allowed combined retaining wall height between
808 a property line and the foundation of a structure shall be no
809 more than 16-feet. Multiple smaller retaining walls may be
810 used, but the sum of all the retaining walls shall not exceed 16-
811 feet. No one single retaining wall shall exceed 8-feet in height.

812
813 (B) All retaining walls over four-feet in height shall be required to
814 incorporate a drainage system designed to ensure water is
815 diverted around the wall and never over the top.

816

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- 817 3. A statement from an Engineering Geologist identifying the presence or absence of any
818 geologic hazards and describing the buildable footprint area on the lot or parcel for the
819 proposed structure.
820
- 821 4. A statement from a Geotechnical Engineer verifying that the slope stability of the
822 proposed structure location will have a ≥ 1.1 dynamic (pseudostatic) and ≥ 1.5 static
823 factor of safety. The statement shall clearly identify the anticipated conditions, such as
824 the seismic ground acceleration and pseudostatic coefficients used, and any required
825 mitigation measures to achieve the required factors of safety.
826
- 827 5. A statement from a Utah-licensed Professional Structural Engineer stating that they
828 have reviewed the geologic and geotechnical reports, which may be combined into one
829 report, and that they have designed the structure in accordance with the report
830 recommendations, accounting for any identified geologic and geotechnical hazards in
831 accordance with the currently statewide adopted International Building Code and
832 related standards.
833
- 834 6. Written verification from the consultant's issuer of professional errors and omissions
835 liability insurance, in the amount of [\$2,000,000.00] per consultant, which covers the
836 licensed Professional Engineering Geologist, Geotechnical Engineer, and Structural
837 Engineer, and which are in effect on the date of issuance of the building permit by the
838 City Building Official.
839
- 840 7. A Hold Harmless Agreement on a city approved form, which is executed and recorded
841 on the subject property.
842
- 843 8. A Geologic Hazards Disclosure on a city approved form, which is executed and recorded
844 for the subject property.
845
- 846 9. All conditions of the adopted statewide building and fire codes (see
847 <https://le.utah.gov/xcode/Title15A/15A.html>) must be adhered to.
848
- 849 B. Upon receipt of a complete building permit application, North Logan City shall arrange for a 3rd
850 party Utah-licensed Professional Geologist, specializing in engineering geology, to review the
851 building permit request on behalf of the City. North Logan's geologist will provide written
852 feedback to the applicant and their consultants regarding the proposed building and grading
853 plans pursuant to the requirements of this article. Reimbursement to the City for the direct

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854 costs of this 3rd party review shall be paid by the applicant prior to the issuance of a building
855 permit.

856

857 C. Prior to the issuance of a Certificate of Occupancy:

858

859 1. An Excavation Inspection Report shall be submitted by a Geotechnical Engineer to the
860 City Building Official prior to footing placement, which verifies that the proposed
861 building was in accordance with the recommendations of the geologic and geotechnical
862 reports, which may be combined into one report; and

863

864 2. The City Building Official may require, at any time, written verification from a
865 Geotechnical Engineer or a Utah-licensed Professional Structural Engineer, that the
866 structure conforms to the recommendations of the original reports and designs. If the
867 structure requires design modifications following the issuance of the original building
868 permit, such modifications shall first be communicated to the building official for review
869 and approval before additional work on the structure may proceed. At their discretion,
870 the Building Official shall have the option to pass the design modifications over to an
871 appropriately licensed 3'rd party professional for additional review; and

872

873 3. All requirements of the statewide adopted Utah State Construction and Fire Codes Act
874 (<https://le.utah.gov/xcode/Title15A/15A.html>) must be met.

875

876 **12F-900 – Geologic Hazard Investigation Field Review**

877

878 A field review by North Logan is required during subsurface exploration activities (test pits, trenches,
879 drilling, etc.) to allow the City to evaluate the subsurface conditions, such as the age and type of
880 deposits encountered, the presence or absence of faulting, etc. with the applicant's geologic consultant.
881 Discussions about questionable features or appropriate setback distances are acceptable, but North
882 Logan will not assist with field logging, explaining stratigraphy, or give verbal approval of the proposed
883 development during the field review. Exploratory trenches when excavated, shall be open, safe, and in
884 compliance with applicable federal Occupational Safety and Health Administration, State of Utah, and
885 other excavation safety regulations, have the walls appropriately cleaned, and a field log completed by
886 the time of the review. The applicant must provide North Logan with a minimum notice of 15 business
887 days to schedule the field review.

888

889 **12F-1000 – Submittal and Certification of Geologic Hazard Reports**

890

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- 891 A. All applicants for land use approval within a Geologic Hazard Study Area shall prepare and
892 submit a geologic hazard report (may be combined with geotechnical and/or other geologic
893 reports) pursuant to the requirements of this article prior to any consideration for a concept
894 plan; preliminary or final plat; commercial, institutional, or one-, two-, and multi-family dwelling
895 permit; or any conditional use permit which requires site plan approval. Additionally, the
896 applicant is required to submit the following additional information with the report:
897
- 898 1. A written, stamped certification from a Utah-licensed Professional Geologist that the
899 geologic hazard report has been prepared pursuant to the requirements of this
900 ordinance; and
901
 - 902 2. As may be applicable, a written, stamped certification from a Utah-licensed Professional
903 Geologist and a Professional Engineer that every proposed development lot or parcel,
904 along with its proposed building pad, does not present an unreasonable or unacceptable
905 risk to the health, safety, and welfare of persons or property, including buildings, storm
906 drains, public streets, culinary water facilities, utilities, or critical facilities, whether off
907 site, on adjacent properties, or on site, because of the presence of geologic hazards or
908 because of modifications to the site due to the proposed land use; and
909
 - 910 3. As may be applicable, a written, stamped certification from a Utah-licensed Professional
911 Geologist and a Professional Engineer that every proposed development lot or parcel,
912 building pad, and lot or parcel layout demonstrates that, consistent with regional
913 standards of practice, the identified geologic hazards can be mitigated to a level where
914 the risk to human life and damage to property are reduced to an acceptable and
915 reasonable level in a manner which will not violate applicable federal, state, and local
916 statutes, ordinances, and regulations. Mitigation measures shall consider in their design,
917 the intended aesthetic functions of other governing ordinances of North Logan; and
918
 - 919 4. A written, stamped certification from a Utah-licensed Professional Geologist and a
920 Professional Engineer along with a mitigation plan, if necessary, that demonstrates that
921 the identified hazards or limitations will be addressed without impacting or adversely
922 affecting off site areas, including adjacent properties. Mitigation measures must be
923 reasonable and practical to implement and shall not require ongoing maintenance by
924 property owners; and
925
 - 926 5. Written verification from the issuer of professional errors and omissions liability
927 insurance, in the amount of [\$2,000,000.00] each, which covers the Utah-licensed

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928 Professional Geologist and Professional Engineer, and which are in effect on the date of
929 preparation and submission of all required reports and certifications.

930

931 B. North Logan may set other requirements as are necessary to mitigate any geologic hazards and
932 to ensure that the purposes of this article are met. These requirements may include, but are not
933 limited to:

934

935 1. Additional or more detailed investigations and professional certifications to understand
936 or quantify the hazards and/or determine whether mitigation measures recommended
937 in the report are adequate; and

938

939 2. Specific mitigation requirements, establishing buildable and non-buildable areas,
940 limitations on slope grading, controls on grading, and/or revegetation; and

941

942 3. Prior to receiving a grading, excavation, or building permit, final grading plans, when
943 required, shall be prepared, signed and sealed by the Utah licensed Engineering
944 Geologist and Geotechnical Engineer that prepared the geologic hazard and
945 geotechnical report(s) to verify that their recommendations have been appropriately
946 incorporated in the final grading plan and that building locations are approved; and

947

948 4. As built grading plans, when required, shall be prepared, signed, and sealed by the Utah
949 licensed Engineering Geologist and Geotechnical Engineer that prepared the geologic
950 hazard and geotechnical report(s) to verify that their recommendations have been
951 appropriately incorporated and that building locations are approved, prior to the
952 issuance of a building permit; and

953

954 5. Grading plans, when required, shall include, at a minimum, the following:

955

956 a. Maps of existing and proposed contours and the source and accuracy of
957 topographic data used; and

958

959 b. Present and proposed slopes for each graded area; and

960

961 c. Existing and proposed drainage patterns; and

962

963 d. Location and depth of all proposed cuts and fills; and

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- 965 e. Description of the methods to be employed to achieve soil and/or rock
966 stabilization and compaction, as appropriate; and
967
- 968 f. Location and capacities of proposed structures, and drainage and erosion
969 control measures based on maximum runoff for a 100-year storm or greater;
970 and
971
- 972 g. Location of existing buildings, structures, roads, wells, retention and other
973 basins, and on-site sewage disposal systems on or within 100 feet of the site
974 that may be affected by the proposed grading and construction; and
975
- 976 h. A plan for construction monitoring and documentation of testing, field
977 inspection during grading, and reporting to North Logan; and
978
- 979 6. Installation of monitoring equipment for surface and subsurface geologic conditions,
980 including determining groundwater levels; and
981
- 982 7. Other requirements, such as time schedules for completion of the mitigation and
983 phasing of development.
984
- 985 C. North Logan may also set requirements necessary to protect the health, safety, and welfare of
986 the citizens of North Logan, protect the infrastructure and financial health of North Logan, and
987 minimize potential adverse effects of geologic hazards to the public health, safety, and property
988 as a condition of approval of any development which requires a geologic hazard report.
989
- 990 D. North Logan may require the Engineering Geologist and Geotechnical Engineer that prepared
991 the geologic hazard and/or geotechnical report(s) be on site, at the cost of the applicant, during
992 certain phases of construction, particularly during grading phases, the construction of retaining
993 walls in excess of 4 feet in exposed height, and geologic hazard mitigation.
994
- 995 E. North Logan shall review any proposed land use that requires preparation of a geologic report
996 under this article to determine the possible risks to the health, safety, and welfare of persons,
997 property, and City infrastructure from geologic hazards.
998
- 999 1. Prior to consideration of any request for preliminary plat approval or site plan approval,
1000 the geologic report shall be submitted to North Logan for review.
1001
- 1002 2. North Logan will complete each review in a reasonable time frame.

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3. All direct costs associated with the review of the geologic report shall be paid by the applicant.

4. North Logan shall determine whether the report complies with the following standards:

a. A suitable geologic hazards report has been prepared by qualified, Utah-licensed professionals; and

b. The proposed land use does not present an unreasonable risk to the health, safety, and welfare of persons or property, including buildings, storm drains, public streets, culinary and other water facilities, utilities or critical facilities, whether off-site or on-site, or to the aesthetics and natural functions of the landscape, such as slopes, streams or other waterways, drainage, or wildlife habitat, whether off-site or on-site, because of the presence of geologic hazards or because of modifications to the site due to the proposed land use; and

c. The proposed land use demonstrates that, consistent with the current, regional state of practice, the identified geologic hazards can be mitigated to a level where the risk to human life and damage to property are reduced to an acceptable and reasonable level in a manner which will not violate applicable federal, state, and local statutes, ordinances, and regulations. The applicant must include with the geologic report, a mitigation plan that defines how the identified hazards or limitations will be addressed without impacting or adversely affecting off-site areas. Mitigation measures must be reasonable and practical to implement, especially if such measures require on-going maintenance by property owners; and

d. Should a geologic report be found deficient with respect to this ordinance and/or the current, regional state of practice, a letter will be provided to the applicant summarizing the specific deficiencies. If a submitted report is found deficient three times or a report was excessively deficient, North Logan will notify the Utah Division of Occupational & Professional Licensing about the licensed professional(s) deficient reports that were submitted to a public entity that were not in compliance with Utah Rules R156-76-502 (Professional Geologists, <https://rules.utah.gov/publicat/code/r156/r156-76.htm>) and/or R156-22-502 (Professional Engineers, <https://rules.utah.gov/publicat/code/r156/r156-22.htm>).

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F. For any real property with respect to which development has proceeded on the basis of a geologic hazard and/or geotechnical report which has been accepted by North Logan, no final inspection shall be completed, Certificate of Occupancy issued, or performance bond released until the Engineering Geologist and Geotechnical Engineer who signed, stamped, and approved the report(s), certifies in writing, that the completed development, improvements, and structures conform to the descriptions and requirements contained within the report, and that all the required inspections were made and approved by the Engineering Geologist and Geotechnical Engineer that prepared said report(s). If the preparing Engineering Geologist and Geotechnical Engineer are unavailable, an Engineering Geologist and Geotechnical Engineer, similarly qualified and licensed in Utah, shall provide the certifications.

G. An applicant may appeal any decision made under the provisions of this article only after the land-use authority has issued a final decision and shall set forth the specific grounds or issues upon which the appeal is based. The appeal shall be submitted in writing to North Logan in accordance with the appeals provision ordinances of North Logan and current State of Utah code.

H. North Logan shall retain a copy of each geologic hazard and/or geotechnical report in the project file that will be available for public inspection and will provide a copy to the UGS for archiving. Currently, the UGS archives these reports in the GeoData Archive System (<https://geodata.geology.utah.gov>).

12F-1100 – Disclosure When a Geologic Hazard Report is Required

A. Whenever a geologic hazard report is required under this article; the owner of the parcel shall record a notice running with the land on a form provided by North Logan prior to the approval of any development or subdivision of such parcel or commencement of construction activity. Disclosure shall include signing a Disclosure and Acknowledgment Form provided by North Logan, which includes:

1. Notice that the parcel is located within a Geologic Hazard Study Area or as otherwise defined in this article; and
2. Notice that a geologic hazard report was prepared and is available for public inspection in North Logan's files.

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1078 3. Where geologic hazards, related setbacks, and non-buildable areas are delineated in a
1079 subdivision, the owner shall also place additional notification on the plat stating the
1080 above information, prior to final approval of the plat by North Logan.
1081

1082 **12F-1200 – Warning and Disclaimer**
1083

1084 The Geologic Hazard Study Areas designated herein represent only those potentially geologic hazardous
1085 areas known to North Logan and should not be construed to include all possible potential hazard areas.
1086 The geologic hazard ordinance and the Geologic Hazard Study Areas may be amended as new
1087 information becomes available, pursuant to procedures set forth in this ordinance. The provisions of this
1088 ordinance do not in any way assure or imply that areas outside the Geologic Hazard Study Areas are free
1089 from the possible adverse effects of geologic hazards. This article shall not create any liability on the part
1090 of North Logan, its officers, reviewers, or employees thereof, for any damages from geologic hazards
1091 that result from reliance on this ordinance or any administrative requirement or decision lawfully made
1092 hereunder.
1093

1094 **12F-1300 – Change of Use**
1095

1096 No change in use which results in the conversion of a building or structure from one not used for human
1097 occupancy to one that is so used shall be permitted unless the building or structure complies with the
1098 provisions of this article.
1099

1100 **12F-1400 – Hold Harmless Agreement**
1101

1102 Applicants receiving any permit or approval within a Geologic Hazard Study Area shall be required to
1103 sign and record on the property a Hold Harmless Agreement available from North Logan.
1104

1105 **12F-1500 – Conflicting Regulations**
1106

1107 In cases of conflict between the provisions of existing zoning classifications, building codes, the
1108 subdivision ordinance, or any other ordinance of North Logan and this geologic hazard ordinance, the
1109 most restrictive provision shall apply.
1110

1111
1112 **12F-1600 – Geologic Hazard Investigations and Reports**
1113

1114 Each geologic hazard investigation and report shall be site-specific and shall identify all known or
1115 suspected potential geologic hazards, whether previously identified or unrecognized, that may affect the

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1116 subject property, both on and adjacent to the property. A geologic hazard report may be combined with
1117 a geotechnical report and/or contain information on multiple hazards.

1118
1119 A. A field review by North Logan is required during subsurface exploration activities (test pits,
1120 trenches, drilling, etc.) to allow the City to evaluate the subsurface conditions, such as the age
1121 and type of deposits encountered, the presence or absence of landslides and faults, etc. with
1122 the applicant's consultant. Discussions about questionable features or appropriate setback
1123 distances are appropriate, but North Logan will not assist with field logging, explaining
1124 stratigraphy, or give approval of the proposed development during the field review. Exploratory
1125 trenches when excavated, shall be open, safe, and in compliance with applicable federal
1126 Occupational Safety and Health Administration, State of Utah, and other excavation safety
1127 regulations, have the walls appropriately cleaned, and a field log completed by the time of the
1128 review. The applicant must provide a minimum notice of 15 business days to North Logan for
1129 scheduling the field review.

1130
1131 B. Surface fault rupture is a displacement of the ground surface along a tectonic fault during an
1132 earthquake. If a fault were to displace the ground surface beneath a building or other structure,
1133 significant structural damage or collapse may occur, possibly causing injuries and loss of life. As
1134 a result, North Logan requires site-specific surface-fault-rupture hazard investigations and
1135 submittal of a report for all properties that contain Quaternary faults, depending on the fault
1136 activity level and the IBC Risk Category of proposed structures. These investigations and reports
1137 shall conform with the Guidelines for Evaluating Surface-Fault-Rupture Hazards in Utah (Lund
1138 and others, 2020; UGS Circular 128, Chapter 3, <https://doi.org/10.34191/C-128>), as appropriate,
1139 including:

1140
1141 1. The requirement for site-specific investigation of surface faulting depends on the fault
1142 activity level as defined by the most recent Western States Seismic Policy Council
1143 (WSSPC) Policy Recommendation (PR, [https://www.wsspc.org/public-](https://www.wsspc.org/public-policy/adoptedrecommendations/)
1144 [policy/adoptedrecommendations/](https://www.wsspc.org/public-policy/adoptedrecommendations/)) for faults that cross properties with proposed
1145 structures. The current PR is 18-3: Definitions of Recency of Surface Faulting for the
1146 Basin and Range Province and defines latest Pleistocene- Holocene, late Quaternary,
1147 and Quaternary faults as:

- 1148
1149 a. Latest Pleistocene-Holocene fault – A fault whose movement in the past 15 ka
1150 (15,000 years) has been large enough to break the ground surface.
1151
1152 b. Late Quaternary fault – A fault whose movement in the past 130 ka (130,000
1153 years) has been large enough to break the ground surface.

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c. Quaternary fault – A fault whose movement in the past 2.6 Ma (2.6 million years) has been large enough to break the ground surface.

North Logan requires site-specific investigation on parcels with latest Pleistocene-Holocene faults for all new critical facilities and structures for human occupancy (IBC Risk Category II, III, and IV structures), on parcels with latest Pleistocene-Holocene and late Quaternary faults for all new critical facilities (IBC Risk Category III and IV structures), and on parcels with the faults listed in item 2 below.

Investigations are required for all critical facilities, whether near a mapped Quaternary fault or not, to ensure that previously unknown faults are not present. If evidence for a Quaternary fault is found, subsurface investigations are required and trenching to locate a suitable buildable area may be necessary (IBC Sections 1704.6.1 and 1803.5.11).

2. The UGS Utah Quaternary Fault and Fold Database

(<https://geology.utah.gov/apps/qfaults/>) provides the latest information on Quaternary faulting in Utah to determine fault activity levels as defined above and where surface-fault-rupture Geologic Hazard Study Areas have been defined. Where data are inadequate to determine the fault activity class, the fault shall be assumed to be latest Pleistocene-Holocene, pending detailed surface-fault-rupture and/or paleoseismic investigations.

North Logan may require a site-specific investigation if on-site and/or nearby fault-related features not shown in the database are identified during other geologic and/or geotechnical investigations and/or during project construction.

3. Surface-fault-rupture hazard maps show the locations of fault traces and recommended special study areas. These maps and data are published by the UGS in the Utah Quaternary Fault and Fold Database. For areas where maps are not available, investigations are required within Geologic Hazard Study Areas as defined by:

a. Areas that horizontally extend 500 feet on the downthrown and 250 feet on the upthrown side of well-defined Quaternary faults (solid lines) and 1000 feet on both sides of buried or inferred Quaternary faults (dotted lines). For traces of buried or inferred Quaternary faults less than 1000 feet long that lie between and on-trend with well-defined faults or lie at the tail end of a well-defined

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Quaternary faults, the well-defined Quaternary fault special-study-area zone is used (Figure 2A and 2B); and

b. In areas where a buffer “window” exists, the window is filled in if its width is less than the greater of the two surrounding buffers (Figure 2C). In situations where the ground expression of the fault scarp is larger than the special-study zone, in which case the zone does not cover the entire fault scarp, the 1000-foot buffer is used; and

c. Well-defined Quaternary faults are those Quaternary fault traces that are clearly identifiable by a geologist qualified to conduct surface-fault-rupture hazard investigations as a physical feature at or just below the ground surface (typically shown as a solid line on geologic maps), and buried or inferred Quaternary faults are those Quaternary fault traces that are not evident at or just below the ground surface by a qualified geologist (typically shown as a dotted line for buried faults and a dotted line for inferred faults on geologic maps).

4. When an alternative subsurface exploration plan is proposed in lieu of paleoseismic trenching, a map and written description and plan shall be submitted to North Logan for review, prior to the scoping meeting and exploration implementation. The plan must include at a minimum, a map of suitable scale showing the site limits, surface geologic conditions within 2000 feet of the site boundary, the location and type of the proposed exploration, the anticipated subsurface geologic conditions, and a through description of why the alternative exploration is being proposed.

5. Small-displacement faults with less than 4 inches of displacement are not exempted from structure setback requirements. However, if structural risk reduction measures are proposed for these faults, the following criteria must be met:

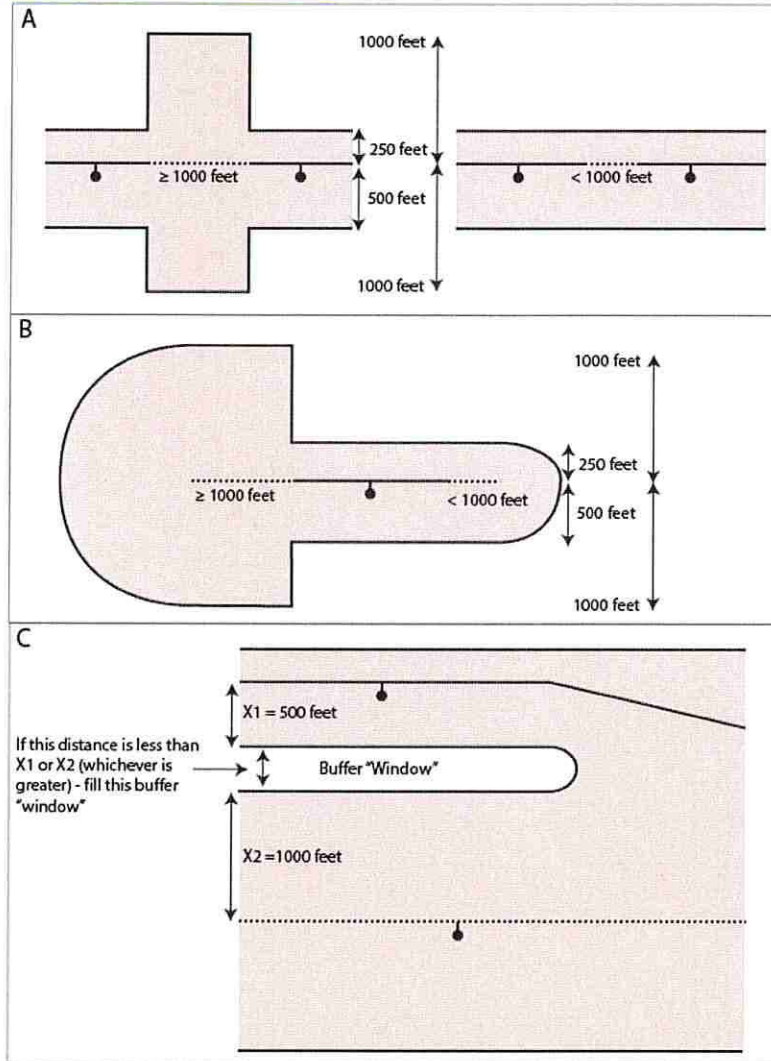
a. Reasonable geologic data indicating that future surface displacement along the faults will not exceed 4 inches following the Guidelines for Evaluating Surface-Fault-Rupture Hazards in Utah (Lund and others, 2020; UGS Circular 128, Chapter 3, <https://doi.org/10.34191/C-128>), and

b. Specific structural mitigation to minimize structural damage and ensure safe occupant egress designed by a Utah-licensed Structural Engineer with plans and specifications reviewed and approved by North Logan.

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**Figure 2 (A, B, & C): Areas around Quaternary faults defining surface-fault-rupture
Geologic Hazard Study Areas**



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C. Landslides are the downslope movement of earth (soil, rock, and/or debris) materials and can cause significant property damage, injury, and/or death. The evaluation of landslides generally requires quantitative slope stability analyses, involving Engineering Geologists and Geotechnical Engineers experienced in landslide investigation, analysis, and mitigation. Considering the complexity inherent in performing slope stability analyses, additional effort beyond the minimum standards presented herein may be required at some sites to adequately address slope stability. Slope stability and landslide hazard investigations and reports shall conform with

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1240 the Guidelines for Evaluating Landslide Hazards in Utah (UGS Circular 128, Chapter 4,
1241 <https://doi.org/10.34191/C-128>), as appropriate, and

- 1242
- 1243 1. Landslide hazard maps show the location of previous landsliding, areas of potential
1244 landsliding, and recommended Geologic Hazard Study Areas. These maps are published
1245 by the UGS (<https://geology.utah.gov/hazards/info/maps/>). For areas where maps are
1246 not available, investigations are required within Geologic Hazard Study Areas as defined
1247 by:
 - 1248
 - 1249 a. Cut and fill slopes steeper than, or equal to, 50 percent (2H:1V) and natural
1250 slopes steeper than or equal to 30 percent (3.3H:1V); and
 - 1251
 - 1252 b. Natural and cut slopes with geologic conditions, such as an existing landslide or
1253 other geologic hazard; bedding, foliation, or other structural features that are
1254 potentially averse to slope stability; and
 - 1255
 - 1256 c. Buttresses and stability fills and cut, fill, and natural slopes of water-retention
1257 basins or flood-control channels; and
 - 1258
 - 1259 d. Mapped landslide areas in the UGS Utah Landslide Database,
1260 (<https://gis.utah.gov/data/geoscience/landslides/>); and
 - 1261
 - 1262 e. Low, moderate, and high landslide susceptibility areas identified in the Landslide
1263 Susceptibility Map of Utah (Giraud and Shaw, 2007; UGS Map M-228,
1264 <https://ugspub.nr.utah.gov/publications/maps/m-228/m-228.pdf>); and
 - 1265
 - 1266 f. Units on the most recent geologic maps published by the UGS
1267 (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive
1268 Geologic Map Portal, (<https://geology.utah.gov/apps/intgeomap/>), but contact
1269 the UGS for interim, progress update, and other non-final maps that may be
1270 available, but not online.
 - 1271
 - 1272 2. Development of properties within these areas require submittal and review of a site-
1273 specific geologic hazard report discussing landslide hazards, prior to receiving a land-use
1274 or building permit from North Logan. It is the responsibility of the applicant to retain a
1275 qualified Engineering Geologist and Geotechnical Engineer to perform the slope stability
1276 analysis.
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3. When evaluating site conditions to determine the need for slope stability analyses, off-property conditions shall be considered (both up-slope to the tops of adjacent, ascending slopes and down-slope to and beyond the toes of adjacent, descending slopes). Also, the professionals shall demonstrate that the proposed hillside development will not affect adjacent sites or limit adjacent property owners' ability to develop their sites.

4. Investigations shall also address the potential for surficial instability, rock slope instability, debris/mudflows, rockfalls, and soil creep on all slopes that may affect the proposed development, be affected by the proposed development, and along access roads. Intermediate geomaterials (IGM), those earth materials with properties between soil and rock, if present, shall be appropriately investigated, sampled, and tested.

5. An Engineering Geologist shall provide appropriate input to the Geotechnical Engineer with respect to the potential impact of the geology, stratigraphy, and hydrologic conditions on slope stability. The shear strength and other geotechnical properties shall be evaluated by the Geotechnical Engineer. Qualified Engineering Geologists may assess and quantitatively evaluate slope stability; however, the Geotechnical Engineer shall perform all design stability calculations. Ground motion parameters for use in seismic stability analysis may be provided by either the Engineering Geologist or the Geotechnical Engineer.

6. Except for the derivation of the input ground motions for pseudostatic and seismic deformation analyses described below, slope stability analyses and evaluations shall be performed in general accordance with the latest version of Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California (Blake and others, 2002). Procedures for developing input ground motions to be used in North Logan are described below. If on-site sewage and/or stormwater or other water disposal exists or is proposed, the slope stability analyses shall also include the effects of the effluent plume on slope stability.

7. The minimum acceptable static factor of safety (FS) is 1.5 for both overall and surficial slope stability and 1.1 for a calibrated pseudostatic analysis using Stewart and others (2003) or other method pre-approved by North Logan.

8. Soil and/or rock sampling and testing shall be based on current ASTM International and/or American Association of Highway Officials (AASHTO) standards, as appropriate. Laboratory tests shall be performed using current ASTM International or AASHTO

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1316 standards, as appropriate, in a laboratory accredited by the AASHTO Materials
1317 Reference Laboratory and/or the U.S. Army Corps of Engineers to ensure compliance
1318 with current laboratory testing standards and quality control procedures. The final
1319 report shall include complete laboratory test results reported in conformance with
1320 current ASTM International or AASHTO standards, as appropriate.
1321

1322 9. Soil and/or rock properties, including unit weight and shear strength parameters
1323 (cohesion and friction angle), shall be based on conventional laboratory tests on
1324 appropriate samples. Where appropriate, such as for landslide slip surfaces, along
1325 bedding planes, for surficial stability analyses, etc., laboratory tests for saturated,
1326 residual shear strengths must be performed.
1327

1328 Estimation of the shear resistance along bedding or landslide planes normally requires
1329 an evaluation of saturated, residual, along-bedding strength values of the weakest
1330 interbedded or slide plane material encountered during the subsurface exploration, or
1331 in the absence of enough exploration, the weakest material that may be present,
1332 consistent with site geologic conditions. Soil strength parameters derived solely from
1333 CPT data are most often not appropriate for slope-stability analysis in many cases,
1334 particularly for strengths along existing slip surfaces, where residual strengths have
1335 developed. Additional guidance on the selection of strength parameters for slope
1336 stability analyses is contained in Blake and others (2002).
1337

1338 10. Residual strength parameters may be determined using direct or ring shear testing
1339 equipment; however, ring shear tests are preferred. If performed properly, direct shear
1340 test results may approach ring shear test results. The specimen must be subjected to
1341 enough deformation (such as, a significant number of shearing cycles in the direct shear
1342 test or a significant amount of rotation in the ring shear test) to assure that residual
1343 strength has been developed. In the direct and ring shear tests, stress-deformation
1344 curves can be used to determine when enough shearing cycles have been performed by
1345 showing that no further significant drop in shear strength results with the addition of
1346 more cycles or rotation. The stress-deformation curves obtained during the shear tests
1347 must be submitted with the other pertinent laboratory test results. It shall be
1348 recognized that for most clayey soils, the residual shear strength envelope is curved and
1349 passes through the origin (for example, at zero normal stress there is zero shear
1350 strength). Any apparent shear strength increases resulting from a non-horizontal shear
1351 surface, such as ramping or bulldozing in residual direct shear tests, shall be discounted
1352 in the interpretation of the strength parameters.
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- 1354 11. Inherent in the analyses, the Geotechnical Engineer will need to use judgment in the
1355 selection of appropriate shear test methods and in the interpretation of the results to
1356 develop shear strength parameters commensurate with the slope stability conditions to
1357 be evaluated. Scatter plots of shear strength data may need to be presented to allow for
1358 assessment of idealized parameters. The report shall summarize shear strength
1359 parameters used for slope stability analyses and describe the methodology used to
1360 interpret test results and estimate those parameters, including:
1361
- 1362 a. Peak shear strengths may be used to represent across-bedding failure surfaces
1363 or compacted fill, in situations where strength degradations are not expected to
1364 occur (see Blake and others, 2002). Where peak strengths cannot be relied
1365 upon, fully softened or lower strengths shall be used; and
1366
 - 1367 b. Ultimate shear strength parameters shall be used in static slope stability
1368 analyses when there has not been past deformation. Residual shear strength
1369 parameters shall be used in static slope stability analyses when there has been
1370 past deformation; and
1371
 - 1372 c. Averaged strength parameters may be appropriate for some across-bedding
1373 conditions, if enough representative samples have been carefully tested.
1374 Analyses for along bedding or along existing landslide slip surfaces shall be
1375 based on the lower bound interpretations of residual shear strength parameters
1376 and comparison of those results to correlations, such as those of Stark and
1377 others (2005).
1378
- 1379 12. The potential effects of soil creep shall be addressed where any proposed structure is
1380 planned near an existing fill or natural slope. The potential effects on the proposed
1381 development shall be evaluated and mitigation measures proposed, including
1382 appropriate setback recommendations that consider the potential effects of creep
1383 forces.
1384
- 1385 13. Gross stability includes rotational and translational deep-seated slope failures or
1386 portions of slopes existing within or outside of, but potentially affecting the proposed
1387 development. The following guidelines, in addition to those in Blake and others (2002),
1388 shall be followed when evaluating slope stability:
1389
- 1390 a. Stability shall be analyzed along cross sections depicting the most adverse
1391 conditions, such as the highest slope, most adverse bedding planes, shallowest

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- 1392 likely groundwater table, steepest slope, etc. Often, analyses are required for
1393 different conditions and for more than one cross section to demonstrate which
1394 condition is the most adverse. When evaluating the stability of an existing
1395 landslide, analyses must also address the potential for partial reactivation.
1396 Inclinometers may be used to help determine critical failure surfaces, and along
1397 with high-precision GPS/GNSS, the activity state of existing landslides. The
1398 critical failure surfaces on each crosssection shall be identified, evaluated, and
1399 plotted on the large-scale cross section; and
1400
- 1401 b. Rock slope stability shall be based on current rock mechanics practice, using the
1402 methods of Wyllie and Mah (2004), based on Hoek and Bray (1981); Practical
1403 Rock Engineering
1404 (<https://www.rocsience.com/assets/resources/learning/hoek/Practical-Rock-Engineering-Full-Text.pdf>); Federal Highway Administration (1989); and similar
1405 references, such as <https://www.rocsience.com/learning/hoekscorner/publications>; and
1406
1407
1408
- 1409 c. If the long-term static FS is ≤ 1.5 , mitigation measures shall be required to bring
1410 the factor of safety up to the required level or the project may be redesigned to
1411 achieve a minimum FS of ≥ 1.5 ; and
1412
- 1413 d. The temporary stability of excavations shall be evaluated, and mitigation
1414 measures shall be recommended as necessary to obtain a minimum FS of ≥ 1.3 ;
1415 and
1416
- 1417 e. Long-term slope stability shall be analyzed using the highest known and
1418 anticipated groundwater level based upon a groundwater assessment as
1419 described in the Guidelines for Evaluating Landslide Hazards in Utah (Beukelman
1420 and Hylland, 2020; UGS Circular 128, Chapter 4, <https://doi.org/10.34191/C-128>), along with groundwater sensitivity analyses; and
1421
1422
- 1423 f. Slope stability and analysis input parameters, such as groundwater elevations
1424 and conditions, cannot be contingent on uncontrollable factors, such as limiting
1425 landscape irrigation, etc.; and
1426
- 1427 g. Where back-calculation is appropriate, shear strengths utilized for design shall
1428 be no higher than the lowest strength computed using back calculation. If a
1429 professional proposes to use shear strengths higher than the lowest back-

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- 1430 calculated value, justification shall be required. Assumptions used in back-
1431 calculations regarding pre-sliding topography and groundwater conditions at
1432 failure must be discussed and justified; and
1433
- 1434 h. Reports shall describe how the shear strength testing methods used are
1435 appropriate in modeling field conditions and the long-term performance of the
1436 analyzed slope. The utilized design shear strength values shall be justified with
1437 laboratory test data and geologic descriptions and history, along with past
1438 performance history, if known, of similar materials; and
1439
- 1440 i. Reports shall include shear strength test plots consisting of normal stress versus
1441 shear resistance (failure envelope). Plots of shear resistance versus
1442 displacement shall be provided for all residual and fully softened (ultimate)
1443 shear tests; and
1444
- 1445 j. The degree of saturation for all test specimens shall be reported. Direct shear
1446 tests on partially saturated samples may grossly overestimate the cohesion that
1447 can be mobilized when the material becomes saturated in the field. This
1448 potential shall be considered when selecting shear strength parameters. If the
1449 rate of shear displacement exceeds 0.005 inches per minute, the Geotechnical
1450 Engineer shall provide data to demonstrate that the rate is sufficiently slow for
1451 drained conditions; and
1452
- 1453 k. Shear strength values higher than those obtained through site-specific
1454 laboratory tests will generally not be accepted; and
1455
- 1456 l. If direct shear or triaxial shear testing is not appropriate to model the strength
1457 of highly jointed and fractured rock masses, the design strengths shall be
1458 evaluated in a manner that considers overall rock mass quality and be
1459 consistent with current rock mechanics practice; and
1460
- 1461 m. Shear strengths used in slope stability analyses shall be evaluated considering
1462 the natural variability of engineering characteristics inherent in earth materials.
1463 Multiple shear tests on each site material are likely to be required; and
1464
- 1465 n. Shear strengths for proposed fill slopes shall be evaluated using samples mixed
1466 and remolded to represent anticipated field conditions. Tests to confirm
1467 strengths may be required during grading; and

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- o. Where bedding planes and/or discontinuities are laterally unsupported in slopes, potential failures along the unsupported bedding planes and/or discontinuities shall be analyzed. Similarly, stability analyses shall be performed where bedding planes and/or discontinuities form a dip-slope or near dip-slope using composite, potential failure surfaces that consist of potential slip surfaces along bedding planes and/or discontinuities in the upper portions of the slope, in combination with slip surfaces across bedding planes and/or discontinuities in the lower portions of the slope; and
- p. The stability analysis shall include the effect of expected maximum moisture conditions on unit weight; and
- q. For effective stress analyses, measured groundwater conditions adjusted to consider likely unfavorable conditions with respect to anticipated future groundwater levels, seepage and pore pressure shall be included in the slope stability analyses; and
- r. Tension crack development shall be considered in the analyses of potential failure surfaces. The height and location of the tension crack shall be determined by modeling; and
- s. Anticipated surcharge loads, as well as external boundary pressures from groundwater, shall be included in the slope stability evaluations, as deemed appropriate; and
- t. Generally, computer-aided modeling techniques should be used, so that the potential failure surface with the lowest factor of safety can be located. However, analytical chart solutions may be used, provided they were developed for conditions like those being analyzed. Examples of typical modeling techniques are illustrated on Figures 9.1a to 9.1f in Blake and others (2002). However, verification of the reasonableness of the analytical results is the responsibility of the Geotechnical Engineer and Engineering Geologist, and
- u. The critical potential failure surface used in the analysis may be composed of circles, wedges, planes, or other shapes considered to yield the minimum FS most appropriate for the geologic site conditions. The critical potential failure surface having the lowest factor of safety with respect to shearing resistance

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1506 must be sought. Both the lowest FS and the critical failure surface shall be
1507 documented.

1508

1509 14. Surficial slope stability refers to slumping and sliding of near-surface materials and is
1510 most critical during the snowmelt and rainy season or when excessive landscape
1511 irrigation is applied. The assessment of surficial slope stability shall be based on analysis
1512 procedures for stability of an infinite slope with seepage parallel to the slope surface or
1513 an alternate failure mode that would produce the minimum factor of safety. The
1514 minimum acceptable saturation depth for surficial stability evaluation shall be 4 feet.

1515

1516 a. Residual shear strengths comparable to actual field conditions shall be used in
1517 surficial stability analyses. Surficial stability analyses shall be performed under
1518 rapid draw-down conditions, where appropriate, such as for debris and
1519 detention basins; and

1520

1521 b. Where 2H:1V or steeper slopes have soil conditions that can result in the
1522 development of an infinite slope with parallel seepage, calculations shall be
1523 performed to demonstrate that the slope has a minimum static FS of 1.5,
1524 assuming a fully saturated 4-foot thickness. If conditions will not allow the
1525 development of a slope with parallel seepage, surficial slope stability analyses
1526 may not be required if approved by North Logan; and

1527

1528 c. Surficial slope stability analyses shall be performed for fill, cut, and natural
1529 slopes assuming an infinite slope with seepage parallel to the slope surface or
1530 other failure mode that would yield the minimum FS against failure. A suggested
1531 procedure for evaluating surficial slope stability is presented in Blake and others
1532 (2002); and

1533

1534 d. Soil properties used in surficial stability analyses shall be determined as noted
1535 for residual strengths above. Residual shear strength parameters for surficial
1536 slope stability analyses shall be developed for a stress range that is consistent
1537 with the near-surface conditions being modeled. It shall be recognized that for
1538 most clayey soils, the residual shear strength envelope is curved and passes
1539 through the origin (for example, at zero normal stress, there is zero shear
1540 strength). For sites with deep slip surfaces, the guidelines given by Blake and
1541 others (2002) should be followed; and

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e. The minimum acceptable vertical depth for which seepage parallel to the slope shall be applied is 4 feet for cut or fill slopes. Greater depths may be necessary when analyzing natural slopes that have significant thicknesses of loose surficial material.

15. In addition to static slope stability analyses, slopes shall be evaluated for seismic slope stability. Acceptable methods for evaluating seismic slope stability include using calibrated pseudostatic limit-equilibrium procedures and simplified methods, such as, those based on Newmark (1965), to estimate permanent seismic slope movements and are summarized in Blake and others (2002). Nonlinear, dynamic finite element/finite difference numerical methods also may be used to evaluate slope movements resulting from seismic events, if the procedures, input data, and results are thoroughly documented, and deemed acceptable by North Logan.

a. Regarding design ground accelerations for seismic slope-stability analyses, North Logan prefers a probabilistic approach to determining the likelihood that different levels of ground motion will be exceeded at a site within a given time period. To more closely represent the seismic characteristics of the region, design ground motion parameters for seismic slope stability analyses shall be based on the peak accelerations with a 2% probability in 50 years (2,500- year return period); and

b. Peak ground accelerations (PGA) shall be used from the most recent USGS National Seismic Hazard Maps (<https://www.usgs.gov/natural-hazards/earthquakehazards/maps>) and adjusted for effects of soil/rock (site-class) conditions in accordance with Seed and others (2001) or other appropriate methods that consider the site-specific soil conditions and their potential for amplification or de-amplification of the high-frequency strong motion. Site-specific response analysis may also be used to develop PGA values if the procedures, input data, and results are thoroughly documented, and deemed acceptable by North Logan; and

c. Pseudostatic methods for evaluating seismic slope stability are acceptable if minimum factors of safety are satisfied, and due consideration is given in the selection of the seismic coefficient (k) reduction in material shear strengths, and the factor of safety for pseudostatic conditions; and

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1580 d. Pseudostatic seismic slope stability analyses can be performed using the
1581 "screening analysis" procedure described in Blake and others (2002). For that
1582 procedure, a k-value is selected from seismic source characteristics (modal
1583 magnitude and distance, and firm rock PGA) and ≤ 2 inches (5 cm) of
1584 deformation is specified. For that procedure, a factor of safety of ≥ 1.0 is
1585 considered acceptable; otherwise, an analysis of permanent seismic slope
1586 deformation shall be performed.

1587
1588 16. For seismic slope stability analyses, estimates of permanent seismic displacement are
1589 preferred and may be performed using the procedures outlined in Blake and others
1590 (2002). It should be noted that Bray and Rathje (1998), referenced in Blake and others
1591 (2002), has been updated and superseded by Bray and Travararou (2007), which is
1592 North Logan's currently preferred method. For those analyses, calculated seismic
1593 displacements shall be ≤ 2 inches (5 cm), or mitigation measures shall be proposed to
1594 limit calculated displacements to ≤ 2 inches (5 cm).

1595
1596 For specific projects, different levels of tolerable displacement may be possible, but site-
1597 specific conditions, which shall include the following, must be considered:

- 1598
1599 a. The extent to which the displacements are localized or broadly distributed;
1600 broadly distributed shear deformations would generally be less damaging, and
1601 more displacement could be allowed; and
1602
1603 b. The displacement tolerance of the foundation system—stiff, well-reinforced
1604 foundations with lateral continuity of vertical support elements would be more
1605 resistant to damage and could potentially tolerate larger displacements than
1606 typical slabs-on-grade or foundation systems with individual spread footings,
1607 and;
1608
1609 c. The potential of the foundation soils to experience strain softening—slopes
1610 composed of soils likely to experience strain softening should be designed for
1611 relatively low displacements if peak strengths are used in the evaluation of the
1612 yield coefficient (k_y) due to the potential for progressive failure, which could
1613 involve very large displacements following strain softening. To consider a
1614 threshold larger than 2 inches, the project professional shall provide prior,
1615 acceptable justification to North Logan and obtain the City's approval. Such
1616 justification shall demonstrate, to the satisfaction of North Logan, that the
1617 proposed project will achieve acceptable performance.

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17. Slope stability analyses shall be performed for cut, fill, and natural slopes of water-retention basins or flood-control channels. In addition to analyzing typical static and seismic slope stability, those analyses shall consider the effects of rapid drawdown, if such a condition could occur.

18. When slope stability hazards are determined to exist on a project, measures to mitigate impacts from those hazards shall be implemented. Some guidance regarding mitigation measures is provided in Blake and others (2002) and methods include:

- a. Hazard avoidance; or
- b. Grading to improve slope stability; and/or
- c. Reinforcement of the slope and/or improvement of the soil within the slope, and/or;
- d. Reinforcement of the structures built on the slope to tolerate anticipated slope displacements.

Where mitigation measures that are intended to add stabilizing forces to the slope are to be implemented, consideration may need to be given to strain compatibility. For example, if a compacted fill buttress is proposed to stabilize laterally unsupported bedding or a landslide, the amount of deformation needed to mobilize the recommended shear strength in the buttress shall be considered to confirm that it will not result in adverse movements of the upslope bedding or landslide deposits. Similarly, if a series of drilled piers is to be used to support a potentially unstable slope and a structure will be built on the piers, pier deformations resulting from movements needed to mobilize the soil's shear strength shall be compared to tolerable deflections in the supported structure.

19. Full mitigation of slope stability hazards shall be performed for developments in North Logan. Remedial measures that produce static FS ≥ 1.5 and acceptable seismic displacement estimates shall be implemented as needed.

20. On some projects or portions of, such as small structural additions, residential infill projects, non-habitable structures, and non-structural natural-slope areas, full mitigation of seismic slope displacements may not be possible, due to physical and/or

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1656 economic constraints. In those cases, partial mitigation, to the extent that it prevents
1657 structural collapse, injury, and loss of life, may be possible if consistent with IBC design
1658 criteria, and if it is approved by North Logan. The applicability of partial mitigation to
1659 specific projects shall be evaluated on a case-by-case basis.

1660
1661 21. For developments when full mitigation of seismic slope displacements is not
1662 implemented, a Notice of Geologic Hazard shall be recorded with the proposed
1663 development describing the displacement hazard at issue and the partial mitigation
1664 employed. The Notice shall clearly state that the seismic displacement hazard at the site
1665 has been reduced by the partial mitigation, but not eliminated. In addition, the owner
1666 shall assume all risks, waive all claims against North Logan and its consultants, and
1667 indemnify and hold North Logan and its consultants harmless from any and all claims
1668 arising from the partial mitigation of the seismic displacement hazard.

1669
1670 D. Liquefaction is a process by which strong shaking during an earthquake causes the ground to
1671 temporarily lose its strength and to behave like a viscous liquid rather than a solid material.
1672 Liquefaction can cause buildings to tip and settle; roads to crack, deform and flood; buried
1673 storage tanks to rise towards the surface; and other types of damage to buildings and
1674 infrastructure. Liquefaction hazard investigation reports shall conform with the requirements
1675 described below and be prepared by a qualified Geotechnical Engineer as defined above.

1676
1677 1. Liquefaction hazard maps show the location and relative anticipated severity of
1678 liquefaction during an earthquake. These maps are published by the UGS. For areas
1679 where maps are not available, Geologic Hazard Study Areas are defined by:

1680
1681 a. Within Federal Emergency Management Agency (FEMA)-defined flood Zone A,
1682 Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE,
1683 Zone AR/AO, Zone AR/A1-A30, and Zone AR/A areas; and

1684
1685 b. Units on the most recent geologic maps published by the UGS
1686 (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive
1687 Geologic Map Portal (<https://geology.utah.gov/apps/intgeomap/>), but contact
1688 the UGS for interim, progress update, and other non-final maps that may be
1689 available, but not online; and

1690
1691 c. For all IBC Risk Category III and IV facilities, regardless whether the site lies
1692 within a designated Geologic Hazard Study Area or not.

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- 1694 2. A liquefaction-hazard investigation shall be performed in conjunction with any
1695 geotechnical and/or geologic hazards investigation prepared within North Logan.
1696
- 1697 3. For all structures where liquefaction-hazard analyses indicate that ground settlement
1698 and/or lateral spread may be anticipated, the project Structural Engineer must provide
1699 documentation that the building is designed to accommodate the predicted ground
1700 settlements and displacements in such a manner as to be protective of life (collapse
1701 prevention) during and after the design seismic event.
1702
- 1703 4. The investigation of liquefaction hazard is an interdisciplinary practice. The site
1704 investigation report must be prepared by a qualified Geotechnical Engineer, who must
1705 have competence in the field of seismic hazard evaluation and mitigation.
1706
- 1707 Because of the differing expertise and abilities of qualified Engineering Geologists and
1708 Geotechnical Engineers, the scope of the site investigation report for a project may
1709 require that both types of professionals prepare and review the report, each practicing
1710 in the area of their expertise. Involvement of both a qualified Engineering Geologist and
1711 Geotechnical Engineer will generally provide greater assurance that the hazard is
1712 properly identified, assessed, and mitigated.
1713
- 1714 Liquefaction-hazard analyses are the responsibility of the Geotechnical Engineer,
1715 although the Engineering Geologist should be involved in the application of screening
1716 criteria and general geologic site evaluation to map the likely extent of liquefiable
1717 deposits and shallow groundwater. Engineering properties of earth materials shall be
1718 evaluated and the performance of quantitative liquefaction-hazard analyses resulting in
1719 a numerical factor of safety and quantitative assessment of settlement and liquefaction-
1720 induced permanent ground displacement shall be performed by the Geotechnical
1721 Engineer. The Geotechnical and Structural Engineers shall develop all mitigation and
1722 design recommendations. Ground motion parameters for use in quantitative
1723 liquefaction-hazard analyses may be provided by either the Engineering Geologist or
1724 Geotechnical Engineer.
1725
- 1726 Except for the derivation of input ground motion, liquefaction-hazard investigations
1727 shall be performed in general accordance with the latest version of Recommended
1728 Procedures for Implementation of DMG Special Publication 117, Guidelines for
1729 Analyzing and Mitigating Liquefaction in California (Martin and Lew, 1999). Additional
1730 protocol for liquefaction-hazard investigations is provided in Youd and Idriss (1997,
1731 2001), Assessment of the Liquefaction Susceptibility of Fine-Grained Soils (Bray and

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1732 Sancio, 2006), SPT-Based Liquefaction Triggering Procedures (Idriss and Boulanger,
1733 2010), and the State of the Art and Practice in the Assessment of Earthquake-Induced
1734 Soil Liquefaction and Its Consequences (Committee on State of the Art and Practice in
1735 Earthquake Induced Soil Liquefaction Assessment, 2016). Acceptable factors of safety
1736 for liquefaction are shown in Table 1.

1737
1738 5. Soil liquefaction is caused by strong seismic ground shaking where saturated,
1739 cohesionless, granular soil undergoes a significant loss in shear strength that can result
1740 in settlement and permanent ground displacement. Surface effects of liquefaction
1741 include settlement, bearing capacity failure, ground oscillations, lateral spread, and flow
1742 failure. It has been well documented that soil liquefaction may occur in clean sands, silty
1743 sands, sandy silt, non-plastic silts, and gravelly soils. The following conditions must be
1744 present for liquefaction to occur:

- 1745
- 1746 a. Soils must be saturated, either below the water table or above a confining layer,
1747 and
 - 1748 b. Soils must be loose to moderately dense, and
 - 1749 c. Earthquake ground shaking must be relatively intense, and
 - 1750 d. The duration of ground shaking must be large enough for the soils to generate
1751 seismically induced excess pore water pressure and lose their shearing
1752 resistance.

1753
1754 6. The following screening criteria may be applied to determine if further quantitative
1755 evaluation of liquefaction hazard is required:
1756

1757 **Table 1: Minimum factors of safety for various International Building Code Facility types**

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Type of Facility	Minimum Factor of Safety (FS)
Critical Facilities, including essential or hazardous facilities and special occupancy structures	1.3
IBC Category III and IV Structures	

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Industrial and Commercial Structures	1.25
IBC Category II(b) Structures	

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- a. If the estimated maximum past-, current-, and maximum- future-groundwater-levels (i.e., the highest groundwater level applicable for liquefaction-hazard analyses) are determined to be deeper than 50 feet below the existing ground surface or proposed finished grade (whichever is deeper), liquefaction hazard assessments are not required. For soil materials that are located above the groundwater level, a quantitative assessment of seismically induced settlement is required; and
- b. If bedrock underlies the site, those materials need not be considered liquefiable and no analysis of their liquefaction potential is necessary; and
- c. If the corrected Standard Penetration Test (SPT) blow count, $(N1)_{60}$, is ≥ 33 in all samples with an acceptable number of blow counts recorded, liquefaction-hazard assessments are not required. If CPT soundings are made, the corrected CPT tip resistance, qc_{1N} , should be ≥ 180 in all soundings in sandy soils; otherwise, liquefaction-hazard assessments are needed; and
- d. If plastic soils with a Plasticity Index (PI) ≥ 18 are encountered during site exploration, those materials may be considered non-liquefiable. Additional acceptable screening criteria regarding the effects of plasticity on liquefaction susceptibility are presented in Boulanger and Idriss (2004), Bray and Sancio (2006), and Seed and others (2003). Youd and others (2002) provide additional guidance on analyzing lateral spreads.

If the screening investigation clearly demonstrates the absence of liquefaction hazards at a project site and North Logan concurs, the screening investigation will satisfy the site investigation report requirement for liquefaction hazards. If not, a quantitative evaluation is required to assess the liquefaction hazards.

- 7. Geologic research and reconnaissance are important to provide information to define the extent of unconsolidated deposits that may be prone to liquefaction. Such information shall be presented on geologic maps and cross sections and provide a

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1795 description of the formations present at the site that includes the nature, thickness, and
1796 origin of Quaternary deposits with liquefaction potential. There shall also be an analysis
1797 of groundwater conditions at the site that includes the highest recorded water level and
1798 the highest water level likely to occur under the most adverse foreseeable conditions in
1799 the future, including seasonal changes.

1800
1801 During the field investigation, the Engineering Geologist shall map the limits of
1802 unconsolidated deposits with liquefaction potential. Liquefaction typically occurs in
1803 cohesionless silt, sand, and fine-grained gravel deposits of Holocene to late Pleistocene
1804 age, in areas where the groundwater is shallower than about 50 feet, but other soil
1805 types are may also be liquefiable.

1806
1807 Shallow groundwater may exist for a variety of natural and/or manmade reasons.
1808 Landscape irrigation, on-site sewage disposal, and unlined manmade lakes, reservoirs,
1809 and storm-water detention basins may create a shallow groundwater table in soils that
1810 were previously unsaturated.

1811
1812 8. Subsurface exploration shall consist of drilled borings and/or CPT soundings. The
1813 exploration program shall be planned to determine the soil stratigraphy, groundwater
1814 level, and indices that could be used to evaluate the potential for liquefaction by
1815 insitutesting or laboratory testing of soil samples. If borings are utilized, the use of mud-
1816 rotary drilling methods is highly recommended to achieve minimal disturbance of the in-
1817 situ soils. If mud-rotary drilling is not used, a through explanation is required in the
1818 submitted report. Borings and CPT soundings must penetrate a minimum of 45 feet
1819 below the final ground surface. If during the investigation, the liquefaction evaluation
1820 indices the liquefaction potential may extend below 45 feet, the exploration shall be
1821 continued for a minimum of 10 feet, to the extent possible, until non-liquefiable soils
1822 are encountered.

1823
1824 For saturated cohesionless soils where the SPT (N1)60 values are < 15 or where CPT tip
1825 resistances are < 60 tsf, grain-size analyses, hydrometers tests, and Atterberg Limits
1826 tests shall be performed on these soils to further evaluate their potential for permanent
1827 ground displacement (Youd and others, 2002) and other forms of liquefaction-induced
1828 ground failure and settlement. In addition, it is also recommended that these same tests
1829 be performed on saturated cohesionless soils with SPT (N1)60 values between 15 and 30
1830 to further evaluate the potential for liquefaction-induced settlement.

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1832 Where a structure may have below grade construction and/or deep foundations, such
1833 as drilled shafts or piles, the investigation depth shall extend to a minimum of 20 feet
1834 below the lowest expected foundation level (e.g., drilled shaft or pile tip) or to 45 feet
1835 below the existing ground surface or lowest proposed finished grade, whichever is
1836 deeper. If during the investigation, the liquefaction evaluation indices indicate that
1837 liquefaction potential may extend below that depth, the exploration shall be continued
1838 at least 10 additional feet, to the extent possible, until non-liquefiable soils are
1839 encountered.

1840

1841 9. For the design ground accelerations used in liquefaction analyses, North Logan prefers a
1842 probabilistic approach to determining the likelihood that different levels of ground
1843 motion will be exceeded at a site within a given time period. To more closely represent
1844 the seismic characteristics of the region, design ground motion parameters for seismic
1845 slope stability analyses shall be based on the peak accelerations with a 2% probability in
1846 50 years (2,500-year return period). PGA values shall be obtained from the USGS
1847 National Seismic Hazard Maps and Site-Specific Data webpage
1848 (<https://www.usgs.gov/natural-hazards/earthquake-hazards/maps>) using the latest
1849 long-term model. PGAs obtained from the USGS shall be adjusted for effects of soil/rock
1850 (site-class) conditions in accordance with Seed and others (2001) or other appropriate
1851 and documented methods that are deemed acceptable by North Logan that consider
1852 the site-specific soil conditions and their potential for amplification or de-amplification
1853 of the high frequency strong ground motion.

1854

1855 Site specific response analysis may also be used to develop PGA values if the
1856 procedures, input data, and results are thoroughly documented and deemed acceptable
1857 by North Logan.

1858

1859 10. Sites, facilities, buildings, structures, and utilities that are founded on or traverse
1860 liquefiable soils may require further remedial design and/or relocation to avoid
1861 liquefaction-induced damage. These shall be investigated and evaluated on a site-
1862 specific basis with appropriate geologic and geotechnical investigation to support the
1863 remedial design and/or mitigative plan. This design or plan may include changes/
1864 modifications to the soil, permanent dewatering, earthquake drains, foundation
1865 systems, building structural frame or support, etc. Remedial design and/or mitigation
1866 measures shall be reviewed and approved by North Logan.

1867

1868 11. Liquefaction hazard reports shall include: boring logs, geologic cross-sections, laboratory
1869 data, a detailed explanation pertaining to how idealized subsurface conditions and

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1870 parameters used for the analyses were developed, analytical results and software
1871 output files, and summaries of the liquefaction-hazard analyses and conclusions
1872 regarding liquefaction potential and likely types and magnitudes of ground failure in
1873 addition to the other report requirements detailed in this chapter.

1874
1875 Subsurface geologic and groundwater conditions developed by the Engineering
1876 Geologist must be illustrated on geologic cross sections and must be utilized by the
1877 Geotechnical Engineer for the liquefaction hazard analyses. If on-site sewage or storm-
1878 water disposal exists or is proposed, the liquefaction-hazard analyses shall include the
1879 effects of the effluent plume on liquefaction potential.

1880
1881 The results of any liquefaction-hazard analyses must be submitted with pertinent
1882 documentation, including calculations, software output, etc. Documentation of input
1883 data, output data, and graphical plots must be submitted for each computer-aided
1884 liquefaction-hazard analysis and included as an appendix to the report. Additional
1885 information and/or data may be requested to facilitate North Logan's review.

1886
1887 E. Debris flows are fast-moving, flow-type landslides composed of a slurry of rock, mud, organic
1888 matter, and water that move down drainage basin channels onto alluvial fans. In addition to
1889 threatening lives, debris flows can damage structures and infrastructure by sediment burial,
1890 erosion, direct impact, and associated water flooding. Debris flow hazard investigations and
1891 reports shall conform with the Guidelines for the Geologic Investigation of Debris-Flow Hazards
1892 on Alluvial Fans in Utah (Giraud, 2020; UGS Circular 128, Chapter 5, [https://doi.org/10.34191/C-](https://doi.org/10.34191/C-128)
1893 [128](https://doi.org/10.34191/C-128)); and

1894
1895 Debris flow hazard maps show the locations of previous debris flows, areas of potential debris
1896 flows, and recommended special study areas. These maps are published by the UGS. For areas
1897 where maps are not available, Geologic Hazard Study Areas are defined by:

- 1898
1899 1. All properties located on alluvial fans and drainage channels subject to flash flooding
1900 and debris flows; and
1901
1902 2. Units on the most recent geologic maps published by the UGS
1903 (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive Geologic
1904 Map Portal (<https://geology.utah.gov/apps/intgeomap/>), but contact the UGS for
1905 interim, progress update, and other non-final maps that may be available, but not
1906 online.

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F. Rockfall is a type of landslide and a natural mass-wasting process that involves the dislodging and rapid downslope movement of individual rocks and rock masses. Rockfall hazard investigations and reports shall conform with the Guidelines for Evaluating Rockfall Hazards in Utah (Lund and Knudsen, 2020; UGS Circular 128, Chapter 7, <https://doi.org/10.34191/C-128>); and

1. Rockfall hazard maps show the locations of known rockfall, areas of potential rockfall, and recommended special study areas. These maps are published by the UGS. For areas where maps are not available, Geologic Hazard Study Areas are defined by:

a. All properties containing or directly below bedrock cliffs; and

b. Units on the most recent geologic maps published by the UGS (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive Geologic Map Portal (<https://geology.utah.gov/apps/intgeomap/>), but contact the UGS for interim, progress update, and other non-final maps that may be available, but not online.

G. Land subsidence is the sinking of the ground surface caused by groundwater depletion and/or underground mine subsidence or collapse. Subsidence often causes earth fissures which are permanent, linear tension cracks in the ground that extend upward from the groundwater table. Land subsidence and earth fissure investigations and reports shall conform with the Guidelines for Evaluating Land-Subsidence and Earth Fissure Hazards in Utah (Lund, 2020; UGS Circular 128, Chapter 6, <https://doi.org/10.34191/C-128>) and:

1. Land subsidence and earth fissure maps show the location of known land subsidence and earth fissures and recommended special study areas. These maps are published by the UGS.

H. Radon is a radioactive gas that emanates from uranium-bearing rock and soil and may concentrate in enclosed spaces in buildings. Radon is a major contributor to the ionizing radiation dose received by the general population, is the second leading cause of lung cancer after smoking and has resulted in the majority of geologic hazard related deaths in Utah. Radon gas hazard investigations and reports shall conform with the Guidelines for Site-Specific Evaluation of Radon Hazard in Utah (Lund and others, 2020; UGS Circular 128, Chapter 8, <https://doi.org/10.34191/C-128>); and

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1. Radon gas hazard maps show the location of known radon gas hazard and recommended special study areas. These maps are published by the UGS. For areas where maps are not available, Geologic Hazard Study Areas are defined by:

a. Carbon, Duchesne, Grand, Piute, Sanpete, Sevier, and Uinta Counties as listed in Table AF101(1) of the 2018 International Residential Code, Appendix F of high radon potential (EPA Zone 1); and

b. All other Utah counties are considered at least a moderate potential for radon.

I. Problem soil and rock hazards consist of caliche, collapsible soils, corrosive soils, expansive soil and rock, piping and erosion, shallow bedrock, soluble soil and rock, wind-blown sand, and other similar geologic hazards. While the UGS has not prepared guidelines for these problem soil and rock hazards, investigations of these hazards shall conform to Guidelines for Investigating Geologic Hazards and Preparing Engineering-Geology Reports, With a Suggested Approach to Geologic-Hazard Ordinances in Utah, Second Edition (Bowman and Lund, editors, 2020; <https://doi.org/10.34191/C-128>).

1. Specific problem soil and rock hazard maps show the location of known hazards and recommended special study zones. These maps are published by the UGS. For areas where maps are not available, Geologic Hazard Study Areas are defined for specific problem soil and rock hazards below, or for those geologic hazards not listed, in Section 12F-400:

a. Caliche

b. Collapsible Soils

c. Corrosive Soils

d. Expansive Soil and Rock

e. Piping and Erosion

f. Soluble Soil and Rock: Units

g. Wind-Blown Sand

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- h. Geologic units listed above are those on the most recent geologic maps published by the UGS (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive Geologic Map Portal (<https://geology.utah.gov/apps/intgeomap/>), but contact the UGS for interim, progress update, and other non-final maps that may be available, but not online.
 - J. Snow avalanches are landslides consisting mainly of snow and ice, but can contain soil, rock, and/or debris. These investigations and reports shall be prepared by a qualified snow avalanche expert Utah-licensed as a Professional Geologist and/or Engineer, conform with the guidelines and methods described in Colorado Geological Survey Bulletin 49: Snow-Avalanche Hazard Analysis for Land Use Planning and Engineering (Mears, 1992); and
 - 1. Avalanche hazard maps show the locations of previous avalanches, areas of potential avalanches, and recommended special study areas. As a result, investigations are required within Geologic Hazard Study Areas as defined by those areas within North Logan above elevations of 5000 feet with an adequate snow supply to produce snow avalanches and which include slopes greater than 47 percent (2.1H:1V, 25 degrees); and
 - 2. Avalanche areas shall be delineated on a detailed site avalanche map, at a scale equal to or more detailed than 1 inch = 100 feet. The site avalanche map shall include the location and boundaries of the property, locations of avalanche areas, avalanche-source areas, avalanche-runout areas, and buildable and non-buildable areas; delineation of recommended setback distances from the hazard; and recommended locations for structures. Avalanche-source areas may be off-site, and in areas of steep terrain, may be at great distances from the site; and
 - 3. If the avalanche analysis indicates that the site may be impacted by avalanches, the report shall delineate the following areas:
 - a. A "red zone" of high avalanche potential corresponding to a return period of 25 years or less, and/or impact pressures \geq 600 pounds per square foot (psf) within which critical facilities or structures for human occupancy are not permitted; and
 - b. A "blue zone" corresponding to a return period between 25 and 300 years, and impact pressures less than 600 psf within which critical facilities or structures

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for human occupancy shall only be permitted when at least one of the following requirements has been met:

(1) The structure is designed to incorporate direct protection measures that address the estimated impact forces of flowing snow/debris and powder blast loading. The estimated impact forces shall be calculated by the avalanche expert and the structure shall be designed by, and the plans stamped by, a qualified, Utah-licensed Professional Structural Engineer, or;

(2) Appropriate engineering controls (such as, deflection structures, snow retention nets, dams, etc.) are designed and installed to mitigate the avalanche hazard. Design or performance criteria for engineered mitigation measures, including estimated impact forces, flow heights, location, and dimensions of the mitigation structures and all supporting modeling or other analyses, calculations, and assumptions, shall be calculated by the avalanche expert and included in the report. Final design plans and specifications for engineered mitigation must be signed and stamped by a qualified, Utah-licensed Geotechnical or Professional Structural Engineer, as appropriate.

4. The report shall include:

- a. The probability of avalanche occurrence, if possible, estimates of avalanche volumes, and the likely effects of avalanches on the proposed development; and
- b. A description of the avalanche expert's qualifications to perform the investigation; and
- c. Engineering design parameters for avalanche mitigation, as appropriate, implications of the risk-reduction measures on the development and adjacent properties, and the need for long-term maintenance.

K. While flooding hazards are typically addressed by locally adopted Federal Emergency Management Agency regulations, many areas outside of federally designated 100-year flood zones (Zone A and related) are susceptible to flooding and cause significant damage in Utah. While the UGS has not prepared guidelines for flooding hazards, investigations of these hazards shall conform to the Guidelines for Conducting Engineering-Geology Investigations and

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2057 Preparing Engineering-Geology Reports in Utah (Bowman and Lund, 2020; UGS Circular 128,
2058 Chapter 2, <https://doi.org/10.34191/C-128>).

2059
2060 1. Geologic-based flooding hazard maps show the location of known young flood-related
2061 geologic materials (deposits) and recommended special study zones. For areas where
2062 maps are not available, Geologic Hazard Study Areas are defined by:

2063 a. Units on the most recent geologic maps published by the UGS
2064 (<https://geology.utah.gov/>). Most maps are available in the UGS Interactive
2065 Geologic Map Portal (<https://geology.utah.gov/apps/intgeomap/>), but contact
2066 the UGS for interim, progress update, and other non-final maps that may be
2067 available, but not online.

2068
2069 L. All geologic hazard reports shall meet the submittal and preparation requirements of this
2070 ordinance, the Guidelines for Conducting Engineering-Geology Investigations and Preparing
2071 Engineering-Geology Reports in Utah (Bowman and Lund, 2020; UGS Circular 128, Chapter 2,
2072 <https://doi.org/10.34191/c-128>), and the following:

2073
2074 1. A 1:24,000-scale geologic map with references, showing the general surface geology,
2075 including landslides, rockfall, alluvial fans, bedrock geology where exposed, bedding
2076 attitudes, faults, other geologic structural features, and the location of any other known
2077 geologic hazards; and

2078
2079 2. A detailed site geologic map and geologic cross section(s), at a scale equal to or more
2080 detailed than 1 inch = 100 feet to illustrate local geologic structure. The site geologic
2081 map shall include locations of all subsurface exploratory trenches, test pits, borings, etc.,
2082 and site-specific geologic mapping performed as part of the geologic hazard
2083 investigation, including boundaries and features related to any geologic hazards,
2084 topography, and drainage. The site geologic map must show the location and
2085 boundaries of the property, geologic hazards, delineation of any recommended setback
2086 distances from hazards, and recommended locations for structures. Buildable and non-
2087 buildable areas shall be clearly identified; and

2088
2089 3. Trench and test pit logs, when applicable, with standard geologic nomenclature at a
2090 scale equal to or more detailed than 1 inch = 5 feet. Field logs shall be kept by the
2091 consultant and may be requested by North Logan for further review during the project;
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- 2094 4. Boring logs, when applicable, shall be prepared with standard geologic and engineering
2095 nomenclature and format; and
2096
- 2097 5. Conclusions and recommendations, clearly supported by adequate data included in the
2098 report, that summarize the characteristics of the geologic hazards, and that address the
2099 potential effects of the geologic conditions and geologic hazards on the proposed
2100 development and occupants thereof, particularly in terms of risk and potential damage;
2101 and
2102
- 2103 6. An evaluation of whether mitigation measures are required, including an evaluation of
2104 multiple, viable mitigation options that include specific recommendations for avoidance
2105 or mitigation of the effects of the hazards, consistent with the purposes set forth in
2106 Section 12F-100, including design or performance criteria for engineered mitigation
2107 measures and all supporting calculations, analyses, modeling or other methods, and
2108 assumptions. Final design plans and specifications for engineered mitigation must be
2109 signed and stamped by a qualified, Utah-licensed Engineer (specializing in geotechnical
2110 or civil) and/or Structural Engineer, as appropriate; and
2111
- 2112 7. A statement by the Engineering Geologist shall be provided regarding the suitability of
2113 the site for the proposed development from a geologic hazard perspective; and
2114
- 2115 8. All geologic hazard reports shall be signed and stamped by the Utah-licensed
2116 professional(s) that prepared the reports in accordance with Utah Code 58-76-603
2117 (Professional Geologists, [https:// le.utah.gov/xcode/Title58/Chapter76/58-76.html](https://le.utah.gov/xcode/Title58/Chapter76/58-76.html)) and
2118 58-22-603 (Professional Engineers, [https://le.utah.gov/xcode/Title58/Chapter22/58-](https://le.utah.gov/xcode/Title58/Chapter22/58-22.html)
2119 [22.html](https://le.utah.gov/xcode/Title58/Chapter22/58-22.html)).
2120
- 2121 When a submitted report does not contain adequate data to support its findings, additional or
2122 more detailed investigations shall be required by North Logan to explain and/or quantify the
2123 geologic hazard and/or to describe how mitigation measures recommended in the report are
2124 appropriate and adequate. When a final geologic hazard report indicates that a geologic hazard
2125 does not exist within an adopted Geologic Hazard Study Area indicated by a map referenced by
2126 this article, North Logan will consider the new geologic information in potentially revising the
2127 adopted hazard maps to remove the specific area from the adopted Geologic Hazard Study
2128 Area. North Logan will also forward this information to the Utah Geological Survey for potential
2129 update of their hazard maps.
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- 2131 **12F-1700 – References**

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2272 **SECTION V: CONFLICT.** To the extent of any conflict between this ordinance and any other North
2273 Logan City ordinance(s) or regulation(s), the provisions of this Ordinance shall be controlling.

2274 **SECTION VI: SEVERABILITY.** The sections, paragraphs, sentences, clauses, and phrases of this Ordinance
2275 are severable. If any such section, paragraph, sentence, clause, or phrase shall be declared invalid or
2276 unconstitutional by the valid judgment or decree of a Court of competent jurisdiction, such invalidity or
2277 unconstitutionality shall not affect the validity or constitutionality of any of the remaining sections,
2278 paragraphs, sentences, clauses, or phrases of this Ordinance.

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2279 **SECTION VII: EFFECTIVE DATE.** In the opinion of the City Council of North Logan, it is necessary that this
2280 ordinance take effect immediately; therefore, this Ordinance shall take effect immediately upon its
2281 passage and first posting as provided by law.

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2283

2284 ADOPTED AND PASSED by the City Council of the City of North Logan, Utah, this 20th day of
2285 November, 2024

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NORTH LOGAN CITY, A Utah Municipal Corporation

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2290 ATTEST:

By


Lyndsey Peterson, Mayor

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Scott Bennett, City Recorder

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CERTIFICATE OF DUE POSTING

I, SCOTT BENNETT, City Recorder of North Logan, Utah, hereby certify that I, on the 21st day of November, 2024, in the City of North Logan, Cache County, State of Utah, posted the foregoing Ordinance No. 24- 06 in a likely manner, a copy of which is hereto attached, in each of three public places in the said City of North Logan, to-wit:

1. North Logan City Offices, 2525 North 600 East
2. North Logan City Library, 475 East 2500 North
3. North Park Police Department, 2575 North 600 East

WITNESS my hand this 21st day of November, 2024.



Scott Bennett, City Recorder