Geologic Hazards, Land-Use Laws, and Professional Standards of Practice in Colorado

David C. Noe, P.G., Senior Geologist
Colorado Geological Survey, Engineering Geology Section
1313 Sherman Street, Room 715, Denver, CO 80203, (303) 866-2611
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The purpose of this paper is to give an overview of natural and geologic hazards, as legally defined in Colorado, and to describe the role of the Colorado Geological Survey (CGS) in conducting land-use reviews and assisting local governments in making land-use decisions. The paper describes developer and/or consultant reporting responsibilities and the CGS review process in relationship with pertinent state statutes and local regulations, and lists a number of resources on the topics of geologic hazards and land-use considerations. It also discusses issues regarding professional standards of practice for geologists and engineers in Colorado.

Natural Hazards and Geologic Hazards

Natural hazards and geologic hazards are legally defined in **House Bill 1041 (1974)**[1]. The natural hazards named and defined in this statute consist of wildfire hazards, flood hazards, and geological hazards. A geological hazard is defined as "*...a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property.*" The term includes, but is not limited to avalanches; landslides; rock falls; mudflows; unstable or potentially unstable slopes; seismic effects; radioactivity; and ground subsidence. There are several geo-logic phenomena that qualify as geologic hazards that are not named in the statute. These include debris flows; expansive soil; heaving bedrock; corrosive soil; erodible soil and rock; and coal-bed methane seeps.

The Colorado Geological Survey

The Colorado Geological Survey (CGS), created in 1967, is an agency within the Department of Natural Resources. The CGS enabling act, **House Bill 1282 (1973)**[2], sets forth the following general purposes for the agency with regard to land-use activities: (1) assist, consult with, and advise existing state and local governmental agencies on geologic problems; and (2) determine areas of natural geologic hazards that could affect the safety of or (cause) economic loss to the citizens of Colorado. In addition, the CGS is charged with conducting studies, collecting geologic information, and publishing maps, reports, and bulletins when

necessary to achieve these purposes.

Geologic Land-Use Report Submittals

Several state statutes and/or state agency regulations specify requirements for the submission of geologic suitability reports in conjunction with land-use applications. Other statutes address the manner in which geologic hazards are to be addressed and disclosure of hazards and/or soil conditions to new homebuyers. These are summarized as follows:

Senate Bill 35 (1972)[3] requires subdividers to submit reports concerning geologic characteristics, potential radiation hazards, soil suitability, storm drainage plans, on-lot sewage disposal, and any soil or topographic conditions that present hazards or require special precautions. The subdivider must identify areas of a proposed subdivision where such relevant site characteristics exist, and the proposed uses of those areas should be shown to be compatible with such conditions. SB 35 directs county planning agencies to refer a copy of the preliminary plan submittal to the CGS for review.

House Bill 1041 (see footnote 1) requires that all developments in areas designated by counties as geological hazard areas shall be engineered and administered in a manner that will minimize significant hazards to public heath and safety or to property. Local governments are instructed to administer such areas in a manner that is consistent with model guidelines for land use in each type of natural hazard area. The model guidelines for geologic-hazard areas were published by the CGS in Special Publication 6 (Rogers and others, 1974).

House Bill 1045 (1984)[4] requires school districts to submit reports regarding geologic suitability for raw land purchases, new school plans, and improvements to existing schools to the CGS for review.

Senate Bill 13 (1984)[5] requires the developer or builder of a new residence to provide the purchaser with a summary of soil and hazard analyses and the site recommendations. This should be done at least fourteen days prior to closing the sale. On those sites where significant potential for expansive soils is found, the builder must supply the buyer with a publication that addresses the following items: (a) problems that are associated with swelling soils; (b) building methods to address these problems; and (c) suggested care and maintenance. The CGS has re-written and published a popular swelling soils book for homebuyers and homeowners, Special Publication 43 (Noe and others, 1997) that addresses these items.

Applicants for new or replacement water treatment facilities having 2,000 gpd or greater capacity are required to submit geologic suitability reports The Colorado Department of Public Health and Environ-ment, Water Quality Division (WQD). Such reports were previously referred to the CGS; however, CGS geologic reviews are no longer mandatory as a result of 1998 rule changes by WQD. Water and sanitation districts and/or local government agencies may, for certain cases and at their option, request a CGS special-use review of water treatment facilities.

Qualifications for Geologic-Suitability Reports

House Bill 1574 (1973)[6] states the following requirements for geologic-report writers:

> *Any report required by law or by rule or regulation, and prepared as a result of or based on a geologic study or on geologic data, or which contains information relating to geology ...and which is to be presented to or is prepared for any state agency, political subdivision of the state, or recognized state or local board or commission, shall be prepared or approved by a professional geologist.*

The statute defines a "professional geologist" as:

> *...a person who is a graduate of an institution of higher education which is accredited ..., with a minimum of thirty semester (forty-five quarter) hours of undergraduate or graduate work in a field of geology and whose post-baccalaureate training has been in the field of geology with a specific record of an additional five years of geological experience to include no more than two years of graduate work.*

Geologic Land-Use Report Reviews by CGS

The CGS is charged, under SB 35, with evaluating geologic factors that would have significant impact on the proposed use of the land for subdivision purposes by reviewing preliminary plat applications. The agency conducts a variety of special-use reviews and provides technical assistance to county and city governments (HB 1041), school districts (HB 1045), and water and sanitation districts and quasi-govern-ment agencies upon request. Subdivision reviews account for a majority of CGS review activities. The CGS is authorized, under **House Bill 1572 (1983)**[7], to establish and collect fees to recover direct costs of providing review services.

For most cases, the CGS receives and reviews geologic-suitability reports (under various titles such as "geologic" or "geotechnical" reports), drainage reports, and plat maps submitted for proposed SB 35 subdivisions. A CGS engineering geologist visits the actual subdivision site and performs a reconnaissance in order to check the submitted information. The reviewer then writes a review letter to the local-govern-ment planning agency from which the submittal packet was sent. A review period of twenty-one days is specified, under SB 35. There are four basic levels of response:

(1) the submitted findings and recommendations are completely adequate;

(2) the submitted findings and recommendations are mostly adequate, and additional suggestions are given;

(3) more information is needed because potentially serious geologic problems were not sufficiently recognized or addressed; or

(4) the project is infeasible for geologic and/or other or technical reasons.

CGS reviews are advisory in nature, and are therefore non-binding. The local-government planning agency may choose to disregard the CGS review, although this is seldom the case. The extent of the review is determined primarily by the stage of planing, complexity of the project, and/or the severity of geologic constraints. Each site will have unique geologic conditions, and must therefore be investigated and reported accordingly. For preliminary plat-level reports, the geologic investigation should go beyond a simple reconnaissance; it should

be a solid, preliminary level investigation that addresses subsurface as well as surface conditions.

Suggestions for Writers of Geologic-Suitability Reports

Model engineering geology report guidelines can be found in CGS Special Publication 12 (Shelton and Prouty, 1979). Such reports should describe all geologic conditions at the project site, identify and interpret correctly the impact of those conditions on the development as proposed, and make complete and reasonable recommendations regarding the mitigation of any adverse conditions and/or mineral-resource conflicts. In general, the geologic data and interpretations should be used to formulate a development plan that considers and incorporates all potentially impactive geologic conditions. The data and interpretations should not be used solely as a justification for the proposed development.

Engineering geologists in Colorado have, through time, strayed from including statements of credit and qualification as part of a geologic-suitability report (i.e., who supervised the geologic investigation, who did the field work, and the qualifications of those workers as professional geologists as defined in HB 1574). The CGS suggests that geologists should return to this practice to ensure the credibility of the engineering geology profession. In addition, a statement should be made that the report is in compliance with the appropriate state statute and local-government regulations, and those statutes and/or regulations should be specifically cited.

Resources for Land-Use Practitioners

A variety of resources are available to the professional geologist and other practitioners who wish to learn more about geologic hazards and associated land-use planning in Colorado. The reader is referred to CGS Information Series 47 (Johnson and Himmelreich, 1998) for more information. The following paragraphs outline some of these resources:

State statutes and local regulations. Developers, geologists, and engineers should be familiar with the statutes and local land-use regulations that are applicable within the jurisdiction in which their projects are located. The statutes are found in the Colorado Revised Statutes. The local land-use regulations are available through county or city planning departments. Many of these resources are available on the internet.

HB 1041 Maps. House Bill 1041 directed counties to create their own geologic-hazard maps to establish areas of state interest (natural hazard areas) and to serve as planning tools. The counties used the CGS and/or private-sector consulting geologists to produce the maps, which are basically reconnaissance-level studies. These maps should be regarded as being a starting point for any site-specific geologic-suitability investigation. A particular county's HB 1041 maps should be available for inspection at the county planning department, as well as at the CGS.

CGS publications. The CGS has published numerous books, reports, and maps that may be used in conjunction with land-use planning. The information contained within these publications ranges from general to site-specific in scope, and may address single or numerous topics. Some of the most useful CGS publications, with regard to land-use activities, are listed below. A listing of other pertinent CGS publications is available through the CGS publication office, at (303) 866-3340, or on the CGS web page

(http://geosurvey.state.co.us/pubs/pub_list/publications_information.htm).

Special Publication 6, "*Guidelines and criteria for identification and land-use controls of geologic hazard and mineral resource areas*," by W.P. Rogers and others (1974). These are the model guidelines, created under HB 1041, for use by local governments in their land-use regulations. The book lists qualifications for professional geologists, engineering geologists, and professional engineers, as well as the responsibilities of geologists and engineers with respect to technical-report preparation.

Special Publication 12, "*Nature's building codes -- Geology and construction in Colorado*," by D.C. Shelton and D. Prouty (1979). This booklet describes and illustrates different natural hazards, and discusses numerous aspects of geology as related to land-use planning. Model engineering geology report guidelines are included.

Special Publication 43, "*A guide to swelling soils for Colorado homebuyers and home-owners*," by D.C. Noe and others (1997). This book is geared toward satisfying the disclosure requirements for new-home buyers in accordance with SB 13. The book substantially updates and replaces two older CGS publications, Special Publications 11 and 14.

Information Series 47, "*Geologic Hazards Avoidance or Mitigation*," by E.J. Johnson and J.W. Himmelreich, Jr. (1998). This booklet contains a compilation of pertinent land-use and professional-practice laws in Colorado that deal with geology and geologic hazards. It contains excerpts from other CGS publications

"*Solving land-use problems*," by J.M. Soule and others. This free booklet is geared toward planners and developers. It describes geologic hazards and SB 35 reviews conducted by CGS, and is periodically updated to provide the latest information to the general public.

CGS Mine Subsidence Library. On behalf of several federal and state mining agencies, the CGS maintains a library of coal-mine and associated ground-subsidence hazard reports and maps for use by geologic and engineering consultants. Copies of these materials are available to researchers upon request, at a minimal cost. Information requests by the general public are researched at no cost to the requestor.

Professional Standards of Practice

In Colorado, there are presently two related issues of interest to geologists and engineers. One issue concerns the boundaries and overlap between the two practices. The limits of professional practice for geology and engineering are of interest because engineering geologists and geotechnical engineers often perform overlapping functions. Some practitioners qualify as both, but most are either a geologist or an engineer by training. There is concern that reports containing geologic information are not being prepared or approved by a qualified geologist, as is required by in HB 1574. Conversely, there is concern that engineering reports are being reviewed by geologists, and not engineers, as part of the SB 35 review process.

The second issue concerns the need for a registration of geologists. Geology is not a registered practice in Colorado at this time; the profession is defined and geologists are qualified under HB 1574. At least three attempts for professional registration have been defeated over the past decades, largely because of objections from minerals and mineral-fuels geologists. In general, the engineering geologists in Colorado rely on the definition and typical scope-of-work of a professional engineering geologist that is provided by the Association of Engineering Geologists, a national organization.

Several notable activities have occurred recently or are occurring at present in Colorado in response to these issues:

(1) The Colorado Board of Registration for Professional Engineers and Professional Land Surveyors (BRPEPLS) has published Policy Statement 15, which lists key guidelines and limitations for engineering in designated natural hazard areas (see Attachment 1). A task force of engineers and geologists updated Policy Statement 15 in mid-1998. *[note; and again in 2000]*

(2) BRPEPLS solicited the input of various professional engineering and geological organizations and agencies, in 1998, regarding the adoption of documents from the California Board of Registration for Professional Engineers and Land Surveyors. The California documents suggest job activities done by professional engineers, those done by professional geologists, and those shared by both professions. Because of the controversy generated by those documents in Colorado and elsewhere, CBRPEPLS has requested that engineers and geologists should engage in a dialog concerning the limits of professional practice, and has indicated an interest in facilitating these discussions.

(3) The Inter-Geo Society, which is comprised of leaders from the various professional geological organizations in Colorado, held a series of meetings in late 1998 to raise the issue of professional registration for Colorado geologists. A meeting and panel discussion called "*To be or not to be... licensed...registered...certified*," occurred in November 1998. These and future meetings are intended to facilitate an opportunity for geologists to discuss the potential need for professional registration in Colorado. *[note: a licensure bill for professional geologists is slated to be submitted for the 2001-2002 legislative session]*

Conclusions

Geologic hazards are an important consideration for land-use and development activities in Colorado. This paper has outlined many of the State's pertinent statutes for geologic suitability assessment, and the role of the Colorado Geological Survey in providing technical assistance to local government agencies and technical information to the private sector and the general public. The role of geologists and engineers and the need for registration of geologists have received recent attention; these issues may have a future impact on professional standards of practice for Colorado geologists and engineers.

Footnotes

1. C.R.S. 24-65.1-101, et seq., "Areas and Activities of State Interest."
2. C.R.S. 34-1-101, et seq., "Colorado Geological Survey."
3. C.R.S. 30-28-101, et seq., "County Planning and Building Codes."
4. C.R.S. 22-32-124, et seq., "Building Codes – Zoning – Planning."
5. C.R.S. 6-6.5-101, "Soil and Hazard Analyses of Residential Construction."
6. C.R.S. 34-1-201, "Geology."

7. C.R.S. 34-1-105, "Colorado Geological Survey."

ATTACHMENT 1

Policy Statement 15
Engineering in Designated Natural Hazard Areas

(Source: Colorado BRPEPLS, 1998)

In areas having "Natural Hazards" in accordance with section 24-65.1-101 et seq., C.R.S., such as expansive soil and rock, corrosive soils and unstable slopes, engineers performing soils (geotechnical) investigations, construction observation, and design of structures including foundations, grading and drainage, buried utilities, streets and pavements, and remedial work to these improvements shall demonstrate knowledge and incorporate knowledge of and expertise in: 1) methods used to mitigate such hazards and, 2) investigation, design and construction guidelines adopted by local governments.

It is the opinion of the Board that this policy statement should be implemented by the following guidelines:

1. Recognition and Mitigation of Natural Hazards

Registrants should be thoroughly familiar with applicable natural hazard legislation and local government policies and regulations for the mitigation of effects of natural hazards. Local government policies and regulations may vary. It is the responsibility of each registrant to become familiar with the applicable policies and regulations. Local government policies and regulations, or lack thereof, concerning natural hazards do not relieve the registrant of sound engineering practice in the recognition and mitigation of natural hazards.

2. Multi-Disciplinary Approach

Registrants should recognize and acknowledge that the mitigation of effects from natural hazards requires a multi-disciplinary approach encompassing the fields of engineering, geology, hydrology, architecture, and land-use planning. It is incumbent on the registrant that these fields are adequately represented in the mitigation of natural hazards through demonstrated knowledge and experience. In general, the Board believes that individual registrants are unlikely to possess the necessary knowledge and expertise to deal with all natural hazards in all cases.

3. Education

Knowledge of natural hazards should be demonstrated by attendance at courses on natural hazards sponsored by the Colorado Geological Survey, universities, local government, or professional societies. Registrants should be prepared to demonstrate appropriate knowledge and expertise.

4. Disclosure

Registrants should be open and forthright about the existence of natural hazards, risks to their clients and the public, methods of mitigation, and the chances of success in mitigation. This applies to all stages of the design process, from feasibility through final design and construction. Registrants should not knowingly take part in remedial work in natural hazard areas where the intent is to disguise either the hazards or existing damage.

(Adopted 02-20-95/Revised 08-07-98)

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