Designated Dipping Bedrock Area Guide

Map of an Area of Potential Heaving Bedrock Associated with Expansive, Steeply Dipping Bedrock in Jefferson County, Colorado is at the end of this document

The Designated Dipping Bedrock Area (DDBA) defines an area of Jefferson County where heaving bedrock is possible under certain geological and human-influenced conditions. The conditions warrant special consideration in all phases of development, including site exploration and evaluation, facilities, design, construction, and subsequent maintenance. In some areas, avoidance may be the best mitigation method.

Heaving Bedrock Geological Hazard

Historically, a high rate of damage to roads, utilities and lightly loaded structures has occurred where steeply dipping beds of expansive claystone bedrock are found near the ground surface. In such areas, ridges of "heaving bedrock," as large as two feet high, several tens of feet wide, and several hundreds of feet long have been mapped. The ridges form where adjacent, dipping layers of bedrock, each possessing a different potential for expansion, are exposed to water. We see damage from heaving bedrock typically within ten years after development and ground deformations may continue for years or decades. This geological hazard is responsible for tens of millions of dollars in excess maintenance costs to County taxpayers and homeowners. Compared to damage caused by flat-lying expansive soils and bedrock, which are found to the east over much of the Denver metropolitan area, heaving bedrock problems are more complex in nature and difficult to predict, and the resulting damage is often more localized and destructive.

Considerations for Proposed and Existing Subdivisions

The DDBA contains many areas where geological conditions are favorable for development and where satisfactory performance of homes and other facilities has occurred. Developers and builders should conduct detailed geological/ geotechnical investigations for proposed developments within the DDBA to delineate areas where favorable conditions occur, such as thick alluvial soils or layers of nonexpansive bedrock are encountered. These are summarized as follows:

- For all inhabited structures, at least ten feet of overburden soil or structural fill beneath the bottom of the foundation.
- Minimum foundation design requirements that are part of the Building Code.
- Subsurface groundwater collection systems, which must have positive drainage and daylight points.

Minimum design requirements for water, sewer and subsurface groundwater collection system.

Existing subdivisions are not subject to most of the overlay district regulations. However, large additions or remedial, structural repair work may be subject to minimum foundation-design standards and special review of the Building Department. Potential home buyers should be aware that the distribution of areas of damage within the DDBA may be erratic. A home that exhibits structural damage may be next to other homes that have no damage. When purchasing an existing home within the map area, or any other expansive soil area, the buyer may want to have an engineer conduct a detailed evaluation of the home to ensure that it is structurally sound.

Geology and Boundaries

The DDBA contains eight sedimentary formations of Cretaceous age, including the Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Formation, Pierre Shale, Fox Hills Sandstone, and Laramie Formation and parts of the Arapahoe/Denver/Dawson Formations. The western boundary corresponds to the contact between the Graneros Shale and underlying Dakota Sandstone on the eastern dip slope of the Hogback ridge or near Golden where these units are missing due to faulting, to the mapped location of the Golden Fault. The eastern boundary corresponds roughly to the eastern extent of the bedrock which dips at greater than 30 degrees from horizontal. Bedrock layers underlying the DDBA dip to the east or northeast at 30 to 90 degrees from horizontal. The map does not show internal contacts between different bedrock formations, nor attempts to delineate areas of natural alluvial deposits that may cover and significantly reduce the heaving potential of the bedrock.

Submittal Requirements Special to the DDBA

Zoning

1. Detailed grading plans shall be submitted which show overburden soil or fill at least ten (10) feet thick beneath the anticipated level of the bottom of the structure foundation(s) and the top of bedrock. If deep (pier) foundations are proposed, the Zoning Administrator may require review of such plans by the Engineering Advisory Board.

or

If ten (10) feet of overburden or fill are not proposed, detailed engineering plans shall be submitted to the Engineering Advisory Board. The alternate mitigation plans shall contain the information necessary to determine that potential hazards can be adequately mitigated by other methods.

2. The rezoning application shall include geologic and soils/geotechnical reports prepared according to Section 25 of the Land Development Regulation. The geologic report includes a contour map of the top of the bedrock surface and may require trenching to expose the claystone bedrock for detailed geologic mapping. The geotechnical investigation requires test borings be drilled every 250,000 square feet to a minimum depth of 25 feet. One of the objectives of the geotechnical investigation is to establish the depth to bedrock across the site.

Preliminary Platting

1. Detailed grading plans shall be submitted which show overburden soil or fill at least ten (10) feet thick beneath the anticipated level of the bottom of the structure foundation(s) and the top of bedrock. If deep (pier) foundations are proposed, the Zoning Administrator may require review of such plans by the Engineering Advisory Board.

or

If ten (10) feet of overburden or fill are not proposed, detailed engineering plans shall be submitted to the Engineering Advisory Board. The alternate mitigation plans shall contain the information necessary to determine that other methods can adequately mitigate potential hazards.

2. The platting application shall include geologic and soils/geotechnical reports prepared according to Section 25 of the Land Development Regulation.

3. Subsurface groundwater collection system plans designated according to Section 19 of the Land Development Regulation.

Final Plat

1. Detailed grading plans shall be submitted which show overburden soil or fill at least ten (10) feet thick beneath the anticipated level of the bottom of the structure foundation(s) and the top of bedrock. If deep (pier) foundations are proposed, the Zoning Administrator may require review of such plans by the Engineering Advisory Board.

or

If ten (10) feet of overburden or fill are not proposed, detailed engineering plans shall be submitted to the Engineering Advisory Board. The alternate mitigation plans shall contain the information necessary to determine that other methods can adequately mitigate potential hazards.

2. The plat application shall include geologic and soils/geotechnical reports prepared according to Section 25 of the Land Development Regulation.

3. Subsurface groundwater collection system design and maintenance plans in accordance with Section 19 of the Land Development Regulation.

4. Central Water System plans designated according to Section 21 of the Land Development Regulation.

5. Central wastewater collection system plans designated according to Section 22 of the Land Development Regulation.

6. Grading plans designed according to Section 17 of the Land Development Regulation. These regulations establish excavation and fill construction specifications including test methods and frequencies.

Building Permit

Meet the minimum foundation design requirements for piers, foundation walls and drainage and grading. These requirements may be found in the Jefferson County Supplement to the Uniform Building Code and are available from the Building Department.

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