

Geology and Soils Reports  
Performed For  
A VACATION AND REPLAT OF LOT 1,  
V I L FILING No. 1  
PORTION OF THE NORTHWEST QUARTER OF  
SECTION 30, TOWNSHIP 13 SOUTH,  
RANGE 63 WEST OF THE 6TH M.M., EL PASO  
COUNTY, COLORADO

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July 11, 2022

## General Information

Location and size of subject area and its general setting with respect to major geographic and geologic features

The subject area is in eastern El Paso County, east of the Falcon NW Quadrangle for which a geologic map published in 2003 is available. The then motivation for the Falcon NW Quadrangle study was the eastern movement of Colorado Springs-based development as the growing population sought residential units in that direction. Since that study was commissioned, the eastward march of development has continued though no such equivalent study has been completed for the area which would include the subject of this report.

This property being subdivided is a 20-acre, more or less, single lot into four lots of approximately 5-acres each. Located starting at the northeast corner of the intersection of Jones Road and Murr Road as shown in the map of Figure 1.

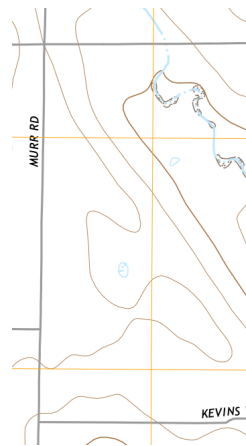


Figure 1: Property lines are rectilinear with the roads with the north boundary extending from the intersection then slightly into the FEMA Zone 'A' beginning west of the .

### Geologic mapping on which the report is based and when the mapping was done

There is not a known geologic mapping for the subject proposed subdivision but there is one in the nearby Geologic Map of the Falcon NW Quadrangle. It is from this mapping that information was used along with site surveys on the subject subdivision and into the Falcon NW Quadrangle to make the geological inferences of this report.

Any other kinds of investigations made by the geologist and, where pertinent, reasons for doing the work

Field surveys into the Falcon NW Quadrangle were made to find substantiation for inferences of the geologic conclusions. The "Soil Survey of El Paso County Area, Colorado" by the USDA, Soil Conservation Service was consulted for descriptive information of surficial soils.

#### Topography and drainage in the subject area

The topography is the end of a higher elevation that begins to descend just east of Murr Road and finds a lower elevation in the bed of a once more active drainage path on the east side of the subject proposed subdivision. In other words, the subject property is a topographic transition from a higher elevation to a stream eroded lower elevation. As a transition it is noteworthy to not be too severe, manifesting at most a 9% downward slope to the east.

#### Abundance, distribution, and general nature of exposures of earth materials within the area

As far as geologic features not covered with self-sustaining vegetation, there are no such on the subject property. The erosion, both wind and water has rendered the site with gradual sloping which shows no sign of slides, gullies or other such markings in the topography.

#### Structure Sections

It is believed the 3-dimensional relationships of the property can be described satisfactorily in words alone, therefore, structure sections are not provided in this geology and soils report.

Contours, run generally from northwest to southeast with the grade descending to the east. The exception to this is an interruption of the contours north of the east-west midline where a slight draw occurs leaving a relative high point just above 6450 feet. At the northeast corner the last contour is 6415 feet. Below this elevation which cuts diagonally across the northeast corner is a designated flood plain, per Federal Emergency Management Agency designation, the flood plain is Zone 'A' for a 100-year flood plain. The remaining approximately 95% of the subject property is designated Zone 'X'.

## Test Hole, Percolation Test, and Soil Investigation Test Pit Excavation Locations

The six excavations conducted as part of this investigation have been annotated on the attached plat. Each of the proposed four lots had at least one excavation.

## Geologic Descriptions

The entirety of the area of the proposed subdivision is likely stratigraphically designated Qes for Eolian sand (Holocene and Pleistocene?). A question mark is a direct quote from the geologic map of the Falcon NW Quadrangle. In other words, the authors of that study were expressing their uncertainty of the Pliestocene period. The reasonableness of this inference is founded on the absence of a geological map for the subject area thence use of the nearest Geologic Map of the Falcon NW Quadrangle for El Paso County. On that geologic map the Eolian sand appears best to correspond in both description and extent with the proposed area of the subdivision. Also, experience in those areas of the Falcon NW Quadrangle substantiate this inference. As further support for the inference is the presence of no less than three pits or mines for extraction of material similar to that meeting the description of material observed in the test excavations done as field work for this report.

The bedrock is of the Dawson Formation and again, from the Geologic Map of the Falcon NW Quadrangle, the bedrock beneath this subject area would likely bear the stratigraphic designation TKda.2. This inference is based on the fact the TKda.2 lies below the TKda.4 found on the north edge of the Falcon NW Quadrangle which yields to the below TKda.2 in a southerly direction. That the bedrock is not TKda.1 is probable since no such is found on the Falcon NW Quadrangle.

If the above inferences are correct, then as an eolian sand, the higher parts near the western edge of the proposed subdivision would be remains of wind-drifted sands, or dunes and the slope to the west would be a combination of wind drifting and subsequent erosion from the one-time more active watercourse that is now manifest in the northeast corner as Zone 'A' 100-year flood area.

## Structural Features

In each of the six excavations the soil profile showed sand to loamy sand per the U.S. Department of Agriculture Soil Classification System. The soil profiles were consistent in not showing stratification, foliation, schistosity, folds, and zones of contortion or crushing, joints, shear zones, faults, etc.

## Surficial (Unconsolidated) Deposits

Topsoil at this site is shallow and found to not be deeper than 12 inches though half of the locations excavated displayed topsoil on the order of 6 inches.

The proposed subdivision manifests at most four soils. Blackland loamy sand and Truckton sandy loam comprise approximately 95% of the proposed subdivision's spatial extent. Blendon sandy loam is found in the FEMA Zone 'A'. Per the Soil Conservation Service mapping there is possibly a small area of Truckton sandy loam in the southwest corner of proposed Lot 4.

At a few scattered locations surficial disturbances exist indicating possible burial of livestock or debris from early settlers on this property. Otherwise, no artificial (man-made) fill, topsoil, stream-laid alluvium, beach sands and gravels, residual debris, lake and pond sediments, swamp accumulations, dune sands, marine and non-marine terrace deposits, talus accumulations, creep and slopewash materials, various kinds of slump and slide debris, etc., was detected.

## Drainage of Surface Water and Groundwater

There are no streams, ponds, swamps, springs, seeps or known subsurface basins. The only part of the property to see such would be the northeast corner of proposed lot number one and then only as a 100-year event.

The effect of water on the properties of the in-place materials would be limited to ferric staining. This would be as a result of highly oxygenated waters permeating and damming on an impermeable lower strata. However, to 16-feet no evidence of such was observed. To the depth explored there is no known effect of water on the in-place material properties.

As the entire study area is near 20 acres, the Rational Method for determining surface drainage is prescribed. Each of the four proposed lots slope toward the Haegler drainage path bordering on the east side of the proposed subdivision. The overland drainage distance for lots 1 and 4 are 733 feet, while the lengths for lots 2 and 3 are 660 feet. The distances differ as the contours in the former are at a diagonal to the individual lot boundaries with the latter being nearly perpendicular to those boundaries. The general slope across the proposed subdivision is 2.3%. Hydrologic soil groups are A and B. The land use or characteristics are pasture/meadow with 10- and 100-year values for the coefficient 'C' in the Rational equation of 0.25 and 0.35, respectively. Less than 5% of lot 1 is developed with no development on the other three lots. 'C' coefficients for the 5% of lot 1 of 0.80 and 0.90 are believed conservative for frequencies 10 and 100, respectively. Calculation of 'C' for lot 1 follows:

$$C_{10} = 0.80 \times 0.05 + 0.25 \times 0.95$$

$$C_{10} = 0.24$$

$$C_{100} = 0.90 \times 0.05 + 0.35 \times 0.95$$

$$C_{100} = 0.33$$

With the above data in hand and using DCM Figures 5-1 and 5-2:

Off-Site Drainage Calculation

Lot	Frequency	C	Tc	I	A	Q
1	10	0.24	36	2.4	5	2.9
1	100	0.33	31	4.0	5	6.6
2	10	0.25	40	2.3	5	2.9
2	100	0.35	32	3.9	5	6.8
3	10	0.25	40	2.3	5	2.9
3	100	0.35	32	3.9	5	6.8
4	10	0.25	36	2.4	5	3.0
4	100	0.35	31	4.0	5	7.0

The total flow from the entire subdivision for the 10- and 100-year events will be 12.7 and 27.2 cfs, respectively. Assuming a 5% post-construction development and the same 'C' values as used in Lot 1 the post development Q for the 10- and 100-year events will be not more than 13.0 and 27.5 cfs respectively. These flows off the lots will be sheet flows.

## Features of Special Significance

Geological and soils features not in evidence at the subject proposed subdivision include:

- accelerated erosion (e.g., cliff reentrants, badlands, advancing gully heads);
- Features indicating subsidence or settlement (e.g., fissures, scarplets, offset reference features, historic records and measurements);
- Features indicating creep (e.g., fissures, scarplets, distinctive patterns of cracks or vegetation, topographic bulges, displaced or tilted reference features, historic records and measurements);
- Slump and slide masses in bedrock or surficial deposits; distribution, geometric characteristics, correlation with topographic and geologic features, age and rates of movement;

- Deposits related to recent floods (e.g., talus aprons, debris ridges, canyon-bottom trash); and
- Active faults and their recent effects on topography and drainage.

## Mineral Resources

The mineral resource most readily apparent is the sand to sandy loam which from the field survey appears abundant at this site. This material in some engineering contexts could be considered as select material. However, the worth of such material is a function of other deposits currently being exploited and their proximity to the deposit on this property. It is that an existing mine operation producing such material lies within 5 miles of this property. The capacity of that mining operation renders the value of deposits on this property likely non-competitive.

A review of "Colorado Front Range Inactive Coal Mine Data and Subsidence Information, El Paso County" by Turney and Murray-Williams finds no record of mining operations with the proposed subdivision.

## Compatibility with Proposal

The general compatibility of natural features with the proposed land use of residential in a rural setting is good. Specifically, the lateral relief is at most -40 vertical feet from west to east which is not severe for slope stability given the width of the parcel. Further, the three, as yet undeveloped proposed lots, have very little relief on the west sides. This works well as the west and only access to these lots will be from Murr Road.

While the native soil is low in fines as seen in Figure 2 and thus the soil has low cohesion, ample area is available for homesites on level ground. Even so, the grade on less level areas is uniformly in those areas less than 9%.

No deposit of clay was found in the field survey and test excavations. Sieve analysis further substantiated low content of fines and hence a low expansion potential for this site making construction easier and lower cost as soil remediation of special engineering will not be required. Of course these conclusions are to be born out with site specific testing.

The only area subject to flooding is the northeast corner which has a FEMA designation of Zone 'A' for 100-year flood plain. This is a small area and a recognized no-build zone with more than 80% of this single, already developed proposed lot available. Otherwise, the granular soil has little ability to pond or retain surface water.

Erosion was the apparent cause of the flat area in the northeast corner though no exposed soils, escarpments or other signs of recent severe erosion are apparent. The earth

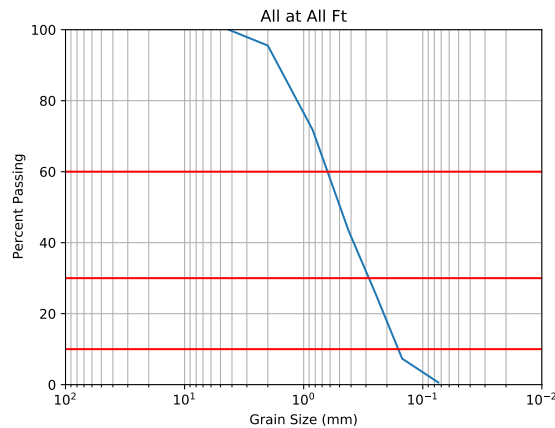


Figure 2: Composite sieve analysis. All sieves for all holes when plotted appear near identical.

gradually comes to the edge of the Zone 'A' with continuity of the vegetation cover.

There is no visual indication features or conditions on the two adjacent properties pose any threat to the existing conditions on the proposed subdivision. The county roadways on the other two sides of the property are well maintained with ample drainage cuts.

### Proposed Cuts

The material found in each of the six test excavations across the four lots was consistent as noted in the description of Figure 2. The stability of excavations in such material should be a concern to future excavation contractors. Safe management of those excavations would be accomplished by terracing or shoring.

### Proposed Masses of Fill

The only proposed "masses of fill" would be those resulting from excavations for home-sites or utility lines. In those cases masses of fill should not be placed uphill of an excavation or adjacent to the sides. Overburden loading of low-cohesive soils as exist on this proposed subdivision should be considered a dangerous practice. Good practice would be to distance the closest edge of masses of fill at a minimum distance determined from projecting the 45-degree line from the bottom of the excavation to the ground surface.

Existing soils observed on this proposed subdivision are excellent fill materials requiring minimal compaction. Underdrainage in the form of perimeter drains is always a good



precaution where the area to be protected is high-cost finished living areas. If an area is not protected there is always opportunity for poorly maintained surface management to result in moisture infiltration. The type of management alluded to is that pertaining to downspouts from rain gutters and maintenance of grade against the house. Prudent is the structure where the grade drops uniformly one foot for the first 10 feet perpendicular to the home and that water not be retained but conveyed further from the structure. Figure 3 depicts proper downspout maintenance and perimeter drain details.

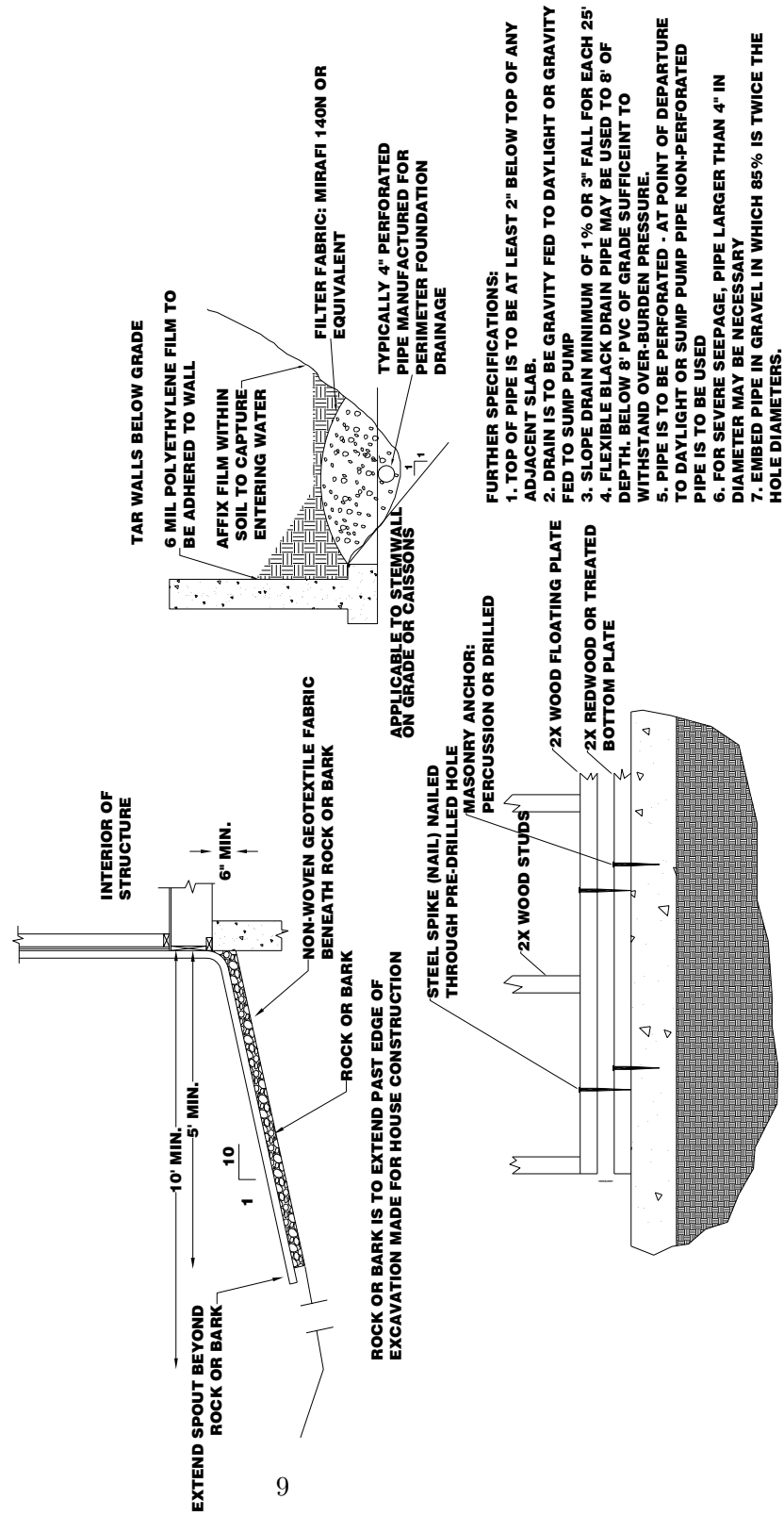


Figure 3: Engineering Details.

A homesite under development where excavations are made and open for a matter of months should be protected by proper surface control. Specifically, berming of downhill areas from masses of fill and tapering of the excavated material to avoid steep slopes where erosion forces in the form of accumulated mass water movements could develop.

The equivalent hydrostatic soil pressure is near 35-lbs beginning at surface and extending to the deepest test excavation of 16 feet. In low-cohesive soils such as this buttressing of basement walls is a general practice in the Pikes Peak region and is recommended in this instance.

### Onsite Wastewater Treatment Systems

Per the U.S. Department of Agriculture Soil Classification System, the soils across the proposed subdivision and to the maximum depth of 16 feet examined among the six test excavations the soil was found to be sand to sandy loam. Though not used anymore in El Paso County, this roughly correlates with a percolation rate of from 5 to 15 minutes per inch. For a treatment level of one the Long Term Acceptance Rate, LTAR, would be 0.80 gallons per day per square foot.

With the most adverse slope being about 9%, leach fields could, with subsurface conditions proving consistent, be placed anywhere on the three yet undeveloped proposed lots resulting from subdividing. On such slopes the leach lines are to be run parallel to the land contours.

### Recommendations for Subsurface Testing and Exploration

Cuts and test holes needed for additional geologic information would be needed to determine consistency with the findings of this study and to comply with the requirements of the El Paso County Health Department. Geotechnical reports are required by the Regional Building Department and the engineer of record will want to assure those examinations are sufficiently proximal to each proposed construction. It is expected the program of subsurface exploration and testing necessary to satisfactorily determine site-specific subsurface conditions can be accomplished with a backhoe. Use of an exploratory drill will likely extend to a depth not useful for foundation or septic system design.

### Expected Geotechnical Recommendations Per Non-Site Specific Investigation

The geotechnical report should anticipate allowable bearing pressures of 1500 psf with equivalent hydrostatic pressures of 35-psf though at each building site these numbers are to be independently determined. Additional considerations are provided with the included context from the geotechnical report under 'Compatibility with Proposal.'

### Consolidation and Expansion Potentials

The soil within the zone of influence is not of a character of which significant expansion is expected and the soil is too granular for a reliable swell-consolidation test. Nonetheless, sufficient fines are contained in the native soil that slabs should have sufficient control joints with approximate limits of 120 square-feet and with limited horizontal extents of 12 feet. Also, non-load-bearing partition walls should be floating per the detail provided in Figure 3.

The soil should be vibratory compacted before form placement.

### Detection of Fill

No fills other than a few small sites where historical burials from the last century were observed. These are superficially apparent and display antique-like artifacts.

### Concrete

Preliminarily, Type II cement is recommended in all concrete applications within this subdivision.

Concrete must not be poured on frozen ground or be allowed to freeze.

### Special Considerations

Excavation will not require unusually heavy equipment and the soil is so light that it should be compacted before form placement.

### Recommended Foundation

This soils test does not constitute a foundation design. A spread footer capable of spanning 10-feet unsupported is the likely most cost-effective foundation for these lots. This does not counter that specialized buildings would not be cost-effectively constructed using other foundation types.

### Slab Considerations

The soils within the proposed subdivision generally exhibited low expansion potential. Anticipated slab performance can be characterized as follows:

## Anticipated Concrete Slab Performance

Slab Performance Risk Category	Anticipated Percent Swell With 500 psf Surcharge	Anticipated Percent Swell With 1000 psf Surcharge
Low	0 to less than 3	0 to less than 2
Moderate	3 to less than 5	2 to less than 4
High	5 to less than 8	4 to less than 6
Very High	8 or more	6 or more

The above characterization is that advised by the Colorado Association of Geotechnical Engineers.

### Special Recommendations

Of course the FEMA Zone 'A' 100-year flood plain in the northeast corner of the proposed subdivision is a no-build area and should be left undisturbed. Given its distance from the currently established homesite with plenty of room for out buildings and leach fields there is likely no reason the Zone 'A' would be needed other than for possible livestock grazing.

Slide masses are not a consideration on this proposed subdivision.

### Flood Protection

No problems of groundwater circulation or positioning of structures due to active faults are apparent inasmuch as no recorded faults are proximal to this proposed subdivision. Flood protection is relevant for the Zone 'A' but otherwise not an issue.

### Relationship to Other County Regulations

The proposed subdivision is for residential structures and light agricultural activities. Otherwise, no public improvements are a part of this proposed subdivision. Embankment structures are explicitly not a part of the intended development and therefore, beyond individual wastewater disposal systems water retention is expressly not a part of this subdivision. Nonetheless, the following paragraph is included for completeness.

In addition to these requirements set forth in this Code, the ECM requires geologic hazards and geotechnical reports addressing site constraints and mitigation for projects involving construction of public improvements. The DCM Volume 1 addresses the need for geotechnical analyses for embankment structures and DCM Volume 2 addresses geotechnical construction requirements for water quality best management practices (BMPs).

Applicants are also required to comply with the State Engineer's requirements regarding embankments and dams utilized for storage of water.

### Referral to and Resolution of Issues Raised by the CGS

The geology and soils report will be referred to the CGS for review and recommendations. The applicant is responsible for payment of fees associated with the review by the CGS. The applicant is responsible for resolution of issues raised by the CGS, to the satisfaction of the PCD Director.

### Effect of Approval

The geology and soils report will be maintained in the subdivision file, available for public viewing. The applicant is responsible for implementation of the report recommendations and review agency recommendations to the satisfaction of the PCD Director. The resolution of an issue may be in the form of modification of the development design to mitigate the constraints and hazards, placement of notes on the preliminary plan and final plat to advise buyers of the constraints and hazards, restrictions on construction within a lot or within the subdivision, or a determination that the constraint or hazard may be mitigated by specialized engineering or construction techniques and identification of the entity responsible for such mitigation.

If we can address any questions, please contact us on one of our numbers noted on the title page of this report.

Sincerely,



James L. Allison, Ph.D., P.E.