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July 27, 2006

Airport Development Group, Inc.
1776 South Jackson Street, Suite 950
Denver, Colorado 80210

Attention: Stephen P. Marshall

Subject: Preliminary Engineering Geology and Surface Soils Evaluation
Meadow Lake Airport Sketch Plan
Falcon, El Paso County, Colorado
Project No. 06-126

Dear Mr. Marshall:

This report presents the results of our Preliminary Engineering Geology and Surface Soils Evaluation for the Meadow Lake Airport Sketch Plan in El Paso County, Colorado. This report presents discussions of site geology and surface soils and our opinions of the potential effect of these conditions on planning the development. The information included in this report has been compiled from analysis of aerial photographs, brief field observations and mapping of the site, review of previous studies for the area, and geologic research and analysis. Conditions disclosed by additional surface or subsurface investigations and laboratory analysis may make some revisions of the conclusions of this report appropriate.

PROPOSED DEVELOPMENT

The site will include various uses such as extension/expansion of runways, general aviation, industrial, commercial, warehousing, drainage/detention facilities, and open space. A central water supply system and a central sewage disposal system are proposed to service the development.

SITE DESCRIPTION

The Meadow Lake Airport Sketch Plan is located adjacent and south of Judge Orr Road, north of Falcon Highway, and west of Curtis Road in the Falcon area of El Paso County, Colorado (see Figure 1). The site is located in portions of Sections 4, 5 and 9, Township 13 South, Range 64 West of the Sixth Principal Meridian, and consists of about 1,008 acres.

Topographically, the site is dominated by gently rolling hills and ridges with local areas of poor (interior) drainage. Separating the rolling hills and ridges are broad valleys consisting of gently to very

gently sloping ground consisting of swales, streams, and stream terraces (see Figure 2).

Grazing appears to have been the dominant use of much of the site in the past and most of the site appears to be in a natural condition. One stock pond is located along the stream that flows through the easterly part of the site. A drainage pond is also located in the northwestern part of the site (see Figure 4).

Native grasses and some yucca and cactus dominate the vegetation on the site. In the poorly drained areas lush 'grasses' were observed. In the areas in and adjacent to the main drainages and ponds, riparian and/or wetland type vegetation was observed (see Figure 4).

The site is located in the area east of Falcon which is experiencing increased development activity.

PREVIOUS STUDIES

In 2004 John Himmelreich & Associates performed a geologic study for the Santa Fe Springs Sketch Plan area east of the site (Reference 1). Kumar published a geologic study for the proposed Meadow Lake Estates Filing No. 9 in 2003 that includes 163 acres of the site (Reference 2). Previous other studies that have been conducted in the area include regional studies published by the U. S. Geological Survey (Reference 3), and by C. S. Robinson and Associates (Reference 4). The Soils Conservation Service has also published a soil survey of the region (Reference 5) and FEMA has published flood maps for the area (Reference 6). El Paso County has published an Aggregate Resource Evaluation map that includes the site area (Reference 7).

SITE GEOLOGY

The areas along the drainages are underlain by stream-deposited alluvium consisting of the Piney Creek Alluvium and Recent Alluvium (Figure 2). Various portions of the site are underlain by deposits of eolian (wind-blown) sand, silt and clay. Portions of the site are underlain by an older alluvial deposit (Rocky Flats Alluvium). Black Squirrel Creek and its tributaries deposited the alluvial materials in both historic times and in the geologic past. Alluvial deposits are continuing to form to this day in the active flood plains of the streams and small drainages on the site. The Rocky Flats Alluvium, Piney Creek Alluvium, and Recent Alluvium consist of inter-bedded and intermixed sand, silt and clay with some gravel. The eolian deposits typically consist of silty sand but may also contain significant amounts of clay. The Rocky Flats Alluvium appears to range from a thin veneer to in excess of 25 feet below the site. The Piney Creek Alluvium and Recent Alluvium ranges from a thin veneer (less than 5 feet) to possibly 20 feet deep under the site. The eolian deposits are expected to range from a thin veneer to possibly 15 feet deep under some portions of the site.

Underlying the surficial soil deposits in this area is bedrock of the Denver Formation. The Denver Formation consists of inter-bedded claystone, siltstone, and sandstone. The formation contains significant amounts of material weathered from volcanic rocks (andesites and basalts). The andesitic nature of the claystones results in significant potential for expansion (expansive bedrock and derived soils). The regional dip of the strata is very gentle to the north. The Denver Formation is a regional

aquifer, part of the Denver Basin aquifer system. No bedrock exposures were observed on the site. Relatively shallow bedrock (3 feet below the ground surface) was encountered in three of the test borings drilled by Kumar in the northeast part of the site (Reference 2).

Shallow perched groundwater exists or is likely to be encountered under the site in the Piney Creek and Recent alluvial deposits. Perched groundwater also might exist at depth under the Rocky Flats Alluvium and the eolian deposits. Several areas of shallow groundwater and/or seasonally wet conditions were mapped on the site (see Figure 4). Groundwater is also likely to be encountered in some of the bedrock layers.

The Soil Conservation Service (Reference 5) has mapped 5 soil types on the site. These are shown on Figure 5 and described on Figures 5a- 5e.

RECOVERABLE RESOURCES

Under the provision of House Bill 1529, it was made a policy of the State of Colorado to preserve for extraction any commercial mineral resource located in a populous county. The El Paso County Aggregate Resource Evaluation map indicates that the alluvial deposits and eolian sand underlying this area has been classified as a potential source of sand and fine aggregate. Processing of the sands for a use higher than backfill is likely to be required.

GEOLOGIC HAZARDS AND CONSTRAINTS

We believe that the subject site is relatively free from serious geologic hazards. The more significant geologic hazards or constraints to development recognized on the site are the potential for flooding and the potential for erosion. Other potential hazards include the presence of shallow groundwater, stability of cut slopes, and soils/foundation considerations (such as settlement, hydrocompaction, expansive soils/bedrock). Certain regional problems also affect the site. The geologic hazards identified on this site are relatively common to the region and are mitigated by employing proper planning, design, and construction practices.

CONSTRUCTION AND DEVELOPMENT CONSIDERATIONS

There are geotechnical conditions that will influence development and construction on this site. While none of the conditions are believe to present an unacceptable risk, they should be considered. The following sections discuss our opinions of the conditions.

Flooding and Surface Drainage

As shown on the Preliminary Geologic Map (Figure 2), Recent Alluvium is found in and along the drainages. The Piney Creek Alluvium also forms low terraces in the valleys. A significant potential for flooding is associated with the larger drainages and some of the lower Piney Creek terrace deposits.

FEMA has mapped a floodplain along the largest drainage passing through the site (see Figure 4). It should be noted that no drainage study was performed as part of this report and the FEMA 100-year floodplain might not 'match' the physiographic floodplain. Flood hazard zones should be defined by detailed drainage studies and mitigation should be designed based on the detailed studies.

Some areas of the site are poorly drained or possess a very low slope. Planning and design should provide for adequate surface drainage for all proposed structures and roadways.

Erosion

The soils on the site are susceptible to erosion by both wind and water because the sandy soils have low cohesion. Stream banks are prone to erosion during flood events.

All areas disturbed during construction should be protected from erosion at the earliest opportunity. The details for protection from erosion should be addressed in an erosion control plan, which was not part of our scope of work.

Shallow Groundwater and Subsurface Drainage

Areas of the site exhibit problems with shallow groundwater and subsurface drainage (see Figure 4). The Recent and Piney Creek alluvial deposits commonly contain shallow perched groundwater or are seasonally wet. This is considered a permanent feature of the site and groundwater levels may increase due to irrigation and during flood events. The variable permeability characteristics of the surficial soils are such that the cleaner sands carry water, perched on lower permeability layers or bedrock. Subsurface seepage will move laterally along the top of the lower permeability layers and either daylight on the surface, on a slope, in a drainageway, or in a foundation excavation. Swales and small drainages are also areas where subsurface drainage is likely to be concentrated.

Subsurface drainage systems constructed with the utilities (such as the sanitary sewer) are likely to be necessary in some portions of the site. Geotechnical and hydrogeologic investigations are recommended to evaluate the subsurface conditions in detail and provide design recommendations for the systems. Basement construction may need to be avoided in some areas. Special de-watering or construction techniques also may be necessary in some areas. Alternately, the ground level could be raised to provide adequate separation from the groundwater.

For individual structures, mitigation of subsurface drainage problems usually takes the form of perimeter drains around and/or under foundations. In areas where shallow groundwater is encountered, basements may need to be avoided. The need for and capacity of these individual subsurface drainage systems should be based on an individual site analysis for each specific structure. The observation of the subsurface soil and moisture conditions in excavations for foundations should take seasonal variations and external influences (such as flood events) into account.

Trenching/Slopes

The sandy soils underlying the site generally lack cohesion and therefore are prone to caving and sloughing on steep slopes and in excavations. Permanent cut slopes should either be laid back or supported with a retaining structure. Excavations in the surficial soils or areas where seepage is encountered may expose material which is poorly consolidated and which may be wet at least on a seasonal basis. Cuts in these soils should be treated with caution, especially in utility trenches and other excavations.

Corrosive Minerals

The soils, bedrock, or groundwater may contain corrosive minerals. Corrosive minerals can be detrimental to concrete or buried metals. The potential for corrosive minerals should be addressed when utility and building designs are completed. The use of sulfate resistant concrete is commonly used for foundations and other concrete structures.

Expansive Soil and Bedrock

The claystones in the underlying Denver Formation bedrock are expansive and the expansion potential should be evaluated if foundations are carried into this material. The alluvium and wind-blown soils also sometimes contain clay layers or zones that may be expansive. For structures, the expansion potential of soils is normally addressed by a subdivision-wide and/or site-specific soil and foundation investigation. Expansive soils are rather common in the Front Range of Colorado and techniques for mitigation are fairly well developed. It is therefore important that each subdivision and structure be analyzed individually so the potential problem can be assessed and individual design measures taken. Mitigation for expansive soils typically involves removal of the expansive material to a specified depth below foundations, the use of deep foundation systems, or special foundation designs.

Ground Subsidence

The alluvial and wind-blown soils that underlie the site will have variable properties with regard to foundation support. The sandy surficial soils are commonly of low-density and hence low foundation bearing pressures are usually appropriate. The sandy soils are prone to settlement when heavily loaded. Thick deposits of saturated, low-density clay (if encountered) may consolidate under heavy loads or under thick deposits of fill. Comparatively low bearing pressures normally are not a major concern for relatively light residential and commercial structures. Heavy structures may need to utilize deep foundations founded in the underlying bedrock or other specialized foundation designs. Some of the surficial deposits (especially the eolian soils) are commonly hydrocompactive (the soil structure collapses when saturated).

The potential for settlement, consolidation, and hydrocompaction (and mitigation) are normally addressed in site-specific soil and foundation investigations for each subdivision and/or structure. Special foundation designs or ground preparation may be appropriate to mitigate these conditions.

Man-placed Fills

Most of the site has apparently been left in a natural condition. No large areas of man-placed fills were observed on the site. Small areas of fill are associated with the embankment for the stock pond on the site. All of the fills are considered non-structural and not suitable for the support of structures. Mitigation typically involves the removal of the fill and replacement with structural fill. Deleterious materials and debris are not suitable for structural fill and if encountered will need to be properly disposed.

Seismic Activity

This area, like most of central Colorado, is subject to a degree of seismic risk. The Colorado Geological Survey and the study published by C. S. Robinson & Associates consider this area of Colorado to be in Seismic Risk Zone 2, which could be affected by a moderate earthquake. Seismic forces are not required to be used in design of residential structures in this zone. Critical structures and essential facilities are required to be designed for seismic forces in Zone 2.

Radioactivity/Radon Gas

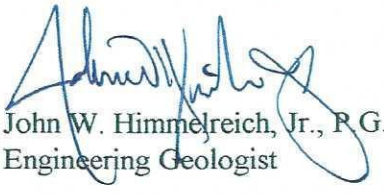
There is not believed to be any unusual hazard from naturally occurring sources of radioactivity on this site; however, most of Colorado is generally considered to have the potential for elevated levels of radon gas. Providing increased ventilation of basements and crawl spaces, venting of perimeter foundation drains, and sealing of joints can mitigate build-ups of radon. Radon hazards are best mitigated at the building design and construction phases.

LIMITATIONS

The opinions presented in this report were developed from review of aerial photographs, topographic and geologic maps, brief site observations, review of test boring logs by others, and research of published and unpublished information. Should additional surface or subsurface data become available, the conclusions and recommendations contained in this report shall not be considered valid unless the data are reviewed and the conclusions of this report are modified or approved in writing by our firm. Evaluation of wildfire hazards and an environmental site assessment were beyond the scope of this report. If you have questions or require additional information, please contact us.

Respectfully,

JOHN HIMMELREICH & ASSOCIATES



John W. Himmelreich, Jr., P.G.
Engineering Geologist

PARTIAL LIST OF REFERENCES

1. Himmelreich, J. W., Jr. (3-8-04). Preliminary Engineering Geology and Surface Soils Evaluation, Santa Fe Springs Sketch Plan, El Paso County, Colorado. John Himmelreich & Associates Project No. 02-164.

2. Berends, B. E. and Pardi, M. (2-5-03). Revised Soils and Geology Study, Proposed Meadow Lake Estates Filing No. 9, El Paso County, Colorado. Kumar & Associates, Inc. Project No. 012-150.1.

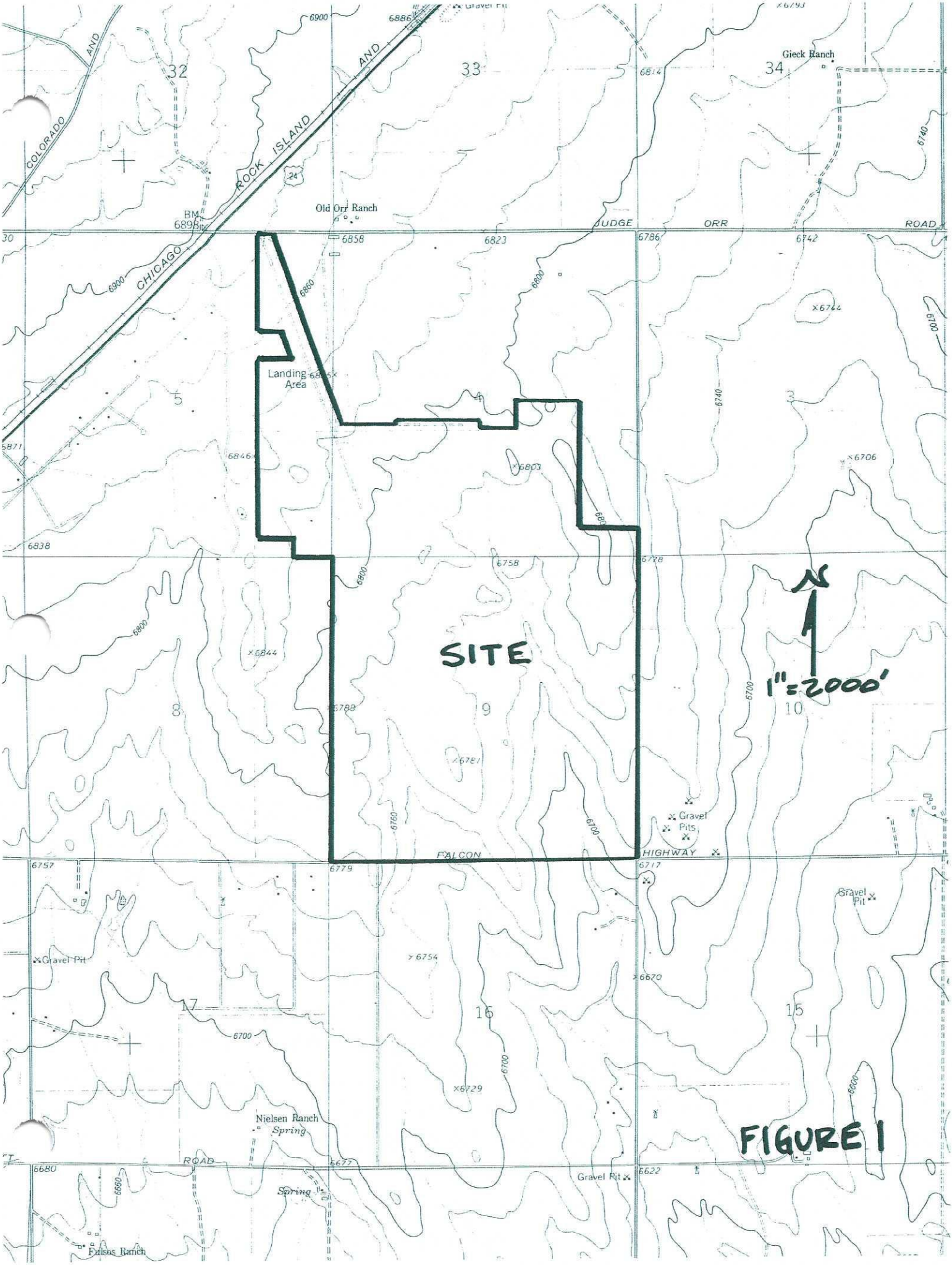
3. Scott, G. R. and others (1978). Geological Map of the Pueblo 1degree x 2degree Quadrangle, South-Central Colorado. U. S. Geological Survey Map I-1022.

4. Cochran, D. M. (1977). Falcon Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits; Environmental and Engineering Geologic Map for Land Use. C. S. Robinson and Associates.

5. Soil Conservation Service (1981). Soil Survey of El Paso County Area, Colorado.

6. Federal Emergency Management Agency (FEMA), (March 1997). Flood Insurance Rate Maps, Panel 08041C0575 F.

7. El Paso County Planning Department (October 1995). El Paso County, Map 1, Aggregate Resource Evaluation.


SITE
1"=2000'
Landing Area
Old Orr Ranch
Gieck Ranch
Nielsen Ranch
Spring
Spring
Gravel Pit
Gravel Pits
Gravel Pit
Gravel Pit
Furlong Ranch
JUDGE ORR ROAD
FALCON HIGHWAY
ROCK ISLAND AND CHICAGO
COLORADO AND
BM 6898
32
33
34
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16
17
6900
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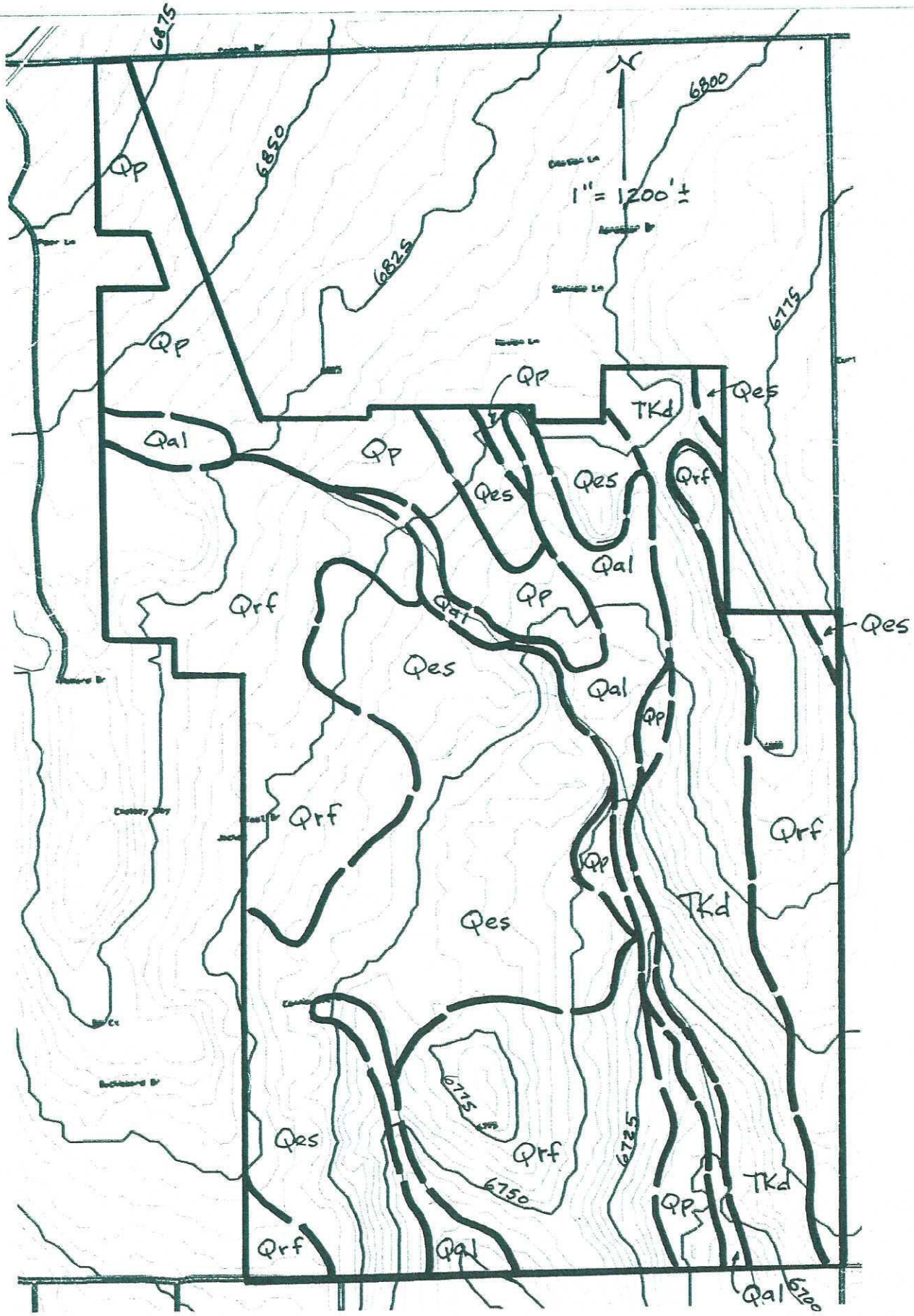
FIGURE 1



SEE TABLE I FOR LEGEND

PRELIMINARY GEOLOGIC MAP

FIGURE 2

TABLE I

GEOLOGIC MAP EXPLANATION
(Modified from Cochran [Robinson], 1977)

Qal -Recent Alluvium: Silt, sand, and gravel in streambeds and lowest terraces on valley floor.

Workability: Excavation and compaction easy except where perched water exists.

Surface Drainage:

Infiltration: Medium to high.

Runoff: Moderate.

Erosion: Subject to stream scour and stream bank erosion.

Groundwater: Water table may be permanently or seasonally within a few feet of the surface.

Suitability for Waste Disposal:

Septic Systems: Unsatisfactory, generally within or adjacent to waterway and in area of seasonal high groundwater.

Dump Sites: Unsatisfactory because of high groundwater or seasonal flooding.

Foundation Stability: Poor, loose and erosion-prone materials.

Slopes: Permanent cut and fill slopes should be limited to 3:1 (horizontal to vertical) or less.

Potential Geologic Hazards: Deposits are subject to annual or periodic flooding. Low terrace banks may be undercut by stream erosion. Walls of excavations may collapse if unsupported.

Known, Reported and Possible Geologic Resources: Source of sand and gravel locally.

Qes -Eolian Sands: Coarse to fine grained sand and silty or clayey sand deposited by wind. In some areas forms stabilized dunes. Deflation (poorly drained 'bowls') areas are common.

Workability:

Excavation: Easy.

Compaction: Vibratory equipment may be necessary for proper compaction.

Surface Drainage:

Infiltration: Medium to high.

Runoff: Low.

Erosion: Prone to erosion by wind and water if vegetation is removed or water is concentrated.

Groundwater: May contain perched groundwater locally.

Suitability for Waste Disposal:

Septic Systems: Poor to good, depending on percolation rate and groundwater level.

Dump Sites: Generally unsatisfactory because of high infiltration rates.

Foundation Stability: Fair to good for light structures. May be subject to settlement and/or hydrocompaction.

Slopes: Permanent cut and fill slopes should be limited to 3:1 (horizontal to vertical) or less.

Potential Geologic Hazards: Susceptible to wind erosion if vegetation is removed. May be subject to hydrocompaction. Walls of excavations may collapse if unsupported.

Known, Reported and Possible Geologic Resources: Source of sand locally.

Qp -Piney Creek Alluvium: Organic rich, clayey silt, and sand with gravel in terraces along drainages. Top of some terraces up to about 10 feet above current drainage level.

Workability: Excavation and compaction easy.

Surface Drainage:

Infiltration: Medium to Low.

Runoff: Moderate to rapid. Locally, water may stand in flat areas for several days following heavy precipitation.

Erosion: Prone to erosion by concentrated water flows.

Groundwater: Commonly contains perched groundwater on a permanent or seasonal basis.

Suitability for Waste Disposal:

Septic Systems: Excellent to poor. In some areas, groundwater may be too high.

Dump Sites: Generally unsatisfactory because of high infiltration rates.

Foundation Stability: Good to poor. May have expansive clay or high groundwater in some areas.

Slopes: Permanent cut and fill slopes should be limited to 3:1 (horizontal to vertical) or less.

Potential Geologic Hazards: Locally expansive soils. Lower areas may be subject to flooding. Steep slopes along stream banks may be unstable or undercut by stream erosion. Walls of excavations may collapse, if unsupported.

Known, Reported, and Possible Geologic Resources. Local source of sand and gravel.

Qrf – Rocky Flats Alluvium: Gravelly sand and silt. Locally, may have clays with a low to high potential for swelling. Top of terraces are up to about 70 feet above larger streams.

Workability:

Excavation: Easy.

Compaction: Moderately easy.

Surface Drainage:

Infiltration: High except where clayey.

Runoff: Low except where clayey.

Erosion: Moderately resistant to erosion. Prone to erosion by concentrated water flows.

Groundwater: Commonly contains perched groundwater on a permanent or seasonal basis near the base of the deposit.

Suitability for Waste Disposal:

Septic Systems: Fair to poor, depending on adequate percolation rates.

Dump Sites: Unsatisfactory because of high infiltration rates.

Foundation Stability: Generally good. May have expansive clays locally.

Slopes: Permanent cut and fill slopes should be limited to 3:1 (horizontal to vertical) or less.

Potential Geologic Hazards: Locally may have expansive clays. Walls of excavations may collapse, if unsupported.

Known, Reported, and Possible Geologic Resources: Local source of sand and gravel.

TKd -Denver Formation: Variable sandstone, siltstone, and claystone.

Workability:

Excavation: Difficult in cemented sandstones. Easy to fair in uncemented bedrock.

Compaction: Fair using uncemented bedrock. Oversized material generated in highly cemented sandstone.

Surface Drainage: Fair to good.

Infiltration: Slow

Runoff: Moderate

Erosion: Claystones and siltstones slake when exposed to air.

Groundwater: Seepage from fractures in bedrock locally. Permeability is low.

Suitability for Waste Disposal:

Septic Systems: Not suitable

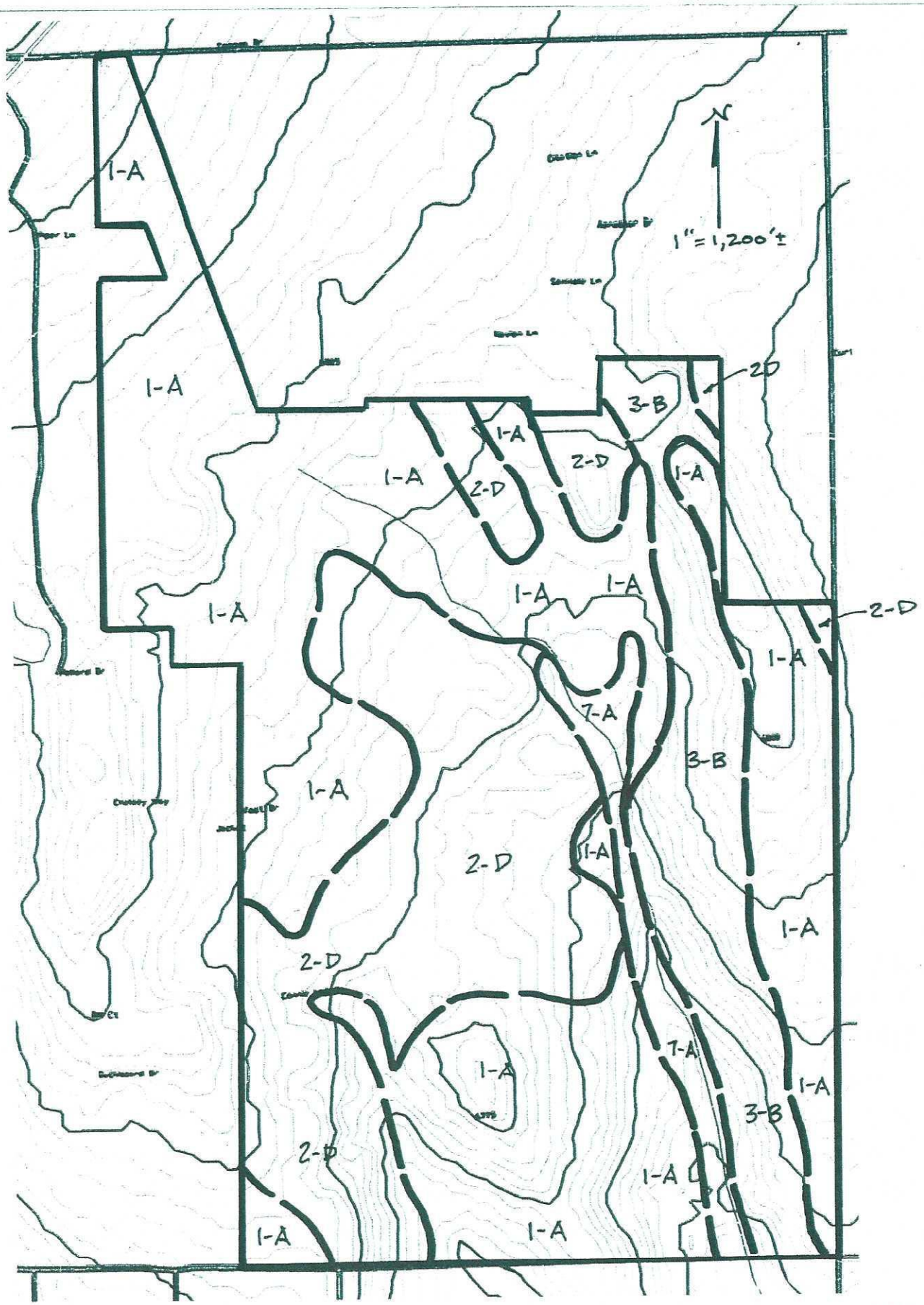
Dump Sites: Poor

Foundation Stability: Good to poor. High bearing capacity. Claystones range to highly expansive.

Slopes: Generally good. Potentially unstable on steep slopes.

Potential Geologic Hazards: Expansive soils. Cemented bedrock locally. Local seepage from fractures.

Known, Reported, and Possible Geologic Resources: None.



SEE TABLE II FOR LEGEND
ALSO SEE FIGURE 4

PRELIMINARY ENGINEERING GEOLOGIC MAP

FIGURE 3

TABLE II

ENVIRONMENTAL AND ENGINEERING GEOLOGIC MAP FOR LAND USE

(Modified from Cochran [Robinson], 1977)

Geologic and soils engineering investigation to verify the uniformity of geologic conditions and geotechnical properties of surficial deposits and bedrock.

1-A Stable alluvium, colluvium and bedrock on flat to gentle slopes. Emphasis on surface and subsurface drainage and geotechnical engineering properties of soil and bedrock.

Reconnaissance geologic investigation and mapping to delineate surficial deposits, bedrock, areas of potential instability, and drainage features, and a soils engineering investigation to define geotechnical engineering properties of surficial deposits and bedrock.

2-D Eolian deposits generally on flat to gentle slopes of upland areas. Emphasis on wind erosion, stabilization, depth to bedrock, and potential for hydrocompaction.

Detailed geologic investigation and map to define surficial deposits and bedrock, slope condition and drainage features, and a standard soils engineering investigation over the entire area to define general engineering properties of soils, including bearing capacity and swelling potential.

3-B Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%). Emphasis on potential for swell, depth of bedrock, design of foundation and drainage.

Extensive detailed geologic, soils engineering and hydrologic investigation required for any development planning. Utility corridors and structures may utilize some of these areas only after extensive design for the specialized problems involved.

7-A FEMA 100-year floodplains along major streams where floodplain studies have been conducted. Emphasis on frequency, depth and control, and groundwater.

See Figure 4 Areas of active seepage, springs, and/or shallow groundwater. May be wet only on a seasonal basis. Emphasis on surface and subsurface drainage. May contain wetlands, protected habitat, or protected species.

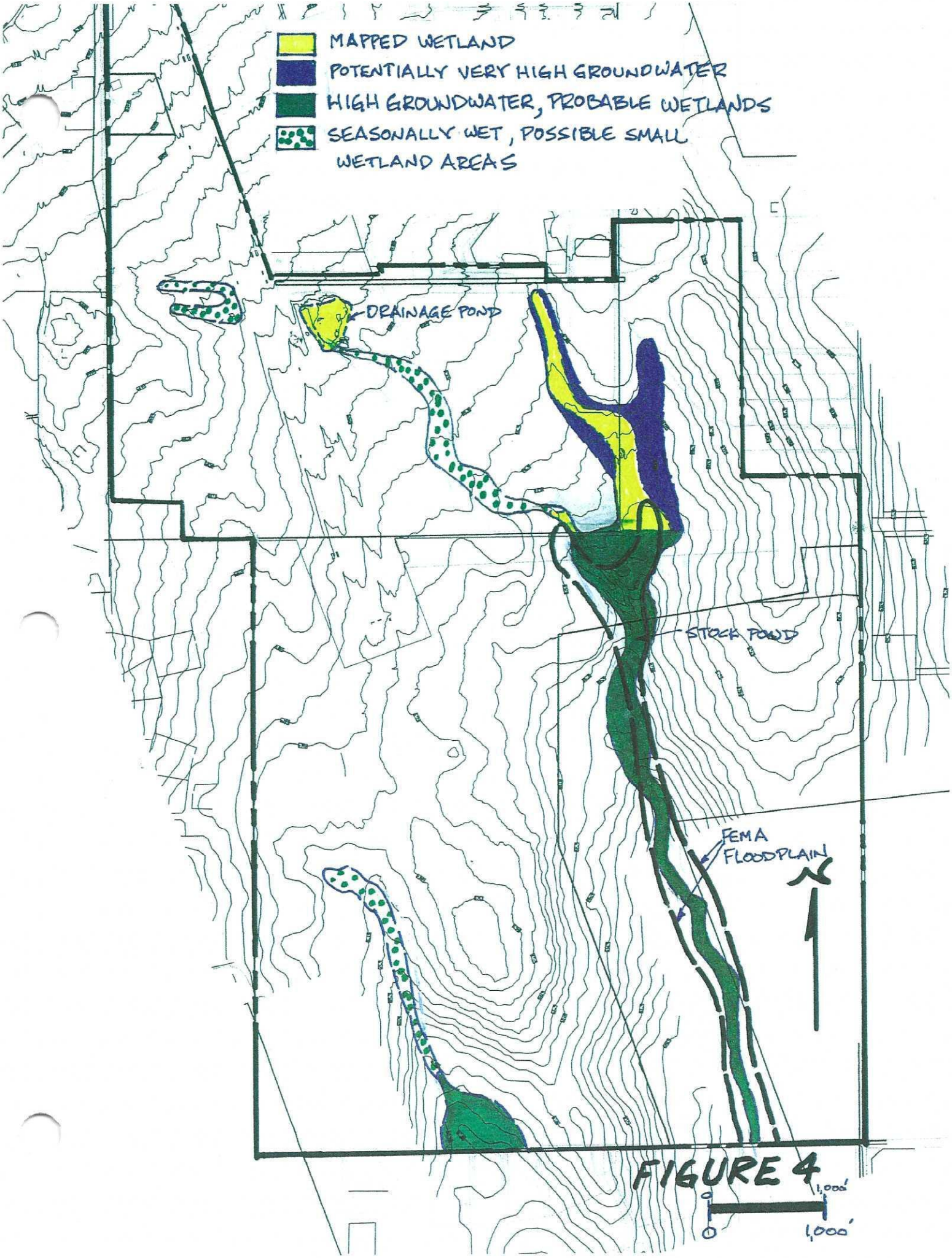
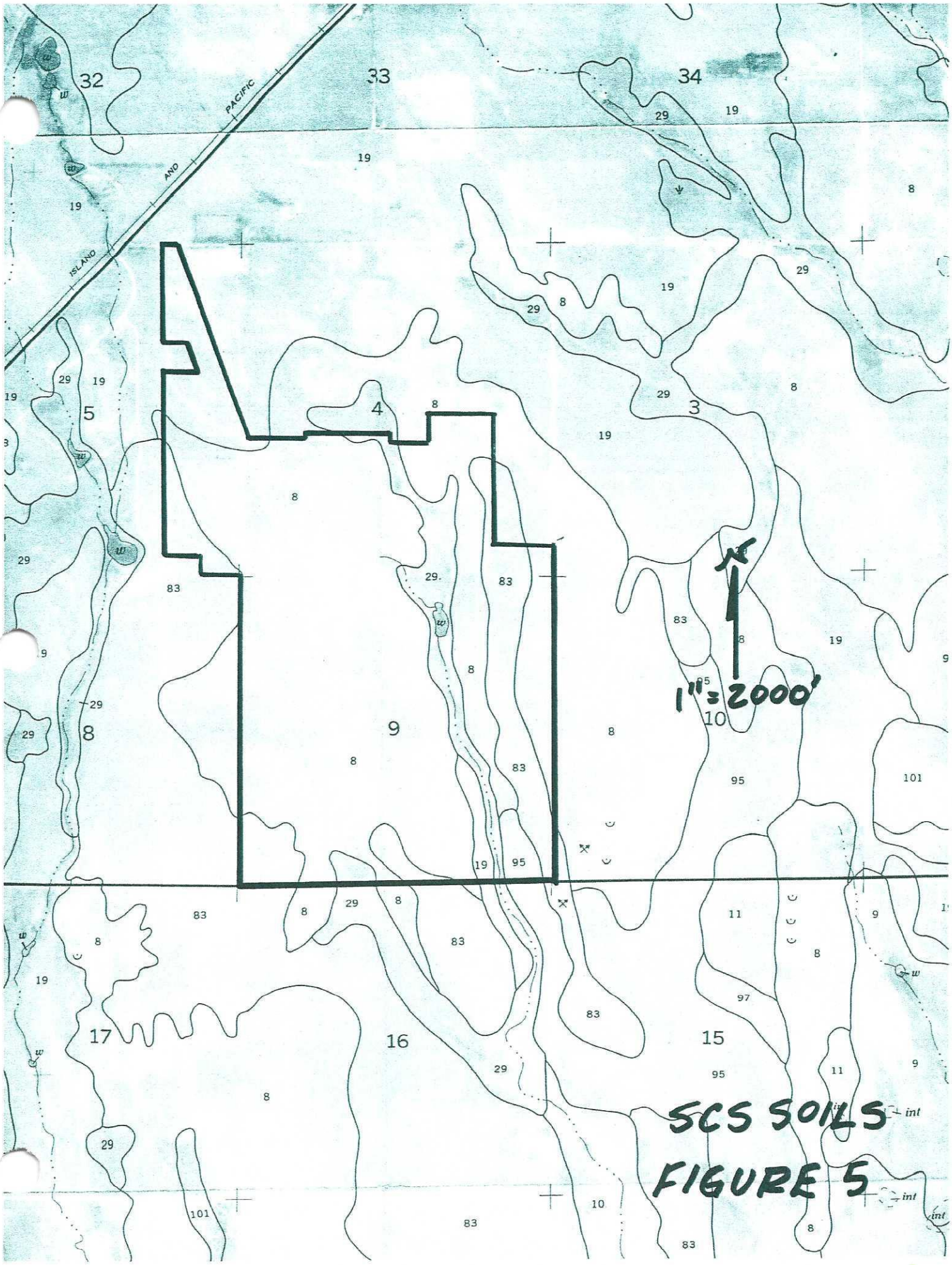

MAPPED WETLAND
POTENTIALLY VERY HIGH GROUNDWATER
HIGH GROUNDWATER, PROBABLE WETLANDS
SEASONALLY WET, POSSIBLE SMALL WETLAND AREAS
DRAINAGE POND
STOCK POND
FEMA FLOODPLAIN
0
1,000'
1,000'

FIGURE 4


PACIFIC
AND
ISLAND
1" = 2000'
SCS SOILS
FIGURE 5

8—Blakeland loamy sand, 1 to 9 percent slopes. This deep, somewhat excessively drained soil formed in alluvial and eolian material derived from arkosic sedimentary rock on uplands. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The substratum, to a depth of 27 inches, is brown loamy sand; it grades to pale brown sand that extends to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; Truckton sandy loam, 0 to 3 percent slopes; Truckton sandy loam, 3 to 9 percent slopes; and Stapleton sandy loam, 3 to 8 percent slopes. In some areas, mainly north of Colorado Springs in the Cottonwood Creek area, arkosic beds of sandstone and shale are at a depth of 0 to 40 inches.

Permeability of this Blakeland soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Organic matter content of the surface layer is medium. Surface runoff is slow, the hazard of erosion is moderate, and the hazard of soil blowing is severe.

Most areas of this soil are used for range, homesites, and wildlife habitat.

Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread. This soil is best suited to deep-rooted grasses.

Proper range management is necessary to prevent excessive removal of plant cover from the soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for urban development. Soil blowing is a hazard if protective vegetation is removed. Special erosion control practices must be provided to minimize soil losses. Capability subclass VIe.

19—Columbine gravelly sandy loam, 0 to 3 percent slopes. This deep, well drained to excessively drained soil formed in coarse textured material on alluvial terraces and fans and on flood plains. Elevation ranges from 6,500 to 7,300 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown gravelly sandy loam about 14 inches thick. The underlying material is light yellowish brown very gravelly loamy sand.

Included with this soil in mapping are small areas of Stapleton sandy loam, 3 to 8 percent slopes; Blendon sandy loam, 0 to 3 percent slopes; Louviers silty clay loam, 3 to 18 percent slopes; and Fluvaquentic Haplaquolls, nearly level. In places the parent arkose beds of sandstone or shale are at a depth of 0 to 40 inches.

Permeability of this Columbine soil is very rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is slight to moderate.

This soil is used mainly for grazing livestock and for wildlife habitat. It is also used for homesites.

Native vegetation is mainly western wheatgrass, sideoats grama, needleandthread, and little bluestem. The main shrub is true mountainmahogany.

Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the principal limitations to the establishment of trees and shrubs. The soil is so loose that trees need to be planted in the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

Rangeland wildlife, such as pronghorn antelope, cottontail, coyote, and scaled quail, is best adapted to life on this droughty soil. Forage production is typically loam, and proper livestock grazing management is necessary if wildlife and livestock share the range. Livestock watering developments are also important and are used by various wildlife species.

The main limitation of this soil for urban development is a hazard of flooding in some areas. Care must be taken when locating septic tank absorption fields because of possible pollution as a result of the very rapid permeability of this soil. Capability subclass VIe.

29—Fluvaquentic Haplaquolls, nearly level. These deep, poorly drained soils are in marshes, in swales, and on creek bottoms. The average annual precipitation is about 14 inches, and the average annual air temperature is about 47 degrees F.

Included with these soils in mapping are small areas of Ustic Torrifluvents, loamy; Blakeland loamy sand, 1 to 9 percent slopes; Columbine gravelly sandy loam, 0 to 3 percent slopes; and Ellicott loamy coarse sand, 0 to 5 percent slopes.

These soils are stratified. Typically, the surface layer is light gray to very dark gray loamy fine sand to gravelly loam 2 to 6 inches thick. The underlying material, 48 to 58 inches thick, is very pale brown to gray, stratified heavy sandy clay loam to sand and gravel. The lower part of some of the soils, at depths ranging from 18 to 48 inches, ranges from light blueish gray to greenish gray. The water table is usually at a depth of less than 48 inches, and it is on the surface during part of the year.

Permeability of these soils is moderate. Effective rooting depth is limited by the water table. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. At times overflow deposits a damaging amount of silt and sand in the lower lying areas.

These soils are in meadow. They are used for native hay or for grazing.

These soils are well suited to the production of native vegetation suitable for grazing. The vegetation is mainly switchgrass, indiangrass, sedges, rushes, prairie cordgrass, western wheatgrass, and bluegrass. Cattails and bulrushes commonly grow in the swampy areas.

Management of distribution of livestock and stocking rates is necessary on these soils to avoid abuse of the range. In large areas, fences should be used to control grazing.

Wetland wildlife can be attracted to these soils and the wetland habitat enhanced by several means. Shallow water developments can be created by digging or by blasting potholes to create open-water areas. Fencing to control livestock use is beneficial, and it allows wetland plants such as cattails, reed canarygrass, and rushes to grow. Control of unplanned burning and prevention of drainage that would remove water from the wetlands are also good practices. These shallow marsh areas are often especially important for winter cover if natural vegetation is allowed to grow.

These soils are severely limited for use as homesites. The main limitations are a high water table and a hazard of periodic flooding. Community sewerage systems are needed because the high water table prevents septic tank absorption fields from functioning properly. Roads must also be designed to prevent frost-heave damage. Capability subclass Vw.

83—Stapleton sandy loam, 3 to 8 percent slopes. This deep, noncalcareous, well drained soil formed in sandy alluvium derived from arkosic bedrock on uplands. Elevation ranges from 6,500 to 7,300 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown sandy loam about 11 inches thick. The subsoil is grayish brown gravelly sandy loam about 6 inches thick. The substratum extends to a depth of 60 inches or more. It is pale brown gravelly sandy loam in the upper part and grades to gravelly loamy sand in the lower part.

Included with this soil in mapping are small areas of Louviers silty clay loam, 3 to 18 percent slopes; Blakeland loamy sand, 1 to 9 percent slopes; Columbine gravelly sandy loam, 0 to 3 percent slopes; and Fluvaquentic Haplaquolls, nearly level. Also included are areas where arkose beds of sandstone and shale are at a depth of 0 to 40 inches. Included areas make up about 20 percent of the mapped acreage.

Permeability of this Stapleton soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazards of erosion and soil blowing are moderate.

This soil is used as rangeland, for wildlife habitat, and as homesites.

Native vegetation is mainly western wheatgrass, sideoats grama, needleandthread, and little bluestem. The predominant shrub on this soil is true mountainmahogany. Yucca occurs in some areas.

Deferred grazing late in summer and in fall improves the condition of the range. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are generally suited to this soil. Soil blowing is the principal limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of this soil for urban use is frost-action potential. Special design of roads and streets is necessary to minimize frost heave damage. Special practices must be provided to minimize water erosion and soil blowing on construction sites where vegetation has been removed. Access roads must have adequate cut-slope grade and be provided with drains to control surface runoff. Capability subclass IVe.

95—Truckton loamy sand, 1 to 9 percent slopes. This deep, well drained soil formed in alluvium and residuum derived from arkosic sedimentary rock on uplands. Elevation ranges from 6,000 to 7,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown loamy sand about 8 inches thick. The subsoil is brown sandy loam about 18 inches thick. The substratum is light yellowish brown coarse sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Blakeland loamy sand, 1 to 9 percent slopes; Bresser sandy loam, 3 to 5 percent sloeps; Bresser sandy loam, 5 to 9 percent slopes; Truckton sandy loam, 0 to 3 percent slopes; and Truckton sandy loam, 3 to 9 percent slopes.

Permeability of this Truckton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is moderate to high.

Almost all areas of this soil are used as rangeland. A few areas of crops such as alfalfa and corn are grown under sprinkler irrigation.

This soil is well suited to the production of native vegetation suitable for grazing. It is best suited to deep-rooted grasses. The native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, sideoats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand is the main limitation for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to openland and rangeland wildlife habitat. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitation of this soil for roads and streets is frost action potential. Special designs for roads are needed to minimize this limitation. Practices are needed to control soil blowing and water erosion on construction sites where the plant cover has been removed. Capability subclass VIe, nonirrigated.