250 to 1,000 feet long. Elevation is 3,400 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Roy cobbly clay loam, Roy clay loam, deep Tamaneen soils, and deep, salt- and alkali-affected Adger soils.

Typically, the surface layer of this Roy soil is dark grayish brown gravelly clay loam about 7 inches thick. The subsoil is brown and grayish brown very cobbly clay loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray and grayish brown extremely cobbly clay loam.

Permeability is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the low available water capacity, the hazards of water erosion and soil blowing, and low precipitation. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are moderately slow permeability, shrink-swell potential, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

194—Roy very stony clay loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central part of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 3,400 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Roy stony clay loam.

Typically, the surface layer of this Roy soil is dark grayish brown very stony clay loam about 7 inches thick. The subsoil is brown and grayish brown very cobbly clay loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray and grayish brown extremely cobbly clay loam.

Permeability is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is used as rangeland. If the stones are removed from the surface layer, the soil can be used for hay and pasture and for nonirrigated crops.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion if it is disturbed or if the range is overgrazed. It is not suited to mechanical treatment because of the large stones in the surface layer.

This soil is poorly suited to windbreaks. It is limited mainly by stoniness.

The main limitations for homesite development on this soil are moderately slow permeability, shrink-swell potential, potential frost action, content of rock fragments, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Removal of stones from the surface layer is necessary for landscaping.

This map unit is in capability subclass VIs, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

195—Roy-Winifred complex, 8 to 45 percent slopes. This map unit is on uplands in the central part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,400 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 60 percent Roy stony clay loam and 30 percent Winifred clay loam. The Roy soil is on terrace edges and fans and has slopes of 25 to 45 percent. The Winifred soil is on uplands below areas of the Roy soil and has slopes of 8 to 45 percent.

Included in this unit are small areas of moderately deep Eltsac and Doney soils on uplands. Included areas make up about 10 percent of the total acreage.

The Roy soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown stony clay loam about 7 inches thick. The subsoil is brown and grayish brown very cobbly clay loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray and grayish brown extremely cobbly clay loam.

Permeability of the Roy soil is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Winifred soil is moderately deep and well drained. It formed in alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The subsoil is grayish brown silty clay and clay about 26 inches thick. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to nonirrigated cultivated crops and to hay and pasture because of steepness of slope and large stones in the surface layer of the Roy soil.

The potential plant community on the Roy soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential plant community on the Winifred soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. These soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the Roy soil are moderately slow permeability, slope, shrink-swell potential, potential frost action, content of rock fragments, and low soil strength. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour, and the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of

suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Removal of stones from the surface layer is necessary for landscaping and establishing a lawn.

The main limitations for homesite development on the Winifred soil are slow permeability, slope, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of slope, slow permeability, and moderate depth to shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass VIe, nonirrigated. The Roy soil is in Silty range site, 15- to 19-inch precipitation zone, and the Winifred soil is in Clayey range site, 15- to 19-inch precipitation zone.

196—Sanje clay loam, 0 to 4 percent slopes. This deep, well drained soil is on terraces and fans in the southeastern part of the county. It formed in alluvium derived dominantly from shale and limestone. Slopes commonly are more than 1,000 feet long. Elevation is 3,800 to 4,200 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of deep Crago soils and shallow Ashuelot Variant soils on ridges. The Ashuelot Variant soils are underlain by lime-cemented rock fragments at a depth of 15 to 20 inches.

Typically, the surface layer of this Sanje soil is grayish brown clay loam about 5 inches thick. The upper 13 inches of the subsoil is grayish brown and light brownish gray clay, and the lower 12 inches is gray clay. The upper 12 inches of the substratum is very pale brown extremely gravelly sandy clay loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly sandy loam.

Permeability is moderately slow to a depth of 30 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly for hay and pasture. It is also used as rangeland and for nonirrigated crops such as wheat, barley, and oats.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion and by low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, grassed waterways, and growing sod crops such as hay and pasture control soil blowing and water erosion.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are shrink-swell potential and low soil strength. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

197—Savage silty clay loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium. Slopes commonly are more than 1,000 feet long. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 16 inches, the average

annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Savage soils that have slopes of 2 to 4 percent.

Typically, the surface layer of this Savage soil is grayish brown silty clay loam about 6 inches thick. The upper 7 inches of the subsoil is brown silty clay, and the lower 16 inches is brown silty clay loam. The substratum to a depth of 66 inches or more is pale brown silty clay loam and clay loam.

Permeability is slow. Available water capacity is high. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, and oats. It is also used for hay and pasture and as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation. Crop residue left on or near the surface helps to conserve moisture, increases the water intake rate, and improves tilth. Tall grass barriers trap snow, which increases the amount of moisture in the soil. Tillage should be kept to a minimum.

The potential plant community on this soil is mainly western wheatgrass, bluebunch wheatgrass, green needlegrass, and basin wildrye. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Sandberg bluegrass, plains reedgrass, Idaho fescue, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, broom snakeweed, perennial weeds, and annuals may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIc, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

198—Savage silty clay loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in the central and western parts of the county. It formed in alluvium. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Savage soils that have slopes of 0 to 2 percent and 8 to 10 percent. Also included are small areas of moderately deep Regent soils on uplands.

Typically, the surface layer of this Savage soil is grayish brown silty clay loam about 6 inches thick. The upper 7 inches of the subsoil is brown silty clay, and the lower 16 inches is brown silty clay loam. The substratum to a depth of 66 inches or more is pale brown silty clay loam and clay loam.

Permeability is slow. Available water capacity is high. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, and oats. It is also used for hay and pasture and as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control water erosion. Returning crop residue to the soil helps to maintain good tilth and a desirable water intake rate.

The potential plant community on this soil is mainly western wheatgrass, bluebunch wheatgrass, green needlegrass, and basin wildrye. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Sandberg bluegrass, plains reedgrass, Idaho fescue, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, broom snakeweed, perennial weeds, and annuals may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to

control water erosion. The surface layer is susceptible to water erosion if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, shrink-swell potential, and low strength. If the soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

199—Shambo loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Shambo soils that have slopes of 2 to 4 percent.

Typically, the surface layer of this Shambo soil is very dark brown loam about 6 inches thick. The subsoil is brown and pale brown loam about 12 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, and oats, and for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

200—Shambo loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer of this Shambo soil is very dark brown loam about 6 inches thick. The subsoil is brown and pale brown loam about 12 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium,

and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, and oats, and for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of soil blowing and water erosion. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, grassed waterways, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

201—Shambo-Labre complex, 2 to 8 percent slopes. This map unit is on fans and foot slopes in the central part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Shambo loam and 35 percent Labre gravelly loam. The Shambo soil is on plane side slopes, and the Labre soil is on the upper parts of fans and on convex side slopes.

Included in this unit are small areas of deep Savage soils on the lower parts of fans. Included areas make up about 15 percent of the total acreage.

The Shambo soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is very dark brown loam about 6 inches thick. The subsoil is brown and pale brown loam about 12 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Permeability of the Shambo soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Labre soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown gravelly loam about 5 inches thick. The subsoil is grayish brown gravelly loam about 6 inches thick. The upper 17 inches of the substratum is grayish brown very gravelly and extremely gravelly loam, the next 7 inches is brown clay loam, and the lower part to a depth of 60 inches or more is grayish brown very gravelly loam.

Permeability of the Labre soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. They are also used as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by the low available water capacity of the Labre soil, low precipitation, and the hazards of water erosion and soil blowing. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,100 pounds of air-dry vegetation in years of above-

normal precipitation and 1,300 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Shambo soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Labre soil is suited to windbreaks, but the low available water capacity of the soil limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the soils in this unit are potential frost action, low soil strength, and moderate permeability. If the soils are used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

202—Shambo-Labre complex, 8 to 15 percent slopes. This map unit is on fans and foot slopes in the central part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 45 percent Shambo loam and 40 percent Labre gravelly loam. The Shambo soil is on plane side slopes, and the Labre soil is on the upper parts of fans and on convex side slopes.

Included in this unit are small areas of deep Shambo and Labre soils that have slopes of 15 to 20 percent. Included areas make up about 15 percent of the total acreage.

The Shambo soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is very dark brown loam about 6 inches thick. The subsoil is brown and pale brown loam about 12 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Permeability of the Shambo soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Labre soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown gravelly loam about 5 inches thick. The subsoil is grayish brown gravelly loam about 6 inches thick. The upper 17 inches of the substratum is grayish brown very gravelly and extremely gravelly loam, the next 7 inches is brown clay loam, and the lower part to a depth of 60 inches or more is grayish brown very gravelly loam.

Permeability of the Labre soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. They are also used as rangeland.

These soils are suited to nonirrigated crops. They are limited mainly by the low available water capacity of the Labre soil, low precipitation, and the hazards of water erosion and soil blowing. Minimum tillage, contour cultivation, grassed waterways, stripcropping, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,300 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Shambo soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are

Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Labre soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the soils in this unit are potential frost action, low soil strength, slope, and the moderate permeability of the Shambo soil. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If the soils are used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

203—Sheege-Rock outcrop complex, 15 to 60 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,800 to 8,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 40 percent Sheege very stony loam and about 30 percent Rock outcrop. The Sheege soil is on plane and convex side slopes, and Rock outcrop occurs as cliffs and ledges on mountains.

Included in this unit are small areas of moderately deep Skaggs soils on plane and concave side slopes, moderately deep Firada soils on north-facing side slopes, and deep Whitecow soils on south-facing side slopes. The Whitecow and Firada soils support woodland vegetation, and the Skaggs soils support grassland vegetation. Included areas make up about 30 percent of the total acreage.

The Sheege soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is dark gray very stony loam about 6 inches thick. The underlying material is pale brown very channery loam about 6 inches thick. Limestone is at a depth of about 12 inches. Depth to limestone ranges from 10 to 20 inches.

Permeability of the Sheege soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

Rock outcrop consists of exposures of limestone. It occurs as ledges and low to high escarpments and rock walls.

This unit is used as rangeland.

The soils in this unit are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Sheege soil is mainly bluebunch wheatgrass, western wheatgrass, bearded wheatgrass, and Columbia needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, big sagebrush, Sandberg bluegrass, and eriogonum increases. If excessive grazing continues, plants such as broom snakeweed, perennial forbs, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion if it is disturbed or if the range is overgrazed. These soils are not suited to mechanical treatment because of slope and rough topography.

The soils in this unit are not suited to windbreaks. They are limited mainly by slope.

This unit is poorly suited to homesite development because of the steepness of slope, the shallow depth to limestone in the Sheege soil, and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated, and in Shallow range site, 20- to 24-inch precipitation zone.

204—Sheege-Skaggs very stony loams, 2 to 15 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,800 to 8,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 45 percent Sheege very stony loam and about 35 percent Skaggs very stony loam. The Sheege soil is on convex side slopes, and the Skaggs soil is in plane and convex areas.

Included in this unit are small areas of Sheege and Skaggs channery loams. Included areas make up about 20 percent of the total acreage.

The Sheege soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is dark gray very stony loam about 6 inches thick. The underlying material is pale brown very channery loam about 6 inches thick. Limestone is at a depth of about 12 inches. Depth to limestone ranges from 10 to 20 inches.

Permeability of the Sheege soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Skaggs soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is very dark grayish brown very stony loam about 8 inches thick. The upper 16 inches of the underlying material is light gray and white very gravelly loam, and the lower 8 inches is pale yellow very gravelly clay loam. Limestone is at a depth of about 32 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Skaggs soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the large stones in the surface layer.

The potential plant community on the Sheege soil is mainly bluebunch wheatgrass, western wheatgrass, bearded wheatgrass, and Columbia needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, big sagebrush, Sandberg bluegrass, and eriogonum increases. If excessive grazing continues, plants such as broom snakeweed, perennial forbs, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential plant community on the Skaggs soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,400 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion if it is disturbed or if the range is overgrazed. These soils are not suited to mechanical treatment, because of the large stones in the surface layer.

These soils are poorly suited to windbreaks. They are limited by stoniness.

The main limitations for homesite development on the soils in this unit are shallow and moderate depth to limestone, potential frost action, content of rock fragments, and the low strength of the Skaggs soil. These soils are severely limited for septic tank absorption fields because of the shallow and moderate depth to limestone. Cuts to level building sites can expose limestone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Removal of stones from the surface layer is necessary for landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIs, nonirrigated. The Sheege soil is in Shallow range site, 20- to 24-inch precipitation zone, and the Skaggs soil is in Silty range site, 20- to 24-inch precipitation zone.

205—Sipple loam, 0 to 4 percent slopes. This deep, well drained soil is on terraces in the southwestern part of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are more than 1,000 feet long. Elevation is 4,000 to 4,800 feet. The average annual precipitation is about 19 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of deep Doughty soils.

Typically, the surface layer of this Sipple soil is dark grayish brown loam about 6 inches thick. The upper 7 inches of the subsoil is brown clay loam, the next 9 inches is pale brown loam, and the lower 12 inches is light gray silty clay loam. The upper 18 inches of the substratum is light gray and white silty clay loam, and the lower part to a depth of 66 inches or more is very pale brown very gravelly loam.

Permeability is moderately slow to a depth of 52 inches and moderately rapid below this depth. Available water capacity is high. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is 66 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazard of soil blowing and the short growing season. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, and growing sod crops such as hay and pasture.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may

invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderately slow permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

206—Skaggs-Sheege very stony loams, 15 to 60 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,800 to 8,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 50 percent Skaggs very stony loam and 40 percent Sheege very stony loam.

Included in this unit is about 10 percent deep Hanson soils on foot slopes.

The Skaggs soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is very dark grayish brown very stony loam about 8 inches thick. The upper 16 inches of the underlying material is light gray and white very gravelly loam, and the lower 8 inches is pale yellow very gravelly clay loam. Limestone is at a depth of about 32 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Skaggs soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Sheege soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is dark gray very stony loam about 6 inches thick. The underlying material is pale brown very channery loam about 6 inches thick. Limestone is at a depth of about 12 inches. Depth to limestone ranges from 10 to 20 inches.

Permeability of the Sheege soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Skaggs soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,400 pounds in years of below-normal precipitation.

The potential plant community on the Sheege soil is mainly bluebunch wheatgrass, western wheatgrass, bearded wheatgrass, and Columbia needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, big sagebrush, Sandberg bluegrass, and eriogonum increases. If excessive grazing continues, plants such as broom snakeweed, perennial forbs, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion if it is disturbed or if the range is overgrazed. The soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The soils in this unit are poorly suited to homesite development because of the steepness of slope, the moderate depth to limestone in the Skaggs soil, and the shallow depth to limestone in the Sheege soil.

This map unit is in capability subclass VIIe, nonirrigated. The Skaggs soil is in Silty range site, 20- to 24-inch precipitation zone, and the Sheege soil is in Shallow range site, 20- to 24-inch precipitation zone.

207—Skaggs-Sheege complex, 2 to 15 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet

long. Elevation is 4,800 to 8,000 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 85 days.

This unit is about 50 percent Skaggs loam and 30 percent Sheege channery loam. The Skaggs soil is on plane side slopes, and the Sheege soil is in convex areas.

Included in this unit is about 10 percent Skaggs channery loam and 10 percent Sheege flaggy loam in convex areas.

The Skaggs soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The upper 16 inches of the underlying material is light gray and white very gravelly loam, and the lower 8 inches is pale yellow very gravelly clay loam. Limestone is at a depth of about 32 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Skaggs soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Sheege soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard limestone. Typically, the surface layer is dark gray channery loam about 6 inches thick. The underlying material is pale brown very channery loam about 6 inches thick. Limestone is at a depth of about 12 inches. Depth to limestone ranges from 10 to 20 inches.

Permeability of the Sheege soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used for nonirrigated crops, mainly wheat, barley, and oats, for hay and pasture, and as rangeland.

These soils are suited to nonirrigated crops. They are limited mainly by the short growing season, low to very low available water capacity, and the hazards of soil blowing and water erosion. Timeliness is of prime importance in all tillage, seeding, and harvesting operations. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on the Skaggs soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,400 pounds in years of below-normal precipitation.

The potential plant community on the Sheege soil is mainly bluebunch wheatgrass, western wheatgrass, bearded wheatgrass, and Columbia needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, big sagebrush, Sandberg bluegrass, and eriogonum increases. If excessive grazing continues, plants such as boom snakeweed, perennial forbs, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Skaggs soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The Sheege soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the soils in this unit are moderate and shallow depth to limestone, potential frost action, content of rock fragments, and the low strength of the Skaggs soil. The soils are severely limited for septic tank absorption fields because of the moderate and shallow depth to limestone. Cuts to level building sites can expose limestone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IVe, nonirrigated. The Skaggs soil is in Silty range site, 20- to 24-inch precipitation zone, and the Sheege soil is in Shallow range site, 20- to 24-inch precipitation zone.

208—Straw loam, 0 to 2 percent slopes. This deep, well drained soil is on low terraces and flood plains in the central and western parts of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 3,700 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Sudworth soils that are underlain by loamy sand and gravel at a depth of 20 to 40 inches.

Typically, the surface layer of this Straw soil is dark grayish brown loam about 16 inches thick. The next layer is grayish brown silty clay loam about 8 inches thick. The underlying material is light brownish gray loam that is stratified with sandy loam and is about 5 inches thick. The next layer is a buried surface layer of dark grayish brown clay loam about 6 inches thick. The next layer is dark grayish brown loam that is stratified with sandy loam and is about 13 inches thick. Below this to a depth of 60 inches or more is a buried surface layer of grayish brown silty clay loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during periods of rare flooding. The hazard of soil blowing is moderate.

This soil is used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by rare floods and the hazard of soil blowing. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,900 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to water erosion during rare periods of flooding and to soil blowing if it is disturbed or the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The hazards of rare flooding and of streams changing channels make homesite development on this soil impractical.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

209—Straw loam, 2 to 8 percent slopes. This deep, well drained soil is on fans in the central part of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,700 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of soils that are similar to this Straw soil but have more cobbles and pebbles throughout the profile.

Typically, the surface layer of this Straw soil is dark grayish brown loam about 16 inches thick. The next layer is grayish brown silty clay loam about 8 inches thick. The underlying material is light brownish gray loam that is stratified with sandy loam and is about 5 inches thick. The next layer is a buried surface layer of dark grayish brown clay loam about 6 inches thick. The next layer is dark grayish brown loam that is stratified with sandy loam and is about 13 inches thick. Below this to a depth of 60 inches or more is a buried surface layer of grayish brown silty clay loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used for nonirrigated crops, mainly wheat, barley, and oats, and for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread,

western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,900 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

210—Straw clay loam, 0 to 2 percent slopes. This deep, well drained soil is on low terraces and flood plains in the central and western parts of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 3,700 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Sudworth soils that are underlain by loamy sand and gravel at a depth of 20 to 40 inches.

Typically, the surface layer of this Straw soil is dark grayish brown clay loam about 16 inches thick. The next layer is grayish brown silty clay loam about 8 inches thick. The underlying material is light brownish gray loam that is stratified with sandy loam and is about 5 inches thick. The next layer is a buried surface layer of dark grayish brown clay loam about 6 inches thick. The next layer is dark grayish brown loam that is stratified with sandy loam and is about 13 inches thick. Below this to a depth of 60 inches or more is a buried surface layer of grayish brown silty clay loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during rare periods of flooding. The hazard of soil blowing is moderate.

This soil is used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazards of rare periods of flooding and soil blowing. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to water erosion during rare periods of flooding and to soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The hazards of rare flooding and of streams changing channels make homesite development impractical.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

211—Straw-Korchea loams, 0 to 2 percent slopes. This map unit is on flood plains and low terraces in the central part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 3,700 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 45 percent Straw loam and 40 percent Korchea loam.

Included in this unit are small areas of deep, well drained Shambo soils on fans; deep, somewhat poorly drained Enbar soils along drainageways; and deep, well drained Sudworth soils on low terraces. The Enbar soils have a seasonal high water table at a depth of 30 to 60 inches. The Sudworth soils are underlain at a depth of 20 to 40 inches by material that has a high content of rock fragments.

The Straw soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown loam about 16 inches thick. The next layer is grayish brown silty clay loam about 8 inches thick. The underlying material is light brownish gray loam that is stratified with sandy loam and is about 5 inches thick. The next layer is a buried surface layer of dark grayish brown clay loam about 6 inches thick. The next layer is dark grayish brown loam that is stratified with sandy loam and is about 13 inches thick. Below this to a depth of 60 inches or more is a buried surface layer of grayish brown silty clay loam.

Permeability of the Straw soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during periods of occasional flooding. The hazard of soil blowing is moderate.

The Korchea soil is deep and well drained. It formed in alluvium derived dominantly from mixed rock sources. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The upper 47 inches of the underlying material is grayish brown loam stratified with silt loam and fine sandy loam, and the lower part to a depth of 66 inches or more is grayish brown loam stratified with silt loam.

Permeability of the Korchea soil is moderate. Available water capacity is high. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during periods of occasional flooding. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the hazards of flooding and soil blowing. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, and growing sod crops such as hay and pasture.

The potential plant community on these soils is mainly western wheatgrass, green needlegrass, slender wheatgrass, and basin wildrye. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of western wheatgrass, prairie junegrass, needleandthread, and silver sagebrush increases. If excessive grazing continues, plants such as Kentucky bluegrass, clubmoss, pricklypear, and curlycup gumweed may invade. The potential plant community produces about 2,500 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to water erosion during occasional periods of flooding and to soil blowing if it is disturbed or if the range is overgrazed.

These soils are well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The hazards of occasional flooding and of streams changing channel make homesite development on these soils impractical.

This map unit is in capability subclass IIIw, nonirrigated, and in Overflow range site, 15- to 19-inch precipitation zone.

212—Sudworth loam. This deep, well drained soil is on low terraces and flood plains in the central part of the county. It formed in alluvium derived from mixed rock sources. Slope ranges from 0 to 2 percent. Slopes commonly are more than 1,000 feet long. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Straw and Nesda soils. The Nesda soils are underlain by loamy sand and gravel at a depth of 10 to 20 inches.

Typically, the surface layer of this Sudworth soil is dark grayish brown loam about 19 inches thick. The next layer is grayish brown loam about 8 inches thick. The underlying material to a depth of about 66 inches or more is grayish brown extremely gravelly loamy sand.

Permeability is moderate to a depth of 27 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during periods of rare flooding. The hazard of soil blowing is high.

This soil is used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the moderate available water capacity and the hazards of flooding and soil blowing. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, and growing sod crops such as hay and pasture.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to water erosion during rare periods of flooding and to soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The hazards of rare flooding and of streams changing channel make homesite development on this soil impractical. The very gravelly or extremely gravelly material below a depth of 20 to 40 inches is good road fill.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

213—Sudworth-Nesda loams. This map unit is on low terraces and flood plains in the central and western parts of the county. Slope ranges from 0 to 2 percent. Slopes commonly are more than 1,000 feet long. Elevation is 2,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Sudworth loam and 30 percent Nesda loam. The Sudworth soil is on plane side slopes, and the Nesda soil is on convex side slopes.

Included in this unit are small areas of Nesda gravelly loam on slight rises and small areas of deep Straw soils on plane side slopes.

The Sudworth soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark grayish brown loam about 19 inches thick. The next layer is grayish brown loam about 8 inches thick. The underlying material to a depth of 66 inches or more is grayish brown extremely gravelly loamy sand.

Permeability of the Sudworth soil is moderate to a depth of 27 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight except during rare periods of flooding. The hazard of soil blowing is high.

The Nesda soil is deep and well drained. It formed in alluvium derived dominantly from limestone and sandstone. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The next layer is grayish brown loam about 8 inches thick. The upper 2 inches of the underlying material is pale brown loamy sand, and the lower part to a depth of 60 inches or more is light brownish gray and grayish brown extremely gravelly sand.

Permeability of the Nesda soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 36 inches. Runoff is slow, and the hazard of water erosion is slight except during rare periods of flooding. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the very low to moderate available water capacity and the hazards of flooding and soil blowing. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Soil blowing can be reduced by returning crop residue to the soil, practicing minimum tillage, and growing sod crops such as hay and pasture.

The potential plant community on the Sudworth soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

The potential plant community on the Nesda soil is mainly western wheatgrass, needleandthread, plains muhly, and prairie junegrass. If the range is excessively grazed, the proportion of most of these plants decreases

and the proportion of needleandthread, muttongrass, blue grama, and fringed sagewort increases. If excessive grazing continues, plants such as curlycup gumweed, broom snakeweed, perennial weeds, and annuals may invade. The potential plant community produces about 1,800 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to water erosion during rare periods of flooding and to soil blowing if it is disturbed or if the range is overgrazed.

The Sudworth soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Nesda soil is suited to windbreaks, but the very low to low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils.

The hazards of rare flooding and of streams changing channels make homesite development on these soils impractical. The very gravelly or extremely gravelly material below a depth of 15 to 40 inches is good road fill.

This map unit is in capability subclass IVs, nonirrigated. The Sudworth soil is in Silty range site, 15- to 19-inch precipitation zone, and the Nesda soil is in Shallow to Gravel range site, 15- to 19-inch precipitation zone.

214—Syblon loam, 2 to 8 percent slopes. This moderately deep, well drained soil is on uplands in the eastern part of the county. It formed in residuum and alluvium derived dominantly from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of moderately deep, salt- and alkali-affected Weingart soils, shallow Ernem soils, and moderately deep Tanna soils.

Typically, the surface layer of this Syblon soil is grayish brown and brown loam about 9 inches thick. The upper 12 inches of the subsoil is brown clay, and the lower 8 inches is dark gray clay. Grayish brown shale is at a depth of about 29 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is very slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used mainly as rangeland and for hay and pasture. It is also used for nonirrigated crops such as wheat, barley, and oats.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of water erosion and soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as pricklypear, perennial weeds, annuals, and clubmoss may invade. The potential plant community produces about 1,500 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Where clubmoss and blue grama are the dominant vegetation on this soil, pitting, furrowing, chiseling, or other mechanical treatment practices can be used to improve depleted rangeland. This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. The low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are very slow permeability, moderate depth to shale, shrink-swell potential, potential frost action, and low soil strength. This soil is severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale. Cuts to level building sites

can expose shale. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 10- to 14-inch precipitation zone.

215—Tally fine sandy loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium derived dominantly from sandstone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,400 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer of this Tally soil is brown fine sandy loam about 6 inches thick. The subsoil is brown and pale brown fine sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is very pale brown loamy fine sand.

Included in this unit are small, convex areas of moderately deep Vebar soils.

Permeability is moderately rapid to a depth of 32 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 36 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Crop residue left on or near the surface conserves moisture and increases the water intake rate.

The potential plant community on this soil is mainly prairie sandreed, needleandthread, western wheatgrass, and little bluestem. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of needleandthread, sand dropseed, blue grama, and western wheatgrass increases. If excessive grazing continues, plants such as horseweed fleabane, needleleaf sedge, red threeawn, and perennial weeds may invade. The potential plant community produces about 1,600 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. The moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are potential frost action and the hazard of soil blowing. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe, nonirrigated, and in Sandy range site, 15- to 19-inch precipitation zone.

216—Tally-Flasher complex, 4 to 25 percent slopes. This map unit is on uplands in the western part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 65 percent Tally fine sandy loam and 30 percent Flasher loamy fine sand. The Tally soil is on foot slopes and has slopes of 4 to 25 percent. The Flasher soil is on uplands and has slopes of 8 to 25 percent.

Included in this unit is about 5 percent Rock outcrop consisting of sandstone ledges.

The Tally soil is deep and well drained. It formed in alluvium derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsoil is brown and pale brown fine sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is very pale brown loamy fine sand.

Permeability of the Tally soil is moderately rapid to a depth of 32 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 36 inches.

Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Flasher soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from weakly consolidated, sandy sedimentary beds. Typically, the surface layer is brown loamy fine sand about 11 inches thick. The underlying material is very pale brown loamy fine sand about 5 inches thick. Pale yellow sedimentary beds are at a depth of about 16 inches. Depth to sedimentary beds ranges from 10 to 20 inches.

Permeability of the Flasher soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the hazard of soil blowing, droughtiness, and shallow depth to sedimentary beds in the Flasher soil.

The potential plant community on the Tally soil is mainly prairie sandreed, needleandthread, western wheatgrass, and little bluestem. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of needleandthread, sand dropseed, blue grama, and western wheatgrass increases. If excessive grazing continues, plants such as horseweed fleabane, needleleaf sedge, red threeawn, and perennial weeds may invade. The potential plant community produces about 1,600 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

The potential plant community on the Flasher soil is mainly prairie sandreed, western wheatgrass, little bluestem, and plains muhly. If the range is excessively grazed, the proportion of these plants decreases and the proportion of needleandthread, threadleaf sedge, blue grama, and fringed sagewort increases. If excessive grazing continues, plants such as red threeawn, annuals, and perennial weeds may invade. The potential plant community produces about 1,500 pounds of air-dry vegetation in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition; however, extreme care is needed where slopes are more than 15 percent. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

Where slopes are 4 to 15 percent, the Tally soil is suited to windbreaks; however, it has moderate available water capacity, which limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture. Where slopes are 15 to 25 percent, the Tally soil is poorly suited to windbreaks. It is limited mainly by slope.

The Flasher soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The Tally soil is suited to homesite development. The main limitations are slope and the hazard of soil blowing. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. In places excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion.

The Flasher soil is poorly suited to homesite development. The main limitations are slope, shallow depth to sedimentary beds, and the hazard of soil blowing. If the soil is used for septic tank absorption fields, the moderate permeability of the underlying sedimentary beds and the slope can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Where slopes are more than 15 percent, absorption lines should be installed on the contour. In places excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass VIe, nonirrigated. The Tally soil is in Sandy range site, 15- to 19-inch precipitation zone, and the Flasher soil is in Shallow range site, 15- to 19-inch precipitation zone.

217—Tally-Flasher complex, 25 to 45 percent slopes. This map unit is on uplands in the northwestern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Tally fine sandy loam and 30 percent Flasher loamy fine sand. The Tally soil is on foot slopes, and the Flasher soil is on uplands.

Included in this unit are small areas of moderately deep Doney soils, shallow Wayden soils, and shallow Cabba soils. Included areas make up about 20 percent of the total acreage.

The Tally soil is deep and well drained. It formed in alluvium derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsoil is brown and pale brown fine sandy loam about 26 inches thick. The substratum to a

depth of 60 inches or more is very pale brown loamy fine sand.

Permeability of the Tally soil is moderately rapid to a depth of 32 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 36 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Flasher soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from weakly consolidated, sandy sedimentary beds. Typically, the surface layer is brown loamy fine sand about 11 inches thick. The underlying material is very pale brown loamy fine sand about 5 inches thick. Pale yellow sedimentary beds are at a depth of about 16 inches. Depth to sedimentary beds ranges from 10 to 20 inches.

Permeability of the Flasher soil is rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high.

Most areas of the soils in this unit are used as rangeland. A few areas are used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Tally and Flasher soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the Tally soil is dominated by arrowleaf balsamroot, common snowberry, common chokecherry, Saskatoon serviceberry, Idaho fescue, Columbia needlegrass, bluebunch wheatgrass, western yarrow, and sedge. The understory provides moderate amounts of forage for livestock.

The Tally soil is suited to the production of ponderosa pine. The site index is about 45. At the culmination of the mean annual increment (CMAI), the Tally soil can produce about 30 cubic feet, or 70 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

The hazard of erosion is severe, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is slight.

The main limitations of the Tally soil for management of timber are steepness of slope and soil texture. Slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and moderate available water capacity make establishment of tree seedlings difficult. Reducing the risk of erosion is essential in harvesting timber.

The potential native understory vegetation on the Flasher soil is dominated by bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, western yarrow, common snowberry, and common chokecherry. The understory provides moderate amounts of forage for livestock.

The Flasher soil is suited to the production of ponderosa pine. The site index is about 35. At the culmination of the mean annual increment (CMAI), the Flasher soil can produce about 20 cubic feet, or 40 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

The hazard of erosion is severe, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is moderate.

The main limitations of the Flasher soil for management of timber are steepness of slope, soil texture, depth to sedimentary beds, and very low available water capacity. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. Reducing the risk of erosion is essential in harvesting timber.

These soils are not suited to road construction.

The soils in this unit are poorly suited to homesite development because of the steepness of slope and the shallow depth to sedimentary beds in the Flasher soil.

This map unit is in capability subclass VIIe, nonirrigated. The Tally soil is in woodland suitability group 6r8, and the Flasher soil is in group 7d14.

218—Tamaneen clay loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces in the western part of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are more than 1,000 feet long. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of soils that are underlain by loamy sand and gravel at a depth of 20 to 40 inches.

Typically, the surface layer of this Tamaneen soil is dark grayish brown clay loam about 7 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 4 inches is pale brown clay loam. The upper 5 inches of the substratum is very pale brown very gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy loam.

Permeability is moderately slow to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low to moderate available water capacity and low precipitation. Crop residue left on or near the surface helps to conserve moisture, increases the water intake rate, and improves tilth. Growing sod crops such as hay and pasture also increases the water intake rate. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are shrink-swell potential, potential frost action, and low soil strength. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The very gravelly or extremely gravelly material below a depth of about 20 inches is good road fill. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIs, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

219—Tamaneen clay loam, 2 to 4 percent slopes. This deep, well drained soil is on terraces and fans in the western part of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are more than 1,000 feet long. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of soils that are underlain by loamy sand and gravel at a depth of 20 to 40 inches.

Typically, the surface layer of this Tamaneen soil is dark grayish brown clay loam about 7 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 4 inches is pale brown clay loam. The upper 5 inches of the substratum is very pale brown very gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy loam.

Permeability is moderately slow to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low to moderate available water capacity, low precipitation, and the hazard of water erosion. Minimum tillage, contour cultivation, grassed waterways, and stripcropping help to control water erosion. Crop residue returned to the soil helps to maintain good tilth and a desirable water intake rate. Growing sod crops such as hay and pasture also helps to control water erosion, and it increases the water intake rate, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are

Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are shrink-swell potential, potential frost action, and low soil strength. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The very gravelly or extremely gravelly material below a depth of about 20 inches is good road fill. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

220—Tamaneen-Judith clay loams, 0 to 2 percent slopes. This map unit is on terraces in the western part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 3,200 to 4,400 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 60 percent Tamaneen clay loam and 30 percent Judith clay loam. The Tamaneen soil is on plane side slopes, and the Judith soil is in slightly convex areas.

Included in this unit is about 10 percent deep Windham soils in convex areas.

The Tamaneen soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 4 inches is pale brown clay loam. The upper 5 inches of the substratum is very pale brown very gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy loam.

Permeability of the Tamaneen soil is moderately slow to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The Judith soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper 11 inches of the subsoil is brown and very pale brown clay loam, and the lower 7 inches is white clay loam. The upper 22 inches of the substratum is very pale brown extremely gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy clay loam.

Permeability of the Judith soil is moderate to a depth of about 24 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The soils in this unit are used primarily for nonirrigated crops, mainly wheat, barley, and oats. They are also used for hay and pasture and as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by the hazard of soil blowing on the Judith soil and by the low to moderate available water capacity. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, and stubble-mulch tillage help to control soil blowing. Growing sod crops such as hay and pasture also helps to control soil blowing, and it increases the water intake rate, which increases the amount of moisture in the soil.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer of the Judith soil is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

The Tamaneen soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Judith soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils.

The main limitations for homesite development on the soils in this unit are potential frost action, low soil strength, and the shrink-swell potential of the Tamaneen soil. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The very gravelly or extremely gravelly material below a depth of about 20 inches is good road fill. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

221—Tamaneen-Judith clay loams, 2 to 4 percent slopes. This map unit is on terraces in the western part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,200 to 4,400 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Tamaneen clay loam and 40 percent Judith clay loam. The Tamaneen soil is on plane side slopes, and the Judith soil is in slightly convex areas.

Included in this unit is about 10 percent deep Windham soils in convex areas.

The Tamaneen soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 4 inches is pale brown clay loam. The upper 5 inches of the substratum is very pale brown very gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy loam.

Permeability of the Tamaneen soil is moderately slow to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The Judith soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper 11 inches of the subsoil is brown and very pale brown clay loam, and the lower 7 inches is white clay loam. The upper 22 inches of the substratum is very pale brown extremely gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy clay loam.

Permeability of the Judith soil is moderate to a depth of about 24 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used primarily for nonirrigated crops, mainly wheat, barley, and oats. They are also used for hay and pasture and as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by the hazards of soil blowing and water erosion and by the low to moderate available water capacity. Minimum tillage, contour cultivation, grassed waterways, and stripcropping help to control soil blowing and water erosion. Growing sod crops such as hay and pasture also help to control soil blowing and water erosion, and it increases the water intake rate, which increases the amount of water in the soil.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Tamaneen soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Judith soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the soils in this unit are potential frost action, low soil strength, and the shrink-swell potential of the Tamaneen soil. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The very gravelly or extremely gravelly material below a depth of about 20 inches is good roadfill. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

222—Tanna silty clay loam, 0 to 4 percent slopes. This moderately deep, well drained soil is on uplands in the northern and eastern parts of the county. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,700 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of moderately deep Marmarth soils.

Typically, the surface layer of this Tanna soil is grayish brown silty clay loam about 6 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 15 inches is light grayish brown and gray silty clay loam. The substratum is light gray silty clay loam about 5 inches thick. Light gray shale is at a depth of about 32 inches. Depth to shale and sandstone ranges from 20 to 40 inches.

Permeability is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the low available water capacity, low precipitation, and the hazard of water erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, moderate depth to shale and sandstone, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale and sandstone. Cuts to level building sites can expose shale and sandstone. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

223—Tanna-Abor complex, 2 to 8 percent slopes. This map unit is on uplands in the northern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,700 to 3,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 60 percent Tanna silty clay loam and 30 percent Abor silty clay. The Tanna soil is on plane side slopes, and the Abor soil is on convex side slopes.

Included in this unit are small areas of deep Kobar soils on foot slopes and shallow Yawdim soils on convex side slopes and on ridges. Included areas make up about 10 percent of the total acreage.

The Tanna soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Typically, the surface layer is grayish brown silty clay loam about 6 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 15 inches is light grayish brown and gray silty clay loam. The substratum is light gray silty clay loam about 5 inches thick. Light gray shale is at a depth of about 32 inches. Depth to shale and sandstone ranges from 20 to 40 inches.

Permeability of the Tanna soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The Abor soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown silty clay about 6 inches thick. The subsoil is light brownish gray and olive silty clay about 24 inches thick. Pale yellow shale is at a depth of about 30 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Abor soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. They are also used as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by low available water capacity, low precipitation, and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, stripcropping, tall grass barriers, grassed waterways, return of crop residue to the soil, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers also reduce evaporation and trap snow, which increase the amount of moisture in the soil. Returning crop residue to the soil also helps to maintain good tilth. Chiseling through stubble in fall on the contour or across the slope helps to control water erosion.

The potential plant community on these soils is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Where clubmoss and blue grama are the dominant vegetation on these soils, pitting, furrowing, chiseling, or other mechanical treatment practices can be used to improve depleted rangeland. These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

These soils are suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the soils in this unit are slow permeability, moderate depth to shale and sandstone, shrink-swell potential, and low soil strength. The soils are severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale and sandstone. Cuts to level building sites can expose shale and sandstone. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

224—Tanna-Ethridge-Cabston complex, 8 to 25 percent slopes. This map unit is on uplands in the eastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,700 to 3,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 40 percent Tanna clay loam, about 30 percent Ethridge clay loam, and 25 percent Cabston channery clay loam. The Tanna soil is on plane side slopes of uplands and has slopes of 8 to 25 percent.

The Ethridge soil is on fans and has slopes of 8 to 15 percent. The Cabston soil is on foot slopes and fans and has slopes of 8 to 25 percent.

Included in this unit is about 5 percent deep, salt- and alkali-affected Gerdrum soils on fans.

The Tanna soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Typically, the surface layer is grayish brown clay loam about 6 inches thick. The upper 6 inches of the subsoil is grayish brown silty clay, and the lower 15 inches is light grayish brown and gray silty clay loam. The substratum is light gray silty clay loam about 5 inches thick. Light gray shale is at a depth of about 32 inches. Depth to shale and sandstone ranges from 20 to 40 inches.

Permeability of the Tanna soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Ethridge soil is deep and well drained. It formed in alluvium derived dominantly from shale and sandstone. Typically, the surface layer is grayish brown clay loam about 6 inches thick. The upper 10 inches of the subsoil is brown and light brownish gray silty clay, and the lower 15 inches is light brownish gray silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray and light gray silty clay.

Permeability of the Ethridge soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Cabston soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from shale and sandstone. Typically, the surface layer is grayish brown channery clay loam about 4 inches thick. The subsoil is grayish brown and light brownish gray very channery clay loam about 17 inches thick. The substratum to a depth of 66 inches or more is light brownish gray very channery clay loam.

Permeability of the Cabston soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to pasture because of the steepness of slope and the hazard of water erosion.

The potential plant community on these soils is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition; however, extreme care should be exercised where slopes are more than 15 percent. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Ethridge soil is suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The Tanna and Cabston soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the soils in this unit are moderately slow to slow permeability, shrink-swell potential, low soil strength, and moderate depth to shale and sandstone in the Tanna soil. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. The Tanna soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale and sandstone. If the Ethridge and Cabston soils are used for septic tank absorption fields, the slow and moderately slow permeability can be overcome by increasing the size of the absorption field. Cuts to level building sites can expose shale and sandstone in the Tanna soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass VIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

225—Teigen silty clay loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in the eastern part of the county. It formed in alluvium derived dominantly from acid shale. Slopes commonly are more than 1,000 feet long. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of moderately deep Julin soils on uplands and deep, salt- and alkali-affected Gerdrum soils in concave areas.

Typically, the surface layer of this Teigen soil is gray silty clay loam about 4 inches thick. The upper 5 inches of the subsoil is gray silty clay loam, and the lower 4 inches is light brownish gray clay loam. The upper 4 inches of the substratum is grayish brown clay loam, the next 3 inches is light brownish gray loam, and the lower part to a depth of 60 inches or more is grayish brown clay loam.

Permeability is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly as rangeland and for hay and pasture. It is also used for nonirrigated crops such as wheat, barley, and oats.

This soil is suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion and by low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly western wheatgrass, thickspike wheatgrass, prairie sandreed, and wild rose. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, goldenrod, longleaf sagebrush, and big sagebrush increases. If excessive grazing continues, plants such as goldenpea, annuals, perennial weeds, and creeping juniper may invade. The potential plant community produces about 1,000 pounds of air-dry vegetation in years of above-normal precipitation and 500 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

226—Teigen-Julin complex, 2 to 25 percent slopes. This map unit is on uplands in the eastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 45 percent Teigen silty clay loam and 25 percent Julin silty clay. The Teigen soil is on fans and foot slopes, and the Julin soil is on uplands.

Included in this unit are small areas of shallow Dilts soils and moderately deep, salt- and alkali-affected Weingart soils. Also included are small areas of deep, salt- and alkali-affected Gerdrum and Absher soils on fans. The Absher soils have a crusty surface layer and are nearly barren of vegetation. Included areas make up about 30 percent of the total acreage.

The Teigen soil is deep and well drained. It formed in alluvium derived dominantly from acid shale. Typically, the surface layer is gray silty clay loam about 4 inches thick. The upper 5 inches of the subsoil is gray silty clay loam, and the lower 4 inches is light brownish gray clay loam. The upper 4 inches of the substratum is grayish brown clay loam, the next 3 inches is light brownish gray loam, and the lower part to a depth of 60 inches or more is grayish brown clay loam.

Permeability of the Teigen soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil

is under native vegetation is about 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Julin soil is moderately deep and well drained. It formed in residuum derived dominantly from consolidated shale. Typically, the surface layer is gray silty clay about 7 inches thick. The underlying material is gray silty clay about 23 inches thick. Gray shale is at a depth of about 30 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Julin soil is slow. Available water capacity is low to very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of slope and the hazards of soil blowing and water erosion.

The potential plant community on these soils is mainly western wheatgrass, thickspike wheatgrass, prairie sandreed, and wild rose. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, goldenrod, longleaf sagebrush, and big sagebrush increases. If excessive grazing continues, plants such as goldenpea, annuals, perennial weeds, and creeping juniper may invade. The potential plant community produces about 1,000 pounds of air-dry vegetation in years of above-normal precipitation and 500 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition; however, extreme care should be exercised where slopes are more than 15 percent. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The granular surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

Where slopes are 2 to 15 percent, the Teigen soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture. Where slopes are 15 to 25 percent, the Teigen soil is poorly suited to windbreaks. It is limited mainly by slope.

The Julin soil is poorly suited to windbreaks. It is limited mainly by slope and the very low to low available water capacity.

The main limitations for homesite development on the soils in this unit are slow permeability, slope, shrink-swell potential, low soil strength, and moderate depth to shale in the Julin soil. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If the Teigen soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. The Julin soil is severely limited for septic tank absorption fields because of slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass VIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

227—Terrad silty clay, 2 to 8 percent slopes. This deep, well drained soil is on uplands in the central part of the county. It formed in alluvium and residuum derived dominantly from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,900 to 4,600 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Timberg and Darret soils.

Typically, the surface layer of this Terrad soil is dark grayish brown silty clay about 7 inches thick. The subsoil is reddish brown silty clay about 33 inches thick. The substratum is reddish brown silty clay about 9 inches thick. Reddish brown semiconsolidated shale is at a depth of about 49 inches. Depth to shale ranges from 40 to 60 inches.

Permeability is slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, stripcropping, tall grass barriers, grassed waterways, return of crop residue to the soil, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers also reduce

evaporation and trap snow, which increase the amount of moisture in the soil. Returning crop residue to the soil also helps to maintain good tilth. Chiseling through stubble in fall on the contour or across the slope helps to control water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Planting on the contour helps to conserve moisture. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

228—Teton loam, 2 to 8 percent slopes. This moderately deep, well drained soil is on uplands in the southern part of the county. It formed in residuum derived dominantly from fractured hard sandstone. Slopes commonly are more than 1,000 feet long. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

Included in this unit are small areas of shallow Cheadle soils in convex areas and deep Adel soils in concave areas.

Typically, the surface layer of this Teton soil is dark gray loam about 7 inches thick. The subsoil is brown and pale brown loam about 25 inches thick. Sandstone is at a depth of about 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is suited to nonirrigated crops. It is limited mainly by the short growing season, low available water capacity, and the hazards of water erosion and soil blowing. Timeliness is of prime importance in all tillage, seeding, and harvesting operations. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderate depth to sandstone, potential frost action, and low soil strength. The soil is severely limited for septic tank absorption fields because of the moderate depth to sandstone. Cuts to level building sites can expose sandstone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated, and in Silty range site, 20- to 24-inch precipitation zone.

229—Teton-Adel loams, 8 to 15 percent slopes. This map unit is on uplands and fans in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 50 percent Teton loam and 45 percent Adel loam. The Teton soil is on uplands, and the Adel soil is on fans and foot slopes.

Included in this unit are small areas of shallow Cheadle soils on uplands. Included areas make up about 5 percent of the total acreage.

The Teton soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark gray loam about 7 inches thick. The subsoil is brown and pale brown loam about 25 inches thick. Sandstone is at a depth of about 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Teton soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Adel soil is deep and well drained. It formed in alluvium derived dominantly from sandstone. Typically, the surface layer is dark gray loam about 13 inches thick. The next layer is dark grayish brown loam about 18 inches inches thick. The next layer is grayish brown loam about 7 inches thick. The subsoil to a depth of 60 inches or more is brown channery loam.

Permeability of the Adel soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the hazards of water erosion and soil blowing and by the short growing season. Timeliness is of prime importance in all tillage, seeding, and harvesting operations. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,500 pounds of air-dry vegetation in years of above-normal precipitation and 2,700 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Teton soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac.

The Adel soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the soils in this unit are potential frost action, low soil strength, and moderate depth to sandstone in the Teton soil. The Teton soil is severely limited for septic tank absorption fields because of the moderate depth to sandstone. Cuts to level building sites can expose sandstone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated, and in Silty range site, 20- to 24-inch precipitation zone.

230—Teton-Cheadle loams, 2 to 8 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,700 to 6,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 60 percent Teton loam and 35 percent Cheadle loam. The Teton soil is on plane side slopes, and the Cheadle soil is in convex areas.

Included in this unit are small areas of Cheadle channery loam. Also included are small areas of deep Adel soils in swales and on fans. Included areas make up about 5 percent of the total acreage.

The Teton soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark gray loam about 7 inches thick. The subsoil is brown and pale brown loam about 25 inches thick. Sandstone is at a depth of about 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Teton soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Cheadle soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The upper 8 inches of the underlying material is brown extremely channery loam, and the lower 4 inches is light yellowish brown extremely flaggy loam. Very pale brown sandstone is at a depth of about 19 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Cheadle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the hazards of water erosion and soil blowing and by the short growing season. Timeliness is of prime importance in all tillage, seeding, and harvesting operations. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on the Teton soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

The potential plant community on the Cheadle soil is mainly bluebunch wheatgrass, rough fescue, Columbia needlegrass, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, prairie junegrass, western wheatgrass, and timber oatgrass increases. If excessive grazing continues, plants such as broom snakeweed, onespike danthonia, perennial forbs, and annuals may invade. The potential plant community produces about 2,100 pounds of air-dry vegetation in years of above-normal precipitation and 1,300 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Teton soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The Cheadle soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the soils in this unit are moderate and shallow depth to sandstone, potential frost action, and low soil strength. The soils are severely limited for septic tank absorption fields because of the moderate and shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated. The Teton soil is in Silty range site, 20- to 24-inch precipitation zone, and the Cheadle soil is in Shallow range site, 20- to 24-inch precipitation zone.

231—Teton-Cheadle loams, 8 to 15 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,700 to 6,000 feet. The average annual

precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 50 percent Teton loam and 40 percent Cheadle loam. The Teton soil is on plane side slopes, and the Cheadle soil is on ridges.

Included in this unit are a few small areas of Cheadle channery loam and Cheadle channery fine sandy loam on ridges and knolls. Included areas make up about 10 percent of the total acreage.

The Teton soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark gray loam about 7 inches thick. The subsoil is brown and pale brown loam about 25 inches thick. Sandstone is at a depth of about 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Teton soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Cheadle soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The upper 8 inches of the underlying material is brown extremely channery loam, and the lower 4 inches is light yellowish brown extremely flaggy loam. Very pale brown sandstone is at a depth of about 19 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Cheadle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland and for hay and pasture.

These soils are poorly suited to nonirrigated crops. They are limited mainly by the short growing season and the hazards of water erosion and soil blowing.

These soils are suited to hay and pasture. They are limited mainly by the hazards of water erosion and soil blowing. Seedbed preparation on the contour or across the slope, where practical, helps to control water erosion. All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Rotation grazing helps to maintain the quality of forage.

The potential plant community on the Teton soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onepsike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

The potential plant community on the Cheadle soil is mainly bluebunch wheatgrass, rough fescue, Columbia needlegrass, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, prairie junegrass, western wheatgrass, and timber oatgrass increases. If excessive grazing continues, plants such as broom snakeweed, onespike danthonia, perennial forbs, and annuals may invade. The potential plant community produces about 2,100 pounds of air-dry vegetation in years of above-normal precipitation and 1,300 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Teton soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The Cheadle soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the soils in this unit are moderate and shallow depth to sandstone, potential frost action, and low soil strength. The soils are severely limited for septic tank absorption fields because of the moderate and shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated. The Teton soil is in Silty range site, 20- to 24-inch precipitation zone, and the Cheadle soil is in Shallow range site, 20- to 24-inch precipitation zone.

232—Teton-Cheadle channery loams, 2 to 8 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,700 to 6,000 feet. The average annual precipitation is about 22 inches, the

average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 40 percent Teton channery loam and 30 percent Cheadle channery loam. The Teton soil is on plane side slopes, and the Cheadle soil is in convex areas.

Included in this unit are about 20 percent Teton loam and 10 percent Cheadle loam.

The Teton soil is moderately deep and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark gray channery loam about 7 inches thick. The subsoil is brown and pale brown loam about 25 inches thick. Sandstone is at a depth of about 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Teton soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Cheadle soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is dark grayish brown channery loam about 7 inches thick. The upper 8 inches of the underlying material is brown extremely channery loam, and the lower 4 inches is light yellowish brown extremely flaggy loam. Very pale brown sandstone is at a depth of about 19 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Cheadle soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland and for hay and pasture. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the hazards of water erosion and soil blowing and by the short growing season. Timeliness is of prime importance in all tillage, seeding, and harvesting operations. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on the Teton soil is mainly rough fescue, bluebunch wheatgrass, Columbia needlegrass, and mountain brome. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, western wheatgrass, Letterman needlegrass, and spikeoat increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and perennial forbs may invade. The potential plant community produces about 3,400 pounds of air-dry vegetation in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

The potential plant community on the Cheadle soil is mainly bluebunch wheatgrass, rough fescue, Columbia needlegrass, and western wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, prairie junegrass, western wheatgrass, and timber oatgrass increases. If excessive grazing continues, plants such as broom snakeweed, onespike danthonia, perennial forbs, and annuals may invade. The potential plant community produces about 2,100 pounds of air-dry vegetation in years of above-normal precipitation and 1,300 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Teton soil is suited to windbreaks, but the low available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The Cheadle soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the soils in this unit are moderate and shallow depth to sandstone, potential frost action, content of rock fragments, and low soil strength. The soils are severely limited for septic tank absorption fields because of the moderate and shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IVe, nonirrigated. The Teton soil is in Silty range site, 20- to 24-inch precipitation zone, and the Cheadle soil is in Shallow range site, 20- to 24-inch precipitation zone.

233—Thebo clay, 2 to 8 percent slopes. This moderately deep, well drained soil is on uplands in the northeastern part of the county. It formed in residuum derived from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44

degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of shallow Neldore soils and small areas of soils that have slopes of more than 8 percent.

Typically, the surface layer of this Thebo soil is grayish brown clay about 5 inches thick. The underlying material is grayish brown clay about 28 inches thick. Gray shale is at a depth of about 33 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is very slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used mainly as rangeland. It is also used for hay and pasture and for nonirrigated crops such as wheat, barley, and oats.

This soil is suited to nonirrigated crops. It is limited mainly by low to moderate available water capacity, difficulty of cultivation, the hazards of soil blowing and water erosion, and low precipitation. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Minimum tillage, contour cultivation, stripcropping, tall grass barriers, grassed waterways, return of crop residue to the soil, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers also reduce evaporation and trap snow, which increase the amount of moisture in the soil. Returning crop residue to the soil also helps to maintain good tilth. Chiseling through stubble in fall on the contour or across the slope helps to control water erosion.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, Sandberg bluegrass, prairie junegrass, and big sagebrush increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, curlycup gumweed, and annual bromes may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are very slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

234—Thebo clay, 8 to 25 percent slopes. This moderately deep, well drained soil is on uplands in the northeastern part of the county. It formed in residuum derived from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of shallow Neldore soils on ridge crests and small areas of deep, salt- and alkali-affected Gerdrum soils in concave areas on foot slopes and fans. Glacial boulders are on the surface in some places where this unit is mapped near glaciated areas.

Typically, the surface layer of this Thebo soil is grayish brown clay about 5 inches thick. The underlying material is grayish brown clay about 28 inches thick. Gray shale is at a depth of about 33 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is very slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

This soil is used as rangeland.

This soil is poorly suited to cultivated crops and to hay and pasture because of slope and the hazards of soil blowing and water erosion.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, bluebunch

wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, Sandberg bluegrass, prairie junegrass, and big sagebrush increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, curlycup gumweed, and annual bromes may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. Mechanical treatment is not practical because of moderately steep slopes and dissection by drainageways.

Where slopes are 8 to 15 percent, this soil is suited to windbreaks. The low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture. Where slopes are 15 to 25 percent, the soil is poorly suited to windbreaks.

The main limitations for homesite development on this soil are very slow permeability, slope, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass VIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

235—Thebo-Weingart-Absher clays, 4 to 15 percent slopes. This map unit is on uplands in the eastern and northeastern parts of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 40 percent Thebo clay, 25 percent Weingart clay, and 15 percent Absher clay. The Thebo soil is in convex areas, and the Weingart and Absher soils are in plane and convex areas and have slopes of 4 to 8 percent.

Included in this unit are small areas of shallow Neldore soils on ridges and shale Rock outcrop on ridge crests. Also included are small areas of deep Pendroy soils and deep, salt- and alkali-affected Gerdrum soils in concave areas. Also included are a few small areas of soils that have semiconsolidated shale at a depth of 40 to 60 inches and soils that have a gravelly surface layer. These included areas make up about 20 percent of the total acreage.

The Thebo soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown clay about 5 inches thick. The underlying material is grayish brown clay about 28 inches thick. Gray shale is at a depth of about 33 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Thebo soil is very slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Weingart soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is light gray clay loam about 2 inches thick; however, where the soil has been mixed to a depth of 7 inches, the texture is clay. The upper 11 inches of the subsoil is grayish brown and light yellowish brown clay, and the lower 8 inches is light brownish gray clay. The upper part of the substratum is light brownish gray clay about 8 inches thick, and the lower 6 inches is light olive gray shaly clay. Light olive gray shale is at a depth of about 35 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Weingart soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Absher soil is deep and well drained. It formed in alluvium derived from shale and other kinds of rock. Typically, the surface layer is light gray loam about 1 inch thick. The upper 7 inches of the subsoil is brown clay, and the lower 11 inches is grayish brown clay. The upper 6 inches of the substratum is grayish brown clay, and the lower part to a depth of 60 inches or more is grayish brown gravelly clay.

Permeability of the Absher soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22

inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the hazards of soil blowing and water erosion and the high content of salt and alkali in the Absher soil.

The potential plant community on the Thebo soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, Sandberg bluegrass, prairie junegrass, and big sagebrush increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, curlycup gumweed, and annual bromes may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential plant community on the Weingart soil is mainly western wheatgrass, thickspike wheatgrass, green needlegrass, and prairie junegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, clubmoss, and annuals may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The potential plant community on the Absher soil is mainly western wheatgrass, green needlegrass, Cusick bluegrass, and Nuttall saltbush. If the range is excessively grazed, the proportion of these plants decreases and the proportion of blue grama, Sandberg bluegrass, fringed sagewort, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, knotweed, pricklypear, and tumblegrass may invade. The potential plant community produces about 200 pounds of air-dry vegetation in years of above-normal precipitation and 75 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Thebo soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac.

The Weingart soil is suited to windbreaks, but it is strongly saline, which limits the choice of trees and shrubs to Russian-olive and silver buffaloberry.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The Absher soil is not suited to windbreaks. It is limited mainly by the high content of salt and alkali.

The main limitations for homesite development on the Thebo soil are very slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Weingart and Absher soils are very slow permeability, salinity, shrink-swell potential, corrosivity to concrete, and low soil strength. The soils are severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale in the Weingart soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIe, nonirrigated. The Thebo soil is in Clayey range site, 10- to 14-inch precipitation zone, and the Weingart and Absher soils are in Dense Clay range site, 10- to 14-inch precipitation zone.

236—Tibs-Whitecow cobbly clay loams, 25 to 60 percent slopes. This map unit is on mountainsides in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,100 to 6,000 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 90 days.

This unit is about 45 percent Tibs cobbly clay loam, 20 percent Whitecow cobbly clay loam in south-facing areas, and 15 percent Whitecow cobbly clay loam in north-facing areas.

Included in this unit are small areas of moderately deep, well drained Hughesville soils; shallow, well drained Sheege soils; deep, poorly drained Tomty soil; and deep, moderately well drained Delette soils. Included areas make up about 20 percent of the total acreage.

The Tibs soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from shale and limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 1 inch thick. The surface layer is reddish brown cobbly clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is reddish brown and red very cobbly clay.

Permeability of the Tibs soil is slow. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Whitecow soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 2 inches thick. The surface layer is brown cobbly clay loam about 2 inches thick. The upper 7 inches of the subsoil is brown cobbly clay loam, and the lower 7 inches is brown very cobbly clay loam. The upper 11 inches of the substratum is pale brown very cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown and pale brown extremely cobbly loam and extremely cobbly clay loam.

Permeability of the Whitecow soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Most areas of the soils in this unit are used as rangeland. A few areas are used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Tibs and Whitecow soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the Tibs soil is dominated by common juniper, russet buffaloberry, Oregon-grape, common snowberry, white spirea, pinegrass, and Woods rose. The understory provides moderate amounts of forage for livestock.

The Tibs soil is suited to the production of ponderosa pine and Douglas-fir. The site index is about 58 for ponderosa pine and 35 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the Tibs soil can produce about 45 cubic feet, or 120 board feet, of ponderosa pine and 45 cubic feet, or 130 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

The hazard of erosion is severe, equipment limitations are severe, seedling mortality is moderate, plant competition is moderate, and the hazard of windthrow is slight.

The main limitations of the Tibs soil for management of timber are slow permeability, steepness of slope, soil texture, and low soil strength. Slow permeability and steepness of slope increase the hazard of erosion. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. The cobbly clay loam texture of the surface layer limits the use of equipment.

The Tibs soil has low strength when wet, which results in poor trafficability and soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes this limitations. Reducing plant competition helps in establishing seedlings. Roads should not be built across this soil if avoiding it is possible. Timber should be harvested only than 45 percent.

The potential native understory vegetation on the south-facing slopes of the Whitecow soil is dominated by common juniper, arrowleaf balsamroot, Idaho fescue, Engelmann aster, Oregon-grape, creeping juniper, Rocky Mountain juniper, Columbia needlegrass, and bluebunch wheatgrass. The understory provides moderate amounts of forage for livestock.

The south-facing slopes of the Whitecow soil are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Whitecow soil can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

The potential native understory vegetation on the north-facing slopes of the Whitecow soil is dominated by common juniper, mallow ninebark, Columbia brome, Woods rose, pinegrass, common snowberry, white spirea, and elk sedge. The understory provides moderate amounts of forage for livestock.

The north-facing slopes of the Whitecow soil are suited to the production of Douglas-fir and ponderosa pine. The site index is about 40 for Douglas-fir and 60 for ponderosa pine. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Whitecow soil can produce about 55 cubic feet, or 160 board feet, of Douglas-fir and 45 cubic feet, or 130 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

On the Whitecow soil, the hazard of erosion is moderate, equipment limitations are moderate, plant competition is severe, and the hazard of windthrow is slight. Seedling mortality is severe on south-facing slopes and moderate on north-facing slopes.

The main limitations of the Whitecow soil for management of timber are steepness of slope and moderate available water capacity. Steepness of slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and moderate available water capacity make establishment of tree seedlings difficult. Reducing plant competition helps in establishing seedlings. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. The Tibs soil is in woodland suitability group 5c12. The Whitecow soil is in woodland suitability group 6r4 on south-facing slopes and group 6r2 on north-facing slopes.

237—Tibs-Widen-Mocmont complex, 15 to 45 percent slopes. This map unit is on uplands, foot slopes, and mountainsides in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,200 to 5,300 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Tibs clay loam, 30 percent Widen clay loam, 15 percent Mocmont very flaggy sandy loam in north-facing areas, and 10 percent Mocmont very flaggy sandy loam in south-facing areas. The Tibs soil is on uplands and foot slopes. The Widen and Mocmont soils are on mountainsides.

Included in this unit are small areas of shallow Castner soils on ridges and moderately deep Timberg soils in convex areas that support grassland vegetation. Included areas make up about 5 percent of the total acreage.

The Tibs soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from shale and limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 1 inch thick. The surface layer is reddish brown clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is reddish brown and red very cobbly clay.

Permeability of the Tibs soil is slow. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Widen soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated siltstone. Typically, the surface is covered by a mat of conifer forest litter and humus about 2 inches thick. The surface layer is dark gray loam about 1 inch thick. The next layer is pinkish gray clay loam about 3 inches thick. The subsoil is pale olive silty clay about 8 inches thick. The substratum is light olive gray silty clay about 24 inches thick. Pale yellow semiconsolidated siltstone is at a depth of about 36 inches. Depth to siltstone ranges from 20 to 40 inches.

Permeability of the Widen soil is slow. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Mocmont soil is deep and well drained. It formed in alluvium, colluvium, and residuum derived dominantly from sandstone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 2 inches thick. The surface layer is very pale brown very flaggy sandy loam about 6 inches thick. The next layer is pinkish gray very flaggy sandy loam about 8 inches thick. The upper 20 inches of the subsoil is brown very flaggy sandy clay loam, and the lower part to a depth of 60 inches or more is light gray very flaggy sandy loam.

Permeability of the Mocmont soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Most areas of the soils in this unit are used as rangeland. A few areas are used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Tibs, Widen, and Mocmont soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the Tibs soil is dominated by common juniper, russet buffaloberry, Oregon-grape, common snowberry, white spirea, pinegrass, and Woods rose. The understory provides moderate amounts of forage for livestock.

The Tibs soil is suited to the production of ponderosa pine and Douglas-fir. The site index is about 58 for ponderosa pine and 35 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the Tibs soil can produce about 45 cubic feet, or 120 board feet, of ponderosa pine and 45 cubic feet, or 130 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is moderate, plant competition is moderate, and the hazard of windthrow is slight. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 25 to 45 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Tibs soil for management of timber are slow permeability, steepness of slope, soil texture, and low soil strength. Slow permeability and steepness of slope increase the hazard of erosion. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. The cobbly clay loam texture of the surface layer limits the use of equipment.

The Tibs soil has low strength when wet, which results in poor trafficability and soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes these limitations. Reduction of plant competition helps in establishing seedlings.

The potential native understory vegetation on the Widen soil is dominated by common snowberry, Columbia needlegrass, Idaho fescue, blue wildrye, Oregon-grape, Woods rose, common juniper, black hawthorn, russet buffaloberry, bluebunch wheatgrass, and northern bedstraw. The understory provides moderate amounts of forage for livestock.

The Widen soil is suited to the production of ponderosa pine and Douglas-fir. The site index is about 60 for ponderosa pine and 30 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the Widen soil can produce about 45 cubic feet, or 130 board feet, of ponderosa pine and 35 cubic feet, or 100 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is moderate, plant competition is moderate, and the hazard of windthrow is moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 25 to 45 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Widen soil for management of timber are slow permeability, soil texture, and low soil strength. Slow permeability and steepness of slope increase the hazard of erosion. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. The clay loam texture of the surface layer limits the use of equipment.

The Widen soil has low strength when wet, which results in poor trafficability and in soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes these limitations. Reduction of plant competition helps in establishing seedlings.

The potential native understory vegetation on the north-facing slopes of the Mocmont soil is dominated by kinnikinnick, common juniper, white spirea, pinegrass, russet buffaloberry, Idaho fescue, arrowleaf balsamroot, Oregon-grape, western meadowrue, and heartleaf arnica. The understory provides moderate amounts of forage for livestock.

The north-facing slopes of the Mocmont soil are suited to the production of ponderosa pine and Douglas-fir. The site index is about 65 for ponderosa pine and 38 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Mocmont soil can produce about 50 cubic feet, or 150 board feet, of ponderosa pine and 50 cubic feet, or 150 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is slight. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are slight. Where slopes are 25 to 45 percent, the hazard of erosion and equipment limitations are moderate.

The potential native understory vegetation on the south-facing slopes of the Mocmont soil is dominated by arrowleaf balsamroot, common snowberry, common chokecherry, Saskatoon serviceberry, Idaho fescue, Columbia needlegrass, bluebunch wheatgrass, western yarrow, and sedge. The understory provides moderate amounts of forage for livestock.

The south-facing slopes of the Mocmont soil are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Mocmont soil can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is severe, plant competition is severe, and the hazard of windthrow is slight. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are slight. Where slopes are 25 to 45 percent, the hazard of erosion and equipment limitations are moderate.

The main limitations of the Mocmont soil for management of timber are steepness of slope and very low to low available water capacity. Where slopes are 25 to 45 percent, maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. Competition of understory vegetation and very low to low available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings.

The main limitations for homesite development on the Tibs and Widen soils are slow permeability, slope, moderate depth to shale in the Widen soil, shrink-swell

potential, content of rock fragments in the Tibs soil, and low soil strength. The soils are severely limited for septic tank absorption fields because of slow permeability, slope, and moderate depth to shale in the Widen soil. Cuts to level building sites can expose shale in the Widen soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

The main limitations for homesite development on the Mocmont soil are slope and content of rock fragments. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIIe, nonirrigated. The Tibs soil is in woodland suitability group 5c10 where slopes are 15 to 25 percent and group 5c4 where slopes are 25 to 45 percent. The Widen soil is in woodland suitability group 5c2 where slopes are 15 to 25 percent and group 5c4 where slopes are 25 to 45 percent. The north-facing slopes of the Mocmont soil are in woodland suitability group 5o2 where slopes are 15 to 25 percent and group 5r14 where slopes are 25 to 45 percent; and the south-facing slopes are in group 6o8 where slopes are 15 to 25 percent and group 6r6 where slopes are 25 to 45 percent.

238—Tigeron very gravelly loam, 15 to 60 percent slopes. This deep, well drained soil is on uplands in the central part of the county. It formed in colluvium and alluvium derived dominantly from igneous rock. Slopes commonly are more than 1,000 feet long. Elevation is 4,600 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

Included in this unit are small areas of deep Libeg soils in areas of grassland and small areas of shallow soils overlying igneous rock on ridgetops.

Typically, the surface of this Tigeron soil is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, cones, and leaves about 2 1/2 inches thick. The surface layer is light gray very gravelly loam about 15 inches thick. The subsoil to a depth of 60 inches or more is pale brown extremely gravelly clay loam and extremely gravelly loam.

Permeability is moderate. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Most areas of this soil are used as rangeland. A few areas are used as woodland.

This soil is poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

This soil is forested. It is suited to livestock grazing. The potential native understory vegetation is dominated by common juniper, white spirea, Woods rose, pinegrass, twinflower, Oregon-grape, tufted hairgrass, gooseberryleaf alumroot, raceme pussytoes, and heartleaf arnica. The understory provides moderate amounts of forage for livestock. Slopes of 45 to 60 percent adversely affect the distribution and management of livestock.

This soil is suited to the production of Douglas-fir and lodgepole pine. The site index is about 36 for Douglas-fir and 47 for lodgepole pine. At the culmination of the mean annual increment (CMAI), the soil can produce about 45 cubic feet, or 140 board feet, of Douglas-fir and 35 cubic feet, or 110 board feet (Scribner rule), of lodgepole pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is moderate. Where slopes are 15 to 30 percent, the hazard of erosion and equipment limitations are slight. Where slopes are 30 to 60 percent, the hazard of erosion and equipment limitations are moderate.

The main limitations of this soil for management of timber are steepness of slope and very low to low available water capacity. Slopes of 30 to 60 percent restrict the kind of equipment that can be used and make its operation difficult. Competition from understory vegetation and very low to low available water capacity make establishment of tree seedlings difficult. In some areas this soil supports dense stands of trees. The large number of trees in these areas restricts development of plant roots and results in trees being subject to windthrow. Maintaining small openings and thinning over a period of several years reduce windthrow. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

This soil is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. This Tigeron soil is in woodland suitability group 6o3 where slopes are 15 to 30 percent and group 6r3 where slopes are 30 to 60 percent.

239—Timberg clay, 2 to 8 percent slopes. This moderately deep, well drained soil is on uplands in the south-central part of the county. It formed in residuum

derived dominantly from semiconsolidated shale interbedded with sandstone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer of this Timberg soil is reddish brown clay about 6 inches thick. The subsoil is reddish brown and brown silty clay about 19 inches thick. The substratum is dark yellowish brown silty clay about 12 inches thick. Dark yellowish brown shale is at a depth of about 37 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the low to moderate available water capacity and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

240—Timberg-Castner complex, 2 to 8 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Timberg clay loam and 40 percent Castner channery loam. The Timberg soil is on plane side slopes, and the Castner soil is in convex areas.

Included in this unit are small areas of moderately deep Hibar soils on plane side slopes and small areas of Castner loam. Included areas make up about 10 percent of the total acreage.

The Timberg soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Typically, the surface layer is reddish brown clay loam about 6 inches thick. The subsoil is reddish brown and brown silty clay about 19 inches thick. The substratum is dark yellowish brown silty clay about 12 inches thick. Dark yellowish brown shale is at a depth of about 37 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Timberg soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Castner soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is grayish brown channery loam about 7 inches thick. The underlying material is pale brown very channery loam about 7 inches thick. Light gray sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Castner soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. They are also used as rangeland.

These soils are suited to nonirrigated crops. They are limited mainly by the very low available water capacity of the Castner soil and by the hazards of soil blowing and water erosion. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on the Timberg soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential plant community on the Castner soil is mainly rough fescue, bluebunch wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, blue grama, needleandthread, and prairie junegrass increases. If excessive grazing continues, plants such as Kentucky bluegrass, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Timberg soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The Castner soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the Timberg soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Castner soil are shallow depth to sandstone, potential frost action, and content of rock fragments. The soil is severely limited for septic tank absorption fields because of the shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IVe, nonirrigated. The Timberg soil is in Clayey range site, 15- to 19-inch precipitation zone, and the Castner soil is in Shallow range site, 15- to 19-inch precipitation zone.

241—Timberg-Castner complex, 8 to 15 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 45 percent Timberg clay loam and 40 percent Castner channery loam. The Timberg soil is on plane side slopes, and the Castner soil is on ridges.

Included in this unit are a few small areas of Castner loam and Castner stony loam. Included areas make up about 15 percent of the total acreage.

The Timberg soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Typically, the surface layer is reddish brown clay loam about 6 inches thick. The subsoil is reddish brown and brown silty clay about 19 inches thick. The substratum is dark yellowish brown silty clay about 12 inches thick. Dark yellowish brown shale is at a depth of about 37 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Timberg soil is slow. Available water capacity is low to moderate. Effective rooting

depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Castner soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is grayish brown channery loam about 7 inches thick. The underlying material is pale brown very channery loam about 7 inches thick. Light gray sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Castner soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of rough topography and shallow depth to sandstone in the Castner soil.

The potential plant community on the Timberg soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential plant community on the Castner soil is mainly rough fescue, bluebunch wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, blue grama, needleandthread, and prairie junegrass increases. If excessive grazing continues, plants such as Kentucky bluegrass, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Timberg soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour conserves moisture.

The Castner soil is poorly suited to windbreaks. It is limited mainly by the very low available water capacity.

The main limitations for homesite development on the Timberg soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Castner soil are shallow depth to sandstone, potential frost action, and content of rock fragments. The soil is severely limited for septic tank absorption fields because of the shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIe, nonirrigated. The Timberg soil is in Clayey range site, 15- to 19-inch precipitation zone, and the Castner soil is in Shallow range site, 15- to 19-inch precipitation zone.

242—Timberg-Castner complex, 15 to 45 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Timberg clay loam and 25 percent Castner stony loam. The Timberg soil is on plane side slopes, and the Castner soil is on ridges.

Included in this unit are small areas of deep Bitton, Fergus, and Twin Creek soils on foot slopes and fans; Timberg silty clay; and Rock outcrop in the form of ledges. Included areas make up about 25 percent of the total acreage.

The Timberg soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Typically, the surface layer is reddish brown clay loam about 6 inches thick. The subsoil is reddish brown and brown silty clay about 19 inches thick. The substratum is

dark yellowish brown silty clay about 12 inches thick. Dark yellowish brown shale is at a depth of about 37 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Timberg soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Castner soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is grayish brown stony loam about 7 inches thick. The underlying material is pale brown very channery loam about 7 inches thick. Light gray sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Castner soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Timberg soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential plant community on the Castner soil is mainly rough fescue, bluebunch wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, blue grama, needleandthread, and prairie junegrass increases. If excessive grazing continues, plants such as Kentucky bluegrass, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The suface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soils are not suited to mechanical treatment because of steepness of slope and rough topography.

These soils are not suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the Timberg soil are slow permeability, slope, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of slope, slow permeability, and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Castner soil are slope, shallow depth to sandstone, potential frost action, and content of rock fragments. The soil is severely limited for septic tank absorption fields because of slope and shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIIe, nonirrigated. The Timberg soil is in Clayey range site, 15- to 19-inch precipitation zone, and the Castner soil is in Shallow range site, 15- to 19-inch precipitation zone.

243—Tomty complex, 4 to 25 percent slopes. This map unit is on foot slopes in the southern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,600 to 5,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Tomty silty clay and 30 percent Tomty silty clay loam.

Included in this unit are small areas of soils that are similar to these Tomty soils but are 40 to 60 inches deep over shale. Also included are small areas of moderately deep Castle soils and deep Lipke soils. Included areas make up about 20 percent of the total acreage.

The Tomty silty clay is deep and somewhat poorly drained. It formed in colluvium and alluvium derived dominantly from shale. Typically, the surface layer is black silty clay about 6 inches thick. The upper 12 inches of the subsoil is very dark gray and dark gray silty clay and clay, and the lower 12 inches is light gray silty clay. The upper 10 inches of the substratum is gray clay, and the lower part to a depth of 60 inches or more is gray and light gray silty clay.

The Tomty silty clay loam is deep and somewhat poorly drained. It formed in colluvium and alluvium derived dominantly from shale. Typically, the surface

layer is black silty clay about 6 inches thick. The upper 12 inches of the subsoil is very dark gray and dark gray silty clay loam and clay, and the lower 12 inches is light gray silty clay. The upper 10 inches of the substratum is gray clay, and the lower part to a depth of 60 inches or more is gray and light gray silty clay.

Permeability of the Tomty soils is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. A seasonal high water table is at a depth of 18 to 36 inches in spring and early in summer. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland. They are also used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of wetness and steepness of slope.

The Tomty soils are forested. They are suited to livestock grazing. The potential native understory vegetation is dominated by blue wildrye, Saskatoon serviceberry, Scouler silene, mountain sweetroot, lupine, northern bedstraw, sweetscented bedstraw, Oregon-grape, heartleaf arnica, russet buffaloberry, white spirea, common snowberry, shrubby cinquefoil, and black hawthorn. The understory provides large amounts of forage for livestock.

The Tomty soils are suited to the production of quaking aspen. The site index is about 55. At the culmination of the mean annual increment (CMAI), the Tomty soils can produce about 35 cubic feet, or 40 board feet (Scribner rule), of quaking aspen per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is moderate, and the hazard of windthrow is slight. Where slopes are 4 to 15 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Tomty soil for management of timber are the seasonal high water table, steepness of slope, soil texture, and low soil strength. The silty clay and silty clay loam texture of the surface layer limits the use of equipment. The soils have low strength when wet, which results in poor trafficability and in soil compaction if heavy equipment is used to yard logs. Operating equipment when the soils are dry or frozen overcomes these limitations. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. Reduction of plant competition helps in establishing seedlings.

The soils in this unit are poorly suited to homesite development because of the seasonal high water table, wetness, shrink-swell potential, and low soil strength.

This map unit is in capability subclass VIe, nonirrigated. The Tomty soils are in woodland suitability group 4w101 where slopes are 4 to 15 percent and group 4w103 where slopes are 15 to 25 percent.

244—Tomty-Delette complex, 8 to 25 percent slopes. This map unit is on fans and foot slopes in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,600 to 5,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 42 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Tomty silty clay loam and 35 percent Delette loam. The Tomty soil is on foot slopes below areas of the Delette soil.

Included in this unit are small areas of soils that are similar to the Tomty and Delette soils but are underlain by shale at a depth of 20 to 60 inches. Also included are small areas of moderately deep Teton and Kildor soils at higher elevations. Included areas make up about 25 percent of the total acreage.

The Tomty soil is deep and somewhat poorly drained. It formed in colluvium and alluvium derived dominantly from shale. Typically, the surface layer is black silty clay loam about 6 inches thick. The upper 12 inches of the subsoil is very dark gray and dark gray silty clay and clay, and the lower 12 inches is light gray silty clay. The upper 10 inches of the substratum is gray clay, and the lower part to a depth of 60 inches or more is gray and light gray silty clay.

Permeability of the Tomty soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 60 inches or more. A seasonal high water table is at a depth of 18 to 36 inches in spring and early in summer. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is slight.

The Delette soil is deep and moderately well drained. It formed in alluvium and colluvium derived dominantly from sandstone. Typically, the surface is covered by a mat of forest litter of leaves, twigs, and partially decomposed organic matter about 1 1/2 inches thick. The surface layer is very dark gray loam about 5 inches thick. The next layer is dark brown and brown loam about 45 inches thick. The subsoil and clay loam to a depth of 60 inches or more is pinkish gray loam.

Permeability of the Delette soil is moderate to a depth of about 50 inches and slow below this depth. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. A seasonal high water table is at a depth of 42 to 60 inches in spring and early in summer. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are also used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of wetness and steepness of slope.

The Tomty and Delette soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the Tomty soil is dominated by blue wildrye, Saskatoon serviceberry, Scouler silene, mountain sweetroot, lupine, northern bedstraw, sweetscented bedstraw, Oregon-grape, heartleaf arnica, russet buffaloberry, white spirea, common snowberry, shrubby cinquefoil, and black hawthorn. The understory provides high amounts of forage for livestock.

The Tomty soil is suited to the production of quaking aspen. The site index is about 55. At the culmination of the mean annual increment (CMAI), the Tomty soil can produce about 35 cubic feet, or 40 board feet (Scribner rule), of quaking aspen per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is moderate, and the hazard of windthrow is slight. Where slopes are 8 to 15 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Tomty soil for management of timber are the seasonal high water table, steepness of slope, soil texture, and low soil strength. The silty clay loam texture of the surface layer limits the use of equipment. The soil has low strength when wet, which results in poor trafficability and in soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes these limitations. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. Reduction of plant competition helps in establishing seedlings.

The potential native understory vegetation on the Delette soil is dominated by mountain brome, common snowberry, Oregon-grape, violet, common chokecherry, Woods rose, Saskatoon serviceberry, western meadowrue, blue wildrye, black hawthorn, russet buffaloberry, and mountain maple. The understory provides large amounts of forage for livestock.

The Delette soil is suited to the production of quaking aspen. The site index is about 47. At the culmination of the mean annual increment (CMAI), the Delette soil can produce about 30 cubic feet, or 30 board feet (Scribner rule), of quaking aspen per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is moderate, and the hazard of windthrow is slight. Where slopes are 8 to 15 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Delette soil for management of timber are the seasonal high water table and steepness of slope. Maintaining adequate plant cover on disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. Reduction of plant competition helps in establishing seedlings.

The soils in this unit are poorly suited to homesite development because of the seasonal high water table, wetness, and slope.

This map unit is in capability subclass VIe, nonirrigated. The Tomty soil is in woodland suitability group 4w101 where slopes are 8 to 15 percent and group 4w103 where slopes are 15 to 25 percent. The Delette soil is in woodland suitability group 4w105 where slopes are 8 to 15 percent and group 4w107 where slopes are 15 to 25 percent.

245—Turner loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces in the central part of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 3,600 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of soils that are similar to this Turner soil but are 15 to 20 inches deep over sand and gravel and are in convex areas. Also included are small areas of deep Farnuf soils in swales.

Typically, the surface layer of this Turner soil is dark grayish brown loam about 6 inches thick. The upper 9 inches of the subsoil is brown clay loam, and the lower 11 inches is pale brown loam. The upper 4 inches of the substratum is brown very gravelly loam, and the lower part to a depth of 60 inches or more is brown extremely gravelly sand.

Permeability is moderate to a depth of about 26 inches and rapid below this depth. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the low to moderate available water capacity, limited precipitation, and the hazard of soil blowing. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Suitable practices for controlling soil blowing are stripcropping, tall grass

barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 1,600 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are shrink-swell potential, potential frost action, and low soil strength. These limitations can be overcome by excavating to the very gravelly substratum.

This map unit is in capability subclass IIIs, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

246—Twin Creek loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central and southern parts of the county. It formed in alluvium derived dominantly from sandstone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Fergus soils on the lower parts of fans and in swales.

Typically, the surface layer of this Twin Creek soil is brown loam about 7 inches thick. The subsoil is brown and reddish brown loam about 22 inches thick. The substratum to a depth of 60 inches or more is reddish brown loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is about 60 inches. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, rough fescue, and western wheatgrass. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, needleandthread, western wheatgrass, and blue grama increases. If excessive grazing continues, plants such as timothy, Kentucky bluegrass, clubmoss, and perennial weeds may invade. The potential plant community produces about 2,400 pounds of air-dry vegetation in years of above-normal precipitation and 1,900 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

247—Typic Albaqualfs, level. These deep, poorly drained soils are in upland basins in the northern and eastern parts of the county. They formed in alluvium. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,000 to 4,200 feet. The average annual precipitation is about 14 inches, the average annual air temperature is

about 44 degrees F, and the average frost-free period is about 125 days.

These soils commonly have a gray or grayish brown clay loam surface layer. The underlying material is mainly gray, brownish gray, or reddish brown clay, silty clay, or silty clay loam.

Permeability of these soils is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where these soils are under native vegetation is 60 inches or more. Water commonly ponds on these soils in spring. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

These soils are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of ponding.

The potential plant community on these soils is mainly western wheatgrass, green needlegrass, needleandthread, and basin wildrye. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of needleandthread, western wheatgrass, plains reedgrass, and blue grama increases. If excessive grazing continues, plants such as curlycup gumweed, curly dock, foxtail barley, and Kentucky bluegrass may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

These soils are poorly suited to mechanical treatment because of ponding. Grazing should be delayed until the soils have dried sufficiently and are firm enough to withstand trampling by livestock.

These soils are poorly suited to windbreaks. They are limited mainly by periods of ponding.

The ponding makes homesite development on these soils impractical.

This map unit is in capability subclass VIw, nonirrigated, and in Overflow range site, 15- to 19-inch precipitation zone.

248—Typic Cryaquolls, nearly level. These deep, poorly drained soils are on flood plains and fans in the southern part of the county. They formed in alluvium. Slope is 0 to 2 percent. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,800 to 6,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

Included in this unit are small areas of well drained soils on fans and soils that have slopes of 2 to 8 percent and are on fans and foot slopes.

These dark gray soils range from loam to clay throughout. In some areas these soils have a very gravelly or extremely gravelly substratum below a depth of about 20 inches.

Permeability of these soils ranges from very slow to moderate. Available water capacity is moderate to high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 3 feet from April to July. The average annual wetting depth where these soils are under native vegetation is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight except during periods of occasional flooding. The hazard of soil blowing is slight.

These soils are used as rangeland. They are poorly suited to cultivated crops and to hay and pasture because of wetness and the hazard of flooding.

The potential plant community on these soils is mainly American mannagrass, bearded wheatgrass, tall sedges, and tufted hairgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of redtop, tufted hairgrass, shrubby cinquefoil, and low sedges increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, cinquefoil forbs, and perennial weeds may invade. The potential plant community produces about 5,500 pounds of air-dry vegetation in years of above-normal precipitation and 4,500 pounds in years of below-normal precipitation.

Grazing should be delayed until the soils have dried sufficiently and are firm enough to withstand trampling by livestock. Mechanical treatment is limited because of susceptibility to flooding and the hazard of water erosion during floods.

These soils are poorly suited to windbreaks because of the seasonal high water table, which is at a depth of 12 to 36 inches during most of the growing season.

The occasional floods and the seasonal high water table make homesite development on these soils impractical.

This map unit is in capability subclass Vw, nonirrigated, and in Subirrigated range site, 20- to 24-inch precipitation zone.

249—Typic Haplaquepts and Typic Haplaquolls, saline. This map unit consists of deep, poorly drained, saline soils on flood plains in narrow valleys in the northern and eastern parts of the county. The soils are subject to frequent flooding. Slope ranges from 0 to 2 percent. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of deep, well drained soils on fans.

The soils in this unit range from loam to clay throughout. In some areas these soils have a very gravelly or extremely gravelly substratum below a depth of about 20 inches.

Permeability of these soils ranges from slow to moderate. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 3 feet from spring to early

in summer. The average annual wetting depth where these soils are under native vegetation is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight except during periods of frequent flooding. The hazard of soil blowing is slight.

These soils are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of salinity, dissection by drainageways, and the hazard of flooding.

The potential plant community on these soils is mainly alkali sacaton, alkaligrass, Nuttall saltbush, and alkali cordgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of greasewood, saltgrass, bottlebrush squirreltail, and wild rose increases. If excessive grazing continues, plants such as poverty sumpweed, arrowgrass, foxtail barley, and glasswort may invade. The potential plant community produces about 2,600 pounds of air-dry vegetation in years of above-normal precipitation and 1,200 pounds in years of below-normal precipitation.

Grazing should be delayed until the soils have dried sufficiently and are firm enough to withstand trampling by livestock. Mechanical treatment is limited because of susceptibility to flooding and the hazard of water erosion during floods.

These soils are poorly suited to windbreaks. They are limited mainly by the high content of salt and alkali.

The frequent floods and the seasonal high water table make homesite development on these soils impractical.

This map unit is in capability subclass VIw, nonirrigated, and in Saline Lowland range site, 10- to 14-inch precipitation zone.

250—Typic Haplaquolls, moderately sloping. These deep, poorly drained soils are on foot slopes and terrace edges and in swales in the central and western parts of the county. The soils formed in alluvium. Slope ranges from 2 to 15 percent. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of moderately deep, poorly drained soils overlying shale. Also included are small areas of well drained soils on fans and soils, on flood plains, that have slopes of 0 to 2 percent.

These soils are dark gray. Texture is variable throughout the profile, ranging from loam to clay.

Permeability of these soils ranges from very slow to moderate. Available water capacity is high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 3 feet from April to July. The average annual wetting depth where these soils are under native vegetation is 60 inches or more. Runoff is slow to rapid, and the hazard of water erosion is slight to high. The hazard of soil blowing is slight.

These soils are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the seasonal high water table, wetness, and the hazard of occasional flooding in the lower lying areas.

The potential plant community on these soils is mainly tall sedges, American mannagrass, slender wheatgrass, and prairie cordgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of mat muhly, sedges, Baltic rush, and western wheatgrass increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, and annuals may invade. The potential plant community produces about 5,500 pounds of air-dry vegetation in years of above-normal precipitation and 4,000 pounds in years of below-normal precipitation.

Grazing should be delayed until the soils have dried sufficiently and are firm enough to withstand trampling by livestock.

These soils are poorly suited to windbreaks. The seasonal high water table at a depth of 12 to 36 inches during most of the growing season limits the choice of trees and shrubs to those that are water tolerant. Suitable trees for planting are Russian-olive, green ash, Siberian elm, white willow, golden willow, and plains cottonwood. Suitable shrubs are Tatarian honeysuckle, common chokecherry, lilac, purpleosier willow, silver buffaloberry, and redosier dogwood.

The occasional floods in low-lying areas and the seasonal high water table make homesite development on these soils impractical.

This map unit is in capability subclass VIw, nonirrigated, and in Subirrigated range site, 15- to 19-inch precipitation zone.

251—Typic Ustifluvents, saline. These deep, poorly drained soils are on foot slopes, terraces, and fans in the western part of the county. They formed in alluvium. Slope is 0 to 8 percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of very strongly saline soils that support very little vegetation. Also included are small areas of soils that are moderately deep to shale and are on uplands and the edges of small terraces.

These soils are gray. Texture is variable throughout the profile, ranging from clay loam to clay.

Permeability of these soils ranges from very slow to moderately slow. Available water capacity is moderate to high. These soils are salt- and alkali-affected. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1 foot to 4 feet from spring to early in summer. The average annual wetting depth where these soils are under native vegetation is 60 inches or more. Runoff is slow to medium, and the hazard of water

erosion is slight to moderate. The hazard of soil blowing is slight.

These soils are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of wetness and the high content of salt and alkali.

The potential plant community on these soils is mainly alkali sacaton, alkaligrass, Nuttall saltbush, and alkali cordgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of greasewood, saltgrass, bottlebrush squirreltail, and wild rose increases. If excessive grazing continues, plants such as poverty sumpweed, arrowgrass, foxtail barley, and glasswort may invade. The potential plant community produces about 2,800 pounds of air-dry vegetation in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

Grazing should be delayed until the soils have dried sufficiently and are firm enough to withstand trampling by livestock.

These soils are poorly suited to windbreaks. They are limited mainly by the high content of salt and alkali. They are also limited by the seasonal high water table.

The high content of salt and alkali and the seasonal high water table make homesite development on these soils impractical.

This map unit is in capability subclass VIw, nonirrigated, and in Saline Lowland range site, 15- to 19-inch precipitation zone.

252—Vanda clay, 0 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the northwestern part of the county. It formed in alluvium derived dominantly from shale. Slopes commonly are more than 1,000 feet long. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of deep, salt- and alkali-affected Marvan soils on plane side slopes and very small areas of deep, salt- and alkali-affected Nobe soils in slightly depressional areas. The Nobe soils have a crusty surface layer and are nearly barren of vegetation.

Typically, the surface layer of this Vanda soil is a light brownish gray vesicular crust of silty clay about 1/2 inch thick. The next layer is grayish brown clay about 3 1/2 inches thick. The upper 16 inches of the underlying material is grayish brown clay, the next 4 inches is light brownish gray clay loam, and the lower part to a depth of 60 inches or more is grayish brown clay.

Permeability is very slow. Available water capacity is moderate. This soil is salt- and alkali-affected below a depth of 10 to 16 inches. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is high.

This soil is used as rangeland.

This soil is not suited to nonirrigated crops and to hay and pasture because of the crusty surface and the high content of salt and alkali.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, Nuttall saltbush, and big sagebrush. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Sandberg bluegrass, prairie junegrass, black greasewood, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, knotweed, and annuals may invade. The potential plant community produces about 600 pounds of air-dry vegetation in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion and soil blowing if it is disturbed or the range is overgrazed. This soil is poorly suited to mechanical treatment because of the high content of salt and alkali, the high content of clay, and the tendency of the surface to crust.

This soil is poorly suited to windbreaks. It is limited mainly by the clayey texture and the high content of salt and alkali.

The main limitations for homesite development on this soil are very slow permeability, salinity, shrink-swell potential, corrosivity to concrete, and low soil strength. If the soil is used for septic tank absorption fields, the very slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIe, nonirrigated, and in Dense Clay range site, 10- to 14-inch precipitation zone.

253—Vanda-Nobe clays, 0 to 4 percent slopes. This map unit is on terraces and fans in the northeastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 50 percent Vanda clay and 30 percent Nobe clay. The Vanda soil is on plane side slopes, and the Nobe soil is in concave areas.

Included in this unit are small areas of gently sloping, deep, salt- and alkali-affected Absher and Marvan soils. Included areas make up about 20 percent of the total acreage.

The Vanda soil is deep and well drained. It formed in clayey alluvium derived dominantly from shale. Typically, the surface layer is a light brownish gray vesicular crust of silty clay about 1/2 inch thick. The next layer is grayish brown clay about 3 1/2 inches thick. The upper 16 inches of the underlying material is grayish brown clay, and the lower part to a depth of 60 inches or more is light brownish gray and grayish brown clay and clay loam.

Permeability of the Vanda soil is very slow. Available water capacity is moderate. This soil is salt- and alkali-affected below a depth of 10 to 16 inches. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Nobe soil is deep and moderately well drained. It formed in alluvium derived dominantly from shale. Typically, the surface layer is light gray fine sandy loam about 1 inch thick. The subsoil is grayish brown clay about 7 inches thick. The upper 16 inches of the substratum is light olive gray clay, and the lower part to a depth of 60 inches or more is olive gray clay.

Permeability of the Nobe soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the high content of salt and alkali.

The potential plant community on the Vanda soil is mainly western wheatgrass, green needlegrass, Nuttall saltbush, and big sagebrush. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Sandberg bluegrass, prairie junegrass, black greasewood, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, knotweed, and annuals may invade. The potential plant community produces about 600 pounds of air-dry vegetation in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

The potential plant community on the Nobe soil is mainly western wheatgrass, bottlebrush squirreltail, alkaligrass, and Nuttall saltbush. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Sandberg bluegrass, inland saltgrass, black greasewood, and big sagebrush increases. If excessive grazing continues, plants such as foxtail barley, glasswort, seepweed, and annuals may invade. The potential plant community produces about 200 pounds of air-dry vegetation in years of above-normal precipitation and 75 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soils are poorly suited to mechanical treatment because of the high content of salt and alkali, the high content of clay, and the susceptibility of the surface of the Vanda soil to crusting.

These soils are poorly suited to windbreaks. They are limited mainly by the clayey texture and the high content of salt and alkali.

The main limitations for homesite development on the soils in this unit are very slow permeability, salinity, shrink-swell potential, corrosivity to concrete, and low soil strength. If the soils are used for septic tank absorption fields, the very slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIs, nonirrigated. The Vanda soil is in Dense Clay range site, 10- to 14-inch precipitation zone, and the Nobe soil is in Saline Upland range site, 10- to 14-inch precipitation zone.

254—Vebar fine sandy loam, 4 to 15 percent slopes. This moderately deep, well drained soil is on uplands in the central and northwestern parts of the county. It formed in residuum derived dominantly from weakly consolidated, sandy sedimentary beds. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of shallow Flasher soils on ridges.

Typically, the surface layer of this Vebar soil is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is brown fine sandy loam about 8 inches thick. The substratum is very pale brown fine sandy loam about 5 inches thick. Pale yellow sedimentary beds are at a depth of about 23 inches. Depth to sedimentary beds ranges from 20 to 40 inches.

Permeability is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 20

to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 36 inches. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is high.

This soil is used mainly for hay and pasture and as rangeland. It is also used for nonirrigated crops such as wheat, barley, and oats.

This soil is suited to nonirrigated crops. It is limited mainly by low to moderate available water capacity and the hazards of soil blowing and water erosion. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly prairie sandreed, needleandthread, western wheatgrass, and little bluestem. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of needleandthread, sand dropseed, blue grama, and western wheatgrass increases. If excessive grazing continues, plants such as horseweed fleabane, needleleaf sedge, red threeawn, and perennial weeds may invade. The potential plant community produces about 2,200 pounds of air-dry vegetation in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserves moisture and helps to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, western sandcherry, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderate depth to sedimentary beds, potential frost action, and the hazard of soil blowing. If this soil is used for septic tank absorption fields, the moderate permeability of the underlying sedimentary beds can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. In places, excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy range site, 15- to 19-inch precipitation zone.

255—Verson clay loam, 0 to 4 percent slopes. This deep, well drained soil is on terraces in the eastern part of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are more than 1,000 feet long. Elevation is 2,300 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of extremely gravelly soils along terrace edges and deep, salt- and alkali-affected Creed soils in concave areas.

Typically, the surface layer of this Verson soil is grayish brown clay loam about 4 inches thick. The upper 3 inches of the subsoil is grayish brown clay. The next 5 inches is brown silty clay loam, and the lower 6 inches is light brownish gray silty clay loam. The upper 11 inches of the substratum is light gray silty clay loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is slow to a depth of about 29 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly as rangeland and for hay and pasture. It is also used for nonirrigated crops such as wheat, barley, and oats.

This soil is suited to nonirrigated crops. It is limited mainly by moderate available water capacity, low precipitation, and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture control soil blowing.

The potential plant community on this soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the slow permeability can be overcome by excavating to the extremely gravelly part of the substratum. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

256—Verson-Linnet clay loams, 2 to 8 percent slopes. This map unit is on terraces in the eastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,300 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 50 percent Verson clay loam and 40 percent Linnet clay loam.

Included in this unit are small areas of deep Crago soils in convex areas. Also included are small areas of soils that are similar to these Verson and Linnet soils but have a very gravelly substratum at a depth of 40 to 60 inches. Included areas make up about 10 percent of the total acreage.

The Verson soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is grayish brown clay loam about 4 inches thick. The upper 3 inches of the subsoil is grayish brown clay, the next 5 inches is brown silty clay loam, and the lower 6 inches is light brownish gray silty clay loam. The upper 11 inches of the substratum is light gray silty clay loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability of the Verson soil is slow to a depth of about 29 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Linnet soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is grayish brown clay loam about 7 inches thick. The subsoil is grayish brown silty clay about 18 inches thick. The substratum to a depth of 60 inches or more is light gray and light brownish gray silty clay loam.

Permeability of the Linnet soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. They are also used as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by the moderate available water capacity of the Verson soil, low precipitation, and the hazards of soil blowing and water erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Minimum tillage, contour cultivation, stripcropping, tall grass barriers, grassed waterways, return of crop residue to the soil, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers also reduce evaporation and trap snow, which increases the amount of moisture in the soil. Returning crop residue to the soil also helps to maintain good tilth. Chiseling through stubble in fall on the contour or across the slope helps to control water erosion.

The potential plant community on these soils is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and fringed sagewort increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Where clubmoss and blue grama are the dominant vegetation on these soils, pitting, furrowing, chiseling, or other mechanical treatment practices can be used to improve depleted rangeland. These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface

layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Verson soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Linnet soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils.

The main limitations for homesite development on the soils in this unit are slow permeability, shrink-swell potential, and low soil strength. If the Verson soil is used for septic tank absorption fields, the slow permeability can be overcome by excavating to the very gravelly part of the substratum. If the Linnet soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 10- to 14-inch precipitation zone.

257—Weingart very stony clay loam, 2 to 8 percent slopes. This moderately deep, well drained soil is on uplands in the eastern part of the county. It formed in residuum derived dominantly from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,300 to 4,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of deep, salt- and alkali-affected Gerdrum soils on fans and moderately deep Syblon and Thebo soils on uplands.

Typically, the surface layer of this Weingart soil, where mixed to a depth of 7 inches, is grayish brown and light gray very stony clay loam. The upper 6 inches of the subsoil is light yellowish brown clay, and the lower 8 inches is light brownish gray clay. The upper 8 inches of the substratum is light brownish gray clay, and the lower 6 inches is light olive gray shaly clay. Light olive gray shale is at a depth of about 35 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This soil is used as rangeland.

This soil is poorly suited to cultivated crops and to hay and pasture because large stones are in the surface layer.

The potential plant community on this soil is mainly western wheatgrass, thickspike wheatgrass, green needlegrass, and prairie junegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and big sagebrush increases. If excessive grazing continues, may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. This soil is suitable for deferred grazing, rotation grazing, and aerial spraying for brush management. This soil is not suited to mechanical treatment because of the large stones in the surface layer.

This soil is poorly suited to windbreaks. It is limited by stoniness.

The main limitations for homesite development on this soil are very slow permeability, salinity, shrink-swell potential, corrosivity to concrete, low soil strength, and moderate depth to shale. The soil is severely limited for septic tank absorption fields because of the very slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIs, nonirrigated, and in Dense Clay range site, 10- to 14-inch precipitation zone.

258—Weingart-Gerdrum clay loams, 0 to 4 percent slopes. This map unit is on uplands, foot slopes, and fans in the eastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,300 to 4,000

feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 45 percent Weingart clay loam and 35 percent Gerdrum clay loam. The Weingart soil is on uplands, and the Gerdrum soil is on foot slopes and fans.

Included in this unit are small areas of deep, salt- and alkali-affected Creed soils on fans and moderately deep Syblon and Thebo soils on uplands. Included areas make up about 20 percent of the total acreage.

The Weingart soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer, where mixed to a depth of 7 inches, is grayish brown and light gray clay loam. The upper 6 inches of the subsoil is light yellowish brown clay, and the lower 8 inches is light brownish gray clay. The upper 8 inches of the substratum is light brownish gray clay, and the lower 6 inches is light olive gray shaly clay. Light olive gray semiconsolidated shale is at a depth of about 35 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Weingart soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Gerdrum soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown loam about 1 1/2 inches thick. The subsurface layer is light gray clay loam about 2 inches thick. The subsoil is grayish brown clay about 23 1/2 inches thick. The substratum to a depth of 60 inches or more is olive gray and pale yellow silty clay.

Permeability of the Gerdrum soil is slow. Available water capacity is moderate. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland and for hay and pasture. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the low to moderate available water capacity, low precipitation, and the hazards of soil blowing and water erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Subsoiling opens up the soil and allows water and salts to pass through. Crusting of the surface and compaction can be reduced by returning crop residue to the soil. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly western wheatgrass, thickspike wheatgrass, green needlegrass, and prairie junegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, clubmoss, and annuals may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Weingart soil is suited to windbreaks, but it is strongly saline, which limits the choice of trees and shrubs to Russian-olive and silver buffaloberry.

The Gerdrum soil suited to windbreaks, but it is moderately saline, which limits the choice of trees and shrubs to those that are salt tolerant. Suitable trees for planting are Russian-olive, black hawthorn, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, common chokecherry, skunkbush sumac, and silver buffaloberry. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on these soils are very slow and slow permeability, salinity, shrink-swell potential, corrosivity to concrete, low soil strength, and moderate depth to shale in the Weingart soil. The Weingart soil is severely limited for septic tank absorption fields because of the very slow permeability and the moderate depth to shale. If the Gerdrum soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Cuts to level building sites can expose shale in the Weingart soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass IVs, nonirrigated, and in Dense Clay range site, 10- to 14-inch precipitation zone.

259—Weingart-Gerdrum clay loams, 4 to 15 percent slopes. This map unit is on uplands, foot slopes, and fans in the eastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,300 to 4,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 40 percent Weingart clay loam and 30 percent Gerdrum clay loam. The Weingart soil is on uplands, and the Gerdrum soil is on foot slopes and fans.

Included in this unit are small areas of shallow Neldore soils and moderately deep Thebo soils on uplands. Included areas make up about 30 percent of the total acreage.

The Weingart soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer, where mixed to a depth of 7 inches, is grayish brown and light gray clay loam. The upper 6 inches of the subsoil is light yellowish brown clay, and the lower 8 inches is light brownish gray clay. The upper 8 inches of the substratum is light brownish gray clay, and the lower 6 inches is light olive gray shaly clay. Light olive gray semiconsolidated shale is at a depth of about 35 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Weingart soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is high.

The Gerdrum soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown loam about 1 1/2 inches thick. The subsurface layer is light gray clay loam about 2 inches thick. The subsoil is grayish brown clay about 23 1/2 inches thick. The substratum to a depth of 60 inches or more is olive gray and pale yellow silty clay.

Permeability of the Gerdrum soil is slow. Available water capacity is moderate. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the high content of salt and alkali and the hazard of water erosion.

The potential plant community on these soils is mainly western wheatgrass, thickspike wheatgrass, green needlegrass, and prairie junegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, clubmoss, and annuals may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Weingart soil is suited to windbreaks, but it is strongly saline, which limits the choice of trees and shrubs to Russian-olive and silver buffaloberry.

The Gerdrum soil is suited to windbreaks, but it is moderately saline, which limits the choice of trees and shrubs to those that are salt tolerant. Suitable trees for planting are Russian-olive, black hawthorn, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, common chokecherry, skunkbush sumac, and silver buffaloberry.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on these soils are very slow and slow permeability, soil texture, salinity, shrink-swell potential, corrosivity to uncoated steel, corrosivity to concrete, low soil strength, and moderate depth to shale in the Weingart soil. The Weingart soil is severely limited for septic tank absorption fields because of the very slow permeability and the moderate depth to shale. If the Gerdrum soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Cuts to level building sites can expose shale in the Weingart soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIe, nonirrigated, and in Dense Clay range site, 10- to 14-inch precipitation zone.

260—Weingart-Absher clays, 0 to 4 percent slopes. This map unit is on uplands in the eastern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 2,300 to 4,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 50 percent Weingart clay and 25 percent Absher clay. The Weingart soil is on plane side slopes, and the Absher soil is in depressional areas.

Included in this unit are small areas of deep, salt- and alkali-affected Gerdrum soils on fans and small areas of shallow Ernem soils and moderately deep Tanna and Syblon soils on uplands. Also included are small areas of soils that are similar to the Absher soil but have shale at a depth of 40 to 60 inches. Included soils make up about 25 percent of the total acreage.

The Weingart soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer, where mixed to a depth of 7 inches, is grayish brown light gray clay. The upper 6 inches of the subsoil is light yellowish brown clay, and the lower 8 inches is light brownish gray clay. The upper 8 inches of the substratum is light brownish gray clay, and the lower 6 inches is light olive gray shaly clay. Light olive gray shale is at a depth of about 35 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Weingart soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is slow to medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Absher soil is deep and moderately well drained. It formed in alluvium derived from shale and mixed rock sources. Typically, the surface layer is light gray loam about 1 inch thick. The upper 7 inches of the subsoil is brown clay, and the lower 11 inches is grayish brown clay. The upper 6 inches of the substratum is grayish brown clay, and the lower part to a depth of 60 inches or more is grayish brown gravelly clay.

Permeability of the Absher soil is very slow. Available water capacity is low. This soil is salt- and alkali-affected in the subsoil and substratum. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 22 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the high content of salt and alkali in the subsoil and substratum.

The potential plant community on the Weingart soil is mainly western wheatgrass, thickspike wheatgrass, green needlegrass, and prairie junegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, blue grama, Sandberg bluegrass, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, clubmoss, and annuals may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The potential plant community on the Absher soil is mainly western wheatgrass, green needlegrass, Cusick bluegrass, and Nuttall saltbush. If the range is excessively grazed, the proportion of these plants decreases and the proportion of blue grama, Sandberg bluegrass, fringed sagewort, and big sagebrush increases. If excessive grazing continues, plants such as broom snakeweed, knotweed, pricklypear, and tumblegrass may invade. The potential plant community produces about 200 pounds of air-dry vegetation in years of above-normal precipitation and 75 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Weingart soil is suited to windbreaks, but the soil is strongly saline, which limits the choice of trees and shrubs to Russian-olive and silver buffaloberry. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The Absher soil is poorly suited to windbreaks. It is limited mainly by the clayey texture and the high content of salt and alkali.

The main limitations for homesite development on these soils are very slow permeability, salinity, shrink-swell potential, corrosivity to concrete, low soil strength, and moderate depth to shale in the Weingart soil. The Weingart soil is severely limited for septic tank absorption fields because of the very slow permeability and the moderate depth to shale. If the Absher soil is used for septic tank absorption fields, the very slow permeability can be overcome by increasing the size of the absorption field. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these

limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Use of salt-resistant concrete is necessary to overcome the corrosivity.

This map unit is in capability subclass VIs, nonirrigated, and in Dense Clay range site, 10- to 14-inch precipitation zone.

261—Whitecow-Hughesville complex, 2 to 20 percent slopes. This map unit is on mountainsides in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 90 days.

This unit is about 35 percent Whitecow channery clay loam on south-facing side slopes, 20 percent Whitecow channery clay loam on north-facing side slopes, and 30 percent Hughesville flaggy clay loam, which is mainly on south-facing side slopes. Where the Hughesville soil is on north-facing slopes, the production of vegetation is about the same as that on the Whitecow soil on north-facing side slopes. The Whitecow soil is in plane and concave areas, and the Hughesville soil is in convex areas and along ridges.

Included in this unit are small areas of shallow soils on ridges and small areas of Rock outcrop on ridgetops. Included areas make up about 15 percent of the total acreage.

The Whitecow soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 2 inches thick. The surface layer is brown channery clay loam about 2 inches thick. The upper 7 inches of the subsoil is brown channery clay loam, and the lower 7 inches is brown very cobbly clay loam. The upper 11 inches of the substratum is pale brown very cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown and pale brown extremely cobbly loam and extremely cobbly clay loam.

Permeability of the Whitecow soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hughesville soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from fractured hard limestone. Typically, the surface is covered by a mat of forest litter of decomposed and undecomposed needles, twigs, and cones about 2 inches thick. The surface layer is dark grayish brown flaggy loam about 2 inches thick. The upper 8 inches of the subsoil is brown flaggy clay loam, and the lower 12 inches is pale brown very flaggy loam. The upper 10 inches of the substratum is light gray extremely flaggy loam, and the lower 6 inches is white extremely flaggy loam. Limestone is at a depth of about 38 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Hughesville soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland. They are also used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of the large number of flat rock fragments in the surface layer, slope, and the very low available water capacity of the Hughesville soil.

The Whitecow and Hughesville soils are forested. They are well suited to livestock grazing. The potential native understory vegetation on the south-facing slopes of the Whitecow and Hughesville soil is dominated by common juniper, arrowleaf balsamroot, Idaho fescue, Engelmann aster, Oregon-grape, creeping juniper, Rocky Mountain juniper, Columbia needlegrass, and bluebunch wheatgrass. The understory provides moderate amounts of forage for livestock.

The south-facing slopes of the Whitecow and Hughesville soils are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Whitecow and Hughesville soils can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on south-facing side slopes, the hazard of erosion is slight, equipment limitations are slight, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is slight.

Where the Hughesville soil is on south-facing slopes, the hazard of erosion is slight, equipment limitations are slight, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is moderate.

The potential native understory vegetation on the north-facing slopes of the Whitecow soil is dominated by common juniper, mallow ninebark, Columbia brome, Woods rose, pinegrass, common snowberry, white spirea, and elk sedge. The understory provides moderate amounts of forage for livestock.

The north-facing slopes of the Whitecow soil are suited to the production of Douglas-fir and ponderosa

pine. The site index is about 40 for Douglas-fir and 60 for ponderosa pine. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Whitecow soil can produce about 55 cubic feet, or 160 board feet, of Douglas-fir and 45 cubic feet, or 130 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on north-facing slopes, the hazard of erosion is slight, equipment limitations are slight, seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is slight.

The main limitation of the Whitecow soil for management of timber is low to moderate available water capacity. Competition from understory vegetation and low to moderate available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings.

The main limitations of the Hughesville soil for management of timber are moderate depth to limestone and very low available water capacity. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings. The limited soil depth restricts development of plant roots, which results in trees being subject to windthrow. Maintaining small openings or progressively removing trees over a period of several years reduces windthrow.

The main limitation for homesite development on the Whitecow soil is content of rock fragments. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

The main limitations for homesite development on the Hughesville soil are moderate depth to limestone and content of rock fragments. The soil is severely limited for septic tank absorption fields because of the moderate depth to limestone. Cuts to level building sites can expose limestone. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIs, nonirrigated. The Whitecow soil is in woodland suitability group 6o6 on south-facing slopes and group 6o4 on north-facing slopes. The Hughesville soil is in woodland suitability group 6f6 on south-facing slopes.

262—Whitecow-Hughesville complex, 20 to 60 percent slopes. This map unit is on mountainsides in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 90 days.

This unit is about 45 percent Whitecow cobbly silty clay loam on south-facing side slopes, 20 percent Whitecow cobbly silty clay loam on north-facing side slopes, and 25 percent Hughesville very flaggy clay loam, which is mainly on south-facing side slopes. Where the Hughesville soil is on north-facing side slopes, the production of vegetation is about the same as that on the Whitecow soil on north-facing side slopes. The Whitecow soil is in plane and concave areas on mountainsides, and the Hughesville soil is in convex areas and along ridges.

Included in this unit are small areas of Rock outcrop and small areas of shallow soils on ridgetops. Included areas make up about 10 percent of the total acreage.

The Whitecow soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 2 inches thick. The surface layer is brown cobbly silty clay loam about 2 inches thick. The upper 7 inches of the subsoil is brown cobbly silty clay loam, and the lower 7 inches is brown very cobbly clay loam. The upper 11 inches of the substratum is pale brown very cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown and pale brown extremely cobbly clay loam and extremely cobbly loam.

Permeability of the Whitecow soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hughesville soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from fractured hard limestone. Typically, the surface is covered by a mat of forest litter of decomposed and undecomposed needles, twigs, and cones about 2 inches thick. The surface layer is dark grayish brown flaggy loam about 2 inches thick. The upper 8 inches of the subsoil is brown very flaggy clay loam, and the lower 12 inches is pale brown very flaggy loam. The upper 10 inches of the substratum is light gray extremely flaggy loam, and the lower 6 inches is white extremely flaggy loam. Limestone is at a depth of about 38 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Hughesville soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland. They are also used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Whitecow and Hughesville soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the south-facing slopes of the Whitecow and Hughesville soils is dominated by common juniper, arrowleaf balsamroot, Idaho fescue, Engelmann aster, Oregon-grape, creeping juniper, Rocky Mountain juniper, Columbia needlegrass, and bluebunch wheatgrass. The understory provides moderate amounts of forage for livestock.

The south-facing slopes of the Whitecow and Hughesville soils are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Whitecow and Hughesville soils can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on south-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is slight.

Where the Hughesville soil is on south-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is moderate.

The potential native understory vegetation on the north-facing slopes of the Whitecow soil is dominated by common juniper, mallow ninebark, Columbia brome, Woods rose, pinegrass, common snowberry, white spirea, and elk sedge. The understory provides moderate amounts of forage for livestock.

The north-facing slopes of the Whitecow soil are suited to the production of Douglas-fir and ponderosa pine. The site index is about 40 for Douglas-fir and 60 for ponderosa pine. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Whitecow soil can produce about 55 cubic feet, or 160 board feet, of Douglas-fir and 45 cubic feet, or 130 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on north-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is slight.

The main limitations of the Whitecow soil for management of timber are steepness of slope and low to moderate available water capacity. Steepness of slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and low to moderate available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The main limitations of the Hughesville soil for management of timber are steepness of slope, moderate depth to limestone, and very low available water capacity. Steepness of slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings. The limited soil depth restricts development of plant roots, which results in trees being subject to windthrow. Maintaining small openings or progressively removing trees over a period of several years reduces windthrow. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The main limitations for homesite development on these soils are steepness of slope and moderate depth to limestone in the Hughesville soil.

This map unit is in capability subclass VIIe, nonirrigated. The Whitecow soil is in woodland suitability group 6r4 on south-facing slopes and group 6r2 on north-facing slopes. The Hughesville soil is in woodland suitability group 6f8 on south-facing slopes.

263—Whitecow-Hughesville-Rock outcrop complex, 45 to 60 percent slopes. This map unit is on mountainsides in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 70 days.

This unit is about 30 percent Whitecow cobbly clay loam on south-facing side slopes, 10 percent Whitecow cobbly clay loam on north-facing side slopes, 15 percent Hughesville very flaggy clay loam on south-facing side slopes, 10 percent Hughesville very flaggy clay loam on north-facing side slopes, and 15 percent Rock outcrop. The Whitecow soil is in plane and concave areas on mountainsides, the Hughesville soil is in convex areas and along ridges, and Rock outcrop is on cliffs and ledges.

Included in this unit are small areas of moderately deep Skaggs soils and shallow Sheege soils in areas of open grassland. Also included are small areas of talus below areas of Rock outcrop. Included areas make up about 20 percent of the total acreage.

The Whitecow soil is deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 2 inches thick. The surface layer is brown cobbly clay loam about 2 inches thick. The upper 7 inches of the subsoil is brown cobbly clay loam, and the lower 7 inches is brown very cobbly clay loam. The upper 11 inches of the substratum is pale brown very cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown and pale brown extremely cobbly loam and extremely cobbly clay loam.

Permeability of the Whitecow soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hughesville soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from fractured hard limestone. Typically, the surface is covered by a mat of forest litter of decomposed and undecomposed needles, twigs, and cones about 2 inches thick. The surface layer is dark grayish brown very flaggy loam about 2 inches thick. The upper 8 inches of the subsoil is brown very flaggy clay loam, and the lower 12 inches is pale brown very flaggy loam. The upper 10 inches of the substratum is light gray extremely flaggy loam, and the lower 6 inches is white extremely flaggy loam. Limestone is at a depth of about 38 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Hughesville soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Rock outcrop consists of ledges and escarpments of limestone.

Most areas of the soils in this unit are used as rangeland. A few areas are used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Whitecow and Hughesville soils are forested. They are poorly suited to livestock grazing. The potential native understory vegetation on the south-facing slopes of the Whitecow and Hughesville soils is dominated by common juniper, arrowleaf balsamroot, Idaho fescue, Engelmann aster, Oregon-grape, creeping juniper, Rocky Mountain juniper, Columbia needlegrass, and bluebunch wheatgrass. The understory provides limited amounts of forage for livestock. Steepness of slope adversely affects the distribution and management of livestock.

The south-facing slopes of the Whitecow and Hughesville soils are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Whitecow and Hughesville soils can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on south-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is slight.

Where the Hughesville soil is on south-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is severe, plant competition is severe, and the hazard of windthrow is moderate.

The potential native understory vegetation on the north-facing slopes of the Whitecow and Hughesville soils is dominated by common juniper, mallow ninebark, Columbia brome, Woods rose, pinegrass, common snowberry, white spirea, and elk sedge. The understory provides limited amounts of forage for livestock.

The north-facing slopes of the Whitecow and Hughesville soils are suited to the production of Douglas-fir and ponderosa pine. The site index is about 40 for Douglas-fir and 60 for ponderosa pine. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Whitecow and Hughesville soils can produce about 55 cubic feet, or 160 board feet, of Douglas-fir and 45 cubic feet, or 130 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Where the Whitecow soil is on north-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is slight.

Where the Hughesville soil is on north-facing slopes, the hazard of erosion is moderate, equipment limitations are moderate, seedling mortality is moderate, plant competition is severe, and the hazard of windthrow is moderate.

The main limitations of the Whitecow soil for management of timber are steepness of slope and low to moderate available water capacity. Slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and low to moderate available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The main limitations of the Hughesville soil for management of timber are steepness of slope, moderate depth to limestone, and very low available water capacity. Slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. The areas of Rock outcrop and the limitations of this soil make harvesting of timber and other forest management practices very difficult. Reduction of plant competition helps in establishing seedlings. The limited soil depth restricts development of plant roots, which results in trees being subject to windthrow. Maintaining small openings or progressively removing trees over a period of several years reduces windthrow. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. This soil is not suited to road construction.

The main limitations for homesite development on these soils are steepness of slope, moderate depth to limestone in the Hughesville soil, and areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Whitecow soil is in woodland suitability group 6r4 on south-facing slopes and group 6r2 on north-facing slopes. The Hughesville soil is in woodland suitability group 6f8 on south-facing slopes and group 6f4 on north-facing slopes.

264—Whitore-Firada cobbly clay loams, 15 to 60 percent slopes. This map unit is on uplands in the southern part of the county. Slopes commonly are more than 1,000 feet long. Elevation is 4,800 to 8,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 60 days.

This unit is about 65 percent Whitore cobbly clay loam and 25 percent Firada cobbly clay loam. The Whitore soil is on mountainsides, and the Firada soil is in convex areas on mountains.

Included in this unit are small areas of shallow soils and small areas of Rock outcrop on ridgetops. Included areas make up about 10 percent of the total acreage.

The Whitore soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from limestone. Typically, the surface is covered by a mat of forest litter of undecomposed and decomposed needles, twigs, and cones about 1 1/2 inches thick. The surface layer is pale brown cobbly clay loam about 2 inches thick. The upper 6 inches of the subsoil is brown cobbly clay loam, the next 15 inches is brown and pale brown very cobbly clay loam, and the lower part to a depth of 66 inches or more is very pale brown and white very cobbly clay loam and extremely cobbly clay loam.

Permeability of the Whitore soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is 66 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Firada soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from fractured hard limestone. Typically, the surface is covered by a mat of forest litter of needles and twigs about 1 1/2 inches thick. The surface layer is light gray cobbly clay loam about 3 inches thick. The subsoil is brown and pale brown very cobbly clay loam about 14 inches thick. The substratum is light brownish gray extremely flaggy clay loam about 8 inches thick. Limestone is at a depth of about 25 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Firada soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used mainly as rangeland. They are also used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The Whitore and Firada soils are forested. They are poorly suited to livestock grazing. The potential native understory vegetation on the Whitore soil is dominated by raceme pussytoes, arnica, white spirea, sidebells wintergreen, Oregon-grape, yellow bristlegrass, alpine bluebells, Rocky Mountain clematis, slender hawkweed, onion, and mountain sweetroot. The understory provides limited amounts of forage for livestock.

The Whitore soil is suited to the production of Douglas-fir and white spruce. The site index is about 40 for Douglas-fir and 30 for white spruce. At the culmination of the mean annual increment (CMAI), the Whitore soil can produce about 50 cubic feet, or 160 board feet, of Douglas-fir and 35 cubic feet, or 100 board feet (Scribner rule), of white spruce per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is severe, and the hazard of windthrow is moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are slight. Where slopes are 25 to 60 percent, the hazard of erosion and equipment limitations are moderate.

The main limitations of the Whitore soil for management of timber are steepness of slope and low to moderate available water capacity. Where slopes are 25 to 60 percent, the kind of equipment that can be used is restricted and its operation is difficult. Competition from understory vegetation and low to moderate available water capacity make establishment of tree seedlings difficult. Maintaining adequate plant

cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality where slopes of 15 to 60 percent.

The potential native understory vegetation on the Firada soil is dominated by Oregon-grape, white spirea, common snowberry, blue huckleberry, heartleaf arnica, twinflower, northern bedstraw, common pipsissewa, feather solomonseal, and clematis. The understory provides limited amounts of forage for livestock. Where slopes are 30 to 60 percent, the distribution and management of livestock are adversely affected.

The Firada soil is suited to the production of Douglas-fir and white spruce. The site index is about 36 for Douglas-fir and 27 for white spruce. At the culmination of the mean annual increment (CMAI), the Firada soil can produce about 45 cubic feet, or 140 board feet, of Douglas-fir and 45 cubic feet, or 140 board feet (Scribner rule), of white spruce per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is severe, and the hazard of windthrow is moderate. Where slopes are 15 to 25 percent, the hazard of erosion is slight, equipment limitations are slight. Where slopes are 25 to 60 percent, the hazard of erosion and equipment limitations are moderate.

The main limitations of the Firada soil for management of timber are steepness of slope, moderate depth to limestone, and very low available water capacity. Where slopes are 25 to 60 percent, the kind of equipment that can be used is restricted and its operation is difficult. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. The limited soil depth restricts development of plant roots, which results in trees being subject to windthrow. Maintaining small openings or progressively removing trees over a period of several years reduces windthrow. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The main limitations for homesite development on these soils are steepness of slope and moderate depth to limestone in the Firada soil.

This map unit is in capability subclass VIIe, nonirrigated. The Whitore soil is in woodland suitability group 6o1 where slopes are 15 to 25 percent and group 6r1 where slopes are 25 to 60 percent. The Firada soil is in woodland suitability group 6f1 where slopes are 15 to 25 percent and group 6f3 where slopes are 25 to 60 percent.

265—Widen-Hughesville-Lipke complex, 15 to 60 percent slopes. This map unit is on uplands and foot slopes in the south-central part of the county. Slopes commonly are less than 250 to 1,000 feet long. Elevation is 4,200 to 5,300 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 100 days.

This unit is about 30 percent Widen silty clay loam, 20 percent Hughesville very flaggy clay loam on south-facing side slopes, 10 percent Hughesville very flaggy clay loam on north-facing side slopes, and 25 percent Lipke clay loam. The Widen and Hughesville soils are on uplands, and the Lipke soil is on foot slopes.

Included in this unit are small areas of deep Tibs and Whitecow soils on foot slopes and small areas of deep Mocmont soils on uplands. Included areas make up about 15 percent of the total acreage.

The Widen soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated siltstone. Typically, the surface is covered by a mat of conifer forest litter and humus about 1 inch thick. The surface layer is dark gray silt loam about 1 inch thick. The subsurface layer is pinkish gray silty clay loam about 3 inches thick. The upper 8 inches of the subsoil is brown silty clay, and the lower 24 inches is pale yellow silty clay. Pale yellow siltstone is at a depth of about 36 inches. Depth to siltstone ranges from 20 to 40 inches.

Permeability of the Widen soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Hughesville soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from fractured hard limestone. Typically, the surface is covered by a mat of forest litter of decomposed and undecomposed needles, twigs, and cones about 2 inches thick. The surface layer is dark grayish brown flaggy loam about 2 inches thick. The upper 8 inches of the subsoil is brown very flaggy clay loam, and the lower 12 inches is pale brown very flaggy loam. The upper 10 inches of the substratum is light gray extremely flaggy loam, and the lower 6 inches is white extremely flaggy loam. Limestone is at a depth of about 38 inches. Depth to limestone ranges from 20 to 40 inches.

Permeability of the Hughesville soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Lipke soil is deep and well drained. It formed in alluvium and residuum derived dominantly from shale. Typically, the surface is covered by a mat of pine cones, needles, twigs, and humus about 2 inches thick. The surface layer is dark grayish brown clay loam about 1 inch thick. The next layer is dark grayish brown and

grayish brown clay loam about 11 inches thick. The upper 8 inches of the subsoil is light brownish gray clay, and the lower 22 inches is brown and pale brown clay. The substratum to a depth of 60 inches or more is light yellowish brown and gray clay.

Permeability of the Lipke soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Most areas of the soils in this unit are used as rangeland. A few areas are used as woodland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

These soils are forested. They are suited to livestock grazing. The potential native understory vegetation on the Widen soil is dominated by common snowberry, Columbia needlegrass, Idaho fescue, blue wildrye, Oregon-grape, Woods rose, common juniper, black hawthorn, russet buffaloberry, bluebunch wheatgrass, and northern bedstraw. The understory provides moderate amounts of forage for livestock.

The Widen soil is suited to the production of ponderosa pine and Douglas-fir. The site index is about 60 for ponderosa pine and 30 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the Widen soil can produce about 45 cubic feet, or 130 board feet, of ponderosa pine and 35 cubic feet, or 100 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is moderate, plant competition is moderate, and the hazard of windthrow is moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 25 to 60 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Widen soil for management of timber are slow permeability, steepness of slope, soil texture, and low soil strength. Slow permeability and steepness of slope increase the hazard of erosion. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. The clay loam texture of the surface layer limits the use of equipment. The soil has low strength when wet, which results in poor trafficability and in soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes these limitations. Reduction of plant competition helps in establishing seedlings.

The potential native understory vegetation on the south-facing slopes of the Hughesville soil is dominated by common juniper, arrowleaf balsamroot, Idaho fescue, Engelmann aster, Oregon-grape, horizontal juniper, Rocky Mountain juniper, Columbia needlegrass, and bluebunch wheatgrass. The understory provides moderate amounts of forage for livestock.

The south-facing slopes of the Hughesville soil are suited to the production of ponderosa pine. The site index is about 50. At the culmination of the mean annual increment (CMAI), the south-facing slopes of the Hughesville soils can produce about 35 cubic feet, or 90 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

The potential native understory vegetation on the north-facing slopes of the Hughesville soil is dominated by common juniper, mallow ninebark, Columbia brome, Woods rose, pinegrass, common snowberry, white spirea, and elk sedge. The understory provides moderate amounts of forage for livestock.

The north-facing slopes of the Hughesville soil are suited to the production of Douglas-fir and ponderosa pine. The site index is about 40 for Douglas-fir and 60 for ponderosa pine. At the culmination of the mean annual increment (CMAI), the north-facing slopes of the Hughesville soil can produce about 55 cubic feet, or 160 board feet, of Douglas-fir and 45 cubic feet, or 130 board feet (Scribner rule), of ponderosa pine per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

On the Hughesville soil, the hazard of erosion is moderate, equipment limitations are moderate, plant competition is severe, and the hazard of windthrow is moderate. Seedling mortality is severe on south-facing slopes and moderate on north-facing slopes.

The main limitations of the Hughesville soil for management of timber are steepness of slope, moderate depth to limestone, and very low available water capacity. Steepness of slope restricts the kind of equipment that can be used and makes its operation difficult. Competition from understory vegetation and very low available water capacity make establishment of tree seedlings difficult. Reduction of plant competition helps in establishing seedlings. The limited soil depth restricts development of plant roots, which results in trees being subject to windthrow. Maintaining small openings or progressively removing trees over a period of several years reduces windthrow. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The potential native understory vegetation on the Lipke soil is dominated by Oregon-grape, common snowberry, white spirea, common chokecherry, Saskatoon serviceberry, heartleaf arnica, blue wildrye, northern bedstraw, western meadowrue, Engelmann aster, starry false solomonseal, and Canada violet. The understory provides moderate amounts of forage for livestock.

The Lipke soil is suited to the production of ponderosa pine and Douglas-fir. The site index is about 78 for ponderosa pine and 37 for Douglas-fir. At the culmination of the mean annual increment (CMAI), the Lipke soil can produce about 65 cubic feet, or 220 board feet, of ponderosa pine and 45 cubic feet, or 140 board feet (Scribner rule), of Douglas-fir per acre per year. Potential production is estimated for an even-aged, fully stocked stand of trees.

Seedling mortality is slight, plant competition is moderate, and the hazard of windthrow is moderate. Where slopes are 15 to 25 percent, the hazard of erosion and equipment limitations are moderate. Where slopes are 25 to 60 percent, the hazard of erosion and equipment limitations are severe.

The main limitations of the Lipke soil for management of timber are slow permeability, steepness of slope, soil texture, and low soil strength. Slow permeability and steepness of slope increase the hazard of erosion. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality. The soil has low strength when wet, which results in poor trafficability and in soil compaction if heavy equipment is used to yard logs. Operating equipment when the soil is dry or frozen overcomes this limitation. Reduction of plant competition helps in establishing seedlings. Maintaining adequate plant cover in disturbed areas and using sediment filter strips of undisturbed vegetation along streams reduce soil erosion and problems of water quality.

The main limitations for homesite development on these soils are steepness of slope, moderate depth to siltstone in the Widen soil, and moderate depth to limestone in the Hughesville soil.

This map unit is in capability subclass VIIe, nonirrigated. The Widen soil is in woodland suitability group 5c2 where slopes are 15 to 25 percent and group 5c6 where slopes are 25 to 60 percent. The south-facing slopes of the Hughesville soil are in woodland suitability group 6f6 where slopes are 15 to 25 percent and group 6f8 where slopes are 25 to 60 percent; and the north-facing slopes are in group 6f2 where slopes are 15 to 25 percent and group 6f4 where slopes are 25 to 60 percent. The Lipke soil is in woodland suitability group 4c2 where slopes are 15 to 25 percent and group 4c4 where slopes are 25 to 45 percent.

266—Windham gravelly loam, 0 to 4 percent slopes. This deep, well drained soil is on terraces in the central and western parts of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are more than 1,000 feet long. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Windham loam and small areas of deep Judith soils. The Judith soils are mainly in concave areas.

Typically, the surface layer of this Windham soil is dark grayish brown gravelly loam about 6 inches thick. The subsoil is pale brown gravelly clay loam about 6 inches thick. The upper 6 inches of the substratum is white very gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, and oats, and for hay and pasture. It is also used as rangeland.

This soil is suited to nonirrigated crops. It is limited mainly by the very low to low available water capacity, low precipitation, and the hazard of soil blowing. Crops that are tolerant of drought are most suitable because the available moisture is not adequate for good growth of most other crops. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, fringed sagewort, and wild rose increases. If excessive grazing continues, plants such as broom snakeweed, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitation for homesite development on this soil is the content of rock fragments. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced

chlorosis are well suited to use in landscaping. An annual application of iron chelates reduces the risk of chlorosis. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. The very gravelly or extremely gravelly material below a depth of about 15 inches is good road fill.

This map unit is in capability subclass IVs, nonirrigated, and in Limy range site, 15- to 19-inch precipitation zone.

267—Windham very gravelly loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of Windham loam, Windham gravelly loam, and Windham very cobbly loam. Also included are small areas of soils that are underlain by sand and gravel at a depth of 15 to 24 inches.

Typically, the surface layer of this Windham soil is dark grayish brown very gravelly loam about 6 inches thick. The subsoil is pale brown very gravelly clay loam about 6 inches thick. The upper 6 inches of the substratum is white very gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used as rangeland.

This soil is poorly suited to cultivated crops and to hay and pasture because it has many small stones in the surface layer and is droughty.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, fringed sagewort, and wild rose increases. If excessive grazing continues, plants such as broom snakeweed, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitation for homesite development on this soil is the content of rock fragments. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. An annual application of iron chelates reduces the chlorosis. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. The very gravelly or extremely gravelly material below a depth of about 6 inches is good roadfill.

This map unit is in capability subclass VIs, nonirrigated, and in Limy range site, 15- to 19-inch precipitation zone.

268—Windham very gravelly loam, 8 to 45 percent slopes. This deep, well drained soil is on the edge of terraces in the central and western parts of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of soils that are underlain by bedrock at a depth of 10 to 40 inches. These soils are along steep and very steep edges of terraces on uplands.

Typically, the surface layer of this Windham soil is dark grayish brown very gravelly loam about 6 inches thick. The subsoil is pale brown very gravelly clay loam about 6 inches thick. The upper 6 inches of the substratum is white very gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

This soil is used as rangeland.

This soil is poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, fringed sagewort, and wild rose increases. If excessive grazing continues, plants such as broom snakeweed, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soil is not suited to mechanical treatment because of slope and rough topography.

This soil is poorly suited to windbreaks. It is limited mainly by slope.

The main limitations for homesite development on this soil are slope and content of rock fragments. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. An annual application of iron chelates reduces the chlorosis. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. The very gravelly or extremely gravelly material below a depth of about 6 inches is good road fill.

This map unit is in capability subclass VIe, nonirrigated, and in Limy range site, 15- to 19-inch precipitation zone.

269—Windham very stony loam, 2 to 15 percent slopes. This deep, well drained soil is on fans and terraces in the central and western parts of the county. It formed in alluvium derived dominantly from limestone. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of shallow Castner soils and moderately deep Winifred soils on uplands. Also included are small areas of deep Judith soils and soils that are similar to this Windham soil but have slopes of 15 to 25 percent.

Typically, the surface layer of this Windham soil is dark grayish brown very stony loam about 6 inches thick. The subsoil is pale brown very gravelly clay loam about 6 inches thick. The upper 6 inches of the substratum is white very gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This soil is used as rangeland.

This soil is poorly suited to cultivated crops and to hay and pasture because of the large stones in the surface layer.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, fringed sagewort, and wild rose increases. If excessive grazing continues, plants such as broom snakeweed, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of this soil is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. This unit is not suited to mechanical treatment because of the large stones in the surface layer.

This soil is poorly suited to windbreaks. It is limited by stoniness.

The main limitation for homesite development on this soil is content of rock fragments. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. An annual application of iron chelates reduces the chlorosis. Removal of stones from the surface is necessary for landscaping and establishment of lawns. The very gravelly or extremely gravelly material below a depth of about 6 inches is good road fill.

This map unit is in capability subclass VIs, nonirrigated, and in Limy range site, 15- to 19-inch precipitation zone.

270—Winifred clay loam, 2 to 8 percent slopes. This moderately deep, well drained, undulating and gently rolling soil is on uplands in the central and western parts of the county. It formed in alluvium and residuum derived dominantly from semiconsolidated shale. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep Judith soils on terrace remnants and deep Linwell soils on fans and foot slopes. The Judith soils are underlain by very gravelly material below a depth of about 24 inches.

Typically, the surface layer of this Winifred soil is dark grayish brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of water erosion and soil blowing. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Winifred soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

271—Winifred-Castner-Norbert complex, 8 to 45 percent slopes. This map unit is on uplands in the south-central part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 4,000 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 40 percent Winifred silty clay loam, 30 percent Castner channery loam, and 20 percent Norbert clay. The Winifred soil is on plane and concave side slopes, and the Castner and Norbert soils are on convex side slopes.

Included in this unit are small areas of deep Linwell soils on fans and foot slopes and small areas of Rock outcrop on ridge crests. The Linwell soils have slopes of 8 to 15 percent. Included areas make up about 10 percent of the total acreage.

The Winifred soil is moderately deep and well drained. It formed in alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown silty clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown silty clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Castner soil is shallow and well drained. It formed in loamy residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is grayish brown channery loam about 7 inches thick. The underlying material is pale brown very channery loam about 7 inches thick. Light gray sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Castner soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Norbert soil is shallow and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is olive gray clay about 3 inches thick. The upper 6 inches of the underlying material is olive gray clay, and the lower 8 inches is gray shaly clay. Olive gray shale is at a depth of about 14 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Norbert soil is very slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Winifred soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential plant community on the Castner soil is mainly rough fescue, bluebunch wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of Idaho fescue, blue grama, needleandthread, and prairie junegrass increases. If excessive grazing continues, plants such as Kentucky bluegrass, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,200 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential plant community on the Norbert soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and big sagebrush. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, Sandberg bluegrass, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as broom snakeweed, pricklypear, perennial weeds, and annuals may invade. The potential plant community produces about 1,100 pounds of air-dry vegetation in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. These soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the Winifred and Norbert soils are slow and very slow permeability, slope, moderate and shallow depth to shale, shrink-swell potential, and low soil strength. These soils are severely limited for septic tank absorption fields because of the slow and very slow permeability, slope, and moderate and shallow depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Castner soil are slope, shallow depth to sandstone, potential frost action, and content of rock fragments. The soil is severely limited for septic tank absorption fields because of slope and shallow depth to sandstone. Cuts to level building sites can expose sandstone. Frost action can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIIe, nonirrigated. The Winifred soil is in Clayey range site, 15- to 19-inch precipitation zone, the Castner soil is in Shallow range site, 15- to 19-inch precipitation zone, and the Norbert soil is in Shallow Clay range site, 15- to 19-inch precipitation zone.

272—Winifred-Judith clay loams, 4 to 8 percent slopes. This map unit is on uplands and terraces in the central and western parts of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Winifred clay loam and 30 percent Judith clay loam. The Winifred soil is on uplands, and the Judith soil is on terraces.

Included in this unit are small areas of Judith gravelly clay loam on convex side slopes and small areas of deep Linwell soils on foot slopes and fans. Included areas make up about 20 percent of the total acreage.

The Winifred soil is moderately deep and well drained. It formed in local alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Judith soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper 11 inches of the subsoil is brown and very pale brown clay loam, and the lower 7 inches is white clay loam. The upper 22 inches of the substratum is very pale brown extremely gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy clay loam.

Permeability of the Judith soil is moderate to a depth of about 24 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. They are also used as rangeland.

These soils are well suited to nonirrigated crops. They are limited mainly by the moderate to low available water capacity, low precipitation, and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Winifred soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Judith soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the Winifred soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Judith soil are potential frost action and low soil strength. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The extremely gravelly material below a depth of about 24 inches is good road fill.

This map unit is in capability subclass IIIe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

273—Winifred-Judith clay loams, 8 to 15 percent slopes. This map unit is on uplands and terraces in the central and western parts of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about

43 degrees F, and the average frost-free period is about 120 days.

This unit is about 50 percent Winifred clay loam and 25 percent Judith clay loam. The Winifred soil is on uplands, and the Judith soil is on terraces.

Included in this unit are small areas of Judith gravelly clay loam and small areas of deep Windham soils on terrace edges. Also included are small areas of deep Linwell soils on foot slopes. Included areas make up about 25 prcent of the total acreage.

The Winifred soil is moderately deep and well drained. It formed in local alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Judith soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper 11 inches of the subsoil is brown and very pale brown clay loam, and the lower 7 inches is white clay loam. The upper 22 inches of the substratum is very pale brown extremely gravelly loam, and the lower part to a depth of 66 inches or more is very pale brown extremely gravelly sandy clay loam.

Permeability of the Judith soil is moderate to a depth of about 24 inches and moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the moderate to low available water capacity, low precipitation, and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Winifred soil is suited to windbreaks, but the low to moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Judith soil is suited to windbreaks, but the high concentration of lime at a depth of less than 15 inches and the limited moisture supply restrict the choice of trees and shrubs. Suitable trees for planting are Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, and skunkbush sumac.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on the Winifred soil are slow permeability, moderate depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Judith soil are potential frost action and low soil strength. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. The extremely gravelly material below a depth of about 24 inches is good road fill.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

274—Winifred-Linwell clay loams, 8 to 15 percent slopes. This map unit is on uplands, fans, and foot slopes in the central and western parts of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 40 percent Winifred clay loam and 35 percent Linwell clay loam. The Winifred soil is on uplands, and the Linwell soil is on fans and foot slopes.

Included in this unit are small areas of moderately deep Eltsac soils on uplands and small areas of deep, gravelly Windham soils on ridges. Included areas make up about 25 percent of the total acreage.

The Winifred soil is moderately deep and well drained. It formed in local alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Linwell soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is grayish brown clay loam about 6 inches thick. The subsoil is grayish brown and light brownish gray silty clay loam about 22 inches thick. The substratum to a depth of 66 inches or more is light brownish gray silty clay loam.

Permeability of the Linwell soil is slow. Available water capacity is high. Effective rooting depth is 66 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used mainly for hay and pasture and as rangeland. They are also used for nonirrigated crops such as wheat, barley, and oats.

These soils are suited to nonirrigated crops. They are limited mainly by the hazards of water erosion and soil blowing. Minimum tillage, contour cultivation, grassed waterways, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing and water erosion.

The potential plant community on these soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,000 pounds of air-dry vegetation in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Winifred soil is suited to windbreaks, but the moderate available water capacity limits the growth of both trees and shrubs. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

The Linwell soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster.

Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings on these soils. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on these soils are slow permeability, shrink-swell potential, low soil strength, and moderate depth to shale in the Winifred soil. The soils are severely limited for septic tank absorption fields because of the slow permeability and the moderate depth to shale in the Winifred soil. If the Linwell soil is used for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption field. Cuts to level building sites can expose shale in the Winifred soil. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey range site, 15- to 19-inch precipitation zone.

275—Winifred-Windham-Eltsac complex, 15 to 45 percent slopes. This map unit is on uplands and terraces in the western and southern parts of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

This unit is about 40 percent Winifred clay loam, 25 percent Windham very gravelly loam, and 25 percent Eltsac clay. The Winifred soil is on plane side slopes of uplands, the Windham soil is on terrace edges, and the Eltsac soil is on uplands.

Included in this unit are small areas of shallow Norbert soils on ridges and deep Lawther soils on foot slopes and fans. Included areas make up about 10 percent of the total acreage.

The Winifred soil is moderately deep and well drained. It formed in local alluvium and residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay loam about 3 inches thick. The upper 3 inches of the subsoil is dark grayish brown clay loam, the next 8 inches is grayish brown silty clay, and the lower 18 inches is grayish brown clay. Light brownish gray and yellowish brown shale is at a depth of about 32 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Winifred soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Windham soil is deep and well drained. It formed in loamy alluvium derived dominantly from limestone. Typically, the surface layer is dark grayish brown very gravelly loam about 6 inches thick. The subsoil is pale brown very gravelly clay loam about 6 inches thick. The upper 6 inches of the substratum is white very gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly loam.

Permeability of the Windham soil is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Eltsac soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is dark grayish brown clay about 4 inches thick. The upper 17 inches of the underlying material is grayish brown clay, the next 8 inches is grayish brown and gray clay, and the lower 9 inches is dark gray and yellowish brown clay and shale fragments. Dark gray shale is at a depth of about 38 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Eltsac soil is very slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Winifred and Eltsac soils is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and Idaho fescue. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of Idaho fescue, plains reedgrass, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as broom snakeweed, Kentucky bluegrass, perennial weeds, and annuals may invade. The potential plant community produces about 2,300 pounds of air-dry vegetation in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential plant community on the Windham soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, fringed sagewort, and wild rose increases. If excessive grazing continues, plants such as broom snakeweed, clubmoss, perennial weeds, and annuals may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the Winifred and Eltsac soils are slow and very slow permeability, slope, moderate depth to shale, shrink-swell potential, and low soil strength. The soils are severely limited for septic tank absorption fields because of the slow and very slow permeability, slope, and moderate depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

The main limitations for homesite development on the Windham soil are slope and content of rock fragments. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass VIIe, nonirrigated. The Winifred and Eltsac soils are in Clayey range site, 15- to 19-inch precipitation zone, and the Windham soil is in Limy range site, 15- to 19-inch precipitation zone.

276—Work clay loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium. Slopes commonly are more than 1,000 feet long. Elevation is 3,500 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer of this Work soil is gray clay loam about 6 inches thick. The upper 25 inches of the subsoil is brown and grayish brown clay loam, and the lower 5 inches is grayish brown loam. The substratum to a depth of 60 inches or more is grayish brown sandy clay loam.

Included in this unit are small, concave areas of deep Daglum soils that are salt and sodium affected.

Permeability is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 1,600 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderately slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

277—Work clay loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the central and western parts of the county. It formed in alluvium. Slopes commonly are 250 to 1,000 feet long. Elevation is 3,500 to 4,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Included in this unit are small areas of deep, salt- and alkali-affected Daglum soils in concave areas and small areas of deep Roy soils on fans near the Judith Mountains.

Typically, the surface layer of this Work soil is gray clay loam about 6 inches thick. The upper 25 inches of the subsoil is brown and grayish brown clay loam, and the lower 5 inches is grayish brown loam. The substratum to a depth of 60 inches or more is grayish brown sandy clay loam.

Permeability is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used primarily for nonirrigated crops, mainly wheat, barley, oats, alfalfa, and grass for hay and pasture. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of soil blowing and water erosion. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, and needleandthread. If the range is excessively grazed, the proportion of some of these plants decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama increases. If excessive grazing continues, plants such as Kentucky bluegrass, timothy, clubmoss, and perennial weeds may invade. The potential plant community produces about 1,600 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Where clubmoss and blue grama are the dominant vegetation on this soil, pitting, furrowing, chiseling, or other mechanical treatment practices can be used to improve depleted rangeland. This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

This soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings. Planting on the contour helps to conserve moisture.

The main limitations for homesite development on this soil are moderately slow permeability, shrink-swell potential, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 15- to 19-inch precipitation zone.

278—Yamac loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in the northeastern part of the county. It formed in alluvium derived from mixed rock sources. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,400 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of Chinook and Kobar soils. The Chinook soils formed in deep, sandy eolian and alluvial material, and the Kobar soils formed in deep clayey alluvium.

Typically, the surface layer of this Yamac soil is grayish brown loam about 3 inches thick. The upper 4 inches of the subsoil is grayish brown loam, the next 5 inches is light brownish gray silt loam, and the lower 10 inches is light brownish gray silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray loam and silty clay loam.

Permeability is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This soil is used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazards of water erosion and soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Minimum tillage, contour cultivation, grassed waterways, stripcropping, and growing sod crops such as hay and pasture help to control soil blowing and water erosion. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as pricklypear, perennial weeds, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

The Yamac soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 10- to 14-inch precipitation zone.

279—Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes. This map unit is on foot slopes, fans, and uplands in the northeastern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,400 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 35 percent Yamac loam, 30 percent Delpoint loam, and 15 percent Yawdim clay loam. The Yamac soil is on foot slopes and fans. The Delpoint and Yawdim soils are on uplands (fig. 6).

Included in this unit are small areas of shallow Cabbart soils on ridges. Also included are small areas of moderately deep Abor soils in convex areas and deep salt- and alkali-affected Gerdrum and Absher soils on fans and foot slopes. The Absher soils have a crusty surface layer and are nearly barren of vegetation. Included areas make up about 20 percent of the total acreage.

The Yamac soil is deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper 4 inches of the subsoil is grayish brown loam, the next 5 inches is light brownish gray silt loam, and the lower 10 inches is light brownish gray silty clay loam. The substratum to a depth of 60 inches or more is light brownish gray loam and silty clay loam.

Permeability of the Yamac soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 24 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Delpoint soil is moderately deep and well drained. It formed in residuum derived from weakly consolidated, sandy and silty sedimentary beds. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper 8 inches of the subsoil is light brownish gray loam, and the lower 6 inches is light gray loam. The substratum is light gray loam about 8 inches thick. Light gray, weakly consolidated, sandy and silty sedimentary beds are at a depth of about 25 inches. Depth to sedimentary beds ranges from 20 to 40 inches.

Permeability of the Delpoint soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil

Figure 6.—Typical area of Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes. The Yamac and Delpoint soils are in concave or smooth areas, and the Yawdim soil is in convex areas.

is under native vegetation is 20 to 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Yawdim soil is shallow and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown clay loam about 3 inches thick. The underlying material is grayish brown silty clay loam about 9 inches thick. Grayish brown, gray, and light olive brown shale is at a depth of about 12 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Yawdim soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Yamac and Delpoint soils is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as pricklypear, perennial weeds, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential plant community on the Yawdim soil is mainly bluebunch wheatgrass, western wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and threadleaf sedge increases. If excessive grazing continues, plants such as red threeawn, annuals, and perennial weeds may invade. The potential plant community produces about 900 pounds of air-dry vegetation in years of above-normal precipitation and 500 pounds in years of below-normal precipitation.

These soils are suitable for seeding to adapted grasses and forbs if the range is in poor condition. Seedbed preparation and planting on the contour or across the slope, where practical, conserve moisture and help to control water erosion. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on the Yamac soil are moderate permeability, slope, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption field. Slope is also a concern. Absorption lines should be installed on the contour. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

The main limitations for homesite development on the Delpoint soil are moderate permeability, slope, moderate depth to sedimentary beds, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the slow permeability of the underlying sedimentary beds can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Frost action and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

The main limitations for homesite development on the Yawdim soil are slow permeability, slope, shallow depth to shale, shrink-swell potential, and low soil strength. The soil is severely limited for septic tank absorption fields because of the slow permeability and shallow depth to shale. Cuts to level building sites can expose shale. Shrinking and swelling and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass VIe, nonirrigated. The Yamac and Delpoint soils are in Silty range site, 10- to 14-inch precipitation zone, and the Yawdim soil is in Shallow range site, 10- to 14-inch precipitation zone.

280—Yamac Variant loam. This deep, well drained soil is on terraces in the eastern part of the county. It formed in alluvium derived from mixed rock sources. Slope ranges from 0 to 2 percent. Slopes commonly are more than 1,000 feet long. Elevation is 2,400 to 3,400 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

Included in this unit are small areas of soils that are similar to this Yamac Variant soil but have a surface layer of fine sandy loam.

Typically, the surface layer of this Yamac Variant soil is grayish brown loam about 4 inches thick. The subsoil is grayish brown and light brownish gray loam about 21 inches thick. The upper 14 inches of the substratum is pale brown loam, the next 5 inches is grayish brown silty

clay, the next 6 inches is pale brown loam, and the lower part to a depth of 66 inches or more is grayish brown silty clay.

Permeability is moderate to a depth of about 39 inches and moderately slow below this depth. Available water capacity is high. Effective rooting depth is 60 inches or more. The average annual wetting depth where this soil is under native vegetation is about 24 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used mainly for hay and pasture and for nonirrigated crops such as wheat, barley, and oats. It is also used as rangeland.

This soil is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grains and summer fallow is best. Stripcropping, tall grass barriers, field windbreaks, minimum tillage, stubble-mulch tillage, and growing sod crops such as hay and pasture help to control soil blowing.

The potential plant community on this soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as pricklypear, perennial weeds, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This soil is suitable for seeding to adapted grasses and forbs if the range is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or if the range is overgrazed.

The Yamac soil is well suited to windbreaks. Suitable trees for planting are Russian-olive, Siberian crabapple, green ash, Siberian elm, white willow, ponderosa pine, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, lilac, common chokecherry, silver buffaloberry, and cotoneaster. Summer fallow, cultivation for weed control, and adapted plants are needed to insure establishment and survival of seedlings.

The main limitations for homesite development on this soil are moderately slow permeability, shrink-swell potential, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling, frost action, and low soil strength can damage roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. In the construction of basements or foundations for dwellings, the shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated, and in Silty range site, 10- to 14-inch precipitation zone.

281—Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes. This map unit is on uplands in the northern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 35 percent Yawdim silty clay loam, 25 percent Abor clay loam, and 15 percent Rentsac channery loam. The Abor soil has slopes of 8 to 45 percent, the Yawdim soil has slopes of 8 to 50 percent, and the Rentsac soil has slopes of 8 to 60 percent.

Included in this unit are small areas of deep Kobar and Yamac soils on foot slopes and fans, shallow Cabbart soils on uplands, and Rock outcrop.

The Yawdim soil is shallow and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown silty clay loam about 3 inches thick. The underlying material is grayish brown silty clay loam about 9 inches thick. Grayish brown, gray, and light olive brown semiconsolidated shale is at a depth of about 12 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Yawdim soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Abor soil is moderately deep and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown clay loam about 6 inches thick. The subsoil is light brownish gray and olive silty clay about 24 inches thick. Pale yellow shale is at a depth of about 30 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Abor soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Rentsac soil is shallow and well drained. It formed in residuum derived dominantly from fractured hard sandstone. Typically, the surface layer is pale olive channery loam about 3 inches thick. The next layer is pale brown channery loam about 4 inches thick. The underlying material is light yellowish brown extremely flaggy loam about 10 inches thick. Light gray sandstone is at a depth of about 17 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Rentsac soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Yawdim soil is mainly bluebunch wheatgrass, western wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and threadleaf sedge increases. If excessive grazing continues, plants such as red threeawn, annuals, and perennial weeds may invade. The potential plant community produces about 900 pounds of air-dry vegetation in years of above-normal precipitation and 500 pounds in years of below-normal precipitation.

The potential plant community on the Abor soil is mainly western wheatgrass, green needlegrass, bluebunch wheatgrass, and thickspike wheatgrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of plains reedgrass, Sandberg bluegrass, prairie junegrass, and big sagebrush increases. If excessive grazing continues, plants such as perennial weeds, broom snakeweed, curlycup gumweed, and annual bromes may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential plant community on the Rentsac soil is mainly bluebunch wheatgrass, western wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and threadleaf sedge increases. If excessive grazing continues, plants such as red threeawn, annuals, and perennial weeds may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on these soils are steepness of slope, shallow depth to shale in the Yawdim soil, moderate depth to shale in the Abor soil, and shallow depth to hard sandstone in the Rentsac soil.

This map unit is in capability subclass VIIe, nonirrigated. The Yawdim and Rentsac soils are in Shallow range site, 10- to 14-inch precipitation zone, and the Abor soil is in Clayey range site, 10- to 14-inch precipitation zone.

282—Yawdim-Delpoint-Rock outcrop complex, 25 to 50 percent slopes. This map unit is on uplands in the northern part of the county. Slopes commonly are 250 to 1,000 feet long. Elevation is 2,400 to 3,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is about 130 days.

This unit is about 30 percent Yawdim clay loam, 25 percent Delpoint loam, and 25 percent Rock outcrop. The Yawdim soil is on convex side slopes, the Delpoint soil is on plane and convex side slopes, and Rock outcrop is on ledges and side slopes. The Delpoint soil has slopes of 25 to 45 percent, and the Yawdim soil has slopes of 25 to 50 percent.

Included in this unit are small areas of shallow Cabbart and Rentsac soils and moderately deep Abor soils on uplands. Also included are small areas of deep Kobar and Yamac soils on foot slopes. These included soils make up about 20 percent of this unit.

The Yawdim soil is shallow and well drained. It formed in residuum derived dominantly from semiconsolidated shale. Typically, the surface layer is grayish brown clay loam about 3 inches thick. The underlying material is grayish brown silty clay loam about 9 inches thick. Grayish brown, gray, and light olive brown semiconsolidated shale is at a depth of about 12 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Yawdim soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. The average annual wetting depth where this soil is under native vegetation is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Delpoint soil is moderately deep and well drained. It formed in residuum derived dominantly from weakly consolidated, sandy and silty sedimentary beds. Typically, the surface layer is grayish brown loam about 3 inches thick. The upper 8 inches of the subsoil is light brownish gray loam, and the lower 6 inches is light gray loam. The substratum is light gray loam about 8 inches thick. Light gray, weakly consolidated, sandy and silty sedimentary beds are at a depth of about 25 inches. Depth to sedimentary beds ranges from 20 to 40 inches.

Permeability of the Delpoint soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. The average annual wetting depth where this soil is under native vegetation is 20 to 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Rock outcrop consists of exposures of sandstone and small areas of shale. The sandstone is on ledges, and the shale is on very steep side slopes.

The soils in this unit are used as rangeland.

These soils are poorly suited to cultivated crops and to hay and pasture because of steepness of slope and rough topography.

The potential plant community on the Yawdim soil is mainly bluebunch wheatgrass, western wheatgrass, plains muhly, and green needlegrass. If the range is excessively grazed, the proportion of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and threadleaf sedge increases. If excessive grazing continues, plants such as red threeawn, annuals, and perennial weeds may invade. The potential plant community produces about 800 pounds of air-dry vegetation in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The potential plant community on the Delpoint soil is mainly bluebunch wheatgrass, western wheatgrass, green needlegrass, and needleandthread. If the range is excessively grazed, the proportion of most of these plants decreases and the proportion of needleandthread, blue grama, prairie junegrass, and fringed sagewort increases. If excessive grazing continues, plants such as pricklypear, perennial weeds, annuals, and clubmoss may invade. The potential plant community produces about 1,400 pounds of air-dry vegetation in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or if the range is overgrazed. The soils are not suited to mechanical treatment because of slope and rough topography.

These soils are poorly suited to windbreaks. They are limited mainly by slope.

The main limitations for homesite development on these soils are steepness of slope, shallow depth to shale in the Yawdim soil, and moderate depth to sedimentary beds in the Delpoint soil.

This map unit is in capability subclass VIIe, nonirrigated. The Yawdim soil is in Shallow range site, 10- to 14-inch precipitation zone, and the Delpoint soil is in Silty range site, 10- to 14-inch precipitation zone.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the county. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help in avoiding soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; and as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main cultivated crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 25 percent of Fergus County is cropland. Winter wheat is the principal crop. Barley, spring wheat, alfalfa hay, grass hay, and oats are other important crops. Safflower and sunflower are grown as oilseed crops.

The main considerations in managing nonirrigated cropland are conserving moisture, reducing soil blowing and water erosion, controlling weeds, and maintaining soil fertility. Soil blowing and water erosion can be reduced and moisture can be conserved by protecting the surface with stubble mulch, stripcropping and contour farming, field windbreaks, grassed waterways, timely tillage, minimum tillage, and a cover crop or grass in moderately steep areas. Generally, a combination of several practices is used. Controlling erosion helps to maintain fertility. All of the soils in the county used as cropland respond to fertilizer.

Fergus County has some irrigated cropland or pastureland. The most common needs in managing irrigated soils are using water efficiently, maintaining fertility, and controlling erosion. The irrigation system is chosen to provide optimum control and distribution of water at minimum cost. Overirrigation wastes water, leaches plant nutrients, and erodes the soil. It also creates drainage problems, raises the water table, and increases soil salinity.

Erosion of streambanks is a major concern in the irrigated valleys. A solution to the problem of streambank erosion from waste irrigation water is to retain a grass barrier between streambanks and cropland. Close, continuous grazing and trailing by livestock also contribute to streambank erosion. Eliminating this source of erosion could be accomplished by not grazing these areas when the soils are high in content of moisture and by shortening the length of the grazing period in these areas.

Wet salty areas, or saline seeps, are a major problem on terraces, fans, and foot slopes in areas of nonirrigated cropland, hayland, and rangeland. These saline seeps are caused primarily by water moving below the root zone during periods of high precipitation or during the summer fallow period in a crop-fallow system.

Intermittent ponding of water on the surface also contributes to deep percolation. In all cases, the water moves through the substratum and dissolves salts as it moves downslope, where it resurfaces to form saline seeps. For farmers and landowners, seeps cause severe economic losses and are nonproductive. They commonly are too wet to farm across and are inconvenient and time consuming to farm around. Once formed, saline seeps may increase in size at the rate of 5 to 10 percent per year. In areas of rangeland, the seeps commonly are below dams or are downslope from cropland.

The best solution to the saline seep problem on nonirrigated cropland is to use the water where it falls by cropping more intensively. This requires using annual or flexible cropping systems or seeding legumes or grasses. Annual cropping with adequate fertilization prevents the development of saline seeps in some fields.

Where saline seeps are already present and increasing in size, use of deep-rooted legumes and grasses probably will be necessary to halt the process and initiate reclamation. The depth to the impermeable or slowly permeable layer is important to the choice of crops. Where depth to the layer is more than 10 feet, growing legumes will dry out the deep subsoil and provide a reservoir for the storage of surplus water. For this purpose, alfalfa is the best perennial tested to date, but sainfoin and cicer milkvetch are also good. Where depth to the layer is 6 to 10 feet, biennial sweetclover and grasses are well suited. Where depth to the layer is less than 6 feet, growing annual cereal crops is a good method of controlling the development of saline seeps in many places. Adequate fertilization is important because it increases the rooting depth of barley and wheat by 1 foot to 2 feet and increases the use of soil water by 1 inch to 3 inches.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields shown in table 5 for soils in the 10- to 14-inch precipitation zone are for a crop-fallow cropping system. The yields for soils in the 15- to 19-inch precipitation zone are for a flexible cropping system that includes summer fallow only when there is insufficient moisture for annual cropping. The yields for soils in a precipitation zone of more than 19 inches are for an annual cropping system.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the county, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for these crops.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

About 63 percent of the total acreage in Fergus County is rangeland. The average ranch is about 2,800 acres, of which about 1,800 acres is rangeland. The rangeland supports dominantly grasses, grasslike plants, forbs, and shrubs. This vegetation helps to conserve water and maintain stable watersheds.

Cow-and-calf operations are most common in the survey area. Cattle and sheep graze at least 6 months during the year, generally from May through September. Livestock also graze when there is only a light cover of snow.

The production of the potential plant community is the amount of herbage, including roots, that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all herbage, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruit of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry herbage for years of above-normal and below-normal precipitation. In a year of above-normal precipitation the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a year of below-normal precipitation, growing conditions are well below average, generally because of low available soil moisture. The amount of the herbage that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more nearly the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The condition of the plant community in many parts of the survey area is a result of prolonged heavy grazing. The more desirable forage plants have decreased and have been replaced by less desirable plants. The density and vigor of the plants are less than those of the potential plant community. About 45 percent of the rangeland in Fergus County is producing at half of its potential or less.

Additional information on rangeland is given in the map unit descriptions in the section "Detailed soil map units."

woodland management and productivity

About 14 percent of the land in Fergus County is forested. To aid those who manage forest land in the county, soil interpretations relating to woodland use and management have been developed. Woodland management information for each forested soil is presented in the map unit descriptions in the section "Detailed soil map units." Following is a list of the map units in this survey area that support a forest resource.

31	Bridger Variant clay loam, 15 to 60 percent slopes
64	Dilts-Julin-Rock outcrop complex, 15 to 60 percent slopes

65 Dilts-Thebo-Neldore clays, 4 to 60 percent slopes
66 Dilts-Welter-Julin complex, 4 to 25 percent slopes
76 Dryadine flaggy silt loam, 2 to 25 percent slopes
81 Elve-Arcette complex, 15 to 60 percent slopes
102 Firada-Sheege-Rock outcrop complex, 25 to 60 percent slopes
118 Havre and Harlem soils, occasionally flooded
124 Hughesville-Skaggs flaggy loams, 15 to 60 percent slopes
125 Hughesville-Tibs-Whitecow complex, 2 to 25 percent slopes
168 Mocmont very gravelly loam, 15 to 60 percent slopes
169 Mocmont-Lipke association, steep
170 Mocmont-Oraid complex, 2 to 25 percent slopes
171 Mocmont-Oraid complex, 25 to 60 percent slopes
172 Mocmont-Oraid complex, warm, 4 to 60 percent slopes
173 Mocmont-Roy flaggy loams, 15 to 45 percent slopes
177 Nesda Variant complex
178 Nesda-Sudworth complex, occasionally flooded
217 Tally-Flasher complex, 25 to 45 percent slopes
236 Tibs-Whitecow cobbly clay loams, 25 to 60 percent slopes
237 Tibs-Widen-Mocmont complex, 15 to 45 percent slopes
238 Tigeron very gravelly loam, 15 to 60 percent slopes
243 Tomty complex, 4 to 25 percent slopes
244 Tomty-Delette complex, 8 to 25 percent slopes
261 Whitecow-Hughesville complex, 2 to 20 percent slopes
262 Whitecow-Hughesville complex, 20 to 60 percent slopes
263 Whitecow-Hughesville-Rock outcrop complex, 45 to 60 percent slopes
264 Whitore-Firada cobbly clay loams, 15 to 60 percent slopes
265 Widen-Hughesville-Lipke complex, 15 to 60 percent slopes

Potential yield estimates presented in the map units, with the exception of those for plains cottonwood, were determined from graphs of average annual yield at the culmination of the mean annual increment (CMAI) versus site index. The curves were developed through the adjustment of data presented in published yield tables. "Tables of yields and mean annual increments of fully stocked stands in major forest types in region one" (*14*) was used for estimating yields of ponderosa pine, Douglas-fir, and white spruce; "Yield tables for managed stands of lodgepole pine in Colorado and Wyoming" (*10*) was used for estimating yields of lodgepole pine; and "The growth and yield of aspen in Saskatchewan" (*8*) was used to estimate yields of quaking aspen. Board foot yield estimates are based upon Scribner's log rule and include those for all trees more than 5 inches in diameter at breast height (dbh). Total cubic foot yields are based on all trees more than 0.6 inch dbh excluding bark and twigs.

To estimate yields of plains cottonwood, gross board foot volumes per acre have been determined from field sampling of stands of varying age and growing on soils similar to or the same as those growing in Fergus County. Eight foot logs to a top diameter of 8 inches were measured in determining board foot volumes. A conversion factor of 5.2 board feet per cubic foot was used to determine total cubic foot volume excluding bark and twigs.

Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The following are definitions and explanations of some of the terms used in the woodland interpretation part of the map unit descriptions. They include the kinds of understory plants, the suitability of the plant community for grazing by livestock, timber productivity and species suitability, erosion hazard, equipment limitations, plant competition, seedling mortality, and windthrow hazard.

Suitability of the forest understory plant community for grazing by livestock is a relative rating based upon the animal-unit-months of grazing available per year from the potential native plant community beneath a forest overstory canopy representing the optimum stocking for timber production. Limited suitability for livestock grazing is defined as production of 0.20 to 0.35 animal-unit-months per acre, moderate as 0.36 to 0.55, and high as 0.56 to 0.80.

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. Production can be increased above that indicated by thinning out the forest overstory; however, wood crop production

would be reduced. Many forest stands contain too many trees for optimum timber production. In these stands, both timber production and forage production can be increased by thinning out excess trees.

The potential productivity of merchantable or common trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The specified number of years (base age) varies by the author of the publication used to determine the site index of a species. The specified base age is 50 years for Douglas-fir (*6*), subalpine fir, and white spruce (*5*); 80 years for quaking aspen (*4*); and 100 years for lodgepole pine (*1*) and ponderosa pine (*9*). Site index values for plains cottonwood (base age 30 years) were determined by adjusting site index curves for eastern cottonwood. The site index applies to fully stocked, even-aged, unmanaged stands.

In the map units that include forested soils, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitations* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

Ratings of *windthrow hazard* consider the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The last paragraph of the map unit descriptions lists the woodland suitability group for each soil. Soils assigned to the same group require the same general management and have about the same potential productivity.

The first part of the group symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, r.

The last number in the symbol indicates the group. Groups with the same class and subclass may support different understory vegetation, produce different tree species, or have slight differences in other interpretations, such as equipment limitations and seedling mortality. The woodland suitability group symbol identifies each unique group.

windbreaks

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Windbreaks are discussed in the map unit descriptions in the section "Detailed soil map units." Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Fergus County is rich in recreational resources. Sportsmen enjoy the hunting and fishing opportunities. White-tailed deer, mule deer, Rocky Mountain elk, pronghorn antelope, and black bear are hunted. Bird hunters find ring-necked pheasant, sage grouse, sharp-tailed grouse, ruffed grouse, blue grouse, gray partridge, and Merriam's turkey in the county.

Numerous ponds, lakes, and streams offer a variety of fishing. Big Spring Creek, which flows through Lewistown, is an excellent fishing stream.

For people who enjoy other types of outdoor recreation there are mountains to climb; mining camps, ghost towns, and caves to explore; picnicing and camping areas; and lakes and ponds for water skiing and swimming.

The potential for wintertime recreation also is good. The terrain in the county is ideal for snowmobiling and cross-country skiing.

Knowledge of soils is necessary in properly planning, developing, and maintaining areas used for recreation. The soils of Fergus County are rated in table 6 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 6, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 6 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 8 and interpretations for dwellings without basements and for local roads and streets in table 7.

Camp areas are used intensively for tents and small camping trailers and the accompanying activities of outdoor living. Site preparation is required, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. They are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds are used intensively for field sports—baseball, football, soccer, and other organized games. They require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

By Ronald F. Batchelor, biologist, Soil Conservation Service.

Wildlife is a product of the land. Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water.

The quality and distribution of habitat largely determine wildlife populations. The suitability of a given habitat for a wildlife species depends greatly on the nature of the plant community present, and the quantity, quality, and distribution of a particular element of wildlife habitat are determined by prevailing land use practices and management.

Rating soils for their ability to produce habitat for wildlife does not take into account climatic influences, present use of the soils, juxtaposition of habitat types and elements, or present distribution of wildlife species. For these reasons, onsite evaluation is needed to

determine the suitability of an area for wildlife habitat development. Grassland, coniferous forest, irrigated and nonirrigated cropland, riparian woodland, streams, ponds, marshes, and reservoirs provide a variety of habitats for the wildlife of Fergus County.

The advent of irrigated and nonirrigated farming in the county led to the successful introduction of the ring-necked pheasant and the gray partridge, particularly on the botton lands. This was made possible because of varied land use patterns that include small grain, irrigated crops, annual weeds, and brushy cover. Further increase in the pheasant population, however, is limited by the very farming practices that fostered it. In recent years, use of more intensive clean cultivation and the loss of brushy fence rows, densely vegetated ditchbanks, and other odd areas have resulted in a decline in the number of pheasants. Because many areas of cropland have been converted from small grain to alfalfa and pasture, increased numbers of cattle graze on the flood plains adjacent to and within areas of winter cover for pheasants.

Land management practices beneficial to pheasants include proper grazing use, protection of woody cover from burning or other destruction, and the retention of stubble and waste grain during winter by eliminating fall tillage. Woody plantings, in the form of shelterbelts and hedgerows, on cropland for control of erosion are beneficial to pheasants as well as to numerous nongame birds, especially when they are planned with wildlife needs in mind.

The irrigated and nonirrigated cropland, brushy ditchbanks, and fence rows on the bottom lands in general soil map unit 1 support habitat for ring-necked pheasant. The grainfields, shelter belts, and brushy drainageways in general soil map units 3, 4, 5, and 9 also provide good habitat for pheasant.

General soil map units 6, 9, 10, 13, and 14 have good potential for providing habitat for gray partridge and sharp-tailed grouse. Gray partridge are associated with the areas of cropland and grassland in the county. Sharp-tailed grouse are throughout much of the prairie uplands of the county where grainfields, brushy cover, and an abundance of fruit-bearing shrubs, including chokecherry, rose, snowberry, sumac, and buffaloberry, provide excellent habitat. During winter they readily feed on the stubble and stocks of grain and on grain in cattle feedlots. During dry periods in July or August, they may collect in large shelter belts where water and shade are available.

Gray partridge and sharp-tailed grouse exhibit fluctuating populations that build to a high level and then decline. Such fluctuations appear to be the result of changes in available habitat and weather and possibly the result of disease. Populations of sharp-tailed grouse in the dry sagebrush areas and in the more moist upland prairies vary greatly. When populations are high, sharp-tailed grouse may travel into areas of native grassland, commonly along drainageways surrounded by small grain, to breed. When populations are low, they are more restricted to the upper parts of drainageways, where stands of trees and shrubs are intermingled with areas of grassland.

Land management practices beneficial to sharp-tailed grouse and gray partridge include proper grazing to insure that sufficient vegetation remains for nesting, roosting, and rearing of young and protection of woody vegetation in draws and along fence rows that provides food and shelter. The establishment of properly designed shelterbelts can also benefit sharp-tailed grouse, especially during severe winter weather.

Sage grouse are throughout the county in areas of rangeland that are covered with sagebrush. The best habitat for sage grouse is areas characterized by big sagebrush and silver sagebrush and a variety of forbs and grasses. The brushy drainageways and sagebrush covered rangeland in general soil map units 1, 8, and 11 provide good habitat for sage grouse.

Two species of forest-dwelling grouse, blue grouse and ruffed grouse, are common in the coniferous forests and riparian woodland of the county, especially in the Big Snowy and Judith Mountains. In Montana, blue grouse are closely associated with the true firs and Douglas-fir. The extent and quality of habitat are largely determined by the forest management practices used, grazing, and fire. The brushy thickets, stream bottoms, mixed forests, and grazable woodland of general soil map units 18, 19, and 20 provide habitat for forest grouse.

Various kinds of habitat are important to forest-dwelling grouse. Blue grouse winter at high elevations, and early in spring they descend to semiopen areas of timber for breeding and brood rearing. Ruffed grouse inhabit areas that have a dense cover of mixed coniferous and deciduous trees and shrubs, and they are most often observed along stream bottoms. Adult ruffed grouse may spend most of their lives in an area of less than 2 square miles.

Black bear use various kinds of forest habitat ranging from areas of open ponderosa pine to spruce and fir. In Fergus County black bear most commonly are in the Judith and Big Snowy Mountains. General soil map units 18, 19, and 20 provide most of the habitat for black bear in the county.

Merriam's turkey has been introduced in several areas in the county, especially in the Moccasin Mountains. Suitable habitat generally is restricted to open ponderosa pine forest in areas of rugged terrain. Turkey have been most successful in forests that support ponderosa pine and grasses, deciduous trees, and shrubs in scattered small openings and drainageways. General soil map units 12 and 20, east of Two-Calf Island, support most of the habitat for Merriam's turkey in the county.

Pronghorn antelope occupy the prairies along with domestic livestock; therefore, the potential for maintaining herds of pronghorn antelope in the county

depends on proper management of the rangeland. Competition for food between livestock and pronghorn antelope is not a serious problem on well managed rangeland. Pronghorn antelope use forbs and forage that cattle commonly do not eat unless forced to do so because of overgrazing. General soil map units 7, 8, 11, and 16 provide most of the habitat for the pronghorn antelope in the county.

Both white-tailed deer and mule deer are throughout the county. White-tailed deer generally inhabit the lowlands and valleys, stream bottoms, and lower foothills adjacent to farmland. Mule deer are throughout the Snowy, Judith, and Moccasin Mountains, along the Missouri River breaks, along brushy bottoms, in areas of dissected or broken rangeland, and in other timbered areas. General soil map units 1, 12, 13, 17, and 20 support much of the habitat for white-tailed deer in the county, and general soil map units 1, 2, 12, and 15 provide most of the habitat for mule deer.

Rocky Mountain elk inhabit the Judith Mountains and the breaks of the Missouri River, at the northern end of the county. Habitat for elk generally is confined to rugged breaks and canyons, timbered areas of mountains, and meadows. Elk prefer areas of rangeland in native bunchgrasses, but they can adapt to adjacent woodland. General soil map units 12 and 20 provide most of the habitat for elk in the county.

Beaver, mink, muskrat, and raccoon are throughout areas of the principal watercourses in the county, and cottontail rabbit, badger, ground squirrel, coyote, bobcat, and a variety of small mammals are throughout the county. Marshes, ponds, and reservoirs throughout the county provide habitat for waterfowl during spring and fall migrations. Ducks, geese, and a variety of shore birds and marsh birds use these areas for resting, nesting, and rearing of young.

Big Spring Creek, Warm Spring Creek, the Judith River, and a number of smaller streams, ponds, and reservoirs in Fergus County support rainbow, brown, and brook trout. Warmwater fish such as northern pike, channel catfish, largemouth bass, sauger, and walleye live in the Missouri River and the large reservoirs. Populations of game and nongame species can be enhanced through application of conservation practices that improve habitat. Among these are development of odd or irregularly shaped areas in and adjacent to farmland, protection of such areas from fire and grazing, and establishment of woody vegetation that provides shelter in winter. Wildlife habitat may also be enhanced by increased application of common conservation practices such as proper grazing use, planned grazing systems, stripcropping, minimum tillage, field windbreaks, and the construction of ponds.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Laboratory data are not included as a part of this survey. Analyses of some soils were conducted by the Montana Highway Department, Materials Division, in cooperation with the Federal Highway Administration, Department of Transportation. These data were considered in determining the estimated engineering properties given in tables 11 and 12.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5)

plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 7 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 8 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 8 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is

evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 8 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 8 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 9 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil

after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. The water table may be at a depth of 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They may be wet, and the depth to the water table may be less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 9, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 10 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5

feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help in characterizing key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 11 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. Information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 12 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate or high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or extremely gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 13 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 13 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 13 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 13.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An

artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*15*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 14, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll (*Bor*, meaning northern or cool, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiborolls (*Argi*, meaning argillic horizon, plus *boroll*, the suborder of the Borolls that have a frigid temperature regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiborolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic Typic Argiborolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*13*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*15*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Abor series

The Abor series consists of moderately deep, well drained soils on uplands. These soils formed in residuum and alluvium derived dominantly from semiconsolidated shale. Slope is 2 to 45 percent. Elevation is 2,400 to 4,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Vertic Camborthids.

Typical pedon of an Abor silty clay in an area of Tanna-Abor complex, 2 to 8 percent slopes, in cropland, about 660 feet south and 300 feet east of the northwest corner of sec. 20, T. 21 N., R. 18 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium granular structure; hard, firm, sticky and plastic; slightly effervescent; moderately alkaline; clear wavy boundary.

B2—6 to 19 inches; light brownish gray (2.5Y 6/2) silty clay, olive (5Y 5/3) moist; weak coarse prismatic structure parting to strong medium subangular blocky; extremely hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; few slickensides; strongly effervescent; moderately alkaline; clear wavy boundary.

B3ca—19 to 30 inches; olive (5Y 5/3) silty clay, olive (5Y 4/3) moist; moderate medium subangular structure; extremely hard, firm, sticky and plastic; common fine and very fine roots; common very fine pores; films and streaks of gypsum and lime; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr—30 to 60 inches; pale yellow (5Y 7/4) semiconsolidated shale that crushes to silty clay loam, pale olive (5Y 6/4) moist; massive; hard, firm, sticky and plastic; slightly effervescent; moderately alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches.

The A horizon is clay loam, silty clay loam, or silty clay and averages 35 to 50 percent clay. It is 0 to 15 percent pebbles. It is mildly alkaline or moderately alkaline.

The B and C horizons are silty clay loam or silty clay and average 35 to 60 percent clay. They are moderately alkaline or strongly alkaline.

Absarokee series

The Absarokee series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated shale interbedded with sandstone. Slope is 2 to 45 percent. Elevation is 3,000 to 4,600 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Absarokee clay loam, 2 to 8 percent slopes, in cropland, about 1,320 feet west and 2,220 feet south of the northeast corner of sec. 6, T. 17 N., R. 17 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, very dark gray (10YR 3/2) moist; moderate fine granular structure; hard, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B2t—7 to 15 inches; brown (10YR 5/3) light silty clay, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; continuous clay films on faces of peds; neutral; clear wavy boundary.

B3ca—15 to 18 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—18 to 26 inches; light gray (10YR 7/1) clay loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; 5 percent rock fragments; disseminated lime; violently effervescent; strongly alkaline; abrupt smooth boundary.

Cr—26 to 60 inches; light gray (10YR 7/1) consolidated shale interbedded with sandstone.

Semiconsolidated shale interbedded with sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon is 0 to 10 percent angular pebbles.

The B horizon is clay loam or silty clay and averages 35 to 50 percent clay. It is neutral to moderately alkaline.

The C horizon is clay loam or channery clay loam and averages 30 to 40 percent clay. It is 5 to 35 percent angular pebbles.

Absher series

The Absher series consists of deep, moderately well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 100 to 135 days.

These soils are fine, montmorillonitic Borollic Natrargids.

Typical pedon of an Absher clay loam in an area of Absher-Nobe complex, 0 to 4 percent slopes, in rangeland, about 2,280 feet north and 220 feet west of the southeast corner of sec. 9, T. 15 N., R. 21 E.

A2—0 to 1 1/2 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate very thick platy structure parting to moderate fine and very fine granular; slightly hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many very fine pores; few coarse fragments; neutral; abrupt wavy boundary.

B21t—1 1/2 to 4 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium columnar structure parting to moderate fine and very fine subangular blocky; extremely hard, firm, sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—4 to 10 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 3/2) moist; strong fine and medium subangular blocky structure; extremely hard, firm, sticky and very plastic; many fine and very fine and few medium roots; many fine and very fine and few medium pores; thin continuous clay films on faces of peds; mildly alkaline; gradual irregular boundary.

B3cs—10 to 19 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine and medium subangular blocky structure; extremely hard, firm, sticky and very plastic; common fine and very fine and few medium roots; many fine and very fine pores; common fine irregular disseminated filaments or threads and soft masses of lime, gypsum, and other salts; slightly effervescent; moderately alkaline; diffuse wavy boundary.

C1cs—19 to 26 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and fine subangular blocky structure; extremely hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; few fine irregular disseminated filaments or threads and soft masses of lime, gypsum, and other salts; slightly effervescent; moderately alkaline; diffuse wavy boundary.

C2cs—26 to 33 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; common fine irregular shaped threads and soft masses of lime, gypsum, and other salts; moderately alkaline; diffuse wavy boundary.

C3cs—33 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; many very fine pores; common fine irregular disseminated filaments or threads and soft masses of lime, gypsum, and other salts; slightly effervescent; moderately alkaline.

The solum is 14 to 26 inches thick.

The A horizon is 0 to 10 percent pebbles.

The B2t horizon is clay loam, silty clay loam, or clay and averages 35 to 60 percent clay. It is neutral to moderately alkaline.

The cs horizon is at a depth of 8 to 18 inches. It is clay loam, silty clay, or clay and averages 35 to 50 percent clay. The cs horizon is 0 to 15 percent pebbles.

Acel series

The Acel series consists of deep, well drained soils on terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 2 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Mollic Eutroboralfs.

Typical pedon of an Acel clay loam in an area of Danvers-Acel clay loams, 0 to 2 percent slopes, in cropland, about 2,600 feet east and 1,915 feet south of the northwest corner of sec. 27, T. 19 N., R. 13 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; very hard, friable, sticky and plastic; common vesicular pores; neutral; abrupt smooth boundary.

B21t—6 to 11 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine angular blocky; extremely hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; thin distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—11 to 17 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium and fine subangular blocky; extremely hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; thin distinct clay films on faces of peds; mildly alkaline; clear irregular boundary.

B3ca—17 to 25 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable, sticky and plastic; few fine and very fine roots; many very fine pores; common fine distinct masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—25 to 33 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; many very fine pores; many fine distinct masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—33 to 60 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; massive; hard, friable, sticky and plastic; many very fine pores; disseminated lime; violently effervescent; strongly alkaline.

The mollic epipedon is 7 to 15 inches thick.

The B2t horizon is silty clay or clay and averages 40 to 55 percent clay. The Bca horizon is at a depth of 15 to 20 inches. The Bca and C1ca horizons are clay loam, silty clay loam, or silty clay and average 35 to 45 percent clay. They are 0 to 15 percent pebbles and are moderately alkaline or strongly alkaline.

Adel series

The Adel series consists of deep, well drained soils on fans and foot slopes. These soils formed in alluvium and colluvium derived dominantly from sandstone. Slope is 2 to 45 percent. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine-loamy, mixed Pachic Cryoborolls.

Typical pedon of an Adel loam in an area of Teton-Adel loams, 8 to 15 percent slopes, in rangeland, about 1,050 feet west and 450 feet south of the northeast corner of sec. 9, T. 13 N., R. 18 E.

A11—0 to 13 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; many wormcasts; slightly acid; gradual wavy boundary.

A12—13 to 31 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine and fine pores; many wormcasts; slightly acid; diffuse wavy boundary.

A13—31 to 38 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; neutral; gradual wavy boundary.

B2—38 to 60 inches; brown (10YR 5/3) channery loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting to moderate very fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine pores; 20 percent angular pebbles and 5 percent angular cobbles; neutral.

The mollic epipedon is 16 to 60 inches thick.

The A horizon is 0 to 15 percent angular pebbles. It is slightly acid or neutral.

The B horizon, where present, is loam or clay loam and averages 18 to 30 percent clay. It is 5 to 20 percent angular pebbles and 0 to 5 percent angular cobbles. It is slightly acid or neutral.

Some pedons have a C horizon that has characteristics similar to those of the B horizon.

Adger series

The Adger series consists of deep, moderately well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from shale or mixed rock sources. Slope is 0 to 8 percent. Elevation is 3,400 to 4,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Leptic Natriborolls.

Typical pedon of an Adger clay in an area of Daglum-Adger complex, 2 to 8 percent slopes, in cropland, about 750 feet south and 2,000 feet east of the northwest corner of sec. 34, T. 20 N., R. 15 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; very hard, firm, sticky and very plastic; common very fine roots; many bleached silt and sand grains; moderately alkaline; abrupt smooth boundary.

B21t—6 to 9 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse irregular subangular blocky; extremely hard, very firm, sticky and very plastic; common very fine roots; common very fine pores; thick continuous clay films; moderately alkaline; clear wavy boundary.

B22t—9 to 14 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; extremely hard, very firm, sticky and very plastic; common very fine roots; common very fine pores; thick continuous clay films; intersecting slickensides; strongly alkaline; clear wavy boundary.

B3cs—14 to 37 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few very fine roots; few very fine pores; streaks and clusters of gypsum; few films of lime; strongly alkaline; clear wavy boundary.
C1cs—37 to 60 inches; light olive brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) moist; massive; extremely hard, very firm, sticky and very plastic; distinct streaks and clusters of gypsum; few films of lime; strongly alkaline.

The mollic epipedon is 7 to 14 inches thick. The solum is 24 to 40 inches thick.

The A horizon is 0 to 15 percent pebbles and cobbles.

The Bt horizon is clay or silty clay and averages 40 to 60 percent clay. It is moderately alkaline or strongly alkaline.

The B3 and C horizons are clay loam, silty clay, or clay and average 35 to 55 percent clay. They are 0 to 20 percent pebbles.

Alder series

The Alder series consists of moderately deep, well drained soils on uplands. These soils formed in residuum and alluvium derived dominantly from consolidated shale interbedded with sandstone. Slope is 2 to 45 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine, mixed Udic Argiborolls.

Typical pedon of Alder clay loam, 8 to 15 percent slopes, in rangeland, about 750 feet east and 350 feet north of the southwest corner of sec. 6, T. 14 N., R. 19 E.

A11—0 to 3 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 4/1) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable slightly sticky and plastic; many fine and very fine roots and common medium roots; less than 5 percent rock fragments, mainly less than 3 inches in diameter; neutral; clear smooth boundary.
A12—3 to 8 inches; dark gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores and few medium pores; less than 5 percent rock fragments, mainly less than 3 inches in diameter; neutral; abrupt smooth boundary.
B21t—8 to 15 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; less than 5 percent rock fragments, mainly less than 3 inches in diameter; few wormcasts; mildly alkaline; gradual wavy boundary.
B22t—15 to 21 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 5 percent angular sandstone pebbles; few wormcasts; mildly alkaline; clear wavy boundary.
B23t—21 to 26 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; 10 percent angular sandstone pebbles; moderately alkaline; clear irregular boundary.
B3ca—26 to 31 inches; yellow (10YR 7/6) clay loam, brownish yellow (10YR 6/6) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores and few medium pores; 10 percent angular sandstone pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.
Cr—31 to 60 inches; white (5Y 8/1) consolidated shale interbedded with sandstone.

Consolidated shale interbedded with sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 14 inches thick.

The A horizon is neutral or slightly acid.

The B2t horizon is clay loam, silty clay, or clay and averages 35 to 50 percent clay. It is 0 to 15 percent angular pebbles. It is neutral or mildly alkaline. The B3 horizon is clay loam, silty clay loam, or clay and averages 30 to 45 percent clay. It is 5 to 20 percent angular pebbles and 0 to 10 percent angular cobbles. It is mildly alkaline or moderately alkaline.

Amherst series

The Amherst series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated shale interbedded with sandstone. Slope is 2 to 25 percent. Elevation is 3,000 to 4,600 feet. The average annual precipitation is about

15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are clayey, montmorillonitic Lithic Argiborolls.

Typical pedon of an Amherst clay loam in an area of Amherst-Absarokee clay loams, 2 to 8 percent slopes, in rangeland, about 450 feet south and 2,240 feet west of the northeast corner of sec. 3, T. 15 N., R. 18 E.

A1—0 to 2 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine platy structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; 10 percent angular sandstone pebbles; neutral; clear wavy boundary.

B21t—2 to 5 inches; grayish brown (10YR 5/2) channery clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, sticky and plastic; many very fine roots; many very fine pores; 15 percent angular sandstone pebbles; continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—5 to 12 inches; brown (10YR 5/3) channery clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and very plastic; many very fine roots; many very fine pores; continuous clay films on faces of peds; 30 percent angular sandstone fragments; neutral; gradual smooth boundary.

R—12 to 60 inches; light brownish gray (10YR 6/2) consolidated shale interbedded with thin layers of sandstone.

Consolidated shale interbedded with sandstone is at a depth of 10 to 20 inches. The mollic epipedon is 8 to 15 inches thick.

The A horizon is loam or clay loam and averages 20 to 35 percent clay. It is 0 to 15 percent angular pebbles.

The B horizon is clay loam or clay and is 35 to 50 percent clay. It is 15 to 35 percent rock fragments, of which 0 to 10 percent is angular cobbles and 5 to 25 percent is angular pebbles.

Amor series

The Amor series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 2 to 15 percent. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed Typic Haploborolls.

Typical pedon of Amor loam, 2 to 8 percent slopes, in cropland, about 2,310 feet north and 1,700 feet west of the southeast corner of sec. 21, T. 19 N., R. 14 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, sticky and plastic; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B2—7 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

B3ca—12 to 19 inches; very pale brown (10YR 7/3) loam; brown (10YR 5/3) moist; moderate coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; common fine masses and threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—19 to 27 inches; very pale brown (10YR 7/3) loam; brown (10YR 5/3) moist; weak coarse prismatic structure; hard, friable, sticky and plastic; common very fine and few fine roots; many very fine pores and common fine pores; common fine masses and threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2r—27 to 60 inches; light gray (2.5Y 7/2) weakly consolidated sandy and silty sedimentary beds that crush mainly to loam; grayish brown (2.5Y 5/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 20 to 40 inches. The mollic epipedon is 7 to 12 inches thick.

The A horizon is neutral or mildly alkaline.

The B horizon is loam or clay loam and averages 20 to 30 percent clay. It is neutral to moderately alkaline.

The C horizon is mildly alkaline or moderately alkaline.

Arcette series

The Arcette series consists of deep, excessively drained soils on mountaintops, ridgetops, and uplands. These soils formed in residuum derived dominantly from acid igneous rock. Slope is 15 to 60 percent. Elevation is 5,000 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fragmental, mixed Typic Cryochrepts.

Typical pedon of an Arcette extremely gravelly loam in an area of Elve-Arcette complex, 15 to 60 percent slopes, in woodland, about 1,650 feet east and 1,980

feet south of the northwest corner of sec. 20, T. 17 N., R. 20 E.

O1 and O2—2 inches to 0; decomposed and undecomposed pine needles, cones, and twigs.
A1—0 to 2 inches; yellowish brown (10YR 5/4) extremely gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many coarse, medium, fine, and very fine roots; 55 percent angular pebbles and 10 percent angular cobbles; medium acid; clear wavy boundary.
B2—2 to 8 inches; brownish yellow (10YR 6/6) extremely gravelly loam, brown (7.5YR 4/4) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; common coarse, medium, and fine roots; 55 percent angular pebbles and 10 percent angular cobbles; medium acid; gradual wavy boundary.
B3—8 to 17 inches; brownish yellow (10YR 6/6) extremely gravelly loam, strong brown (7.5YR 5/6) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; few coarse roots and common medium and fine roots; 55 percent angular pebbles and 20 percent angular cobbles; medium acid; gradual wavy boundary.
C1—17 to 60 inches; yellow (10YR 7/6) fragmental material, light brown (7.5YR 6/4) moist; few medium and fine roots; silt and very fine sand coating coarse fragments; 50 percent angular pebbles and 45 percent angular cobbles.

The A1 horizon is 1 to 9 inches thick. It is 55 to 70 percent angular pebbles and 5 to 20 percent angular cobbles. The horizon is strongly acid to slightly acid.

The B horizon is loam or sandy loam and is 10 to 20 percent clay. It is 60 to 90 percent rock fragments, of which 10 to 25 percent is angular cobbles and 50 to 65 percent is angular pebbles.

The C horizon is 90 to 95 percent rock fragments. It is 0 to 10 percent clay. It is strongly acid to slightly acid.

Ashuelot Variant

The Ashuelot Variant consists of shallow, well drained soils on terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 4 percent. Elevation is 3,300 to 4,600 feet. The average annual precipitation is about 12 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are loamy-skeletal, carbonatic, shallow Petrocalcic Calciborolls.

Typical pedon of an Ashuelot Variant cobbly clay loam in an area of Ashuelot Variant-Crago complex, 0 to 4 percent slopes, in rangeland, about 2,400 feet south and 1,000 feet west of the northeast corner of sec. 35, T. 12 N., R. 23 E.

Ap—0 to 4 inches; grayish brown (10YR 5/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and pores; 10 percent pebbles and 10 percent cobbles; slightly effervescent in spots; neutral; abrupt smooth boundary.
A12—4 to 9 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots and pores; 5 percent pebbles; strongly effervescent; mildly alkaline; clear irregular boundary.
IIC1ca—9 to 15 inches; pale brown (10YR 6/3) extremely gravelly light clay loam, grayish brown (10YR 5/2) moist; massive; very hard, firm, slightly sticky and slightly plastic; common fine and very fine roots and pores; 65 percent pebbles and 15 percent cobbles; violently effervescent; mildly alkaline; abrupt wavy boundary.
IIIC2cam—15 to 24 inches; pale brown (10YR 6/3) calcium-carbonate-cemented rock fragments, grayish brown (10YR 5/2) moist; extremely hard, extremely firm, nonsticky and nonplastic; few fine roots following fractures; violently effervescent; mildly alkaline; gradual irregular boundary.
IVC3—24 to 62 inches; very pale brown (10YR 8/3) extremely gravelly loamy sand; pale brown (10YR 6/3) moist; single grain; loose; 85 percent pebbles and a few cobbles; violently effervescent; mildly alkaline.

The petrocalcic horizon is at a depth of 15 to 20 inches.

The Ap horizon is loam or clay loam and is 20 to 35 percent clay. It is 15 to 35 percent rock fragments, of which 0 to 5 percent is stones, 5 to 20 percent is cobbles, and 5 to 20 percent is pebbles. It is neutral or mildly alkaline. The A12 horizon is loam or clay loam and is 20 to 35 percent clay. It is 5 to 45 percent rock fragments, of which 0 to 10 percent is stones, 5 to 20 percent is cobbles, and 5 to 25 percent is pebbles.

The IIC horizon is loam or clay loam and is 20 to 35 percent clay. It is 35 to 80 percent rock fragments, of which 10 to 15 percent is cobbles and 25 to 65 percent is pebbles. It is mildly alkaline or moderately alkaline. The IIIC2cam horizon ranges from 5 to 20 inches in thickness. The IVC3 horizon is loamy sand and coarse sand and is 60 to 90 percent rock fragments.

Bitton series

The Bitton series consists of deep, well drained soils on fans and foot slopes and along the edges of terraces. These soils formed in alluvium and colluvium derived dominantly from sandstone. Slope is 15 to 60 percent. Elevation is 3,000 to 4,700 feet. The average annual

precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 100 to 125 days.

These soils are loamy-skeletal, mixed Entic Haploborolls.

Typical pedon of a Bitton channery loam in an area of Bitton-Winifred-Castner complex, 15 to 60 percent slopes, in rangeland, about 790 feet north and 440 feet west of the southeast corner of sec. 9, T. 14 N., R. 19 E.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium and coarse roots; 20 percent coarse fragments of sandstone; slightly effervescent; mildly alkaline; clear smooth boundary.

A12—7 to 11 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores; 30 percent coarse fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—11 to 21 inches; pale brown (10YR 6/3) extremely channery loam, brown (10YR 5/3) moist; weak fine and very fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores; 70 percent coarse fragments; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2ca—21 to 30 inches; pale brown (10YR 6/3) extremely channery loam, dark brown (10YR 4/3) and brown (10YR 5/3) moist; weak fine and very fine subangular blocky structure; hard, very friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; 70 percent coarse fragments that have a crust of lime 1/16 inch thick on underside; many fine irregular threads and soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3ca—30 to 60 inches; pale brown (10YR 6/3) very channery loam, dark brown (10YR 4/3) and brown (10YR 5/3) moist; weak fine and very fine subangular blocky structure; hard, friable, sticky and plastic; few fine and very fine roots; few fine and very fine pores; 55 percent coarse fragments that have a lime coating that is thicker on the underside; few fine irregular threads and soft masses of lime; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A horizon is 18 to 27 percent clay. It is 15 to 35 percent rock fragments, of which 0 to 15 percent is stones, 5 to 10 percent is cobbles, and 10 to 25 percent is pebbles.

The C horizon is 18 to 27 percent clay. It is 35 to 75 percent angular pebbles and angular cobbles.

Borky series

The Borky series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated sandstone interbedded with shale. Slope is 2 to 15 percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are clayey-skeletal, mixed Typic Argiborolls.

Typical pedon of a Borky very stony loam in an area of Borky-Sinnigam very stony loams, 2 to 15 percent slopes, in rangeland, about 2,500 feet north and 700 feet west of the southeast corner of sec. 21, T. 15 N., R. 21 E.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine crumb structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent angular sandstone fragments; neutral; clear smooth boundary.

B1—2 to 5 inches; dark brown (10YR 4/3) stony clay loam, very dark brown (10YR 3/3) moist; strong fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; 25 percent angular sandstone fragments; neutral; clear wavy boundary.

B21t—5 to 12 inches; dark brown (10YR 4/3) very stony light clay, very dark brown (10YR 3/3) moist; moderate medium and coarse prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 45 percent angular sandstone fragments; neutral; clear wavy boundary.

B22t—12 to 18 inches; brown (10YR 5/3) very stony heavy clay loam, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 55 percent sandstone fragments; neutral; clear irregular boundary.

C1ca—18 to 36 inches; light grayish brown (10YR 6/2) very stony clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; some thin coatings of lime on undersides of coarse fragments; 55 percent angular sandstone fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2r—36 to 60 inches; light gray (2.5Y 7/2) consolidated sandstone interbedded with shale.

Consolidated sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 14 inches thick.

The A horizon is clay loam or loam and is 20 to 35 percent clay. It is 20 to 60 percent rock fragments, of which 5 to 25 percent is stones, 5 to 10 percent is cobbles, and 10 to 25 percent is pebbles.

The B2t horizon is clay loam or clay and is 35 to 50 percent clay. It is 35 to 60 percent rock fragments, of which 10 to 25 percent is stones, 10 to 15 percent is cobbles, and 15 to 20 percent is pebbles.

The Cca horizon is clay or clay loam and is 30 to 45 percent clay. It is 35 to 60 percent rock fragments, of which 5 to 25 percent is stones, 10 to 15 percent is cobbles, and 10 to 20 percent is pebbles.

Brazon series

The Brazon series consists of deep, well drained soils on foot slopes and fans. These soils formed in colluvium and alluvium derived dominantly from semiconsolidated shale. Slope is 2 to 45 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 110 days.

These soils are clayey-skeletal, mixed Typic Calciborolls.

Typical pedon of a Brazon very stony clay loam in an area of Brazon-Loken complex, 2 to 15 percent slopes, about 840 feet south and 2,380 feet west of the northeast corner of sec. 12, T. 17 N., R. 17 E.

A1—0 to 8 inches; very dark gray (10YR 3/1) very stony clay loam, black (10YR 2/1) moist; moderate fine and medium granular structure; hard, very friable, sticky and plastic; many fine and very fine roots and common medium roots; 20 percent stones, 10 percent cobbles, and 10 percent pebbles; slightly effervescent; mildly alkaline; clear irregular boundary.

B2—8 to 17 inches; light brownish gray (10YR 6/2) very stony heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores and common medium pores; 35 percent stones, 10 percent cobbles, and 5 percent pebbles; violently effervescent; moderately alkaline; clear irregular boundary.

B3ca—17 to 25 inches; light brownish gray (2.5Y 6/2) very cobbly light clay, dark grayish brown (2.5Y 4/2) moist; weak fine and very fine subangular blocky structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many very fine and fine pores; 35 percent cobbles, 10 percent stones, and 5 percent pebbles; common fine threads of lime and common fine and medium masses of lime; violently effervescent; moderately alkaline; gradual irregular boundary.

C1ca—25 to 40 inches; light brownish gray (2.5Y 6/2) very cobbly clay, grayish brown (2.5Y 5/2) moist; massive; very hard, friable, very sticky and very plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; 40 percent cobbles, 5 percent stones, and 10 percent pebbles; many fine distinct threads of lime and many medium and coarse masses of lime; violently effervescent; moderately alkaline; gradual irregular boundary.

IIC2ca—40 to 46 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots and few medium roots; common fine and very fine pores; less than 5 percent cobbles and 5 percent pebbles; many fine and medium distinct threads of lime and common medium and coarse masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC3r—46 to 60 inches; brownish yellow (10YR 6/6) semiconsolidated shale that crushes to clay; yellowish brown (10YR 5/6) moist; extremely hard, very firm, sticky and very plastic; few very fine roots; common fine and very fine pores; common fine and medium distinct threads and masses of lime; strongly effervescent; moderately alkaline.

About 0 to 25 percent of the surface is covered by stones.

The ca horizon is at a depth of 12 to 19 inches. Semiconsolidated shale is at a depth of 40 to 60 inches. The mollic epipedon is 7 to 9 inches thick.

The A horizon is clay loam or silty clay loam and is 30 to 40 percent clay. It is 0 to 50 percent rock fragments, of which 0 to 20 percent is stones, 0 to 20 percent is

cobbles, and 0 to 10 percent is pebbles. It is neutral or mildly alkaline.

The B2 horizon is clay loam or clay and is 35 to 50 percent clay. It is 35 to 60 percent rock fragments, of which 25 to 35 percent is stones, 5 to 10 percent is cobbles, and 5 to 15 percent is pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is clay loam or clay and is 35 to 50 percent clay. It is 35 to 65 percent rock fragments, of which 5 to 10 percent is stones, 25 to 40 percent is cobbles, and 5 to 15 percent is pebbles.

Bridger series

The Bridger series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 4,700 to 6,000 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine, mixed Argic Cryoborolls.

Typical pedon of Bridger clay loam, 2 to 8 percent slopes, in rangeland, about 180 feet north and 2,500 feet west of the southeast corner of sec. 29, T. 13 N., R. 20 E.

A11—0 to 6 inches; very dark gray (10YR 3/1) light clay loam, black (10YR 2/1) moist; strong very fine granular structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; few limestone pebbles; neutral; gradual smooth boundary.

A12—6 to 10 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate fine and very fine subangular blocky structure parting to moderate fine granular; hard, very friable, sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores and few medium pores; few limestone pebbles; neutral; clear irregular boundary.

B21t—10 to 14 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate medium prismatic parting to strong very fine subangular blocky structure; very hard, friable, very sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; few limestone pebbles; neutral; gradual wavy boundary.

B22t—14 to 20 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; slightly hard, friable, very sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; 5 percent limestone pebbles; mildly alkaline; abrupt irregular boundary.

B3ca—20 to 28 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to moderate fine and very fine subangular blocky; hard, friable, very sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; 10 percent limestone pebbles; many fine irregular filaments or threads and soft masses of lime; violently effervescent; moderately alkaline; diffuse irregular boundary.

IIC1ca—28 to 60 inches; very pale brown (10YR 7/4) very gravelly clay loam, light yellowish brown (10YR 6/4) moist; weak very coarse prismatic structure parting to weak fine and very fine subangular blocky; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine pores; 50 percent angular limestone pebbles; common fine irregular filaments and soft masses of lime; violently effervescent; strongly alkaline.

Very gravelly clay loam or gravelly clay loam is at a depth of 20 to 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon is 27 to 35 percent clay. It is 5 to 30 percent rock fragments, of which 0 to 20 percent is cobbles and 5 to 20 percent is pebbles. It is neutral or slightly acid.

The B horizon is clay loam, silty clay loam, or silty clay and averages 35 to 45 percent clay. It is 5 to 10 percent pebbles and 0 to 10 percent cobbles. It is neutral to moderately alkaline.

The C horizon is loam or clay loam and is 20 to 35 percent clay. It is 35 to 60 percent rock fragments, of which 0 to 15 percent is cobbles and 30 to 55 percent is pebbles. It is moderately alkaline or strongly alkaline.

Bridger Variant

The Bridger Variant consists of deep, well drained soils on mountainsides. These soils formed in colluvium and alluvium derived dominantly from red clayey shale and limestone. Slope is 15 to 60 percent. Elevation is 5,000 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, mixed Argic Cryoborolls.

Typical pedon of Bridger Variant clay loam, 15 to 60 percent slopes, in woodland, about 1,320 feet west and 500 feet north of the southeast corner of sec. 7, T. 12 N., R. 21 E.

O1—3 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A1—0 to 9 inches; reddish brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure in upper 2 inches grading to moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many coarse, medium, and fine roots; many fine and very fine pores; 10 percent rock fragments; neutral; clear wavy boundary.

B2t—9 to 27 inches; reddish brown (5YR 4/3) flaggy clay, dark reddish brown (5YR 3/4) moist; strong fine and medium blocky structure; very hard, firm, very sticky and very plastic; common coarse, medium, and fine roots and many very fine roots; many fine and very fine pores; 20 percent rock fragments; neutral; gradual irregular boundary.

B3ca—27 to 66 inches; reddish brown (5YR 5/3) very flaggy clay, reddish brown (5YR 4/3) moist; moderate medium and fine blocky structure; very hard, firm, very sticky and very plastic; common coarse, medium, fine, and very fine roots; many medium, fine, and very fine pores; 50 percent rock fragments; few threads of lime; strongly effervescent; moderately alkaline.

The A horizon is 0 to 5 percent angular pebbles and 5 to 10 percent angular cobbles. It is neutral or mildly alkaline. The A1 horizon is 7 to 15 inches thick.

The B2t horizon is clay loam or clay and averages 35 to 50 percent clay. It is 10 to 20 percent angular pebbles and 10 to 20 percent angular cobbles. It is neutral or mildly alkaline. Depth to the strongly calcareous horizon is 11 to 30 inches.

The B3 horizon is clay loam or clay and is 35 to 50 percent clay. It is 40 to 60 percent rock fragments, of which 30 to 50 percent is cobbles and 10 to 20 percent is pebbles.

Burnel series

The Burnel series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in alluvium. Slope is 0 to 8 percent. Elevation is 4,100 to 4,800 feet. The average annual precipitation is 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine, montmorillonitic Pachic Udic Argiborolls.

Typical pedon of Burnel silty clay loam, 2 to 8 percent slopes, in hayland, about 1,550 feet east and 700 feet south of the northwest corner of sec. 26, T. 14 N., R. 17 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; strong very fine granular structure in upper 1 inch to strong fine and very fine subangular blocky in lower 5 inches; hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many very fine pores; few angular sandstone pebbles; slightly acid; clear smooth boundary.

B21t—6 to 14 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong very fine and fine subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores and few medium pores; few angular sandstone pebbles; thin continuous clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—14 to 21 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores and few medium pores; common thin very dark brown (10YR 3/2) clay films on faces of peds; slightly acid; clear wavy boundary.

B31t—21 to 26 inches; brown (10YR 5/3) light silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, sticky and plastic; common fine, very fine, and medium roots; many fine and very fine pores and few medium pores; common thin very dark grayish brown (10YR 3/2) clay films on faces of prisms; strongly effervescent; mildly alkaline; gradual irregular boundary.

B32ca—26 to 33 inches; grayish brown (10YR 5/2) light silty clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and plastic; common fine, very fine, and medium roots; many fine and very fine pores and few medium pores; common medium masses of lime; strongly effervescent; mildly alkaline; gradual irregular boundary.

B33ca—33 to 50 inches; grayish brown (10YR 5/2) light silty clay, dark grayish brown (10YR 4/2) moist; few to common distinct reddish brown (5YR 4/3) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores and few medium pores; common medium masses of lime; strongly effervescent; mildly alkaline; gradual irregular boundary.

C1—50 to 66 inches; light brownish gray (10YR 6/2) light silty clay loam stratified with loam and fine sandy loam, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; massive; hard, friable, sticky and plastic; few fine and very fine roots; common fine and very fine pores; few fine seams of lime; strongly effervescent; mildly alkaline.

The mollic epipedon is 17 to 30 inches thick.

The A horizon is slightly acid or neutral.

The B2t and B3 horizons are silty clay loam or silty clay and average 35 to 50 percent clay. The B2t horizon is slightly acid or neutral, and the B3 horizon is mildly alkaline or moderately alkaline.

The C horizon is silty clay loam or clay loam stratified with fine sandy loam, loam, and silt loam and averages 27 to 40 percent clay. It is mildly alkaline or moderately alkaline.

Burnette series

The Burnette series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in alluvium. Slope is 2 to 25 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of Burnette silty clay loam, 2 to 8 percent slopes, in cropland, about 1,650 feet east and 1,700 feet south of the northwest corner of sec. 20, T. 13 N., R. 18 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine crumb structure; slightly hard, friable, slightly sticky and plastic; neutral; abrupt smooth boundary.

A12—8 to 19 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; neutral; clear wavy boundary.

B21t—19 to 30 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong medium and fine angular and subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine roots; many fine and very fine pores; fine sand grains in upper 3 inches; thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—30 to 42 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3 with 3/3 coats) moist; strong medium and fine prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; neutral; gradual wavy boundary.

B3ca—42 to 60 inches; yellowish brown (10YR 5/4) silty clay, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; a few pebbles that have thin coats of lime; weakly effervescent; mildly alkaline.

The mollic epipedon is 16 to 38 inches thick.

The A horizon is slightly acid or neutral.

The B horizon is silty clay loam, silty clay, or clay and averages 35 to 50 percent clay. It is 0 to 10 percent pebbles and is neutral or mildly alkaline.

The C horizon, where present, is clay loam, silty clay, or clay and averages 35 to 45 percent clay. It is 5 to 20 percent pebbles.

Burnette Variant

The Burnette Variant consists of moderately deep, well drained soils on uplands. These soils formed in residuum and alluvium derived dominantly from semiconsolidated shale. Slope is 2 to 15 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of a Burnette Variant silty clay loam in an area of Burnette-Burnette Variant silty clay loams, 2 to 8 percent slopes, in rangeland, about 1,540 feet north and 2,200 feet west of the southeast corner of sec. 17, T. 13 N., R. 18 E.

Ap—0 to 6 inches; dark gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; less than 5 percent rock fragments; medium acid; clear smooth boundary.

A12—6 to 11 inches; very dark gray (10YR 3/1) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse, medium, and fine prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores with wormholes and wormcasts; less than 5 percent rock fragments; medium acid; clear wavy boundary.

B21t—11 to 18 inches; very dark gray (10YR 3/1) clay, very dark brown (10YR 2/2) moist; moderate coarse and medium prismatic structure; hard, firm, sticky and plastic; many fine and very fine, and few medium roots; many fine and very fine pores and few medium pores with wormcasts; thin clay films on faces of peds; less than 5 percent rock fragments; slightly acid; abrupt smooth boundary.

B22t—18 to 28 inches; reddish brown (5YR 5/3) and gray (10YR 5/1) clay, dark reddish brown (5YR 3/3) and gray (10YR 4/1) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; extremely hard, very firm, sticky and very plastic; common fine and very fine roots and few medium roots; common fine and very fine pores; common distinct slickensides; thin clay films on faces of peds; less than 5 percent rock fragments; slightly acid; clear wavy boundary.

C1ca—28 to 36 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; extremely hard, very firm, sticky and very plastic; common fine and very fine roots; common fine and very fine pores; less than 5 percent rock fragments; common medium irregular segregated masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

C2r—36 to 60 inches; dark gray (10YR 4/1) and light yellowish brown (10YR 6/4) semiconsolidated shale that crushes to clay, dark gray (10YR 4/1) and yellowish brown (10YR 5/4) moist; massive; extremely hard, very firm, sticky and very plastic; few very fine roots; few fine irregular segregated soft masses of lime; strongly effervescent; mildly alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. The mollic epipedon is 16 to 30 inches thick.

The A horizon is medium acid to neutral. It is 0 to 5 percent angular pebbles.

The B2t horizon is silty clay loam, clay, or silty clay and averages 35 to 55 percent clay. It is 0 to 5 percent angular pebbles. It is slightly acid or neutral.

The C horizon is clay loam, clay, or silty clay and averages 35 to 45 percent clay. It is mildly alkaline or moderately alkaline.

Cabba series

The Cabba series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 4 to 60 percent. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 43 to 45 degrees F, and the frost-free period is 105 to 130 days.

These soils are loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

Typical pedon of a Cabba loam in an area of Cabba-Doney-Wayden complex, 4 to 8 percent slopes, in rangeland, about 1,450 feet north and 25 feet east of the southwest corner of sec. 35, T. 18 N., R. 15 E.

A1—0 to 2 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine crumb structure; soft, friable, slightly sticky and slightly plastic; slightly effervescent; mildly alkaline; clear smooth boundary.

AC—2 to 8 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and very fine roots; common very fine pores; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1—8 to 15 inches; yellow (10YR 7/6) channery loam, brownish yellow (10YR 6/6) moist; massive; soft, friable, nonsticky and nonplastic; many fine and very fine roots matted in the lower part; 20 percent angular sandstone pebbles that have lime undercoats; strongly effervescent; moderately alkaline; clear smooth boundary.

C2r—15 to 60 inches; very pale brown (10YR 7/4) weakly consolidated sandy and silty sedimentary beds that crush to loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, nonsticky and nonplastic; slightly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 10 to 20 inches.

The C horizon is loam, silt loam, or clay loam and averages 15 to 35 percent clay. It is 0 to 30 percent angular sandstone pebbles. It is mildly alkaline or moderately alkaline.

Cabbart series

The Cabbart series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 4 to 8 percent. Elevation is 2,400 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 46 degrees F, and the frost-free period is 115 to 135 days.

These soils are loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents.

Typical pedon of a Cabbart loam in an area of Marmarth-Cabbart loams, 4 to 8 percent slopes, in cropland, about 30 feet south and 100 feet east of the northwest corner of sec. 21, T. 21 N., R. 18 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) heavy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure parting to moderate very fine granular; slightly hard, very friable, sticky and slightly plastic; common fine and very fine roots; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—6 to 13 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; few sandstone pebbles; many fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2ca—13 to 18 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak very coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; common fine irregularly shaped soft masses of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

C3r—18 to 60 inches; light gray (2.5Y 7/1) weakly consolidated sandy and silty sedimentary beds that crush to loam, olive gray (5Y 5/2) moist; strong medium platy sandstone; hard, firm, nonsticky and nonplastic; few fine and very fine roots to a depth of 30 inches; common fine and very fine pores to a depth of 30 inches; slightly effervescent; strongly alkaline.

Sedimentary beds are at a depth of 10 to 20 inches.

The A horizon is 0 to 10 percent angular pebbles.

The C horizon is fine sandy loam, loam, silt loam, or clay loam and averages 15 to 35 percent clay. It is 0 to 15 percent angular pebbles.

Cabston series

The Cabston series consists of deep, well drained soils on fans and foot slopes. These soils formed in alluvium and colluvium derived dominantly from shale and sandstone. Slope is 2 to 60 percent. Elevation is 2,700 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey-skeletal, mixed Aridic Haploborolls.

Typical pedon of a Cabston channery clay loam in an area of Cabston-Delplain channery clay loams, 25 to 60 percent slopes, in rangeland, about 550 feet south and 2,300 feet west of the northeast corner of sec. 25, T. 15 N., R. 23 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) channery clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; 25 percent hard shale and sandstone pebbles; neutral; clear wavy boundary.

B2—4 to 14 inches; grayish brown (10YR 5/2) very channery heavy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores and few medium pores; 35 percent hard shale and sandstone pebbles; mildly alkaline; clear irregular boundary.

B3—14 to 21 inches; light brownish gray (10YR 6/2) very channery heavy clay loam grayish brown (10YR 5/2); weak very coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, sticky and plastic; 40 percent hard shale and sandstone pebbles; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1—21 to 31 inches; light brownish gray (2.5Y 6/2) very channery clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; 60 percent hard shale and sandstone pebbles; patchy lime coatings on rock fragments; strongly effervescent; mildly alkaline; diffuse boundary.

C2—31 to 66 inches; light brownish gray (2.5Y 6/2) very channery heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; few fine and very fine roots; few fine and very fine pores; 60 percent hard shale and sandstone pebbles; strongly effervescent; mildly alkaline.

The mollic epipedon is 6 to 15 inches thick.

The A horizon is 27 to 40 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 5 percent is cobbles and 5 to 30 percent is pebbles. It is neutral or mildly alkaline.

The B horizon is 35 to 40 percent clay. It is 15 to 60 percent rock fragments, of which 0 to 5 percent is angular cobbles and 15 to 55 percent is pebbles. It is neutral to moderately alkaline.

The C horizon is clay loam or clay and is 35 to 60 percent clay. It is 35 to 60 percent rock fragments, of which 0 to 5 percent is cobbles and 35 to 55 percent is pebbles. It is mildly alkaline or moderately alkaline.

Castle series

The Castle series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 2 to 35 percent. Elevation is 4,500 to 5,600 feet. The average annual precipitation is about 19 to 26 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 60 to 90 days.

These soils are very-fine, montmorillonitic Vertic Cryoborolls.

Typical pedon of Castle clay, 15 to 35 percent slopes, in rangeland, about 2,420 feet north and 220 feet east of the southwest corner of sec. 34, T. 14 N., R. 19 E.

A1—0 to 3 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and very fine granular structure; extremely hard, firm, sticky and very plastic; many fine and very fine roots, common medium roots, and few coarse roots; few limestone pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

B1—3 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine subangular blocky structure; extremely hard, firm, sticky and very plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

B2—8 to 14 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong very fine angular blocky structure; extremely hard, firm, sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium pores; common slickensides; strongly effervescent; moderately alkaline; clear irregular boundary.

B3—14 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine yellowish brown (10YR 5/6) mottles; moderate fine and very fine angular blocky structure; extremely hard, firm, sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium pores; few slickensides; few fine soft masses of lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—18 to 32 inches; gray (5Y 6/1) clay, light gray (5Y 5/1) moist; common fine yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; extremely hard, firm, sticky and very plastic; common very fine roots and few fine roots; many very fine pores and common fine pores; few slickensides; common fine soft masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2r—32 to 60 inches; gray (5Y 5/1) semiconsolidated shale that crushes to clay, dark gray (5Y 4/1) moist; common fine light olive brown (2.5Y 5/4) mottles; massive; extremely hard, extremely firm, sticky and plastic; slightly effervescent; neutral.

Semiconsolidated shale is at a depth of 20 to 40 inches. The mollic epipedon is 10 to 15 inches thick.

The A horizon is 2 to 10 inches thick. It is mildly alkaline or moderately alkaline.

The B horizon is 10 to 25 inches thick. It is mildly alkaline or moderately alkaline.

The C horizon is neutral to moderately alkaline.

Castner series

The Castner series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 60 percent. Elevation is 3,500 to 4,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 120 days.

These soils are loamy-skeletal, mixed Lithic Haploborolls.

Typical pedon of a Castner channery loam in an area of Timberg-Castner complex, 2 to 8 percent slopes, in cropland, about 2,540 feet west and 850 feet north of the southeast corner of sec. 23, T. 15 N., R. 18 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine pores; 20 percent angular sandstone fragments; slightly effervescent; mildly alkaline; clear wavy boundary.

C1—7 to 14 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots; 55 percent angular sandstone fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

R—14 inches; light gray, fractured hard sandstone.

Hard sandstone is at a depth of 10 to 20 inches. The mollic epipedon is 7 to 12 inches thick.

The A horizon is 10 to 20 percent clay. It is 10 to 60 percent rock fragments, of which 0 to 25 percent is stones, 5 to 15 percent is angular cobbles, and 5 to 35 percent is angular pebbles. It is neutral or mildly alkaline.

The C horizon is 10 to 20 percent clay. It is 45 to 75 percent rock fragments, of which 5 to 15 percent is angular cobbles and 30 to 65 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

Cheadle series

The Cheadle series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 70 percent. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, mixed Lithic Cryoborolls.

Typical pedon of a Cheadle channery loam in an area of Teton-Cheadle channery loams, 2 to 8 percent slopes, in rangeland, about 800 feet west and 1,100 feet south of the northeast corner of sec. 29, T. 14 N., R. 18 E.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) channery loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; 25 percent rock fragments; neutral; clear wavy boundary.

C1—7 to 15 inches; brown (10YR 4/3) extremely channery loam, dark brown (10YR 3/3) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; 65 percent rock fragments that have lime coatings on undersides; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2—15 to 19 inches; light yellowish brown (10YR 6/4) extremely flaggy light loam, dark yellowish brown (10YR 4/4) moist; weak fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots matted between rock fragments; 75 percent rock fragments, mainly pebbles and cobbles; lime coatings on undersides of fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.

R—19 inches; very pale brown (10YR 7/3) consolidated fractured hard sandstone.

Hard sandstone is at a depth of 10 to 20 inches. The mollic epipedon is 10 to 16 inches thick.

The A horizon is 10 to 27 percent clay. It is 5 to 50 percent rock fragments, of which 0 to 10 percent is stones, 0 to 30 percent is cobbles, and 5 to 35 percent is pebbles. It is neutral or mildly alkaline.

The C horizon is 10 to 27 percent clay. It is 35 to 75 percent rock fragments, of which 0 to 10 percent is stones, 10 to 30 percent is angular cobbles, and 25 to 50 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

Chinook series

The Chinook series consists of deep, well drained soils on fans, foot slopes, and uplands. These soils formed in alluvial and eolian material derived dominantly from sandstone. Slope is 2 to 35 percent. Elevation is 2,400 to 3,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are coarse-loamy, mixed Aridic Haploborolls.

Typical pedon of Chinook fine sandy loam, 2 to 15 percent slopes, in cropland, about 900 feet east and 150 feet north of the southwest corner of sec. 35, T. 19 N., R. 23 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak fine platy structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots and few medium roots; many fine and very fine pores; neutral; abrupt smooth boundary.

B21—6 to 9 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; neutral; clear wavy boundary.

B22—9 to 14 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak very fine granular; soft, very friable, nonsticky and nonplastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; neutral; clear wavy boundary.

B3ca—14 to 21 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure parting to weak very fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; common fine distinct masses and threads of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—21 to 28 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak very fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; few faint threads and masses of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

C2ca—28 to 60 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots to a depth of 45 inches and few roots below; many fine and very fine pores and few medium pores; common fine distinct threads and masses of lime; strongly effervescent; mildly alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A and B horizons are neutral or mildly alkaline. The B and C horizons are fine sandy loam or sandy loam. The C horizon is mildly alkaline or moderately alkaline.

Crago series

The Crago series consists of deep, well drained soils on terraces, terrace edges, and fans. These soils formed in gravelly alluvium derived dominantly from limestone. Slope is 0 to 45 percent. Elevation is 2,400 to 4,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are loamy-skeletal, carbonatic Borollic Calciorthids.

Typical pedon of a Crago very gravelly loam in an area of Abor-Thebo-Crago complex, 15 to 45 percent slopes, in rangeland, about 1,950 feet west and 1,420 feet north of the southeast corner of sec. 21, T. 12 N., R. 24 E.

A1—0 to 3 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and plastic; many fine and very fine roots and common medium roots; 50 percent pebbles; strongly effervescent; mildly alkaline; clear wavy boundary.

AC—3 to 7 inches; pale brown (10YR 6/3) extremely gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots and common medium roots; 65 percent pebbles; violently effervescent; mildly alkaline; clear irregular boundary.

C1ca—7 to 18 inches; very pale brown (10YR 7/3) extremely gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine and very fine granular structure; slightly hard, very friable, sticky and plastic; common fine and very fine roots and few medium roots; 70 percent pebbles; violently effervescent; mildly alkaline; gradual wavy boundary.

C2ca—18 to 30 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; 80 percent pebbles and cobbles; violently effervescent; mildly alkaline; diffuse boundary.

C3—30 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few fine and very fine roots; 75 percent pebbles and cobbles; violently effervescent; mildly alkaline.

The A horizon is loam or clay loam and is 20 to 30 percent clay. It is 15 to 70 percent rock fragments, of which 0 to 15 percent is cobbles and 15 to 55 percent is pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is sandy loam or loam and is 18 to 27 percent clay. It is 40 to 80 percent rock fragments, of which 10 to 20 percent is cobbles and 30 to 60 percent is pebbles. It is mildly alkaline or moderately alkaline.

Crago Variant

The Crago Variant consists of deep, well drained soils on terraces. These soils formed in alluvium. Slope is 0 to 4 percent. Elevation is 3,200 to 4,200 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are loamy-skeletal, mixed Aridic Haploborolls.

Typical pedon of Crago Variant clay loam, 0 to 4 percent slopes, in pastureland, about 1,500 feet east and 60 feet north of the southwest corner of sec. 35, T. 12 N., R. 24 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to moderate fine and very fine granular; slightly hard, very friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; 5 percent limestone pebbles and 5 percent cobbles; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B2—7 to 12 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, very friable, sticky and plastic; 5 percent limestone pebbles; few fine and medium soft masses of lime; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B3ca—12 to 22 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, very friable, sticky and plastic; 10 percent limestone pebbles; many fine and medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

IICca—22 to 60 inches; very pale brown (10YR 8/3) extremely gravelly sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; 65 percent limestone pebbles and 5 percent cobbles; common fine and very fine roots to a depth of 30 inches and few fine roots below; violently effervescent; moderately alkaline.

The Ap horizon is neutral or mildly alkaline. It is 5 to 10 percent pebbles and 0 to 5 percent cobbles.

The B2 and B3 horizons are heavy loam or clay loam and average 25 to 35 percent clay. They are 5 to 20 percent pebbles and 0 to 10 percent cobbles and are mildly alkaline or moderately alkaline.

The IIC horizon is 50 to 75 percent pebbles and 5 to 10 percent cobbles. It is at a depth of 15 to 30 inches.

Creed series

The Creed series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 8 percent. Elevation is 2,300 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Natrargids.

Typical pedon of a Creed loam in an area of Creed-Gerdrum complex, 0 to 2 percent slopes, in rangeland, about 300 feet west and 2,400 feet south of the northeast corner of sec. 2, T. 18 N., R. 21 E.

A1—0 to 5 inches; pale brown (10YR 6/3) heavy loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure parting to moderate very fine granular; soft, very friable, sticky and slightly plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; about 1 percent pebbles; slightly acid; clear wavy boundary.

A2—5 to 8 inches; light gray (10YR 7/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate very thin platy structure parting to moderate very fine granular; slightly hard, very friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; few pebbles; slightly acid; abrupt wavy boundary.

B21t—8 to 12 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 4/3) moist; strong medium and fine columnar structure parting to strong fine angular blocky; extremely hard, firm, sticky and very plastic; many fine and very fine roots and few medium roots; many very fine pores; thin clay films on faces of peds; few pebbles; mildly alkaline; gradual wavy boundary.

B22t—12 to 20 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong medium and fine subangular blocky; very hard, firm, sticky and very plastic; common fine and very fine roots and few medium roots; many very fine pores; thin clay films on faces of peds; few pebbles; moderately alkaline; clear irregular boundary.

B3cacs—20 to 27 inches; pale brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; few pebbles; many medium and fine masses of lime and gypsum; strongly effervescent; moderately alkaline; clear irregular boundary.

C1—27 to 42 inches; pale brown (10YR 6/3) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and very plastic; few fine and very fine roots; common fine and very fine pores; few pebbles; few medium and coarse distinct masses of lime and other salts; strongly effervescent; strongly alkaline; clear irregular boundary.

IIC2—42 to 60 inches; very pale brown (10YR 7/3) very gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, sticky and plastic; few fine and very fine roots; common fine and very fine pores; 45 percent lime-coated pebbles; strongly effervescent; strongly alkaline.

The A horizon is 0 to 15 percent pebbles and cobbles. It is slightly acid or neutral.

The B2t horizon is clay loam, silty clay loam, clay, or silty clay and averages 35 to 55 percent clay. It is 0 to 10 percent pebbles and is mildly alkaline or moderately alkaline.

The B3 and C1 horizons are clay loam, silty clay, or clay and average 30 to 45 percent clay. They are 0 to 15 percent pebbles and are moderately alkaline or strongly alkaline.

The IIC horizon, where present, is sandy clay loam or clay loam and averages 27 to 35 percent clay. It is 5 to 45 percent pebbles.

Daglum series

The Daglum series consists of deep, moderately well drained soils on terraces and fans. These soils formed in

alluvium derived from mixed rock sources. Slope is 0 to 8 percent. Elevation is 3,200 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Natriborolls.

Typical pedon of a Daglum loam in an area of Daglum-Adger complex, 2 to 8 percent slopes, in rangeland, about 500 feet north and 2,000 feet east of the southwest corner of sec. 23, T. 19 N., R. 15 E.

A1—0 to 7 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable; common clear sand grains; mildly alkaline; clear smooth boundary.

A2—7 to 10 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate medium and coarse prismatic structure parting to moderate medium platy; hard and very friable; many very fine roots; many very fine pores; many clear sand grains; mildly alkaline; abrupt wavy boundary.

B21t—10 to 13 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium and coarse columnar structure; extremely hard, very firm, sticky and plastic; many very fine roots; many very fine pores; mildly alkaline; clear wavy boundary.

B22t—13 to 17 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong medium subangular blocky; extremely hard, very firm, sticky and plastic; many very fine roots; common very fine pores; mildly alkaline; clear wavy boundary.

B3ca—17 to 30 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong medium subangular blocky; extremely hard, firm, sticky and plastic; common very fine roots; common very fine pores; common threads of lime; slightly effervescent; strongly alkaline; gradual wavy boundary.

Ccs—30 to 60 inches; grayish brown (10YR 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, firm, sticky and very plastic; few fine roots; few fine pores; common seams of gypsum; moderately alkaline.

The mollic epipedon is 6 to 10 inches thick.

The A horizon is loam or clay loam and averages 18 to 35 percent clay. It is neutral or mildly alkaline.

The B horizon is clay or silty clay and averages 40 to 55 percent clay. It is mildly alkaline to strongly alkaline.

The C horizon is clay loam or clay and averages 30 to 45 percent clay. It is moderately alkaline or strongly alkaline.

Danvers series

The Danvers series consists of deep, well drained soils on terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Danvers clay loam, 0 to 2 percent slopes, in rangeland, about 2,530 feet west and 2,565 feet south of the northwest corner of sec. 21, T. 19 N., R. 13 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 2/2) moist; dark gray (10YR 4/1) coatings on peds, black (10YR 2/1) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; neutral; gradual smooth boundary.

A12—2 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; dark gray (10YR 4/1) coatings on peds, black (10YR 2/1) moist; weak medium prismatic structure parting to weak fine platy; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; stained fine sand grains on faces of peds; neutral; clear wavy boundary.

B21t—4 to 8 inches; brown (10YR 4/3) light silty clay, dark brown (10YR 3/3) moist; dark grayish brown (10YR 4/2) coatings on peds, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, friable, sticky and plastic; common very fine roots; many very fine and common fine tubular pores; distinct clay films on faces of peds; neutral; gradual wavy boundary.

B22t—8 to 14 inches; brown (10YR 5/3) light silty clay, dark brown (10YR 4/3) moist; dark grayish brown (10YR 4/2) coatings on peds, very dark grayish brown (10YR 3/2) moist; moderate medium and fine prismatic structure parting to strong fine and very fine blocky; very hard, friable, sticky and plastic; distinct continuous clay films on faces of peds; few pebbles; mildly alkaline; clear wavy boundary.

B3ca—14 to 17 inches; grayish brown (2.5Y 5/2) light clay, olive brown (2.5Y 4/3) moist; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common very fine roots; many very fine and few fine tubular pores; patchy clay films; common soft masses of segregated lime; few pebbles that have lime crusts on undersides and in pockets; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—17 to 27 inches; light yellowish brown (2.5Y 6/3) light clay, light olive brown (2.5Y 6/3) moist; moderate very coarse prismatic structure parting to moderate fine and medium blocky; very hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; many soft white (2.5Y 8/1, 9/1) masses and nodules of segregated lime and much diffused lime; few lime-coated pebbles; violently effervescent; moderately alkaline; diffuse boundary.

C2ca—27 to 44 inches; very pale brown (10YR 7/3) heavy clay loam, pale brown (10YR 6/3) moist; moderate very coarse prismatic structure; very hard, friable, sticky and plastic; few very fine roots; few very fine tubular pores; lime diffused throughout and segregated into a few soft masses; few lime-coated pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3—44 to 60 inches; very pale brown (10YR 7/3) gravelly clay loam, brown (10YR 5/3) moist; massive; hard, friable, sticky and plastic; few very fine roots; about 20 percent coarse fragments, mainly limestone; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick.

The A horizon has 0 to 10 percent pebbles. It is neutral or mildly alkaline.

The B horizon is clay or silty clay and averages 40 to 50 percent clay. It is neutral to moderately alkaline.

The C horizon is clay loam or clay and averages 35 to 45 percent clay. It is mildly alkaline or moderately alkaline. Depth to the gravelly to extremely gravelly IIC horizon commonly is 40 to 60 inches.

Darret series

The Darret series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Slope is 2 to 15 percent. Elevation is 4,000 to 4,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 100 to 125 days.

These soils are fine, mixed Typic Argiborolls.

Typical pedon of a Darret clay loam in an area of Darret-Terrad complex, 8 to 15 percent slopes, in rangeland, about 1,650 feet north and 160 feet east of the southwest corner of sec. 4, T. 15 N., R. 19 E.

Ap—0 to 6 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; less than 5 percent angular sandstone pebbles; neutral; abrupt smooth boundary.

A12—6 to 8 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; trace of angular sandstone pebbles; neutral; clear smooth boundary.

B21t—8 to 13 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak medium and fine prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; trace of angular sandstone pebbles; neutral; clear wavy boundary.

B22t—13 to 17 inches; reddish brown (2.5YR 5/4) silty clay, reddish brown (2.5YR 4/4) moist; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; very hard, firm, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; thin clay films on faces of peds; trace of angular sandstone pebbles; neutral; clear wavy boundary.

B3ca—17 to 23 inches; light reddish brown (2.5YR 6/4) silty clay, reddish brown (2.5YR 4/4) moist; moderate fine and very fine subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots; many fine and very fine pores; common fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—23 to 32 inches; reddish brown (2.5YR 5/4) and light yellowish brown (10YR 6/4) silty clay, reddish brown (2.5YR 4/4) and yellowish brown (10YR 5/4) moist; massive; very hard, very firm, sticky and very plastic; few fine and very fine roots; common very fine pores; few fine and medium masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2r—32 to 60 inches; reddish brown (2.5YR 5/4) semiconsolidated shale interbedded with sandstone, reddish brown (2.5YR 4/4) moist; variegated colors of dark reddish brown (2.5YR 3/4) and yellowish brown (10YR 5/4) moist; massive; extremely hard, very firm; few very fine pores; strongly effervescent; moderately alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon is loam or clay loam and averages 20 to 35 percent clay. It is 0 to 10 percent angular pebbles and is neutral or mildly alkaline.

The B horizon is silty clay loam or silty clay and averages 35 to 45 percent clay. It is neutral to moderately alkaline.

The C horizon is clay loam, silty clay loam, clay, or silty clay and averages 30 to 45 percent clay. It is 0 to 15 percent angular sandstone and shale fragments.

Delette series

The Delette series consists of deep, moderately well drained soils on fans and foot slopes. These soils formed in alluvium and colluvium. Slope is 8 to 25 percent. Elevation is 4,500 to 5,600 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are fine-loamy, mixed Pachic Udic Haploborolls.

Typical pedon of a Delette loam in an area of Tomty-Delette complex, 8 to 25 percent slopes, in woodland, about 725 feet west and 2,440 feet north of the southeast corner of sec. 28, T. 14 N., R. 18 E.

O1—1 1/2 inches to 0; forest litter of leaves, twigs, and partially decomposed organic matter.

A11—0 to 5 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many medium, fine, and very fine roots and common coarse roots; many very fine pores; trace of angular pebbles; many wormcasts; medium acid; clear wavy boundary.

A12—5 to 16 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak medium and fine subangular blocky structure parting to weak very fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; trace of angular pebbles; medium acid; diffuse wavy boundary.

A13—16 to 50 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; few faint brown (10YR 5/3) mottles; weak medium and fine subangular blocky structure parting to weak very fine granular; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; trace of angular pebbles; streaks and patches of pinkish gray (7.5YR 6/2) silt and fine sand; medium acid; clear wavy boundary.

A&B—50 to 60 inches; 60 percent pinkish gray (7.5YR 6/2) loam (A material) and about 40 percent pockets and thin bands of brown (7.5YR 5/2) clay loam (B material), dark brown (7.5YR 4/2) moist; common faint gray (N 6/0) mottles; weak medium and fine subangular blocky structure; very hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; thin clay films in some pores; trace of angular pebbles; strongly acid.

The mollic epipedon is 16 inches to more than 40 inches thick.

The A and B horizons are loam or clay loam and average 25 to 35 percent clay. They are 0 to 10 percent angular pebbles and are strongly acid to neutral.

Delplain series

The Delplain series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from hard shale and sandstone. Slope is 4 to 60 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey-skeletal, mixed, nonacid, frigid Lithic Ustic Torriorthents.

Typical pedon of a Delplain very channery clay loam in an area of Ernem-Delplain-Tanna complex, 4 to 25 percent slopes, in rangeland, about 1,650 feet north and 1,200 feet east of the southwest corner of sec. 19, T. 15 N., R. 24 E.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) very channery clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; soft, friable, sticky and plastic; 40 percent hard angular shale pebbles; neutral; clear smooth boundary.

C1—4 to 8 inches; grayish brown (2.5Y 5/2) extremely channery heavy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; 70 percent hard angular shale pebbles; neutral; clear wavy boundary.

C2—8 to 18 inches; grayish brown (2.5Y 5/2) extremely channery heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; 80 percent hard angular shale pebbles; neutral; clear smooth boundary.

R—18 inches; light gray (2.5Y 7/2) hard shale and fine-grained sandstone.

Hard shale and sandstone are at a depth of 10 to 20 inches.

The A horizon is loam or clay loam and is 20 to 40 percent clay. It is 20 to 50 percent rock fragments, of which 0 to 5 percent is angular cobbles and 20 to 45 percent is angular pebbles. It is neutral or mildly alkaline.

The C horizon is clay loam or clay and is 35 to 45 percent clay. It is 40 to 80 percent rock fragments, of which 0 to 10 percent is angular cobbles and 40 to 70 percent is angular pebbles. It is neutral or mildly alkaline.

Delpoint series

The Delpoint series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 4 to 45 percent. Elevation is 2,400 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed Borollic Camborthids.

Typical pedon of a Delpoint loam in an area of Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes, in rangeland, about 1,840 feet north and 2,310 feet east of the southwest corner of sec. 3, T. 18 N., R. 26 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; slightly effervescent; mildly alkaline; clear wavy boundary.

B2—3 to 11 inches; light brownish gray (2.5Y 6/2) heavy loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

B3ca—11 to 17 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse prismatic structure parting to weak medium and coarse angular blocky; hard, very friable, sticky and slightly plastic; common fine and very fine roots and few medium roots; many very fine pores; many fine distinct white (10YR 8/2) masses of lime on faces of peds; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—17 to 25 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse and very coarse prismatic structure; very hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots in peds; common fine and very fine pores and few medium pores; strongly effervescent; strongly alkaline; diffuse wavy boundary.

C2r—25 to 60 inches; light gray (2.5Y 7/2) weakly consolidated sandy and silty sedimentary beds that crush mainly to loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, nonsticky and nonplastic; strongly effervescent; strongly alkaline.

Sedimentary beds are at a depth of 20 to 40 inches. The A horizon is mildly alkaline or moderately alkaline. The B and C horizons are very fine sandy loam, loam, silt loam, or silty clay loam and average 18 to 30 percent clay. They are moderately alkaline or strongly alkaline.

Dilts series

The Dilts series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated shale. Slope is 4 to 50 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey, montmorillonitic, acid, frigid, shallow Ustic Torriorthents.

Typical pedon of a Dilts clay in an area of Dilts-Welter-Julin complex, 4 to 25 percent slopes, in rangeland, about 2,500 feet south and 1,200 feet east of the northwest corner of sec. 4, T. 15 N., R. 23 E.

A11—0 to 3 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; slightly hard, friable, sticky and very plastic; many fine and very fine roots and common medium and coarse roots; strongly acid; abrupt smooth boundary.

C1—3 to 10 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine and very fine subangular blocky structure; very hard, friable, sticky and very plastic; common medium, fine, and very fine roots; many fine and very fine pores; strongly acid; clear wavy boundary.

C2—10 to 15 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; many fine and very fine pores and few medium and coarse pores; 10 percent hard shale fragments; strongly acid; clear wavy boundary.

C3r—15 to 60 inches; gray (5Y 5/1) consolidated hard platy shale.

Consolidated shale is at a depth of 10 to 20 inches. The C1 and C2 horizons are clay or shaly clay and average 40 to 60 percent clay. They are 5 to 20 percent angular shale fragments and are very strongly acid or strongly acid.

Doney series

The Doney series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 4 to 60 percent. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed, frigid Typic Ustochrepts.

Typical pedon of a Doney loam in an area of Cabba-Doney-Wayden complex, 4 to 8 percent slopes, in cropland, about 1,000 feet west and 900 feet north of the southeast corner of sec. 20, T. 19 N., R. 14 E.

Ap—0 to 4 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline; abrupt smooth boundary.

B2—4 to 14 inches; very pale brown (10YR 7/3) loam, light yellowish brown (10YR 6/3) moist; weak coarse prismatic structure; hard, very friable, slightly sticky and slightly plastic; few nodules and films of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—14 to 25 inches; very pale brown (10YR 7/3) loam, light yellowish brown (10YR 6/3) moist; weak coarse prismatic structure; hard, very friable, slightly sticky and slightly plastic; few sandstone and siltstone fragments; few nodules and films of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2r—25 to 60 inches; pale yellow (2.5Y 7/4) weakly consolidated sandy and silty sedimentary beds that crush mainly to loam; light yellowish brown (2.5Y 6/4) moist; massive; hard, friable, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 20 to 40 inches.

The A horizon is 0 to 15 percent angular pebbles. It is neutral or mildly alkaline.

The B and C horizons are loam or clay loam and average 20 to 30 percent clay. They are 0 to 15 percent angular fragments and are mildly alkaline or moderately alkaline.

Doughty series

The Doughty series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 4,000 to 4,800 feet. The average annual precipitation is about 17 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine-loamy, mixed Udic Argiborolls.

Typical pedon of a Doughty loam in an area of Doughty-Sipple loams, 0 to 2 percent slopes, in cropland, about 400 feet west and 1,400 feet south of the northeast corner of sec. 16, T. 14 N., R. 16 E.

A1—0 to 5 inches, dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; less than 5 percent pebbles; neutral; clear wavy boundary.

B2t—5 to 14 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; very dark grayish brown (10YR 3/2) organic stains on faces of peds; strong medium prismatic structure parting to strong medium and fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; less than 5 percent pebbles; neutral; abrupt irregular boundary.

B3ca—14 to 20 inches, pale brown (10YR 6/3) light clay loam, brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 5 percent limestone pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C1ca—20 to 32 inches; very pale brown (10YR 7/3) light clay loam, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; 10 percent limestone pebbles; many fine masses and threads of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC2ca—32 to 42 inches; very pale brown (10YR 7/3) extremely gravelly loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; 55 percent pebbles and 10 percent cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3ca—42 to 66 inches; very pale brown (10YR 7/3) extremely gravelly sandy clay loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine roots; 55 percent pebbles and 10 percent cobbles; violently effervescent; moderately alkaline.

Very gravelly loam or extremely gravelly sandy loam is at a depth of 20 to 36 inches. The mollic epipedon is 10 to 16 inches thick.

The A horizon is 18 to 27 percent clay. It is 5 to 25 percent rock fragments, of which 0 to 15 percent is cobbles and 5 to 10 percent is pebbles.

The B horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is 0 to 15 percent pebbles and is neutral to moderately alkaline.

The C horizon is loam or clay loam and is 20 to 30 percent clay. It is 5 to 30 percent pebbles.

The IIC horizon is loam or sandy loam and is 10 to 20 percent clay. It is 60 to 80 percent rock fragments, of which 10 to 20 percent is cobbles and 50 to 60 percent is pebbles.

Dryadine series

The Dryadine series consists of moderately deep, well drained soils on mountaintops. These soils formed in residuum derived dominantly from fractured hard limestone. Slope is 2 to 25 percent. Elevation is 8,000 to 9,000 feet. The average annual precipitation is about 30 to 40 inches, the average annual air temperature is 34 to 38 degrees F, and the frost-free period is 40 to 60 days.

These soils are loamy-skeletal, carbonatic Typic Cryochrepts.

Typical pedon of Dryadine flaggy silt loam, 2 to 25 percent slopes, in woodland, about 2,620 feet west and 210 feet north of the southeast corner of sec. 27, T. 12 N., R. 18 E.

O1—1 1/2 inches to 1 inch; pine needles, twigs, and cones.

O2—1 inch to 0; partially weathered organic matter.

A1—0 to 2 1/2 inches; very dark grayish brown (10YR 3/2) flaggy silt loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and plastic; many fine and very fine roots and common medium and coarse roots; 15 percent angular cobbles and 10 percent angular pebbles; medium acid; abrupt wavy boundary.

AC—2 1/2 to 12 inches; pale brown (10YR 6/3) extremely flaggy silt loam, brown (10YR 4/3) moist; moderate very fine subangular blocky structure parting to moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; many coarse, medium, fine, and very fine roots; 35 percent angular pebbles and 30 percent angular cobbles; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—12 to 25 inches; very pale brown (10YR 7/3) extremely flaggy silt loam, brown (10YR 5/3) moist; moderate very fine subangular blocky structure parting to weak very fine granular; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots and few coarse and medium roots; many fine and very fine pores and common medium pores; 55 percent angular cobbles and 30 percent angular pebbles; strongly effervescent; mildly alkaline; diffuse irregular boundary.

C2—25 to 34 inches; pale brown (10YR 6/3) extremely flaggy silt loam, brown (10YR 5/3) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; 80 percent flat angular cobbles and 15 percent angular pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

R—34 inches; pale brown (10YR 6/3) consolidated hard fractured limestone.

About 15 to 30 percent of the surface is covered by angular cobbles and stones. Fractured hard limestone is at a depth of 20 to 40 inches.

The A horizon is 10 to 20 percent clay. It is 15 to 60 percent rock fragments, of which 0 to 5 percent is stones, 5 to 30 percent is angular cobbles, and 10 to 35 percent is angular pebbles.

The AC horizon is loam or silt loam and is 10 to 20 percent clay. It is 35 to 70 percent rock fragments, of which 15 to 40 percent is angular cobbles and 20 to 35 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is loam or silt loam and is 10 to 20 percent clay. It is 60 to 95 percent rock fragments, of which 30 to 60 percent is angular cobbles and 30 to 50 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

Eltsac series

The Eltsac series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 2 to 60 percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are very-fine, montmorillonitic (calcareous), frigid Vertic Ustorthents.

Typical pedon of an Eltsac clay in an area of Eltsac-Norbert clays, 8 to 25 percent slopes, in rangeland, about 2,630 feet east and 220 feet south of the northwest corner of sec. 7, T. 15 N., R. 19 E.

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure parting to medium fine granular; very hard, firm, sticky and very plastic; many fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

C1—4 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2ca—15 to 21 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; extremely hard, firm, very sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores; few fine irregular soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—21 to 29 inches; grayish brown (2.5Y 5/2) and gray (5Y 5/1) clay, olive gray (2.5Y 4/2) and very dark gray (N 3/0) moist; weak fine subangular blocky structure; very hard, firm, sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores; intersecting slickensides; few fine irregular soft masses of lime; slightly effervescent; moderately alkaline; diffuse wavy boundary.

C4—29 to 38 inches; dark gray (N 4/0) and yellowish brown (10YR 5/6) clay and shale fragments, very dark gray (N 3/0) moist; platy shale beds; extremely hard, very firm, sticky and very plastic; few gypsum seams between plates; slightly effervescent; neutral; gradual wavy boundary.

C5r—38 to 60 inches; dark gray (N 4/0) semiconsolidated shale that crushes to clay, black (N 2/0) moist; extremely hard, extremely firm, sticky and plastic; few fine and very fine roots; medium acid.

Semiconsolidated shale is at a depth of 20 to 40 inches.

The A horizon is mildly alkaline or moderately alkaline.

The C horizon is moderately alkaline to neutral.

Elve series

The Elve series consists of deep, somewhat excessively drained soils on mountainsides. These soils formed in colluvium and alluvium derived dominantly from igneous rock. Slope is 15 to 60 percent. Elevation is 5,000 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 44 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryochrepts.

Typical pedon of an Elve very cobbly loam in an area of Elve-Arcette complex, 15 to 60 percent slopes, in woodland, about 1,400 feet west and 200 feet south of the northeast corner of sec. 30, T. 17 N., R. 20 E.

O1 and O2—1 inch to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A21—0 to 2 inches; pale brown (10YR 6/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine and very fine pores; 25 percent angular cobbles and 30 percent angular pebbles; medium acid; abrupt wavy boundary.

A22—2 to 17 inches; very pale brown (10YR 7/4) very cobbly loam, yellowish brown (10YR 5/4) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine and very fine pores; 30 percent angular cobbles and 25 percent angular pebbles; strongly acid; gradual wavy boundary.

B2—17 to 33 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, yellowish brown (10YR 5/6) moist; moderate fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine and very fine pores; 35 percent angular cobbles and 30 percent angular pebbles; strongly acid; gradual wavy boundary.

B3—33 to 46 inches; yellow (10YR 7/6) extremely cobbly heavy sandy loam, yellowish brown (10YR 5/6) moist; weak fine subangular blocky structure parting to weak fine granular; hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine and very fine pores; 35 percent angular cobbles and 30 percent angular pebbles; strongly acid; gradual wavy boundary.

C—46 to 60 inches; yellow (10YR 7/6) extremely cobbly sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine and very fine roots; common fine irregular pores; 45 percent angular cobbles and 40 percent angular pebbles; strongly acid.

The A horizon is 10 to 20 percent clay. It is 35 to 60 percent rock fragments, of which 10 to 30 percent is angular cobbles and 25 to 30 percent is angular pebbles. It is strongly acid to slightly acid.

The B horizon is loam or sandy loam and is 10 to 20 percent clay. It is 60 to 85 percent rock fragments, of

which 25 to 40 percent is angular cobbles and 20 to 45 percent is angular pebbles.

The C horizon is sandy loam or loam and is 10 to 20 percent clay. It is 60 to 85 percent rock fragments, of which 25 to 45 percent is angular cobbles and 35 to 50 percent is angular pebbles. It is strongly acid to slightly acid.

Enbar series

The Enbar series consists of deep, somewhat poorly drained soils on low terraces and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed Cumulic Haploborolls.

Typical pedon of an Enbar loam in an area of Enbar-Nesda loams, 0 to 2 percent slopes, about 750 feet east and 10 feet north of the southwest corner of sec. 21, T. 15 N., R. 17 E.

A11—0 to 3 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; hard, very friable, slightly sticky and plastic; many medium, fine, and very fine roots and few coarse roots; slightly effervescent; mildly alkaline; clear wavy boundary.

A12—3 to 16 inches; grayish brown (10YR 5/2) loam; very dark brown (10YR 2/2) moist; moderate fine and very fine subangular blocky structure; very hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; strongly effervescent; mildly alkaline; gradual wavy boundary.

A13—16 to 22 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium and fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—22 to 29 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; common fine faint dark yellowish brown (10YR 3/4) mottles; weak fine and very fine blocky structure; very hard, friable, slightly sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; few fine irregular soft masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2g—29 to 42 inches; gray (5Y 6/2) loam that has strata of fine sandy loam and clay loam, dark gray (5Y 4/1) moist; many fine distinct dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; 5 percent pebbles; strongly effervescent; moderately alkaline; abrupt irregular boundary.

C3g—42 to 50 inches; gray (5Y 6/1) loam, dark gray (5Y 4/1) moist; many fine prominent brownish yellow (10YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine and very fine pores; 10 percent rock fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.

IIC4—50 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly coarse sandy loam, dark brown (10YR 4/3) moist; common fine distinct brownish yellow (10YR 6/6) mottles; massive; soft, friable, nonsticky and nonplastic; 75 percent rock fragments, mainly less than 3 inches in diameter; strongly effervescent; moderately alkaline.

Extremely gravelly coarse sandy loam or loamy sand is at a depth of 36 to 50 inches. The mollic epipedon is 16 to 28 inches thick.

The A horizon is mildly alkaline or moderately alkaline.

The C1 horizon is loam or clay loam and is 18 to 30 percent clay. It is 0 to 15 percent pebbles.

The Cg horizon is loam or sandy loam and is 10 to 27 percent clay. It is 0 to 15 percent pebbles.

The IIC horizon is sandy loam or loamy sand and is 5 to 18 percent clay. It is 35 to 75 percent rock fragments, of which 0 to 5 percent is cobbles and 35 to 70 percent is pebbles.

Ernem series

The Ernem series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from hard sandstone. Slope is 2 to 25 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey-skeletal, mixed Lithic Argiborolls.

Typical pedon of Ernem clay loam, 2 to 8 percent slopes, in rangeland, about 660 feet south and 1,950 feet west of the northeast corner of sec. 25, T. 15 N., R. 23 E.

A1—0 to 3 inches; grayish brown (10YR 5/2) heavy loam, very dark grayish brown (10YR 3/2) moist; strong very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; 5 percent sandstone pebbles; slightly acid; clear wavy boundary.

A3—3 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong very fine subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; 10 percent pebbles; slightly acid; clear wavy boundary.

B21t—6 to 11 inches; brown (10YR 5/3) very channery clay, dark brown (10YR 4/3) moist; strong fine and very fine subangular blocky structure; hard, friable, sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; distinct continuous clay films on faces of peds; 50 percent pebbles; slightly acid; clear smooth boundary.

B22t—11 to 14 inches; brown (10YR 5/3) extremely channery clay, dark brown (10YR 4/3) moist; strong very fine subangular blocky structure; hard, friable, sticky and very plastic; common fine and very fine roots; many fine and very fine pores between rock fragments; thin continuous clay films on faces of peds and on fragments; 65 percent sandstone pebbles and a few flagstones; neutral; gradual smooth boundary.

R—14 inches; hard fine-grained sandstone.

Hard sandstone is at a depth of 10 to 20 inches.

The A horizon is clay loam or loam and is 20 to 35 percent clay. It is 10 to 60 percent rock fragments, of which 0 to 20 percent is stones, 5 to 15 percent is angular cobbles, and 5 to 25 percent is angular pebbles. It is slightly acid or neutral.

The B2t horizon is clay loam or clay and is 35 to 50 percent clay. It is 35 to 60 percent rock fragments, of which 10 to 20 percent is stones, 10 to 20 percent is angular cobbles, and 15 to 20 percent is angular pebbles. It is slightly acid to mildly alkaline.

Ethridge series

The Ethridge series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvium derived dominantly from shale and sandstone. Slope is 0 to 15 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Aridic Argiborolls.

Typical pedon of Ethridge silty clay loam, 0 to 2 percent slopes, in rangeland, about 2,165 feet south and 2,465 feet west of the northeast corner of sec. 26, T. 21 N., R. 18 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure in upper 3 inches and moderate medium and fine subangular blocky below; very hard, very friable, sticky and plastic; many fine and very fine roots and pores; neutral; abrupt wavy boundary.

B2t—6 to 13 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and pores; thin continuous clay films on faces of peds; moderately alkaline; clear irregular boundary.

B31—13 to 16 inches; light brownish gray (2.5Y 6/2) light silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and coarse angular blocky; hard, friable, sticky and plastic; many fine and very fine roots and pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

B32ca—16 to 31 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse angular blocky; very hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; common fine distinct white (2.5Y 8/2) masses and threads of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C1ca—31 to 37 inches; light brownish gray (2.5Y 6/2) light silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few fine masses and threads of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2cs—37 to 60 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, very sticky and very plastic; few fine roots and common very fine roots; many fine and very fine pores; common fine white (10YR 8/2) masses and threads of gypsum; slightly effervescent; moderately alkaline.

The A horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is neutral or mildly alkaline.

The B2t horizon is silty clay loam, clay, or silty clay and averages 35 to 45 percent clay. It is neutral to moderately alkaline.

The B3 and C horizons are clay loam, silty clay loam, or silty clay and average 30 to 45 percent clay. They are moderately alkaline or strongly alkaline.

Evanston series

The Evanston series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium. Slope is 0 to 8 percent. Elevation is 2,600 to 3,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed Aridic Argiborolls.

Typical pedon of Evanston loam, 0 to 2 percent slopes, in rangeland, about 1,320 feet north and 1,320 feet west of the southeast corner of sec. 7, T. 18 N., R. 26 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; neutral; abrupt wavy boundary.

B21t—5 to 11 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—11 to 14 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; very hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; thin continuous clay films on faces of peds; neutral; abrupt smooth boundary.

B3ca—14 to 36 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores and few medium pores; few threads and fine masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C1ca—36 to 60 inches; light brownish gray (2.5Y 6/2) loam that has strata of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; common fine masses of lime; strongly effervescent; strongly alkaline.

Depth to the strongly effervescent horizon is 12 to 16 inches.

The B2t horizon is heavy loam, clay loam, or silty clay loam and averages 25 to 35 percent clay. It is neutral to moderately alkaline.

The B3 and C horizons are fine sandy loam, loam, or clay loam and average 15 to 30 percent clay. They are moderately alkaline or strongly alkaline.

Fairfield series

The Fairfield series consists of deep, well drained soils on terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed Typic Argiborolls.

Typical pedon of Fairfield clay loam, 0 to 2 percent slopes, in cropland, about 1,980 feet north and 10 feet west of the southeast corner of sec. 6, T. 15 N., R. 18 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, sticky and plastic; neutral; abrupt smooth boundary.

B2t—6 to 9 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate very fine subangular blocky; hard, friable, sticky and plastic; many very fine roots; many very fine pores; neutral; clear irregular boundary.

C1ca—9 to 19 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and slightly plastic; common fine and very fine roots; many very fine pores; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—19 to 43 inches; white (10YR 8/2) silty clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, sticky and slightly plastic; few fine roots; common very fine pores; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

IIC3ca—43 to 60 inches; brownish yellow (10YR 6/6) very gravelly sandy loam, yellowish brown (10YR 5/6) moist; single grain; few very fine roots; 45 percent pebbles; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. Depth to the strongly calcareous horizon is 7 to 10 inches.

The B2t horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is 2 to 7 inches thick in undisturbed areas. It is neutral or mildly alkaline.

The C horizon is loam, clay loam, or silty clay loam and averages 25 to 35 percent clay. It is mildly alkaline or moderately alkaline.

The IIC horizon is sandy loam or loam and is 10 to 20 percent clay. It is 35 to 55 percent pebbles and is moderately alkaline or strongly alkaline.

Farnuf series

The Farnuf series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvium. Slope is 0 to 15 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed Typic Argiborolls.

Typical pedon of Farnuf loam, 0 to 4 percent slopes, in cropland, about 1,782 feet north and 225 feet west of the southeast corner of sec. 29, T. 19 N., R. 14 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

B2t—5 to 12 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; peds coated dark brown (10YR 3/3) moist; strong medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; neutral; clear irregular boundary.

B3ca—12 to 21 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; common films and nodules of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—21 to 39 inches, light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; many nodules and common films of lime; few pebbles that have undercoating of lime; strongly effervescent; mildly alkaline; abrupt wavy boundary.

C2—39 to 64 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly effervescent; mildly alkaline.

Depth to the strongly calcareous horizon is 10 to 18 inches.

The B2t horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is neutral or mildly alkaline.

The B3 and C horizons are loam or clay loam and average 20 to 30 percent clay. They are 0 to 15 percent pebbles and are mildly alkaline or moderately alkaline.

Fergus series

The Fergus series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium. Slope is 0 to 8 percent. Elevation is 3,600 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, mixed Typic Argiborolls.

Typical pedon of Fergus clay loam, 2 to 8 percent slopes, in cropland, about 110 feet west and 2,040 feet north of the southeast corner of sec. 22, T. 15 N., R. 18 E.

Ap—0 to 6 inches; brown (7.5YR 4/2) clay loam, very dark brown (7.5YR 2/2) moist; medium fine granular structure; slightly hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

B21t—6 to 8 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium prismatic structure parting to moderate medium platy; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—8 to 16 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; extremely hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; many moderately thick clay films on faces of peds; mildly alkaline; clear wavy boundary.

B23t—16 to 21 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/4) moist; moderate medium and fine subangular blocky structure; extremely hard, firm, sticky and plastic; many fine and very fine roots; many very fine pores; thin clay films on faces of peds; mildly alkaline; abrupt wavy boundary.

B3—21 to 26 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C1ca—26 to 50 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; few fine and very fine roots; few fine pores and common very fine pores; common threads of segregated lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—50 to 60 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; common very fine pores; common threads of segregated lime; violently effervescent; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick. Depth to the strongly calcareous horizon is 14 to 30 inches.

The B2t horizon is clay loam, clay, or silty clay and averages 35 to 50 percent clay. It is 0 to 10 percent pebbles and is neutral or mildly alkaline.

The B3 and C horizons are clay loam or silty clay loam and average 27 to 40 percent clay. They are 0 to 15 percent pebbles. They are mildly alkaline or moderately alkaline.

Firada series

The Firada series consists of moderately deep, well drained soils on uplands and mountainsides. These soils formed in residuum and colluvium derived dominantly from fractured hard limestone. Slope is 15 to 60 percent. Elevation is 4,800 to 8,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 40 to 44 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryochrepts.

Typical pedon of a Firada cobbly clay loam in an area of Whitore-Firada cobbly clay loams, 15 to 60 percent slopes, in woodland, about 2,500 feet north and 1,190 feet west of the southeast corner of sec. 7, T. 12 N., R. 18 E.

O1—1 1/2 inches to 0; forest litter of needles and twigs.

A2—0 to 3 inches; light gray (10YR 7/2) cobbly clay loam, brown (10YR 4/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and plastic; many fine, medium, and coarse roots; many very fine and fine pores; 30 percent rock fragments, mainly angular cobbles; slightly acid; clear wavy boundary.

B2—3 to 13 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; strong fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine, medium, and coarse roots; many very fine and fine pores; 25 percent cobbles and 15 percent angular pebbles; neutral; clear wavy boundary.

B3—13 to 17 inches; pale brown (10YR 6/3) very cobbly light clay loam, brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine, medium, and coarse roots; many very fine and fine pores; 30 percent cobbles and 20 percent angular pebbles; slightly effervescent; mildly alkaline; gradual wavy boundary.

C1—17 to 25 inches; light brownish gray (10YR 6/2) extremely flaggy light clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; common fine, medium, and coarse roots; many very fine and fine pores; 45 percent flagstones and 30 percent angular pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

R—25 inches; fractured extremely hard limestone.

Limestone is at a depth of 20 to 40 inches.

The A horizon is 27 to 35 percent clay. It is 25 to 35 percent rock fragments, of which 20 to 25 percent is angular cobbles and 5 to 10 percent is angular pebbles. It is slightly acid or neutral.

The B horizon is loam or clay loam and is 20 to 35 percent clay. It is 30 to 60 percent rock fragments, of which 15 to 30 percent is angular cobbles and 15 to 30 percent is angular pebbles. It is slightly acid to mildly alkaline.

The C horizon is loam or clay loam and is 18 to 35 percent clay. It is 50 to 80 percent rock fragments, of which 30 to 50 percent is angular cobbles and 20 to 30 percent is angular pebbles.

Flasher series

The Flasher series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in weakly consolidated, sandy sedimentary beds. Slope is 4 to 45 percent. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 14 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are mixed, frigid, shallow Typic Ustipsamments.

Typical pedon of a Flasher loamy fine sand in an area of Tally-Flasher complex, 4 to 25 percent slopes, in rangeland, about 825 feet west and 2,150 feet south of the northeast corner of sec. 31, T. 19 N., R. 16 E.

A1—0 to 11 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and plastic; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—11 to 16 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; thin threads of lime on sandstone; strongly effervescent; mildly alkaline; gradual wavy boundary.

C2r—16 to 60 inches; pale yellow (2.5Y 7/4) weakly consolidated sandy sedimentary beds that crush to loamy sand, light yellowish brown (2.5Y 6/4) moist; single grain; slightly effervescent; mildly alkaline.

Sedimentary beds are at a depth of 10 to 20 inches. The C horizon is loamy sand, loamy fine sand, or fine sand and averages 5 to 10 percent clay.

Floweree series

The Floweree series consists of deep, well drained soils on fans and terraces. These soils formed in alluvial and eolian material. Slope is 2 to 8 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-silty, mixed Aridic Haploborolls.

Typical pedon of Floweree silt loam, 2 to 8 percent slopes, in rangeland, about 2,000 feet south and 2,500 feet west of the northeast corner of sec. 29, T. 21 N., R. 17 E.

A1—0 to 7 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak medium granular structure in upper part and weak medium prismatic structure parting to weak medium and fine subangular blocky in lower part; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

B2—7 to 14 inches; grayish brown (2.5Y 5/2) heavy silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; few threads of lime; slightly effervescent; moderately alkaline; clear wavy boundary.

B3ca—14 to 36 inches; grayish brown (2.5Y 5/2) heavy silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; common threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—36 to 45 inches; light olive brown (2.5Y 5/4) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, nonsticky and nonplastic; common fine and very fine roots; common fine pores and many very fine pores; common threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—45 to 60 inches; light olive brown (2.5Y 5/4) silt loam that has strata of very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; common very fine pores and few fine pores; few threads of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 10 inches thick. Depth to the strongly effervescent horizon is 11 to 14 inches. The A horizon is neutral or mildly alkaline. The B and C horizons are silt loam or silty clay loam and average 20 to 30 percent clay.

Frazer series

The Frazer series consists of deep, well drained soils on low terraces and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 3,000 to 4,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Fluventic Haploborolls.

Typical pedon of Frazer silty clay loam, in cropland, about 1,700 feet west and 100 feet north of the southeast corner of sec. 28, T. 18 N., R. 15 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; slightly effervescent; mildly alkaline; clear smooth boundary.

C1—6 to 14 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; mildly alkaline; clear smooth boundary.

C2—14 to 22 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure; hard, friable, sticky and plastic; many very fine roots; many very fine pores; common seams of gypsum; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C3cs—22 to 34 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine angular blocky structure; hard, firm, sticky and very plastic; common very fine roots; many very fine pores; many seams of gypsum; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C4—34 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; few very fine roots; many very fine pores; slightly effervescent; strongly alkaline; gradual wavy boundary.

C5—50 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common distinct olive brown and gray mottles; massive; hard, friable, sticky and plastic; common very fine pores; slightly effervescent; strongly alkaline.

The mollic epipedon is 10 to 16 inches thick. The A horizon is mildly alkaline or moderately alkaline. The C horizon is silty clay loam, silty clay, or clay and averages 35 to 45 percent clay. It is mildly alkaline to strongly alkaline.

Gerber series

The Gerber series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Vertic Argiborolls.

Typical pedon of a Gerber clay loam in an area of Gerber-Winifred clay loams, 2 to 8 percent slopes, in cropland, about 1,940 feet west and 2,390 feet north of the southeast corner of sec. 3, T. 17 N., R. 14 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; strong fine and very fine granular structure; hard, friable, sticky and plastic; neutral; abrupt wavy boundary.

B21t—5 to 8 inches; yellowish brown (10YR 5/4) heavy silty clay, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; extremely hard, firm, sticky and very plastic; common fine and very fine roots; common fine pores; continuous clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—8 to 17 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; extremely hard, firm, sticky and very plastic; common fine and very fine roots; common fine pores; continuous clay films on faces of peds; mildly alkaline; clear wavy boundary.

B23t—17 to 20 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; extremely hard, firm, sticky and very plastic; common fine and very fine roots; common fine pores; continuous clay films on faces of peds; slightly effervescent; moderately alkaline; clear wavy boundary.

B3ca—20 to 30 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; strong fine and very fine subangular blocky structure; extremely hard, friable, sticky and plastic; few fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—30 to 38 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; extremely hard, friable, sticky and plastic; few fine roots; few fine pores; common medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—38 to 60 inches; light brownish clay (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, friable, sticky and plastic; few fine roots; few fine pores; few threads and fine masses of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A horizon is clay loam or silty clay and averages 30 to 45 percent clay. It is neutral or mildly alkaline.

The B2t horizon is silty clay or clay and averages 45 to 55 percent clay. It is mildly alkaline or moderately alkaline.

The B3 and C horizons are clay loam, silty clay loam, or silty clay and average 35 to 45 percent clay. They are 0 to 10 percent pebbles. They are mildly alkaline or moderately alkaline.

Gerdrum series

The Gerdrum series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 15 percent. Elevation is 2,300 to 4,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Natrargids.

Typical pedon of Gerdrum clay loam, 0 to 4 percent slopes, in rangeland, about 1,380 feet west and 100 feet north of the southeast corner of sec. 26, T. 19 N., R. 22 E.

A21—0 to 1 1/2 inches; pale brown (10YR 6/3) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; 10 percent rock fragments, mainly less than 3/4 inch in size; slightly acid; clear smooth boundary.

A22—1 1/2 to 3 1/2 inches; light gray (10YR 7/2) clay loam, brown (10YR 4/3) moist; weak fine and very fine platy structure parting to moderate very fine granular; soft, very friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and common medium pores; 10 percent rock fragments, mainly less than 3/4 inch in size; neutral; abrupt smooth boundary.

B2t—3 1/2 to 9 inches; grayish brown (10YR 5/2) clay, brown (10YR 4/3) moist; dark brown (10YR 3/3) coatings on peds; moderate medium prismatic structure parting to strong fine and medium subangular blocky; extremely hard, firm, very sticky and very plastic; many very fine roots, common fine roots, and few medium roots; many very fine pores; 5 percent rock fragments; mildly alkaline; clear wavy boundary.

B31ca—9 to 20 inches; grayish brown (2.5Y 5/2) light clay, dark grayish brown (2.5Y 4/2) moist; strong medium and coarse angular blocky structure; extremely hard, firm, very sticky and plastic; common very fine and fine roots and few medium roots; common fine and very fine pores; few slickensides and many pressure faces on peds; 5 percent rock fragments; few fine masses and coatings of lime on pebbles; strongly effervescent; strongly alkaline; clear irregular boundary.

B32cs—20 to 27 inches; grayish brown (2.5Y 5/2) light clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse angular blocky structure; extremely hard, firm, very sticky and plastic; few fine and very fine roots; common very fine pores; less than 5 percent rock fragments; many coarse and medium soft masses of gypsum; slightly effervescent; strongly alkaline; gradual wavy boundary.

C1cs—27 to 46 inches; olive gray (5Y 5/2) heavy silty clay, olive gray (5Y 4/2) moist; massive; extremely hard, firm, very sticky and very plastic; few very fine roots and pores; less than 5 percent rock fragments; common to many medium and coarse soft masses of gypsum; slightly effervescent; moderately alkaline; diffuse irregular boundary.

C2—46 to 60 inches; pale yellow (2.5Y 7/4) silty clay, light yellowish brown (2.5Y 6/4) moist; massive; hard, friable, very sticky and plastic; few medium masses of gypsum; strongly effervescent; strongly alkaline.

The A1 and A2 horizons are loam or clay loam and average 20 to 35 percent clay. They are 5 to 15 percent pebbles. They are slightly acid or neutral. The horizons are 2 to 4 inches thick.

The B2t horizon is clay or silty clay and averages 40 to 55 percent clay. It is mildly alkaline or moderately alkaline.

The B3 and C horizons are clay or silty clay and average 40 to 50 percent clay. They are moderately alkaline or strongly alkaline. In some pedons a very gravelly C horizon is at a depth of 40 to 60 inches.

Hanson series

The Hanson series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in calcareous alluvium and colluvium derived dominantly from limestone. Slope is 0 to 45 percent. Elevation is 4,600 to 8,000 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, carbonatic Calcic Cryoborolls.

Typical pedon of a Hanson stony loam in an area of Kildor-Skaggs-Hanson complex, 15 to 45 percent slopes, in rangeland, about 2,600 feet west and 700 feet south of the northeast corner of sec. 14, T. 13 N., R. 19 E.

A11—0 to 11 inches; very dark grayish brown (10YR 3/2) stony loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; friable, nonsticky and slightly plastic; 10 percent stones; slightly effervescent; mildly alkaline; gradual wavy boundary.

A12—11 to 15 inches; dark grayish brown (10YR 4/2) cobbly light clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and common medium roots; many fine and very fine pores; 25 percent cobbles that have undercoats of lime; slightly effervescent; mildly alkaline; clear smooth boundary.

C1ca—15 to 21 inches; pale brown (10YR 6/3) extremely gravelly clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and few medium roots; many fine and very fine pores; 55 percent pebbles and 15 percent cobbles that have coatings of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—21 to 47 inches; very pale brown (10YR 8/3, 8/2) extremely gravelly light clay loam, pale brown (10YR 6/3, 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; 60 percent pebbles and 15 percent cobbles; common threads and streaks of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C3ca—47 to 62 inches; pale brown (10YR 6/3) extremely gravelly light clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few fine roots; common very fine pores; 60 percent pebbles and 20 percent cobbles that have partial coatings of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A11 horizon is 18 to 27 percent clay. It is 25 to 35 percent rock fragments, of which 0 to 20 percent is stones, 10 to 15 percent is cobbles, and 15 to 25 percent is pebbles.

The A12 and C horizons are loam or clay loam and are 20 to 30 percent clay. They are 50 to 80 percent rock fragments, of which 0 to 5 percent is stones, 15 to 25 percent is cobbles, and 35 to 60 percent is pebbles. They are mildly alkaline or moderately alkaline.

Harlem series

The Harlem series consists of deep, well drained soils on flood plains and low terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic (calcareous), frigid Ustic Torrifluvents.

Typical pedon of Harlem silty clay loam, in cropland, about 1,320 feet south and 1,200 feet east of the northwest corner of sec. 20, T. 15 N., R. 24 E.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable, sticky and plastic; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—8 to 17 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and thin platy structure; hard, firm, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; few threads of lime; slightly effervescent; mildly alkaline; clear smooth boundary.

C2—17 to 24 inches; grayish brown (2.5Y 5/2) silt loam that has strata of silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; few threads of lime; strongly calcareous; moderately alkaline; clear smooth boundary.

C3—24 to 38 inches; grayish brown (2.5Y 5/2) silty clay loam that has strata of silty clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct reddish brown (5YR 3/3) mottles; weak thin platy structure; hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C4—38 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam that has strata of silt loam, dark grayish brown (2.5Y 4/2) moist; few medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few threads of gypsum; strongly effervescent; moderately alkaline; clear smooth boundary.

C5—52 to 66 inches; grayish brown (2.5Y 5/2) silty clay that has strata of silty clay loam, dark grayish brown (2.5Y 4/2) moist; few medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine pores; few threads and few medium masses of gypsum; strongly effervescent; moderately alkaline.

The A horizon is mildly alkaline or moderately alkaline.

The C horizon is clay loam, silty clay loam, clay, or silty clay and has a few thin layers of silt loam. It averages 35 to 50 percent clay.

Havre series

The Havre series consists of deep, well drained soils on flood plains and low terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.

Typical pedon of Havre loam, in cropland, about 1,200 feet east and 700 feet south of the northwest corner of sec. 26, T. 21 N., R. 18 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine platy structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; strongly effervescent; mildly alkaline; clear smooth boundary.

C1—5 to 18 inches; light brownish gray (2.5Y 6/2) loam that has strata of very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to very weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; few threads of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—18 to 62 inches; light brownish gray (2.5Y 6/2) loam that has strata of fine sandy loam, dark grayish brown (2.5Y 4/2) moist; yellowish brown (10YR 5/4) mottles below a depth of 50 inches; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine pores; few threads of lime; strongly effervescent; moderately alkaline.

The A horizon is loam or silty clay loam and averages 18 to 35 percent clay. It is mildly alkaline or moderately alkaline.

The C horizon is loam or clay loam that has thin strata of fine sandy loam or silty clay loam. It averages 18 to 35 percent clay.

Hibar series

The Hibar series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 15 percent. Elevation is 4,200 to 4,700 feet. The average annual precipitation is about 17 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine-loamy, mixed Udic Haploborolls.

Typical pedon of a Hibar loam in an area of Hibar-Castner loams, 2 to 8 percent slopes, in rangeland, about 2,300 feet north and 800 feet east of the southwest corner of sec. 12, T. 14 N., R. 18 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine pores; 5 percent angular sandstone pebbles; medium acid; abrupt smooth boundary.

B21—6 to 13 inches; brown (10YR 4/3) heavy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and plastic; many fine and very fine roots; many fine and very fine pores; few wormcasts; 5 percent angular sandstone pebbles; slightly acid; clear wavy boundary.

B22—13 to 22 inches; brown (10YR 5/3) heavy loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse prismatic structure parting to weak medium and fine subangular blocky; hard, friable, slightly sticky and plastic; many fine and very fine roots; many fine and very fine pores and few medium pores; 5 percent angular sandstone pebbles; mildly alkaline; abrupt irregular boundary.

Cca—22 to 32 inches; very pale brown (10YR 7/4) heavy loam, light yellowish brown (10YR 6/4) moist; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots, mainly between peds; many fine and very fine pores and few medium pores; 15 percent angular sandstone pebbles; common medium masses of lime; strongly effervescent; mildly alkaline; diffuse wavy boundary.

R—32 inches; very pale brown (10YR 7/4) fractured hard sandstone; few fine roots in fractures.

Fractured hard sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 10 to 16 inches thick.

The A horizon is 15 to 27 percent clay. It is 5 to 25 percent rock fragments, of which 0 to 5 percent is flat angular cobbles and 5 to 20 percent is flat angular pebbles. It is slightly acid or medium acid.

The B horizon is loam or clay loam and averages 22 to 35 percent clay. It is 5 to 10 percent angular pebbles and is slightly acid to mildly alkaline.

The C horizon is loam or clay loam and is 18 to 35 percent clay. It is 5 to 30 percent rock fragments, of which 0 to 5 percent is angular cobbles and 5 to 25 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

Hoosan series

The Hoosan series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in clayey alluvium derived dominantly from shale and limestone. Slope is 2 to 8 percent. Elevation is 4,700 to 5,600 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, mixed Pachic Cryoborolls.

Typical pedon of Hoosan silty clay loam, 2 to 8 percent slopes, in cropland, about 500 feet north and 450 feet west of the southeast corner of sec. 14, T. 13 N., R. 18 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.
A12—6 to 12 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable, slightly sticky and plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; neutral; diffuse wavy boundary.
B21—12 to 20 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.
B22—20 to 28 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; strongly effervescent; mildly alkaline; clear wavy boundary.
B3ca—28 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; many fine threads of lime; violently effervescent; moderately alkaline; clear wavy boundary.
Cca—34 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and plastic; very few fine and very fine roots; many fine and very fine pores; few shale particles; common fine threads of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 16 to 24 inches thick.

The A horizon is neutral or mildly alkaline. It is 0 to 5 percent angular pebbles.

The B and C horizons are clay loam, silty clay loam, or silty clay and average 35 to 50 percent clay. They are 0 to 15 percent angular pebbles and are mildly alkaline or moderately alkaline.

Hughesville series

The Hughesville series consists of moderately deep, well drained soils on mountainsides and foothills. These soils formed in residuum and colluvium derived dominantly from fractured hard limestone. Slope is 2 to 60 percent. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are loamy-skeletal, carbonatic Udic Haploborolls.

Typical pedon of a Hughesville very flaggy clay loam in an area of Whitecow-Hughesville complex, 20 to 60 percent slopes, in woodland, about 250 feet north and 400 feet west of the southeast corner of sec. 36, T. 13 N., R. 17 E.

O1 and O2—2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.
A1—0 to 2 inches; dark grayish brown (10YR 4/2) flaggy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; 15 percent angular cobbles and 10 percent angular pebbles; mildly alkaline; clear wavy boundary.
B2—2 to 10 inches; brown (10YR 5/3) very flaggy light clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; many fine, medium, and coarse roots; many fine and medium irregular pores; 30 percent angular cobbles and 15 percent angular pebbles that have lime cutans on undersides; slightly effervescent; moderately alkaline; clear wavy boundary.
B3ca—10 to 22 inches; pale brown (10YR 6/3) very flaggy heavy loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine and medium irregular pores; 35 percent angular cobbles and 15 percent angular pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.
C1ca—22 to 32 inches; light gray (10YR 7/2) extremely flaggy loam, pale brown (10YR 6/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine and medium irregular pores; 40 percent angular cobbles and stones and 30 percent angular pebbles; violently effervescent; moderately alkaline; clear wavy boundary.
C2ca—32 to 38 inches; white (10YR 8/2) extremely flaggy loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many fine and medium pores; 90 percent rock fragments, mainly angular cobbles and stones; violently effervescent; moderately alkaline; abrupt smooth boundary.
R—38 inches; fractured hard limestone.

Limestone is at a depth of 20 to 40 inches.

The A horizon is loam or clay loam and is 18 to 35 percent clay. It is 15 to 30 percent rock fragments, of which 0 to 5 percent is stones and 15 to 25 percent is

angular cobbles. The horizon is 1 inch to 3 inches thick. It is neutral or mildly alkaline.

The B2 horizon is loam, clay loam, or silty clay loam and is 18 to 35 percent clay. It is 35 to 60 percent rock fragments, of which 0 to 5 percent is stones, 20 to 30 percent is angular cobbles, and 15 to 25 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is loam, clay loam, or silty clay loam and is 18 to 35 percent clay. It is 60 to 95 percent rock fragments, of which 0 to 15 percent is stones, 45 to 60 percent is cobbles, and 15 to 25 percent is pebbles. It is moderately alkaline or strongly alkaline.

Judell series

The Judell series consists of deep, well drained soils on fans and terraces. These soils formed in calcareous alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 3,200 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, carbonatic Typic Calciborolls.

Typical pedon of a Judell clay loam in an area of Fairfield-Judell clay loams, 2 to 8 percent slopes, in rangeland, about 1,800 feet west and 650 feet south of the northeast corner of sec. 10, T. 15 N., R. 18 E.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; less than 5 percent limestone pebbles; slightly effervescent; mildly alkaline; clear smooth boundary.

B2ca—7 to 11 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; less than 5 percent limestone pebbles; few fine irregular disseminated soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

B3ca—11 to 27 inches; very pale brown (10YR 7/3) clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium pores; less than 5 percent lime-coated pebbles; common fine and medium irregular soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C1ca—27 to 53 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; common fine and medium subangular blocky structure; hard, friable, sticky and plastic; few fine and very fine roots and few medium roots; many fine and very fine pores; less than 5 percent limestone pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

IIIC2—53 to 66 inches; pale brown (10YR 6/3) extremely gravelly loam, dark brown (10YR 4/3) moist; massive; soft, friable, sticky and plastic; few fine and very fine roots; common very fine and fine pores; 65 percent rock fragments, mainly limestone pebbles; violently effervescent; moderately alkaline.

The calcic horizon is at a depth of 7 to 10 inches. The very gravelly or extremely gravelly IIIC horizon commonly is at a depth of 40 to 60 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon is mildly alkaline or moderately alkaline. It is 0 to 15 percent pebbles.

The B horizon is loam or clay loam and averages 20 to 35 percent clay. It is 0 to 15 percent pebbles.

The C horizon is loam or clay loam and averages 20 to 35 percent clay. It is 0 to 15 percent pebbles.

The IIIC horizon is loam or clay loam and is 12 to 35 percent clay. It is 35 to 75 percent rock fragments, of which 0 to 10 percent is cobbles and 35 to 65 percent is pebbles.

Judith series

The Judith series consists of deep, well drained soils on terraces and fans. These soils formed in calcareous alluvium derived dominantly from limestone. Slope is 0 to 15 percent. Elevation is 3,200 to 4,700 feet. The average annual precipitation is about 15 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 125 days.

These soils are fine-loamy, carbonatic Typic Calciborolls.

Typical pedon of a Judith gravelly clay loam in an area of Judith-Windham gravelly clay loams, 0 to 2 percent slopes, in cropland, about 1,400 feet east and 1,230 feet south of the northwest corner of sec. 16, T. 14 N., R. 23 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores; 10 percent pebbles and 5 percent cobbles; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B2—6 to 9 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores and few medium pores; 5 percent pebbles that have undercoating of lime; slightly effervescent; mildly alkaline; clear wavy boundary.

B31ca—9 to 17 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; moderate fine and very fine subangular blocky structure; hard, very friable, sticky and plastic; many fine and very fine roots, common medium roots, and few coarse roots; many fine and very fine pores and few medium pores; 5 percent pebbles; common fine and medium distinct masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

B32ca—17 to 24 inches; white (10YR 8/2) clay loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; hard, very friable, sticky and plastic; common medium, fine, and very fine roots and few coarse roots; many fine and very fine pores; 5 percent pebbles; disseminated lime and many fine and medium distinct masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

IIC1ca—24 to 46 inches; very pale brown (10YR 7/3) extremely gravelly loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; common medium, fine, and very fine roots; many fine and very fine pores; 50 percent pebbles and 10 percent cobbles; disseminated lime and lime coatings on pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2ca—46 to 66 inches; very pale brown (10YR 7/4) extremely gravelly sandy clay loam; light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few medium, fine, and very fine roots; many fine and very fine pores; 55 percent pebbles and 15 percent cobbles; disseminated lime; rock fragments that have partial coatings of lime; violently effervescent; moderately alkaline.

The very gravelly or extremely gravelly IIC horizon is at a depth of 24 to 40 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon is loam or clay loam and is 20 to 35 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 15 percent is cobbles and 5 to 25 percent is pebbles. It is mildly alkaline or moderately alkaline.

The B horizon is loam or clay loam and is 20 to 35 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 10 percent is cobbles and 5 to 25 percent is pebbles.

The IIC horizon is loam, clay loam, or sandy clay loam and is 20 to 35 percent clay. It is 35 to 80 percent rock fragments, of which 10 to 20 percent is cobbles and 25 to 60 percent is pebbles.

Julin series

The Julin series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated shale. Slope is 2 to 25 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 15 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic, acid, frigid Ustic Torriorthents.

Typical pedon of a Julin silty clay in an area of Teigen-Julin complex, 2 to 25 percent slopes, in rangeland, about 1,320 feet north and 2,000 feet west of the southeast corner of sec. 30, T. 16 N., R. 22 E.

A11—0 to 2 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate very fine granular structure; soft, very friable, sticky and very plastic; many medium, fine, and very fine roots; very strongly acid; clear wavy boundary.

A12—2 to 7 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate very fine and fine granular structure; soft, friable, sticky and very plastic; many very fine, fine, and medium roots; many very fine pores; few fine shale chips; very strongly acid; clear wavy boundary.

C1—7 to 25 inches; gray (10YR 6/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine granular structure parting to strong fine platy; soft, friable, sticky and very plastic; many very fine, fine, and medium roots; 50 percent weathered shale chips; extremely acid; clear wavy boundary.

C2—25 to 30 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; very hard, very firm, sticky and plastic; common very fine and fine roots and few medium and coarse roots; partly weathered shale fragments; extremely acid; clear wavy boundary.

C3r—30 to 60 inches; gray (5Y 5/1) consolidated shale.

Shale is at a depth of 20 to 40 inches.

The A horizon is silty clay or clay and averages 40 to 55 percent clay. It is extremely acid to strongly acid.

The C horizon is silty clay or clay and averages 40 to 55 percent clay. It is 50 to 85 percent shale fragments and is extremely acid to strongly acid.

Kildor series

The Kildor series consists of moderately deep, well drained soils on uplands. These soils formed in alluvium and residuum derived dominantly from semiconsolidated shale. Slope is 2 to 45 percent. Elevation is 4,600 to

6,000 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, montmorillonitic Typic Cryoborolls.

Typical pedon of a Kildor clay loam in an area of Kildor-Skaggs-Hanson complex, 15 to 45 percent slopes, in rangeland, about 1,320 feet east and 1,320 feet south of the northwest corner of sec. 20, T. 12 N., R. 22 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 5 percent rock fragments; neutral; clear smooth boundary.

A12—2 to 5 inches; dark grayish brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; 5 percent rock fragments; slightly effervescent; neutral; clear wavy boundary.

B21—5 to 13 inches; light olive gray (5Y 6/2) light clay, olive gray (5Y 4/2) moist; strong medium prismatic structure parting to strong fine and medium subangular blocky; hard, firm, very sticky and plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

B22ca—13 to 22 inches; pale olive (5Y 6/3) silty clay, olive (5Y 4/3) moist; strong medium and coarse prismatic structure parting to strong medium and fine subangular blocky; very hard, firm, very sticky and plastic; common fine and very fine roots; many fine and very fine pores; common fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

B23ca—22 to 30 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; strong medium and coarse prismatic structure parting to strong medium blocky; few fine and very fine roots; common fine and very fine pores; strongly effervescent; moderately alkaline; diffuse wavy boundary.

B3ca—30 to 37 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; few fine and medium distinct olive yellow mottles (5Y 6/8) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; few fine and very fine roots; common fine and very fine pores; common fine and medium masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

Cr—37 to 60 inches; pale olive and olive (5Y 6/3, 5/3) massive clay shale beds; few fine and very fine roots and pores; strongly effervescent; moderately alkaline.

Clay shale beds are at a depth of 20 to 40 inches.

The A horizon, where mixed, is 27 to 40 percent clay. It is 5 to 15 percent rock fragments, of which 0 to 5 percent is stones, 0 to 10 percent is cobbles, and 5 to 10 percent is pebbles. It is neutral or mildly alkaline.

The B and C horizons are clay loam, silty clay loam, or silty clay and average 35 to 50 percent clay. They have a trace of pebbles and 0 to 10 percent angular cobbles. They are mildly alkaline or moderately alkaline.

Klayent series

The Klayent series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in clayey alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 2,400 to 3,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, mixed (calcareous), frigid Fluvaquentic Haplaquolls.

Typical pedon of Klayent clay loam, 0 to 2 percent slopes, in cropland, about 2,200 feet west and 1,900 feet south of the northeast corner of sec. 10, T. 18 N., R. 22 E.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) heavy clay loam, dark grayish brown (10YR 4/2) dry; weak medium and fine platy structure; hard, friable, sticky and plastic; many fine, very fine, and medium roots and few coarse roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.

B2—5 to 14 inches; very dark gray (10YR 3/1) light clay, dark gray (10YR 4/1) dry; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine pores and common medium pores; less than 1 percent rock fragments of pebble size; few fine masses of salt; slightly effervescent; moderately alkaline; clear irregular boundary.

B3cacs—14 to 23 inches; grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) light clay with very dark gray (10YR 3/1) organic coatings on peds, light grayish brown (2.5Y 6/2) and grayish brown (2.5Y 5/2) dry; few fine distinct very pale brown (10YR 7/4) mottles; weak coarse prismatic structure parting to weak medium and fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and common medium pores; many fine, medium, and coarse distinct masses of lime and other salts; strongly effervescent; strongly alkaline; clear wavy boundary.

C1gsa—23 to 30 inches; gray (5Y 5/1) clay, light gray (5Y 6/1) dry; common fine distinct very pale brown (10YR 7/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, very sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and common medium pores; many medium and coarse distinct masses of salts; slightly effervescent; strongly alkaline; clear wavy boundary.

C2gsa—30 to 42 inches; gray (5Y 5/1) clay loam that has thin strata of light clay, light gray (5Y 6/1) dry; many fine and medium distinct brownish yellow (10YR 6/8) mottles; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine pores; many fine, medium, and coarse distinct masses of salts; strongly effervescent; strongly alkaline; gradual wavy boundary.

C3g—42 to 66 inches; greenish gray (5GY 6/1) sandy clay loam that has thin strata of loam and sandy clay, greenish gray (5GY 6/1) dry; many medium and coarse distinct brownish yellow (10YR 6/8) and reddish brown (2.5Y 4/4) mottles; massive; extremely hard, firm, sticky and plastic; few very fine roots; few fine and very fine pores; common fine and medium and few coarse masses of salts; strongly effervescent; strongly alkaline.

The mollic epipedon is 10 to 16 inches thick. The ca horizon is at a depth of 12 to 20 inches.

The A horizon is clay loam or silty clay and averages 27 to 50 percent clay. It is neutral to moderately alkaline.

The B horizon is clay loam, silty clay loam, or clay and averages 35 to 50 percent clay. It is 0 to 5 percent pebbles.

The C horizon, to a depth of about 40 inches, is clay loam, silty clay loam, or clay and averages 30 to 45 percent clay. It is 0 to 15 percent pebbles. It is moderately alkaline or strongly alkaline.

Kobar series

The Kobar series consists of deep, well drained soils on terraces and fans. These soils formed in clayey alluvium. Slope is 0 to 25 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Camborthids.

Typical pedon of Kobar silty clay loam, 2 to 8 percent slopes, in rangeland, about 800 feet east and 1,350 feet north of the southwest corner of sec. 9, T. 18 N, R. 26 E.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure in upper 3 inches grading to weak medium and fine subangular blocky in lower part; hard, very friable, sticky and plastic; many fine and very fine roots and pores; slightly effervescent; neutral; abrupt wavy boundary.

B2—7 to 15 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine angular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

B3ca—15 to 20 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to weak medium and coarse subangular blocky; extremely hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few fine faint masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

C1ca—20 to 31 inches; light brownish gray (2.5Y 6/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse angular blocky structure; extremely hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few fine faint masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

C2cacs—31 to 60 inches; light brownish gray (2.5Y 6/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; many very fine pores; common fine distinct masses and threads of salt and lime; strongly effervescent; strongly alkaline.

The A horizon is 0 to 5 percent pebbles. It is neutral or mildly alkaline.

The B horizon is 0 to 5 percent pebbles. It is mildly alkaline to strongly alkaline.

The C horizon is clay loam, silty clay loam, or clay and averages 35 to 45 percent clay. It is 0 to 5 percent pebbles and is moderately alkaline or strongly alkaline.

Korchea series

The Korchea series consists of deep, well drained soils on low terraces and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are fine-loamy, mixed (calcareous), frigid Mollic Ustifluvents.

Typical pedon of Korchea loam, in cropland, about 2,220 feet east and 1,540 feet south of the northwest corner of sec. 5, T. 19 N., R. 16 E.

Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak fine platy structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—7 to 24 inches; grayish brown (2.5Y 5/2) loam that has strata of silt loam and fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; few fine threads and specks of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—24 to 54 inches; grayish brown (2.5Y 5/2) loam that has thin strata of silt loam and very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; few fine lime nodules; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—54 to 66 inches; grayish brown (2.5Y 6/2) loam that has strata of silt loam, dark grayish brown (2.5Y 4/2) moist; common distinct mottles, yellowish brown (10YR 5/8) moist; massive; friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly effervescent; moderately alkaline.

In some pedons very gravelly or extremely gravelly material is at a depth of 40 to 60 inches.

The A horizon is mildly alkaline or moderately alkaline.

The C horizon is loam or clay loam and has strata of silt loam, sandy loam, or silty clay loam. It averages 18 to 30 percent clay. It is mildly alkaline or moderately alkaline.

Labre series

The Labre series consists of deep, well drained soils on fans and foot slopes. These soils formed in alluvium. Slope is 2 to 15 percent. Elevation is 3,300 to 4,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are loamy-skeletal, mixed Typic Haploborolls.

Typical pedon of a Labre gravelly loam in an area of Shambo-Labre complex, 2 to 8 percent slopes, in rangeland, about 2,100 feet east and 2,000 feet south of the northwest corner of sec. 6, T. 14 N., R. 23 E.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and very fine roots; 15 percent angular pebbles and 5 percent angular cobbles; mildly alkaline; clear smooth boundary.

B2—5 to 11 inches; grayish brown (10YR 5/2) gravelly heavy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and very fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 20 percent angular pebbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—11 to 16 inches; grayish brown (10YR 5/2) extremely gravelly loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 60 percent angular pebbles that have undercoats of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—16 to 28 inches; grayish brown (2.5Y 5/2) extremely gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; 70 percent angular pebbles; slightly effervescent; mildly alkaline; abrupt smooth boundary.

IIBb—28 to 35 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few threads of segregated lime; 10 percent angular pebbles; slightly effervescent; mildly alkaline; abrupt smooth boundary.

IIIC3ca—35 to 60 inches; grayish brown (2.5Y 5/2) extremely gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; 60 percent angular pebbles; strongly effervescent; mildly alkaline.

The profile is 10 to 27 percent clay. The mollic epipedon is 7 to 15 inches thick.

The A horizon is 15 to 20 percent rock fragments, of which 0 to 5 percent is cobbles and 10 to 15 percent is pebbles.

The B horizon is 10 to 25 percent rock fragments, of which 0 to 10 percent is cobbles and 10 to 15 percent is pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is 60 to 70 percent pebbles. It is mildly alkaline or moderately alkaline.

Lawther series

The Lawther series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in

clayey alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 3,200 to 4,200 feet. The average annual precipitation is about 15 to 17 inches, the average annual air temperature is 38 to 44 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Vertic Haploborolls.

Typical pedon of Lawther silty clay, 2 to 4 percent slopes, in cropland, about 1,400 feet north and 250 feet west of the southeast corner of sec. 36, T. 19 N., R. 13 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium granular structure; hard, firm, sticky and very plastic; slightly effervescent; moderately alkaline; clear smooth boundary.

B2—6 to 14 inches; light grayish brown (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure; extremely hard, firm, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

B3ca—14 to 20 inches; light grayish brown (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and coarse blocky; extremely hard, very firm, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; few small masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—20 to 41 inches; light grayish brown (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, sticky and very plastic; common fine and very fine roots; many fine and very fine pores; distinct slickensides and wedge-shaped aggregates; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—41 to 64 inches; light grayish brown (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, sticky and very plastic; few very fine roots; many very fine pores; common streaks and films of gypsum crystals; slightly effervescent; moderately alkaline.

The profile is silty clay or clay and averages 40 to 55 percent clay. It is mildly alkaline or moderately alkaline.

Libeg series

The Libeg series consists of deep, well drained soils on mountainsides. These soils formed in colluvium and alluvium derived dominantly from sandstone and igneous rock. Slope is 15 to 70 percent. Elevation is 4,800 to 6,500 feet. The average annual precipitation is about 18 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Argic Cryoborolls.

Typical pedon of Libeg flaggy loam, 15 to 45 percent slopes, in rangeland, about 950 feet west and 2,380 feet north of the southeast corner of sec. 30, T. 17 N., R. 20 E.

A11—0 to 5 inches; dark brown (10YR 4/3) flaggy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; 30 percent rock fragments; neutral; clear wavy boundary.

A12—5 to 11 inches; brown (10YR 5/3) very flaggy loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; 45 percent rock fragments; slightly acid; gradual wavy boundary.

B21t—11 to 17 inches; pale brown (10YR 6/3) extremely flaggy light clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; thin clay films on faces of peds; 65 percent rock fragments; slightly acid; gradual irregular boundary.

B22t—17 to 40 inches; yellowish brown (10YR 5/4) extremely flaggy light clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and very fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; thin clay films on faces of peds; 75 percent rock fragments; slightly acid; gradual irregular boundary.

B3—40 to 60 inches; light yellowish brown (10YR 6/4) extremely flaggy light clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and very fine roots; many fine and very fine pores; 85 percent rock fragments; medium acid.

The mollic epipedon is 8 to 14 inches thick.

The A horizon is 10 to 27 percent clay. It is 15 to 35 percent rock fragments, of which 0 to 5 percent is stones, 10 to 25 percent is angular cobbles, and 5 to 10 percent is angular pebbles. It is slightly acid or neutral.

The B horizon is loam or light clay loam and is 20 to 35 percent clay. It is 35 to 80 percent rock fragments, of which 5 to 15 percent is stones, 25 to 50 percent is angular cobbles, and 10 to 25 percent is angular pebbles.

Linnet series

The Linnet series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 8 percent. Elevation is 2,300 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Ustertic Argiborolls.

Typical pedon of Linnet clay loam, 0 to 2 percent slopes, in cropland, about 1,320 feet north and 1,320 feet east of the southwest corner of sec. 23, T. 21 N., R. 18 E.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; common unstained sand grains; neutral; abrupt smooth boundary.

B2t—7 to 16 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure parting to moderate medium and subangular blocky; very hard, firm, sticky and plastic; many very fine roots; many very fine pores; thin continuous clay films on faces of peds; neutral; clear irregular boundary.

B3ca—16 to 25 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine roots; many very fine pores; common fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—25 to 45 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—45 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many films of lime; violently effervescent; moderately alkaline.

The A horizon is neutral or mildly alkaline. It is 0 to 10 percent pebbles.

The B2t horizon is clay or silty clay and averages 45 to 60 percent clay. It is 0 to 10 percent pebbles.

The B3 and C horizons are clay loam, silty clay loam, or silty clay and average 35 to 45 percent clay. They are 0 to 15 percent pebbles.

In some pedons a IIC horizon is below a depth of 40 inches. It is sandy loam or loam and is 10 to 27 percent clay. It is 25 to 65 percent pebbles.

Linwell series

The Linwell series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 15 percent. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Haploborolls.

Typical pedon of Linwell silty clay loam, 0 to 2 percent slopes, in cropland, about 600 feet west and 60 feet south of the northeast corner of sec. 15, T. 18 N., R. 15 E.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure in upper 1 inch parting to moderate fine and very fine subangular blocky in lower 5 inches; hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

B21—6 to 11 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium pores; few wormcasts; slightly effervescent; mildly alkaline; clear wavy boundary.

B22—11 to 15 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium pores; few wormcasts; common fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

B3ca—15 to 28 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium and coarse pores; few wormcasts; few medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—28 to 38 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; very hard, friable, sticky and plastic; moderate fine and very fine roots and few medium and coarse roots; many fine and very fine pores and few medium and coarse pores; few wormcasts; common medium masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.
C2—38 to 66 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; few distinct yellowish brown (10YR 5/6) mottles; massive; very hard, friable, sticky and plastic; few fine and very fine roots; many fine and very fine pores and few medium pores; few fine masses and seams of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 15 inches thick. Depth to the strongly calcareous horizon is 12 to 20 inches. Some pedons have an accumulation of gypsum below a depth of 24 inches.

The A horizon is clay loam or silty clay loam and averages 30 to 40 percent clay. It is neutral or mildly alkaline.

The B horizon is silty clay loam or silty clay and averages 35 to 45 percent clay. It is mildly alkaline or moderately alkaline.

The C horizon is clay loam, silty clay loam, or silty clay and averages 35 to 45 percent clay. It is 0 to 15 percent angular pebbles.

Lipke series

The Lipke series consists of deep, well drained soils on uplands and foot slopes. These soils formed in alluvium and residuum derived dominantly from shale. Slope is 15 to 60 percent. Elevation is 4,200 to 5,300 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are fine, montmorillonitic Udic Haploborolls.

Typical pedon of a Lipke clay loam in an area of Mocmont-Lipke association, steep, in woodland, about 1,580 feet south and 1,650 feet west of the northeast corner of sec. 13, T. 14 N., R. 18 E.

O1—2 inches to 0; pine cones, needles, twigs, and humus.
A11—0 to 1 inch; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and very plastic; many fine and very fine roots; medium acid; abrupt wavy boundary.
A12—1 inch to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; medium acid; clear wavy boundary.
A13—4 to 12 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; very hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; medium acid; clear wavy boundary.
B21—12 to 20 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and very fine angular blocky structure; very hard, firm, sticky and plastic; common very fine, fine, medium, and coarse roots; many fine and very fine pores; medium acid; clear wavy boundary.
B22—20 to 25 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong fine angular blocky structure; extremely hard, firm, sticky and very plastic; common very fine, fine, and medium roots; many fine and very fine pores; few slickensides; medium acid; clear wavy boundary.
B3—25 to 42 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine, fine, and medium roots; many fine and very fine pores; neutral; diffuse boundary.
C—42 to 60 inches; light yellowish brown and gray (10YR 6/4 and 5Y 6/1) clay, yellowish brown and gray (10YR 4/4 and 5Y 5/1) moist; massive; extremely hard, extremely firm, sticky and very plastic; few very fine roots; few fine and common very fine pores; 5 percent shaly clay fragments; common fine masses of lime; strongly effervescent; mildly alkaline.

The mollic epipedon is 7 to 15 inches thick.

The A horizon is loam or clay loam and averages 18 to 40 percent clay. It is medium acid or slightly acid.

The B horizon is clay or silty clay and averages 45 to 60 percent clay. It is medium acid to neutral.

Little Horn series

The Little Horn series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard limestone. Slope is 2 to 15 percent. Elevation is 4,600 to 6,500 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine, montmorillonitic Argic Cryoborolls.

Typical pedon of Little Horn silt loam, 2 to 8 percent slopes, in rangeland, about 450 feet west and 250 feet north of the southeast corner of sec. 31, T. 13 N., R. 20 E.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) moist; moderate fine granular structure; soft, friable, nonsticky and slightly plastic; neutral; clear wavy boundary.

A12—5 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; clear wavy boundary.

B21t—8 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; continuous clay films faces of peds; neutral; clear wavy boundary.

B22t—15 to 22 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin clay films on faces of peds; neutral; clear wavy boundary.

Cca—22 to 29 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots; few angular limestone fragments; violently effervescent; mildly alkaline; abrupt smooth boundary.

R—29 to 33 inches; fractured hard limestone.

Limestone is at a depth of 20 to 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon is silt loam or stony loam and averages 18 to 27 percent clay. It is 5 to 15 percent angular pebbles, 0 to 10 percent angular cobbles, and 0 to 10 percent stones. It is neutral or mildly alkaline.

The B horizon is clay loam, silty clay loam, or silty clay and averages 35 to 45 percent clay. It is 0 to 15 percent angular pebbles and 0 to 10 percent angular cobbles. It is neutral or mildly alkaline.

The C horizon is clay loam or silty clay loam and is 30 to 40 percent clay. It is 0 to 25 rock fragments, of which 0 to 10 percent is angular cobbles and 0 to 15 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

Loken series

The Loken series consists of deep, well drained soils on mountainsides and uplands. These soils formed in alluvium and colluvium derived dominantly from limestone and shale. Slope is 2 to 45 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine, mixed Udic Haploborolls.

Typical pedon of a Loken silty clay loam in an area of Loken-Brazon silty clay loams, 2 to 8 percent slopes, in rangeland, about 330 feet north and 1,800 feet east of the southwest corner of sec. 1, T. 17 N., R. 17 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine subangular blocky structure parting to strong fine granular; hard, very friable, sticky and plastic; many fine and very fine roots and pores; 5 percent rock fragments; neutral; abrupt wavy boundary.

B2—6 to 11 inches; brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, friable, sticky and plastic; many fine and very fine roots and pores; 5 percent rock fragments; mildly alkaline; clear irregular boundary.

B3ca—11 to 15 inches; grayish brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, very friable, sticky and plastic; many fine and very fine roots and pores; 10 percent rock fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—15 to 27 inches; light gray (10YR 7/2) gravelly heavy clay loam, pale brown (10YR 6/3) moist; weak medium and coarse prismatic structure parting to weak fine subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; 25 percent rock fragments; common medium and fine masses of lime; violently effervescent; moderately alkaline; diffuse wavy boundary.

C2ca—27 to 60 inches; light gray (10YR 7/2) gravelly heavy clay loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots in upper part grading to none in lower part; common fine and very fine pores in upper part

grading to few very fine pores in lower part; 30 percent rock fragments; common medium and fine masses of lime; violently effervescent; moderately alkaline.

The mollic epipedon is 8 to 15 inches thick. Depth to the strongly calcareous horizon is 8 to 16 inches.

The A horizon is clay loam or silty clay loam and is 30 to 40 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 10 percent is stones, 0 to 15 percent is cobbles, and 5 to 10 percent is pebbles. It is slightly acid or neutral.

The B horizon is clay loam, silty clay loam, or clay and averages 35 to 50 percent clay. It is 5 to 10 percent pebbles and 0 to 5 percent cobbles. It is neutral to moderately alkaline.

The C horizon is clay loam or light clay and is 35 to 50 percent clay. It is 0 to 35 percent rock fragments, of which 0 to 5 percent is stones, 0 to 5 percent is cobbles, and 0 to 25 percent is pebbles.

Lolo series

The Lolo series consists of deep, somewhat excessively drained soils on terraces and fans. These soils formed in alluvium. Slope is 0 to 4 percent. Elevation is 3,800 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 125 days.

These soils are loamy-skeletal, mixed Pachic Haploborolls.

Typical pedon of Lolo very gravelly loam, 0 to 4 percent slopes, in rangeland, about 1,800 feet south and 1,500 feet west of the northeast corner of sec. 1, T. 16 N., R. 20 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 35 percent angular igneous pebbles; slightly acid; abrupt wavy boundary.

A12—2 to 5 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; strong fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; 40 percent igneous pebbles; slightly acid; clear irregular boundary.

B21—5 to 12 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; strong medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; very dark gray (10YR 3/1) organic films on faces of peds; 40 percent angular igneous pebbles; slightly acid; clear irregular boundary.

B22—12 to 22 inches; brown (10YR 5/3) extremely gravelly loam, dark brown (10YR 3/3) moist; strong fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; very dark grayish brown (10YR 3/2) organic films on faces of peds; 70 percent igneous pebbles; neutral; diffuse wavy boundary.

B3—22 to 60 inches; brown (10YR 5/3) extremely gravelly loam; dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 60 percent igneous pebbles and 10 percent angular cobbles; neutral.

The mollic epipedon is 24 inches to more than 60 inches thick.

The A horizon is 18 to 25 percent clay. It is 35 to 60 percent rock fragments, of which 0 to 5 percent is stones, 5 to 10 percent is cobbles, and 35 to 45 percent is pebbles. It is slightly acid or neutral.

The B2 horizon is 18 to 25 percent clay. It is 35 to 80 percent rock fragments, of which 0 to 5 percent is stones, 5 to 15 percent is cobbles, and 25 to 60 percent is pebbles. It is slightly acid to mildly alkaline.

The B3 horizon is 15 to 22 percent clay. It is 60 to 80 percent rock fragments, of which 0 to 5 percent is stones, 5 to 15 percent is cobbles, and 55 to 65 percent is pebbles.

Maginnis series

The Maginnis series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from hard shale interbedded with sandstone. Slope is 15 to 45 percent. Elevation is 3,000 to 4,600 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are clayey-skeletal, montmorillonitic Lithic Haploborolls.

Typical pedon of a Maginnis channery clay loam in an area of Absarokee-Bitton-Maginnis complex, 15 to 60 percent slopes, in rangeland, about 1,400 feet east and 40 feet north of the southwest corner of sec. 11, T. 15 N., R. 18 E.

A1—0 to 7 inches; grayish brown (10YR 5/2) channery clay loam, very dark grayish brown (10YR 3/2) moist, moderate very fine granular structure; hard, very friable, sticky and plastic; many fine and very fine roots; 20 percent angular pebbles; neutral; clear wavy boundary.

B21—7 to 10 inches; grayish brown (10YR 5/2) very channery clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many very fine pores; 40 percent angular pebbles; neutral; abrupt wavy boundary.

B22—10 to 14 inches; grayish brown (2.5Y 5/2) very channery clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; 55 percent angular pebbles; neutral; abrupt smooth boundary.

B3—14 to 17 inches; grayish brown (2.5Y 5/2) extremely channery clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; common fine and very fine roots; few very fine pores; 80 percent angular pebbles; abrupt smooth boundary.

R—17 inches; hard shale interbedded with sandstone.

Hard shale interbedded with sandstone is at a depth of 10 to 20 inches. The mollic epipedon is 7 to 14 inches thick.

The A horizon is neutral or mildly alkaline. It is 15 to 35 percent angular shale and sandstone pebbles.

The B horizon is clay loam or clay and is 35 to 45 percent clay. It is 35 to 80 percent shale fragments and angular sandstone pebbles. It is neutral or mildly alkaline.

Marcott series

The Marcott series consists of deep, somewhat poorly drained soils on low terraces and flood plains. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 3,300 to 4,600 feet. The average annual precipitation is about 15 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 100 to 125 days.

These soils are fine, mixed Aquic Haploborolls.

Typical pedon of Marcott silty clay loam, in cropland, about 2,000 feet west and 660 feet north of the southeast corner of sec. 18, T. 18 N., R. 14 E.

Ap—0 to 8 inches; gray (10YR 5/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure parting to moderate very fine granular; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; less than 1 percent pebbles; common masses and seams of salts; strongly effervescent; moderately alkaline; abrupt smooth boundary.

B21—8 to 13 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure parting to moderate very fine subangular blocky; slightly hard, friable, very sticky and plastic; common very fine, fine, and medium roots; many fine, very fine, and medium pores; common very dark grayish brown organic stains on faces of peds; few masses and seams of salts; strongly effervescent; moderately alkaline; clear wavy boundary.

B22—13 to 19 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to moderate very fine subangular blocky; very hard, friable, very sticky and plastic; common fine and very fine roots; many very fine and fine pores and few medium pores; few masses and seams of salt; strongly effervescent; moderately alkaline; gradual wavy boundary.

B3ca—19 to 25 inches; light gray (2.5Y 7/2) heavy silty clay, grayish brown (2.5Y 5/2) moist; moderate fine subangular blocky structure; extremely hard, firm, sticky and very plastic; common fine and very fine roots; many fine and fine pores and few medium pores; less than 1 percent pebbles; common fine and medium masses of lime and salts; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—25 to 33 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; common fine and very fine faint gray (10YR 6/1) mottles; weak fine and very fine subangular blocky structure; extremely hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores and few medium pores; less than 1 percent pebbles; common fine and medium masses of lime and salts; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2g—33 to 42 inches; light gray (2.5Y 7/2) light clay, gray (10YR 4/1) moist; many medium distinct light olive gray (2.5Y 5/6) mottles; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine pores; 5 percent pebbles; common fine and medium masses of lime and salts; strongly effervescent; moderately alkaline; gradual wavy boundary.

IIC3—42 to 66 inches; light gray (2.5Y 7/2) extremely gravelly sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, very friable, slightly sticky and slightly plastic; few fine and very fine pores; 75 percent rock fragments, of which 5 percent is larger than 3 inches; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 15 inches thick. The seasonal water table is at a depth of 24 to 36 inches.

The A horizon is neutral to moderately alkaline.

The B and C horizons are clay loam, clay, silty clay loam, or silty clay and average 35 to 50 percent clay. They are 0 to 5 percent cobbles and 0 to 10 percent pebbles. They are mildly alkaline or moderately alkaline. The ca horizon is at a depth of 12 to 24 inches.

The IIC horizon is loam or sandy clay loam and is 10 to 25 percent clay. It is 15 to 80 percent rock fragments, of which 0 to 10 percent is cobbles and 15 to 70 percent is pebbles. The extremely gravelly IIC horizon generally is at a depth of 40 to 60 inches.

Marias series

The Marias series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic (calcareous), frigid Ustertic Torriorthents.

Typical pedon of Marias silty clay, 2 to 8 percent slopes, in cropland, about 1,900 feet west and 200 feet north of the southeast corner of sec. 17, T. 21 N., R. 19 E.

Ap—0 to 6 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; strong fine granular structure; hard, firm, sticky and plastic; moderately alkaline; clear smooth boundary.

C1—6 to 12 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; strong fine subangular blocky structure; hard, firm, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—12 to 22 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; strong fine subangular blocky structure; very hard, firm, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

C3—22 to 30 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C4—30 to 42 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine and very fine roots; common fine and very fine pores; few fine threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C5—42 to 60 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; few fine and very fine roots; common fine masses of gypsum and few fine threads of lime; strongly effervescent; moderately alkaline.

The profile is clay or silty clay and averages 45 to 60 percent clay. It is moderately alkaline or strongly alkaline.

Marmarth series

The Marmarth series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated, sandy and silty sedimentary beds. Slope is 2 to 8 percent. Elevation is 2,900 to 3,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed Aridic Argiborolls.

Typical pedon of Marmarth loam, 2 to 8 percent slopes, in cropland, about 1,200 feet south and 600 feet west of the northeast corner of sec. 10, T. 20 N., R. 18 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

B21t—6 to 10 inches; brown (10YR 4/3) light silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; many very fine roots; many very fine pores; continuous moderately thick clay films on faces of peds; neutral; gradual wavy boundary.

B22t—10 to 15 inches; brown (10YR 5/3) light silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, friable, slightly sticky and plastic; many very fine roots; many very fine pores; continuous moderately thick clay films on faces of peds; neutral; clear wavy boundary.

B3ca—15 to 21 inches; light brownish gray (2.5Y 6/2) heavy silt loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; common medium masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

C1ca—21 to 34 inches; light brownish gray (2.5Y 6/2) heavy silt loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine pores; common medium masses of lime; strongly effervescent; mildly alkaline; gradual smooth boundary.

C2r—34 to 60 inches; light brownish gray (2.5Y 6/2) weakly consolidated sandy and silty sedimentary beds that crush to loam, grayish brown (2.5Y 5/2) moist; weak fine platy; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; few medium masses of lime; slightly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 20 to 40 inches.

The B horizon is clay loam, silt loam, or silty clay loam and averages 22 to 35 percent clay. It is neutral to moderately alkaline.

The C horizon is loam or silt loam and averages 18 to 25 percent clay. It is mildly alkaline or moderately alkaline.

Martinsdale series

The Martinsdale series consists of deep, well drained soils on terraces and fans. These soils formed in loamy alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 3,500 to 3,800 feet. The average annual precipitation is about 15 to 17 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 130 days.

These soils are fine-loamy, mixed Typic Argiborolls.

Typical pedon of a Martinsdale loam in an area of Martinsdale-Judith loams, 4 to 8 percent slopes, in cropland, about 1,440 feet south and 700 feet east of the northwest corner of sec. 8, T. 19 N, R. 14 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B2t—6 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, sticky and plastic; many fine and very fine pores; thin continuous clay films on faces of peds; neutral; clear irregular boundary.

B3ca—14 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and plastic; many fine and very fine roots; many fine and very fine pores; common large masses of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—24 to 43 inches; light gray (2.5Y 7/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; 5 percent pebbles; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2ca—43 to 60 inches; light gray (2.5Y 7/2) very gravelly loam, grayish brown (2.5Y 5/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine pores and common very fine pores; disseminated lime; 55 percent pebbles; violently effervescent; moderately alkaline.

The mollic epipedon is 8 to 15 inches thick. The solum is 12 to 20 inches thick.

The A horizon is neutral or mildly alkaline. It is 0 to 10 percent pebbles.

The B horizon is clay loam or sandy clay loam and averages 27 to 35 percent clay. It is 0 to 10 percent pebbles. It is neutral or mildly alkaline.

The C horizon is loam, clay loam, or sandy clay loam and averages 20 to 30 percent clay. It is 0 to 10 percent pebbles. It is mildly alkaline or moderately alkaline.

The IIC horizon is loam or sandy loam and averages 15 to 25 percent clay. It is 35 to 55 percent pebbles. The gravelly or very gravelly IIC horizon is at a depth of 40 to 60 inches.

Marvan series

The Marvan series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 2,300 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic (calcareous), frigid Ustertic Torriorthents.

Typical pedon of Marvan silty clay, 0 to 2 percent slopes, in rangeland, about 1,000 feet north and 2,400

feet west of the southeast corner of sec. 4, T. 21 N., R. 25 E.

A11—0 to 2 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; extremely hard, friable, very sticky and very plastic; many fine and very fine roots and few medium roots; slightly effervescent; moderately alkaline; clear wavy boundary.

A12—2 to 5 inches; grayish brown (2.5Y 5/2) heavy silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine angular blocky structure; extremely hard, firm, very sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

C1—5 to 14 inches; grayish brown (2.5Y 5/2) heavy silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine angular blocky structure; extremely hard, firm, very sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; common fine distinct threads and masses of gypsum; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2cs—14 to 42 inches; grayish brown (2.5Y 5/2) heavy silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine angular blocky structure; extremely hard, firm, very sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; common fine distinct threads and masses of gypsum; slightly effervescent; moderately alkaline; gradual wavy boundary.

C3cs—42 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, very sticky and plastic; few fine and very fine roots; common fine and very fine pores; common fine distinct threads and masses of gypsum; slightly effervescent; moderately alkaline.

The C horizon is clay or silty clay and averages between 45 and 60 percent clay. It is moderately alkaline or strongly alkaline.

Mocmont series

The Mocmont series consists of deep, well drained soils on mountainsides and uplands. These soils formed in alluvium, colluvium, and residuum derived dominantly from igneous rock and sandstone. Slope is 2 to 60 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are loamy-skeletal, mixed Typic Eutroboralfs.

Typical pedon of Mocmont very gravelly loam, 15 to 60 percent slopes, in woodland, about 1,180 feet west and 1,330 feet north of the southeast corner of sec. 2, T. 16 N., R. 17 E.

O1 and O2—2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, cones, and leaves.

A2—0 to 9 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and nonplastic; many medium, fine, and very fine roots and few coarse roots; many very fine pores; 30 percent angular pebbles and 10 percent angular cobbles; slightly acid; clear wavy boundary.

A&B—9 to 12 inches; very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; weak very fine subangular blocky structure parting to moderate very fine granular; hard, friable, slightly sticky and slightly plastic; many medium, fine, and very fine roots and common coarse roots; many fine and very fine pores; 35 percent angular pebbles and 15 percent angular cobbles; medium acid; gradual wavy boundary.

B21t—12 to 24 inches; light yellowish brown (10YR 6/4) extremely gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; thin clay films on faces of peds and rock fragments; 50 percent angular pebbles and 20 percent angular cobbles; medium acid; gradual wavy boundary.

B22t—24 to 38 inches; pale brown (10YR 6/3) extremely gravelly light clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots, common fine and medium roots, and few coarse roots; many fine and very fine pores; thin clay films on faces of peds and rock fragments; 50 percent angular pebbles and 30 percent angular cobbles; medium acid; diffuse wavy boundary.

B3—38 to 60 inches; pale brown (10YR 6/3) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots and few medium roots; many very fine pores; 45 percent angular cobbles and 40 percent angular pebbles; medium acid.

The A1 horizon is loam or sandy loam and is 10 to 20 percent clay. It is 20 to 60 percent rock fragments, of which 5 to 20 percent is angular cobbles and 10 to 45 percent is angular pebbles.

The B2t horizon is sandy loam, sandy clay loam, or light clay loam and is 15 to 30 percent clay. It is 60 to 85 percent rock fragments, of which 0 to 5 percent is stones, 20 to 25 percent is angular cobbles, and 40 to 60 percent is angular pebbles. It is medium acid or slightly acid.

The B3 horizon is loam and sandy loam and is 10 to 25 percent clay. It is 60 to 95 percent rock fragments, of which 0 to 5 percent is stones, 25 to 35 percent is cobbles, and 35 to 60 percent is pebbles. It is medium acid or slightly acid.

Neldore series

The Neldore series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from consolidated shale. Slope is 4 to 60 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey, montmorillonitic, nonacid, frigid, shallow Ustic Torriorthents.

Typical pedon of a Neldore clay in an area of Dilts-Thebo-Neldore clays, 4 to 60 percent slopes, in rangeland, about 2,000 feet west and 1,700 feet north of the southeast corner of sec. 17, T. 21 N., R. 24 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) heavy clay, very dark grayish brown (2.5Y 3/2) moist; moderate very fine granular structure; hard, friable, very sticky and very plastic; many medium, fine, and very fine roots; slightly acid; clear wavy boundary.

C1—3 to 12 inches; grayish brown (2.5Y 5/2) heavy clay, olive gray (5Y 4/2) moist; weak fine and medium subangular blocky structure parting to moderate fine granular; very hard, friable, sticky and very plastic; common medium, fine, and very fine roots; many very fine pores; 5 percent hard shale fragments; neutral; clear wavy boundary.

C2—12 to 18 inches; light gray (5Y 6/1) clay; very dark gray (5Y 5/1) moist; massive; extremely hard, very firm, sticky and very plastic; common coarse, medium, fine, and very fine roots; few very fine pores through shale fragments that have roots mainly between shale chips; 5 percent hard shale fragments and 75 percent soft shale fragments; shale fragments are light brownish gray (2.5Y 6/2) dry, gray and very dark gray (5Y 5/1, 3/1) moist; slightly acid; gradual wavy boundary.

C3r—18 to 60 inches; gray (5Y 6/1) consolidated shale.

Consolidated shale is at a depth of 10 to 20 inches.

The A horizon is 0 to 5 percent pebbles and 0 to 5 percent cobbles. It is medium acid to mildly alkaline.

The C horizon is clay or silty clay and averages 45 to 60 percent clay. It is medium acid to moderately alkaline.

Nesda series

The Nesda series consists of deep, well drained soils on low terraces and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 2,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 125 days.

These soils are sandy-skeletal, mixed Fluventic Haploborolls.

Typical pedon of a Nesda loam in an area of Sudworth-Nesda loams, in rangeland, about 1,120 feet east and 1,200 feet north of the southwest corner of sec. 4, T. 15 N., R. 18 E.

A11—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, nonsticky and nonplastic; slightly effervescent; neutral; clear wavy boundary.

A12—6 to 14 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; very weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; few threads of lime; slightly effervescent; mildly alkaline; abrupt wavy boundary.

IIC1—14 to 16 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose; common fine and very fine roots; 35 percent pebbles; slightly effervescent; mildly alkaline; abrupt smooth boundary.

IIIC2—16 to 46 inches; light brownish gray (10YR 6/2) extremely gravelly sand; grayish brown (10YR 5/2) moist; single grain; loose; 70 percent pebbles; slightly effervescent; mildly alkaline; abrupt smooth boundary.

IIIC3—46 to 60 inches; grayish brown (10YR 5/2) extremely gravelly sand that has few strata of clay loam, very dark grayish brown (10YR 3/2) moist; single grain; loose; 80 percent pebbles; slightly effervescent; mildly alkaline.

The loamy sand, very gravelly sand, or extremely gravelly sand is at a depth of 10 to 20 inches. The mollic epipedon is 10 to 16 inches thick.

The A horizon is 10 to 20 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 5 percent is stones, 0 to 25 percent is cobbles, and 5 to 30 percent is pebbles. It is neutral or mildly alkaline.

The IIC horizon is sand or loamy sand and is 0 to 10 percent clay. It is 45 to 85 percent rock fragments, of which 0 to 5 percent is stones, 10 to 20 percent is cobbles, and 35 to 80 percent is pebbles. It is neutral or mildly alkaline.

Nesda Variant

The Nesda Variant consists of deep, well drained soils on flood plains. These soils formed in gravelly alluvium. Slope is 0 to 2 percent. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, mixed Cumulic Cryoborolls.

Typical pedon of a Nesda Variant very gravelly loam in an area of Nesda Variant complex, in rangeland, about 1,920 feet east and 950 feet south of the northwest corner of sec. 25, T. 13 N., R. 17 E.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; 55 percent rock fragments, mainly less than 3 inches in diameter; slightly effervescent; mildly alkaline; clear wavy boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; 65 percent rock fragments, mainly less than 3 inches in diameter; strongly effervescent; moderately alkaline; clear wavy boundary.

A13—12 to 20 inches; dark grayish brown (10YR 4/2) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots and common coarse roots; 75 percent rock fragments, mainly less than 3 inches in diameter; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—20 to 32 inches; light brownish gray (10YR 6/2) extremely gravelly loamy coarse sand, grayish brown (10YR 5/2) moist; single grain; loose; many fine roots, common medium roots, and few coarse roots; 85 percent rock fragments of which 20 percent is more than 3 inches in diameter; violently effervescent; moderately alkaline; clear wavy boundary.

C2—32 to 60 inches; grayish brown (10YR 5/2) extremely gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and nonplastic; common fine and medium roots and few coarse roots; 65 percent rock fragments, of which 20 percent is more than 3 inches in diameter; violently effervescent; moderately alkaline.

The mollic epipedon is 16 to 30 inches thick.

The A11 horizon is 10 to 20 percent clay. It is 25 to 60 percent rock fragments, of which 0 to 5 percent is stones, 10 to 20 percent is cobbles, and 10 to 45 percent is pebbles. It is mildly alkaline or moderately alkaline.

The A12, A13, and C horizons are 0 to 20 percent clay. They are 60 to 80 percent rock fragments, of which 0 to 5 percent is stones, 10 to 15 percent is cobbles, and 40 to 70 percent is pebbles. They are mildly alkaline or moderately alkaline. Some pedons have thin strata of loamy sand.

Nobe series

The Nobe series consists of deep, moderately well drained soils on terraces and fans. These soils formed in clayey alluvium. Slope is 0 to 8 percent. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 10 to 15 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 135 days.

These soils are fine, montmorillonitic (calcareous), frigid Ustic Torriorthents.

Typical pedon of a Nobe clay in an area of Vanda-Nobe clays, 0 to 4 percent slopes, in rangeland, about 800 feet south and 60 feet east of the northwest corner of sec. 10, T. 21 N., R. 21 E.

A2—0 to 1 inch; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; vesicular crust; hard, very friable, slightly sticky and nonplastic; mildly alkaline; abrupt smooth boundary.

B21—1 inch to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse platy structure parting to strong fine granular; hard, friable, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; moderately alkaline; abrupt wavy boundary.

B22—2 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong subangular blocky structure; hard, friable, very sticky and very plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; strongly alkaline; abrupt wavy boundary.

C1cs—8 to 24 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots; common fine pores and many very fine pores; common fine masses of gypsum; slightly effervescent; moderately alkaline; clear wavy boundary.

C2cs—24 to 60 inches; olive gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; weak medium blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; many very fine pores; few medium masses of gypsum; slightly effervescent; moderately alkaline.

A cs horizon is at a depth of 4 to 12 inches.

The B horizon is clay or silty clay and averages 45 to 60 percent clay. It is moderately alkaline or strongly alkaline.

The C horizon is clay or silty clay and averages 45 to 60 percent clay. It is moderately alkaline or strongly alkaline.

Norbert series

The Norbert series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 8 to 60 percent. Elevation is 3,400 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents.

Typical pedon of a Norbert clay in an area of Eltsac-Norbert clays, 8 to 25 percent slopes, in rangeland, about 1,600 feet west and 1,660 feet north of the southeast corner of sec. 7, T. 15 N., R. 19 E.

A1—0 to 3 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate medium granular structure; hard, firm, sticky and very plastic; mildly alkaline; clear smooth boundary.

C1—3 to 9 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak medium prismatic structure parting to weak medium angular blocky; extremely hard, firm, sticky and very plastic; many fine roots; common fine and very fine pores; mildly alkaline; gradual wavy boundary.

C2—9 to 14 inches; gray (5Y 5/3) shaly clay, olive (5Y 4/3) moist; platy structure; extremely hard, firm, sticky and very plastic; common fine roots; common fine and very fine pores; 25 percent hard shale fragments; slightly effervescent; moderately alkaline; gradual wavy boundary.

C3r—14 to 60 inches; gray (2.5Y 5/1) platy semiconsolidated shale; slightly effervescent; few fine roots to a depth of 26 inches.

Semiconsolidated shale is at a depth of 10 to 20 inches.

The profile is clay or silty clay and averages 45 to 60 percent clay. It is mildly alkaline or moderately alkaline.

Oraid series

The Oraid series consists of moderately deep, somewhat excessively drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 60 percent. Elevation is 4,200 to 5,300 feet. The average annual precipitation is about 17 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are sandy-skeletal, mixed, frigid Typic Ustorthents.

Typical pedon of an Oraid extremely flaggy sandy loam in an area of Mocmont-Oraid complex, 2 to 25 percent slopes, in rangeland, about 925 feet north and 550 feet west of the southeast corner of sec. 9, T. 13 N., R. 17 E.

O1 and O2—1 1/2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A21—0 to 2 1/2 inches; light brown (7.5YR 6/4) extremely flaggy sandy loam, brown (7.5YR 4/4) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; few coarse roots, common medium roots, and many fine and very fine roots; 35 percent flagstones and 25 percent angular pebbles; medium acid; diffuse wavy boundary.

A22—2 1/2 to 10 inches; light yellowish brown (10YR 6/4) extremely flaggy heavy loamy sand, dark yellowish brown (10YR 4/4) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; few coarse roots, common medium roots, and many fine and very fine roots matted between fragments; 55 percent flagstones and 20 percent angular pebbles; medium acid; diffuse wavy boundary.

A23—10 to 20 inches; very pale brown and pale brown (10YR 7/3, 6/3) extremely flaggy loamy sand, yellowish brown and dark yellowish brown (10YR 5/4, 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few coarse roots and common medium and fine roots; 60 percent flagstones and 25 percent angular pebbles; strongly acid; gradual wavy boundary.

A24r—20 to 25 inches; very pale brown and light yellowish brown (10YR 7/4, 6/4) extremely flaggy loamy sand, yellowish brown and light yellowish brown (10YR 5/4, 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots in upper part; sandstone fragments are extremely hard when dry and extremely firm when moist; 90 percent rock fragments, mainly flagstones; strongly acid; clear smooth boundary.

R—25 inches; very pale brown (10YR 7/4) and light yellowish brown (10YR 6/4) fractured hard sandstone.

Hard sandstone is at a depth of 20 to 40 inches.

The A horizon is sandy loam or loamy sand and is 5 to 10 percent clay. It is 45 to 85 percent rock fragments, of which 35 to 60 percent is angular cobbles and 10 to 30 percent is angular pebbles. It is strongly acid to slightly acid.

The AC horizon, where present, is 5 to 10 percent clay. It is 60 to 85 percent rock fragments, of which 50 to 75 percent is cobbles and 10 to 25 percent is pebbles.

Pekay series

The Pekay series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 4,100 to 4,700 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine, montmorillonitic Udertic Haploborolls.

Typical pedon of Pekay silty clay, 2 to 8 percent slopes, in cropland, about 1,320 feet east and 1,340 feet north of the southwest corner of sec. 14, T. 14 N., R. 19 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium granular structure; hard, firm, sticky and very plastic; common fine and very fine roots; slightly effervescent; mildly alkaline; clear wavy boundary.

B2—7 to 29 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium and coarse prismatic structure; extremely hard, very firm, sticky and very plastic; common fine and very fine roots; common fine and very fine pores; distinct slickensides; few medium masses of lime; slightly effervescent; moderately alkaline; gradual wavy boundary.

B31ca—29 to 47 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; common fine and very fine pores; few medium gypsum crystals; common medium masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

B32ca—47 to 60 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; few medium faint mottles that are brown (10YR 4/3) when moist; moderate medium and coarse prismatic structure; extremely hard, firm, sticky and very plastic; few fine and very fine roots; few very fine pores; common medium masses of lime and few medium masses of gypsum; strongly effervescent; moderately alkaline; clear wavy boundary.

Cca—60 to 66 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; few medium faint mottles that are dark yellowish brown (10YR 4/4) when moist; massive; extremely hard, firm, sticky and very plastic; few very fine roots; few fine pores; common medium masses of lime and common medium masses of gypsum; strongly effervescent; moderately alkaline.

The A horizon is neutral or mildly alkaline. The B and C horizons are clay or silty clay and average 45 to 60 percent clay.

Pendroy series

The Pendroy series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 4 percent. Elevation is 2,600 to 3,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are very-fine, montmorillonitic (calcareous), frigid Ustertic Torriorthents.

Typical pedon of Pendroy clay, 0 to 4 percent slopes, in rangeland, about 1,500 feet south and 2,400 feet west of the northeast corner of sec. 18, T. 21 N., R. 21 E.

A11—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium granular structure; extremely hard, very firm, very sticky and very plastic; many very fine and few fine roots; many fine and very fine pores; moderately alkaline; clear smooth boundary.

A12—3 to 9 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; many very fine and few fine roots; many fine and very fine pores; moderately alkaline; clear wavy boundary.

C1—9 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; many very fine and few fine roots; many fine and very fine pores; slightly effervescent; moderately alkaline; clear wavy boundary.

C2ca—13 to 50 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; common very fine and few fine roots grading to few very fine and fine roots below a depth of 30 inches; many fine and very fine pores; common fine and medium distinct masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—50 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; common fine and very fine pores; few fine masses and threads of lime; strongly effervescent; moderately alkaline.

The profile is mildly alkaline or moderately alkaline. The C horizon averages more than 60 percent clay.

Raynesford series

The Raynesford series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 15 percent. Elevation is 4,600 to 6,000 feet. The average annual precipitation is about 20 to 26 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy, carbonatic Calcic Cryoborolls.

Typical pedon of a Raynesford loam in an area of Raynesford-Hanson complex, 0 to 4 percent slopes, in rangeland, about 2,270 feet south and 1,200 feet west of the northeast corner of sec. 6, T. 12 N., R. 20 E.

A11—0 to 8 inches; dark gray (10YR 4/1) heavy loam, black (10YR 2/1) moist; moderate fine and very fine granular structure; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and pores and common medium roots and pores; 5 percent limestone pebbles; slightly effervescent; mildly alkaline; clear wavy boundary.

A12—8 to 12 inches; grayish brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, very friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores and common medium pores; 5 percent pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—12 to 19 inches; light brownish gray (2.5Y 6/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; common fine, very fine, and medium roots; many fine and very fine pores and common medium pores; 5 percent pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC2—19 to 23 inches; light brownish gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots and few medium roots; many fine and very fine pores and common medium pores; 35 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

IIIC3—23 to 42 inches; pale yellow (5Y 7/3) loam, olive (5Y 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many medium, fine, and very fine pores; 10 percent pebbles; many fine masses of lime in upper 2 inches; violently effervescent; moderately alkaline; clear wavy boundary.

IVC4—42 to 60 inches; light brownish gray (10YR 6/2) very gravelly light clay loam, dark grayish brown (10YR 4/2) moist; massive; soft, friable, sticky and plastic; few fine and very fine roots; 45 percent pebbles; violently effervescent; moderately alkaline.

The mollic epipedon is 12 to 16 inches thick.

The A and C1 horizons are loam or clay loam and are 18 to 35 percent clay. They are 5 to 35 percent rock fragments, of which 0 to 5 percent is stones, 0 to 25 percent is cobbles, and 5 to 25 percent is pebbles. The A horizon is mildly alkaline or moderately alkaline.

The IIC, IIIC, and IVC horizons are loam or clay loam and are 18 to 35 percent clay. They are 10 to 60 percent rock fragments, of which 0 to 5 percent is stones, 5 to 20 percent is cobbles, and 5 to 50 percent is pebbles.

Reeder series

The Reeder series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy and silty sedimentary beds. Slope is 2 to 8 percent. Elevation is 3,400 to 3,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy, mixed Typic Argiborolls.

Typical pedon of Reeder loam, 2 to 8 percent slopes, in cropland, about 1,900 feet north and 2,340 feet west of the southeast corner of sec. 1, T. 18 N., R. 15 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

B21t—7 to 11 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many very fine roots; many very fine pores; thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—11 to 15 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; thin continuous clay films on faces of peds; many very fine roots; many very fine pores; neutral; abrupt irregular boundary.

B3ca—15 to 20 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and slightly plastic; many very fine roots; many very fine pores; common medium masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—20 to 27 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common medium masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—27 to 39 inches; grayish brown (2.5Y 5/2) light loam, dark grayish brown (2.5Y 4/2) moist; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few plates of soft sandstone; few fine masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

C3r—39 to 60 inches; light yellowish brown (10YR 6/4) weakly consolidated sandy and silty sedimentary beds that crush to fine sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, nonsticky and nonplastic; strongly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 20 to 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon is neutral or mildly alkaline.

The B horizon is loam, clay loam, or silty clay loam and averages 25 to 35 percent clay. It is neutral to moderately alkaline.

The C2 horizon is loam or silt loam and averages 18 to 27 percent clay.

Regent series

The Regent series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 2 to 8 percent. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Regent silty clay loam, 2 to 8 percent slopes, in cropland, about 600 feet south and 2,190 feet east of the northwest corner of sec. 29, T. 19 N., R. 14 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

B2t—6 to 13 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong medium and fine subangular blocky; hard, firm, sticky and plastic; many fine and very fine roots; common fine pores and many very fine pores; thin continuous clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B3ca—13 to 29 inches; grayish brown (2.5Y 5/2) silty clay loam, grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, sticky and plastic; many fine and very fine roots; common fine and very fine pores; few films and threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—29 to 35 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; very weak coarse prismatic structure parting to very weak medium and coarse blocky; hard, firm, sticky and plastic; common fine and very fine roots; few medium and fine pores; few shale particles; common threads of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2r—35 to 60 inches; light brownish gray (2.5Y 6/2) semiconsolidated shale that crushes to silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; strongly effervescent; moderately alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. The mollic epipedon is 8 to 16 inches thick.

The A horizon is silty clay loam or silty clay and averages 30 to 45 percent clay.

The B horizon is silty clay loam, clay, or silty clay and averages 35 to 50 percent clay.

The C horizon is clay loam or silty clay loam and averages 30 to 40 percent clay.

Rentsac series

The Rentsac series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 8 to

60 percent. Elevation is 2,400 to 3,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents.

Typical pedon of a Rentsac channery loam in an area of Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes, in rangeland, about 2,500 feet east and 2,600 feet north of the southwest corner of sec. 27, T. 21 N., R. 18 E.

A11—0 to 3 inches; pale olive (5Y 6/3) channery loam, olive (5Y 4/3) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 20 percent angular pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

A12—3 to 7 inches; pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak medium and fine subangular blocky structure parting to moderate fine and very fine granular; slightly hard, very friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; 20 percent angular pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

C—7 to 17 inches; light yellowish brown (10YR 6/4), extremely flaggy loam, dark yellowish brown (10YR 4/4) moist; weak medium and fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; moderate fine and very fine roots matted between coarse fragments; 80 percent angular cobbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

R—17 inches; light gray (10YR 7/2) fractured hard sandstone.

Hard sandstone is at a depth of 10 to 20 inches.

The A horizon is 10 to 27 percent clay. It is 15 to 35 percent rock fragments, of which 0 to 10 percent is cobbles and 15 to 25 percent is angular pebbles.

The C horizon is 10 to 27 percent clay. It is 40 to 75 percent rock fragments, of which 0 to 5 percent is stones, 15 to 40 percent is angular cobbles, and 25 to 60 percent is angular pebbles.

Richey series

The Richey series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Aridic Haploborolls.

Typical pedon of Richey silty clay loam, 0 to 2 percent slopes, in rangeland, about 660 feet west and 2,000 feet south of the northeast corner of sec. 15, T. 15 N., R. 23 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure in upper 4 inches parting to moderate medium subangular blocky below this depth; hard, friable, sticky and plastic; common fine and very fine roots; very fine pores; slightly effervescent; mildly alkaline; abrupt smooth boundary.

B2—7 to 13 inches; grayish brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) moist; very dark grayish brown (10YR 3/2) organic stains on faces of peds; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

B31ca—13 to 20 inches; light brownish gray (10YR 6/2) heavy silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; few fine threads and masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

B32ca—20 to 29 inches; light brownish gray (10YR 6/2) heavy silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; common fine masses of lime; strongly effervescent; strongly alkaline; gradual wavy boundary.

C1cs—29 to 45 inches; light brownish gray (2.5Y 6/2) light silty clay, dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) moist; weak fine subangular blocky structure; extremely hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; common masses of gypsum and other salts; slightly effervescent; strongly alkaline; clear wavy boundary.

C2—45 to 66 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; thin strata of light grayish brown (2.5Y 6/2) loam; massive; extremely hard, firm, sticky and plastic; few very fine roots; common fine and very fine pores; few fine threads and masses of gypsum and other salts; slightly effervescent; strongly alkaline.

The mollic epipedon is 7 to 12 inches thick.

The A horizon is neutral or mildly alkaline.

The B horizon is silty clay loam or silty clay and averages 35 to 45 percent clay. It is moderately alkaline or strongly alkaline.

The C horizon is clay loam, silty clay loam, or silty clay and averages 35 to 45 percent clay. It is moderately alkaline or strongly alkaline.

Roy series

The Roy series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 45 percent. Elevation is 3,400 to 5,300 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are clayey-skeletal, mixed Typic Argiborolls.

Typical pedon of Roy very stony clay loam, 2 to 8 percent slopes, in rangeland, about 2,440 feet east and 1,200 feet south of the northwest corner of sec. 13, T. 16 N., R. 18 E.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) very stony light clay loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; slightly hard, very friable, sticky and plastic; many very fine and fine roots and common medium roots; 25 percent angular stones; mildly alkaline; clear wavy boundary.

B21t—7 to 12 inches; brown (10YR 5/3) very cobbly heavy clay loam, dark brown (10YR 3/3) moist; very dark grayish brown (10YR 3/2, moist) coatings on peds; strong fine subangular blocky structure; very hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; thin continuous clay films on faces of peds; 50 percent angular cobbles; neutral; clear wavy boundary.

B22t—12 to 17 inches; brown (10YR 5/3) very cobbly heavy clay loam, dark brown (10YR 4/3) moist; dark brown (10YR 3/3, moist) coatings on peds; strong fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; thin continuous clay films on faces of peds; 50 percent angular cobbles; mildly alkaline; clear irregular boundary.

B3ca—17 to 24 inches; grayish brown (10YR 5/2) very cobbly clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; 55 percent angular cobbles that have lime coatings on undersides; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—24 to 30 inches; light brownish gray (2.5Y 6/2) extremely cobbly clay loam, olive brown (2.5Y 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; 60 percent angular cobbles; many fine distinct threads and masses of lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2—30 to 60 inches; grayish brown (2.5Y 5/2) extremely cobbly light clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; common fine and very fine pores and few medium pores; 65 percent angular cobbles; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A horizon is clay loam or loam and is 15 to 40 percent clay. It is 10 to 35 percent rock fragments, of which 0 to 25 percent is stones, 5 to 20 percent is rounded and angular cobbles, and 5 to 20 percent is pebbles.

The Bt horizon is clay loam or clay and averages 35 to 50 percent clay. It is 40 to 70 rock fragments, of which 0 to 5 percent is stones, 20 to 60 percent is cobbles, and 15 to 30 percent is pebbles.

The C horizon is loam or clay loam and is 20 to 35 percent clay. It is 60 to 85 percent rock fragments, of which 0 to 5 percent is stones, 40 to 65 percent is cobbles, and 20 to 30 percent is pebbles.

Sanje series

The Sanje series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium derived dominantly from shale and limestone. Slope is 0 to 4 percent. Elevation is 3,800 to 4,200 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey over loamy-skeletal, mixed Aridic Haploborolls.

Typical pedon of Sanje clay loam, 0 to 4 percent slopes, in rangeland, about 2,575 feet west and 2,380 feet north of the southeast corner of sec. 31, T. 12 N., R. 24 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; less than 5 percent pebbles and few cobbles and stones; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B21—5 to 12 inches; grayish brown (10YR 5/2) light clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to strong medium and fine subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; few thin very dark grayish brown films of organic matter on faces of peds; 2 percent pebbles; strongly effervescent; mildly alkaline; clear irregular boundary.

B22—12 to 18 inches; light brownish gray (10YR 6/2) light clay, dark brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common fine roots and many very fine roots; many fine and very fine pores; 3 percent pebbles; few fine and medium masses of lime; strongly effervescent; moderately alkaline; gradual irregular boundary.

B3ca—18 to 30 inches; gray (10YR 6/1) light clay, dark gray (10YR 4/1) moist; moderate medium prismatic structure parting to weak medium and fine subangular blocky; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; 2 percent pebbles; many fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC—30 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sandy loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; 60 percent pebbles and 10 percent cobbles; violently effervescent; moderately alkaline.

The A horizon is neutral or mildly alkaline. It is 0 to 10 percent pebbles and 0 to 5 percent cobbles.

The B horizon is clay loam or clay and averages 35 to 45 percent clay. It is 0 to 10 percent pebbles and 0 to 5 percent cobbles. It is mildly alkaline or moderately alkaline.

The IIC horizon is sandy loam or loam and is 5 to 20 percent clay. It is 45 to 70 percent rock fragments, of which 5 to 15 percent is cobbles and 40 to 55 percent is pebbles. Depth to the very gravelly or extremely gravelly IIC horizon is 20 to 36 inches.

Savage series

The Savage series consists of deep, well drained soils on terraces, fans, and foot slopes. These soils formed in alluvium. Slope is 0 to 8 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Savage silty clay loam, 0 to 2 percent slopes, in cropland, about 1,750 feet south and 1,400 feet west of the northeast corner of sec. 6, T. 14 N., R. 23 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; mildly alkaline; abrupt smooth boundary.

B2t—6 to 13 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; thin continuous clay films on faces of peds; mildly alkaline; clear irregular boundary.

B3ca—13 to 29 inches; brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; common masses and seams of lime, strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—29 to 44 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) and brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; common masses and seams of gypsum and lime; strongly effervescent; moderately alkaline; diffuse wavy boundary.

C2—44 to 52 inches; pale brown (10YR 6/3) light silty clay loam, dark grayish brown (10YR 4/2) moist; many medium prominent reddish yellow (7.5YR 6/6) mottles; massive; very hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; common masses and seams of gypsum and segregated lime; strongly effervescent; mildly alkaline; diffuse wavy boundary.

C3—52 to 66 inches; pale brown (10YR 6/3) light clay loam, yellowish brown (10YR 5/6) moist; common fine prominent reddish yellow (7.5YR 6/6) mottles; massive; very hard, friable, sticky and plastic; few fine and very fine roots; many fine and very fine pores; common masses and seams of gypsum and lime; strongly effervescent; mildly alkaline.

The mollic epipedon is 7 to 14 inches thick.

The A horizon is neutral or mildly alkaline.

The C horizon is silty clay loam or silty clay and averages 30 to 45 percent clay. It is mildly alkaline or moderately alkaline.

Shambo series

The Shambo series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 15 percent. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 130 days.

These soils are fine-loamy, mixed Typic Haploborolls.

Typical pedon of Shambo loam, 2 to 8 percent slopes, in rangeland, about 1,500 feet west and 1,200 feet north of the southeast corner of sec. 35, T. 18 N., R. 15 E.

A1—0 to 6 inches; very dark brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B21—6 to 9 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

B22—9 to 18 inches; pale brown (10YR 6/3) loam, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

C1ca—18 to 26 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine and very fine roots; many very fine pores; common small masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—26 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; hard, friable, nonsticky and nonplastic; common fine and very fine roots; many fine and very fine pores; few small masses of lime; strongly effervescent; moderately alkaline.

The A horizon is neutral or mildly alkaline.

The B horizon is loam or clay loam and averages 20 to 30 percent clay. It is neutral to moderately alkaline.

The C horizon is fine sandy loam, loam, or clay loam and averages 18 to 30 percent clay. It is mildly alkaline or moderately alkaline.

Sheege series

The Sheege series consists of shallow, well drained soils on uplands and mountainsides. These soils formed in residuum derived dominantly from fractured hard limestone. Slope is 2 to 60 percent. Elevation is 4,600 to 8,500 feet. The average annual precipitation is about 20 to 28 inches, the average annual air temperature is 36 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, carbonatic Cryic Lithic Rendolls.

Typical pedon of a Sheege very stony loam in an area of Sheege-Skaggs very stony loams, 2 to 15 percent slopes, in rangeland, about 2,500 feet south and 1,400 feet east of the northwest corner of sec. 33, T. 13 N., R. 18 E.

A1—0 to 6 inches; dark gray (10YR 4/1) very stony loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine and very fine roots; 20 percent stones and 10 percent pebbles; slightly effervescent; mildly alkaline; clear smooth boundary.

Cca—6 to 12 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; many fine and very fine roots; 40 percent angular pebbles and 15 percent cobbles; strongly effervescent; moderately alkaline; abrupt smooth boundary.

R—12 inches; fractured hard limestone.

Hard limestone is at a depth of 10 to 20 inches.

The A horizon is channery loam, stony loam, or very stony loam and averages 18 to 27 percent clay. It is 10 to 30 percent angular pebbles, 10 to 20 percent angular cobbles, and 0 to 20 percent stones. It is mildly alkaline or moderately alkaline.

The C horizon, where present, is loam or silt loam and averages 15 to 27 percent clay. It is 30 to 75 percent rock fragments, of which 0 to 10 percent is stones, 10 to 30 percent is cobbles, and 20 to 40 percent is pebbles. It is mildly alkaline or moderately alkaline.

Sinnigam series

The Sinnigam series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 15 percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are clayey-skeletal, mixed Lithic Argiborolls.

Typical pedon of a Sinnigam channery clay loam in an area of Borky-Sinnigam channery clay loams, 2 to 8 percent slopes, in cropland, about 2,600 feet west and

400 feet south of the northeast corner of sec. 23, T. 15 N., R. 21 E.

Ap—0 to 5 inches; dark brown (10YR 4/3) channery light clay loam, very dark brown (10YR 3/3) moist; strong medium granular structure; hard, friable, slightly sticky and slightly plastic; 30 percent angular sandstone pebbles; neutral; abrupt smooth boundary.

B21t—5 to 9 inches; brown (10YR 5/3) very channery heavy clay loam, brown (10YR 4/3) moist; strong fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 40 percent angular sandstone pebbles; neutral; clear wavy boundary.

B22t—9 to 16 inches; brown (10YR 5/3) very channery heavy clay loam, dark brown (10YR 4/3) moist; strong fine subangular blocky structure; very hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 50 percent angular sandstone pebbles; neutral; abrupt wavy boundary.

R—16 inches; pale brown (10YR 6/3) fractured hard sandstone.

Hard sandstone is at a depth of 10 to 20 inches. The mollic epipedon is 6 to 10 inches thick.

The A horizon is loam or clay loam and is 20 to 35 percent clay. It is 20 to 50 percent rock fragments, of which 0 to 20 percent is stones, 5 to 15 percent is angular cobbles, and 15 to 30 percent is angular pebbles.

The B horizon is clay loam or clay and is 35 to 45 percent clay. It is 40 to 70 percent rock fragments, of which 0 to 5 percent is stones, 20 to 30 percent is angular cobbles, and 20 to 50 percent is angular pebbles.

Sipple series

The Sipple series consists of deep, well drained soils on terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 4 percent. Elevation is 4,000 to 4,800 feet. The average annual precipitation is about 17 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 90 to 110 days.

These soils are fine-loamy, mixed Udic Argiborolls.

Typical pedon of Sipple loam, 0 to 4 percent slopes, in cropland, about 300 feet west and 200 feet north of the southeast corner of sec. 16, T. 14 N., R. 16 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B2t—6 to 13 inches; brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; neutral; abrupt wavy boundary.

B31—13 to 22 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; few pebbles that have heavy undercoating of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

B32ca—22 to 34 inches; light gray (10YR 7/1) silty clay loam, pale brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; common fine and very fine roots; many fine and very fine pores; many films and threads of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C1ca—34 to 52 inches; white or light gray (10YR 8/2, 7/2) silty clay loam, brown and yellowish brown (10YR 5/3, 5/4) moist; weak very fine angular blocky structure; hard, friable, sticky and plastic; few very fine roots; many fine and very fine pores; many threads and films of lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC2—52 to 66 inches; very pale brown (10YR 7/3) very gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 45 percent pebbles; violently effervescent.

The mollic epipedon is 8 to 16 inches thick.

The A horizon is 0 to 10 percent limestone pebbles.

The B horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is neutral to moderately alkaline.

The C horizon is loam, clay loam, or silty clay loam and averages 18 to 30 percent clay. It is 0 to 15 percent pebbles.

The IIC horizon is sandy loam or loam and averages 7 to 25 percent clay. It is 50 to 75 percent rock fragments, of which 5 to 20 percent is cobbles and 45 to 55 percent is pebbles. Depth to the IIC horizon is dominantly 40 to 60 inches.

Skaggs series

The Skaggs series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard limestone. Slope is 2 to 60 percent. Elevation is 4,000 to 8,000 feet. The

average annual precipitation is about 18 to 26 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, carbonatic Calcic Cryoborolls.

Typical pedon of a Skaggs loam in an area of Skaggs-Sheege complex, 2 to 15 percent slopes, in rangeland, about 2,440 feet east and 590 feet south of the northwest corner of sec. 3, T. 13 N., R. 19 E.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) heavy loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine pores; 15 percent pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

C1ca—8 to 18 inches; light gray (10YR 7/2) very gravelly heavy loam, light grayish brown (10YR 6/2) moist; weak medium and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine pores and many very fine pores; 35 percent rock fragments; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—18 to 24 inches; white (10YR 8/2) very gravelly heavy loam, light gray (10YR 7/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; common fine pores and many very fine pores; 45 percent rock fragments; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

C3ca—24 to 32 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 5/3) moist; weak very fine subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine pores; 50 percent rock fragments; few threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

R—32 inches; fractured hard limestone.

Hard limestone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon is loam 18 to 27 percent clay. It is 10 to 35 percent rock fragments, of which 0 to 25 percent is stones, 0 to 20 percent is angular cobbles, and 5 to 20 percent is angular pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is loam, silt loam, or clay loam and is 18 to 30 percent clay. It is 35 to 60 percent rock fragments, of which 0 to 10 percent is stones, 15 to 25 percent is angular cobbles, and 20 to 40 percent is angular pebbles.

Straw series

The Straw series consists of deep, well drained soils on low terraces, fans, and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 8 percent. Elevation is 3,700 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 130 days.

These soils are fine-loamy, mixed Cumulic Haploborolls.

Typical pedon of Straw clay loam, 0 to 2 percent slopes, in cropland, about 1,520 feet east and 2,380 feet north of the southwest corner of sec. 10, T. 15 N., R. 18 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium granular structure; hard, friable, sticky and plastic; many fine and very fine roots; numerous wormcasts; slightly effervescent; mildly alkaline; clear smooth boundary.

A12—7 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse granular structure; hard, friable, sticky and plastic; common fine roots and many very fine roots; many fine and very fine pores; many wormcasts; strongly effervescent; mildly alkaline; clear wavy boundary.

A13—16 to 24 inches; grayish brown (10YR 5/2) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; many wormcasts; strongly effervescent; mildly alkaline; clear wavy boundary.

C1—24 to 29 inches; light brownish gray (10YR 6/2, 6/3) loam that has strata of sandy loam, dark brown (10YR 3/3) moist; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots; many fine and very fine pores; strongly effervescent; mildly alkaline; abrupt wavy boundary.

A11b—29 to 35 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; common very fine roots; many very fine pores; few fine masses and threads of lime; strongly effervescent; mildly alkaline; abrupt smooth boundary.

A12b—35 to 48 inches; dark grayish brown (10YR 4/2) loam that has strata of sandy loam, very dark grayish brown (10YR 3/2) moist; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine pores; strongly effervescent; mildly alkaline; abrupt wavy boundary.

A13b—48 to 60 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; common fine and medium distinct dark gray (10YR 4/1) and reddish brown (5YR 5/6) mottles; massive; very hard, friable, sticky and plastic; few very fine roots; many very fine pores; strongly effervescent; mildly alkaline.

The mollic epipedon is 16 to 40 inches thick.

The A1 horizon is loam or clay loam and averages 20 to 35 percent clay. It is neutral to moderately alkaline.

The C horizon is stratified sandy loam, loam, silt loam, and clay loam. It averages 20 to 32 percent clay. It is 0 to 10 percent pebbles and is mildly alkaline or moderately alkaline.

Sudworth series

The Sudworth series consists of deep, well drained soils on low terraces and flood plains. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 2,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Cumulic Haploborolls.

Typical pedon of a Sudworth loam in an area of Sudworth-Nesda loams, in rangeland, about 1,210 feet east and 915 feet north of the southwest corner of sec. 4, T. 15 N., R. 18 E.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure in the upper 2 inches parting to weak medium and fine subangular blocky in the lower 5 inches; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine pores; 5 percent angular limestone, sandstone, and shale pebbles; strongly effervescent; mildly alkaline; gradual wavy boundary.

A12—7 to 19 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 5 percent angular limestone, sandstone, and shale pebbles; strongly effervescent; mildly alkaline; gradual wavy boundary.

A13—19 to 27 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 5 percent angular limestone, sandstone, and shale pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC—27 to 66 inches; grayish brown (10YR 5/2) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; nonsticky and nonplastic; common fine and very fine roots; 80 percent angular limestone, sandstone, and shale pebbles; strongly effervescent; moderately alkaline.

The mollic epipedon is 16 to 36 inches thick. The upper part of the control section is mainly loam or clay loam and has strata of sandy loam or silt loam. It averages 20 to 33 percent clay. It is mildly alkaline or moderately alkaline. The extremely gravelly or very gravelly IIC horizon is at a depth of 20 to 36 inches.

The A horizon is 0 to 10 percent pebbles. It is mildly alkaline or moderately alkaline.

The IIC horizon is very gravelly loamy sand or extremely gravelly loamy sand and has thin strata of loam, sandy loam, or sand. It is mildly alkaline to moderately alkaline.

Syblon series

The Syblon series consists of moderately deep, well drained soils on uplands. These soils formed in residuum and alluvium derived dominantly from semiconsolidated shale. Slope is 2 to 8 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Abruptic Aridic Argiborolls.

Typical pedon of Syblon loam, 2 to 8 percent slopes, in rangeland, about 900 feet south and 100 feet east of the northwest corner of sec. 7, T. 15 N., R. 24 E.

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; few pebbles; slightly acid; clear wavy boundary.

A12—4 to 9 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak very fine and fine platy structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; few pebbles; slightly acid; clear wavy boundary.

B21t—9 to 15 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; thin clay films on faces of peds; light brownish gray (10YR 6/2) silt coatings on top of prisms and on vertical faces of peds; slightly acid; gradual wavy boundary.

B22t—15 to 21 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to moderate medium and fine angular blocky; very hard, firm, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; thin continuous clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B3—21 to 29 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak very coarse prismatic structure parting to weak medium platy; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots; many very fine pores and common fine pores; mildly alkaline; diffuse wavy boundary.

C2r—29 to 60 inches; grayish brown (2.5Y 5/2) clayey shale that crushes to clay or silty clay, dark grayish brown (2.5Y 4/2) moist; strong fine and very fine platy shale; extremely hard, extremely firm; few roots to a depth of 34 inches; common fine irregular filaments and masses of lime and masses of gypsum between depths of 29 and 35 inches.

Shale is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 10 inches thick.

The A1 horizon is slightly acid or neutral and is less than 5 percent angular pebbles.

The B2t horizon is clay or silty clay and averages 40 to 55 percent clay. It is slightly acid to mildly alkaline.

The B3 horizon is clay loam or clay and averages 35 to 45 percent clay. It is 40 to 70 percent hard shale pebbles and is mildly alkaline or moderately alkaline.

Tally series

The Tally series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvial and eolian material derived dominantly from sandstone. Slope is 2 to 45 percent. Elevation is 3,400 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are coarse-loamy, mixed Typic Haploborolls.

Typical pedon of Tally fine sandy loam, 2 to 8 percent slopes, in rangeland, about 2,395 feet south and 1,155 feet west of the northeast corner of sec. 31, T. 19 N., R. 16 E.

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral; clear irregular boundary.

B2—6 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots; many fine and very fine pores; mildly alkaline; clear wavy boundary.

B3ca—10 to 32 inches; pale brown (10YR 6/3) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable, nonsticky and nonplastic; common fine and very fine roots and few medium roots; many fine and very fine pores; moderately alkaline; diffuse wavy boundary.

C—32 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots to a depth of 40 inches; many very fine pores; moderately alkaline.

The mollic epipedon is 8 to 16 inches thick.

The A horizon averages 10 to 20 percent clay. It is 0 to 10 percent angular pebbles. It is neutral or mildly alkaline.

The B horizon is fine sandy loam or sandy loam and averages 8 to 18 percent clay. It is 0 to 10 percent angular pebbles. It is neutral to moderately alkaline.

The C horizon is sandy loam or loamy sand and averages 5 to 15 percent clay. It is 0 to 10 percent angular pebbles.

Tamaneen series

The Tamaneen series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 4 percent. Elevation is 3,200 to 4,400 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Tamaneen clay loam, 0 to 2 percent slopes, in cropland, about 1,440 feet north and 260 feet east of the southwest corner of sec. 16, T. 15 N., R. 18 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; less than 5 percent rock fragments; mildly alkaline; clear wavy boundary.

B2t—7 to 13 inches; grayish brown (10YR 5/2) light silty clay, dark brown (10YR 3/3) moist; very dark grayish brown (10YR 3/2) organic stains on faces of peds; moderate medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, firm, sticky, and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; 5 percent rock fragments; mildly alkaline; clear wavy boundary.

B3ca—13 to 17 inches; pale brown (10YR 6/3) heavy clay loam, brown (10YR 5/3) moist; moderate fine and very fine subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; 10 percent rock fragments; strongly effervescent; moderately alkaline; clear irregular boundary.

IIC1ca—17 to 22 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, sticky and slightly plastic; common fine and very fine roots; 40 percent rock fragments; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2ca—22 to 66 inches; very pale brown (10YR 8/3) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; 80 percent rock fragments; violently effervescent; moderately alkaline.

The mollic epipedon is 8 to 15 inches thick. Depth to the strongly calcareous horizon is 12 to 16 inches.

The A horizon is 0 to 10 percent pebbles. It is neutral or mildly alkaline.

The B2t horizon is clay loam, silty clay loam, clay, or silty clay and averages 35 to 50 percent clay. It is 0 to 10 percent pebbles. It is neutral or mildly alkaline.

The B3 horizon is clay loam, silty clay, or silty clay loam and is 30 to 45 percent clay. It is 5 to 20 percent pebbles.

The very gravelly or extremely gravelly IIC horizon is at a depth of 17 to 40 inches. The IIC1ca horizon is clay loam or loam and is 18 to 35 percent clay. It is 30 to 45 percent rock fragments, of which 0 to 10 percent is cobbles and 30 to 35 percent is pebbles.

The IIC2ca horizon is sandy loam or loam and is 8 to 25 percent clay. It is 60 to 80 percent rock fragments, of which 5 to 20 percent is cobbles and 55 to 60 percent is pebbles.

Tanna series

The Tanna series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale interbedded with sandstone. Slope is 0 to 25 percent. Elevation is 2,700 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Aridic Argiborolls.

Typical pedon of a Tanna silty clay loam in an area of Tanna-Abor complex, 2 to 8 percent slopes, in cropland, about 2,310 feet west and 858 feet south of the northeast corner of sec. 22, T. 21 N., R. 18 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; mildly alkaline; abrupt smooth boundary.

B21t—6 to 12 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—12 to 15 inches; light grayish brown (2.5Y 6/2) heavy silty clay loam; grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; many fine and very fine roots; common fine and very fine pores; continuous clay films on faces of peds; moderately alkaline; clear wavy boundary.

B3ca—15 to 27 inches; gray (5Y 6/1) heavy silty clay loam, olive gray (5Y 4/2) moist; strong medium and coarse prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; common fine and very fine roots; common fine and very fine pores; common fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—27 to 32 inches; light gray (5Y 7/2) heavy silty clay loam, olive gray (5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; common fine masses of lime; strongly effervescent; strongly alkaline; clear wavy boundary.

C2r—32 to 60 inches; light gray (5Y 7/2) semiconsolidated shale interbedded with sandstone, olive gray (5Y 4/2) and light olive gray (2.5Y 5/6) moist; massive; very hard, firm; few very fine roots; strongly effervescent; strongly alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. Depth to the strongly effervescent horizon is 12 to 18 inches.

The A horizon is clay loam or silty clay loam and averages 27 to 35 percent clay. It is neutral or mildly alkaline.

The B horizon is silty clay loam or silty clay and averages 35 to 45 percent clay. It is mildly alkaline or moderately alkaline.

The C horizon is silty clay or silty clay loam and averages 30 to 45 percent clay. It is moderately alkaline or strongly alkaline.

Teigen series

The Teigen series consists of deep, well drained soils on fans and foot slopes. These soils formed in alluvium derived dominantly from shale. Slope is 2 to 25 percent. Elevation is 2,200 to 4,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Camborthids.

Typical pedon of a Teigen silty clay loam in an area of Teigen-Julin complex, 2 to 25 percent slopes, in rangeland, about 2,500 feet south and 1,320 feet west of the northeast corner of sec. 36, T. 17 N., R. 23 E.

A1—0 to 4 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; moderate fine and very fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; very strongly acid; clear smooth boundary.

B21—4 to 9 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; very strongly acid; abrupt smooth boundary.

B22—9 to 13 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; very strongly acid; gradual wavy boundary.

C1—13 to 17 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 5 percent shale fragments of fine pebble size; very strongly acid; abrupt smooth boundary.

C2—17 to 20 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist, very thinly stratified; very hard, friable, nonsticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; 5 percent fine shale fragments; strongly acid; abrupt smooth boundary.

C3—20 to 35 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, sticky and plastic; common fine and very fine roots; many fine and very fine pores; 5 percent fine shale fragments; slightly acid; diffuse wavy boundary.

C4—35 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; 5 percent fine shale fragments; common fine irregular filaments or threads and soft masses of gypsum; slightly acid.

The A horizon is very strongly acid to medium acid. It is 0 to 10 percent angular shale pebbles.

The B and C horizons are silty clay loam, clay loam, or silty clay and average 35 to 55 percent clay. They are 0 to 15 percent angular shale pebbles and are very strongly acid to slightly acid.

Terrad series

The Terrad series consists of deep, well drained soils on uplands. These soils formed in alluvium and residuum derived dominantly from semiconsolidated shale. Slope is 2 to 15 percent. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 100 to 125 days.

These soils are fine, mixed Typic Argiborolls.

Typical pedon of Terrad silty clay, 2 to 8 percent slopes, in cropland, about 2,250 feet east and 2,000 feet north of the southwest corner of sec. 14, T. 15 N., R. 18 E.

Ap—0 to 7 inches; dark grayish brown (5YR 4/2) silty clay, dark reddish brown (5YR 3/2) moist; moderate medium granular structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

B2t—7 to 23 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak medium and coarse prismatic structure parting to medium fine angular blocky; extremely hard, very firm, very sticky and very plastic; common fine roots; many very fine pores; distinct intersecting slickensides; neutral; clear wavy boundary.

B31—23 to 31 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; weak medium and fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots; many very fine pores; intersecting slickensides; slightly effervescent; mildly alkaline; clear wavy boundary.

B32—31 to 40 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; weak medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; common very fine pores; few seams of gypsum; slightly effervescent; moderately alkaline; clear wavy boundary.

C1cs—40 to 49 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm, sticky and plastic; few very fine pores; many seams of gypsum; slightly effervescent; moderately alkaline; clear smooth boundary.

C2r—49 to 60 inches; reddish brown (2.5YR 4/4) semiconsolidated shale that crushes to clay, dark reddish brown (2.5YR 3/4) moist; massive; very hard, very firm, sticky and plastic; few threads of gypsum; slightly effervescent; moderately alkaline.

Semiconsolidated shale is at a depth of 40 to 60 inches.

The B2t horizon is clay or silty clay and averages 45 to 60 percent clay. It is neutral or mildly alkaline.

The B3 and C horizons are clay or silty clay and average 40 to 55 percent clay. They are mildly alkaline or moderately alkaline.

Teton series

The Teton series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from fractured hard sandstone. Slope is 2 to 15 percent. Elevation is 4,700 to 6,500 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are fine-loamy, mixed Typic Cryoborolls.

Typical pedon of Teton loam, 2 to 8 percent slopes, in cropland, about 1,200 feet west and 350 feet south of the northeast corner of sec. 29, T. 14 N., R. 19 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; less than 5 percent angular sandstone pebbles; slightly acid; clear wavy boundary.

B2—7 to 15 inches; brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong medium and fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; less than 5 percent angular sandstone pebbles; slightly acid; clear wavy boundary.

B3—15 to 32 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; 10 percent angular sandstone pebbles; neutral; diffuse wavy boundary.

R—32 inches; fractured hard sandstone.

Hard sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 15 inches thick.

The A horizon is loam or channery loam and is 18 to 27 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 10 percent is cobbles and 5 to 25 percent is pebbles. It is slightly acid or neutral.

The B2 horizon is loam or light clay loam and is 20 to 30 percent clay. It is 5 to 30 percent rock fragments, of which 0 to 10 percent is angular cobbles and 5 to 20 percent is angular pebbles. It is slightly acid or neutral.

The B3 horizon is loam, sandy loam, or light clay loam and is 18 to 30 percent clay. It is 20 to 80 percent rock fragments, of which 10 to 30 percent is cobbles and 10 to 50 percent is pebbles.

Thebo series

The Thebo series consists of moderately deep, well drained soils on uplands and foot slopes. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 2 to 45 percent. Elevation is 2,200 to 4,500 feet. The average annual precipitation is about 11 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are very-fine, montmorillonitic (calcareous), frigid Ustertic Torriorthents.

Typical pedon of Thebo clay, 2 to 8 percent slopes, in cropland, about 1,320 feet south and 2,340 feet west of the northeast corner of sec. 18, T 19 N., R. 23 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) heavy clay, dark grayish brown (2.5Y 4/2) moist; strong very fine and fine granular structure; very hard, firm, sticky and very plastic; many fine and very fine roots; many fine and very fine pores; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1—5 to 20 inches; grayish brown (2.5Y 5/2) heavy clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, sticky and very plastic; common fine and very fine roots; common very fine pores; many prominent shiny grooved pressure faces of peds; well expressed slickensides that intersect at 15 to 35 degrees from horizontal forming strong fine- and medium-sized wedge-shaped aggregates; slightly effervescent; moderately alkaline; diffuse wavy boundary.

C2—20 to 33 inches; grayish brown (2.5Y 5/2) heavy clay, olive brown (2.5Y 4/3) moist; 10 percent very dark gray (5Y 3/1) moist; massive; extremely hard, firm, sticky and very plastic; common very fine roots; common very fine pores; 5 percent extremely hard shale fragments; slightly effervescent; moderately alkaline; diffuse wavy boundary.

C3r—33 to 60 inches; gray (5Y 5/1) unweathered semiconsolidated shale.

Semiconsolidated shale is at a depth of 20 to 40 inches.

The A horizon is mildly alkaline or moderately alkaline.

Tibs series

The Tibs series consists of deep, well drained soils on uplands and foot slopes. These soils formed in colluvium and alluvium derived dominantly from shale and limestone. Slope is 2 to 60 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are clayey-skeletal, mixed (calcareous), frigid Typic Ustorthents.

Typical pedon of a Tibs cobbly clay loam in an area of Tibs-Whitecow cobbly clay loams, 25 to 60 percent slopes, in woodland, about 1,320 feet west and 1,830 feet north of the southeast corner of sec. 7, T. 12 N., R. 21 E.

O1 and O2—1 inch to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A11—0 to 2 inches; reddish brown (5YR 4/3) cobbly clay loam, dark reddish brown (5YR 3/3) moist; strong fine granular structure; soft, very friable, sticky and plastic; many fine, medium, and coarse roots; 20 percent angular cobbles and 10 percent angular pebbles; slightly effervescent; mildly alkaline; abrupt wavy boundary.

A12—2 to 6 inches; reddish brown (2.5YR 4/4) cobbly heavy clay loam, dark reddish brown (2.5YR 3/4) moist; weak fine subangular blocky structure parting to strong fine granular; slightly hard, friable, sticky and plastic; many fine, medium, and coarse roots; many fine and common medium pores; 25 percent angular cobbles and 10 percent angular pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

C1ca—6 to 12 inches; reddish brown (5YR 4/4) very cobbly heavy clay loam, dark reddish brown (5YR 3/4) moist; strong fine subangular blocky structure parting to strong fine granular; slightly hard, friable, sticky and plastic; many fine, medium, and coarse roots; many fine pores and common medium pores; 25 percent angular cobbles and 15 percent angular pebbles; common fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—12 to 30 inches; reddish brown (2.5YR 5/4) very cobbly light clay, reddish brown (2.5YR 4/4) moist; strong fine angular blocky structure; hard, friable, sticky and plastic; many fine, medium, and coarse roots in upper part and common fine, medium, and coarse roots in lower part; many fine and medium pores; 30 percent angular cobbles and 20 percent angular pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—30 to 60 inches; red (2.5YR 5/6) very cobbly clay, red (2.5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable, very sticky and very plastic; common fine, medium, and coarse roots; common fine and medium pores; 35 percent angular cobbles and 20 percent angular pebbles; strongly effervescent; moderately alkaline.

The A horizon is 30 to 40 percent clay. It is 5 to 35 percent rock fragments, of which 0 to 25 percent is cobbles and 5 to 10 percent is pebbles. It is slightly acid to moderately alkaline.

The C horizon is heavy clay loam or clay and is 35 to 55 percent clay. It is 40 to 60 percent rock fragments, of which 30 to 45 percent is angular cobbles and 10 to 15 percent is angular pebbles.

Tigeron series

The Tigeron series consists of deep, well drained soils on mountains and uplands. These soils formed in colluvium or alluvium derived dominantly from igneous rock. Slope is 15 to 60 percent. Elevation is 4,600 to 6,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryoboralfs.

Typical pedon of Tigeron very gravelly loam, 15 to 60 percent slopes, in woodland, about 2,400 feet south and 400 feet west of the northeast corner of sec. 25, T. 18 N., R. 17 E.

O1 and O2—2 1/2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, cones, and leaves.

A2—0 to 10 inches; light gray (10YR 7/2) very gravelly loam, brown (10YR 5/3) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium and coarse roots; 45 percent angular pebbles; strongly acid; clear wavy boundary.

A&B—10 to 15 inches; light gray (10YR 7/2) very gravelly heavy loam, dark brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores; 40 percent angular pebbles and 15 percent angular cobbles; strongly acid; gradual wavy boundary.

B21t—15 to 44 inches; pale brown (10YR 6/3) extremely gravelly clay loam, dark brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots and common medium and coarse roots; many fine and very fine pores; clay films on faces of peds and coarse fragments; 50 percent angular pebbles and 20 percent angular cobbles; strongly acid; diffuse boundary.

B3—44 to 60 inches; pale brown (10YR 6/3) extremely gravelly heavy loam, dark brown (10YR 4/3) moist; weak very fine subangular blocky structure; slightly hard, friable, sticky and plastic; common medium, fine, and very fine roots and few coarse roots; many fine and very fine pores; 55 percent angular pebbles and 25 percent angular cobbles; strongly acid.

The A2 horizon is 10 to 20 percent clay. It is 25 to 60 percent rock fragments, of which 5 to 20 percent is angular cobbles and 20 to 40 percent is angular pebbles. It is strongly acid or medium acid. The horizon is 8 to 15 inches thick.

The A&B horizon is heavy loam, light clay loam, or sandy clay loam. It is 10 to 20 percent clay in the A part and 20 to 30 percent clay in the B part. The A&B horizon is 50 to 70 percent rock fragments, of which 10 to 15 percent is angular cobbles and 40 to 55 percent is angular pebbles. It is strongly acid to slightly acid. The horizon is 4 to 13 inches thick.

The B2t horizon is loam, clay loam, or sandy clay loam and is 20 to 30 percent clay. It is 60 to 85 percent rock fragments, of which 15 to 25 percent is angular cobbles and 45 to 60 percent is angular pebbles. It is strongly acid to slightly acid.

The B3 horizon is sandy loam, loam, or sandy clay loam and is 10 to 25 percent clay. It is 60 to 85 percent rock fragments, of which 15 to 25 percent is cobbles and 45 to 60 percent is pebbles. It is strongly acid to slightly acid.

Timberg series

The Timberg series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale that has interbedded sandstone. Slope is 2 to 45 percent. Elevation is 3,900 to 4,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 100 to 125 days.

These soils are fine, mixed Typic Haploborolls.

Typical pedon of a Timberg clay loam in an area of Timberg-Castner complex, 2 to 8 percent slopes, in cropland, about 750 feet north and 2,340 feet west of the southeast corner of sec. 23, T. 23 N., R. 18 E.

Ap—0 to 6 inches; reddish brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable, sticky and plastic; slightly effervescent; mildly alkaline; clear smooth boundary.

B2—6 to 17 inches; reddish brown (2.5YR 5/4) silty clay, dark red (2.5YR 3/6) moist; moderate medium prismatic structure parting to strong very fine subangular blocky; hard, friable, very sticky and very plastic; many fine and very fine roots; many fine pores; strongly effervescent; moderately alkaline; clear wavy boundary.

B3ca—17 to 25 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable, very sticky and very plastic; common fine roots; many very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—25 to 37 inches; dark yellowish brown (10YR 4/4) silty clay, dark brown (10YR 3/4) moist; platy structure; very hard, friable, sticky and plastic; few fine roots; few fine pores and common very fine pores; 15 percent hard angular shale pebbles; few threads of lime; moderately alkaline; abrupt wavy boundary.

C2r—37 to 60 inches; dark yellowish brown semiconsolidated shale that has interbedded light yellowish brown sandstone.

Semiconsolidated shale interbedded with sandstone is at a depth of 20 to 40 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon is clay loam or clay and averages 35 to 50 percent clay. It is neutral or mildly alkaline.

The B and C horizons are clay loam, clay, or silty clay and average 35 to 50 percent clay.

Tomty series

The Tomty series consists of deep, somewhat poorly drained soils on foot slopes of uplands. These soils formed in colluvium and alluvium derived dominantly from clay shale. Slope is 4 to 25 percent. Elevation is 4,600 to 5,500 feet. The average annual precipitation is about 19 to 30 inches, the average annual air temperature is 40 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are fine, montmorillonitic Vertic Haploborolls.

Typical pedon of a Tomty silty clay in an area of Tomty complex, 4 to 25 percent slopes, in woodland, about 1,750 feet south and 290 feet east of the northwest corner of sec. 23, T. 13 N., R. 19 E.

A1—0 to 6 inches; black (10YR 2/1) silty clay, black (10YR 2/1) moist; strong very fine granular structure in the upper 2 inches parting to strong fine and very fine subangular blocky below that depth; very hard, firm, sticky and plastic; many fine, very fine, medium, and coarse roots; less than 1 percent limestone pebbles; slightly effervescent; neutral; clear wavy boundary.

B21—6 to 13 inches; very dark gray (10YR 3/1) heavy silty clay, very dark gray (10YR 3/1) moist; strong fine and very fine subangular blocky structure; extremely hard, firm, sticky and very plastic; many very fine, fine, medium, and coarse roots; common fine and very fine pores; less than 1 percent limestone pebbles; few fine and medium masses of lime; slightly effervescent; mildly alkaline; clear wavy boundary.

B22—13 to 18 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine and very fine subangular blocky structure; extremely hard, firm, sticky and very plastic; common very fine, fine, medium, and coarse roots; common fine and very fine pores; common intersecting slickensides; less than 1 percent limestone pebbles; few fine and medium masses of segregated lime; strongly effervescent; mildly alkaline; abrupt smooth boundary.

B3g—18 to 30 inches; light gray (10YR 7/1) heavy silty clay, gray (10YR 5/1) moist; many medium and fine distinct light yellowish brown and brownish yellow (10YR 6/4, 6/6) mottles; moderate medium and fine angular blocky structure; extremely hard, very firm, sticky and very plastic; common very fine, fine, medium, and coarse roots; common fine and very fine pores; few intersecting slickensides; few fine masses of segregated lime; strongly effervescent; mildly alkaline; clear wavy boundary.

C1g—30 to 40 inches; gray (N 5/0) heavy clay, dark gray (N 4/0) moist; common fine distinct yellowish red (5YR 5/6) and reddish yellow (7.5YR 5/6) mottles; weak coarse angular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine, medium, and coarse roots; common fine and very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

C2g—40 to 49 inches; gray (N 5/0) silty clay, dark gray (N 4/0) moist; common medium and large distinct light olive brown (2.5Y 5/6) mottles; weak coarse angular blocky structure; extremely hard, firm, sticky and plastic; few fine, very fine, medium, and coarse roots; common fine and very fine pores; strongly effervescent; mildly alkaline; diffuse wavy boundary.

C3g—49 to 60 inches; light gray (5Y 7/1) silty clay, gray (5Y 5/1) moist; many medium distinct light olive brown (2.5Y 5/4) mottles; massive; extremely hard, firm, sticky and plastic; less than 1 percent limestone pebbles and cobbles; strongly effervescent; mildly alkaline.

The A horizon is silty clay loam or silty clay and averages 30 to 55 percent clay. It is slightly acid to mildly alkaline.

The B and C horizons are clay or silty clay and average 40 to 60 percent clay. They are mildly alkaline or moderately alkaline.

Turner series

The Turner series consists of deep, well drained soils on terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. Elevation is 3,600 to 4,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Typic Argiborolls.

Typical pedon of Turner loam, 0 to 2 percent slopes, in cropland, about 700 feet east and 1,320 feet south of the northwest corner of sec. 35, T. 17 N., R. 18 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B2t—6 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; mildly alkaline; clear wavy boundary.

B3ca—15 to 26 inches; pale brown (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; common small masses of lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIC1ca—26 to 30 inches; brown (10YR 5/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; massive; very friable, slightly sticky and nonplastic; common very fine roots; many very fine pores; 50 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIIC2—30 to 60 inches; brown (10YR 5/3) extremely gravelly sand; single grain; loose; 70 percent pebbles; slightly effervescent; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. Depth to the strongly effervescent horizon is 12 to 18 inches.

The B2 and B3 horizons are loam or clay loam and average 25 to 35 percent clay. They are neutral to moderately alkaline. The very gravelly or extremely gravelly IIC and IIIC horizons are at a depth of 20 to 40 inches. The IIC1 horizon is sandy loam or loam and is 10 to 20 percent clay. It is 40 to 60 percent pebbles. The IIIC2 horizon is sand or fine sand and is 0 to 10 percent clay. It is 50 to 70 percent pebbles.

Twin Creek series

The Twin Creek series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium. Slope is 2 to 8 percent. Elevation is 3,500 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 105 to 125 days.

These soils are fine-loamy, mixed Typic Haploborolls.

Typical pedon of Twin Creek loam, 2 to 8 percent slopes, in cropland, about 2,360 feet south and 2,310 feet east of the northwest corner of sec. 25, T. 15 N., R. 18 E.

Ap—0 to 7 inches; brown (7.5YR 4/2) heavy loam, very dark brown (7.5YR 2/2) moist; moderate medium and fine granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; clear smooth boundary.

B21—7 to 13 inches; brown (2.5YR 4/2) heavy loam, very dark brown (7.5YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

B22ca—13 to 29 inches; reddish brown (5YR 5/4) heavy loam, dark reddish brown (5YR 3/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; common very fine roots; medium fine and very fine pores; common fine masses of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—29 to 60 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; few rock fragments; few fine masses of lime; strongly effervescent; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick.

The A horizon is neutral or mildly alkaline. It is 0 to 5 percent angular pebbles.

The B horizon is loam or clay loam and averages 20 to 32 percent clay. It is 0 to 5 percent angular pebbles. It is mildly alkaline or moderately alkaline.

Vanda series

The Vanda series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium derived dominantly from shale. Slope is 0 to 8 percent. Elevation is 2,300 to 3,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 110 to 135 days.

These soils are fine, montmorillonitic (calcareous), frigid Ustic Torriorthents.

Typical pedon of Vanda clay, 0 to 8 percent slopes, in rangeland, about 1,640 feet south and 2,640 feet east of the northwest corner of sec. 6, T. 21 N., R. 24 E.

A2—0 to 1/2 inch; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; thin vesicular crust parting to weak very fine granular structure; slightly hard, friable, very sticky and very plastic; many fine and very fine roots and few medium and coarse roots; mildly alkaline; abrupt smooth boundary.

AC—1/2 inch to 4 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak fine and very fine subangular blocky structure; extremely hard, firm, very sticky and very plastic; many fine and very fine roots and few medium and coarse roots; many fine and very fine pores; moderately alkaline; gradual wavy boundary.

C1—4 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and very fine subangular blocky structure; extremely hard, firm, very sticky and very plastic; common fine and very fine roots and few medium and coarse roots; many fine and very fine pores; slightly effervescent; moderately alkaline; clear wavy boundary.

C2cs—13 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and very fine subangular blocky structure; very hard, firm, very sticky and very plastic; common fine and very fine roots and few medium and coarse roots; common fine pores and many very fine pores; common fine distinct masses and threads of gypsum; slightly effervescent; moderately alkaline; clear smooth boundary.

C3cs—20 to 25 inches; light brownish gray (2.5Y 6/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium platy structure; hard, friable, sticky and plastic; common fine and very fine roots and few medium and coarse roots; common fine and very fine pores; common fine distinct masses and streaks of gypsum; slightly effervescent; moderately alkaline; clear wavy boundary.

C4cs—25 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine pores; common fine distinct masses and streaks of gypsum; slightly effervescent; moderately alkaline.

The depth to segregated gypsum is 10 to 16 inches. The C horizon is clay loam, clay, or silty clay and averages 35 to 60 percent clay. It is moderately alkaline or strongly alkaline. It has 20 to 30 percent exchangeable sodium in the lower part.

Vebar series

The Vebar series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from weakly consolidated sandy sedimentary beds. Slope is 4 to 15 percent. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 15 to 17 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 130 days.

These soils are coarse-loamy, mixed Typic Haploborolls.

Typical pedon of Vebar fine sandy loam, 4 to 15 percent slopes, in cropland, about 2,400 feet east and 1,900 feet north of the southwest corner of sec. 19, T. 19 N., R. 15 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; abrupt wavy boundary.

B2—10 to 18 inches; brown (10YR 5/3) heavy fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse angular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; neutral; clear irregular boundary.

C1ca—18 to 23 inches; very pale brown (10YR 7/3) heavy fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2r—23 to 60 inches; pale yellow (2.5Y 7/4) sandy sedimentary beds, light olive brown (2.5Y 5/4) moist; few fine and very fine roots in upper part; common very fine pores; strongly effervescent; moderately alkaline.

Sedimentary beds are at a depth of 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick. The solum is 12 to 36 inches thick.

Verson series

The Verson series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 8 percent. Elevation is 2,300 to 3,800 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey over loamy-skeletal, mixed Aridic Argiborolls.

Typical pedon of a Verson clay loam in an area of Verson-Linnet clay loams, 2 to 8 percent slopes, in rangeland, about 2,500 feet east and 1,200 feet south of the northwest corner of sec. 24, T. 15 N., R. 24 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, sticky and plastic; many fine and very fine roots and few medium roots; few pebbles; neutral; clear wavy boundary.

B21t—4 to 7 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine and very fine subangular blocky; hard, friable, sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; thin clay films on faces of peds; few pebbles; neutral; clear wavy boundary.

B22t—7 to 12 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong medium prismatic structure parting to strong fine and very fine subangular blocky; very hard, friable, sticky and very plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; thin clay films on faces of peds; mildly alkaline; abrupt irregular boundary.

B3ca—12 to 18 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and plastic; many fine and very fine roots and few medium roots; many fine and very fine pores; less than 5 percent rock fragments; many fine masses of lime and few large irregular masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—18 to 29 inches; light gray (2.5Y 7/2) silty clay loam, light yellowish brown (2.5Y 6/4) moist; weak very coarse prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable, sticky and plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; disseminated lime and many medium masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2ca—29 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots to a depth of 40 inches; common fine and very fine pores; 65 percent rock fragments; pebbles are completely coated with lime to a depth of 40 inches; violently effervescent; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. Depth to the strongly calcareous horizon is 11 to 19 inches.

The A horizon is 0 to 10 percent pebbles and 0 to 5 percent cobbles. It is slightly acid or neutral.

The B2t horizon is clay loam, silty clay loam, or clay and averages 35 to 50 percent clay. It is 0 to 10 percent pebbles. It is slightly acid to mildly alkaline.

The B3 horizon is heavy clay loam, silty clay loam, or clay and is 35 to 45 percent clay. It is 5 to 25 percent rock fragments, of which 0 to 5 percent is cobbles and 5 to 20 percent is pebbles. It is mildly alkaline or moderately alkaline.

Depth to the IIC horizon 18 to 36 inches. It is sandy loam or loam and is 5 to 15 percent clay. It is 50 to 80 percent rock fragments, of which 5 to 10 percent is cobbles and 45 to 70 percent is pebbles. It is mildly alkaline or moderately alkaline.

Wayden series

The Wayden series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 4 to 60 percent. Elevation is 3,400 to 4,200 feet. The average annual precipitation is about 14 to 17 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents.

Typical pedon of a Wayden silty clay loam in an area of Cabba-Doney-Wayden complex, 4 to 8 percent slopes, in cropland, about 135 feet east and 2,120 feet south of the northwest corner of sec. 34, T. 18 N., R. 15 E.

Ap—0 to 6 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine granular structure; hard, friable, sticky and plastic; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1—6 to 11 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and fine subangular blocky structure; very hard, firm, sticky and plastic; many fine and very fine roots; many fine and very fine pores; few fine threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—11 to 16 inches; light brownish gray (2.5Y 6/2) light silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium platy structure; very hard, firm, sticky and plastic; common fine and very fine roots; common fine and very fine pores; common threads and few fine masses of lime; strongly effervescent; moderately alkaline; gradual smooth boundary.

C3r—16 to 60 inches; light gray (2.5Y 7/2) semiconsolidated shale, grayish brown (2.5Y 5/2) moist; thin platy shale; extremely hard, very firm, sticky and plastic; few very fine roots to a depth of 24 inches; common fine masses of lime and gypsum; strongly effervescent; mildly alkaline.

Semiconsolidated shale is at a depth of 10 to 20 inches.

The C horizon is clay loam, silty clay loam, or silty clay and averages 35 to 50 percent clay. It is moderately alkaline or strongly alkaline.

Weingart series

The Weingart series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 0 to 15 percent. Elevation is 2,300 to 4,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Natrargids.

Typical pedon of a Weingart clay loam in an area of Weingart-Gerdrum clay loams, 4 to 15 percent slopes, in rangeland, about 160 feet east and 900 feet north of the southwest corner of sec. 33, T. 19 N., R. 22 E.

A2—0 to 2 inches; light gray (2.5Y 7/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; moderate very fine platy structure; slightly hard, very friable, sticky and plastic; many medium, fine, and very fine roots; many fine and very fine pores; 5 percent shale fragments; medium acid; abrupt wavy boundary.

B21t—2 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium columnar structure parting to strong fine and very fine angular blocky; extremely hard, firm, sticky and very plastic; many medium, fine, and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; few shale fragments; mildly alkaline; clear irregular boundary.

B22t—7 to 13 inches; light yellowish brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) moist; strong medium and fine angular blocky structure; very hard, firm, sticky and very plastic; common medium, fine, and very fine roots; many fine and very fine pores; thin continuous clay films on faces of peds; few shale fragments; moderately alkaline; clear irregular boundary.

B3ca—13 to 21 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and very plastic; common fine and very fine roots and few medium roots; many fine and very fine pores; few shale fragments that have lime coatings on undersides; common medium and fine masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1cs—21 to 29 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct olive brown (2.5Y 4/4) mottles; weak medium and fine subangular blocky structure; very hard, firm, sticky and very plastic; few to common medium, fine, and very fine roots; common fine and very fine pores; few shale fragments; many medium prominent masses of gypsum and other salts; slightly effervescent; moderately alkaline; clear irregular boundary.

C2—29 to 35 inches; light olive gray (5Y 6/2) shaly clay, dark gray (5Y 4/1) moist; many fine distinct light yellowish brown (10YR 6/4) mottles, yellowish brown (10YR 5/6) moist; massive; extremely hard, firm, sticky and very plastic; few fine and very fine roots; common fine and very fine pores; 45 percent soft shale fragments and 25 percent hard shale fragments; common fine and medium distinct masses of gypsum; mildly alkaline; gradual wavy boundary.

C3r—35 to 60 inches; light olive gray (5Y 6/2) semiconsolidated shale, dark gray and dark (5Y 4/1) and dark grayish brown (2.5Y 4/2) moist; many fine distinct brownish yellow and light yellowish brown (10YR 6/6, 6/4) mottles, yellowish brown (10YR 5/8) moist; massive; extremely hard, extremely firm; few fine and very fine roots between shale fragments; few very fine pores; few fine and medium distinct masses and streaks of gypsum; mildly alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. The depth to accumulated gypsum is 12 to 24 inches. Depth to the strongly effervescent horizon is 10 to 18 inches.

The A2 horizon is loam or clay loam and is 27 to 40 percent clay. It is 0 to 20 percent stones and 0 to 10 percent shale fragments. The horizon is 1 inch to 5 inches thick.

The B2t horizon is clay or silty clay and averages 40 to 60 percent clay. It is neutral to moderately alkaline. The content of exchangeable sodium is 10 to 20 percent. The electrical conductivity is 2 to 8 millimhos per cubic centimeter.

The C horizon is clay loam or clay and averages 35 to 55 percent clay. It is moderately alkaline or strongly alkaline.

Welter series

The Welter series consists of moderately deep, well drained soils on uplands. These soils formed in residuum and colluvium derived dominantly from consolidated shale. Slope is 4 to 25 percent. Elevation is 2,200 to 3,800 feet. The average annual precipitation is about 10 to 15 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine, montmorillonitic Borollic Camborthids.

Typical pedon of a Welter silty clay loam in an area of Dilts-Welter-Julin complex, 4 to 25 percent slopes, in woodland, about 2,420 feet south and 1,980 feet east of the northwest corner of sec. 4, T. 15 N., R. 23 E.

O1 and O2—1 inch to 0; pine cones, needles, twigs, and humus.

A2—0 to 4 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine platy structure; soft, very friable, sticky and plastic; many fine and very fine roots; strongly acid; clear wavy boundary.

B21—4 to 15 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to strong fine and very fine subangular blocky; hard, friable, sticky and very plastic; many coarse, medium, fine, and very fine roots; many fine and very fine pores; few very hard shale fragments; very strongly acid; gradual wavy boundary.

B22—15 to 24 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and very plastic; common coarse and medium roots; many fine and very fine pores; 10 percent soft shale fragments and 5 percent hard shale fragments; strongly acid; diffuse wavy boundary.

Cr—24 to 60 inches; light brownish gray (2.5Y 6/2) consolidated shale, dark gray (N 4/0) moist; brownish yellow (10YR 6/6) coatings on some shale fragments.

Consolidated shale is at a depth of 20 to 40 inches. The A2 horizon is 2 to 8 inches thick. It is very strongly acid to slightly acid.

The B2 horizon is clay or silty clay and averages 40 to 55 percent clay. The B21 horizon is 0 to 15 percent shale chips, and the B22 horizon is 10 to 35 percent shale chips. These horizons are extremely acid or strongly acid.

Whitecow series

The Whitecow series consists of deep, well drained soils on mountainsides and uplands. These soils formed in colluvium and alluvium derived dominantly from limestone. Slope is 2 to 60 percent. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 38 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are loamy-skeletal, carbonatic, frigid Typic Ustochrepts.

Typical pedon of a Whitecow cobbly silty clay loam in an area of Whitecow-Hughesville complex, 20 to 60 percent slopes, in woodland, about 1,320 feet east and 1,500 feet south of the northwest corner of sec. 31, T. 18 N., R. 18 E.

O1 and O2—2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A1—0 to 2 inches; brown (10YR 5/3) cobbly silty clay loam, dark brown (10YR 3/3) moist; moderate very fine granular structure; hard, very friable, sticky and plastic; many fine and medium roots and common coarse roots; 35 percent rock fragments; neutral; gradual wavy boundary.

B2—2 to 9 inches; brown (10YR 4/3) cobbly silty clay loam, dark brown (10YR 3/3) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and medium roots and common coarse roots; many very fine and fine pores; 35 percent rock fragments; mildly alkaline; abrupt wavy boundary.

B3—9 to 16 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; very hard, friable, sticky and plastic; many fine and medium roots and common coarse roots; many very fine and fine pores; 50 percent rock fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1—16 to 27 inches; pale brown (10YR 6/3) very cobbly clay loam, brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and medium roots and few coarse roots; many very fine and fine pores; 55 percent rock fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—27 to 44 inches; very pale brown (10YR 7/3) extremely cobbly light clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and medium roots matted between rock fragments; common fine and medium pores; 75 percent rock fragments; violently effervescent; moderately alkaline; diffuse wavy boundary.

C3—44 to 60 inches; pale brown (10YR 6/3) extremely cobbly heavy loam, olive brown (2.5Y 4/4) moist; weak fine granular structure; hard, very friable, slightly sticky and slightly plastic; few fine and medium roots matted between rock fragments; common very fine pores; 80 percent rock fragments; violently effervescent; moderately alkaline.

The A horizon is clay loam or silty clay loam and is 27 to 35 percent clay. It is 15 to 70 percent rock fragments, of which 0 to 5 percent is stones, 5 to 30 percent is cobbles, and 10 to 35 percent is angular pebbles. It is mildly alkaline or moderately alkaline. The A horizon is 2 to 7 inches thick.

The B and C horizons are loam, clay loam, or silty clay loam and are 18 to 35 percent clay. They are 45 to 85 percent rock fragments, of which 0 to 5 percent is stones, 5 to 15 percent is cobbles, and 40 to 70 percent is pebbles. They are moderately alkaline or strongly alkaline.

Whitore series

The Whitore series consists of deep, well drained soils on mountainsides. These soils formed in colluvium and alluvium derived dominantly from limestone. Slope is 15 to 60 percent. Elevation is 4,800 to 8,500 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 36 to 42 degrees F, and the frost-free period is 50 to 90 days.

These soils are loamy-skeletal, carbonatic Typic Cryochrepts.

Typical pedon of a Whitore cobbly clay loam in an area of Whitore-Firada cobbly clay loams, 15 to 60 percent slopes, in woodland, about 920 feet west and 2,250 feet north of the southeast corner of sec. 7, T. 12 N., R. 18 E.

O1 and O2—1 1/2 inches to 0; forest litter of undecomposed and decomposed needles, twigs, and cones.

A2—0 to 2 inches; pale brown (10YR 6/3) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many coarse, medium, and fine roots; many fine and very fine pores; 15 percent rock fragments; neutral; abrupt wavy boundary.

B2—2 to 8 inches; brown (10YR 4/3) cobbly clay loam, dark yellowish brown (10YR 3/4) moist; strong fine and very fine granular structure; slightly hard, very friable, sticky and plastic; many coarse, medium, and fine roots; many fine and very fine pores; 30 percent rock fragments; neutral; clear wavy boundary.

B31ca—8 to 16 inches; brown (10YR 5/3) very cobbly light clay loam, dark brown (10YR 4/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, sticky and plastic; many coarse, medium, and fine roots; many fine and very fine pores; 45 percent rock fragments; strongly effervescent; mildly alkaline; gradual wavy boundary.

B32ca—16 to 23 inches; pale brown (10YR 6/3) very cobbly light clay loam, brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many coarse, medium, and fine roots; many fine and very fine pores; 50 percent rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

B33ca—23 to 44 inches; very pale brown (10YR 8/3) very cobbly light clay loam, brown (10YR 5/3) moist; moderate fine and very fine subangular blocky structure; slightly hard, very friable, sticky and plastic; common coarse, medium, fine, and very fine roots; many fine and very fine pores; 60 percent rock fragments; common medium threads and masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

B34ca—44 to 66 inches; white (10YR 8/2) extremely cobbly clay loam, pale brown (10YR 6/3) moist; moderate fine and very fine subangular blocky structure; hard, friable, sticky and plastic; few medium and fine roots; common fine pores and many very fine pores; 75 percent rock fragments; lime coatings on fragments; many medium threads and masses of lime; violently effervescent; moderately alkaline.

The A horizon is 27 to 35 percent clay. It is 20 to 35 percent rock fragments, of which 15 to 25 percent is cobbles and 5 to 10 percent is pebbles. It is neutral or mildly alkaline. The A horizon is 1 inch to 4 inches thick.

The B horizon is clay loam or silty clay loam and is 27 to 35 percent clay. It is 35 to 80 percent rock fragments, of which 0 to 10 percent is stones, 25 to 50 percent is cobbles, and 10 to 30 percent is pebbles.

Widen series

The Widen series consists of moderately deep, well drained soils on mountainsides and uplands. These soils formed in residuum derived dominantly from semiconsolidated siltstone. Slope is 15 to 60 percent. Elevation is 4,200 to 5,300 feet. The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 39 to 43 degrees F, and the frost-free period is 80 to 110 days.

These soils are fine, montmorillonitic, frigid Typic Ustochrepts.

Typical pedon of a Widen silty clay loam in an area of Widen-Hughesville-Lipke complex, 15 to 60 percent slopes, in woodland, about 800 feet west and 1,200 feet south of the northeast corner of sec. 2, T. 16 N., R. 19 E.

O1 and O2—1 inch to 0; forest litter of undecomposed and decomposed needles, twig, cones, and leaves.

A1—0 to 1 inch; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; many fine and very fine roots; many very fine pores; slightly acid; clear wavy boundary.

A2—1 inch to 4 inches; pinkish gray (7.5YR 6/2) silty clay loam; brown (7.5YR 4/2) moist; weak medium and fine platy structure parting to strong fine granular; hard, friable, sticky and plastic; many coarse, medium, and fine roots; many very fine pores; slightly acid; clear wavy boundary.

B2—4 to 12 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to strong fine subangular blocky; very hard, firm, very sticky and very plastic; many coarse, medium, and fine roots; common medium and fine pores and many very fine pores; organic stains on faces of peds; slightly acid; clear wavy boundary.

B3—12 to 36 inches; pale yellow (2.5Y 7/4) silty clay, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common coarse, medium, and fine roots and many very fine roots; many fine and very fine pores; common fine threads of lime; strongly effervescent; mildly alkaline; gradual wavy boundary.

Cr—36 to 60 inches; pale yellow (2.5Y 8/4) platy semiconsolidated siltstone, olive yellow (2.5Y 6/6) moist; very hard, firm, sticky and plastic; strongly effervescent; mildly alkaline.

Semiconsolidated siltstone is at a depth of 20 to 40 inches.

The A horizon is clay loam or silty clay loam and averages 27 to 40 percent clay. It is 0 to 10 percent angular pebbles. It is slightly acid to mildly alkaline.

The B horizon is clay loam, silty clay loam, clay, or silty clay and averages 35 to 50 percent clay. It is 0 to 15 percent angular pebbles. It is slightly acid to moderately alkaline.

Windham series

The Windham series consists of deep, well drained soils on fans, terraces, and terrace edges. These soils formed in alluvium derived dominantly from limestone. Slope is 0 to 45 percent. Elevation is 3,200 to 5,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 90 to 125 days.

These soils are loamy-skeletal, carbonatic Typic Calciborolls.

Typical pedon of a Windham gravelly clay loam in an area of Judith-Windham gravelly clay loams, 2 to 8 percent slopes, in cropland, about 35 feet north and 600 feet west of the southeast corner of sec. 12, T. 15 N., R. 17 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; 15 percent limestone pebbles that have lime crusts on undersides; slightly effervescent; mildly alkaline; clear wavy boundary.

B2ca—6 to 12 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 5/3) moist; moderate fine and very fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine pores; 20 percent limestone pebbles; lime diffused throughout mass and as crusts and pendants on pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—12 to 18 inches; white (10YR 8/2) very gravelly heavy loam, very pale brown (10YR 7/3) moist; massive; hard, friable, slightly sticky and nonplastic; many fine and very fine roots; many fine and very fine pores; 60 percent limestone fragments, mainly less than 3 inches in diameter; lime diffused and segregated as masses and as crusts and pendants on pebbles; violently effervescent; moderately alkaline; diffuse wavy boundary.

C3ca—18 to 60 inches; very pale brown (10YR 7/4) extremely gravelly loam, pale brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine and very fine roots; common to few fine pores and very fine pores; 70 percent limestone fragments, mainly less than 3 inches in diameter; lime accumulated as masses and as crusts and pendants on fragments; violently effervescent; moderately alkaline.

Depth to the violently effervescent horizon is 7 to 10 inches.

The A horizon is loam or clay loam and averages 18 to 35 percent clay. It is 10 to 75 percent rock fragments, of which 10 to 50 percent is pebbles, 0 to 10 percent is cobbles, and 0 to 15 percent is stones. It is mildly alkaline or moderately alkaline.

The B horizon is loam or clay loam and averages 18 to 35 percent clay. It is 10 to 75 percent rock fragments, of which 10 to 55 percent is pebbles and 0 to 20 percent is cobbles.

The C horizon is sandy loam, loam, or clay loam and averages 10 to 35 percent clay. It is 60 to 80 percent rock fragments, of which 55 to 60 percent is pebbles and 5 to 20 percent is cobbles. Depth to the C horizon is less than 16 inches.

Winifred series

The Winifred series consists of moderately deep, well drained soils on uplands. These soils formed in alluvium and residuum derived dominantly from semiconsolidated shale. Slope is 2 to 45 percent. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 100 to 125 days.

These soils are fine, montmorillonitic Typic Haploborolls.

Typical pedon of a Winifred clay loam in an area of Winifred-Windham-Eltsac complex, 15 to 45 percent slopes, in rangeland, about 800 feet west and 900 feet north of the southeast corner of sec. 9, T. 15 N., R. 18 E.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; many very fine pores; neutral; clear wavy boundary.

B21—3 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many very fine pores; neutral; clear wavy boundary.

B22—6 to 14 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong fine subangular blocky; very hard, friable, sticky and plastic; common fine roots and many very fine roots; many very fine pores; few fine threads and masses of lime; strongly effervescent; mildly alkaline; gradual irregular boundary.

B31ca—14 to 22 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and plastic; common fine roots and many very fine roots; many very fine pores; common medium masses of lime; strongly effervescent; mildly alkaline; clear wavy boundary.

B32ca—22 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; common medium masses of lime; mildly alkaline; gradual wavy boundary.

Cr—32 to 60 inches; light brownish gray and yellowish brown semiconsolidated shale; slightly effervescent; mildly alkaline.

Semiconsolidated shale is at a depth of 20 to 40 inches. Depth to the horizon of strong lime accumulation is 8 to 16 inches.

The A horizon is clay loam or silty clay loam and averages 27 to 40 percent clay. It is neutral or mildly alkaline.

The B horizon is clay loam, clay, or silty clay and averages 35 to 50 percent clay. It is mildly alkaline or moderately alkaline.

Work series

The Work series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium. Slope is 0 to 8 percent. Elevation is 3,500 to 4,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 110 to 125 days.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Work clay loam, 0 to 2 percent slopes, in cropland, about 400 feet south and 2,440 feet east of the northwest corner of sec. 36, T. 19 N., R. 14 E.

Ap—0 to 6 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak medium platy structure parting to moderate fine granular; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21t—6 to 15 inches; brown (10YR 5/3) heavy clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and plastic; many very fine roots; many very fine pores; thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B22t—15 to 24 inches; grayish brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and plastic; many very fine roots; many very fine pores; thin continuous clay films on faces of peds; neutral; gradual wavy boundary.

B23t—24 to 31 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to moderate medium and fine subangular blocky; many very fine roots; many very fine pores; mildly alkaline; abrupt irregular boundary.

B3ca—31 to 36 inches; grayish brown (10YR 5/2) heavy loam, dark grayish brown (10YR 4/2) moist; strong medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; common threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—36 to 60 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; hard, friable, slightly sticky and slightly plastic; common very fine pores; few fine masses of lime; strongly effervescent; moderately alkaline.

Depth to the strongly effervescent horizon is 12 to 31 inches.

The A horizon is slightly acid or neutral. It is 0 to 5 percent pebbles.

The B2 horizon is clay loam or clay and averages 35 to 50 percent clay. It is neutral or mildly alkaline.

The B3 and C horizons are loam, sandy clay loam, or clay loam and average 25 to 40 percent clay.

Yamac series

The Yamac series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived from mixed rock sources. Slope is 0 to 25 percent. Elevation is 2,300 to 3,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed Borollic Camborthids.

Typical pedon of a Yamac loam in an area of Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes, in rangeland, about 2,640 feet east and 2,440 feet north of the southwest corner of sec. 11, T. 18 N., R. 26 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) heavy loam, very dark grayish brown (2.5Y 3/2) moist; weak fine and very fine platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; many very fine pores; neutral; clear wavy boundary.

B2—3 to 7 inches; grayish brown (10YR 5/2) heavy loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; many fine and very fine pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

B31—7 to 12 inches; light brownish gray (2.5Y 6/2) heavy silt loam, grayish brown (10YR 5/2) moist; moderate medium and coarse prismatic structure parting to weak coarse subangular blocky; hard, very friable, sticky and plastic; common fine, very fine, and medium roots; many fine and very fine pores; strongly effervescent; moderately alkaline; clear irregular boundary.

B32ca—12 to 22 inches; light brownish gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable, sticky and plastic; common very fine, fine, and medium roots; many very fine and fine pores; many medium masses of lime; strongly effervescent; moderately alkaline; gradual irregular boundary.

C1ca—22 to 36 inches; light brownish gray (2.5Y 6/2) heavy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; common fine soft masses of lime; strongly effervescent; strongly alkaline; diffuse wavy boundary.

C2ca—36 to 60 inches; light brownish gray (2.5Y 6/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; common fine and very fine pores; many fine soft masses of lime; strongly effervescent; strongly alkaline.

Depth to the strongly calcareous horizon is 7 to 12 inches.

The A horizon is neutral to mildly alkaline. It is 0 to 10 percent angular pebbles.

The B and C horizons are loam, silt loam, or silty clay loam and average 20 to 30 percent clay. They are 0 to 10 percent angular pebbles. The B2 horizon is mildly alkaline or moderately alkaline, and the B3 and C horizons are moderately alkaline or strongly alkaline.

Yamac Variant

The Yamac Variant consists of deep, well drained soils on terraces. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 2,200 to 3,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are fine-loamy, mixed Aridic Haploborolls.

Typical pedon of Yamac Variant loam, in hayland, about 2,500 feet east and 1,800 feet north of the southwest corner of sec. 22, T. 15 N., R. 24 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine platy structure parting to moderate very fine granular; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots; slightly effervescent; neutral; clear smooth boundary.

B21—4 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak fine and very fine subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; slightly effervescent; mildly alkaline; clear smooth boundary.

B22—11 to 25 inches; light brownish gray (10YR 6/2) heavy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots and few medium roots; many fine and very fine pores and few medium pores; few medium masses of lime; strongly effervescent; mildly alkaline; clear smooth boundary.

C1ca—25 to 39 inches; pale brown (10YR 6/3) heavy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine pores; few medium masses of lime; strongly effervescent; mildly alkaline; abrupt smooth boundary.

IIC2—39 to 44 inches; grayish brown (2.5Y 5/2) silty clay, dark gray (5Y 4/1) moist; massive; very hard, firm, sticky and plastic; common fine and very fine roots; many fine and very fine pores; few medium masses of gypsum and other salts; strongly effervescent; mildly alkaline; abrupt smooth boundary.

IIIC3—44 to 50 inches; pale brown (10YR 6/3) heavy loam, dark grayish brown (10YR 4/2) moist; few fine distinct reddish brown (5Y 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; few fine masses of gypsum and other salts; strongly effervescent; mildly alkaline; abrupt smooth boundary.

IVC4—50 to 66 inches; grayish brown (10YR 5/2) silty clay, very dark gray (10YR 3/1) moist; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine pores; few fine masses of gypsum and other salts; slightly effervescent; mildly alkaline.

The solum is 24 to 40 inches thick. The mollic epipedon is 7 to 12 inches thick. The A horizon is neutral or mildly alkaline. The Cca horizon has reddish brown or yellowish brown mottles in some pedons. The IIC, IIIC, and IVC horizons are silty clay loam or silty clay.

Yawdim series

The Yawdim series consists of shallow, well drained soils on uplands. These soils formed in residuum derived dominantly from semiconsolidated shale. Slope is 4 to 50 percent. Elevation is 2,400 to 4,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 42 to 45 degrees F, and the frost-free period is 115 to 135 days.

These soils are clayey, montmorillonitic (calcareous), frigid, shallow Ustic Torriorthents.

Typical pedon of a Yawdim silty clay loam in an area of Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes, in rangeland, about 1,320 feet north and 1,990 feet west of the southeast corner of sec. 6, T. 20 N., R. 18 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium granular structure; soft, friable, sticky and plastic; slightly effervescent; mildly alkaline; clear wavy boundary.

C1—3 to 12 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, firm, sticky and plastic; many fine roots; many fine and very fine pores; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2r—12 to 17 inches; grayish brown (2.5Y 5/2) partially weathered semiconsolidated shale that crushes to silty clay loam, dark grayish brown (2.5Y 4/2) moist; hard, firm, sticky and plastic; few fine roots; many very fine pores; few threads of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

C3r—17 to 60 inches; gray (2.5Y 5/1) and light olive brown (2.5Y 5/4) semiconsolidated shale that crushes to silty clay loam, dark gray (2.5Y 4/1) and olive brown (2.5Y 4/4) moist; hard, firm; weakly effervescent; moderately alkaline.

Semiconsolidated shale is at a depth of 10 to 20 inches.

The A horizon is clay loam or silty clay loam and averages 27 to 40 percent clay. It is 0 to 10 percent angular pebbles. It is mildly alkaline or moderately alkaline.

The C horizon is clay loam, silty clay loam, or clay and averages 35 to 50 percent clay.

geology

By Eddie Juvan, geologist, Soil Conservation Service.

Fergus County is in the belt between the Rocky Mountains and the Great Plains (*12*). The plains in the county contrast with the isolated, islandlike Big Snowy, Moccasin, and Judith Mountains.

The plains were produced by long periods of sedimentation and erosion. As the seas that covered much of Montana hundreds of millions of years ago fluctuated, sand, mud, and lime were deposited. This sediment became compacted, cemented, and hardened, and eventually it became shale, sandstone, or limestone. As the sediment was laid down and compacted, forces in the earth caused swelling, or bulging, of the surface. The bulging caused some of the sediment to tilt or dip away from its original horizontal position and uplifted the sediment, exposing it to a higher hazard of erosion. Over a period of time, erosion of the younger sediment has

exposed older sediment throughout the county. Many stratigraphic units are exposed at the surface.

The Snowy Mountains in the southern part of Fergus County were formed by uplift. As faulting occurred at great depths, movement caused the older and more brittle rock to break and the overlying younger and more flexible strata to bend or fold. The Judith and Moccasin Mountains were formed by intrusion of igneous rock. Masses of molten rock rose from great depths, pushing through older strata and bending the younger strata upward.

Rock exposed on the surface ranges in age from Quaternary, as represented by Holocene to Pleistocene stream gravel, to Cambrian, which is 550 million years old. The older rocks are exposed only where they have been forced to the surface by mountain-building processes. Cretaceous rock underlies most of the plains area.

The Palezoic Era began with a slow retreat of the sea that had previously covered most of central Montana. The sea repeatedly rose and then withdrew from various parts of central Montana. With each rise of the sea, different deposits of sediment were laid down. Although no mountain-building or igneous activity is known to have occurred in the county during Palezoic time, gentle warping of the sea floor from time to time has resulted in the absence of certain formations in some localities.

Cambrian strata in Fergus County are exposed near the crest of the Moccasin, Judith, and Snowy Mountains, where they have been forced up by mountain-building processes. Generally, the Cambrian strata consist of sandstone at the base (Flathead Formation), a layer of shale (Wolsey Formation), and then a layer of limestone (Meagher Formation and others). Rock outcroppings are near the top of the Snowy Mountains. The total accumulated thickness of the Cambrian strata in Fergus County is about 1,000 feet. Soils of the Dryadine series developed in material derived from Cambrian stata.

Near the end of the Cambrian Period, the sea withdrew and most of Montana became a low-lying area of land. All of Montana, including Fergus County, appears to have been land throughout the Silurian Period and the early part of the Devonian Period. In the Middle Devonian, the sea again submerged central Montana. About 1,000 feet of limestone and dolomite were deposited as products of evaporation. Representative soils in this area are in the Firada, Hughesville, Skaggs, Sheege, Whitecow, and Whitore series.

The Mississippian Period began with all of Montana submerged beneath marine water, and about 1,000 feet of Madison Limestone was deposited. Formation of the Madison Group continued with the deposition of dolomite and occasional thick beds of anhydrite. In the latter part of the Mississippian Period, the extensive Madison Sea became restricted and a long, tongue-shaped gulf extended in an east-west direction across central Montana and into North Dakota. The shale and sandy sediment of the Big Snowy Group (Heath, Otter, and Kibbey Formations) were deposited in the gulf. Rock strata of this group are exposed in the Snowy Mountains in the southwestern part of Fergus County and in the Judith and Moccasin Mountains north and east of Lewistown. Castle, Kildor, Delette, Lipke, Tibs, Tomty, and Widen soils developed in these areas.

During the Pennsylvanian Period, the sea again retreated and there was a notable change in the characteristics of the sediment. There was a widespread influx of clean, white sand similar to beach sand, and about 200 feet of it was deposited on the Quadrant Formation. Evidence of cross-bedding suggests there were also windblown deposits, such as sand dunes, along the sea coast. Outcrop typical of Pennsylvanian strata is in the Snowy Mountains. Soils derived from this material are in the Kildor, Hanson, Hughesville, Skaggs, and Tibs series and the Bridger Variant.

After the Pennsylvanian Period, the Mesozoic Era began with a broad, gentle uplift in north-central Montana; the older strata were domed, or arched, upward across a distance of 300 miles. Erosion then planed the uplifted area, producing a nearly level land surface extending from Canada to Wyoming. The Middle Mississippian strata were deeply cut by this erosion in areas as far south as Lewistown. Fergus County is on the southern edge of this uplifted arch. Soils in this area are in the Absarokee, Alder, Bitton, Castner, Cheadle, Hibar, and Teton series.

In the Triassic Period, most of Montana was a land area undergoing erosion. The sea, which spread into southwestern Montana from Utah, apparently never reached as far north as Fergus County. Conglomerate, sandstone, shale, and impure limestone of the Dinwoody and Thaynes Formations are representative Triassic sediment. Soils that developed in material weathered from these formations are in the Absarokee, Borky, Castner, and Winifred series.

Another sea spread over most of Montana toward the middle of the Jurassic Period, and sandy, shaly, and limy sediment of the Ellis Group was deposited (Swift, Rierdon, and Sawtooth Formations). The total combined thickness of this deposit in Fergus County was about 300 feet. Because the Ellis Group generally yields easily recognizable fossils, it is used for determining geologic time. Jurassic sediment outcrops along the foot slopes of the Snowy, Judith, and Moccasin Mountains. Outcrops of Jurassic material are in T. 14 N., R. 10, 19, 20, and 21 E. In central Montana red and gray shale that has a bed of gypsum 5 to 10 feet thick is mined near Lewistown. Soils that developed in this sediment are in the Bitton, Castner, Cheadle, Hibar, and Teton series.

Before the Jurassic ended, the sea again withdrew from Montana; however, beds of sand and mud were continuously deposited, and the material apparently was carried eastward by rivers flowing across a great coastal

plain. This material is known as the Morrison Formation. It was during this time—about 130 million years ago—that huge dinosaurs roamed the river flood plains. Near the end of the Jurassic, a large swamp, perhaps as large as the Florida Everglades, developed between Great Falls and Lewistown. Peat accumulated and eventually turned to coal. This is the oldest coal formation in Montana.

During the early Cretaceous, a blanket of sand about 100 feet thick was spread over most of Montana. This sand commonly contained fragments of black flint and is called "salt and pepper sandstone" in some areas. Deposits of red mud and additional sand 200 to 300 feet thick followed. This sequence of deposits is known as the Kootenai Formation. Outcrops of this formation are south and east of Lewistown and along the foot slopes of the Judith and Moccasin Mountains. Darret, Fergus, Terrad, and Timberg soils developed in areas of Kootenai Shale, and Castner, Hibar, Oraid, Mocmont, Tigeron, and Twin Creed soils developed in areas of Kootenai Sandstone.

The last of many marine invasions of Montana began in the Late Cretaceous. An inland sea, which extended from the Gulf of Mexico to the Arctic Circle, covered all of the eastern and central parts of Montana. As the sea pushed westward, thick deposits of dark marine shale were laid down. During the retreat of the sea, sandy sediment was deposited.

Overlying the Kootenai Formation is about 2,000 feet of black marine shale and local sandy areas of Late Cretaceous age, known collectively as the Colorado Group or Colorado Shale. Colorado Shale is extensive northeast of Lewistown in Fergus County. Soils that developed in material weathered from Colorado Shale are in the Absarokee, Delplain, Dilts, Ernem, Julin, Sinnigam, Teigen, and Weingart series. This shale generally is not considered to be a ground water aquifer, although very small amounts of highly mineralized water that is poorly suited to most uses may be encountered during drilling.

The Eagle Formation overlies the Colorado Shale. It consists of 250 feet of sandstone and shaly sandstone. This formation is an important aquifer in Fergus County, and it provides water for livestock and for domestic use. Soils that developed in material weathered from the Eagle Formation are in the Cabba, Flasher, Reeded, Tally, and Vebar series.

About 500 feet of dark gray shale overlies the Eagle Formation. This shale is known as the Clagget Formation. A typical landscape of the Clagget Formation is north of Hilger. This formation is not an important source of ground water in Fergus County. Soils in the Eltsac, Lawther, Norbert, Regent, and Winifred series formed in material derived from Clagget Shale.

Light-colored sandstone with interbedded shale and siltstone overlies the Clagget Formation. This is the Judith River Formation and is about 600 feet thick. It is an important aquifer in Fergus County. Soils that developed in material derived from this formation are in the Cabbart, Delpoint, Marmath, Tanna, and Yawdim series.

Dark gray marine Bearpaw Shale 1,000 to 2,000 feet thick overlies the Judith River Formation. The Missouri River Breaks, north and east of Lewistown, formed in Bearpaw sediment. Representative soils derived from this shale are in the Gerdrum, Neldore, Marias, Thebo, and Vanda series. Bearpaw Shale is not considered to be a ground water aquifer in this county. Any water in it is highly mineralized.

A terrestrial deposit consisting of massive sandstone, thin siltstone, silty shale, and thin seams of coal comprises the Hell Creek Formation. This formation is more than 700 feet thick and overlies Bearpaw Shale. Outcrops along Box Elder Creek, east of Roy, characterize the Hell Creek landscape. Soils in the Abor, Chinook, Delpoint, Gerdrum, Kobar, Rentsac, Yamac, and Yawdim series are representative of the soils that formed in material derived from this formation. A massive layer of sandstone at the base of this formation, known as Fox Hills Sandstone, is an important aquifer in Fergus County. The thin coal seams and sandier areas of the Hell Creek Formation generally produce small amounts of water suitable for domestic or livestock use. Beds of coal are interbedded with the sedimentary rock of the Hell Creek Formation and locally with the Eagle and Judith River Formations. These beds indicate the repeated occurrence of swamps on the coastal plains. Large dinosaurs roamed the river flood plains, and their skeletons are often discovered in the rock of the Hell Creek Formation.

Beds of bentonite as much as 3 feet thick are in many of the areas of shale. The bentonite consists of chemically altered volcanic ash that was deposited in the sea.

Toward the end of the Cretaceous Period, forces in the earth caused the uplift of the ancestral Rocky Mountains. Before the second phase of mountain-building during the middle Tertiary, these ancestral mountains were eroded down to a flat, truncated plain. Material derived from this erosional period was spread over hundreds of miles of a plain east of the Rocky Mountains. The Hell Creek Formation of Late Cretaceous age and the Fort Union Formation of early Tertiary age resulted. Soils associated with the Hell Creek Formation are in the Abor, Delpoint, Rentsac, and Yawdim series. The Fort Union Formation, noted in eastern Montana for its thick coal seams, does not occur in Fergus County.

Most of the strata of Tertiary age have been stripped away by erosion. Gravelly terrace remnants are in southwestern Fergus County bordering the Snowy Mountains. This gravel is 50 feet or more thick and blankets the surface for many miles. Soils associated with the Tertiary terrace gravel are in the Doughty,

Judith, Sipple, Tamaneen, and Windham series. Where the recharge area is sufficient, this gravel is an important aquifer.

The eroded surface of the Early Tertiary material was bent or warped upward by block faulting during the Middle to Late Tertiary to form the present Rocky Mountains in western Montana. Also, the isolated mountains of central Montana developed more or less independently of each other during the Middle Tertiary or early Oligocene Epoch. The Big Snowy Mountains were uplifted by vertically directed forces. The Moccasin and Judith Mountains were pushed up by molten rock that rose from great depths.

Alluvial deposits from the Quaternary Period are along most of the drainageways in the county. They comprise stratified silt, sand, and gravel and range in thickness from 5 to 50 feet, with the thickest deposits along the major drainageways. These deposits are an important source of ground water for many domestic and livestock wells; however, because they are shallow, they are subject to contamination.

During the Pleistocene Epoch of the Quaternary Period, which began about 2 million years ago, the climate of North America became cold enough for several thousands of feet of glacial ice to accumulate over most of Canada (*7*). Because of the weight of the ice, the glacier was semifluid and spread southward into the northern United States. As it slipped and slid forward, it gathered soil material and loose rock. As the ice melted, a mantle of glacial drift was left behind. The glacial drift contains pebbles and boulders, and large boulders are still scattered across the surface in places. The Thebo, Neldore, Gerdrum, and Tealette soils have glacial pebbles and boulders.

Only the northeastern corner of Fergus County was covered by ice from the large Keewatin ice sheet. The ice sheet blocked north-flowing rivers, forming large lakes. A small arm of Glacial Lake Musselshell extended into the northeastern part of the county.

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glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3.75
Low	3.75 to 5
Moderate	5 to 7.5
High	More than 7.5

Basal area. The area of the cross section, measured outside the bark, of all the trees in a stand. A measure of stand density.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil material. Material that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. Very channery soil material is 35 to 60 percent these thin, flat fragments, and extremely channery soil material is more than 60 percent. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same. (See potential native plant community.)

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles up to 38 centimeters (15 inches) long.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent these fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Culmination of mean annual increment (CMAI). The point in time during the life of a stand of trees at which the average annual yield is the greatest.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diameter at breast height. Diameter of a tree taken at breast height (officially 4.5 feet above the ground). Unless specified otherwise, the diameter at breast height includes the bark of the tree in the measurement.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage

results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter. Very gravelly soil material is 35 to 60 percent rounded or angular rock fragments, and extremely gravelly soil material is more than 60 percent.

Hardpan. A hardened or cemented soil horizon or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Potential native plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same. (See climax vegetation.)

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all of its horizons and into the parent material.

Range. Range includes rangeland, native pasture, and many forest lands that support an understory or periodic cover of vegetation suitable for grazing.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Riparian. Referring to the area of land adjacent to a body of water that is directly affected by the water. Areas and biotic communities influenced by a high water table. They commonly are adjacent to surface water. Riparian ecosystems are diversified, widespread, and vary in size and vegetative complexity. Riparian zones have the following in common: (1) they create well defined habitat zones within much drier surroundings; (2) they make up a minor proportion of the overall area; (3) they generally are more productive than the rest of the area; and (4) they are sources of diversity. Riparian zones have commonly been recognized as riparian woodland or streambank vegetation in the west.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating. (See soft bedrock.)

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slow intake (in tables). The slow movement of water into the soil.

Soft bedrock. Bedrock that can be excavated using a single-toothed ripping attachment mounted on a tractor with a 200 to 300 drawbar horsepower rating. (See rippable.)

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." (See Soil separates.)

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Woodland suitability group. A grouping of soils that are capable of producing similar kinds and amounts of wood crops and that require similar management to produce those crops.

Yield tables (woodland management). Tables showing the number and size of trees, total basal area, and volumes for normal stands at different ages on sites of different productivity.