are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. The shrubs best suited are skunkbush sumac, lilac, and Siberian peashrub.

Wildlife is an important secondary use of this soil. The cropland areas provide favorable habitat for ring-necked pheasant and mourning dove. Many nongame species can be attracted by establishing areas for nesting and escape cover. For pheasants, undisturbed nesting cover is essential and should be included in plans for habitat development, especially in areas of intensive agriculture.

Rapid expansion of Greeley and the surrounding area has resulted in urbanization of much of this Olney soil. This soil has good potential for urban and recreational development. The only limiting feature is the moderately rapid permeability in the substratum, which causes a hazard of ground water contamination from sewage lagoons. Lawns, shrubs, and trees grow well. Capability class I irrigated.

47—Olney fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained soil on plains at elevations of 4,600 to 5,200 feet. It formed in mixed outwash deposits. Included in mapping are small areas of soils that have a dark surface layer. Some small leveled areas are also included.

Typically the surface layer of this Olney soil is grayish brown fine sandy loam about 10 inches thick. The subsoil is yellowish brown and very pale brown sandy clay loam about 14 inches thick. The substratum to a depth of 60 inches is very pale brown, calcareous fine sandy loam.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. Surface runoff is medium, and the erosion hazard is low.

In irrigated areas this soil is suited to all crops commonly grown in the area, including corn, sugar beets, beans, alfalfa, small grain, potatoes, and onions. An example of a suitable cropping system is 3 to 4 years of alfalfa followed by corn, corn for silage, sugar beets, small grain, or beans. Land leveling, ditch lining, and installing pipelines may be needed for proper water application. All methods of irrigation are suitable, but furrow irrigation is the most common. Barnyard manure and commercial fertilizer are needed for top yields.

In nonirrigated areas this soil is suited to winter wheat, barley, and sorghum. Most of the acreage is planted to winter wheat. The predicted average yield is 28 bushels per acre. The soil is summer fallowed in alternate years to allow moisture accumulation. Generally precipitation is too low for beneficial use of fertilizer.

Stubble mulch farming, stripcropping, and minimum tillage are needed to control soil blowing and water erosion. Terracing also may be needed to control water erosion.

The potential native vegetation on this range site is dominated by sand bluestem, sand reedgrass, and blue grama. Needleandthread, switchgrass, sideoats grama, and western wheatgrass are also prominent. Potential production ranges from 2,200 pounds per acre in favorable years to 1,800 pounds in unfavorable years. As range condition deteriorates, the sand bluestem, sand reedgrass, and switchgrass decrease and blue grama, sand dropseed, and sand sage increase. Annual weeds and grasses invade the site as range condition becomes poorer.

Management of vegetation on this soil should be based on taking half and leaving half of the total annual production. Seeding is desirable if the range is in poor condition. Sand bluestem, sand reedgrass, switchgrass, sideoats grama, blue grama, and pubescent wheatgrass are suitable for seeding. The grass selected should meet the seasonal requirements of livestock. It can be seeded into a clean, firm sorghum stubble, or it can be drilled into a firm prepared seedbed. Seeding early in spring has proven most successful.

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

Wildlife is an important secondary use of this soil. The cropland areas provide favorable habitat for ring-necked pheasant and mourning dove. Many nongame species can be attracted by establishing areas for nesting and escape cover. For pheasants, undisturbed nesting cover is essential and should be included in plans for habitat development, especially in areas of intensive agriculture. Rangeland wildlife, for example, the pronghorn antelope, can be attracted by developing livestock watering facilities, managing livestock grazing, and reseeding where needed.

Rapid expansion of Greeley and the surrounding area has resulted in urbanization of much of the Olney soil. This soil has good potential for urban and recreational development. The only limiting feature is the moderately rapid permeability in the substratum, which causes a hazard of ground water contamination from sewage lagoons. Lawns, shrubs, and trees grow well. Capability subclass IIe irrigated, IVe nonirrigated; Sandy Plains range site.

48—Olney fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained soil on plains at elevations of 4,600 to 5,200 feet. It formed in mixed outwash deposits. Included in mapping are small areas of soils that have a dark surface layer and small areas of soils that have sandstone and shale within a depth of 60 inches.

Typically the surface layer of this Olney soil is grayish brown fine sandy clay loam about 8 inches thick. The subsoil is yellowish brown and very pale brown fine sandy loam about 12 inches thick. The substratum to a depth of 60 inches is very pale brown, calcareous fine sandy loam.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or

percent weathered shale chips; calcareous; moderately alkaline; gradual wavy boundary.
C2r—13 inches; calcareous clayey shale.

Typically these soils have free carbonates at the surface. Depth to shale ranges from 10 to 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 or 4. The C horizon has hue of 10YR or 2.5Y. It is commonly clay that is 40 to 45 percent clay.

Nelson series

The Nelson series consists of moderately deep, well drained soils that formed in residuum from soft calcareous sandstone. Nelson soils are on plains. Slopes are 0 to 9 percent.

Nelson soils are similar to Kim, Otero, Tassel, and Thedalund soils and are near the Olney soils. Kim, Otero and Olney soils are deep. Tassel soils have sandstone between 10 and 20 inches. Thedalund soils are more than 18 percent clay in the C horizon.

Typical pedon of Nelson fine sandy loam, 0 to 3 percent slopes, 2,000 feet south and 2,450 feet east of northwest corner sec. 17, T. 6 N., R. 66 W.

Ap—0 to 9 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable; calcareous; moderately alkaline; abrupt smooth boundary.
C1ca—9 to 30 inches; light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4) moist; massive; hard, very friable; some visible lime occuring as concretions and in fine seams and filaments; calcareous; moderately alkaline; gradual wavy boundary.
C2r—30 inches; soft calcareous sandstone.

Typically these soils have free carbonates at the surface. Depth to soft sandstone ranges from 20 to 40 inches. Content of rock fragments ranges from 0 to 10 percent.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y. It is fine sandy loam or sandy loam.

Nunn series

The Nunn series consists of deep, well drained soils that formed in mixed alluvium and eolian deposits. Nunn soils are on terraces, alluvial fans, and smooth plains. Slopes are 0 to 3 percent.

Nunn soils are similar to the Altvan and Dacono soils and are near the Colombo, Fort Collins, Haverson, and Weld soils. Altvan and Dacono soils have a sand and gravel C horizon at a depth of 20 to 40 inches. Colombo and Haverson soils lack a B horizon. Fort Collins soils are less than 35 percent clay in the B horizon. Weld soils have an abrupt textural boundary between the A and B horizons.

Typical pedon of Nunn clay loam, 0 to 1 percent slopes, 400 feet north and 1,040 feet east of southwest corner sec. 22, T. 6 N., R. 66 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) clay loam; very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; noncalcareous; mildly alkaline; clear smooth boundary.
B2t—9 to 19 inches; light brownish gray (10YR 6/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; very hard, firm; common moderately thick clay films on faces of peds; noncalcareous; mildly alkaline; clear wavy boundary.
B3—19 to 23 inches; light brownish gray (10YR 6/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; calcareous; mildly alkaline; clear wavy boundary.
C1ca—23 to 29 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; some visible lime in fine seams and filaments; calcareous; moderately alkaline; clear wavy boundary.
C2ca—29 to 60 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; some visible lime in fine filaments; calcareous; moderately alkaline.

Thickness of the solum ranges from 17 to 33 inches. Coarse fragments make up as much as 10 percent of the solum. Depth to free carbonates ranges from 12 to 25 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is clay loam, loam, or loamy sand. The B2t horizon is commonly heavy clay loam that is 35 to 40 percent clay.

Olney series

The Olney series consists of deep, well drained soils that formed in alluvium. Olney soils are on plains. Slopes are 0 to 5 percent.

Olney soils are similar to the Fort Collins and Vona soils and are near the Kim, Nelson, Otero, and Thedalund soils. Fort Collins soils are less than 35 percent fine and coarser sand in the B horizon. Vona soils are less than 18 percent clay in the B horizon. Nelson and Thedalund soils have sandstone and shale between 20 and 40 inches.

Typical pedon of Olney fine sandy loam, 0 to 1 percent slopes, 1,320 feet north and 284 feet east of southwest corner sec. 28, T. 6 N., R. 66 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; noncalcareous; mildly alkaline; abrupt smooth boundary.
B2t—10 to 20 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable; common moderately thick clay films on faces of peds; noncalcareous; mildly alkaline; clear wavy boundary.
B3ca—20 to 25 inches; very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) moist; moderate coarse prismatic structure; slightly hard, very friable; some visible lime occuring in fine to medium seams and soft masses; calcareous; moderately alkaline; gradual smooth boundary.
Cca—25 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; some visible lime in fine to medium threads and seams; calcareous; moderately alkaline.

Thickness of the solum ranges from 17 to 30 inches. Coarse fragments make up as much as 15 percent of the solum. Depth to free carbonates ranges from 10 to 24 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 dry and 3 to 5 moist, and chroma of 2 or 3. It is fine sandy loam or loamy sand. The B2t horizon is commonly sandy clay loam, but clay content ranges from 18 to 30 percent.