

RESOURCE INVENTORY

SOILS

Washoe Meadows State Park

1989

by

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INTRODUCTION

The Lake Tahoe Basin is in Soil Region III of the California Department of Conservation classification system (California Dept. of Conservation 1979). Region III includes the Sierra Nevada, Trinity, Cascade, and the Sierras of Southern California. Twenty one percent of the state is in this region. Igneous rock is the dominant parent material. Most soils are ultisolic, with acid reaction and low available phosphorous. The general environmental setting is rugged mountainous topography, ranging from 1,000 to 14,000 feet in elevation. Summers are temperate; winters are cold and wet, with snow. Primary human uses are timber production, watershed, and recreation.

Soil erosion in the Tahoe Basin contributes to the declining water quality of Lake Tahoe. As a result, most studies of soils in the Tahoe Basin have focused on sedimentation and erosion control. Descriptive work has been done by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) and Forest Service (USFS), and by the Tahoe Regional Planning Agency (TRPA). A detailed survey with soil maps of the Tahoe Basin was published in 1974 as part of the USDA soil survey series.

The information presented in this section is primarily from published sources, including the soil survey for the Tahoe Basin Area (USDA 1974) and summary reports prepared by the USFS (USDA Forest Service 1988) and the TRPA (TRPA 1988). No additional field work was conducted.

Information on typical vegetation was taken from the soil survey. For more specific information, refer to the Plant Life section of this inventory.

Soil maps for the units were compiled from existing maps, including the Soil Survey (1:24000 scale), and from maps based on the soil survey, TRPA Land Capability Maps (1:4800 scale and 1:24000 scale), and the Tahoe Land Guide (Foster and Hoffman 1981) (1:4800 scale). Information from these maps was transferred to the base map for each unit. Because of the limitations of the initial SCS survey, and because of the potential errors in transferring information from the different maps, the unit soil maps must be considered as approximations of existing soil conditions. Site specific verification would be required prior to any development.

SOIL DESCRIPTIONS AND INTERPRETATION

General Description

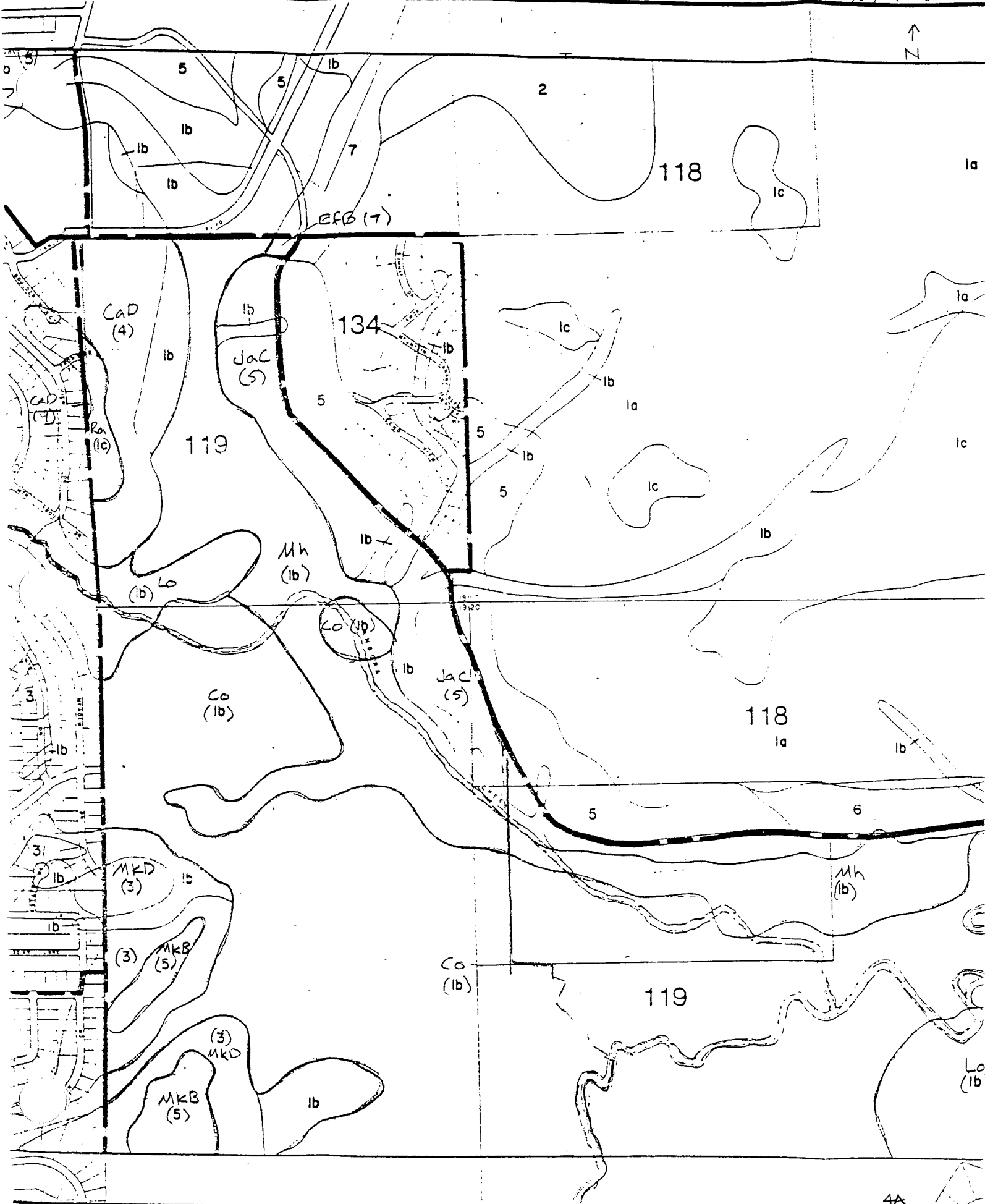
Most of the soils in the Tahoe Basin are of granitic or volcanic parent material. The soils are geologically young and poorly developed. Most soils are shallow, coarse textured, have low cohesion, and contain small amounts of organic material. These attributes account for the high erosion potential of over 75% of the soils in the Tahoe Basin (USDA Forest Service 1988).

The soil survey for the Tahoe Basin (USDA 1974) describes 22 soil series and 73 separate mapping units. This 1974 survey mapped four soil series and eight mapping units within Washoe Meadows State Park (Table 1). The descriptions that follow were taken directly from the soil survey. Additional information on the physical and chemical characteristics of each soil is in Appendix I (Representative Profiles) and in Appendix II (Soil Interpretation Records). For technical terms not defined within these appendices, refer to Soil Taxonomy (USDA Soil Conservation Service 1975) or another similar reference text.

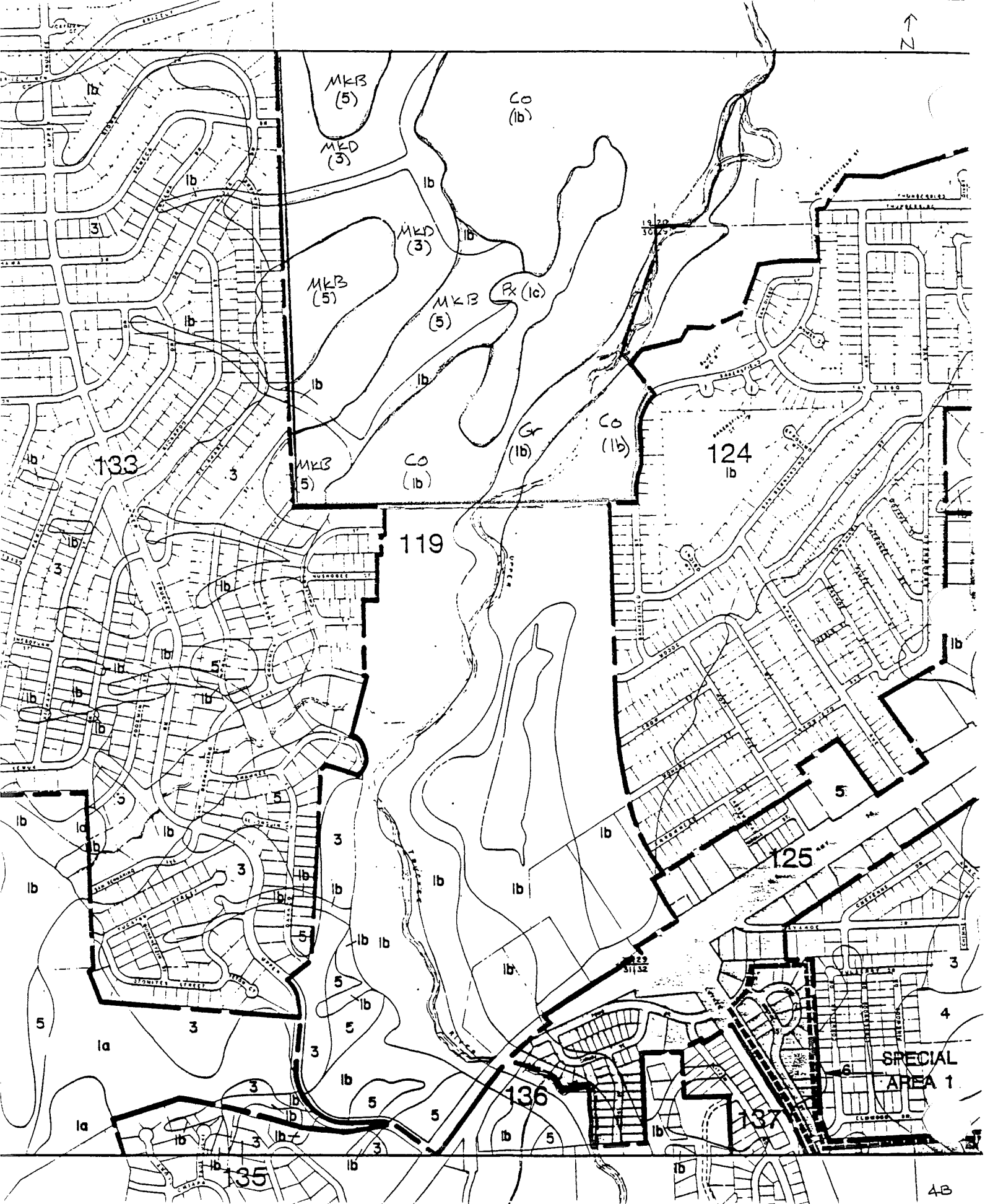
TABLE 1
Soils Mapped Within Washoe Meadows State Park

<u>Map Symbol</u>	<u>Series</u>	<u>Mapping Unit</u>	<u>Land Capability* (Bailey 1974)</u>	<u>Allowable Land Coverage*</u>
CaD	Cagwin	Cagwin-Rock outcrop complex, 5 to 15 percent slopes	4	20%
Co	Celio	Celio gravelly loamy coarse sand	1b	1%
EfB	Elmira	Elmira-Cefo loamy coarse sands, 0 to 5 percent slopes	7	30%
Gr		Gravelly alluvial land	1b	1%
JaC	Jabu	Jabu coarse sandy loam, 0 to 9 percent slopes	5	25%
Lo		Loamy alluvial land	1b	1%
Mh		Marsh	1b	1%
MkB	Meeks	Meeks gravelly loamy coarse sand, 0 to 5 percent slopes	5	25%
MkD	Meeks	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes	3	5%
Px		Pits and dumps	1c	1%
Ra		Rock Land	1c	1%

*See Constraints and Sensitivities section for an explanation of Land Capability and Allowable Land Coverage.



4A



Cagwin Series

The Cagwin series consists of gently rolling to very steep, somewhat excessively drained soils that are 20 to 40 inches deep over granitic material, or grus. These are soils of the mountainous uplands. Slopes range from 5 to 70 percent. Elevations are 6,500 to 9,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is about 42° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense to dense stand of conifers, mostly red fir, white fir, and western white pine and, in many places, a shrub understory of pinemat manzanita and huckleberry oak.

In a representative profile the surface layer is dark grayish-brown and grayish-brown, medium acid and strongly acid loamy coarse sand about 12 inches thick. The next layer is pale-brown, medium acid coarse sand about 14 inches thick. At a depth of 26 inches is the decomposed granitic parent material.

Permeability is rapid. The available water capacity is 1.5 to 2.5 inches.

In the Tahoe area, Cagwin soils are used for watershed, wildlife, recreation, and timber.

Cagwin-Rock outcrop complex, 5 to 15 percent slopes (CaD). -- This complex consists of rolling soils on foot slopes along the fringe of the granitic uplands. It is about 85 to 95 percent soil material and 5 to 15 percent granitic outcrop. The soil material is about 65 percent Cagwin soil; 5 percent Toem coarse sand; and about 30 percent a soil that is similar to the

Cagwin soil, but has a thick, dark-colored surface layer and is deeper than 40 inches over weathered granitic rock.

Along the contact with the glacial outwash deposits are scattered inclusions of Inville gravelly coarse sandy loam, Jabu coarse sandy loam, and Jabu coarse sandy loam, shallow variant.

Runoff is slow in undisturbed areas of the Cagwin soil and medium in disturbed areas. The erosion hazard is moderate.

Rock outcrop has very rapid runoff, but the erosion hazard is only slight.

Outside of the unit, this complex is used for timber production and urban development. The land capability class is 1a; allowable coverage is 1 percent.

Celio Series

The Celio series consists of poorly drained soils that are 40 to 60 inches deep over a very gravelly hardpan strongly cemented with silica. These soils formed in glacial outwash of Quaternary age. The parent material is mixed, but is dominantly of granitic origin. Slopes are 0 to 5 percent. Elevations are 6,200 to 6,400 feet. The average annual precipitation is 30 to 35 inches, the average annual air temperature is about 42⁰ F., and the frost-free season is 50 to 80 days. The vegetation is a dense stand of lodgepole pine and an understory of brush and perennial grasses.

In a representative profile the surface layer is brown, medium acid gravelly loamy coarse sand about 16 inches thick. The next layers are strong-brown and dusky-red, slightly acid gravelly loamy coarse sand and very gravelly coarse and that extend to a depth of 45 inches. The lower layer contains many, large, prominent, reddish-yellow and strong-brown mottles. Below a depth of 45 inches is a yellowish-red, slightly acid hardpan, strongly cemented with silica, that has many, medium, prominent, reddish-yellow and strong-brown mottles. Below the pan is loose, white, stratified coarse sand and gravel.

Permeability is rapid above the pan and slow in the pan. The water table fluctuates between depths of 24 and 60 inches in summer and between depths of 12 and 30 inches the rest of the year. The available water capacity is 1.5 to 2.5 inches, but the soil is continually recharged because of its drainage pattern and position on the landscape. Some areas are subject to flooding. The effective depth is 40 to 60 inches, depending on the depth to the hardpan.

In the Tahoe Basin, Celio soils are used primarily for homesites and recreation.

Celio gravelly loamy coarse sand (Co). -- This nearly level and gently sloping soil is on glacial outwash and in areas where scarps of outwash border creekbeds. It has the profile described as representative of the series.

About 6 percent of the total Tahoe Basin acreage of this soil is Meeks gravelly loamy coarse sand (found in areas adjacent to the Upper Truckee River); 4 percent is Marsh (found in depressional areas in the Lake Valley area where drainage is very poor and the soil material is organic); and

4 percent is Elmira loamy coarse sand, wet variant (found in old eroded areas near Meeks Creek that have been filled with recent, coarse-textured alluvium).

Runoff on this Celio soils is slow, and the erosion hazard is slight. The hazard of deposition of soil and other debris from surrounding areas is moderate.

The principal uses of this soil in the Tahoe region are recreation and housing. The land capability class is 1b; allowable land coverage is 1 percent.

Elmira Series

The Elmira series consists of nearly level to moderately steep, somewhat excessively drained soils that are underlain by sandy granitic alluvium or highly weathered till. These soils are on glacial outwash fans and moraines. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 30 percent. Elevations are 6,200 to 6,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is about 40^o F., and the frost-free season is 50 to 80 days. The typical vegetation is an open stand of sagebrush and coniferous forest and some perennial grasses.

In a representative profile the surface layer is grayish-brown and brown, medium acid gravelly loamy coarse sand about 7 inches thick. The next layers are pale-brown, medium acid and strongly acid gravelly loamy coarse sand and gravelly coarse sand that extend to a depth of 59 inches. The substratum is light-gray, medium acid very gravelly coarse sand.

Outside of the unit, Elmira soils are primarily used for homesites, range, and timber.

Elmira-Gefo loamy coarse sands, 0 to 5 percent slopes (EfB). -- This complex is on alluvial outwash fans along U.S. Highway 50 from Tahoe Valley to

Stateline. The Elmira soil on glacial outwash fans makes up 65 percent of the ^{total Tahoe basin acreage of this soil} unit. The Gefo soil on alluvial fans makes up 30 percent. About 5 percent is Elmira loamy coarse sand, wet variant, in long narrow swales.

Elmira and Gefo soils are 5 to 15 percent gravel, but otherwise have a profile similar to the one described as representative of the respective series.

The Gefo soil is somewhat excessively drained and has very rapid permeability. Even if it is bare of vegetation, runoff is very slow and the erosion hazard is slight. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 2.5 to 4 inches.

The Elmira soil is somewhat excessively drained and has rapid permeability. It also has very slow runoff and is subject to only a slight hazard of erosion if it is bare of vegetation. Roots can penetrate to a depth of more than 60 inches. The available water capacity is 3 to 4.5 inches.

In the Tahoe Basin, most areas of this soil are used for homesites. The land capability class is 7; allowable coverage is 30 percent.

Gravelly Alluvial Land

Gravelly alluvial land (Gr) consists of small areas of recent gravelly alluvium adjacent to stream channels and in meadows. Slopes are 0 to 5 percent. The vegetation typically consists of meadow grasses and sedges and scattered stands of lodgepole pine.

This land is more than 60 inches deep. It varies in color. It is stratified gravelly sandy loam, gravelly loam, and gravelly silt loam that generally becomes very gravelly with increasing depth. In places the surface is covered with 1 inch to 6 inches of peat.

Gravelly alluvial land is somewhat poorly drained to poorly drained. Permeability is moderate. Runoff is very slow, and the erosion hazard is slight. Some areas are flooded in spring during periods of runoff. A seasonal high water table is at a depth of 12 to 24 inches. The available water capacity is 4 to 6 inches.

Included in mapping are scattered areas of Loamy alluvial land and Marsh.

Outside of the unit, Gravelly alluvial land is used for grazing and urban development. The land capability is 1b; allowable land coverage is 1 percent.

Jabu Series

The Jabu series consists of nearly level to moderately steep, well drained to moderately well drained soils that are about 40 inches deep over a dense

fragipan. These soils are on glacial outwash terraces. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 20 percent. Elevations are 6,200 to 6,900 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 42⁰ F., and the frost-free season is 50 to 80 days. The vegetation is a coniferous forest and an understory of shrubs.

In a representative profile the surface layer is brown, medium acid coarse sandy loam about 6 inches thick. To a depth of about 45 inches, the subsoil is brown and strong-brown, medium acid and strongly acid coarse sandy loam and gravelly coarse sandy loam. Below this is a brittle, dense fragipan over highly weathered, compacted till.

Permeability is moderate in the subsoil and slow in the pan. In spring and early in summer, water moves laterally along the contact between the fragipan and the compacted till.

Outside of the unit, Jabu soils are used for homesites, range, and timber.

Jabu coarse sandy loam, 0 to 9 percent slopes (JaC). -- This soil is on glacial outwash terraces. It has a profile similar to the one described as representative of the series, but the surface layer is 8 to 20 inches thick and in some areas the fragipan is underlain by lake-laid sediments.

About 5 percent of the Tahoe Basin acreage of this soil is Jabu coarse sandy loam, shallow variant; about 5 percent is Elmira gravelly loamy coarse sand; about 2 percent is Emira-Gefo loamy coarse sands; and 10 percent is a soil that is similar to this Jabu soil, but does not have a fragipan.

This Jabu soil is well drained. Even in areas bare of vegetation, surface runoff is slow and the erosion hazard is only slight to moderate. Roots can penetrate to a depth of 40 to 60 inches or more. Available water capacity is 4 to 5.5 inches.

Outside of the unit, this soil is used mainly for urban development, with some small areas used for limited grazing and timber. The land capability class is 5; allowable coverage is 25 percent.

Loamy Alluvial Land

Loamy alluvial land (Lo) consists of small areas of recent alluvium adjacent to stream channels and in meadows. It is nearly level to gently sloping. The vegetation is typically sedges, meadow grasses, and scattered lodgepole pine.

The surface layer is dark grayish-brown to dark-brown, slightly acid to medium acid sandy loam to silt loam. In places it is covered with 1 inch to 6 inches of peat. Below this is stratified, mottled sandy loam to silty clay loam. The substratum, at a depth of more than 48 inches, is gravel, lake sediment, or loamy alluvium.

Loamy alluvium is somewhat poorly drained to poorly drained. Permeability and the available water capacity vary. Runoff is very slow, and the erosion hazard is slight. Flooding is a hazard in spring during periods of runoff. The seasonal high water table is at a depth of 12 to 24 inches.

Included in mapping are scattered areas of Gravelly alluvial land and Marsh.

Outside of the unit, Loamy alluvial land is used for grazing and urban development. The land capability class is 1b; allowable coverage is 1 percent.

Marsh

Marsh (Mh) is in the Upper Truckee Marsh and in very poorly drained and ponded meadows. It is mostly nearly level. The vegetation is typically reeds, sedges, and tules in the ponded areas and sedges, meadow grasses, and scattered thickets of willow and lodgepole pine in the very poorly drained areas.

Most of the acreage is under water for at least 10 months of the year. In the very poorly drained areas, the surface is covered with about 6 to 8 inches of reddish-brown peat. Below this is about 6 to 10 inches of black peat, which is underlain by black muck. The substratum, at a depth of 30 to 60 inches, is gleyed sand and gravel.

Permeability varies. Runoff is ponded, and the erosion hazard is slight.

Included in mapping are scattered areas of Elmira soils, wet variant, and Loamy alluvial land.

In the Tahoe Basin, Marsh is used for recreation, wildlife, and limited grazing. Some areas have been filled and used for homesites. The land capability class is 1b; allowable coverage is 1 percent.

Meeks Series

The Meeks series consists of level to very steep, somewhat excessively drained, stony soils that are 41 to 70 inches deep over a hardpan weakly cemented with silica. These soils are on glacial outwash of Tioga and Tahoe age and on mountainous glacial moraines. The parent material is mixed, but is dominantly of granitic origin. Slopes range from 0 to 60 percent. Elevations are 6,200 to 7,700 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 41^o F., and the frost-free season is 30 to 50 days. The vegetation is sparse coniferous woodland and an understory of brush and some perennial grass.

In a representative profile the surface layer is grayish-brown and brown, slightly acid very stony loamy coarse sand and gravelly loamy coarse sand about 11 inches thick. The next layers are pale-brown, slightly acid and medium acid gravelly loamy coarse sand and very gravelly loamy coarse sand about 50 inches thick. Below a depth of 61 inches is light-gray, strongly acid gravelly loamy coarse sand that is weakly cemented with silica and has a nearly continuous, very thin silica-cemented lamina on the surface.

Permeability is rapid as far down as the weakly cemented substratum. It is slow in the substratum.

In the Tahoe Basin, Meeks soils are used for timber, watershed, and homesites.

Meeks gravelly loamy coarse sand, 0 to 5 percent slopes (MkB). -- This soil is on glacial outwash. The surface layer is 14 to 19 inches thick; less than 1 percent of the surface area is covered with cobblestones, stones, and boulders; and the coarse fragments in the underlying horizons consist dominantly of gravel and cobblestones and a few stones and boulders. Otherwise, this soil has a profile similar to the one described as representative of the series.

About 6 percent of the total Tahoe Basin acreage of this soil is Gefo gravelly loamy coarse sand (most of which is southeast of the intersection of U.S. Highway 50 and California Highway 89); about 5 percent is Celio gravelly loamy coarse sand (found adjacent to the Upper Truckee River); and about 3 percent is Gravelly alluvial land (found near Meyers). Scattered throughout are small areas where 1 to 5 percent of the surface area of the Meeks soil is covered with stones.

Runoff is slow on this Meeks soil. The erosion hazard is slight. The available water capacity is 1.5 to 2.5 inches, depending on depth to the weakly silica cemented hardpan. Water is perched on the pan for a short period in spring during the period of snowmelt. The effective depth is 41 to 70 inches.

Outside of the unit, the principal use of this soil is for housing. The land capability class is 5; allowable coverage is 25 percent.

Meeks gravelly loamy coarse sand; 5 to 15 percent slopes (MkD). -- This soil is on scarps of dissected glacial outwash. The surface layer is about

15 inches thick, and less than 1 percent of the surface area is covered with cobblestones, stones, and boulders. Otherwise, this soil has a profile similar to the one described as representative of the series.

About 7 percent of the total Tahoe Basin acreage of this soil is Jabu sandy loam (found at the upper limit of the scarps west of the Upper Truckee road); 7 percent is Celio gravelly loamy coarse sand (found at the bottom of scarps on the east side of the Lake Valley); and about 5 percent is Meeks very stony loamy coarse sand.

Runoff is medium in the strongly sloping areas of this Meeks soil. Seeps occur where road cuts and other disturbance expose the downslope movement of water on the weakly silica cemented hardpan. The erosion hazard is ordinarily slight, but is moderate in disturbed, strongly sloping areas under construction. Available water capacity is 1.5 to 2.5 inches. The depth to the weakly silica cemented substratum is 41 to 68 inches.

Outside of the unit, the principal uses of this soil are timber and housing. The land capability class is 3; allowable coverage is 5 percent.

Pits and Dumps

Pits and dumps (Px) consists of sand and gravel pits, refuse dumps, and rock quarries. These areas are typically barren and vary in natural drainage, permeability, erosion hazard, runoff, and available water capacity. The land capability class is 1c; allowable coverage is 1 percent.

Rock Land

Rock land (Ra) is in areas of granitic, metamorphic, and volcanic rocks. Large areas at the higher elevations in the southwestern part of the Tahoe Basin are the result of glaciation. This land is undulating to very steep. Slopes are 5 to 75 percent. The vegetation consists of open stands of mountain shrubs and scattered conifers. In granitic areas, Rock land is associated with Cagwin, Graylock, and Toem soils and in metamorphic and volcanic areas, with Fugawee, Jorge, Tahoma, Umpa, and Waca soils.

Rock outcrop and stones cover 50 to 90 percent of the surface area. In the crevices is a thin mantle of soil material generally less than 10 inches deep. Drainage is excessive, runoff is rapid, and the erosion hazard is slight. The available water capacity is less than 1 inch.

Included in mapping are scattered areas of Cagwin, Fugawee, Graylock, Jorge, Tahoma, Umpa, and Waca soils, and Rock outcrop and Rubble land.

In the Tahoe Basin, Rock land is used for watershed and wildlife. The land capability class is 1c; allowable coverage is 1 percent.

Constraints and Sensitivities

The sensitivity of various soil types is described in the Soil Survey (USDA 1974), in the Soil Interpretations Record (Appendix II), and in Land Capability Classification of the Lake Tahoe Basin, California-Nevada, A Guide for Planning (Bailey 1974).

The Bailey report incorporated information on soils, hydrology, geomorphology, and vegetation into tolerance levels for disturbance. Bailey developed seven land capability classes based on the frequency and magnitude of potential hazards, including floods, landslides, high water tables, poorly drained soils, fragile flora and fauna, and easily erodible soils (USDA Forest Service 1988). A summary of the land capability classification system is attached as Appendix III. The Bailey report recommended limits on impervious coverage to allow adequate natural hydrologic function of the soil (Table 2). The Tahoe Regional Planning Agency (TRPA) adopted the recommended limits on land coverage and has restricted development on land within sensitive classes (Classes 1 through 3) and within stream environmental zones (SEZs) (TRPA 1988).

The land capability class and the allowable coverage for each soil type in the unit is shown in Table 1. For any site development purpose, the land capability class of each soil type should be considered as a constraint. Although TRPA allows some exceptions for linear public facilities and for specific recreation projects, lands in Classes 1 through 3 and in SEZs should not be considered for most potential development. In addition, TRPA has established a policy of encouraging the relocation of recreational facilities from sensitive lands to higher capability land (TRPA 1986).

The SCS Single Phase Interpretations Records, included in Appendix II, list specific constraints for each soil type. In general, constraints imposed by soil factors parallel those imposed by the Bailey land capability system. Soils classified in capability classes 1, 2, and 3 tend to face severe erosion hazards and have severe restrictions for recreation facilities and building site development.

The Soil Interpretations Records include an assessment of soil suitability for septic systems. However, new septic systems are not allowed within the Tahoe Basin (TRPA 1988).

RECOMMENDATIONS

The existing soil information is useful for planning and siting major land uses. It is not accurate enough to site or design individual projects. Site surveys by TRPA have shown significant variations from mapped soils (Erlich 1989). Land capability verifications would be needed prior to any development.

Additional information is needed on the incidence and control of soil erosion within park units. Existing sites of natural and human-caused erosion should be identified.

In the Tahoe Basin, land coverage is the basis for land development regulation, as well as a salable commodity. Existing coverage and land disturbance in each soil type should be carefully documented to ensure proper coverage credit.

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SOILS

Appendix I