A New Soil Order for Wet Soils

This proposal is the result of deliberations within the International Committee for Subaqueous and Aquic Soils (ICOMSAS). The committee members are Rob Fitzpatrick, Cornie van Huyssteen, David Lindbo, Jerimiah Parsley, Martin Rabenhorst, Matt Ricker, Peter Schad, Mark Stolt (chair), Jim Thompson, and Dan Wing. Curtis Monger served as the NRCS advisor, moderator, or arbitrator of ICOMSAS when he was the Standards and Taxonomy leader.

At the 2021 National Cooperative Soil Survey Conference a formal vote was taken during the Soil Taxonomy committee meeting to consider the proposal for addition into Soil Taxonomy. Of the 55 individuals that voted, 80% voted to approve the proposal toward inclusion into Soil Taxonomy.

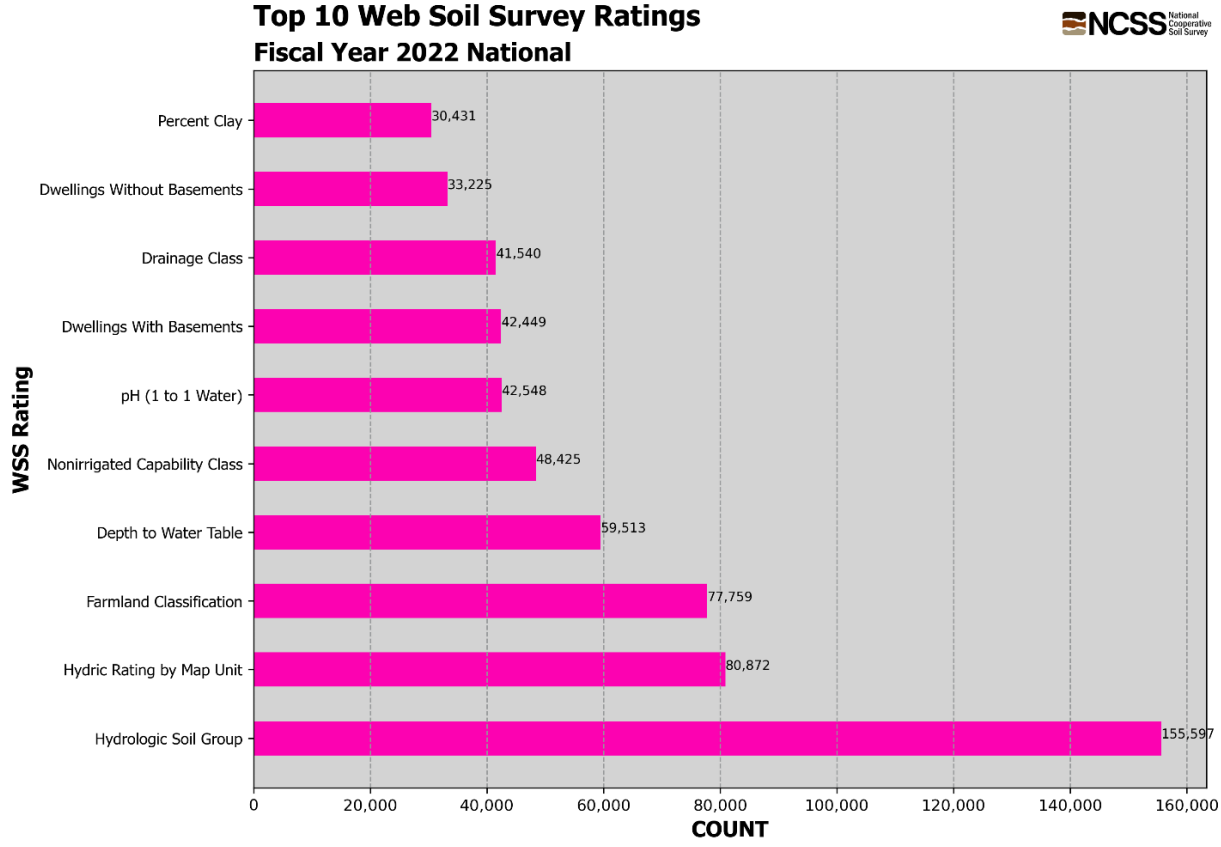
Wet soils serve as the foundation and structure of a range of unique and valued ecosystems. Creating a wet soil order explicitly recognizes the values and functions of these soils which serve as the core of all soil interpretations. This aim is clear in the title of the classification system: “Soil Taxonomy: A Basic System for Making and Interpreting Soil Surveys”. Identifying the wettest soils is one of the most important uses of a soil classification system. The National Soil Survey Handbook (USDA-NRCS, 2015) recognizes over 30 interpretations that are driven by the depth of the water table. Adopting a wet soil order would therefore emphasize the importance of soil interpretations at the highest level in Soil Taxonomy while also recognizing the most important driver of soil morphology (hydrology).

The importance of recognizing wet soils is evident in a recent post from the USDA-NRCS Soil and Plant Science Division news release:

The Kellogg Soil Survey Lab Releases a Suite of Analytical Soil Data from the EPA National Wetlands Condition Assessment

The Soil Science Division and the Kellogg Soil Survey Lab (KSSL), through a cooperative agreement with EPA, participated as a major partner in the 2016 National Wetland Condition Assessment (NWCA). The NWCA project sampled 1,000 wetland sites and soils throughout the conterminous US. This release completes a 2-year effort by KSSL staff that began with samples arriving during summer of 2016. The KSSL completed comprehensive analysis on samples from the 1,000 sites that included samples from every state on the lower 48. The soil samples represent more than 5,000 layers for which the KSSL determined 13 properties by a variety of analytical procedures. The NWCA is a periodic (5-year) assessment of the condition of the nation’s wetlands that involves an intensive evaluation of soil, vegetation, and water quality at representative sites in all wetland types within the USA. The resultant soil data will contribute significantly to the quality and quantity of wetland soil information needed for NRCS conservation activities and planning.

The importance of recognizing wet soils is also evident in the annual tally of requests for soils information from Web Soil Survey (see figure). Five of the top 10 requests for information, including hydrologic soil group (HSG), hydric soil rating, farmland classification, depth of water table, and drainage class, are dependent upon knowing the depth of the water table. In the current use of Aqu at the suborder level (e.g. Aquept) the user is left guessing where in the upper 50 cm of the soil the water table exists. As such, Soil Taxonomy cannot provide an adequate answer to any of the 5 most sought soil interpretations.



Numeric tally of the top 10 requests for information from the Web Soil Survey in fiscal year 2022.

The classification system that we are currently using was developed throughout the 1950's and established in 1960 as the 7th Approximation and was publish as Soil Taxonomy in 1975. A great deal has changed in the intervening 60 years. In 1960, environmental science as we know it did not really exist; hydric soils and wetland delineation were not part of our everyday language or soils activities; subaqueous soils and salt marshes were considered miscellaneous areas (even waste lands); and wet soils were considered to have little value. During this time period wetland soils were being drained for agricultural purposes at a rate of over 500,000 acres

per year (Office of Technology Assessment, 1984). At the same time, under the USDA Agriculture Conservation Program, farmers were receiving subsidies to drain these soils. Finally, in 1985 under the Swampbuster Provisions of the Farm Bill the USDA stopped supporting draining of wetland soils and develop programs instead to support conservation and restoration of these systems.

Guy Smith was asked why wetness was emphasized at the suborder level and not the order level in Soil Taxonomy. In his response he acknowledged that most other soil classification systems identified wet soils at the highest level ---"*In Soil Taxonomy we divided up the wet soils and we put them at the suborder level, not at the order level*," . . . ."*most other taxonomies have an all wet soils group."* "*the Europeans . . . want one order for all the wet soils."*

Guy Smith rationalized that wet soils should be at the suborder level because if the soils were drained they would behave much like their better drained counterparts on the landscape.

"*There was a zonality to the soils with aquic moisture regimes ...."*

"compared the yields on . . . . . the plots that were all Udolls and the plots that were all Aquolls (had been drained). . . . . they were identical."

"if one goes into the Southeast, in the region of Ultisols, one would have the same experience, that after drainage the naturally poorly drained soils will behave like the naturally well drained soils of that area."

It is clear in the Guy Smith interviews that he did not classify the wet soils out first because at the time of the development of Soil Taxonomy draining of wet soils was supported (encouraged) by the government under the same agency that he was working for. This suggests that if draining wasn't an option, Guy Smith would have placed the wet soils at the order level.

The World Reference Base of Soil Resources (WRB), the other international classification system, has two Reference Soil Groups (RSG) for wet soils: Gleysols and Stagnosols. Most country-based soil classifications also have wet soils at the order level. These soils are called Gleyosols (China, South Africa), Gleysolic (Canada), Hydrosols (Australia), Gleissolos (Brazil), Raw Gley and Surface-Water Gley (England and Wales), Gley for groundwater and Subhydrische for subaqueous (Germany), Hydrogenic (Poland), Hidrisols (Romania), or Stagnic (Japan) (Krasilnikov et al., 2009; Spaargaren, 2000; SCWG, 1998; ASC, 2016). Some of these classification systems also classify some wet soils at the suborder level. For example, the Canadian system has Hydric for the Humisols and Mesisols (SCWG, 1998) and the Australian system has Aquic for Podsols and Vertisols (ASC, 2016). The Chinese system uses Stagnic and Aqui, Japan uses Wet, Gleyic¸and Stagnogley, and South Africa uses Gleyic for there not as wet soils (Krasilnikov et al. 2009). In the Netherlands wet soils are identified at the suborder level as Hydropodzols, Hydroearths, and Hydrovagues (Krasilnikov et al. 2009).

A relative and obvious question is what constitutes a wet soil? In support of the Swampbuster Provisions soil scientists in the SCS were asked this question. This was clearly a

soil classification question, and the point at which the formation of the wet soil order was necessitated. Unfortunately, instead they developed a list of soil series that were considered "hydric soils". This list was published under the federal document "Hydric Soils of the United States" (Soil Survey Staff, 1987). The committee that developed this list eventually became the National Technical Committee for Hydric Soils (NTCHS) which now uses a set of morphologic indicators to identify hydric soils. Following this approach and the 1994 Federal Register definition of hydric soils, the ICOMSAS committee defined wet soils as soils where the water table is above, at, or near the soil surface for extended periods of time, such that strongly reducing conditions develop in the upper part of the soil. Conceptually, these soils would correspond to those that are poorly-drained or wetter as defined in the Soil Survey Manual and in general have morphologies similar to those used to identify hydric soils. Soils that meet this requirement would classify as Aquasols (pronounced Ack Wa Sols).

Aquasols would include subaqueous soils, peraquic soils, and those soils where water is removed so slowly that the soil is wet at shallow depths (<30 cm from the soil surface) for sufficient duration to become strongly biochemically reducing and to express this morphologically. Free water is at or near the surface long enough during the growing season that hydrophytic vegetation are predominant and most mesophytic crops cannot be grown, unless the soil is artificially drained. We have proposed eight suborders that key out in the following order: Wassaqs (subaqueous soils), Peraqs (water table at the mineral soil surface), Leptaqs (restrictive layer within 100 cm of the mineral soil surface), Vertaqs (shrink-swell clay soils), Humaqs (significant accumulation of organic soil material), Psammaqs (sandy soils), Argiaqs (have an argillic, kandic, or natric horizon; pronounced "Ar Jacks"), and Orthaqs (other wet soils). Each of the suborders have proposed great groups and subgroups.

Wassaqs are the subaqueous soils. These soils have water over their surface permanently, or in the cases of areas with high tidal fluctuations, for at least 21 hours of every day. In most cases these soils occur in estuaries, shallow lakes and ponds, or at the edges of deeper lakes and ponds. The maximum depth of the overlying water column that should be allowed for these areas to still be considered soil is debatable, but from a sampling and mapping perspective 2.5 to 5 meters is within reason. There are five great groups that key out in the sequence: Fluiwassaqs, Sulfiwassaqs, Psammowassaqs, Humiwassaqs, and Haplowassaqs.

Peraqs have water tables that stay at or near to the mineral soil surface all year long. These soils commonly occur in intertidal zones, fens, bogs, or where water discharge occurs year-round. The proposed great groups are Sulfoperaqs (have a sulfuric horizon within 50 cm of the mineral soil surface), Sulfiperaqs (have sulfidic material within 50 cm of the mineral soil surface), Humiperaqs, Psammoperaqs, Fluviperaqs, and Haploperaqs. In tidal marshes, Sulfiperaqs would be the most common soils. Humiperaqs have histic, mollic, umbric or melanic epipedons and we expect the mineral soils in fens and bogs to classify into this great group.

Fluviperaqs would occur on landscapes where buried surface horizons are common, such as on floodplains.

Leptaqs are wet soils with a root-restrictive layer within 100 cm of the mineral soil surface. Many of these are expected to have episaturation during parts of the year as the water table perches above a restrictive layer such as a fragipan, duripan, or lithic contact. The proposed great groups are Petroleptaqs (duripans, ortsteins, petrocalcic horizons), Fragileptaqs (fragipans), Plintholeptaqs (plinthite), Densileptaqs (densic contact), Litholeptaqs (lithic or paralithic contacts), and Haploleptaqs.

Vertaqs not only have wetness interpretation issues but also contain significant shrink-swell clays. The great groups include Natrivertaqs (natric horizon), Chromivertaqs (higher chroma), Calcivertaqs (a calcic horizon within 100 cm of the mineral soil surface), and Haplovertaqs.

Humaqs are other wet soils that have a significant accumulation of organic soil material at the soil mineral surface in the form of a mollic, umbric, melanic, or histic epipedon making these soils important for carbon accounting. These soils, when drained, are important agricultural soils. The proposed great groups are Mollihumaqs (mollic epipedons), Psammohumaqs (sandy without argillic horizons), Argihumaqs (have an argillic, natric or kandic horizon), Fluvihumaqs (depositional soils), and Haplohumaqs.

Psammaqs have sandy textures throughout the control section. The proposed great groups are Spodopsammaqs (spodic horizon), Calcipsammaqs (calcic horizon), Fluvipsammaqs (depositional environments), Quartzipsammaqs (dominated by minerals resistant to weathering), and Haplopsammaqs.

Argiaqs have an argillic, kandic, or natric horizon. The great groups include Albargiaqs (have an abrupt textural change), Natriargiaqs (natric horizon), Kandiargiaqs (kandic horizon with less than a 20% decrease in clay from clay maximum), Paleargiaqs (argillic horizon with less than a 20% decrease in clay from clay maximum), Kanhapargiaqs (kandic horizon), and Haplargiaqs. The Albargiaqs are likely to have episaturation during some time of the year.

The last suborder is the Orthaqs. At the great group level there are Spodorthaqs (spodic horizon), Andorthaqs (andic soil properties), Halorthaqs (salic horizon or a high ESP), Humorthaqs (combined surface horizons at least 15 cm thick and that meet all the criteria for histic, melanic, mollic, or umbric epipedons except thickness), Fluvorthaqs (depositional environments), and Haplorthaqs.

KEYS TO ORDERS

A. Artesols (proposed)

B. Gelisols

C. Histosols

D. Other soils that have, in one or more horizons within 30 cm of the soil mineral surface, strongly reducing conditions in normal years (unless artificially drained) as indicated by one or more of the following:

   1. A gray/depleted matrix (value 4 or more and chroma 2 or less, due to wetness) that occurs within 30 cm of the soil surface; or
   2. A histic epipedon; or
   3. A gray/depleted matrix (value 4 or more and chroma 2 or less, due to wetness) with an upper depth greater than 30 cm, where all overlying horizons have either a value of 3 or less, and chroma less than 2; a value 2.5 or less and a chroma 2 or less; or a hue of 2.5Y or yellower, a value 3 or less, and chroma 2 or less; or
   4. Sulfidic materials within 30 cm of the soil surface; or
   5. Inundation with 2 cm or more of water for at least 21 hours per day, for every day of the year; or
   6. Have peraquic conditions.

Aquasols

KEY TO SUBORDERS

DA Aquasols that have a field observable water table 2 cm or more thick above the mineral soil surface for more than 21 hours of every day in all years.

Wassaqs

DB Aquasols that have a water table within 25 cm of the mineral soil surface for every day in all years.

Peraqs

DC Aquasols that have a contact such as fragipan, duripan, densic, paralithic, or lithic contact within 100 cm of the mineral soil surface.

Leptaqs

DD Aquasols that have:
1. A layer 25 cm or more thick, within 100 cm of the mineral soil surface, that has *either* slickensides *or* wedge-shaped peds that have their long axes tilted 10 to 60 degrees from the horizontal; *and*
2. A weighted average of 30 percent or more clay in the fine-earth fraction either between the mineral soil surface and a depth of 18 cm or in an Ap horizon, whichever is thicker, *and* 30 percent or more clay in the fine-earth fraction of all horizons between a depth of 18 and 50 cm; *and*
3. Cracks that open and close periodically.

Vertaqs

DE Aquasols that have a histic, melanic, umbric or mollic epipedon.

Humaqs

DF Aquasols that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser in all layers (sandy loam lamellae are permitted) within the particle-size control section, and don't have an argillic horizon (unless buried).

Psammaqs

DG Aquasols that have an argillic, natric or kandic horizon starting within 150 cm of the mineral soil surface.

Argiaqs

DH Other Aquasols.

Orthaqs

KEY TO GREAT GROUPS

DA **WASSAQ GREAT GROUPS**

DAA Wassaqs that have fluid material that extends at least 50 cm from the mineral soil surface.
Fluiwassaqs

DAB Other Wassaqs that have sulfidic material in the upper 50 cm from the mineral soil surface.
Sulfiwassaqs

DAC Other Wassaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers in the upper 100 cm.
Psammowassaqs

DAD Other Wassaqs that have a histic epipedon or meet the color, thickness, and carbon content of a mollic epipedon.
Humiwassaqs

DAE Other Wassaqs.
Haplowassaqs

DB **PERAQ GREAT GROUPS**

DBA Peraqs that have a sulfuric horizon within 50 cm of the mineral soil surface (identified by pH below 4.0).

Sulfoperaqs

DBB Other Peraqs that have hyper sulfidic material within 50 cm of the mineral soil surface (unoxidized, with pyrite, pH initially above 4.0, but drops below 4.0 after incubation).

Sulfiperaqs

DBC Other Peraqs that have a histic epipedon or meets the color, carbon, and thickness requirement of a mollic epipedon.

Humiperaqs

DBD Other Peraqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers (sandy loam lamellae are permitted) within the particle-size control section, and don't have an argillic horizon (unless buried).

Psammoperaqs

DBE Other Peraqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluviperaqs

DBF Other Peraqs.

Haploperaqs

DC **LEPTAQ GREAT GROUPS**

DCA Leptaqs that have a cemented layer within 100 cm of the mineral soil surface.

Petroleptaqs

DCB Other Leptaqs that have a fragipan within 100 cm of the mineral soil surface.

Fragileptaqs

DCC Other Leptaqs that have one or more horizons within 100 cm of the mineral soil surface in which plinthite either forms a continuous layer or constitutes one-half or more of the volume.

Plintholeptaqs

DCD Other Leptaqs that have a densic contact within 100 cm of the mineral soil surface.

Densileptaqs

DCE Other Leptaqs that have a lithic contact within 100 cm of the mineral soil surface.

Litholeptaqs

DCF Other Leptaqs.

Haploleptaqs

DD **VERTAQ GREAT GROUPS**

DDA Vertaqs that have a natric horizon within 100 cm of the surface

Natrivertaqs

DDB Other Vertaqs that have, in one or more horizons within 30 cm of the mineral soil surface, one or both of the following in more than half of each pedon:

1. A color value, moist, of 4 or more; or
2. A color value, dry, of 6 or more.

Chromivertaqs

DDC Other Vertaqs that have a calcic horizon within 100 cm of the mineral soil surface.

Calcivertaqs

DDD Other Vertaqs.

Haplovertaqs

DE **HUMAQ GREAT GROUPS**

DEA Humaqs that have a mollic epipedon.

Mollihumaqs

DEB Other Humaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers (sandy loam lamellae <15 cm combined thickness are permitted) within the particle-size control section.

Psammohumaqs

DEC Other Humaqs that have an argillic, natric or kandic horizon.

Argihumaqs

DED Other Humaqs that have:
1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no densic, lithic, or paralithic contact within that depth; or
b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 and 100 cm below the mineral soil surface.

Fluvihumaqs

DEE Other Humaqs.

Haplohumaqs

DF PSAMMAQ GREAT GROUPS

DFA Psammaqs that do not have a plaggen epipedon or an argillic or kandic horizon above a spodic horizon, *and* have *one or more* of the following:
1. A spodic horizon, an albic horizon in 50 percent or more of each pedon, and a cryic or gelic soil temperature regime; *or*
2. An Ap horizon containing 85 percent or more spodic material; *or*
3. A spodic horizon with *all* of the following characteristics:
    a. *One or more* of the following:
        (1) A thickness of 10 cm or more; *or*
        (2) An overlying Ap horizon; *or*
        (3) Cementation in 50 percent or more of each pedon; *or*
        (4) A texture class that is finer than coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand in the fine-earth fraction *and* a frigid temperature regime in the soil; *or*
        (5) A cryic or gelic temperature regime in the soil; *and*
    b. An upper boundary within the following depths from the mineral soil surface: *either*
        (1) Less than 50 cm; *or*
        (2) Less than 200 cm if the soil has a texture class of coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand, in the fine-earth fraction, in some horizon between the mineral soil surface and the spodic horizon; *and*
    c. A lower boundary as follows:
        (1) *Either* at a depth of 25 cm or more below the mineral soil surface or at the top of a duripan or fragipan or at a densic, lithic, paralithic, or petroferric contact, whichever is shallowest; *or*
        (2) At any depth,
            (a) If the spodic horizon has a texture class that is finer than coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand in the fine earth fraction *and* the soil has a frigid temperature regime; *or*
            (b) If the soil has a cryic or gelic temperature regime; *and*
    d. *Either*:
        (1) A directly overlying albic horizon in 50 percent or more of each pedon; *or*
        (2) No andic soil properties in 60 percent or more of the thickness *either*:
            (a) Within 60 cm either of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no densic, lithic, or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*
            (b) Between either the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a densic, lithic, or paralithic contact, a duripan, or a petrocalcic horizon.

Spodopsammaqs

DFB Other Psammaqs that have:

1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no densic, lithic, or paralithic contact within that depth; or
b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic, or paralithic contact, whichever is shallower.

Fluvipsammaqs

DFC Other Psammaqs have, in the 0.02 to 2.0 mm fraction within the particle-size control section, a total of more than 90 percent (by weighted average) resistant minerals.

Quartzipsammaqs

DFD Other Psammaqs.

Haplopsammaqs

DG **ARGIAQ GREAT GROUPS**

DGA Argiaqs that have an abrupt textural change between the ochric epipedon or albic horizon and the argillic or kandic horizon *and* have a saturated hydraulic conductivity of 0.4 cm/hr (1.0 μm/sec) or slower (moderately low or lower Ksat class) in the argillic or kandic horizon..

Albargiaqs

DGB Other Argiaqs that have a natric horizon within 150 cm of the mineral soil surface.

Natrargiaqs

DGC Other Argiaqs that have an argillic horizon with less than a 20% decrease in clay from clay maximum within 150 cm of the mineral soil surface.

Paleargiaqs

DGD Other Argiaqs that have a kandic horizon with more than a 20% decrease in clay from clay maximum within 150 cm of the mineral soil surface.

Kanhaplargiaqs

DGE Other Argiaqs.

Haplargiaqs

DH **ORTHAQ GREAT GROUPS**

DHA Orthaqs that do not have a plaggen epipedon or an argillic or kandic horizon above a spodic horizon, *and* have *one or more* of the following:

1. A spodic horizon, an albic horizon in 50 percent or more of each pedon, and a cryic or gelic soil temperature regime; *or*
2. An Ap horizon containing 85 percent or more spodic material; *or*
3. A spodic horizon with *all* of the following characteristics:
    a. *One or more* of the following:
        (1) A thickness of 10 cm or more; *or*
        (2) An overlying Ap horizon; *or*
        (3) Cementation in 50 percent or more of each pedon; *or*
        (4) A texture class that is finer than coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand in the fine-earth fraction *and* a frigid temperature regime in the soil; *or*
        (5) A cryic or gelic temperature regime in the soil; *and*
    b. An upper boundary within the following depths from the mineral soil surface: *either*
        (1) Less than 50 cm; *or*
        (2) Less than 200 cm if the soil has a texture class of coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand, in the fine-earth fraction, in some horizon between the mineral soil surface and the spodic horizon; *and*
    c. A lower boundary as follows:
        (1) *Either* at a depth of 25 cm or more below the mineral soil surface or at the top of a duripan or fragipan or at a densic, lithic, paralithic, or petroferric contact, whichever is shallowest; *or*
        (2) At any depth,
            (a) If the spodic horizon has a texture class that is finer than coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand in the fine earth fraction *and* the soil has a frigid temperature regime; *or*
            (b) If the soil has a cryic or gelic temperature regime; *and*
    d. *Either*:
        (1) A directly overlying albic horizon in 50 percent or more of each pedon; *or*
        (2) No andic soil properties in 60 percent or more of the thickness *either*:
            (a) Within 60 cm either of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no densic, lithic, or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*
            (b) Between either the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a densic, lithic, or paralithic contact, a duripan, or a petrocalcic horizon.

DHB Other Orthaqs that have andic soil properties in 60 percent or more of the thickness within 60 cm either of the mineral soil surface or of the top of an organic layer with andic soil properties.

Andorthaqs

DHC Other Orthaqs that have:
1. A salic horizon; or
2. In one or more horizons with a total thickness of 25 cm or more within 50 cm of the mineral soil surface, an exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio [SAR] of 13 or more) and a decrease in ESP (or SAR) values with increasing depth below 50 cm.

Halorthaqs

DHD Other Orthaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for histic, melanic, mollic, or umbric epipedon.

Humorthaqs

DHE Other Orthaqs that have:
1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no densic, lithic, or paralithic contact within that depth; or
b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic, or paralithic contact, whichever is shallower.

Fluvorthaqs

DHF Other Orthaqs.

Haplorthaqs

KEYS TO SUBGROUPS

DA WASSAQS

DAA FLUIWASSAQS SUBGROUPS

DAAA Fluiwassaqs that have sulfidic material within 50 cm of the mineral soil surface and fluid material that extends to at least 100 cm from the mineral soil surface.

Sulfidic Grossic Fluiwassaqs

DAAB Other Fluiwassaqs that have sulfidic material within 100 cm of the mineral soil surface and fluid material that extends to at least 100 cm from the mineral soil surface.

Sulfic Grossic Fluiwassaqs

DAAC Other Fluiwassaqs that have fluid material that extends to at least 100 cm from the mineral soil surface.

Grossic Fluiwassaqs

DAAD Other Fluiwassaqs that have sulfidic material within 50 cm of the mineral soil surface.

Sulfidic Fluiwassaqs

DAAE Other Fluiwassaqs that have sulfidic material within 100 cm of the mineral soil surface.

Sulfic Fluiwassaqs

DAAF Other Fluiwassaqs that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Fluiwassaqs

DAAG Other Fluiwassaqs that have a buried mollic or umbric horizon, or layer of organic soil material, 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-humic Fluiwassaqs

DAAH Other Fluiwassaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Fluiwassaqs

DAAI Other Fluiwassaqs.

Typic Fluiwassaqs

DAB SULFIWASSAQS SUBGROUPS

DABA Sulfiwassaqs that have greater than or equal to 35 percent rock fragments in the upper 25 cm

Piedric Sulfiwassaqs

DABB Other Sulffiwassaqs that have greater than or equal to 35 percent shell fragments in the upper 25 cm.

Shellic Sulfiwassaqs

DABC Other Sulfiwassaqs that have a sandy texture size in the upper 25 cm

Psammic Sulfiwassaqs

DABD Other Sulfiwassaqs that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Sulfiwassaqs

DABE Other Sulfiwassaqs that have a buried mollic or umbric horizon, or layer of organic soil material, 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-humic Sulfiwassaqs

DABF Other Sulfiwassaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Sulfiwassaqs

DABG Other Sulfiwassaqs.

Typic Sulfiwassaqs

DAC PSAMMOWASSAQ SUBGROUPS

DACA Psammowassaqs that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Psammowassaqs

DACB Other Psammowassaqs that have sulfidic materials within 100 cm of the mineral soil surface.

Sulfic Psammowassaqs

DACC Other Psammowassaqs that have a buried mollic or umbric horizon, or layer of organic soil material, 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-humic Psammowassaqs

DACD Other Psammowassaqs that have chroma of 3 or more in 40 percent or more of the matrix of one or more horizons between a depth of 15 and 100 cm from the soil surface.

Aeric Psammowassaqs

DACE Other Psammowassaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Psammowassaqs

DACF Other Psammowassaqs.

Typic Psammowassaqs

HUMIWASSAQ SUBGROUPS

DADA Humiwassaqs that have sulfuric horizon within 50 cm of the mineral soil surface.

Sulfo Humiwassaqs

DADB Other Humiwassaqs that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Humiwassaqs

DADC Other Humiwassaqs that have sulfidic material within 100 cm of the mineral soil surface.

Sulfic Humiwassaqs

DADD Other Humiwassaqs that have greater than or equal to 35 percent rock fragments in the upper 25 cm.

Piedric Humiwassaqs

DADE Other Humiwassaqs that have greater than or equal to 35 percent shell fragments in the upper 25 cm.

Shellic Humiwassaqs

DADF Other Humiwassaqs that have a sandy texture size in the upper 25 cm.

Psammic Humiwassaqs

DADG Other Humiwassaqs that have a buried mollic or umbric horizon, or layer of organic soil material, 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-humic Humiwassaqs

DACD Other Humiwassaqs that have chroma of 3 or more in 40 percent or more of the matrix of one or more horizons between a depth of 15 and 100 cm from the soil surface.

Aeric Humiwassaqs

DADH Other Humiwassaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Humiwassaqs

DADI Other Humiwassaqs.

Typic Humiwassaqs

DAE HAPLOWASSAQ SUBGROUPS

DAEA Haplowassaqs that have a sulfuric horizon within 50 cm of the mineral soil surface.

Sulfo Haplowassaqs

DAEB Other Haplowassaqs that have greater than or equal to 35 percent rock fragments in the upper 25 cm.

Piedric Haplowassaqs

DAEC Other Haplowassaqs that have greater than or equal to 35 percent shell fragments in the upper 25 cm.

Shellic Haplowassaqs

DAED Other Haplowassaqs that have a sandy texture size in the upper 25 cm.

Psammic Haplowassaqs

DAEE Other Haplowassaqs that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Haplowassaqs

DAEF Other Haplowassaqs that have sulfidic material within 100 cm of the mineral soil surface.

Sulfic Haplowassaqs

DAEG Other Haplowassaqs that have a buried mollic or umbric horizon, or layer of organic soil material, 20 cm or more thick, within 200 cm of the mineral soil surface.

Thapto-humic Haplowassaqs

DAEH Other Haplowassaqs that have chroma of 3 or more in 40 percent or more of the matrix of one or more horizons between a depth of 15 and 100 cm from the soil surface.

Aeric Haplowassaqs

DAEI Other Haplowassaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Haplowassaqs

DAEJ Other Haplowassaqs.

Typic Haplowassaqs

DBA SULFOPERAQ SUBGROUPS

DBAA Sulfoperaqs with histic epipedon or meet the color, thickness, and carbon content of a mollic epipedon.

Humic Sulfoperaqs

DBAB Other Sulfoperaqs

Typic Sulfoperaqs

DBB SULFIPERAQ SUBGROUPS

DBBA Sulfiperaqs that have at least 30 cm of fluid, moderately fluid, or very fluid soil material within 50 cm of the mineral soil surface.

Fluic Sulfiperaqs

DBBB Other Sulfiperaqs that have a histic epipedon.

Histic Sulfiperaqs

DBBC Other Sulfiperaqs that have a mollic epipedon greater than or equal to 60 cm thick.

Cumulic Sulfiperaqs

DBBD Other Sulfiperaqs that have a mollic epipedon.

Humic Sulfiperaqs

DBBE Other Sulfiperaqs that have a buried layer that meets the criteria for a histic or mollic, epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Sulfiperaqs

DBBF Other Sulfiperaqs that have less than 35 percent coarse fragments and a texture of loamy fine sand or coarser in all layers within the particle-size control section.

Psammentic Sulfiperaqs

DBBG Other Sulfiperaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Sulfiperaqs

DBBH Other Sulfiperaqs.

Typic Sulfiperaqs

DBC HUMIPERAQ SUBGROUPS

DBCA Humiperaqs that have at least 30 cm of fluid, moderately fluid, or very fluid soil material within 50 cm of the mineral soil surface.

Fluic Humiperaqs

DBCB Humiperaqs that have a histic epipedon.

Histic Humiperaq
s

DBCC Other Humiperaqs that have an umbric or mollic epipedon greater than or equal to 60 cm thick.

Cumulic Humiperaqs

DBCE Other Humiperaqs with sandy textures throughout the upper 100 cm.

Psammentic Humiperaqs

DBDF Other Humiperaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluvic Humiperaqs

DBCG Other Humiperaqs that have a lithic contact within 100 cm of the mineral soil surface.

Lithic Humiperaqs

DBCH Other Humiperaqs.

Typic Humiperaqs

DBD PSAMMOPERAQ SUBGROUPS

DBDA Psammoperaqs that have a buried layer that meets criteria for a histic or mollic, epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Psammoperaqs

DBDB Other Psammoperaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.8 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluvic Psammoperaqs

DBDC Other Psammoperaqs.

Typic Psammoperaqs

DBE FLUVIPERAQ SUBGROUPS

DBEA Fluviperaqs that have a buried layer that meets the criteria for a histic or mollic, epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Fluviperaqs

DBEB Other Fluviperaqs that have a lithic contact within 100 cm of the mineral soil surface.

Lithic Fluviperaqs

DBEC Other Fluviperaqs.

Typic Fluviperaqs

DBF HAPLOPERAQ SUBGROUPS

DBFA Haploperaqs that have at least 30 cm of fluid, moderately fluid, or very fluid soil material within 50 cm of the mineral soil surface.

Fluic Haploperaqs

DBFB Other Haploperaqs that have a lithic within 100 cm of the mineral soil surface.

Lithic Haploperaqs

DBFC Other Haploperaqs

Typic Haploperaqs

DC LEPTAQS

DCA Petroleptaqs

DCAA Petroleptaqs that have ortstein within 100 cm of the mineral soil and a histic, mollic, umbric, or melanic epipedon.

Ortstic Humic Petroleptaqs

DCAB Other Petroleptaqs that have ortstein within 100 cm of the mineral soil surface.

Ortstic Petroleptaqs

DCAC Other Petroleptaqs that have a histic, mollic, umbric, or melanic epipedon.

Humic Petroleptaqs

DCAD Other Petroleptaqs that have a duripan or similar silica-cemented layer within 100 cm of the mineral soil surface.

Duric Petroleptaqs

DCAE Other Petroleptaqs that have a lithic contact below the cemented layer, but within 100 cm of the mineral soil surface.

Lithic Petroleptaqs

DCAF Other Petroleptaqs.

Typic Petroleptaqs

DCB Fragileptaqs

DCBA Fragileptaqs that have a histic, mollic, umbric, or melanic epipedon.

Humic Fragileptaqs

DCBB Other Fragileptaqs that have an argillic horizon starting in or above the fragipan with at least one subhorizon having a base saturation greater than or equal to 35%.

Alfic Fragileptaqs

DCBC Other Fragileptaqs that have an argillic horizon starting in or above the fragipan.

Ultic Fragileptaqs

DCBD Other Fragileptaqs that have a lithic contact within 100 cm of the mineral soil surface.

Lithic Fragileptaqs

DCBE Other Fragileptaqs.

Typic Fragileptaqs

DCC Plintholeptaqs

DCCA Plintholeptaqs that have a histic, mollic, umbric, or melanic epipedon.

Humic Plintholeptaqs

DCCB Other Plintholeptaqs that have a lithic contact within 100 cm of the mineral soil surface.

Lithic Plintholeptaqs

DCCC Other Plintholeptaqs.

Typic Plintholeptaqs

DCD Densileptaqs

DCDA Densileptaqs that have a histic, mollic, umbric, or melanic epipedon.

Humic Densileptaqs

DCDB Other Densileptaqs that have a spodic horizon above the densic contact.

Spodic Densileptaqs

DCDC Other Densileptaqs that have a lithic contact within 100 cm of the mineral soil surface.

Lithic Densileptaqs

DCDD Other Densileptaqs.

Typic Densileptaqs

DCE Litholeptaqs

DCEA Litholeptaqs that have a histic, mollic, umbric, or melanic epipedon.

Humic Litholeptaqs

DCEB Other Litholeptaqs that have an argillic horizon above the lithic contact.

Argic Litholeptaqs

DCEC Other Litholeptaqs that have a spodic horizon above the lithic contact.

Spodic Litholeptaqs

DCED Other Litholeptaqs that have a have a texture class of loamy fine sand or coarser in all layers within the particle-size control section.

Psammentic Litholeptaqs

DCEE Other Litholeptaqs.

Typic Litholeptaqs

DCF Haploleptaqs

DCFA Haploleptaqs that have a texture class of loamy fine sand or coarser in all layers within the particle size control section.

Psammentic Haploleptaqs

DCFB Other Haploleptaqs.

Typic Haploleptaqs

DD VERTAQS

DDA Natrivertaqs

DDAA Natrivertaqs that have a salic horizon within 200 cm of the surface**.**

Salic Natrivertaqs

DDAB Other Natrivertaqs that have a gypsic horizon within 200 cm of the surface.

Gypsic Natrivertaqs

DDAC Other Natrivertaqs that have a calcic horizon within 200 cm of the surface.

Calcic Natrivertaqs

DDAD Other Natrivertaqs that have a Mollic Epipedon.

Mollic Natrivertaqs

DDAE Other Natrivertaqs.

Typic Natrivertaqs

DDB Calcivertaqs

DDBA Calcivertaqs that have a salic horizon within 200 cm of the surface**.**

Salic Calcivertaqs

DDBB Other Calcivertaqs that have a Mollic epipedon.

Mollic Calcivertaqs

DDBD Other Calcivertaqs**.**

Typic Calcivertaqs

DDC Chromivertaqs

DDCA Chromivertaqs that have a lithic contact within 200 cm of the surface**.**

Lithic Chromivertaqs

DDCB Other Chromivertaqs that have a gypsic horizon within 200 cm of the surface.

Gypsic Chromivertaqs

DDCC Other Chromivertaqs that have a calcic horizon within 200 cm of the surface.

Calcic Chromivertaqs

DDCD Other Chromivertaqs that have an argillic horizon within 200 cm of the surface.

Argic Chromivertaqs

DDCE Other Chromivertaqs.

Typic Chromivertaqs

DDD Haplovertaqs

DDDA Other Haplovertaqs that have a lithic contact within 200 cm of the surface.

Lithic Haplovertaqs

DDDB Other Haplovertaqs that have a duripan within 200 cm of the surface.

Duric Haplovertaqs

DDDC Haplovertaqs that have a gypsic horizon within 200 cm of the surface.

Gypsic Haplovertaqs

DDDD Other Haplovertaqs that have a sodic horizon within 200 cm of the surface.

Sodic Haplovertaqs

DDDE Other Haplovertaqs that have a calcic horizon within 200 cm of the surface.

Calcic Haplovertaqs

DDDF Other Haplovertaqs that have a mollic epipedon.

Mollic Haplovertaqs

DDDG Other Haplovertaqs that have an argillic horizon within 200 cm of the surface.

Argic Haplovertaqs

DDDH Other Haplovertaqs.

Typic Haplovertaqs

DE HUMAQS

DEA Mollihumaqs

DEAA Mollihumaqs that have a histic epipedon.

Histic Mollihumaqs

DEAB Other Mollihumaqs that have an argillic horizon and a mollic epipedon greater than or equal to 60 cm thick.

Cumulic Argic Mollihumaqs

DEAC Other Mollihumaqs that have a mollic epipedon greater than or equal to 60 cm thick.

Cumulic Mollihumaqs

DEAD Other Mollihumaqs that have and argillic horizon and slickensides or wedge-shaped structure in a layer 15 cm or more thick that has an upper boundary within 125 cm of the mineral soil surface; or linear extensibility of 6.0 cm or more between the mineral soil surface and 100 cm.

Vertic Argic Mollihumaqs

DEAE Other Mollihumaqs that have slickensides or wedge-shaped structure in a layer 15 cm or more thick that has an upper boundary within 125 cm of the mineral soil surface; or linear extensibility of 6.0 cm or more between the mineral soil surface and 100.

Vertic Mollihumaqs

DEAF Other Mollihumaqs that have a calcic horizon within 200 cm of the mineral soil surface.

Calcic Mollihumaqs

DEAG Other Mollihumaqs that have an abrupt textural change between the eluvial horizon and the upper boundary of the argillic horizon.

Abruptic Mollihumaqs

DEAH Other Mollihumaqs that have an argillic horizon and a texture in at least the upper 100 cm of the mineral soil of loamy fine sand or coarser.

Grossarenic Mollihumaqs

DEAI Other Mollihumaqs that have an argillic horizon and at least the upper 50 cm of the mineral soil is loamy fine sand or coarser.

Arenic Mollihumaqs

DEAJ Other Mollihumaqs that have vertic properties and a natric horizon.

Vertic Natric Mollihumaqs

DEAK Other Mollihumaqs that have a natric horizon.

Natric Mollihumaqs

DEAL Other Mollihumaqs that have an argillic horizon.

Argic Mollihumaqs

DEAM Other Mollihumaqs that have less than 35 percent (by volume) rock fragments and a texture class of loamy fine sand or coarser in all layers (sandy loam lamellae are permitted <15 cm think) within the particle-size control section.

Psammentic Mollihumaqs

DEAN Other Mollihumaqs that have a buried layer that meets criteria for a histic, umbric, or mollic epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Mollihumaqs

DEAO Other Mollihumaqs that have at a depth of 125 cm below the mineral soil surface, and an organic-carbon content (Holocene age) of 0.6 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Mollihumaqs

DEAP Other Mollihumaqs.

Typic Mollihumaqs

DEB Psammohumaqs

DEBA Psammohumaqs that have a histic epipedon and a spodic horizon.

Histic Spodic Psammohumaqs

DEBB Other Psammohumaqs that have a histic epipedon.

Histic Psammohumaqs

DEBC Other Psammohumaqs that have a spodic horizon and an umbric epipedon greater than or equal to 60 cm thick.

Cumulic Spodic Psammohumaq
s

DEBD Other Psammohumaqs that have an umbric epipedon greater than or equal to 60 cm thick.

Cumulic Psammohumaqs

DEBE Other Psammohumaqs that have <0.1% extractable Fe in the spodic horizon or more than 3 times extractable Al than Fe.

Alumic Spodic Psammohumaqs

DEBF Other Psammohumaqs that have spodic horizon.

Spodic Psammohumaqs

DEBG Other Psammohumaqs that have a buried layer that meets the criteria for a histic, umbric, or mollic epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Psammohumaqs

DEBH Other Psammohumaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Psammohumaqs

DEBI Other Psammohumaqs.

Typic Psammohumaqs

DEC Argihumaqs

DECA Argihumaqs that have a texture in at least the upper 100 cm of the mineral soil of loamy fine sand or coarser.

Grossarenic Argihumaqs

DECB Other Argihumaqs that have a texture in at least the upper 50 cm of the mineral soil of loamy fine sand or coarser.

Arenic Argihumaqs

DECC Other Argihumaqs that have a umbric epipedon greater than or equal to 60 cm thick.

Cummulic Argihumaqs

DECD Other Argihumaqs that have an abrupt textural change at the upper boundary of the argillic horizon and have a saturated hydraulic conductivity of 0.4 cm/hr (1.0 μm/sec) or slower (moderately low or lower Ksat class) in the argillic horizon.

Albic Argihumaqs

DECE Other Argihumaqs that have a glossic horizon.

Glossic Argihumaqs

DECF Other Argihumaqs that have at a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more; or an irregular decrease in organic-carbon content (Holocene age) between 25-125 cm depths below the mineral soil surface.

Fluventic Argihumaqs

DECG Other Argihumaqs that have lithic contact within 200 cm of the mineral soil surface.

Lithic Argihumaqs

DECH Other Argihumaqs.

Typic Argihumaqs

DED Fluvihumaqs

DEDA Fluvihumaqs that have a histic epipedon.

Histic Fluvihumaqs

DEDB Other Fluvihumaqs that have an umbric epipedon greater than or equal to 60 cm thick.

Cumulic Fluvihumaqs

DEDC Other Fluvihumaqs that have a buried layer that meets criteria for a histic, umbric, or mollic epipedon within 200 cm of the mineral soil surface; or have a combined thickness of buried surfaces, A and O horizons, that is 20 cm or more thick within 200 cm of the mineral soil surface.

Thapto-Humic Fluvihumaqs

DEDD Other Fluvihumaqs that have a lithic contact within 200 cm of the mineral soil surface.

Lithic Fluvihumaqs

DEDE Other Fluvihumaqs.

Typic Fluvihumaqs

DEE Haplohumaqs

DEEA Haplohumaqs that have a histic epipedon and andic properties.

Histic Andic Haplohumaqs

DEEB Other Haplohumaqs that have andic properties.

Andic Haplohumaqs

DEEC Other Haplohumaqs that have a histic epipedon.

Histic Haplohumaqs

DEEDOther Haplohumaqs have a melanic epipedon.

Melanic Haplohumaqs

DEEE Other Haplohumaqs that have an umbric epipedon greater than or equal to 60 cm thick.

Cumulic Haplohumaqs

DEEF Other Haplohumaqs that have slickensides or wedge-shaped structure in a layer 15 cm or more thick that has an upper boundary within 125 cm of the mineral soil surface; or linear extensibility of 6.0 cm or more between the mineral soil surface and 100 cm.

Vertic Haplohumaqs

DEFG Other Haplohumaqs that have a lithic contact within 200 cm from the mineral soil surface.

Lithic Haplohumaqs

DEEH Other Haplohumaqs.

Typic Haplohumaqs

DF PSAMMAQS

DFA Spodopsammaqs

DFAA Spodopsammaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for either a histic, melanic, mollic or umbric epipedon.

Humic Spodopsammaqs

DFAB Other Spodopsammaqs that have 6.0 percent or more organic-carbon in a layer 10 cm or more thick within the spodic horizon

Humodic Spodopsammaqs

DFAC Other Spodopsammaqs that have all of the following:

1) less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon and
2) have a lithic contact within 200 cm of the mineral soil surface

Lithic Alumnic Spodopsammaqs

DFAD Other Spodopsammaqs that have all of the following:

1) less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon and
2) have an ochric epipedon.

Aeric Alumnic Spodopsammaqs

DFAE Other Spodopsammaqs that have all of the following

1) less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon and
2) have an argillic or kandic horizon within 200 cm of the mineral soil surface**.**

Argic Alumnic Spodopsammaqs

DFAF Other Spodopsammaqs that have all of the following

1) less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon and
2) have a texture class (fine-earth fraction) of coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand throughout a layer extending from the mineral soil surface to the top of a spodic horizon at a depth of 125 cm or more.

Grossarenic Alumnic Spodopsammaqs

DFAG Other Spodopsammaqs that have all of the following

1) less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon and

2) have a texture class (fine-earth fraction) of coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand throughout a layer extending from the mineral soil surface to the top of a spodic horizon at a depth of 75 to 125 cm.

Arenic Alumnic Spodopsammaqs

DFAH Other Spodopsammaqs that have less than 0.10 percent iron (by ammonium oxalate) in 75 percent or more of the spodic horizon**.**

Alumnic Spodopsammaqs

DFAI Other Spodopsammaqs that have a lithic contact within 200 cm of the mineral soil surface.

Lithic Spodopsammaqs

DFAJ Other Spodopsammaqs.

Typic Spodopsammaqs

DFD Fluvipsammaqs

DFDA Fluvipsammaqs that have a that have an organic layer >10 cm thick, or a mineral layer in the upper 15 cm that has a color value and chroma, moist, of 3/3 or darker, and has a color value, dry, of 5 less (crushed and smoothed sample), and has a soil organic-carbon content of at least 0.6 percent.

Humic Fluvipsammaqs

DFDB Fluvipsammaqs that have a buried mollic, umbric or histic epipedon within 200 cm of the mineral soil surface.

Thapto-Humic Fluvipsammaqs

DFDC Other Fluvipsammaqs.

Typic Fluvipsammaqs

DFE Quartzipsammaqs

DFEA Quartzipsammaqs that have an organic layer >10 cm thick, or a mineral layer in the upper 15 cm that has a color value and chroma, moist, of 3/3 or darker, and has a color value, dry, of 5 less (crushed and smoothed sample), and has a soil organic-carbon content of at least 0.6 percent.

Humic Quartzipsammaqs

DFEB Other Quartzipsammaqs.

Typic Quartzipsammaqs

DFF Haplopsammaqs

DFFA Haplopsammaqs that have an organic layer >10 cm thick, or a mineral layer in the upper 15 cm that has a color value and chroma, moist, of 3/3 or darker, and has a color value, dry, of 5 less (crushed and smoothed sample), and has a soil organic-carbon content of at least 0.6 percent.

Humic Haplopsammaqs

DFFB Other Haplopsammaqs.

Typic Haplopsammaqs

DG ARGIAQS

DGA Albargiaqs

DGAA Albargiaqs that have a layer 50-100 cm thick of loamy fine sand or coarser texture starting at the mineral soil surface.

Arenic Albargiaqs

DGAB Other Albargiaqs that have vertic properties within 200 cm of the mineral soil surface**.**

Vertic Albargiaqs

DGAC Other Albargiaqs that have andic properties within 200 cm of the mineral soil surface**.**

Andic Albargiaqs

DGAD Other Albargiaqs that have a natric horizon within 200 cm of the mineral soil surface.

Natric Albargiaqs

DGAE Other Albargiaqs that have a calcic horizon within 200 cm of the mineral soil surface.

Calcic Albargiaqs

DGAF Other Albargiaqs that have a kandic horizon within 200 cm of the mineral soil surface.

Kandic Albargiaqs

DGAG Other Albargiaqs that have evidence of biological mixing within 200 cm of the mineral soil surface.

Vermic Albargiaqs

DGAH Other Albargiaqs that have a lithic contact between 100-200 cm of the mineral soil surface.

Lithic Albargiaqs

DGAI Other Albargiaqs**.**

Typic Albargiaqs

DGB Natrargiaqs

DGBA Natrargiaqs that have vertic properties within 200 cm of the mineral soil surface**.**

Vertic Natrargiaqs

DGBB Natriargiaqs that have evidence of biological mixing within 200 cm of the mineral soil surface**.**

Vermic Natrargiaqs

DGBC Natrargiaqs that have a glossic horizon within 200 cm of the mineral soil surface.

Glossic Natrargiaqs

DGBD Natriargiaqs that have a lithic contact between 100-200 cm of the mineral soil surface

Lithic Natrargiaqs

DGBE Other Natrargiaqs**.**

Typic Natrargiaqs

DGC Paleargiaqs

DGCA Paleargiaqs that have vertic properties within 200 cm of the mineral soil surface.

Vertic Paleargiaqs

DGCB Other Paleargiaqs that have a layer 50-100 cm thick of loamy fine sand or coarser texture starting at surface and a spodic horizon above the kandic or argillic horizon.

Spodic Arenic Paleargiaqs

DGCC Other Paleargiaqs that have a layer 50-100 cm thick of loamy fine sand or coarser texture starting at surface.

Arenic Paleargiaqs

DGCD Other Paleargiaqs that have a texture in at least the upper 100 cm of the mineral soil of loamy fine sand or coarser.

Grossarenic Paleargiaqs

DGCE Other Paleargiaqs that have a glossic horizon within 200 cm of the mineral soil surface.

Glossic Paleargiaqs

DGCF Other Paleargiaqs that have at least 5% plinthite within 200 cm of the mineral soil surface.

Plinthic Paleargiaqs

DGCG Other Paleargiaqs that have a natric horizon within 200 cm of the mineral soil surface.

Natric Paleargiaqs

DGCH Other Paleargiaqs that have a calcic horizon within 200 cm of the mineral soil surface.

Calcic Paleargiaqs

DGCI Other Paleargiaqs that have evidence of biological mixing within 200 cm of the mineral soil surface.

Vermic Paleargiaqs

DGCJ Other Paleargiaqs that have a lithic contact between 100-200 cm of the mineral soil surface.

Lithic Paleargiaq

DGCK Other Paleargiaqs.

Typic Paleargiaq

DGD Haplargiaqs

DGDA Haplargiaqs that have a sulfuric horizon within 100 cm of the mineral soil surface, identified by pH below 4.0.

Sulfuric Haplargiaqs

DGDB Other Haplargiaqs that have a glossic horizon within 200 cm of the mineral soil surface**.**

Glossic Haplargiaqs

DGDC Other Haplargiaqs that have a layer 50-100 cm thick with a texture of loamy fine sand or coarser stating at surface**.**

Arenic Haplargiaqs

DGDD Other Haplargiaqs that have a texture in at least the upper 100 cm of the mineral soil of loamy fine sand or coarser.

Grossarenic Haplargiaqs

DGDE Other Haplargiaqs that have at least 5% plinthite within 200 cm of the mineral soil surface.

Plinthic Haplargiaqs

DGDF Other Haplargiaqs that have a calcic horizon within 200 cm of the mineral soil surface.

Calcic Haplargiaqs

DGDG Other Haplargiaqs that have evidence of biological mixing within 200 cm of the mineral soil surface.

Vermic Haplargiaqs

DGDH Other Haplargiaqs that have a lithic contact between 100-200 cm of the mineral soil surface.

Lithic Haplargiaqs

DGDI Other Haplargiaqs.

Typic Haplargiaqs

DH ORTHAQS
DHA Spodorthaqs

DHAA Spodorthaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for either a histic, melanic, mollic or umbric epipedon.

Humic Spodorthaqs

DHAB Other Spodorthaqs that have 6.0 percent or more organic-carbon in a layer 10 cm or more thick within the spodic horizon

Humodic Spodorthaqs

DHAC Spodorthaqs that have a lithic contact within 200 cm of the mineral soil surface.

Lithic Spodorthaqs

DHAD Other Spodorthaqs that have a densic horizon within 200 cm of the mineral soil surface.

Densic Spodorthaqs

DHAE Other Spodorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andic Spodorthaqs

DHAF Other Spodorthaqs.

Typic Spodorthaqs

DHB Andorthaqs

DHBA Andorthaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for either a histic, melanic, mollic or umbric epipedon AND
have a 1500 kPa water retention of less than 15 percent on air-dried samples and less than 30 percent on undried samples throughout 60 percent or more of the thickness either:
1. Within 60 cm of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no densic, lithic, or paralithic contact, duripan, or petrocalcic horizon within that depth; or
2. Between the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a densic, lithic, or paralithic contact, a duripan, or a petrocalcic horizon.

Vitrihumic Andorthaqs

DHBB Other Andorthaqs that have combined surface horizons that are at least 15 cm thick and that meet all the criteria for either a histic, melanic, mollic or umbric epipedon.

Humic Andorthaqs

DHBC Other Andorthaqs that have a 1500 kPa water retention of less than 15 percent on air-dried samples and less than 30 percent on undried samples throughout 60 percent or more of the thickness either:
1. Within 60 cm of the mineral soil surface or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no densic, lithic, or paralithic contact, duripan or petrocalcic horizon within that depth; or
2. Between the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a densic, lithic, or paralithic contact, a duripan or a petrocalcic horizon.

Vitric Andorthaqs

DHBD Other Andorthaqs that have, at a depth between 25 and 100 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallower, a layer 10 cm or more thick with more than 3.0 percent organic-carbon and the colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower AND all of the following:
1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.2 percent or more and no densic, lithic, or paralithic contact within that depth; or
b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic or paralithic contact, whichever is shallower.

Thapto-fluvic Andorthaqs

DHBE Other Andorthaqs that have, at a depth between 25 and 100 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallower, a layer 10 cm or more thick with more than 3.0 percent organic-carbon and the colors of a mollic epipedon throughout, underlying one or more horizons with a total thickness of 10 cm or more that have a color value, moist, 1 unit or more higher and an organic-carbon content 1 percent or more (absolute) lower.

Thaptic Andorthaqs

DHBF Other Andorthaqs that have more than 2.0 cmol(+)/kg Al^{3+} (by 1N KCl) in the fine-earth fraction of one or more horizons with a total thickness of 10 cm or more at a depth between 25 and 50 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallower.

Alic Andorthaqs

DHBG Other Andorthaqs that lack a cambic horizon.

Entic Andorthaqs

DHBH Other Andorthaqs**.**

Typic Andorthaqs

DHC Halorthaqs

DHCA Halorthaqs that have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio [SAR] of 6 or more) in one or more sub horizons within 100 cm of the mineral soil surface.

Salic Halorthaqs

DHCB Other Halorthaqs that have identifiable secondary gypsum within 200 cm of the mineral soil surface.

Gypsic Halorthaqs

DHCD Other Halorthaqs that have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcic Halorthaqs

DHCD Other Halorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andic Halorthaqs

DHCE Other Halorthaqs that have one or both of the following:
1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge-shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or
2. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Halorthaqs

DHCF Other Halorthaqs.

Typic Halorthaqs

DHD Humorthaqs

DHDA Humorthaqs that have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcic Humorthaqs

DHDB Other Humorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more, AND all of the following:

1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
    a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.2 percent or more and no densic, lithic, or paralithic contact within that depth; or
    b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic, or paralithic contact, whichever is shallower.

Fluvandic Humorthaqs

DHDC Other Humorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andic Humorthaqs

DHDD Other Humorthaqs that have a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample) either throughout the upper 15cm of the mineral soil (unmixed) or between the mineral soil surface and a depth of 15 cm after mixing AND that have all of the following:

1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
    a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.2 percent or more and no densic, lithic, or paralithic contact within that depth; or
    b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic, or paralithic contact, whichever is shallower.

Molli-Fluvic Humorthaqs

DHDE Other Humorthaqs AND that have all of the following:

1. A slope of less than 25 percent; and
2. A total thickness of less than 50 cm of human transported material in the surface horizons; and
3. One or both of the following:
    a. At a depth of 125 cm below the mineral soil surface, an organic-carbon content (Holocene age) of 0.6 percent or more and no densic, lithic, or paralithic contact within that depth; or
    b. An irregular decrease in organic-carbon content (Holocene age) between a depth of 25 cm and either a depth of 125 cm below the mineral soil surface or a densic, lithic, or paralithic contact, whichever is shallower.

Fluvic Humorthaqs

DHDF Other Humorthaqs that have a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample) either throughout the upper 15 cm of the mineral soil (unmixed) or between the mineral soil surface and a depth of 10 cm after mixing AND lack a cambic horizon.

Mollentic Humorthaqs

DHDG Other Humorthaqs that have a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed sample) either throughout the upper 15 cm of the mineral soil (unmixed) or between the mineral soil surface and a depth of 10 cm after mixing.

Mollic Humorthaqs

DHDH Other Humorthaqs that have one or both of the following:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or
2. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Humorthaqs

DHDI Other Humorthaqs that lack a cambic horizon.

Entic Humorthaqs

DHDJ Other Humorthaqs.

Typic Humorthaqs

DHE Fluvorthaqs

DHEA Fluvorthaqs that have, within 150 cm of the mineral soil surface, one or more of the following:

1. A sulfuric horizon; or
2. A horizon 15 cm or more thick that has all of the characteristics of a sulfuric horizon, except that it has a pH value between 3.5 and 4.0 and does not have sulfide or other sulfur-bearing minerals; or
3. Sulfidic material.

Sulfic Fluvorthaqs

DHEB Other Fluvorthaqs that have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio [SAR] of 6 or more) in one or more sub-horizons within 100 cm of the mineral soil surface.

Sodic Fluvorthaqs

DHEC Other Fluvorthaqs that have a buried mollic, umbric or histic epipedon within 200 cm of the mineral soil surface.

Thapto-Humic Fluvorthaqs

DHED Other Fluvorthaqs that lack a cambic horizon AND have identifiable secondary carbonates within 200 cm of the mineral soil surface AND

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or
2. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Calcentic Fluvorthaqs

DHEE Other Fluvorthaqs that lack a cambic horizon AND have

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or
2. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertentic Fluvorthaqs

DHEF Other Fluvorthaqs that lack a cambic horizon AND have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcentic Fluvorthaqs

DHEG Other Fluvorthaqs that have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcic Fluvorthaqs

DHEH Other Fluvorthaqs that lack a cambic horizon AND have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andentic Fluvorthaqs

DHEI Other Fluvorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andic Fluvorthaqs

DHEJ Other Fluvorthaqs that lack a cambic horizon.

Entic Fluvorthaqs

DHEK Other Fluvorthaqs.

Typic Fluvorthaqs

DHF Haplorthaqs

DHFA Haplorthaqs that have identifiable secondary gypsum within 200 cm of the mineral soil surface.

Gypsic Haplorthaqs

DHFB Other Haplorthaqs that lack a cambic horizon AND have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcentic Haplorthaqs

DHFC Other Haplorthaqs that have identifiable secondary carbonates within 200 cm of the mineral soil surface.

Calcic Haplorthaqs

DHFD Other Haplorthaqs that lack a cambic horizon AND have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Entandic Haplorthaqs

DHFE Other Haplorthaqs that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and Al plus ½ Fe (by ammonium oxalate) of 1.0 percent or more.

Andic Haplorthaqs

DHFF Other Haplorthaqs that have an argillic horizon within 200 cm of the mineral soil surface.

Argillic Haplorthaqs

DHFG Other Haplorthaqs that have a densic horizon within 200 cm of the mineral soil surface.

Densic Haplorthaqs

DHFH Other Haplorthaqs that have a spodic horizon within 200 cm of the mineral soil surface.

Spodic Haplorthaqs

DHFI Other Haplorthaqs that have

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; or
2. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Haplorthaqs

DHFJ Other Haplorthaqs that lack a cambic horizon.

Entic Haplorthaqs

DHFK Other Haplorthaqs.

Typic Haplorthaqs