Irrigation Water Management for Montana Fruit Production

(IN A SEMI-ARID CLIMATE)

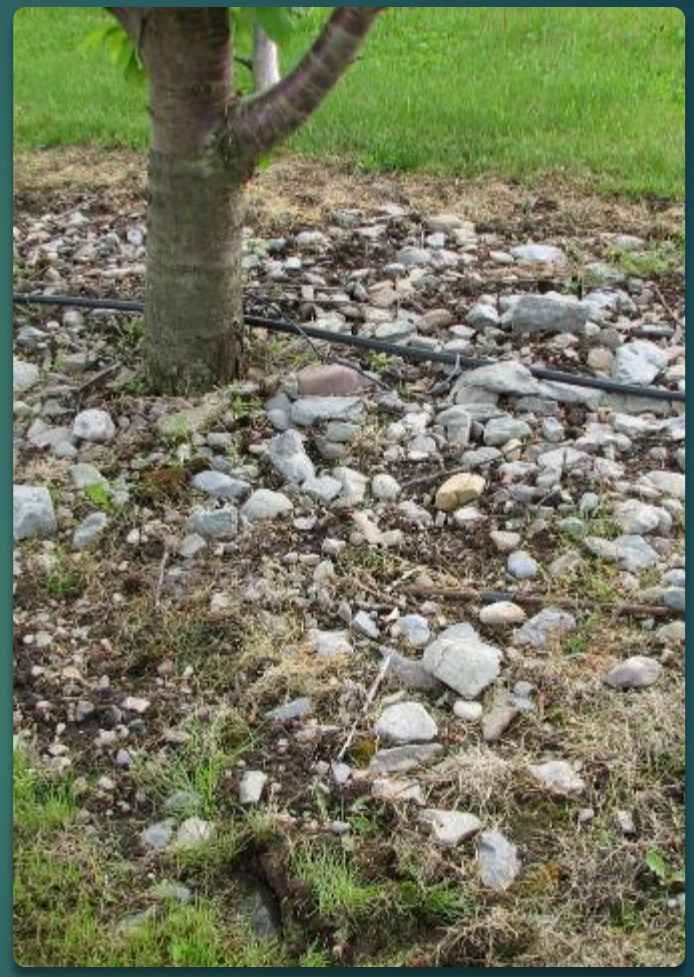
SOILS

Start with a soils inventory - Web Soil Survey

Estimate soil available water holding capacity (AWC)

Sandy/gravelly loam vs Clay loam

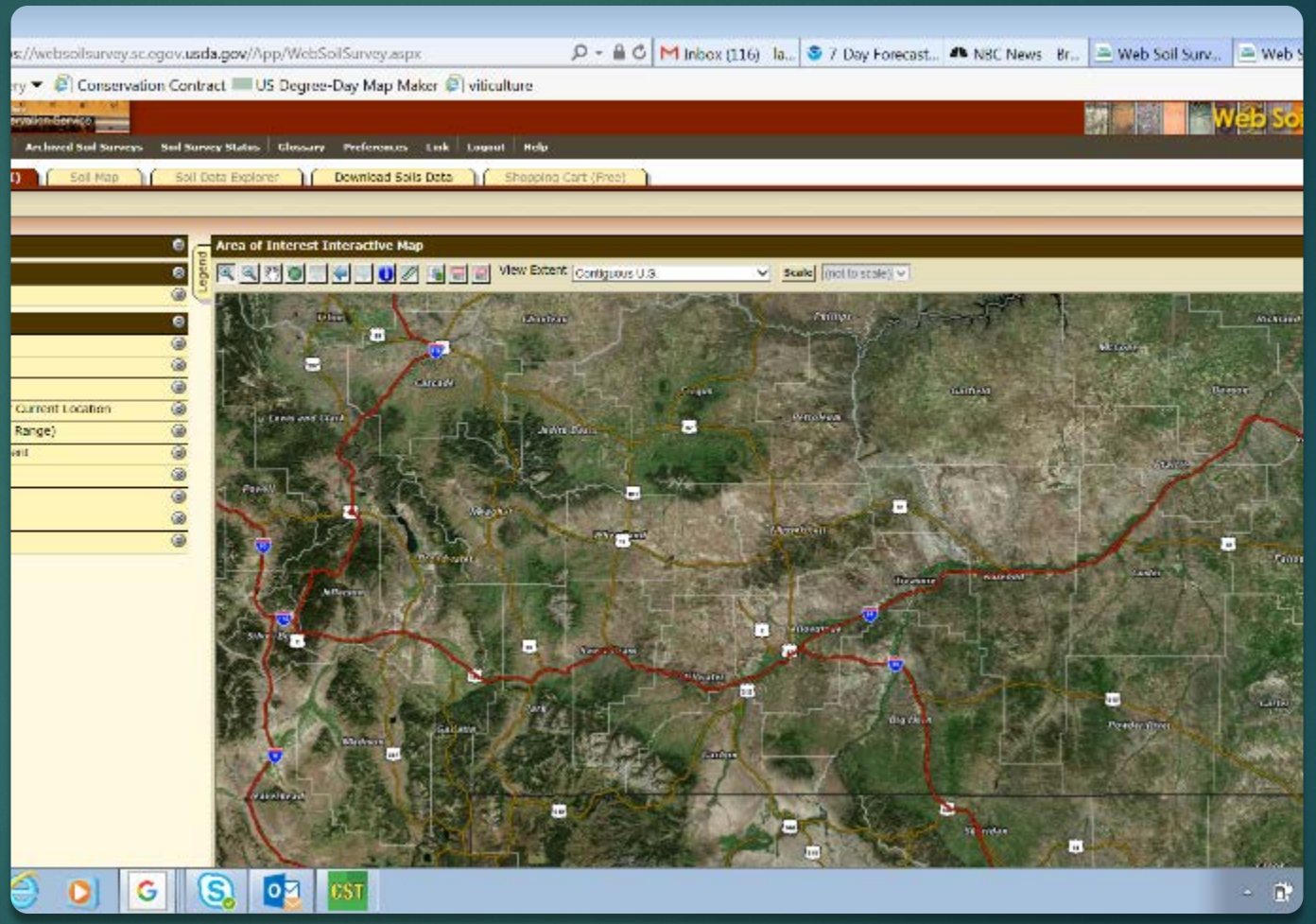
Wide Range AWC - 2 inches/5 feet vs 8 inches/5 feet



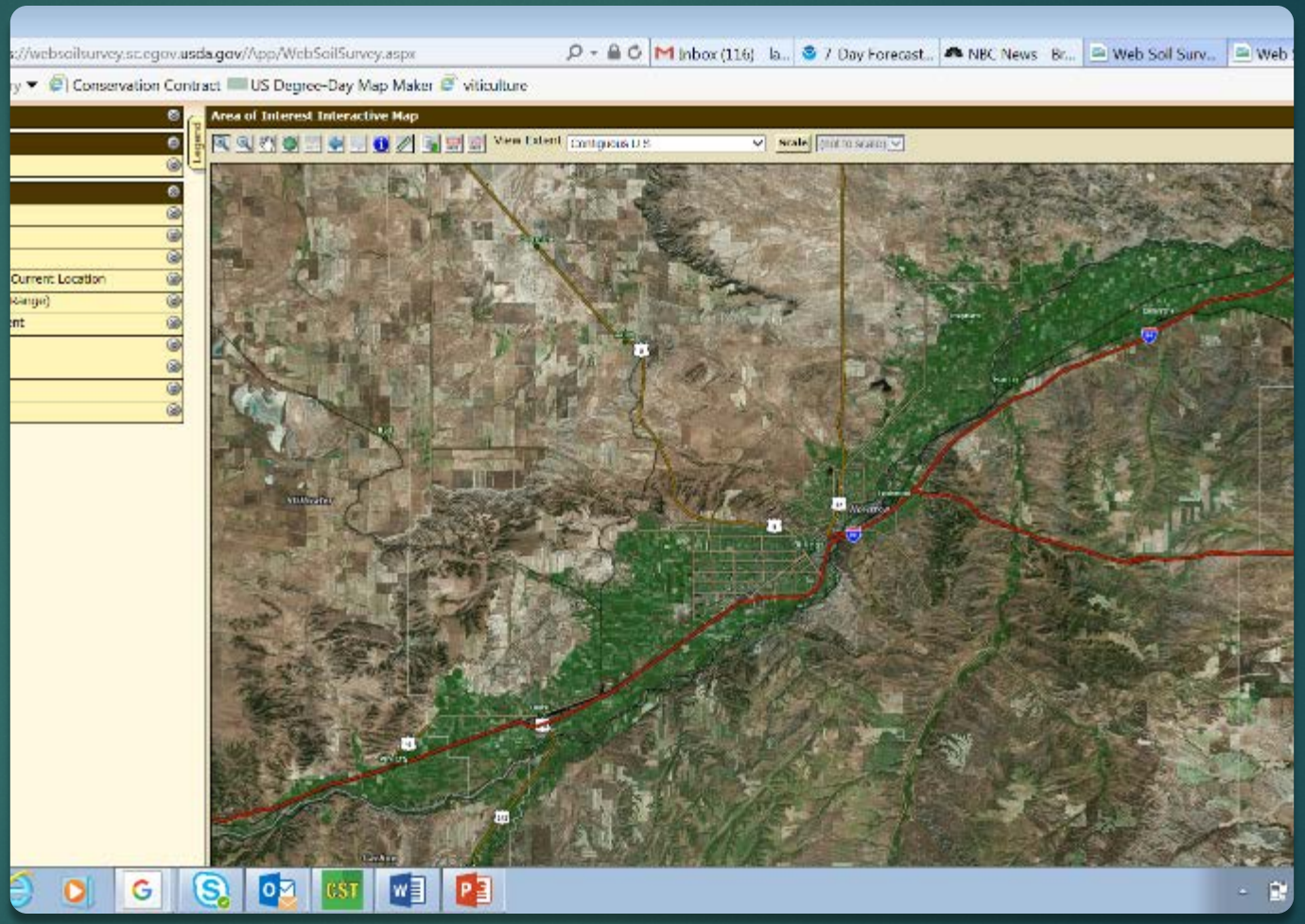
Web Soil Survey Home Page

Use + to narrow search

Draw AOI on map

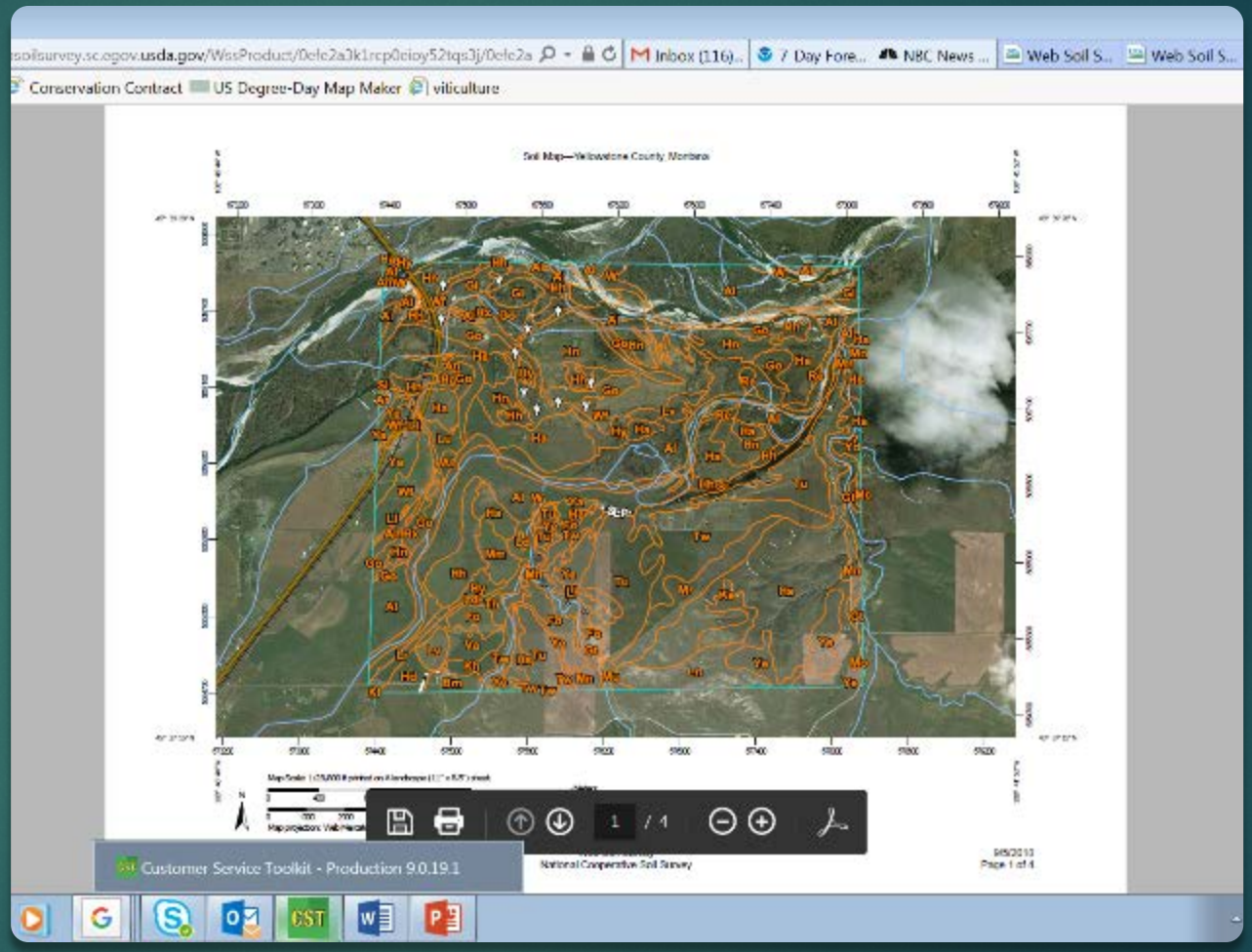


Narrow Search, Create AOI, Go to Soil Map above tool bar

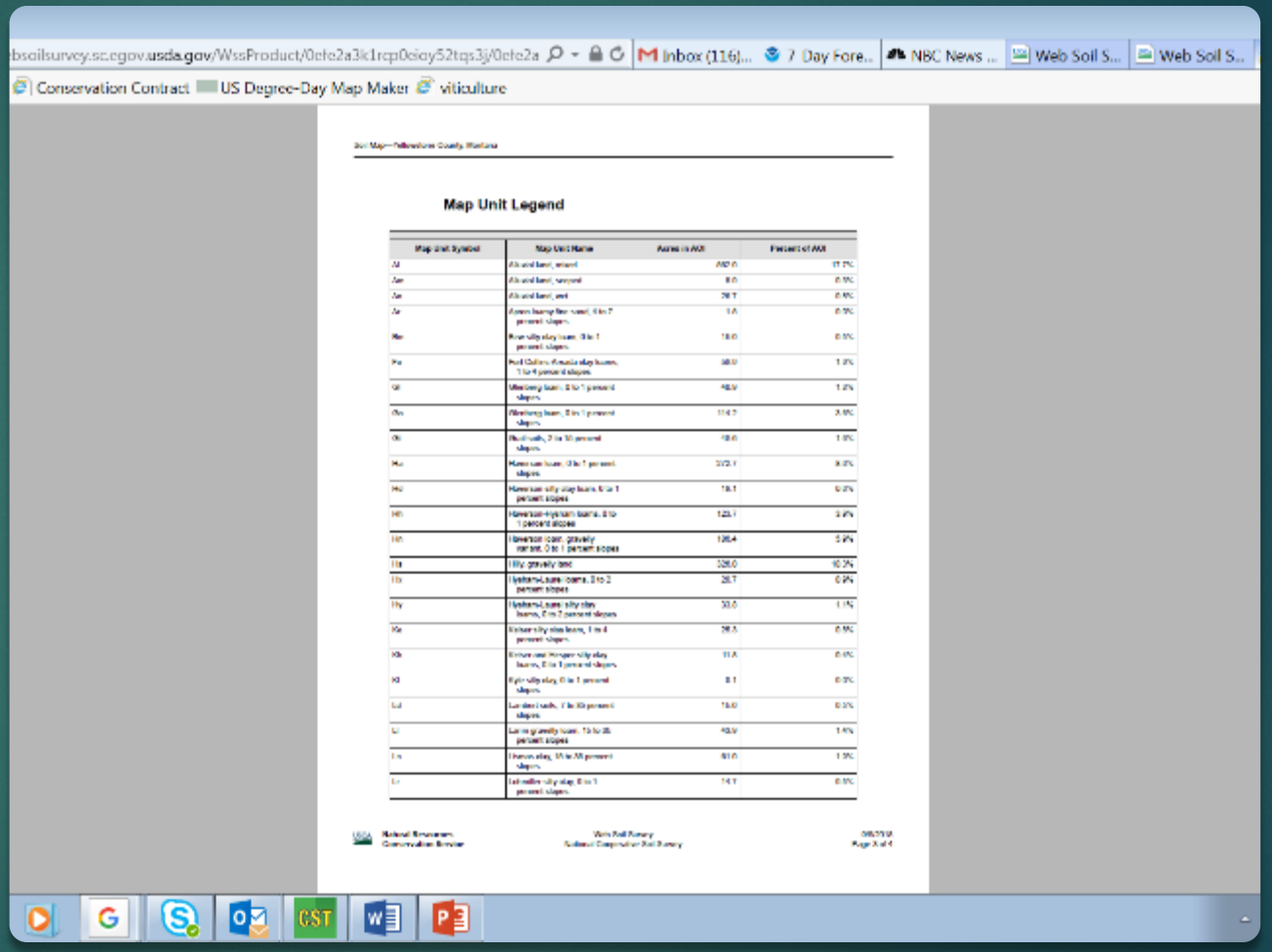


Soil Map

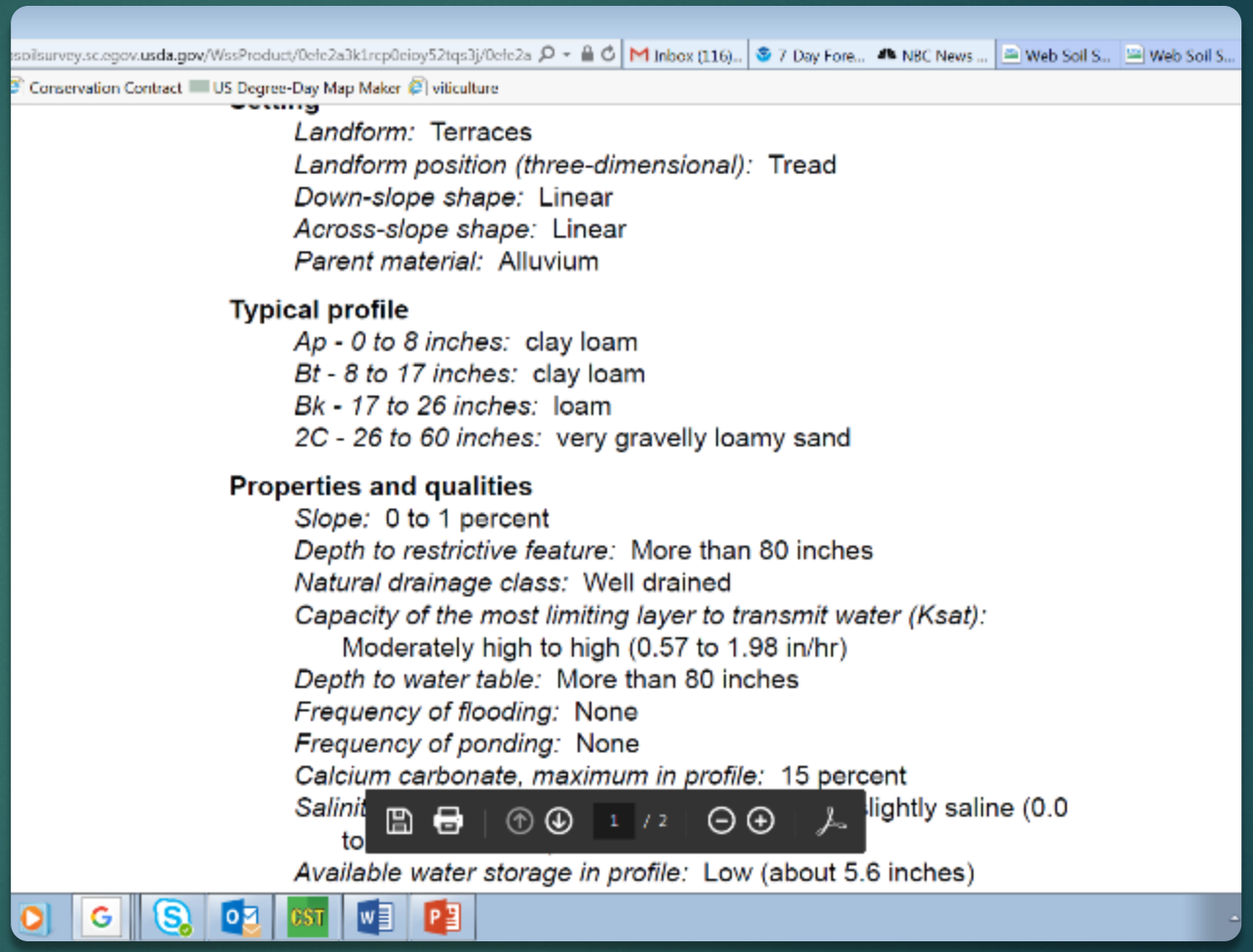
Multiple soil types from clay to fine sandy loams



Soil Types in the AOI



Soil Report for Wf Wanetta clay loam, 0-1% slopes



Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

Ap - 0 to 8 inches: clay loam
Bt - 8 to 17 inches: clay loam
Bk - 17 to 26 inches: loam
2C - 26 to 60 inches: very gravelly loamy sand

Properties and qualities

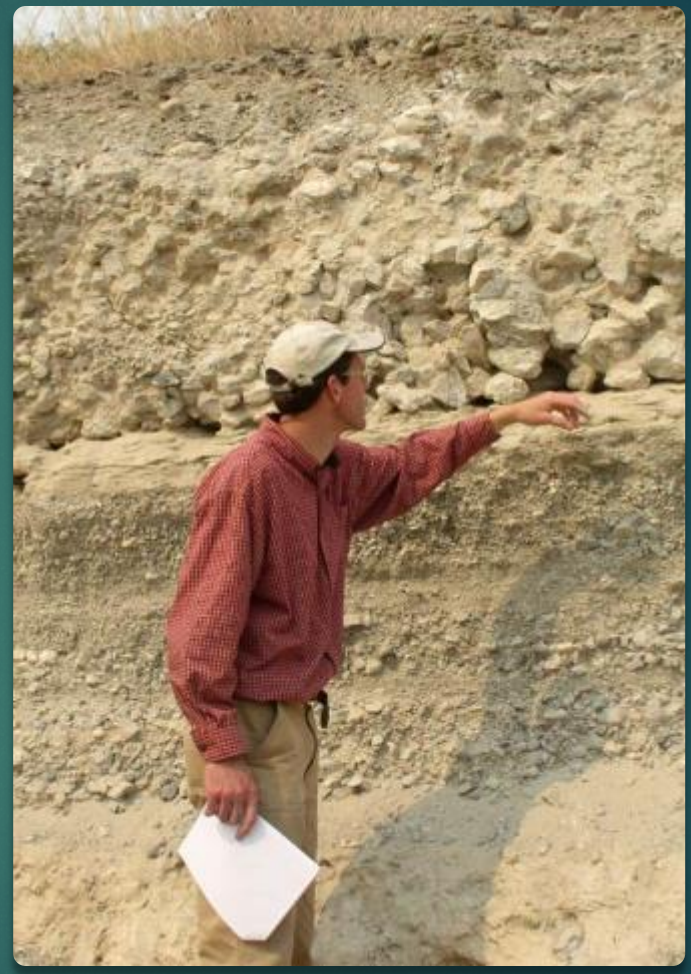
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salini ... lightly saline (0.0
to
Available water storage in profile: Low (about 5.6 inches)

Soil Water

Field Capacity- the water in soil that is held up in the soil profile against the force of gravity- gravitational water

Available water- That between field capacity and the wilting point.

Wilting Point- unavailable water- Water held so tightly the surface tension is too great for plant roots to draw water.



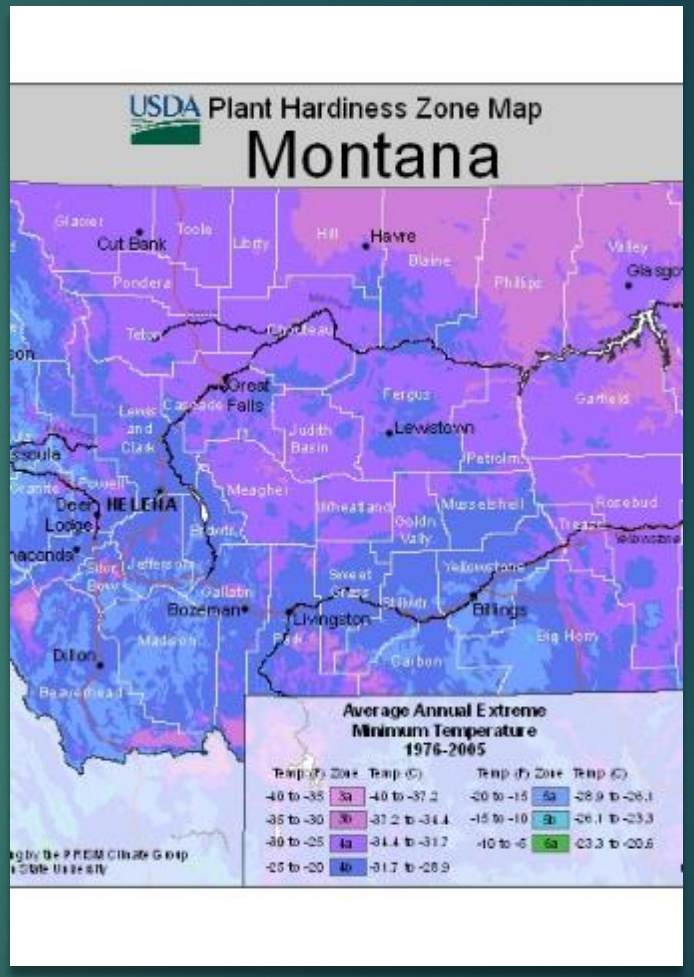
Other Factors for Site Suitability

Growing Degree Days (GDD)

Site aspect

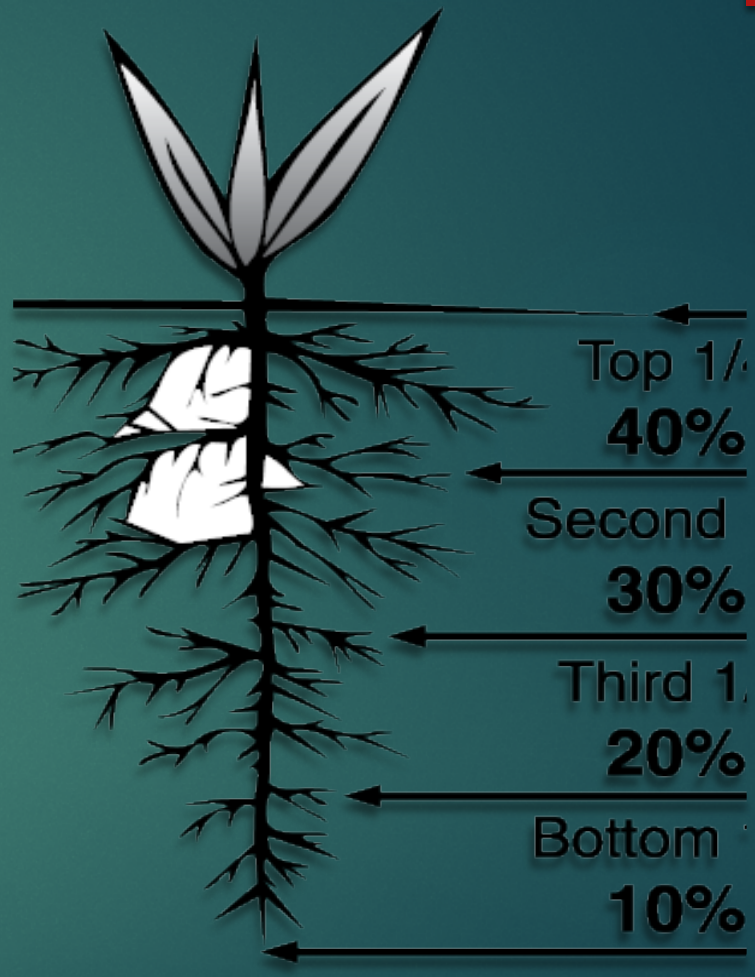
Air drainage, frost susceptibility

USDA Plant Hardiness Zones



Plant Water Use by Rooting Depth

70% of plant available water is in the top half of the rooting depth.



Vineyard/Orchard Irrigation Systems

The Most Common Systems are micro-sprinkler and Drip

Drip w/ 2gph red Rain Bird emitters

Soil Moisture Monitoring

Installing Watermark / Gypsum Block soil moisture sensors

Save dug soil on Canvas

Dig a narrow sensor hole with a tile spade shove and place soil on canvas the way it came out

Replace soil the same way it came out using shovel handle to pack tightly

Installing Sensor

Place sensor on end of ¾" PVC and hold against the side of hole. Hand pack around the sensor as you fill in the hole to a 1' depth, continue packing carefully w/handle

2' depth sensor shown below

Fill Back in Order

Fill to the one foot depth and repeat for the 2nd sensor at 1' depth

1' depth installation shown below

Measuring Soil Moisture

Soil moisture gypsum block readings- what do they mean? 0-8 saturation, 80-100 wilting point???, 150-200 bone dry ???

Calibration – Use moisture readings plus visual vine condition to estimate wilting point threshold.

The Watermark guide estimates 50% soil water depletion at 80, based on heavier soils. Flathead gravelly loam soils have much lower readings for 50%, it's why vineyard calibration is needed.

Other soil moisture sensoring equipment- tensiometers, neutron probes, Spectrum tech sensors, etc.

Irrigation Scheduling

- Vine moisture needs- established vines can use between 4 and 6 gallons of water per day during peak use. Mature fruit trees can use up to 45 gallons/day
- Evapotranspiration- vines, fruit, grass, etc. can use between .15” on cloudy days to .3” on hot days.
- Soil available water holding capacity- You can bank several days of water on higher water holding soils such as loams without much gravel/rocks. Sandy loam/gravelly soils need lighter, more frequent irrigations.

Grape Water Use by Stage of Development

Stage of Development	Fraction of Annual H20 Use
Bud break to flowering	5%
Flowering to fruit set	15%
Fruit set to veraison	60%
Veraison to harvest	20%
Harvest to leaf fall	3-5%

Irrigation of Newly Established Vineyards and Orchards

GOAL First Two Years- To develop a good, deep root system for optimum long term production

#1- weed/grass control

#2- early deep watering depending on winter moisture, read sensors

#3- mild to moderate, occasional shallow soil water stress during the 2nd half of the growing season

#4- Allow most all shoots to grow for maximum leaf area 1st year to develop scaffold root system

#5- 2nd year, Allow most shoots to grow while pruning to favor the training of predominant shoots to establish fruiting cordons

#6-Pick all grape bunches off for two years for maximum root development

Record keeping/ IWM calibration

- Calibrate sensor readings to soil water and fruit conditions
- Keep at least bi-weekly records of soil moisture content, use data logger, etc. for continuous readings if feasible
- Record fruit growth stages along with soil moisture monitoring
- Record rainfall events- first .1” of rainfall will not effect soil moisture- the 1’ sensor will usually not show most rain events(unless the soil water is near field capacity)
- Use data collected to refine a comprehensive Irrigation Water Management system to fit each location