

## Soil Health Summary: Animas River Top Soil

My name is Dr. Michael Remke, I have a Ph.D. in Forestry from the University of Arizona and have studied soil around the world. I have closely reviewed several data points from multiple samples reviewed by various labs across several years of Animas River Top Soil. The soil is derived from fluvial geomorphic processes in the Animas River Valley. The soil is derived from a mixed alluvium of sandstone, limestone and granitic rocks and is a by-product of land manipulation to restore the topography and vegetation of a native wetland. I reviewed information on soil physical, chemical, and biological properties to provide this summarization of soil health for Animas River Top Soil.

### **Summary**

Overall, Animas River Top Soil is a premium soil product that is ultimately derived from the geomorphic processes of the Animas River Valley. Animas River Top Soil contains nutrient levels that are ideal for native plant landscaping and can be modified slightly to favor coniferous trees or commercial crops. Soil texture of Animas River Top soil tends to vary slightly, but is often ideal for water infiltration and retention. This soil also contains a healthy biological community that likely closely resembles and contains species of the native soil biota community making it ideal for native plants.

I highly recommend Animas River Top Soil for native plant landscaping as it requires no to minimal modification and closely resembles healthy soil native to the SW Colorado high desert ecosystem. The soil's texture is also ideal for minimizing watering schedules.

### **Soil Physical Properties**

#### *Soil Texture*

The soil is generally a silty loam, however, given the geomorphic environment, soil texture trends to follow a gradient from finer textures and more clay content to coarser sandy clay loam soils. Finer texture soils with more clay content could slow water infiltration and could use some added sand to help with water infiltration. Close to 60% silt, 25% sand and 15% clay is likely an ideal soil texture for balancing water infiltration and water retention, especially in the high desert region of SW Colorado. Animas River Top Soil is 56.2% silt, 26% sand and 17.5% clay.

### **Soil Chemical Properties**

#### *Soil pH*

Animas River Top Soil is slightly basic with moderate amounts of lime. This is likely the product weathered limestones of the Hermosa Formation in the Animas River Watershed. This pH is not a problem for native flora, though it may be slightly high for coniferous trees or commercial crops. Should a more neutral pH be desired humic acid, sulfates, or other sources of organic matter could be added.

### *Soil Organic Matter*

Animas River Top Soil had had an agricultural history where row crops and grasses have been grown. The resulting soil is derived of 4-6% organic matter. This value is what one may expect to find in high desert ecosystems and is sufficient for native flora as well as commercial crops.

### *Soil Macronutrients*

In general, soil Nitrogen, Phosphorous, Potassium (N-P-K) are low and should be added via fertilizer. This being said, native flora in SW Colorado are generally adapted to low nutrient soils. Thus, soil nutrients are likely adequate for native plant landscaping with no additional fertilizer.

### *Soil Salinity*

Salts in the soil environment can cause stress to plants and hinder plant growth. Animas River Top Soil generally shows low electrical conductivity implying little accumulation of salts making this soil ideal for plant growth.

### *Soil Micronutrients*

Micronutrients are essential nutrients for plant growth in lesser quantities than macronutrients. Plant micronutrients in Animas River Top Soil exists in quantities that would be expected in healthy soil and no additional nutrients should be added. Observed nutrient levels are sufficient for both native plant landscaping and commercial crop growth.

### *Heavy Metals*

The Animas River Watershed generally has high native heavy metal content due to a geology rich in native heavy metals as well as the subsequent effects of substantial mine runoff in the Animas River Watershed. This raises the concern for detectable heavy metals in the soil environment. Analysis by Green Analytical shows detectable levels of Uranium, Selenium, and other heavy metals, but in concentrations that are quite low and thus pose no environmental threat to plant growth or human health. Certain native plants, such as *Astragalus* species, can be planted to remove selenium in soils, however, caution should be used in that grazing livestock in areas with *Astragalus* may result in selenium toxicity in cattle or sheep.

### **Soil Biotic Properties**

Soils contain a suite of beneficial micro-organisms, such as bacteria and mycorrhizal fungi. Mycorrhizal fungi are a type of fungus that live inside of, or on, many native plants' roots. These fungi obtain their carbon from plants and in exchange forage the soil environment for additional nitrogen and phosphorous. In nutrient limited systems like SW Colorado, these organisms greatly facilitate native plant growth. I extracted mycorrhizal fungi spores from Animas River Top Soil and identified at least 13 different species of fungal spores. I also grew corn with Animas River Top soil and observed the roots of corn to be heavily colonized by mycorrhizal fungi. These observations suggest this soil contains healthy soil biota that enhance plant growth.

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