SOIL, WATER AND PLANT TESTING LABORATORY

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Effective January 1, 2009

Analytical Services Provided
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Prices Subject to Change
Without Notice

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ANALYTICAL SERVICES PROVIDED

Soil, Overburden, Waste Materials and Amendments

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Plants and Forages

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Water

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SOIL, OVERBURDEN, WASTE MATERIAL AND AMENDMENTS

Soil and Overburden

Routine
pH, electrical conductivity, organic matter, nitrate-nitrogen, phosphorus, potassium, zinc, iron, manganese, copper, and lime and texture estimates and fertilizer suggestions for agricultural, horticultural or reclamation applications.

Routine + Sodium Evaluation (SAR)
Routine parameters plus sodium adsorption ratio.

Routine + Hydrometer
Routine parameters hydrometer test for % sand, silt and clay with named texture.

Routine + Boron, Molybdenum, Cadmium & Lead
Routine parameters plus boron, molybdenum, cadmium and lead.

Routine + Sulfate-Sulfur
Routine parameters plus sulfate sulfur

Routine + Subsoil Salinity or Nitrate-Nitrogen
Routine parameters plus subsoil salinity or nitrate-nitrogen. Requires the submittal of a subsoil sample along with a surface sample to aid in the reclamation of salt affected soil (subsoil salinity) or to evaluate the fertilizer requirements of crops such as sugar beets, winter wheat or corn.

*Volume Discounts Available upon request

PLEASE CALL FOR PRICING INFORMATION

Packages

SOIL, OVERBURDEN, WASTE MATERIAL AND AMENDMENTS

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SOIL, OVERBURDEN, WASTE MATERIAL AND AMENDMENTS

Packages

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Soil and Overburden (cont’d)

Routine + Subsoil Salinity and Nitrate-Nitrogen
Routine parameters plus subsoil salinity and nitrate-nitrogen. Requires the submittal of a subsoil sample along with a surface sample to aid in the reclamation of salt affected soils and evaluate the fertilizer requirements of deep rooted crops such as sugar beets, winter wheat or corn

Magnesium Chloride

Total Organic Carbon
Total Carbon Less CO\textsubscript{3}-C

Soil Monitoring where sludges/biosolids have been applied -- please see "waste materials" section below.

Amendments

Manure and Composts
Percent dry matter, pH, electrical conductivity, organic matter by WLOI, ammonium-nitrogen, nitrate-nitrogen, total nitrogen, carbon:nitrogen ratio, total phosphorus and total potassium

Waste Materials Sludges/Biosolids
Total solids, volatile solids, pH, total nitrogen, organic nitrogen, nitrate-nitrogen, ammonium-nitrogen, total elemental analysis of: arsenic, barium, beryllium, cadmium, copper, chromium, mercury, potassium, manganese, molybdenum, phosphorus, lead, nickel, selenium, and zinc
Waste Materials/Soils (cont'd)

Add to tests listed in above sludge/biosolids package: electrical conductivity, total aluminum, total silver and total iron.

Soils that Will Have Sludges/Biosolids Applied

Soil Fertility: pH, electrical conductivity, organic matter, total phosphorus, and plant available phosphorus, nitrate-N, potassium

Soils Where Sludges/Biosolids Applied (cont’d)

Soils Metals and Physical Characteristics: Plant available: arsenic, barium, beryllium, cadmium, copper, chromium, mercury, manganese, molybdenum, nickel, lead, selenium, and zinc

Soils Metals and Physical Characteristics: Plant available and total: arsenic, barium, beryllium, cadmium, copper, chromium, mercury, manganese, molybdenum, nickel, lead, selenium, and zinc

Both Fertility and Metals/Physical Characteristics, reporting both plant available and total metals

~~~ Plant Tissues from Soils Where Sludges/Biosolids Applied

Nitrogen, phosphorus, cadmium, copper, lead, nickel, zinc, and nitrates

Soils, Overburdents, Waste Materials and Amendments

Analyses by CN Furnace

Total Nitrogen and/or Total Carbon please call
Soils, Overburdens, Waste Materials and Amendments

Analyses by ICP (Inductively Coupled Plasma-Atomic Emission Spectroscopy)

**TCLP Extract**

**TCLP Extract w/ RCRA metals** (Silver, arsenic, barium, cadmium, chromium, mercury, lead and selenium)

**Water Extracts of Soil:** Calcium, magnesium, sodium, potassium, phosphorus, aluminum, iron, manganese, titanium, copper, zinc, nickel, molybdenum, cadmium, chromium, strontium, boron, barium, lead, silicon and vanadium.

**AB-DTPA (NH₄HCO₃-DTPA) Extracts of Soil** magnesium, sodium, potassium, phosphorus, aluminum, iron, manganese, titanium, copper, zinc, nickel, molybdenum, cadmium, chromium, strontium, boron, barium, lead, silicon and vanadium

**2-Hour DTPA Soil Extracts:** Zinc, iron, manganese, copper, lead, nickel, and cadmium.

**Exchangeable Bases (NH₄OAc and Water Extracts of Soil), including extractions:** Calcium, magnesium, sodium, and potassium
Soils, Overburdens, Waste Materials and Amendments

Analyses by ICP (Inductively Coupled Plasma-Iris) cont’d:

Total Soil Digests (EPA 3050, Nitric Acid Perchloric Acid, or Perchloric-Hydrofluoric Digests): Calcium, magnesium, sodium, potassium, phosphorus, aluminum, iron, manganese, titanium, copper, zinc, nickel, molybdenum, cadmium, chromium, strontium, barium, lead, vanadium, silver, antimony, tin, thallium, beryllium, and silver.

*Volume Discounts Available Upon Request
Sample Preparation and Individual Determinations

**Sample Preparation**

Handling and Preparation of Sample:
- Soil and Overburden
- Waste Materials
- Extraction Fee (NaHCO₃, NH₄HCO₃, -DTPA, etc.)
- Digestion fee (EPA 3050, Nitric, Nitric Perchloric, Nitric Perchloric Hydrofluoric, or special digests as specified by customer)

**Determinations**

- Buffer pH
- pH Ratios (1:1, etc.)
- Paste pH (Saturation Paste)
- Electrical Conductivity
- pH and Electrical Conductivity
- pH, Electrical Conductivity, and Sodium Adsorption Ratio (SAR)
- % Saturation (if performed with paste pH or EC analysis)
- Texture Estimate

- Organic Matter (modified Walkley-Black)
- Weight Loss on Ignition / Volatile Solids

- Ammonium-Nitrogen, Including Extract
- Nitrate-Nitrogen, Including Extract
- Nitrite-Nitrogen, Including Extract
- Mineralizable Nitrogen
  (NOTE: Organic Nitrogen is calculated from Ammonium-Nitrogen, Nitrate-Nitrogen, and Total Nitrogen)
- Other Anions (sulfate, chloride, fluoride, orthophosphorus, bromide per anion, including extracts

*Volume Discounts Available Upon Request*
**SOIL, OVERBURDEN, WASTE MATERIAL AND AMENDMENTS**

**Sample Preparation and Individual Determinations**

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*Volume Discounts Available Upon Request*

**Determinations (cont’d):**

- Sodium Bicarbonate Phosphorus (Olsen’s Phosphorus), Including Extract
- Mehlich Phosphorus, Including Extract
- Bray Phosphorus, Including Extract
- AB-DTPA Phosphorus, Including Extract
- Organic Phosphorus
- Inorganic Phosphorus by Sequential Extraction

- Phosphate Anion Exchange (Phosphorus Fixation Index)

- Lime Estimate

- % Calcium Carbonate Equivalent

- Alkalinity (Carbonate + Bicarbonate)

- Exchangeable Acidity

- Acid:Base Potential (Total Sulfur + Calcium Carbonate + Pyritic Sulfur (if needed))

- Gypsum

- Moisture Determination:  % Water As Received / Total Solids

- Cation Exchange Capacity (CEC)

- Exchangeable Sodium
- Exchangeable Sodium Percentage (ESP)
- Exchangeable Bases (includes handling charge and 2 extractions)

- Total Carbon (Also, See Page 9)
SOIL, OVERBURDEN, WASTE MATERIAL AND AMENDMENTS

Sample Preparation and Individual Determinations

PLEASE CALL FOR PRICES

*Volume Discounts Available Upon Request

Determinations (cont'd):

Redox Potential

Pyritic Sulfur

Total Silicon

Total Organic Carbon (Total Carbon less CO$_2$-C)

**Single Element Determinations in Appropriate Extract or Digest by ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectroscopy):**

**NOTES:** Prices do **NOT** include charge for extraction or digest. Information about specific detection limits available upon request.

Calcium, Magnesium, Sodium, Potassium, Zinc, Iron, Copper, Manganese Nickel, Lead, Chromium, Cadmium, Molybdenum, Vanadium, Boron, Barium Phosphorus, Strontium, Titanium, Aluminum, Beryllium, Thallium, Tin, Antimony, Silver

**Single Element Determinations for Levels Below the ICP Direct Reading Detection Limit:**

Total Arsenic (ICP-Hydride Generation), includes digest
Total Selenium (ICP-Hydride Generation), includes digest
Plant Available Arsenic (ICP-Hydride Generation), includes extract
Plant Available Selenium (ICP-Hydride Generation), includes extract
Single Element Determinations for Levels Below the ICP Direct Reading Detection Limit cont’d:

- Total Mercury (AA--Cold Vapor), includes digest
- Plant Available Mercury (AA--Cold Vapor), includes extract

Particle Size Analysis:

- Hydrometer (% Sand, Silt, Clay, and Texture Classification)
- Pipet (% Sand, Silt Fractions, Clay Fractions, and Texture Classification)
- Sand Fractions -- Price per Fraction (Sieve)
- Very Fine Sand Fraction (Sieve)
- Gravel Content (Total % > 2 mm) (Sieve)
- Gravel Fractions -- Price per Fraction (Sieve)

NOTE: Sieve Sizes available from 20 µm (#635) to 4"

Physical Characteristics

- Color / Classification
- Bulk Density (Clod)
- Bulk Density (Graduated Cylinder)
- Bulk Density (Intact Cylinder)
- Hydraulic Conductivity
- Porosity
- Specific Surface Area

*Volume Discounts Available Upon Request
Moisture Tension Determination:

**NOTES:** Available from 0 BAR through 15 BAR
Common Tensions Are: 0, 1/10, 1/3, 5 and 15 BAR
~ 5 Points are recommended to produce a moisture retention curve.

Setup Fee per Tension (1 to 15 samples per setup)
Determination of Moisture for Each Sample/Tension
Percent Saturation (0 BAR)

Available Water Capacity (1/3 Bar and 15 Bar)

*Volume Discounts Available Upon Request*
PLANT TISSUE

Routine
Nitrogen, Phosphorus, Potassium, Zinc, Iron, Copper,
Manganese, Calcium, Magnesium, Sodium, Boron,
and Nitrates

Plant Tissue Monitoring
Nitrogen, Phosphorus, Cadmium, Copper, Lead,
Nickel, Zinc, and Nitrates

Magnesium Chloride

Analyses by CN Furnace
Total Nitrogen and/or Total Carbon

Analyses by ICP (Inductively Coupled Plasma-
Atomic Emission Spectroscopy)

Plant Digest Solutions
Calcium, Magnesium, Sodium, Potassium,
Phosphorus, Aluminum, Iron, Manganese, Titanium,
Copper, Zinc, Nickel, Molybdenum, Cadmium,
Chromium, Strontium, Boron, Barium, Lead, Silicon
and Vanadium

*Volume Discounts Available Upon Request
**PLANT TISSUE**

Sample Preparation and Individual Determinations

**Preparation**

Handling Charge
Digestion (Nitric, Nitric Perchloric, etc.)

**Determinations**

Bromide (includes extraction)
Fluoride (includes extraction)
Phosphate, Sulfate, Chloride -- per anion
  (includes extraction)
Total Sulfur
Total Nitrogen (includes handling charge)
Nitrate (includes handling charge and extraction)

**Single Element Determinations in Appropriate Extract, by Inductively Couple Plasma-Atomic Emission Spectroscopy**

**NOTES:** Prices do NOT include charge for extract-	on or digest. Information about specific detection limits available upon request.

Calcium, magnesium, sodium, potassium, zinc,
iron, copper, manganese, nickel, lead, chromium,
cadmium, molybdenum, vanadium, silicon, boron,
phosphorus, barium, strontium, titanium, and aluminum.

**Single Element Determinations for Levels Below the ICP Direct Reading Detection Limits**

Total Arsenic (ICP-Hydride Generation)
  (includes digest)
Total Selenium (ICP-Hydride Generation)
  (includes digest)
Total Mercury (AA-Cold Vapor)
  (includes digest)

*Volume Discounts Available Upon Request*
Routine Package (by wet chemistry)
    Moisture, Dry Matter (DM), Ash, Crude Protein (CP),
    Crude Fiber (CF), Acid Detergent Fiber (ADF), Neutral
    Detergent Fiber (NDF), Digestible Energy (DE), Net
    Energy/Lactation (NEL), Net Energy/Maintenance
    (NEM), Net Energy/Gain (NEG), Metabolizable Energy
    (ME), Total Digestible Nutrients (TDN), and Relative
    Feed Value Index (RFV).

Minerals Package (by wet chemistry)
    Phosphorus, Potassium, Calcium, Magnesium, Iron,
    Manganese, Zinc, Copper, Sodium, Boron, and
    Molybdenum

Routine + Minerals Package
    Moisture, Dry Matter (DM), Ash, Crude Protein (CP),
    Crude Fiber (CF), Acid Detergent Fiber (ADF), Neutral
    Detergent Fiber (NDF), Digestible Energy (DE), Net
    Energy/Lactation (NEL), Net Energy/Maintenance
    (NEM), Net Energy/Gain (NEG), Metabolizable Energy
    (ME), Total Digestible Nutrients (TDN), Relative Feed
    Value Index (RFV), Phosphorus, Potassium, Calcium,
    Magnesium, Iron, Manganese, Zinc, Copper, Sodium,
    Boron, and Molybdenum.

Nitrates

Ammonium (from Acetic Acid Extract)

Moisture / Dry Matter

Selenium

Crude Protein
Routine Package
  pH, Conductivity, Calcium, Magnesium, Sodium,
  Potassium, Carbonates, Bicarbonates, Chloride,
  Sulfate, Nitrate, and Boron

Metals Package
  Phosphorus, Aluminum, Iron, Manganese, Copper,
  Zinc, Nickel, Molybdenum, Cadmium, Chromium,
  and Lead

Anions Package
  (from IC): Nitrates, Chloride, Sulfate, Fluoride,
  Bromide, Phosphate

Analyses by CN Furnace
  Total Nitrogen and/or Total Carbon

Analyses by ICP (Inductively Coupled Plasma-
Atomic Emission Spectroscopy)

ICP Package
  Calcium, Magnesium, Sodium, Potassium,
  Phosphorus, Aluminum, Iron, Manganese, Titanium,
  Copper, Zinc, Nickel, Molybdenum, Cadmium,
  Chromium, Strontium, Boron, Barium, Silicon, Lead
  and Vanadium
Determinations

- pH
- Electrical Conductivity

- Sodium Adsorption Ratio (SAR)
- Adjusted SAR

- Alkalinity
- Hardness
- Turbidity
- Gran Titration Alkalinity
- Sulfide
- Sulfate
- Chloride
- Fluoride
- Bromide
- Arsenic
- Selenium
- Mercury
- Carbonate
- Bicarbonate
- Ammonium
- Nitrate
- Nitrite

- Total Dissolved Solids (Gravimetric)
- Volatile Solids
- Total Suspended Solids
- Total Solids

- Total Nitrogen (by combustion)
- Total Phosphorus

- Ortho Phosphorus (PO4)
- Hexavalent Chromium
- Cyanide
Determinations (cont’d)

Color Test

Redox Potential (eh)

Chlorophyll a

Chlorophyll b

Tannins

Single Element Determinations in Appropriate Extract, by Inductively Couple Plasma-Atomic Emission Spectroscopy

NOTES: Prices do NOT include charge for digest.

Information about specific detection limits available upon request.

Calcium, magnesium, sodium, potassium, zinc, iron, copper, manganese, nickel, lead, chromium, cadmium, molybdenum, vanadium, silicon, boron, phosphorus, barium, strontium, titanium, and aluminum.

Individual Determination by Furnace

Total Nitrogen and/or Total Carbon
Total Organic Carbon (TOC)
Dissolved Organic Carbon (DOC)