

## SOILS

### List of Acronyms

|                        |  |                          |  |
|------------------------|--|--------------------------|--|
| <i>ABDTPA</i>          | <i>Ammonium Bicarbonate<br/>Diethylenetriaminepentaacetic Acid</i> | <i>Mg</i>                | <i>Magnesium</i>                           |
| <i>ABP</i>             | <i>Acid Base Potential</i>   | <i>N</i>                 | <i>Nitrogen</i>                            |
| <i>AGP</i>             | <i>Acid Generating Potential</i>                                   | <i>Na</i>                | <i>Sodium</i>                              |
| <i>ASA</i>             | <i>American Society of Agronomy</i>                                | <i>NaHCO<sub>3</sub></i> | <i>Sodium Bicarbonate</i>                  |
| <i>ASTM</i>            | <i>American Society for Testing and<br/>Materials</i>              | <i>NH<sub>4</sub></i>    | <i>Ammonia</i>                             |
| <i>Ca</i>              | <i>Calcium</i>   | <i>NH<sub>4</sub>OAC</i> | <i>Ammonium Acetate</i>                    |
| <i>COD</i>             | <i>Chemical Oxygen Demand</i>                                      | <i>NO<sub>3</sub></i>    | <i>Nitrate</i>                             |
| <i>DEQ</i>             | <i>Department of Environmental Quality</i>                         | <i>PSA</i>               | <i>Particle Size Analysis</i>              |
| <i>DTPA</i>            | <i>Diethylenetriaminepentaacetic Acid</i>                          | <i>SAR</i>               | <i>Sodium Adsorption Ratio</i>             |
| <i>EC</i>              | <i>Electrical Conductivity</i>                                     | <i>SSSA</i>              | <i>Soil Science Society of<br/>America</i> |
| <i>E</i>               | <i>U.S. Environmental Protection Agency<br/>Agency</i>             | <i>TKN</i>               | <i>Total Kjeldahl Nitrogen</i>             |
| <i>HCl</i>             | <i>Hydrochloric Acid</i>   | <i>USDA</i>              | <i>U.S. Department of Agriculture</i>      |
| <i>HNO<sub>3</sub></i> | <i>Nitric Acid</i>   | <i>WAD</i>               | <i>Weak Acid Dissociable</i>               |
| <i>ICP</i>             | <i>Inductively Coupled Plasma</i>                                  |                          |  |
| <i>KCl</i>             | <i>Potassium Chloride</i>  |                          |  |

TM

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## 1. AGRICULTURAL SOILS

| ANALYSIS PACKAGE                                       |   | COST PER SAMPLE                        |
|--|---|--|
| <b>COMPLETE ANALYSIS - Lawns and Gardens (1 depth)</b> |   | Fertilizer Recommendation and analysis |
| Upper Depth (0-6")                                     | pH, nitrate, sodium, sulfate, salt hazard (conductivity), texture, lime, potassium, organic matter, available phosphorus, calcium | Contact Lab                            |

## 2. SOIL AND OVERBURDEN - ACID-BASE ACCOUNTING

| ACID-BASE ACCOUNTING                                  | DETECTION LIMIT | UNIT                        | PRICE       |
|---|-----------------|-----------------------------|-------------|
| <b>MODIFIED SOBEK METHOD, includes the following:</b> | -               | -                           | Contact Lab |
| Neutralization Potential                              | 1               | T CaCO <sub>3</sub> /1000 T | Contact Lab |
| Acid Potential  | 1               | T CaCO <sub>3</sub> /1000 T |             |
| Acid-Base Potential                                   | 1               | T CaCO <sub>3</sub> /1000 T |             |
| Total Sulfur  | 0.01            | %                           |             |
| Hot Water Soluble Sulfur                              | 0.01            | %                           |             |
| Cold HCl Soluble Sulfur                               | 0.01            | %                           |             |
| Hot HNO <sub>3</sub> Soluble Sulfur                   | 0.01            | %                           |             |
| Residual Sulfur                                       | 0.01            | %                           |             |
| <b>SOBEK METHOD, includes the following:</b>          | -               | -                           | Contact Lab |
| Neutralization Potential                              | 1               | T CaCO <sub>3</sub> /1000 T | Contact Lab |
| Acid Potential  | 1               | T CaCO <sub>3</sub> /1000 T |             |
| Acid-Base Potential                                   | 1               | T CaCO <sub>3</sub> /1000 T |             |
| Total Sulfur  | 0.01            | %                           |             |
| Cold HCl Soluble Sulfur                               | 0.01            | %                           |             |
| Hot HNO <sub>3</sub> Soluble Sulfur                   | 0.01            | %                           |             |
| Residual Sulfur                                       | 0.01            | %                           |             |

## 3. SOIL AND OVERBURDEN – CYANIDES

| PARAMETER                      | DETECTION LIMIT | UNIT  |
|--------------------------------|-----------------|-------|
| Cyanide, Total                 | 0.5             | mg/Kg |
| Cyanide, Weak Acid Dissociable | 0.5             | mg/Kg |
| Cyanide, Free                  | 2               | mg/Kg |

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## 4. SOIL AND OVERBURDEN - NON-METALS

| PARAMETER   | DETECTION LIMIT | UNIT                        |
|---|-----------------|-----------------------------|
| Sample Preparation  | -               | -                           |
| Sample Crushing <sup>(1)</sup>  | -               | -                           |
| Comon Soil Extractions  | -               | -                           |
| Acid-Base Potential   | -               | T CaCO <sub>3</sub> /1000 T |
| Acid Potential  | 0.01            | T CaCO <sub>3</sub> /1000 T |
| Ammonia as N  | 1               | mg/Kg                       |
| Base Saturation   | 0.1             | %                           |
| Bicarbonate, Saturated Paste  | 0.01            | meq/L                       |
| Bromide   | 0.5             | mg/Kg                       |
| Bulk Density  | 0.01            | g/cc                        |
| Calcium, Saturated Paste  | 0.1             | meq/L                       |
| Carbon, Total   | 0.05            | %                           |
| Cation Exchange Capacity  | 0.1             | meq/100 g                   |
| Chloride  | 1               | mg/Kg                       |
| Coarse Fragments + 10 mesh, 2 mm  | 2               | %                           |
| Conductivity, paste extract   | 0.1             | mmhos/cm                    |
| Exchange Sodium Percentage – includes CEC, soluble sodium, available sodium, saturation % | 0.1             | %                           |
| Exchangeable Acidity  | 1               | meq/100 g                   |
| Lime  | 0.1             | %                           |
| Lime Requirement, SMP Buffer Method   | 1               | T CaCO <sub>3</sub> /1000 T |
| Loss on Ignition  | 0.1             | %                           |
| Magnesium, Saturated Paste  | 0.1             | meq/L                       |
| Moisture  | 0.1             | %                           |
| Neutralization Potential  | -               | T CaCO <sub>3</sub> /1000 T |
| Net Acid Generating Potential with Peroxide (includes pH after reaction)                  | 1               | T CaCO <sub>3</sub> /1000 T |
| Nitrate as N (NO <sub>3</sub> )   | 1               | mg/Kg                       |
| Nitrogen, Total Kjeldahl (TKN)  | 1               | mg/Kg                       |
| Nitrogen, Total (TKN+ NO <sub>3</sub> )   | 1               | mg/Kg                       |
| Nitrogen, Organic (TKN – NH <sub>4</sub> )  | 1               | mg/Kg                       |
| Organic Carbon, Organic Matter - Walkley-Black  | 0.1             | %                           |
| pH, saturated paste   | 0.1             | Std. units                  |
| Phosphorus, NaHCO <sub>3</sub> (Olsen)  | 1               | mg/Kg                       |
| Phosphorus (Bray)   | 1               | mg/Kg                       |
| Potassium   | 1               | mg/Kg                       |

(1) - Up to 50 lbs of sample of larger than 3 inch pieces. There is a \$25.00 minimum

(2) - \$300.00 for the first sample; \$50.00 for subsequent samples in the group.

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## 4. SOIL AND OVERBURDEN - NON-METALS, continued

| PARAMETER                      | DETECTION LIMIT | UNIT      |
|--------------------------------|-----------------|-----------|
| Potassium, Saturated Paste     | 0.1             | meq/L     |
| SAR (includes Ca, Mg, Na)      | 0.01            | unitless  |
| Saturation Percentage          | 0.1             | %         |
| Sieve Analysis (Dry)           | 0.1             | %         |
| Sodium, extractable            | 0.1             | meq/100 g |
| Sodium, available              | 0.1             | meq/100 g |
| Sodium, sat. paste             | 0.1             | meq/L     |
| Sulfate                        | 1               | mg/Kg     |
| Sulfur Forms                   | 0.01            | %         |
| Sulfur, Total                  | 0.01            | %         |
| Texture (PSA) sand, silt, clay | 1               | %         |
| Total Carbon or TOC by Leco    | 0.05            | %         |
| Very Fine Sand                 | 0.01            | %         |
| Water Holding Capacity         | 0.1             | NA        |

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## 5. SOIL AND OVERBURDEN - METALS

| PARAMETER  | UNITS |
|--|-------|
| Total Metals Digestion (Method SW 3050)          | NA    |
| Total Metals Digestion, Mercury (Method SW 7471) | NA    |
| Aluminum   | mg/Kg |
| Antimony   | mg/Kg |
| Arsenic  | mg/Kg |
| Barium   | mg/Kg |
| Beryllium  | mg/Kg |
| Cadmium  | mg/Kg |
| Calcium  | mg/Kg |
| Chromium   | mg/Kg |
| Cobalt   | mg/Kg |
| Copper   | mg/Kg |
| Iron   | mg/Kg |
| Lead   | mg/Kg |
| Magnesium  | mg/Kg |
| Manganese  | mg/Kg |
| Mercury  | mg/Kg |
| Molybdenum                                       | mg/Kg |
| Nickel   | mg/Kg |
| Potassium  | mg/Kg |
| Selenium   | mg/Kg |
| Sodium   | mg/Kg |
| Silver   | mg/Kg |
| Thallium   | mg/Kg |
| Vanadium   | mg/Kg |
| Zinc   | mg/Kg |

**ORGANIC CONTAMINANTS** - see *Organic Chemistry* section

**PETROLEUM CONTAMINATED SOILS** – see *Organic Chemistry* section

**RADIOCHEMISTRY** – see *Radiochemistry* section

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## RECOMMENDATIONS FOR SAMPLING AND METHODS LISTINGS

| MEASUREMENT                                       | Extraction Method  | Analysis Method                       | Minimum As Received Sample Required for Analysis |
|---|--|---------------------------------------|--|
| Acid Base Potential (ABP)                         | Calculated from Acid & Neutralization Potential                                  | Calculation                           | 100 g (soil jar)                                 |
| Acid Potential                                    | Calculated from Non-Sulfate Sulfur   | Calculation                           | 100 g (soil jar)                                 |
| Alkalinity, saturated paste                       | ASA Mono. #9, Part 2, Method 10-3.2  | A 2320B                               | 1500 g (half of gallon resealable bag)           |
| Ammonia as N, KCl Extract                         | ASA Mono. #9, Part 2, Method 37-7  | E350.1                                | 100 g (soil jar)                                 |
| Base Saturation                                   | Calculation from NH <sub>4</sub> Oac Ca, Mg, Na, K, and CEC                      | Calculation                           | 1500 g (half of gallon resealable bag)           |
| Carbon, Total                                     | NA   | LECO SC-832<br>(203-601-222)          | 100 g (soil jar)                                 |
| Cation Exchange Capacity (CEC)                    | USDA Handbook 60, Method 19  | E6010/E6020                           | 100 g (soil jar)                                 |
| Chloride (H <sub>2</sub> O Extract)               | ASA Mono. #9, Part 2, Method 10-2.3.2  | E300.0<br>(Ion Chromatography)        | 100 g (soil jar)                                 |
| Coarse Fragments                                  | ASA Mono. #9, Part 1, Method 15-5  | 2 mm sieve                            | 1500 g (half of gallon resealable bag)           |
| Conductivity (EC), saturated paste                | ASA Mono. #9, Part 2, Method 10-3.3  | Conductivity Meter                    | 1500 g (half of gallon resealable bag)           |
| Cyanide, Total                                    | E335.2 (Sed.) Mod.   | E335.4 (midi)                         | 100 g (soil jar)                                 |
| Cyanide, Weak Acid Dissociable                    | ASTM D2036 Mod.  | NA                                    | 100 g (soil jar)                                 |
| Cyanide, Free                                     | ASA Mono. #9, Part 2, Method 10-2.3.1  | Electrode Manufacturer's Instructions | 100 g (soil jar)                                 |
| Exchangeable Acidity                              | ASA Mono. #9, Part 2, Method 9-4.1   | Titration                             | 1500 g (half of gallon resealable bag)           |
| Exchangeable Sodium Percentage (ESP)              | Calculated from CEC, soluble sodium, & extractable sodium                        | E6010/E6020                           | 1500 g (half of gallon resealable bag)           |
| Lime as CaCO <sub>3</sub>                         | USDA Handbook 60, Method 23C   | Titration                             | 100 g (soil jar)                                 |
| Lime Requirement, SMP Single Buffer               | ASA Mono. #9, Part 2, Method 12-3.4.4  | pH meter                              | 100 g (soil jar)                                 |
| Moisture (dry basis)                              | USDA Handbook 60, Method 26  | NA                                    | 100 g (soil jar)                                 |
| Net Acid Generating Potential (NAG)               | Field & Lab. Methods Applicable to Overburdens & Mine Spoil, Sobek, 1978 pp69-72 | Titration                             | 100 g (soil jar)                                 |
| Neutralization Potential                          | USDA Handbook 60, Method 23C   | NA                                    | 100 g (soil jar)                                 |
| Nitrate as N (NO <sub>3</sub> + NO <sub>2</sub> ) | ASA Mono. #9, Part 2, Method 33-8.1  | E353.2                                | 100 g (soil jar)                                 |
| Minimum Resistivity                               | -  | California 643                        | 1500 g (half of gallon resealable bag)           |

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## RECOMMENDATIONS FOR SAMPLING AND METHODS LISTINGS, continued

| MEASUREMENT  | Extraction Method                      | Analysis Method            | Minimum As Received Sample Required for Analysis |
|--|--|----------------------------|--|
| Organic Carbon & Organic Matter (Walkley-Black)          | ASA Mono. #9, Part 2, Method 29-3.5.2  | Spectrophotometer          | 100 g (soil jar)                                 |
| Organic Nitrogen   | Calculation from TKN-NH <sub>3</sub>   | Calculation                | 100 g (soil jar)                                 |
| pH, Saturated Paste                                      | ASA Mono. #9, Part 2, Method 10-3.2    | pH Meter                   | 1500 g (half of gallon resealable bag)           |
| Particle Size Analysis (PSA) includes % sand, silt, clay | ASA Mono. #9, Part 1, Method 15-5      | Hydrometer                 | 1500 g (half of gallon resealable bag)           |
| Phosphorus, NaHCO <sub>3</sub> (Olsen)                   | ASA Mono. #9, Part 2, Method 24-5.4    | E365.1                     | 100 g (soil jar)                                 |
| Phosphorus, (Bray)                                       | ASA Mono. #9, Part 2, Method 24-5.1    | E365.1                     | 100 g (soil jar)                                 |
| Potassium, Available (NH <sub>4</sub> Oac)               | ASA Mono. #9, Part 2, Method 13-3.5    | E6010/E6020                | 100 g (soil jar)                                 |
| Saturated Paste Extracts                                 | ASA Mono. #9, Part 2, Method 10-2.3.1  | E6010/E6020                | 1500 g (half of gallon resealable bag)           |
| Saturation Percentage                                    | USDA Handbook 60, Method 27A           | N/A                        | 1500 g (half of gallon resealable bag)           |
| Sieve Analysis   | ASA Mono. #9, Part 1, Method 15-2.2    | Specified Sieve Sizes      | 1500 g (half of gallon resealable bag)           |
| Sodium Adsorption Ratio (SAR-Ca, Mg, Na)                 | ASA Mono. #9, Part 2, Method 10-3.4    | E6010/E6020                | 1500 g (half of gallon resealable bag)           |
| Sodium, extractable (NH <sub>4</sub> OAc)                | ASA Mono. #9, Part 2, Method 13-4.3    | E6010/E6020                | 100 g (soil jar)                                 |
| Sodium, soluble (saturated paste)                        | ASA Mono. #9, Part 2, Method 10-3.4    | E6010/E6020                | 100 g (soil jar)                                 |
| Sulfate, Water Soluble                                   | ASA Mono. #9, Part 2, Method 28-5.1    | E300.0                     | 100 g (soil jar)                                 |
| Sulfur Forms (Modified Sobek)                            | EPA-600/2-78-054 Method 3.2.6 (Mod)    | LECO SC-832<br>LECO SC-632 | 100 g (soil jar)                                 |
| Total Nitrogen   | Calculation from TKN & NO <sub>3</sub> | Calculation                | 100 g (soil jar)                                 |
| Total Kjeldahl Nitrogen (TKN)                            | ASA Mono. #9, Part 2, Method 31-3.1    | A 4500 N org               | 100 g (soil jar)                                 |
| Total Sulfur   | EPA-600/2-78-054 Method 3.2.4          | LECO SC-832<br>LECO SC-632 | 100 g (soil jar)                                 |
| Very Fine Sands (VFS)                                    | ASA Mono. #9, Part 1, Method 15-5      | 140 mesh sieve             | 1500 g (half of gallon resealable bag)           |
| ABDTPA Extraction  | ASA Mono. #9, Part 2, Method 3-5.2     | E6010/E6020                | 100 g (soil jar)                                 |
| DTPA Extraction  | ASA Mono. #9, Part 2, Method 19-3.3    | E6010/E6020                | 100 g (soil jar)                                 |
| Saturated Paste Extraction (H <sub>2</sub> O)            | ASA Mono. #9, Part 2, Method 10-2.3.1  | E6010/E6020                | 1500 g (half of gallon resealable bag)           |