4.0 ANALYTICAL REQUIREMENTS

Analytical requirements have been separated into two sections: those required for baseline characterization (Table 4) and those required for disturbed and orphaned areas (Table 5). The analyses listed aid in properly characterizing soils for classification and. mapping purposes and making interpretations relative to the quality of the soils as they occur in the undisturbed and reconstructed states. They also assist in developing predictions about the degree of usefulness they may have in the post disturbance situation.

Primary emphasis is placed on particle size distribution and identifying materials which are unsuitable due to unfavourable levels of salinity, sodicity or pH. Fine textured sodic and saline-sodic materials are common in Alberta and can restrict plant growth when they occur at or near the surface.

Analyses to quantify other soil characteristics are required with a lesser frequency. Cation exchange capacity, total nitrogen, total carbon and macronutrient analyses can be useful in assessing the availability and mobility of some nutrients. Extractable aluminum and manganese analyses are useful on low pH soils to aid in assessment of toxicities.

Where possible, McKeague (1978) was cited for the methods of soil analyses. The suggested methods have reasonable levels of precision and accuracy.

Table 4. Minimum analytical requirements for baseline characterization – all regions.

Analysis required on all samples.

Analyses	Notes	Preferred [1] Method	Acceptable Method
pH	If one is interested in soil pH only method 3.11 provides a number of advantages (p. 66 of McKeague). However, the saturation extract (method 3.14) is also used for EC and soluble ion analysis.	3.14 or 3.11	3.13
Saturation [2] Percentage	(i) Samples which need to be resaturated after equilibrating for four hours may be resaturated but must be equilibrated for a further four-hour period prior to extraction. This step may have to be repeated several times to achieve saturation. (ii) If the saturated soil cannot be filtered under normal vacuum, make a note of this and report the pH and saturated % only.	3.21	
Electrical Conductivity[2]		3.21	
Soluble Cations[2] (Ca, Mg, Na, K) and SAR		3.21	
Particle Size Distribution		2.11	2.12

[1] McKeague, J.A. 1978. Manual on soil sampling and methods of analysis. Canadian Society of Soil Science. Ottawa, Canada.

[2] In profiles where there is no evidence of salinity and sodicity these analyses are not required on the A and B horizons but are required on a selected number of other samples. In the Northern Forested and Eastern Slopes Regions a lesser number of overburden samples need be analysed for salinity and sodicity parameters.

continued……

Table 4. Continued

Analyses required on selected samples from two representative profiles (A and B horizons only) per major map unit.

Analyses	Notes	Preferred [1] Method	Acceptable Method
Total Nitrogen[1]		3.622/ 3.624	3.621/ 3.623
Organic Carbon[1]		3.611	3.612/ 3.613
Cation Exchange[2] Capacity	Not required for samples containing free carbonates or crystals of soluble salts	Methods of Soil Analyses, Agronomy No_3 9 2nd Edition	3.32
Exchangeble[2] Cations (Ca, Mg, Na, K)	Not required for samples containing free carbonates or crystals of soluble salts	3.321A	

[1] The methods listed make no mention of automatic C, H, N, and S analysers, specific ion electrodes or ICP units. Methodologies associated with these types of equipment would be acceptable.

[2] Cation exchange capacity and exchangeable cation determinations are done primarily to confirm classification of the soils.

[3] Rhoades, J.D. 1982. Cation exchange capacity. pp. 152-154. In Methods of Soil Analyses, Part 2, Chemical and Microbiological Properties, 2nd Edition. A.L. Page (ed). Published by America Society of Agronomy and Soil Science Society of America, Madison, Wisconsin, USA.

continued……

Table 4. Concluded

Analyses required on selected samples from two representative profiles (A and B horizons) per major map unit and representative samples of parent materials and /or bedrock.

Analyses	Notes	Preferred [1] Method	Acceptable Method
Gypsum[1]	(i) Gypsum may be estimated from the lesser of the Ca or $S0_4$ concentration in samples having a specific conductance less than 2 mS /cm in the saturation extract. (ii) The 5/1 (solution/soil) ratio recommended in the preferred method may be insufficient to extract all the gypsum present. Use a ratio large enough to produce a filtrate with a specific conductance less than 2 mS /cm.		
Calcium Carbonate Equivalent	Samples may be screened on the basis of pH. Any sample having a $CaC1_2$ pH or 6.5 or greater or any sample having a "water pH" of 7.2 or greater should be analysed for $CaC0_3$.	3.43	Methods of Soil Analyses, Agronomy No. 9[2]
Aluminum and Manganese – Extractable	Not required if sample pH is greater than 5.5 (water pH)	4.64	3.32

[1] Not required in areas where the baseline characterization study indicates that salinity and sodicity could not be a problem.

[2] Black, C.A. et al. 1965. Methods of Soil Analysis, Part 1. Part 2, Chemical and Microbiological Properties, Agronomy No. 9. America Society of Agronomy, Inc., Madison, Wisconsin, USA. Calcium carbonate equivalent - Chapter 91 on Carbonate by L.E. Allison and C.D. Moodie, Acid Neutralization Method (91-4) pp. 1387-1388. Note that the estimate of carbonate provided by this procedure will usually be somewhat high because constituents other than carbonate can react to some degree with the acid utilized.

Table 5. Minimum analytical requirements for disturbed lands and nonselectively handled areas.

Analyses	Notes	Preferred [1] Method	Acceptable Method
pH	All depths sampled	3.14 or 3.11	3.13
Electrical Conductivity[2]	All depths sampled	3.21	
Saturation Percentage[2]	All depths sampled	3.21	
Soluble Cations (Ca, Mg, Na, K) and SAR[2]	All depths sampled	3.21	
Sulphate	All depths down to 90 cm	Ion Chromatography ICP[3]	Turbidimetric Method[4]
Total Nitrogen	0 to 15 cm	3.622 / 3.624	3.621 / 3.623
Organic Carbon	0 to 15 cm	3.611	3.612 /3 6.13
Calcium Carbonate Equivalent	All depths down to 90 cm where CaC1 pH > 6.5 or water[2] pH > 7.2	3.43	Methods of Soil Analyses, Agronomy No.9
Particle Size Distribution	All depths sampled	2.11	2.12

[1] McKeague, J.A. 1978. Manual on Soil Sampling and Methods of Analysis. Canadian Society of Soil Science. Ottawa, Canada.

[2] Not required in areas where the baseline characterization study indicates that salinity and sodicity are not a problem.

[3] Ion chromatography or ICP determination of S in water extracts are preferred methods however equipment availability could be a concern

[4] Turbidimetric Method - One turbidimetric method that can be used is: Greenberg, A.E. (ed). 1981. Standard Methods for the Examination of Water and Wastewater. 15th Edition. Published jointly by American Water Works Association, American Public Health Association and Water Pollution Control Federation. Turbidimetric Method for sulphate. pp. 439-440.