COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC Operator Guidance

Rule 915.b - Soil Suitability for Reclamation

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Rule Citations

915. CONCENTRATIONS AND SAMPLING FOR SOIL AND GROUNDWATER

b. Soil Suitability for Reclamation. Operators will adhere to the concentrations for soil in Table 915-1 for restoring soil to the agronomic properties for electrical conductivity ("EC"), sodium adsorption ratio ("SAR"), pH, and boron for soils. Subject to prior approval by the Director, Operators may leave materials with elevated concentrations of EC, SAR, or pH in situ. In such cases, the Operator will provide a detailed Reclamation plan that includes, but is not limited to, soil analysis from adjacent undisturbed lands, revegetation techniques, site stabilization, and details of seeded species.

913. SITE INVESTIGATION, REMEDIATION, AND CLOSURE

b. General Site Investigation and Remediation Requirements.

(2) Sampling and Analyses. Operators will conduct sampling and analysis of soil and Groundwater pursuant to Rule 915 to determine the horizontal and vertical extent of any contamination in excess of the cleanup concentrations in Table 915-1 or in WQCC Regulation 41 numeric and narrative Groundwater quality standards and classifications, as incorporated by reference in Rule 901.b.

Purpose of Rule

Rule 915.b codifies, to some extent, the prior practices under the 2009 Frequently Asked Question (FAQ) 32 which allowed operators to leave soils with elevated SAR, EC, and pH at a 3 foot depth in situ following remediation of hydrocarbon impacts or during pit closure. Consistent with the Mission Change, however, the requirements under the new Rule are more stringent than the former application of FAQ 32. There are limitations and requirements which must be met in order for the operator to obtain relief from the clean up standards.

RULE 915.B GUIDANCE

Rule 915 is clear that the soil suitability properties of SAR, EC, pH and boron are clean-up standards. Residual contamination from these inorganic parameters can both inhibit vegetative growth and negatively affect groundwater. The presence of these inorganic contaminants is indicative of produced water spills and therefore soil containing elevated levels of these contaminants are considered E&P Waste. However, Rule 915.b, like FAQ 32 before it, recognizes that, if properly conducted, leaving the material in place may represent less environmental risk than removal by excavation and replacement with clean fill.

Before a site can be considered for relief under Rule 915.b, the nature and extent of contamination must be fully understood. Therefore, in accordance with Rule 913.b.(2), the operator must delineate the contamination before providing a plan to leave it in situ.

Rule 913.b.(2) Guidance, as Applicable to SAR, EC, Boron, and pH

Rule 913.b.(2) states that "Operators will conduct sampling and analysis of soil and Groundwater pursuant to Rule 915 to determine the horizontal and vertical extent of any contamination in excess of the cleanup concentrations in Table 915-1…" Therefore, it is appropriate that soil impacts from SAR, EC, boron, and pH are delineated. The following outlines COGCC's expectations for delineation of these four inorganic pollutants in accordance with Rule 913.

1. Delineation is on a site-specific basis; delineation methodology will be subject to approval by the Environmental Unit on a Form 27.
2. Completion of delineation will be reported on a Form 27, subject to approval by the Environmental Unit.
3. Delineation will be subject to background concentrations of SAR, EC, pH and boron. Background sampling for these inorganics shall be taken, at minimum, within the plant root zone.
4. When documenting vertical confirmation of SAR, EC, pH and boron, take samples within the documented site-specific plant root zone (see figure in Appendix A). As long as confirmation samples taken within the root zone comply with Table 915-1, deeper samples beyond the root zone and at no risk to groundwater may exceed soil suitability levels for Table 915-1, only with Director approval of a site-specific Reclamation plan pursuant to Rule 915.b.
5. The soil material proposed to be left in situ must be characterized at a minimum from the surface through the root zone for SAR, EC, and pH . At no time will soil with SAR, EC, pH or boron levels that exceed Table 915-1 be left within the root zone. At no depth can soils that exceed boron standards be left in place without an approved variance.

6. The horizontal and vertical extent of material with elevated SAR, EC, boron or pH concentrations may be established through soil boring, pot-holing, or excavation with no less than four points to establish the extent.
7. While field screening is possible for these constituents, and should be used to guide field activities, delineation will be finalized with laboratory analysis.
8. Composite sampling is not appropriate, and discrete soil samples at no more than one foot increments should be collected from appropriate depths within the soil column.
9. Delineation will be completed prior to developing the site-specific Reclamation plan required by Rule 915.b (discussed below).

Rule 915.b Guidance

Following completion of delineation of impacts, the Operator may submit a request to leave soils containing elevated concentrations of SAR, EC, and pH in situ as part of their closure plan for the site. In such cases, "the Operator will provide a detailed Reclamation plan that includes, but is not limited to, soil analysis from adjacent undisturbed lands, information on replacement subsoil and topsoil, revegetation techniques, site stabilization, and details of seeded species." A template document for the Reclamation plan which includes the necessary information is provided in Attachment A; use the template as guidance for writing the Reclamation plan for COGCC review. To ensure efficient processing and approval, the Reclamation plan for the purposes of requesting relief under Rule 915.b should include the following, without limitation:

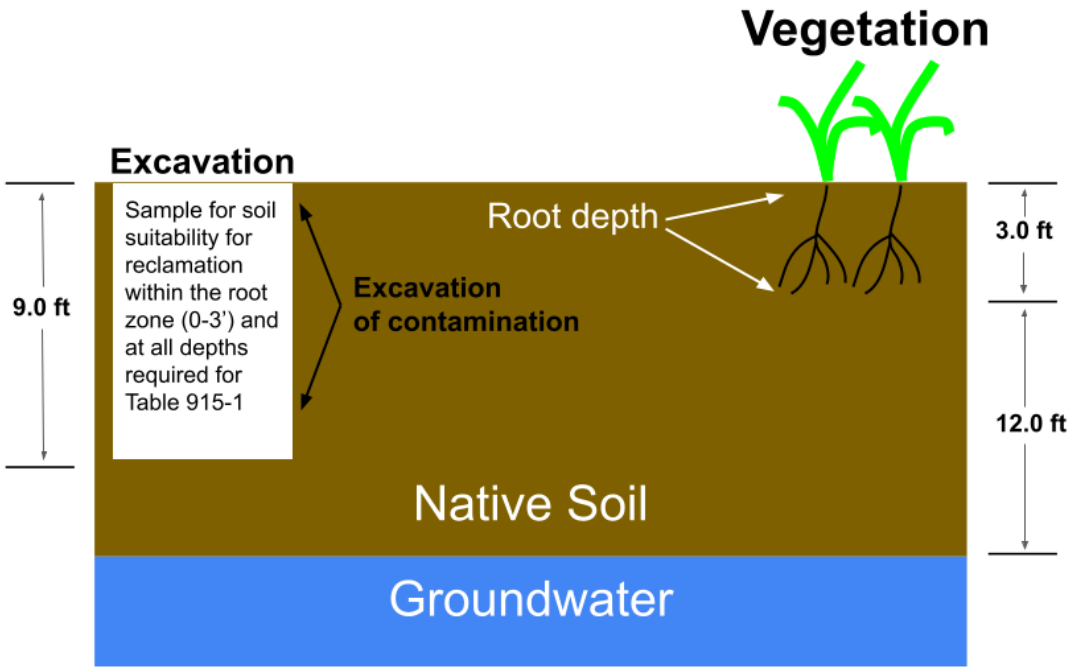
1. Description of the location, source, and nature of contaminants and site characterization, including reference or background information;
2. Soil property information for both reference and disturbed/affected areas, including descriptions, depths, qualitative and quantitative information, other soil quality influences;
3. Site preparation, grading, decompaction, stabilization, stormwater management;
4. Seed mixtures, including consultation with Surface Owner, soil conservation district, CPW, BLM etc.;
5. Weed management, including for noxious and nuisance species;
6. Site controls; and
7. Reclamation monitoring.

General Notes

The Reclamation plan should be tailored to the site-specific circumstances and will be evaluated for approval by the COGCC Reclamation Group to ensure that the Operator has planned for a successful reclamation project which will minimize the potential for land degradation, habitat, or agronomic loss, and will optimize in a timely manner the land reclamation. Please note if The Operator requests a variance from the reclamation rules on behalf of the Surface Owner this request should be included in the Reclamation plan; however all variances from the rules of this nature require a hearing notice for the Commission to consider approval or denial of the variance.

APPENDIX A
Sampling Figure for Soil Suitability

This is one example to illustrate where to conduct soil suitability for reclamation sampling after an Operator has performed an excavation activity to remove contamination. In this example, the plant root zone is in the top three feet of the surface based on the site-specific reference vegetation. The Operator shall take samples within the excavation zone and within the top three feet where the root zone is observed. Sampling shall continue for the full depth required by other Table 915-1 sampling. Samples deeper than the root zone, in this case three feet, that will not pose a risk to groundwater may exceed inorganic levels for Table 915-1 with prior Director approval.



APPENDIX B
Reclamation Plan Template

Title Page:
Reclamation Plan for Rule 915.b.
Operator Name/Number:
Location Name:
Location Number:
Date:

Table of Contents

1.0 Location Description

1.1 Site Characterization

Include a description of the project area and why the Reclamation plan is developed (e.g. bury soil materials with high SAR and pH below the plant root zone).This should include the plant community type and perennial vegetation cover estimates before disturbance or current cropland use . Include information on the adjacent and surrounding land use(s), slope ratio, slope aspect, depth to groundwater and the total estimated size of project area disturbance as constructed (in acres) including access road, on or off-site facilities, well pad, and all pipelines and utility corridors. Include a description of the source and cause of elevated EC, SAR, or pH, as applicable, and describe prior source area and site remediation work. Include a summary of the horizontal and vertical delineation and mass estimate of soil materials affected by high EC, SAR, or pH.

1.2 Reference Area Characterization

Include a description of vegetation within the reference area, reference area coordinates (latitude/longitude), vegetation percent cover estimates and a comparison of the reference area to the project area, by contrasting vegetation, soil type, slope ratio and aspect, etc. Include specific soil sample locations.

1.3 Timing

Include a schedule of completed and planned and reclamation activities including, but not limited to:

1. Soil sampling (include past dates)
2. Consultation for a requested Seed mixture with the Surface Owner.
3. Stormwater BMP installation (include past dates)
4. Soil movement and recontouring
5. Decompaction
6. Topsoil Placement
7. Soil Amendments
8. Seedbed preparation
9. Seeding
10. Seedbed stabilization

2.0 Soil Properties

2.1 Soil description

Include a description of NRCS soil map units or other soil mapping resources within the project area, including the soil profile, soil properties, erosion potential, and any other useful information in the soils description.

2.2 Subsoil

Replacement subsoil should be of the same quality as the reference soil and complies with Table 915-1. As per the 1003.d. for pits or other large excavations, the COGCC may request the following: texture, SAR, EC, pH, boron, percent calcium carbonate equivalency (gravimetric) and total volume of soil in cubic yards to be replaced.

2.3 Topsoil

Include a description of the depth and total volume of topsoil salvaged during construction, location of topsoil storage, volume and depth of topsoil to be used during reclamation of the affected soil areas to be reclaimed, and the volume and location of topsoil that will remain stockpiled for interim or final reclamation. If topsoil will be imported, then it shall be from a source that does not have weed infestation of any kind and should include at a minimum, the following agronomic soil analysis:

- pH, electrical conductivity (EC), SAR, and Boron (methods per the Table 915-1; all values rounded to the nearest 0.10);
- organic matter (Walkely-Black method);
- nitrate, ammonium nitrogen, phosphorus, potassium, zinc, iron, manganese, copper, and chloride (all using AD-DTPA extraction);
- lime and texture estimates;
- percent calcium carbonate equivalency (gravimetric);
- texture (hydrometer with textures reported as USDA); and
- plant available Selenium[1].

2.3 Affected Soil Analysis/Soil Suitability for Reclamation

Include a description of the soil horizons encountered within the affected soil location. The soil horizon profile analysis should include at a minimum, profile depths and soil properties, for the vertical and horizontal extent of the affected soil analysis. Additionally, vegetation root zone depths must be included in the area of the affected soil analysis. Affected Soil Analysis and Root Zone Depths by plant species should be provided in the Supporting Data attachment.

[1] Only applicable for areas of the State with known high Selenium .

2.4 Contouring and Compaction Alleviation

Provide a description of decompaction equipment to be used and methods (i.e., cross ripping to 18 inches depth). Describe the recontouring for the cut and fill slopes, and any other soil materials to be used during the reclamation. Include the volume of soil to be used for the recontouring.

Include a description of how segregated soil horizons (including topsoil) will be replaced and contoured to achieve erosion control and long-term stability. Description should include how the recontouring will blend with surrounding topography and re-establish pre-disturbance hydrology patterns and flood irrigation grading.

3.0 Seeding

3.1 Seed Mixture Consultation

Document the seed mixture surface owner consultation in order to determine whether to use a surface owner requested seed mixture or a seed mixture recommended by the local soil conservation district (NRCS). Potential use of an all native seed mixture provided through Colorado Park and Wildlife consultation may be required, and should be included in this plan (as described in 3.2 below).

3.2 Seed Mixture

Include a table with the seed mixture based on the number of pure live seeds per square foot to be applied. Include in the seed mixture table, the pure live seeds per square foot (e.g. 100 seeds per square foot), the plant species scientific and common names, named varieties, and pure live seed to be applied by weight. The seed mixture can be an attachment to the plan or an embedded table in this section.

3.3 Seeding Methods

Include a description of how the seedbed will be prepared to promote optimal seed/soil contact. Include the seeding method, seeding depth, timing, fertilizers or soil amendments (if used), and watering schedule (when applicable).

4.0 Site Stabilization and Stormwater Erosion

4.1 Site Stabilization Methods

Include a description of erosion control methods to be installed and maintained until location is stabilized through established desirable perennial vegetation, or established crop vegetation. Erosion control methods could include Best

Management Practices ("BMPs"), such as weed free mulch, erosion control blankets, hydromulch, etc., that can protect bare or seeded soils. Include a description of materials to be used, and how they will be installed and maintained.

4.2 Stormwater Controls

Include a detailed description and figure with all of the long-term and short-term stormwater controls (include sizes of BMPs) to be installed and maintained throughout the life of the reclamation project until the project reaches the reclamation vegetation standards. Include a description of materials that will be used and how they will be installed and maintained.

5.0 Weeds

5.1 Weed Management for Vegetation Establishment

Aggressive weeds can rapidly become established after disturbance and threaten the establishment of desirable perennial vegetation. Describe how all weeds and undesirable species will be managed to promote establishment of the desirable perennial vegetation or crops.

5.2 Weed Management

Describe any State or County-listed noxious weeds observed in or near the project area. Include a description of how and when noxious weeds and undesirable species will be treated, including a description of how damage to desirable plant seedlings will be avoided if herbicide is used.

6.0 Fencing

If installed, identify the type (e.g. wildlife friendly, livestock, etc.), materials, and area to be fenced, if needed, to ensure that vegetation is not overgrazed.

7.0 Monitoring

Include a schedule and description of monitoring activities for compliance with this plan. This includes monitoring for compliance with all 1000 Series rules. For instance, monitoring for compliance with the revegetation standards, a crop assessment of density and height, presences of weeds and other undesirable species, site stabilization, and stormwater erosion. Monitoring documents need to record deficiencies identified and corrected (in a timely manner).

Monitoring should be conducted at a frequency that allows the operator to rapidly detect and respond to issues identified during monitoring inspections.

For example, monitoring could be conducted on a monthly basis during the active growing season until site stabilization is achieved with desirable vegetation , and then quarterly to identify weeds and stormwater issues. Monitoring should be conducted more frequently during and after high precipitation events, snow melt, or significant weed treatments to identify and mitigate stabilization or any other issues before site degradation occurs.

8.0 Justifications

Based on the information provided within this Reclamation plan, Operator shall provide justifications detailing how leaving the impacted materials at the indicated depth will not cause adverse impacts to public health, safety welfare the environment and wildlife, including groundwater and reclamation efforts. As a justification for leaving impacted material at depth, root depth information must be provided for the crops planted or the perennial plant species in the reference areas and in the seed mixture. The individual plant root depth information must have scientific backup documentation and sources provided with the plan.

Reclamation Figures

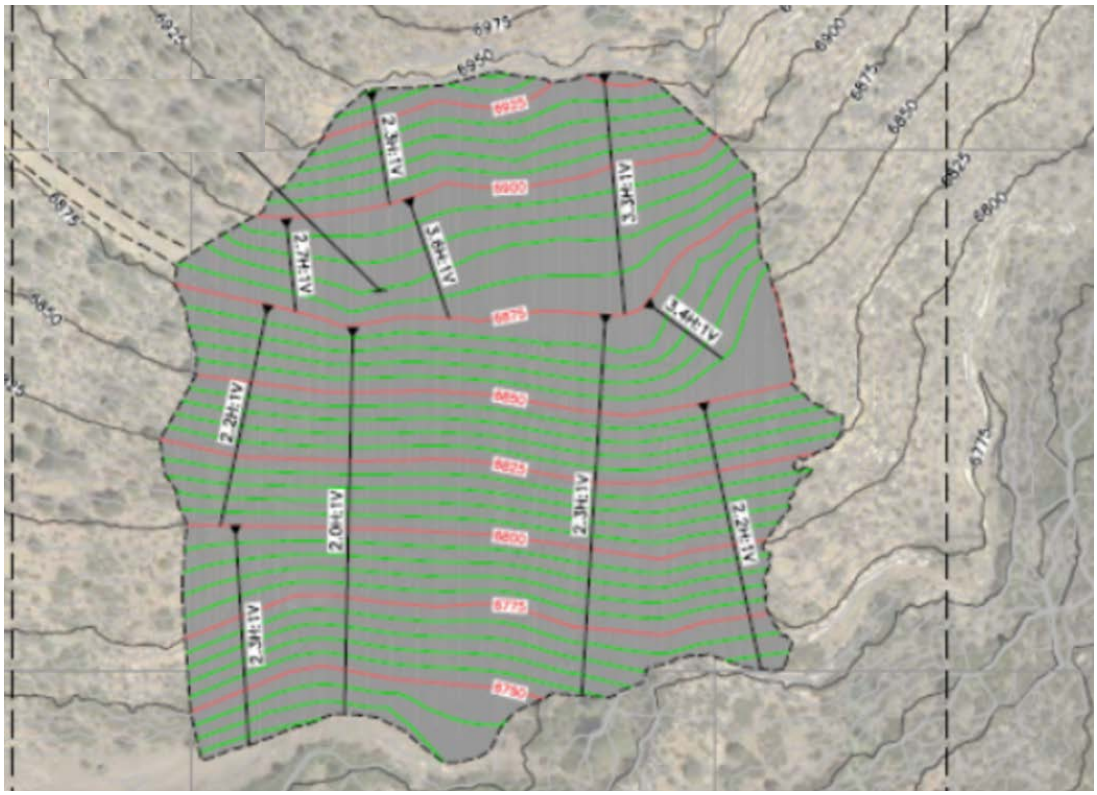
Instructions- The following should be included in Reclamation Figures:

1. Include a figure with a small-scale aerial photograph with an overlaid drawing that clearly depicts the boundaries and locations of any spills, remediation projects, wells, facilities, pits and equipment that are part of the production areas, as well as the areas that will be reclaimed. Figure should show the entire disturbance area for the well location and other project features (ie: access road, staging, offsite facilities, pipelines and utility corridors, spills etc.).
2. Figure should show the reclamation area with acreages.
3. Identify and detail all stormwater controls
4. Include a detailed legend for all figures. Include location name, number, and operator name.
5. Figure should summarize reclamation areas in a small table such as this:

Production, Cuttings Management Area or Spill/Release Area	XX ac
Reclamation Area	XX ac
Total Location Disturbance	XX ac
Access Road Disturbance/Roadside Area to be Reclaimed	XX ac/XX ac
Flowline and/or Utility Line, spills or other high soil properties, affecting Reclamation Disturbance. To be Reclaimed	XX ac
Staging Disturbance Area to be Reclaimed	XX ac
Total Area to be Reclaimed	XX ac

6. Figure should include survey information showing placement of materials with exceedances. Included on the figure, the horizontal and vertical extent of the exceedances.
7. Figure should Include on an aerial, soil sampling locations need to be shown, including where reference samples were taken.

8. A figure should include contours of the Location during all phases of Oil and Gas Operations, including but not limited to, pre-Oil and Gas disturbance, post pad construction, and interim and final reclamation. See example below, showing an example of how Final contours should be shown.



9. Contouring figure(s) should also include, at a minimum, details showing cut and fill balances, as well as the final placement (location and depth) of all materials with Table 915-1 exceedances of Boron, EC, SAR or pH requested to be left on location. This will show how leaving impacted soils may affect recontouring.

Supporting Data

Instructions- The following information should be included in attachments providing Data:

1. Provide all soil data analysis. Include affected soil and the reference soil data at all analysis depths.
2. If topsoil is to be brought in include all data analysis for agronomic properties for all topsoil sources and for the reference topsoil
3. Vegetation assessment data- Vegetation Assessment Data from Project area and Reference Area
4. Root depth information for the species that exist and the proposed seed mixture

Photos

Instructions: The following photos should be included in the document attachments:

1. Location photos taken prior to burying impacted materials.
2. Reference area vegetation, from four cardinal directions and close ups of the vegetation.
3. Identify each photo with a date stamp and direction of view.
4. Photos will be in sufficiently high resolution so that details are readily discernible.