Government of Saskatchewan

Detailed Site Assessment Requirements

Directive PNG018

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Revision 1.0

Governing Legislation:

Act:	*The Oil and Gas Conservation Act*
Regulation:	*The Oil and Gas Conservation Regulations, 2012*
Order:	251/18

Record of Change

Revision	Date	Description
0	November 2013	
1.0	November 2015	Update to facilitate IRIS implementation in 2015.

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1. Introduction

As per *The Oil and Gas Conservation Regulations, 2012* (OGCR), upon abandonment of a well or decommissioning of a facility the licensee must undertake activities that will result in reclamation of the associated site.

Note that "**reclamation**" as defined in section 2(jj) of the OGCR, includes two objectives:

1) Decontamination and remediation of the site which includes: excavating, removing, sequestrating, encapsulating, immobilizing, attenuating, degrading, processing or treating the contaminants in the soil or water in a manner so that, in the opinion of the minister, the contaminants no longer pose a threat or risk to human health, public safety, property or the environment; and

2) Re-contouring and restoration of the site which includes: landscaping, replacing or replenishing the topsoil and re-vegetating the surface of the soil so that it is compatible with its surroundings.

The focus of this document is with respect to the second part of the reclamation definition or the physical restoration of the site once it has been decontaminated and remediated. This document establishes the Detailed Site Assessment (DSA) requirements, to be used by the third party consultants, within Saskatchewan as set out by the Ministry of Energy and Resources (ER) under the Acknowledgement of Reclamation (AOR) Program. As part of the AOR application the third party consultant is required to complete the *DSA Form* (available on Saskatchewan.ca) to provided evidence that the site meets the criteria requirements in this Directive. An example of a completed DSA Form is provided in Appendix B.

As mentioned in the *AOR Requirements Directive*, a passing DSA is a required component of the AOR application within Saskatchewan. The licensee is expected, within reason, to work with the landowner towards a solution for issues that may exist, until a passing DSA is achieved.

1.1 Background

The restoration of abandoned well sites and associated facilities in Saskatchewan is the responsibility of the licensee. The intent of this document is to provide the licensee with restoration criteria that will ensure the consistent quality of restoration throughout industry resulting in reclaimed sites which are stable and have little risk of impaired capability.

It is important to recognize that restoration is impacted by construction practices, by operational management during the life cycle of the site and by practices used during the decommissioning, remediation and restoration processes. Proper soil conservation, prevention of contamination and timely remediation of contamination issues during the life of the site will result in a more successful restoration of the site at the end of its production life cycle.

Successful site reclamation will result in a site that is consistent in terms of land usage and vegetation with that of the surrounding area. Therefore, in the evaluation of the assessment criteria (landscape, soil, vegetation) the data and observations collected should be compared to suitably selected control locations on adjacent or surrounding lands. In certain circumstances it

is acceptable to find representative control land farther from the site, however, the reasons for doing this must be explained in the application.

Topsoil Salvage and Storage – Prior to site construction the topsoil should be stripped at the site and salvaged in a location that is away from potential disturbances (i.e. traffic routes, natural drainage, slopes, etc.). Topsoil stockpiles should be protected from wind and rain through the use of suitable seeding and other measures as necessary.

All contamination must be treated or removed prior to the completion of a DSA. Specific criteria for the assessment and remediation of contaminants (i.e. salts, metals, sterilants, organic chemicals) can be located within the *SPIGEC 4 Upstream Contaminated Sites Remediation Guideline* (available on Saskatchewan.ca). Note: the DSA accompanying the AOR application should be conducted after the minimum required monitoring period has passed; where soils were left in place at a site which had salinity and/or sodicity concentrations which triggered monitoring criteria as specified in *SPIGEC 4*.

AOR applications will be rejected if the DSA is incomplete and/or non-compliant. NOTE: If some parameters within the DSA fail to meet the requirements outlined in this document, the third party consult may still recommend the DSA passes, however, reasonable and detailed justification for doing so must be provided within the DSA.

The following sections describe the minimum acceptable assessment density and level of detail required within the DSA. On sites with a great deal of variability, or sites where justification for deviation from the criteria is submitted, more detail is required.

1.2 Governing Legislation

The requirements outlined in this Directive are based on *The Oil and Gas Conservation Act* (OGCA) and the OGCR. Licensees should consult these documents in conjunction with this Directive.

It is the responsibility of all licensees, as specified in the legislation, to be aware of and to ensure compliance with these requirements through the life-cycle of any well or facility licensed in Saskatchewan.

1.3 Definitions

Anomaly – A result at an assessment location that does not appear representative of the entire grid being evaluated. If an anomaly is encountered, a step-out assessment procedure may be used to see if the location is anomalous or representative of the grid.

Ecosite – a recurring site or stand level representation of ecosystems having a relatively homogeneous combination of soil, site, and vegetation characteristics.

Forage – Perennial agronomic species grown for the purpose of feed.

Justifications – Explanation of why a site should be approved for an AOR if some of the criteria have not been met. This information must be included in the Detailed Site Assessment.

One Full Growing Season – Is the vegetation assessment timing for grasslands, cultivated (perennial) lands or peatlands; which includes an over-wintering period and a minimum of 12 months after initial seeding. For example, a lease was abandoned and reclaimed in October 2010, it was then seeded in May 2011 and the crop runs one full growing cycle in 2011 (i.e. seeding, growing months, harvested). Therefore the earliest a DSA could be conducted for this lease would be within the growing season of 2012 (i.e. June).

Organic Matter (OM) – The organic fraction of the soil includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by the soil population. It is usually determined on soils that have been sieved through a 2.0-mm sieve. (Canada Department of Agriculture, 1976)

Peat – Unconsolidated soil material consisting largely of un-decomposed or only slightly decomposed organic matter; mainly derived from mosses or sedges. (Canada Department of Agriculture, 1976)

Public Lands – Land of the Crown in the Right of Saskatchewan; includes provincial forests.

Site – means, when used in relation to a well, structure test hole, oil shale core hole or facility, the site of the well, structure test hole, oil shale core hole or facility and the area immediately adjacent to that site.

Step-Out Assessment – When an anomaly is encountered at an assessment location, the third party consultant may opt to conduct a step-out assessment to determine if it is representative of the whole grid or not. A step-out consists of assessing a minimum of an additional 3 locations. These additional locations will be less than 10 m from the original point in a triangular shape around it.

Surface Soil – The uppermost mineral/organic material valued as a growing medium. Surface soil is typically salvaged at the time of lease preparation to be used in the future reclamation of the site.

2. Reclamation Criteria - Cultivated Lands

Cultivated land includes any land that has been ploughed to prepare a seed bed at some point in time and has a well-defined ploughed surface including cultivated peat soils. The cultivated land criteria apply to lands under continuous and rotational cropping systems and hay land.

The following provides a summary of the criteria upon which the DSA is to be conducted:

- *Landscape:* drainage, erosion, contour, stability, gravel & rocks, debris.
- *Soil:* surface soil quantity, distribution and quality (% admixing/texture/strength/ aggregate size), topsoil and subsoil profiles.
- *Vegetation:* plant (species/health/height/density), bare areas, weeds (species/type/density).

2.1 Site Assessment Sampling Scheme

In general, sites are to be assessed by establishing a suitable assessment grid (as described in the following sections); followed by measuring/observing the various assessment criteria within

each grid. The results are compared to suitably selected controls located on lands surrounding or adjacent to the site.

Note that the term "**site**" as defined in the OGCR is not constrained to the boundaries of the lease, but rather includes any areas beyond the lease boundaries that were impacted by the operations at the site. Therefore, grids should be designed to include these impacted areas beyond the lease boundaries; unless these areas were previously reclaimed and received the approval of the ministry.
NOTE: An assessment is not required on areas of the lease or access that have received an Exemption from Reclamation issued by ER or were authorized by the landowner(s) to be left in place as an "improvement" (i.e. access road, cement pad, etc.).

2.1.1 Lease

For a standard 100 m x 100 m lease, the lease assessment should be conducted using 9 grids (each approximately 33 m x 33 m) and the edge of the lease assessment area should match up to the lease boundary, as shown in Figure 1.

The assessment grid and grid size should be adjusted to evenly cover the entire lease and account for odd size leases, for example:

- If the lease is < 40 m x 40 m, then 3 grids should be used.
- If the lease is 40 m x 40 m, then 4 grids, each at 20 m x 20 m should be used.
- If the lease is 80 m x 80 m, then 4 grids, each at 40 m x 40 m should be used.
- If the lease is 110 m x 110 m, then 9 grids, each at 37 m x 37 m should be used.
- If the lease is 120 m x 120 m, then 9 grids, each at 40 m x 40 m should be used.
- If the lease is > 120 m x 120 m, then 9 grids, each at ≤ 50 m x ≤ 50 m should be used.
- If the lease is > 150 m x 150 m, then 16 grids, each at > 38 m x > 38 m should be used.

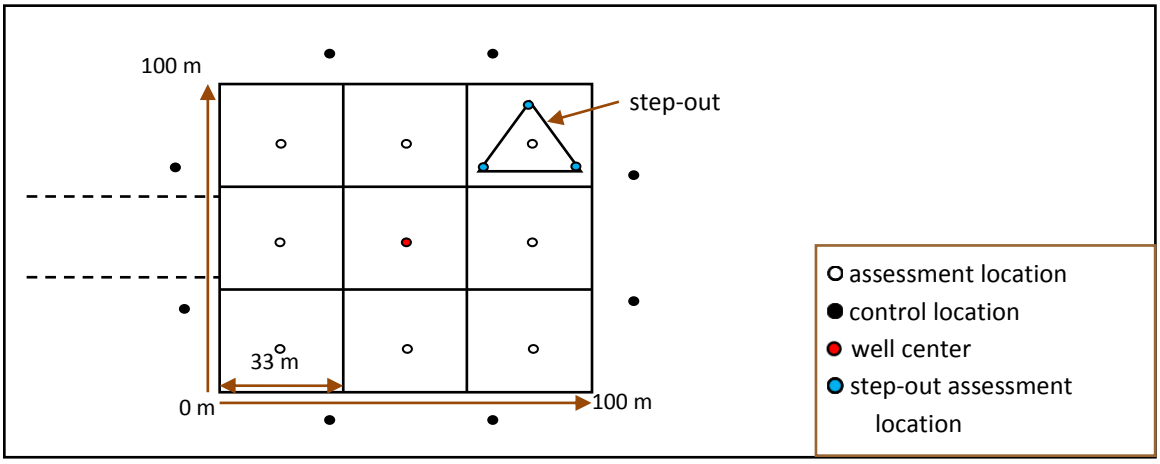


Figure 1. *Assessment locations within an approximate 33 m x 33 m assessment grid on a 100 m x 100 m lease. Soil and vegetation data are collected at each assessment location.*

In general, the assessment location will be in the middle of each grid, however, adjustments should be made or additional locations assessed when the following locations are known: **well centre, sump, flare pit, tank storage area, entrance to lease, historical spill areas or areas of concern noted in either the Phase I or Phase II ESA's.**

When an anomaly is encountered at a lease assessment location, the third party consultant may opt to conduct a "**step-out**" assessment to determine if the anomaly is representative of the entire grid. The step-out assessment process consists of assessing three additional locations which can be up to 10 m from the original point in a triangular shape around it, as shown in Figure 1. The data for the original assessment location, along with the individual step-out data must be reported on the step-out portion of the DSA form. The average of the step out data, denoted as SO #, should then be transferred into the lease assessment table in place of the original assessment point data and used when assessing the criteria requirements for that particular grid.

2.1.2 Controls

In the evaluation of the assessment criteria (landscape, soil, vegetation) the data and observations collected should be compared to suitably selected control locations on adjacent or surrounding lands. Care should be taken when selecting these locations to ensure that they are representative of the average conditions that exist on the surrounding lands with respect to the various evaluation criteria. In particular, the quantity and quality of vegetation may be used as a primary indicator for determining the suitability of control locations.

A **minimum of eight control sites** (two on each side of the disturbed area) must be assessed to provide comparisons for the disturbed area (100 m x 100 m lease situation). In some cases, eight control sites may not adequately represent the natural variability of the surrounding lands and the third party consultant must use their professional judgement. Where control site characteristics vary significantly, the third party consultant may use relevant controls to represent portions of the site. It must be clearly documented which controls represent which assessment points.

Minimum control requirements for different lease sizes:

- If the lease is < 40 m x 40 m, then 3 control points should be used.
- If the lease is 40 m x 40 m, then 3 control points should be used.
- If the lease is 80 m x 80 m, then 4 control points should be used.
- If the lease is 110 m x 110 m, then 8 control points should be used.
- If the lease is ≥ 120 m x 120 m, then a minimum of 8 control points should be used.
- If the lease is > 150 m x 150 m, then a minimum of 16 control points should be used.

Controls can be averaged to determine required replacement depth. If controls are variable, relevant controls can be compared to portions of the lease. **Highlight the portion of the lease each control represents on the DSA Sketch** (as shown in Figure 2). If controls are highly variable and the Minimum Replacement Depth (MRD) cannot be achieved, the third party consultant may qualify results based on control variability. Figure 3 shows a generic control situation that is most common for most upstream oil and gas sites in Saskatchewan.

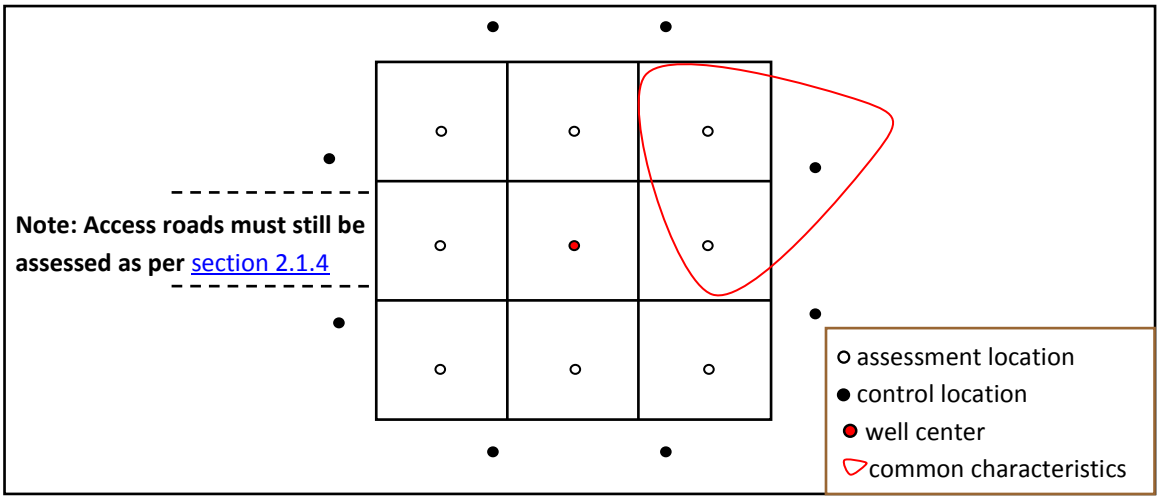


Figure 2. *Example of a site that has variability in topography, soils and land management. Two grid sampling points are represented by a specific control sample point. This must be documented in the DSA form. NOTE:* ***High variability sites may require addition sample points and control sites to properly assess the site.***

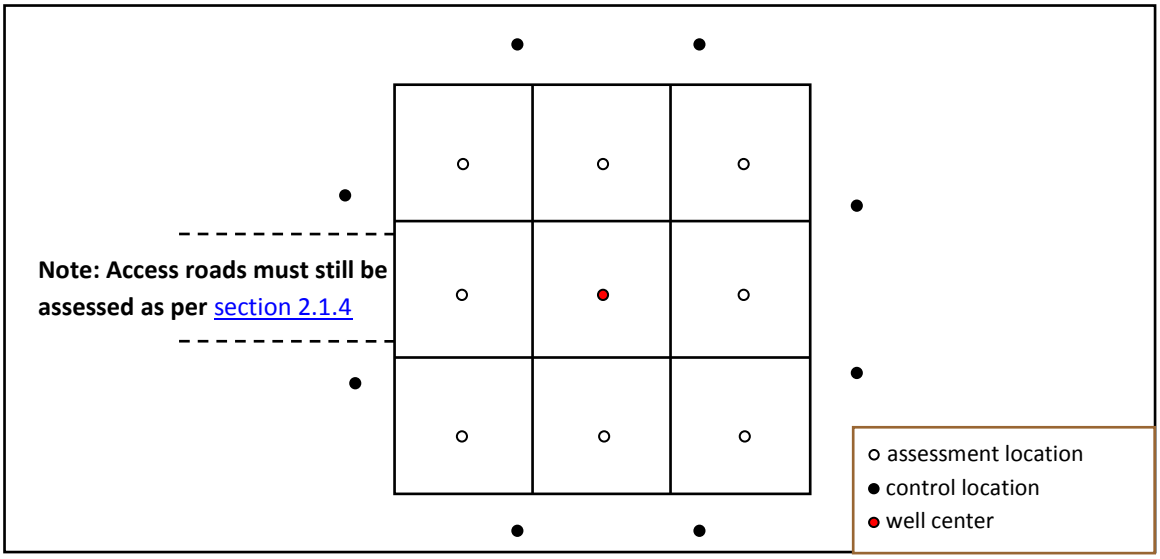


Figure 3. *This is a generic control sample situation where the topography, soil characteristics and land management are consistent throughout the entire site. This is typical of the majority of sites encountered in Saskatchewan. In this situation the eight controls would be averaged together in the assessment.*

2.1.3 Minimal Disturbance Lease

Where construction practices have minimized the level of disturbance on a lease a reduction in sampling intensity can be justified. On minimally disturbed sites the undisturbed and disturbed areas must be delineated and a minimum of three samples from each area (disturbed, undisturbed and control) should be taken, as shown in Figure 4.

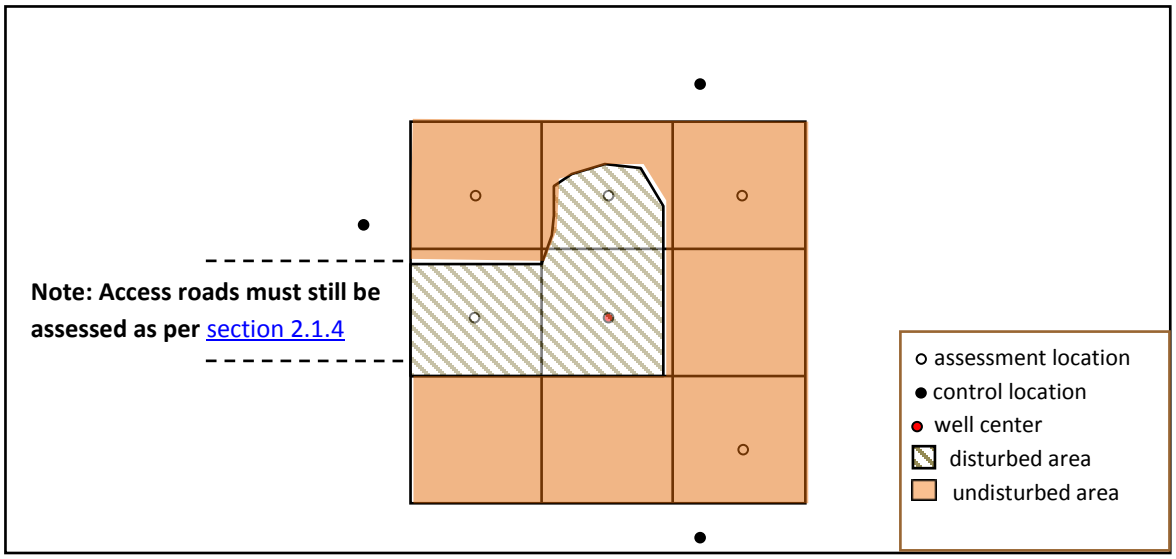


Figure 4. *Example of a minimally disturbed site. The minimum sampling requirement is three assessment locations on the disturbed portion of the lease, three assessment locations on the undisturbed portion of the lease and three control assessment locations off-lease.*

2.1.4 Access

For the access, associated with the lease, the assessment shall be conducted on a paired assessment basis (one on the access and one in a control area). The assessment locations should be adjusted so they are representative of disturbed and control areas, but must also address variability. Assessment points should be adjusted so that the access approach areas are inspected.

At a minimum the access should be assessed as follows:

- For an **access roads ≤100 m in length**, examine a minimum of two paired assessment points. If the topography is variable, more assessment points shall be used.
- For an **access >100 m in length**, assessment points should be located at intervals **no more than 100 m apart**. For example, for a 500 m road, a minimum of five assessment points would be required but they may not necessarily be evenly spaced. If the topography is variable, more assessment points should be used.

2.2 Landscape

Landscape criteria will be assessed by comparing the site with adjacent land. Differences between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or off-site.

Landscape criteria are assessed by looking at the site as a whole rather than individual assessment points. It is necessary to do this from several vantage points on the site. While evaluation of landscape criteria can be somewhat subjective, the DSA should contain a discussion of each landscape parameter defined in Table 1 to make it clear that each of these criteria were considered.

Table 1. DSA landscape parameters for cultivated lands.

Drainage	Site drainage should be consistent with the original patterns, directions and capacity or be compatible with the surrounding landscape. Facilities or features left in place (i.e. clay pads) must not negatively impact drainage.
Erosion	No more soil erosion (i.e. rills, gullies or blowouts) than on adjacent land allowed.
Contour	Contour and roughness must conform and blend with adjacent contours or be consistent with present or intended land use.
Stability	No visible evidence of slope movement, slumping, subsidence, or tension cracks allowed greater than on adjacent landscape.
Gravel and Rocks	May not be piled, windrowed or concentrated in one area. Gravel (<10 cm): No more than an increase of 10% in surface cover is allowed. Rocks (>10 cm): No increase in surface cover is allowed.
Debris	No industrial or domestic debris allowed.

2.3 Surface Soil Quantity, Distribution and Quality

Soil quantity, soil quality and admixing percent are to be included in the DSA soils assessment for each assessment location. The DSA soil assessment should be conducted as follows:

- If the control surface soil is ≥15 cm deep, then the DSA soil assessments may be done after cultivation; or
- If the control surface soil is <15 cm deep, then the DSA soil assessments must be done after cultivation of the site has occurred, however, the third party consultant may wish to assess depth of replaced surface soil before cultivation in order to ensure adequate soil is replaced.

2.3.1 Topsoil Additions

There may be situations where additional topsoil is required at a site. In these cases, topsoil from another source with similar chemical and physical properties to the site and surrounding lands can be used provided the landowner is notified and in agreement. The addition of topsoil must be documented within the DSA (i.e. date of application, source, volume, etc.).

NOTE: Amendments (peat, manure, etc.) are not considered a replacement for topsoil and must be documented in the DSA when applied as part of the remediation and reclamation of the site. A minimum waiting period of **two years** is required following the use of an amendment before conducting the DSA that will be submitted with the AOR application.

2.3.2 Quantity and Distribution of Replaced Surface Soil

The criteria regarding the quantity and distribution of surface soil differs depending on whether the site was initiated before or after the implementation of the AOR process on June 19, 2007. The following sections provide the criteria requirements for both site situations.

2.3.2.1 Quantity and Distribution of Replaced Surface Soil for Sites After June 19, 2007

This section outlines the criteria required when the following conditions apply to the site:

- The well finished drill date is **on or after** June 19, 2007; or
- The facility licence date is **on or after** June 19, 2007; or
- The site prepared date (for built not drilled sites) is **on or after** June 19, 2007.

Surface Soil Quantity Criteria:

The ***Average Replacement Depth (ARD)*** is the overall average soil depth of the **lease** assessment locations and must be equal to or greater than 85% of the average control soil depths associated with the lease.

- i.e. ARD or average lease depth (cm) ≥ average control depth (cm) x 0.85

A**ccess road soil depths** are assessed on a paired basis by comparing the soil depth at the **access** assessment location to the corresponding paired control soil depth. If the soil depth at the access assessment location is equal to or greater than 85% of the corresponding paired control, then the access assessment location passes.

- i.e. Each access depth (cm) ≥ corresponding paired control depth (cm) x 0.85

Lease Surface Soil Distribution Criteria:

While the average replacement soil depth over the entire lease must be at least 85% of the average control depth, at any **individual lease** assessment location, the **Minimum Replacement Depth (MRD)** may be as low as 68% of the average control depth for the lease location to pass.

- i.e. Each lease depth (cm) ≥ MRD or (average control depth (cm) x 0.68)

2.3.2.2 Quantity and Distribution of Replaced Surface Soil for Sites Predating June 19, 2007

This section outlines the criteria required when the following conditions apply to the site:

- The well finished drill date is **before** June 19, 2007; or
- The facility licence date is **before** June 19, 2007; or
- The site prepared date (for built not drilled sites) is **before** June 19, 2007.

Surface Soil Quantity Criteria:

The ***Average Replacement Depth (ARD)*** is the overall average soil depth of the **lease** assessment locations and must be equal to or greater than 60% of the average control soil depths associated with the lease.

- i.e. ARD or average lease depth (cm) ≥ average control depth (cm) x 0.60

A**ccess road soil depths** are assessed on a paired basis by comparing the soil depth at the **access** assessment location to the corresponding paired control soil depth. If the soil depth at the

access assessment location is equal to or greater than 60% of the corresponding paired control, then the access assessment location passes.

- i.e. Each access depth (cm) ≥ corresponding paired control depth (cm) x 0.60

Lease Surface Soil Distribution Criteria:

While the average replacement soil depth over the entire lease must be at least 60% of the average control depth, at any **individual lease** assessment location, the **Minimum Replacement Depth (MRD)** may be as low as 50% of the average control depth for the lease location to pass.

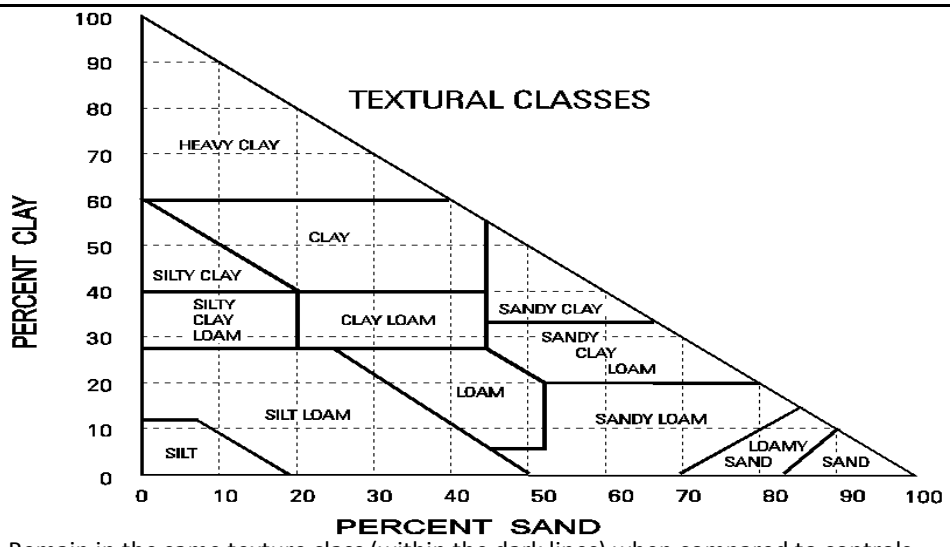
- i.e. Each lease depth (cm) ≥ MRD or (average control depth (cm) x 0.50)

2.3.3 Quality of Replaced Surface Soil

At **each assessment location**, with the exception of the soil profile assessment, the third party consultant will document the soil quality parameters (defined in Table 2) within the DSA. The soil quality parameters should be assessed after cultivation.

When compared with representative controls (i.e. from similar depths with similar light and moisture conditions), the lease and access assessment locations must meet the criteria defined in Table 2 for the assessment location to pass.

Table 2. DSA soil quality parameters for cultivated lands.

Admixing %	Remain in the same class (0 to 30%, >30% to 60%, and >60%) or lower class of admixing when compared to controls.
Texture	 Remain in the same texture class (within the dark lines) when compared to controls. The Soil Texture Classes Triangle was taken from the Government of Canada, Agriculture and Agri-Food Canada, 2011, http://sis.agr.gc.ca/cansis/glossary/t/#figure1.
Soil Strength	Remain in the same class (friable; firm; and hard) when compared to controls.

Soil Aggregate Size	Remain in the same class (<2 cm, 2 cm to 5 cm, and >5 cm to 10 cm) when compared to controls. No soil aggregates greater than 10 cm are allowed unless similar size soil aggregates are present in the control soil.
Soil Profile Assessment	NOTE: When more than one horizon is mixed to make up the minimum requirement for salvaged soil, the control for the quality comparison must be a mix of the salvaged soil horizons. *Assessment Depth* Soils will be assessed to a depth of 50 cm on a grid basis on-site, with appropriate off-site measurements (controls). The assessment depth may need to be deeper than 50 cm in order to successfully identify the restriction; however, the assessment depth does not need to continue below 1 m. If a soil limitation (i.e. root restrictions) occurs before the required assessment depth of 50 cm is reached than the assessment is not required to advance any deeper into the soil, however, the assessment depth measurement must be reported in the DSA. *Restriction Assessment* The process restriction parameters are: • Water permeability. • Vertical root elongation. • Soil aeration. • Compaction For the locations assessed, document in the DSA the topsoil and subsoil process restriction parameters as either “restrictive” or “non-restrictive” as compared to the control. NOTE: a restrictive soil profile is a FAILED class parameter if the representative controls are non-restrictive. Professional judgment should be used to determine whether parameters are restrictive to root growth and establishment. For more details on assessing process restrictions refer to Appendix A. NOTE: Since root elongation is being assessed, soil profile assessment should be done at the same time as the vegetation assessment. *Lease and Control Assessments* Soil profile assessments will be conducted at every second assessment location on and off the lease. For example, a 100 m x 100 m lease would require a total of 8 soil profile assessments. (4 on-site assessment locations and 4 off-site control locations). NOTE: If the following five locations (well centre, sump, flare pit, tank storage area and entrance to lease) on the lease are known, then lease soil profile assessments will be conducted at these five locations. If these five locations are not known, then soil profile assessments will be conducted at every second assessment location on the lease as mentioned above. *Access Roads and Paired Control Assessments* Soil profile assessments are to be carried out on each paired assessment location. For example, a 500 m access road would require a total of 10 soil profile assessments (5 access assessment locations and the 5 paired control locations).

2.3.4 Soil Tolerance

A summary of the passing soil depth quantity and distribution criteria is provided below:

	Average Lease	Each Access Location	Each Lease Location
Sites After June 19, 2007	≥ 85% of average control	≥ 85% of paired control	≥ 68% of Average control
Sites Before June 19, 2007	≥ 60% of average control	≥ 60% of paired control	≥ 50% of average control
NOTE: The replacement depth of any individual lease or access assessment location should never be less than 30% of the control soil depth. If this situation exists on a site further reclamation of the site and subsequent passing DSA would be required.			

It is recognized that it may be difficult to meet the soil criteria (defined above) across the entire site; especially where salvage topsoil was minimal. Therefore, to account for this, it is acceptable that one of the grids may vary from the desired soil outcome. This means a single grid location within the DSA can fail by soil depth, soil quality, or a combination of these for a maximum of one grid failure on the entire site (which is comprised of the lease and access road). NOTE: Within a single grid it is acceptable to fail in one or more of the soil quality parameters listed in Table 2.

NOTE: For smaller lease sizes (i.e. 40 m x 60 m) the tolerance criteria still apply even though fewer grids are assessed and a single grid failure would mean a greater percentage of the disturbed area is below the target criteria in comparison to a larger site. This is acceptable as it is recognized that there is less overall disturbance to the land by using the smaller lease size and credit is given to operators who attempt to minimize disturbance.

The following examples illustrate acceptable soil quantity, distribution and quality tolerances:

Example #1:
If the average control soil depth is 18 cm for a lease with a finished drill date on or after June 19, 2007 and the 98m long access road paired controls are (AC1=20 cm and AC2=19 cm), then:

Surface Soil Quantity Criteria:
The Average Replacement Depth (ARD) of the lease must be ≥ 18 cm x 0.85 = 15.3 cm; for the lease to pass.

The replacement depth at the first access assessment location (A1) must be ≥ 20 cm x 0.85 = 17 and the replacement depth at the second access assessment location (A2) must be ≥ 19 cm x 0.85 = 16.2; for each access grid to pass. NOTE: If A1 < 20 cm x 0.30 = 6 cm or A2 <19 cm x 0.30 =5.7 cm, then further reclamation work is required.

Lease Surface Soil Distribution Criteria:

The replacement depth at each lease assessment location must be ≥ 18 cm x 0.68 = 12.2 cm; for each lease grid to pass. NOTE: If any lease assessment locations is < 18 cm x 0.30 = 5.4 cm, then further reclamation work is required.

Soil Tolerance:
In the case where the soil quantity, distribution and quality are not found to pass for every grid within the lease and access only one the following variations would be acceptable for DSA submission:

- Only one lease grid may fail soil depth (i.e. soil depth between 5.4 cm and 12.2 cm) and not fail the any of the soil quality parameters; or
- Only one access grid may fail soil depth (i.e. soil depth at A1 between 6 cm and 17 cm or soil depth at A2 between 5.7 cm and 16.2 cm) and not fail any of the soil quality parameters; or
- Only one lease or access grid may fail soil depth and the same grid may also fail in one or more of the soil quality parameters (i.e., only one grid in total is affected); or
- All lease and access grids pass soil depth (i.e lease grids ≥ 12cm and A1 ≥ 17, A2 ≥16.2cm) and only one grid within either the lease or access may fail in one or more of the soil quality parameters.

Example #2:

If the average control soil depth is 18 cm for a lease with a finished drill before June 19, 2007 and the 98m long access road paired controls are (AC1=20 cm and AC2=19 cm), then:

Surface Soil Quantity Criteria:
The Average Replacement Depth (ARD) of the lease must be ≥ 18 cm x 0.60 = 10.8 cm; for the lease to pass.

The replacement depth at the first access assessment location (A1) must be ≥ 20 cm x 0.60 = 12 and the replacement depth at the second access assessment location (A2) must be ≥ 19 cm x 0.60 = 11.4; for each access grid to pass. NOTE: If A1 < 20 cm x 0.30 = 6 cm or A2 <19 cm x 0.30 =5.7 cm, then further reclamation work is required.

Lease Surface Soil Distribution Criteria:
The replacement depth at each lease assessment location must be ≥ 18 cm x 0.50 = 9 cm; for each lease grid to pass. NOTE: If any lease assessment locations is < 18 cm x 0.30 = 5.4 cm, then further reclamation work is required.

Soil Tolerance:
In the case where the soil quantity, distribution and quality are not found to pass for every grid within the lease and access **only one** the following variations would be acceptable for DSA submission:

- **Only one** lease grid may fail soil depth (i.e. soil depth between 5.4 cm and 9 cm) and not fail the any of the soil quality parameters; or
- **Only one** access grid may fail soil depth (i.e. soil depth at A1 between 6 cm and 12 cm or soil depth at A2 between 5.7 cm and 11.4 cm) and not fail any of the soil quality parameters; or
- **Only one** lease or access grid may fail soil depth and the same grid may also fail in one or more of the soil quality parameters (i.e., only one grid in total is affected); or

- All lease and access grids pass soil depth (i.e lease grids ≥ 9 cm and A1 ≥ 12, A2 ≥ 11.4cm) and only one grid within either the lease or access may fail in one or more of the soil quality parameters.

2.4 Vegetation

Vegetation parameters, along with bare areas and weeds/undesirable plants, must be assessed at each assessment location and documented within the DSA.

Vegetation must be present at the time of the assessment. No special management practices, not consistent with those used on the control area, are allowed on the disturbed area that would affect the vegetation results. Fertilizer and/or amendment applications will be considered consistent with the control area if:

- the landowner applied fertilizer and/or an amendment to the site as part of his/her normal management practice; or
- the licensee applied fertilizer and/or an amendment to the site to bring it up to the same nutrient levels as the control soils (based on lab fertility analyses).

NOTE: Fertilizer and/or amendment additions must be documented within the DSA (i.e. type, application rate, quantity, etc.) if applied during remediation and/or reclamation of the site.

2.4.1 Use of Non-native Species

Non-native species can be used where their benefits to site properties are known and the species are part of a plan to improve a site. For example, the use of agronomic annuals can be used for erosion control on recently restored sites. However, these species cannot be persistent and must not contribute to the vegetation criteria. The overall objective of the DSA standard is to ensure well/facility sites have been reclaimed properly and are compatible with the surrounding area. Leaving non-native species on-site would not meet this objective.

2.4.2 Timing of Vegetation Assessments

The timing of the DSA vegetation assessment will vary depending on the type of cultivated crop (annual or perennial) at the site. Further clarification is provided in the following sections.

NOTE: Where fertilizer and/or an amendment has been applied, by the licensee, as part of the remediation and reclamation of the site, a minimum waiting period of **two years** is required before conducting the DSA that will be submitted with the AOR application.

2.4.2.1 Annual Crops

For annual crops, without fertilizer or amendment addition, the vegetation assessment should be conducted when the crop is fully headed out. It is acceptable to conduct the vegetation assessment in the same year as the one in which reclamation was completed provided the crop is fully headed out at the time of assessment. Please be advised that it is also acceptable for the vegetation to be assessed on sites where the crop has been cut but not removed if and only if all measurements can be accurately measured and documented.

Please be advised that in the situation where fully headed out crop data is not available due to annual harvest then **stubble data** may be assessed, however, it must be accompanied by a **passing DSA soil assessment** and the AOR application must include the **signed** L*andowner(s) Acknowledgement Form* (referred to in the AOR Directive) to provide further proof that the site production is satisfactory and no vegetation issues are evident at the site. If a signed landowner(s) acknowledgement is not obtained the vegetation assessment portion of the DSA is required when the crop is fully headed out to be considered a passing DSA for AOR submission.

2.4.2.2 Perennial Crops

For perennial crops (includes most forage crops), without fertilizer or amendment addition, the vegetation assessment should be conducted after a minimum of **one full growing season** which includes an over-wintering period and a minimum of twelve months from time of seeding.

2.4.3 Vegetation Assessment Criteria

At **each assessment location**, the third party consultant will document the vegetation parameters (defined in Table 3) within the DSA. The vegetation assessments are based on a visual comparison between the site (lease and access) and the representative controls therefore vegetation must be present at the time of assessment.

When compared with representative controls, the lease and access assessment locations must meet the criteria defined in Table 3 for the assessment location to pass. NOTE: The **lease and access must pass all of the criteria defined in Table 3** to be considered an acceptable DSA within an AOR application submission.

Table 3. DSA vegetation parameters for cultivated lands.

Plant Species Composition	Re-vegetation species and species composition should be compatible with control vegetation or meet reasonable land management objectives. NOTE: Weeds and undesirable plants cannot contribute to the plant vegetation.
Plant Health	Plant health must be equal to or better than the control vegetation. Plant health should be documented within the DSA as either poor, fair, good or excellent. Ideally, plants should be healthy; characteristics to look for are vigour, height, colour, disease-free and vegetation quality. NOTE: Evidence of stressed vegetation should be documented within the DSA and must be comparable to the control vegetation. Where there is evidence of stressed vegetation, a description along with photographic evidence must be supplied in the DSA to demonstrate both on-site and off-site effects are comparable.
Plant Height	Plant height must be equal to or greater than 80% of the control vegetation. • each lease location ≥ (average control x 0.80); and • each access location ≥ (corresponding paired control x 0.80). NOTE: At each assessment location the third party consultant shall document the average crop height (expressed in cm) by measuring a minimum of 10 plants.

Plant Density	Plant density must be equal to or greater than 80% of the control vegetation. • each lease location ≥ (average control x 0.80); and • each access location ≥ (corresponding paired control x 0.80). NOTE: At each assessment location the third party consultant shall document the plant density of live/desirable/healthy plants. NOTE: The crop type, growth phase and other factors will affect the easiest method of measuring plant density; therefore, the results may be expressed in plants, stems or tillers per square meter or linear meter, or percentage cover for the representative area. The measurement methodology must be documented in the DSA and must be consistent across all assessment locations and controls.
Bare Area	The bare area refers to the areas with exposed soil that are devoid of vegetation; areas between seed rows are not included in this definition. The bare area percent should not be greater than 10% as compared to the control. • each lease location ≤ average control + 10%; and • each access location ≤ corresponding paired control + 10%. NOTE: It is important to ensure the grid size is consistent across all assessment locations and controls as the results are to be expressed as % bare area over the entire assessment grid.
Weeds & Undesirable Plants	Weeds are to be managed on all lands as per *The Weed Control Act* which is regulated by the Ministry of Agriculture. NOTE: Once a weed species has been identified at a site, please refer to the *Minister's Order Designating Prohibited, Noxious and Nuisance Weeds (Weed List)* to determine the type of weed and potential action required under *The Weed Control Act* and ER's criteria as defined below: *Weed & Undesirable Plant Species Composition* Weeds and undesirable plant species identified on-site must also be present in the off-site controls; otherwise the on-site weed and/or undesirable plant species must be removed. NOTE: The presence of weeds/undesirable plants may or may not have been directly influenced by well/facility activity. The third party consultant must ensure that the control samples are representative of the surrounding area. If no weed species are present at an assessment location enter "not applicable" in the weed species column and "0" in the weed density column to indicate the weed assessment was conducted. *Weed & Undesirable Plant Species Type* Depending on the species type identified, ER's requirements differ as follows: • *Prohibited Weeds* – must be eradicated on-site to prevent their movement out of the area; • *Noxious Weeds* – must be contained and controlled on-site and any isolated infestations found on-site must be eradicated. • *Nuisance Weeds and Undesirable Plants* – must be controlled on-site. *Weed & Undesirable Plant Density* No prohibited weeds are allowed on-site. The density of noxious/nuisance weeds and undesirable plants on-site must be less than or equal to that found on the controls. • average lease ≤ average control; and • each access location ≤ corresponding paired control. NOTE: The density results may be expressed in weeds per square meter or linear meter, or percentage cover for the representative area. The measurement methodology must be documented in the DSA and must be consistent across all

	assessment locations and controls.

3. Reclamation Criteria - Grasslands

Grasslands include lands that are permanently grassed that include a native component. Native grasslands commonly present a mixture of different native grass species, forbs (flowering/broad-leaved species), shrubs (woody species) and tree species, whereas tame grasslands produce agronomic seeded grass and legume species such as timothy and alfalfa.

When constructing a grasslands site, minimal disturbance of native grassland is recommended. Where disturbance occurs surface soil must be salvaged for replacement. At the time of reclamation, the salvaged soil should be replaced as evenly as possible across the site and the use of native species is encouraged to re-vegetate native grassland.

Modified grasslands have a percentage of both native and tame species and are to be assessed under grassland criteria. For grasslands that have been cultivated/seeded to agronomic species and the land use goal is to be managed as tame forage for hay or pasture; assessment should be conducted under the cultivated land criteria provided in section 2.

The following provides a summary of the criteria upon which the DSA is to be conducted:

- *Landscape:* drainage, erosion, contour, stability, gravel & rocks, debris.
- *Soil:* surface soil quantity, distribution and quality (% admixing/texture/strength/ aggregate size), topsoil and subsoil profiles.
- *Vegetation:* plant (species/health/density), bare areas, weeds (species/type/density).

3.1 Site Assessment Sampling Scheme

In general, sites are to be assessed by establishing a suitable assessment grid followed by measuring/observing the various assessment criteria within each grid. The results are compared to suitably selected controls located on lands surrounding or adjacent to the site.

Note that the term "**site**" as defined in the OGCR is not constrained to the boundaries of the lease, but rather includes any areas beyond the lease boundaries that were impacted by the operations at the site. Therefore, grids should be designed to include these impacted areas beyond the lease boundaries; unless these areas were previously reclaimed and received the approval of the ministry.

NOTE: An assessment is not required on areas of the lease or access that have received an Exemption from Reclamation issued by ER or were authorized by the landowner(s) to be left in place as an "improvement" (i.e. access road, cement pad, etc.).

The sampling scheme for grasslands is the same as previously defined for cultivated land. Therefore, for grasslands assessments please refer to the lease (section 2.1.1), controls (section 2.1.2), minimal disturbance lease (section 2.1.3) and access (section 2.1.4) cultivated land schemes.

3.2 Landscape

Landscape criteria will be assessed by comparing the site with adjacent land. Differences between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or off-site.

Landscape criteria are assessed by looking at the site as a whole rather than individual assessment points. It is necessary to do this from several vantage points on the site. While evaluation of landscape criteria can be somewhat subjective, the DSA should contain a discussion of each landscape parameter defined in Table 4 to make it clear that each of these criteria were considered.

Table 4. DSA landscape parameters for grasslands.

Drainage	Site drainage should be consistent with the original patterns, directions and capacity or be compatible with the surrounding landscape. Facilities or features left in place (i.e. clay pads) must not negatively impact drainage.
Erosion	No more soil erosion (i.e. rills, gullies or blowouts) than on adjacent land allowed.
Contour	Contour and roughness must conform and blend with adjacent contours or be consistent with present or intended land use.
Stability	No visible evidence of slope movement, slumping, subsidence, or tension cracks allowed greater than on adjacent landscape.
Gravel and Rocks	May not be piled, windrowed or concentrated in one area. Gravel (<10 cm) plus rock (>10 cm): No more than an increase of 20% in surface cover is allowed.
Debris	No industrial or domestic debris allowed. Woody debris (roots, slash, etc.) must not interfere with adjacent or normal land use. No large woody debris and no woody debris (roots and slash) that could be removed with a brush rake is allowed.

3.3 Surface Soil Quantity, Distribution and Quality

Soil quantity, soil quality and admixing percent are to be included in the DSA soils assessment for each assessment location.

3.3.1 Topsoil Additions

Grasslands topsoil addition criteria are the same as previously defined for cultivated lands, therefore, please refer to section 2.3.1 of the cultivated land topsoil addition criteria.

NOTE: Amendments (peat, manure, etc.) are not considered a replacement for topsoil and must be documented in the DSA when applied as part of the remediation and reclamation of the site. A minimum waiting period of **two years** is required following the use of an amendment before conducting the DSA that will be submitted with the AOR application.

3.3.2 Quantity and Distribution of Replaced Surface Soil

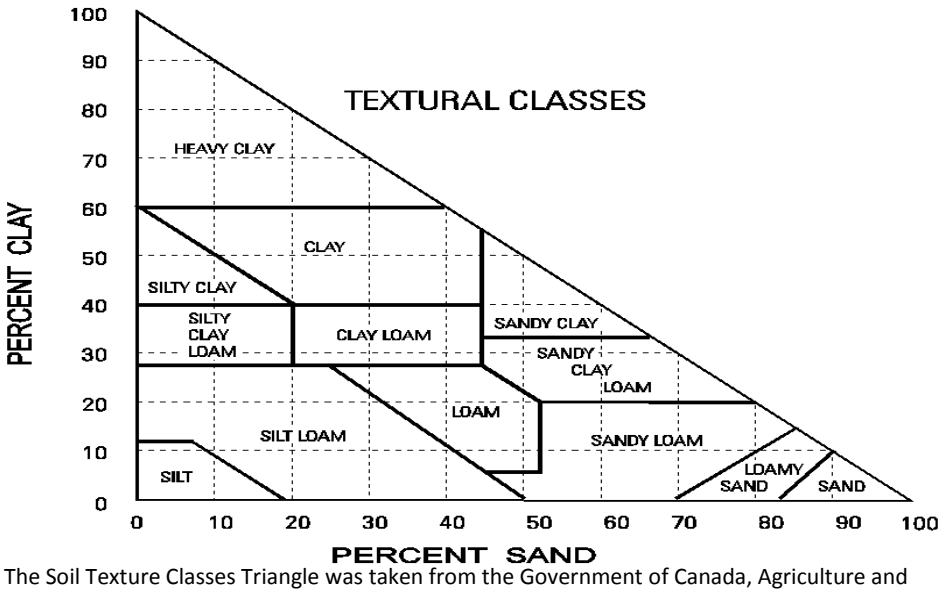
The criteria regarding the quantity and distribution of surface soil differs depending whether the site was initiated before or after the implementation of the AOR process on June 19, 2007. Grasslands quantity and distribution of surface soil criteria are the same as previously defined for cultivated lands, therefore, please refer to section 2.3.2.1 (for sites after June 19, 2007) and/or section 2.3.2.2 (for sites predating June 19, 2007).

3.3.3 Quality of Replaced Surface Soil

At **each assessment location**, with the exception of the soil profile assessment, the third party consultant will document the soil quality parameters (defined in Table 5) within the DSA.

When compared with representative controls (i.e. from similar depths with similar light and moisture conditions), the lease and access assessment locations must meet the criteria defined in Table 5 for the assessment location to pass.

Table 5. DSA soil quality parameters for grasslands.

Admixing %	Remain in the same class (0 to 30%, >30% to 60%, and >60%) or lower class of admixing when compared to controls.
Texture	Remain in the same texture class (within the dark lines) when compared to controls.  The Soil Texture Classes Triangle was taken from the Government of Canada, Agriculture and Agri-Food Canada, 2011, http://sis.agr.gc.ca/cansis/glossary/t/#figure1.
Soil Strength	Remain in the same class (friable; firm; and hard) when compared to controls.
Soil Aggregate Size	Remain in the same class (<2 cm, 2 cm to 5 cm, and >5 cm to 10 cm) when compared to controls. No soil aggregates greater than 10 cm are allowed unless similar size soil aggregates are present in the control soil

Soil Profile Assessment	NOTE: When more than one horizon is mixed to make up the minimum requirement for salvaged soil, the control for the quality comparison must be a mix of the salvaged soil horizons. *Assessment Depth* Soils will be assessed to a depth of 50 cm on a grid basis on-site, with appropriate off-site measurements (controls). The assessment depth may need to be deeper than 50 cm in order to successfully identify the restriction; however, the assessment depth does not need to continue below 1 m. If a soil limitation (i.e. root restrictions) occurs before the required assessment depth of 50 cm is reached than the assessment is not required to advance any deeper into the soil, however, the assessment depth measurement must be reported in the DSA. *Restriction Assessment* The process restriction parameters are: • Water permeability. • Vertical root elongation. • Soil aeration. • Compaction For the locations assessed, document in the DSA the topsoil and subsoil process restriction parameters as either "restrictive" or "non-restrictive" as compared to the control. NOTE: a restrictive soil profile is a FAILED class parameter if the representative controls are non-restrictive. Professional judgment should be used to determine whether parameters are restrictive to root growth and establishment. For more details on assessing process restrictions refer to Appendix A. NOTE: Since root elongation is being assessed, soil profile assessment should be done at the same time as the vegetation assessment. *Lease and Control Assessments* Soil profile assessments will be conducted at every second assessment location on and off the lease. For example, a 100 m x 100 m lease would require a total of 8 soil profile assessments. (4 on-site assessment locations and 4 off-site control locations). NOTE: If the following five locations (well centre, sump, flare pit, tank storage area and entrance to lease) on the lease are known, then lease soil profile assessments will be conducted at these five locations. If these five locations are not known, then soil profile assessments will be conducted at every second assessment location on the lease as mentioned above. *Access Roads and Paired Control Assessments* Soil profile assessments are to be carried out on each paired assessment location. For example, a 500 m access road would require a total of 10 soil profile assessments (5 access assessment locations and the 5 paired control locations).

3.3.4 Soil Tolerance

A summary of the passing soil depth quantity and distribution criteria is provided below:

	Average Lease	Each Access Location	Each Lease Location
Sites After June 19, 2007	≥ 85% of average control	≥ 85% of paired control	≥ 68% of Average control
Sites Before June 19, 2007	≥ 60% of average control	≥ 60% of paired control	≥ 50% of average control
NOTE: The replacement depth of any individual lease or access assessment location should never be less than 30% of the control soil depth. If this situation exists further reclamation of the site and subsequent passing DSA would be required.			

It is recognized that it may be difficult to meet the soil criteria (defined above) across the entire site; especially where salvage topsoil was minimal. Therefore, to account for this, it is acceptable that one of the grids may vary from the desired soil outcome. This means a single grid location within the DSA can fail by soil depth, soil quality, or a combination of these for a **maximum of one grid failure on the entire site** (which is comprised of the lease and access road). NOTE: Within a single grid it is acceptable to fail in one or more of the soil quality parameters listed in Table 5.

NOTE: For smaller lease sizes (i.e. 40 m x 60 m) the tolerance criteria still apply even though fewer grids are assessed and a single grid failure would mean a greater percentage of the disturbed area is below the target criteria in comparison to a larger site. This is acceptable as it is recognized that there is less overall disturbance to the land by using the smaller lease size and credit is given to operators who attempt to minimize disturbance.

Please refer to the examples provided in section 2.3.4 which illustrate acceptable soil quantity, distribution and quality tolerances.

3.4 Vegetation

Vegetation parameters, along with bare areas and weeds/undesirable plants, must be assessed at each assessment location and documented within the DSA.

Vegetation must be present at the time of the assessment. No special management practices, not consistent with those used on the control area, are allowed on the disturbed area that would affect the vegetation results. Fertilizer and/or amendment applications will be considered consistent with the control area if

- the landowner applied fertilizer and/or an amendment to the site as part of his/her normal management practice; or
- the licensee applied fertilizer and/or an amendment to the site to bring it up to the same nutrient levels as the control soils (based on lab fertility analyses).

NOTE: On public lands, it is expected that native species will not be fertilized unless approval from the appropriate governing body is received. Fertilizer and/or amendment additions must be documented within the DSA (i.e. type, application rate, quantity, etc.) if applied during remediation and/or reclamation of the site.

3.4.1 Use of Non-native Species

Non-native species can be used where their benefits to site properties are known and the species are part of a plan to improve a site. For example, the use of agronomic annuals can be used for erosion control on recently restored sites. However, these species cannot be persistent and must not contribute to the vegetation criteria. The overall objective of the DSA standard is to ensure well/facility sites have been reclaimed properly and are compatible with the surrounding area. Leaving non-native species on-site would not meet this objective.

3.4.2 Timing of Assessment

For grasslands, without fertilizer or amendment addition, the vegetation assessment should be conducted after a minimum of **one full growing season** which includes an over-wintering period and a minimum of twelve months from time of seeding. On sites where fertilizer and/or an amendment has been applied, by the licensee, as part of the remediation and reclamation of the site, a minimum waiting period of **two years** is required before conducting the DSA that will be submitted with the AOR application.

3.4.3 Vegetation Assessment Criteria

At **each assessment location**, the third party consultant will document the vegetation parameters (defined in Table 6) within the DSA. The vegetation assessments are based on a visual comparison between the site (lease and access) and the representative controls therefore vegetation must be present at the time of assessment.

When compared with representative controls, the lease and access assessment locations must meet the criteria defined in Table 6 for the assessment location to pass. NOTE: The **lease and access must pass <u>all</u> of the criteria defined in Table 6** to be considered an acceptable DSA within an AOR application submission.

Table 6. DSA vegetation parameters for grasslands.

Plant Species Composition	Re-vegetation species and species composition should be compatible with control vegetation or meet reasonable land management objectives. NOTE: Weeds and undesirable plants <u>cannot</u> contribute to the plant vegetation.
Plant Health	Plant health must be equal to or better than the control vegetation. Plant health should be documented within the DSA as either poor, fair, good or excellent. Ideally, plants should be healthy; characteristics to look for are vigour, height, colour, disease-free and vegetation quality. NOTE: Evidence of stressed vegetation should be documented within the DSA and must be comparable to the control vegetation. Where there is evidence of stressed vegetation, a description along with photographic evidence must be supplied in the DSA to demonstrate both on-site and off-site effects are comparable.

Plant Density	Plant density must be equal to or greater than 80% of the control vegetation. • each lease location ≥ (average control x 0.80); and • each access location ≥ (corresponding paired control x 0.80). NOTE: At each assessment location the third party consultant shall document the plant density of live/desirable/healthy plants. NOTE: The species type, growth phase and other factors will affect the easiest method of measuring plant density; therefore, the results may be expressed as percentage cover for the representative area (lump all plant species together into a single density value and note any observable differences in species composition). The measurement methodology must be documented in the DSA and must be consistent across all assessment locations and controls.
Bare Area	The bare area refers to the areas with exposed soil that are devoid of vegetation; areas between seed rows are not included in this definition. The bare area percent should not be greater than 10% as compared to the control. • each lease location ≤ average control + 10%; and • each access location ≤ corresponding paired control + 10%. NOTE: It is important to ensure the grid size is consistent across all assessment locations and controls as the results are to be expressed as % bare area over the entire assessment grid.
Weeds & Undesirable Plants	Weeds are to be managed on all lands as per *The Weed Control Act* which is regulated by the Ministry of Agriculture. NOTE: Once a weed species has been identified at a site, please refer to the *Minister's Order Designating Prohibited, Noxious and Nuisance Weeds (Weed List)* to determine the type of weed and potential action required under *The Weed Control Act* and ER's criteria as defined below: *Weed & Undesirable Plant Species Composition* Weeds and undesirable plant species identified on-site must also be present in the off-site controls; otherwise the on-site weed and/or undesirable plant species must be removed. NOTE: The presence of weeds/undesirable plants may or may not have been directly influenced by well/facility activity. The third party consultant must ensure that the control samples are representative of the surrounding area. If no weed species are present at an assessment location enter "not applicable" in the weed species column and "0" in the weed density column to indicate the weed assessment was conducted. *Weed & Undesirable Plant Species Type* Depending on the species type identified, ER's requirements differ as follows: • *Prohibited Weeds* – must be eradicated on-site to prevent their movement out of the area; • *Noxious Weeds* – must be contained and controlled on-site and any isolated infestations found on-site must be eradicated. • *Nuisance Weeds and Undesirable Plants* – must be controlled on-site. *Weed & Undesirable Plant Density* No prohibited weeds are allowed on-site. The density of noxious/nuisance weeds and undesirable plants on-site must be less than or equal to that found on the controls. • average lease ≤ average control; and • each access location ≤ corresponding paired control. NOTE: The density results may be expressed in weeds per square meter or linear

	meter, or percentage cover for the representative area. The measurement methodology must be documented in the DSA and must be consistent across all assessment locations and controls.

4. Reclamation Criteria – Peatlands

Peatlands are areas of land with a naturally accumulated layer of peat. Peat is an unconsolidated soil material consisting largely of un-decomposed or only slightly decomposed organic matter; mainly derived from mosses or sedges. Peatlands also include functioning bogs or fens.

When constructing a site in peatlands, the requirements for salvaging surface soil and subsequent reclamation may differ as follows:

- **Deep Peat (>40 cm)** – surface soil salvage is not required as the pad will likely be constructed over the peat. If the land is potentially arable no salvage is required but pad removal may be required at the time of site reclamation.
- **Thin Peat (<40 cm)** – surface soil salvage required (minimum 15 cm depth to maximum depth of 40 cm or to the mineral soil contact). If surface soil has been salvaged, replace what is available as evenly as possible across the site at the time of reclamation.

Peatlands that have not been cultivated, and may or may not be treed, are to be assessed under the peatlands criteria. Whereas, all **cultivated peat soils** shall be assessed under the cultivated land criteria provided in section 2.

The following provides a summary of the criteria upon which the DSA is to be conducted:

- *Landscape:* drainage, erosion, contour, stability, gravel & rocks, debris.
- *Vegetation:* plant (species/health/density), bare areas, weeds (species/type/density).

4.1 Site Assessment Sampling Scheme

Peatlands do not have a defined sampling scheme. In general, the landscape criteria are assessed by looking at the site (lease and access) as a whole. Both landscape and vegetation criteria are assessed from several vantage points on the site and compared to the lands surrounding or adjacent to the site.

NOTE: An assessment is not required on areas of the lease or access that have received an Exemption from Reclamation issued by ER or were authorized by the landowner(s) to be left in place as an “improvement” (i.e. access road, cement pad, etc.).

4.2 Landscape

Landscape criteria will be assessed by comparing the site with adjacent land. Differences between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or off-site.

Landscape criteria are assessed by looking at the site as a whole rather than individual assessment points. It is necessary to do this from several vantage points on the site. While evaluation of landscape criteria can be somewhat subjective, the DSA should contain a

discussion of each landscape parameter defined in Table 7 to make it clear that each of these criteria were considered.

Table 7. DSA landscape criteria for peatlands.

Drainage	Site drainage should be consistent with the original patterns, directions and capacity or be compatible with the surrounding landscape. Facilities or features left in place (i.e. clay pads) must not negatively impact drainage or adjacent forest growth.
Erosion	No more soil erosion (i.e. rills, gullies or blowouts) than on adjacent land allowed.
Contour	Contour and roughness must conform and blend with adjacent contours or be consistent with present or intended land use.
Stability	No visible evidence of slope movement, slumping, subsidence, or tension cracks allowed greater than on adjacent landscape.
Gravel and Rocks	May not be piled, windrowed or concentrated in one area.
Debris	No industrial or domestic debris allowed. Woody debris (roots, slash, etc.) must not interfere with adjacent or normal land use. No large woody debris and no woody debris (roots and slash) that could be removed with a brush rake is allowed without prior approval from landowner (private and public).

4.3 Vegetation

Vegetation parameters, along with bare areas and weeds/undesirable plants, must be assessed at each assessment location and documented within the DSA.

Vegetation must be present at the time of the assessment. No special management practices, not consistent with those used on the control area, are allowed on the disturbed area that would affect the vegetation results. Fertilizer and/or amendment applications will be considered consistent with the control area if:

- the landowner applied fertilizer and/or an amendment to the site as part of his/her normal management practice; or
- the licensee applied fertilizer and/or an amendment to the site to bring it up to the same nutrient levels as the control soils (based on lab fertility analyses).

NOTE: Fertilizer and/or amendment additions must be documented within the DSA (i.e. type, application rate, quantity, etc.) if applied during remediation and/or reclamation of the site.

4.3.1 Use of Non-native Species

Non-native species can be used where their benefits to site properties are known and the species are part of a plan to improve a site. For example, the use of agronomic annuals can be used for erosion control on recently restored sites. However, these species cannot be persistent and must not contribute to the vegetation criteria. The overall objective of the DSA standard is

to ensure well/facility sites have been reclaimed properly and are compatible with the surrounding area. Leaving non-native species on-site would not meet this objective.

4.3.2 Timing of Vegetation Assessment

For peatlands, without fertilizer or amendment addition, the vegetation assessment should be conducted after a minimum of **one full growing season** which includes an over-wintering period and a minimum of twelve months from time of seeding. On sites where fertilizer and/or an amendment has been applied as part of the remediation and reclamation of the site, a minimum waiting period of **two years** is required before conducting the DSA that will be submitted with the AOR application.

4.3.3 Vegetation Assessment Criteria

At **each assessment location**, the third party consultant will document the vegetation parameters (defined in Table 8) within the DSA. The vegetation assessments are based on a visual comparison between the site (lease and access) and the representative controls therefore vegetation must be present at the time of assessment.

When compared with representative controls, the lease and access assessment locations must meet the criteria defined in Table 8 for the assessment location to pass. NOTE: The **lease and access must pass all of the criteria defined in Table 8** to be considered an acceptable DSA within an AOR application submission.

Table 8. DSA vegetation parameters for peatlands.

Plant Species Composition	Re-vegetation species and species composition should be compatible with control vegetation or meet reasonable land management objectives. NOTE: Weeds and undesirable plants cannot contribute to the plant vegetation.
Plant Health	Plant health must be equal to or better than the control vegetation. Plant health should be documented within the DSA as either poor, fair, good or excellent. Ideally, plants should be healthy; characteristics to look for are vigour, height, colour, disease-free and vegetation quality. NOTE: Evidence of stressed vegetation should be documented within the DSA and must be comparable to the control vegetation. Where there is evidence of stressed vegetation, a description along with photographic evidence must be supplied in the DSA to demonstrate both on-site and off-site effects are comparable.
Plant Density	Plant density must be equal to or greater than 80% of the control vegetation. • each lease location ≥ (average control x 0.80); and • each access location ≥ (corresponding paired control x 0.80). NOTE: At each assessment location the third party consultant shall document the plant density of live/desirable/healthy plants. NOTE: The species type, growth phase and other factors will affect the easiest method of measuring plant density; therefore, the results may be expressed in plants, stems or tillers per square meter or linear meter, or percentage cover for the representative area (lump all plant species together into a single density value and note any observable differences

	in species composition). The measurement methodology must be documented in the DSA and must be consistent across all assessment locations and controls.
Bare Area	The bare area refers to the areas with exposed soil that are devoid of vegetation; areas between seed rows are not included in this definition. The bare area percent should not be greater than 10% as compared to the control. • each lease location ≤ average control + 10%; and • each access location ≤ corresponding paired control + 10%. NOTE: It is important to ensure the grid size is consistent across all assessment locations and controls as the results are to be expressed as % bare area over the entire assessment grid.
Weeds & Undesirable Plants	Weeds are to be managed on all lands as per *The Weed Control Act* which is regulated by the Ministry of Agriculture. NOTE: Once a weed species has been identified at a site, please refer to the *Minister's Order Designating Prohibited, Noxious and Nuisance Weeds (Weed List)* to determine the type of weed and potential action required under *The Weed Control Act* and ER's criteria as defined below: *Weed & Undesirable Plant Species Composition* Weeds and undesirable plant species identified on-site must also be present in the off-site controls; otherwise the on-site weed and/or undesirable plant species must be removed. NOTE: The presence of weeds/undesirable plants may or may not have been directly influenced by well/facility activity. The third party consultant must ensure that the control samples are representative of the surrounding area. If no weed species are present at an assessment location enter "not applicable" in the weed species column and "0" in the weed density column to indicate the weed assessment was conducted. *Weed & Undesirable Plant Species Type* Depending on the species type identified, ER's requirements differ as follows: • *Prohibited Weeds* – must be eradicated on-site to prevent their movement out of the area; • *Noxious Weeds* – must be contained and controlled on-site and any isolated infestations found on-site must be eradicated. • *Nuisance Weeds and Undesirable Plants* – must be controlled on-site. *Weed & Undesirable Plant Density* No prohibited weeds are allowed on-site. The density of noxious/nuisance weeds and undesirable plants on-site must be less than or equal to that found on the controls. • average lease ≤ average control; and • each access location ≤ corresponding paired control. NOTE: The density results may be expressed in weeds per square meter or linear meter, or percentage cover for the representative area. The measurement methodology must be documented in the DSA and must be consistent across all assessment locations and controls.

5. Reclamation Criteria – Forested Lands

Public Lands (Provincial Forests)

Any leases located on provincial forested lands are required to follow the reclamation criteria of the provincial governing entity that manages the land(s), such as the Ministry of Environment (ENV) or the Ministry of Agriculture (AGR). Once reclamation is completed, all that is required by ER is a submission of the release/approval verifying that the forested lands have been reclaimed to the satisfaction of ENV or AGR. There is no DSA component within the AOR application for these sites.

Private lands

For leases located on private lands the reclamation and DSA will be handled on a site by site basis. The licensee is required to submit a reclamation site plan prepared by a third party consultant for approval by ER before commencing any reclamation activity on the site. Once approved, the licensee will complete the reclamation as outlined in the submitted plan and will complete a DSA after a timeframe specified by ER. As the DSA criteria are site specific for private forested lands ER will prescribe the DSA criteria when necessary.

6. Changes to Land Use and Applicability of Assessment Criteria

In some cases it may be acceptable that the endpoint land use for a reclaimed site may differ from that of the surrounding area. For example, a reclaimed site located within a forested area may be reclaimed to a pond or may be cultivated for grazing or crops or may be reclaimed to provide for other future industrial/commercial land uses.

In these situations, the applicable endpoint land use criteria should be used for the reclamation assessment. However, it is recognized that representative controls may not be available for proper evaluation of a successful reclamation. In these instances professional judgement with supporting rationale should be supplied in the DSA along with written landowner approval.

NOTE: For provincial forested lands, preapproval from ENV is required before any changes to land are completed.

NOTE: On sites where proposed development is requested (i.e. residential/commercial) as a change in land use, approval will be required from the registered landowner, ER and the Rural Municipality (RM) who governs the area before proceeding.

7. References

Glossary of Terms in Soil Science. Research Branch, revised 1976. Canada Department of Agriculture, Ottawa. Publication 1459.

Alberta Environment, 2010. *2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands*, Alberta Environment, Edmonton, Alberta. 2011.

Alberta Environment, 1995. *Reclamation Criteria for Wellsites and Associated Facilities – 1995 Update*, Alberta Environment, Edmonton, Alberta. 1995.

Appendix A - Root, Permeability, and Aeration restriction indicators

Commonly observed indicators of root, permeability and aeration restriction indicators.

Vertical Root Elongation Restriction Indicators	Water Permeability Restriction Indicators	Soil Aeration Restriction Indicators
• Presence of root mats and bunches • Presence of flattened and highly branched roots • Presence of horizontal roots • Presence of exped roots • Presence of soil layers or abrupt texture or structure transitions • Absence of roots within or below reconstructed profile zones • Presence of dense and massive soil structure • Absence of roots within soil aggregates • Presence of early maturing crop with reduced height and density • In mixed pasture or haylands, uneven distribution of species • Uneven crop height and density in cropland	• Presence of surface ponding • Presence of surface vehicle (equipment) ruts • Presence of stratified or abrupt moisture changes within the soil profile • Presence of dense, massive or layered structure (compaction) • Presence of flooded (yellow or stunted) crop conditions • Presence of abrupt texture or structure transitions	• Presence of dense, massive or layered soil structure (compaction) • Presence of reduced pore size and pore space • Presence of brownish-red ped surfaces • Presence of sour odours

Appendix B – DSA Example

Government of Saskatchewan
Ministry of the Economy

Detailed Site Assessment

Petroleum and Natural Gas Division

A passing DSA is a mandatory component of the AOR application. For further details on DSA requirements and completing this form please refer to the AOR and DSA Guidelines available at www.economy.gov.sk.ca/AOR.

Prepared By (Consultant Company Name): Environmental Services Org

Contact Person: John Doe Position: Senior Environmental Consultant, P.Eng.

Phone #: (306) 555-5555 ext: 203 Email: John.Doe@eso.sk.ca

Prepared For (Licensee Name): Rando Oil and Gas Company Inc.

Site Surface Location:

QTR	LSD	SEC	TWP	RGE	M
NE	16	36	64	29	2

Site Type: [X] Well: Licence #: **99Q213** , Unique Well Identifier (UWI): 41/16-36-64-29 W2M

[ ] Facility: Licence #:

Well/Facility Name: Rando edam D16-36-64-29

ACTIVITY TYPE	DESCRIPTION	DATE (mm/dd/yyyy)
Site Initialized	Well Finished Drilling Date	**01/02/2000**
Abandonment Completed	Well Cut & Capped	01/12/2000
Site Restoration Completed	By third party in consultation with the landowner	05/01/2003
Topsoil Addition	Not Applicable	
Fertilizer Addition	Yes (details provided in question 8 below)	05/01/2001
Amendment Addition	Not Applicable	

1) Land use criteria (indicate all that apply):

[X] Cultivated (Annual Crop) [ ] Cultivated (Perennial Crop) [X] Grasslands [ ] Peat lands [ ] Forest (privately owned)

2) Does the endpoint landuse differ from the historical landuse of the site? Yes; approval(s) attached and explanation provided below:

A large portion of the site was converted from Grassland to Cultivated annual crop usage as per landowners requirest. No approval obtained, site was seeded this based on consultantion with the landowner.

3) Has the landowner agreed to allow "improvements" to remain on site? Yes; list of improvement feature(s) provided below:

Texas gate and a portion of the fence remain on site as improvements authorized by the landowner.

4) Has an Exemption from Reclamation been approved by ECON for any portion of the site or access? Yes

5) How was the site accessed? Develped Access Road

6) Were low/minimal disturbance practices used to construct the site and/or access? No

7) If topsoil additions were applied during site restoration provide additional details below (i.e. date of application, incorporation method, source, voulme, chemical/physical composition compatibility with the site, weed content, etc):

Not applicable. Site was stripped prior to drilling and stockpile was retained on site to be used during reclamataion.

8) If fertilizers or amendments were applied during site restoration provide additional details below (i.e. type, application rate, quantity, location where fertilizer or amendment was applied):

pounds of Fertilizer XYZ was applied to the entire site and access in May 2001. A DSA was conducted several years after the required 2 year waiting period.

A. Landscape Assessment

Landscape criteria is assessed by comparing the site with the adjacent land. This assessment should be conducted by looking from several vantage points at the site as a whole (not at individual assessment points). Any differences noted between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or off-site.

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

While the evaluation of landscape criteria is somewhat subjective, a discussion of each of the following parameters is required:

DRAINAGE		
1) Is the surface water flow and onsite drainage (i.e. cross site flow, direction, dispersion, ponding, depressional storage) comparable to adjacent land offsite?		Yes; Site Passes
2) Are there any facilities or features left in place (i.e. clay pads, etc) onsite that would negatively impact drainage?		No; Site Passes
EROSION		
1) Is there any soil erosion (i.e. rills, gullies or blowouts) occurring onsite?		No
2) Based on a qualitative assessment of bare soil in relation to cover, is the onsite erosion comparable to the adjacent land offsite?		Yes; Site Passes
CONTOUR		
1) Does the contour/roughness onsite conform and blend with adjacent land offsite, and is it consistent with the present and/or intended land use?		Yes; Site Passes
STABILITY		
1) Is there any slope movement, slumping, subsidence, or tension cracks occurring onsite?		No
2) Is the onsite stability comparable to the adjacent land offsite?		Yes; Site Passes
GRAVEL & ROCKS		
1) Is there any gravel (<10cm) and/or rocks (>10cm) piled, windrowed or concentrated in areas onsite?		No; Site Passes
2) For Cultivated Sites:	Is there more than a 10% gravel increase in the surface cover anywhere onsite?	Yes; Site Passes (Justification Used)
	Is there a rock increase in the surface cover anywhere onsite?	No; Site Passes
3) For Grassland Sites:	Is there more than a 20% gravel (plus rock) increase in the surface cover anywhere onsite?	No; Site Passes
DEBRIS		
1) Is there any industrial or domestic debris/refuse onsite?		No; Site Passes
2) For Grassland & Peatland Sites:	Is the organic debris (i.e. straw, wood) onsite consistent with adjacent land offsite?	Yes; Site Passes
	Is there any woody debris (i.e. roots, slash) onsite that is interfering with normal land use or the adjacent lands offsite?	No; Site Passes
COMMENTS OR JUSTIFICATION (provide additional information regarding landscape criteria below):		
More that 10% gravel increase on the cultivated portion of the site, however, the landowner was not concerned and vegetaion is not adversely affected.		

B. Lease Sketch

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

LEGEND

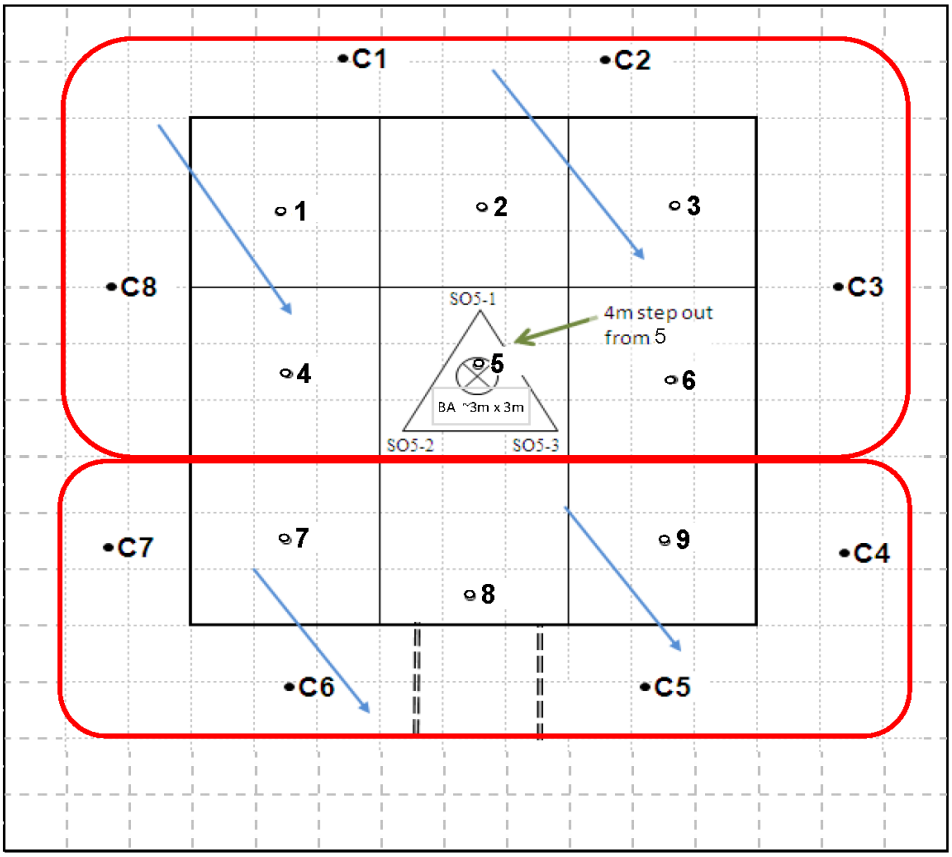
Control Point	Assessment Point	Step Out	Lease Boundary	Access Road Boundary	Drainage Direction	Former Wellhead	Former Storage Tank	Former Sump/Pit	Former Cement Pad
•C#	○#	△	———	═══	→	⊗	⌭	▽	□

LANDSCAPE CRITERIA		VEGETATION CRITERIA	SOIL CRITERIA	OTHER INFORMATION	
PD - Poor Drainage	E - Erosion	VS - Vegetation Stress	AD - Admixing	text	Improvement Feature Remaining Onsite
WP - Water Pooling	C - Contour	PH - Poor Health Areas	PR - Profile Restriction		DEFINE
G/R - Gravel/Rocks	D - Debris	BA - Bare Areas			Approved Reclamation Exempted Area
ST - Stability		W - Weeds			

Lease Size	
Length (m)	100.0
Width (m)	100.0
Area (ha)	1.00

Grid Size (m x m)
33 x 33

Land Use / Vegetation	
Lease	Cultivated (oat)/ Grassland
North	Cultivated (oat)
East	Cultivated (oat)/ Grassland
South	Grassland
West	Cultivated (oat)/ Grassland



COMMENTS	
	The North 2/3 of the site consisted of a cultivated oat crop and the south 1/3 of the site was seeded to native pasture grassland to accomodate the landowners wishes to maintain consistency with the surrounding lands. Controls C4-7 represent the background conditions of the grassland portion of the lease grids 7-9 and controls C1-3 & 8 represent the background conditions of the cultivated portion of the lease grids 1-6. Native Pasture Species comprised Alfalfa, Fescue, Bromegrass is consistent on and offsite. There was a bare area (~3m x 3m) in the grid located by the well center so a step out was conducted 4 m away from the original grid 5 lease assessment point.

C. Lease Soil Assessment

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

Lease Assessement Points	Topsoil					Soil Profile Assessment			Comments/Anomolies Observed
	Depth (cm)	Admixing (%)	Texture	Strength	Aggregate Size (cm)	Depth (cm)	Topsoil	Subsoil	
1	12.0	0 to 30	CL	Friable	<2	50.0	NR	NR	
2	10.0	0 to 30	C	Friable	<2				
3	13.0	0 to 30	CL	Friable	<2	50.0	NR	NR	
4	11.0	0 to 30	CL	Friable	<2				
SO 5	11.0	0 to 30	C	Friable	<2	50.0	NR	NR	step out conducted 4 m from original assessment point (former well center), is compatible with off-site controls
6	10.0	0 to 30	CL	Friable	<2				
7	8.0	0 to 30	C	Friable	2 to 5	50.0	NR	NR	
8	9.0	0 to 30	CL	Friable	2 to 5	50.0	NR	NR	entrance to site
9	9.5	0 to 30	C	Friable	2 to 5	50.0	NR	NR	
Average	10.4								

Control Assessement Points	Topsoil					Soil Profile Assessment			Comments/Anomolies Observed
	Depth (cm)	Admixing (%)	Texture	Strength	Aggregate Size (cm)	Depth (cm)	Topsoil	Subsoil	
C1	14.0	0 to 30	CL	Friable	<2	50.0	NR	NR	
C2	12.0	0 to 30	C	Friable	<2				
C3	10.0	0 to 30	CL	Friable	<2	50.0	NR	NR	
C4	13.0	0 to 30	CL	Friable	2 to 5				
C5	16.0	0 to 30	CL	Friable	2 to 5	50.0	NR	NR	
C6	12.5	0 to 30	CL	Friable	2 to 5				
C7	13.3	0 to 30	C	Friable	2 to 5	50.0	NR	NR	
C8	14.2	0 to 30	CL	Friable	<2				
60% Average	7.9								
50% Average	6.6								

C. Lease Soil Assessment (Step Out Data)

When an anomaly is encountered at a lease soil assessment location, the third party consultant may opt to conduct a step-out assessment to determine if the anomaly is representative of the entire grid. A step-out consists of assessing three additional locations which can be up to 10 m from the original point in a triangular shape around it.

The data for the original assessment location, along with the individual step-out data must be reported on the step-out portion of the DSA form. The average of the step out data, denoted as SO #, should then be transferred into the lease soil assessment table in place of the original assessment point data and used when assessing the criteria requirements for that particular grid.

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

	Topsoil					Soil Profile Assessment			
Assessement Points	Depth (cm)	Admixing (%)	Texture	Strength	Aggregate Size (cm)	Depth (cm)	Topsoil	Subsoil	Comments/Anomolies Observed
5 (original)	6.0	0 to 30	CL	Firm	2 to 5	50.0	NR	NR	former well cente, root elongation could not be observed as there was bare/sparse vegetation, however, compaction was not observed and the soil did not appear to be restricted.
SO 5-1	11.0	0 to 30	CL	Friable	<2	50.0	NR	NR	stepped out 4m, vegetated area so roots could be observed and no issues with soil profile restrictions were observed.
SO 5-2	12.0	0 to 30	CL	Friable	<2	50.0	NR	NR	stepped out 4m, vegetated area so roots could be observed and no issues with soil profile restrictions were observed.
SO 5-3	10.0	0 to 30	CL	Friable	<2	50.0	NR	NR	stepped out 4m, vegetated area so roots could be observed and no issues with soil profile restrictions were observed.

11.0 Average of the 3 Step-Out Locations

D. Lease Vegetation Assessment

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

The assessment method used on and offsite were consistent and is defined as follows:	Plant Vegetation	Bare Area	Weeds / Undesirable Plants
	# of plants per m2	% bare	# of weeds per m2

Lease Assessement Points	Plant				% Bare Area	Weeds			
	Species	Health	Height (cm)	Density		Species	Type	Density	Comments/Anomolies Observed
1	Oats	Excellent	70.0	105	5	Not Applicable		0	
2	Oats	Good	65.0	93	7	Not Applicable		0	
3	Oats	Excellent	60.0	100	10	Not Applicable		0	
4	Oats	Excellent	80.0	97	3	Not Applicable		0	
SO 5	Oats	Good	71.0	104	9	Not Applicable		0	step out conducted 4 m from original assessment point (former well center), is compatible with off-site controls.
6	Oats	Excellent	68.0	92	8	Not Applicable		0	
							Average	0	

Control Assessement Points	Plant				% Bare Area	Weeds			
	Species Type	Health	Height (cm)	Density		Species	Type	Density	Comments/Anomolies Observed
C1	Oats	Excellent	70.0	102	6	Not Applicable		0	
C2	Oats	Good	75.0	105	3	Not Applicable		0	
C3	Oats	Excellent	80.0	115	7	Not Applicable		0	
C8	Oats	Excellent	69.0	100	5	Not Applicable		0	
80% Plant Averages & Bare Area Average + 10%			58.8	84	15		Weed Average	0	

D. Lease Vegetation Assessment Continued

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	0	09/18/2013

The assessment method used on and offsite were consistent and is defined as follows:	Plant Vegetation	Bare Area	Weeds / Undesirable Plants
	% cover	% bare	# of weeds per m2

Lease Assessement Points	Plant				% Bare Area	Weeds			
	Species	Health	Height (cm)	Density		Species	Type	Density	Comments/Anomolies Observed
7	Native Pasture	Excellent		90	10	Thistle	Nu	10	Alfalfa, Fescue, Bromegrass. Weed density looks comparable to controls C6 and C7.
8	Native Pasture	Good		88	12	Not Applicable		0	Alfalfa, Fescue, Bromegrass. Entrance to site.
9	Native Pasture	Excellent		91	9	Not Applicable		0	Alfalfa, Fescue, Bromegrass
							Average	3	

Control Assessement Points	Plant				% Bare Area	Weeds			
	Species Type	Health	Height (cm)	Density		Species	Type	Density	Comments/Anomolies Observed
C4	Native Pasture	Good		90	10	Not Applicable		0	Alfalfa, Fescue, Bromegrass
C5	Native Pasture	Good		85	15	Not Applicable		0	Alfalfa, Fescue, Bromegrass
C6	Native Pasture	Good		87	13	Thistle	Nu	9	Alfalfa, Fescue, Bromegrass
C7	Native Pasture	Good		90	10	Thistle	Nu	8	Alfalfa, Fescue, Bromegrass
80% Plant Averages & Bare Area Average + 10%			#DIV/0!	70	12		Weed Average	4	

D. Lease Vegetation Assessment (Step Out Data)

When an anomaly is encountered at a lease vegetation assessment location, the third party consultant may opt to conduct a step-out assessment to determine if the anomaly is representative of the entire grid. A step-out consists of assessing three additional locations which can be up to 10 m from the original point in a triangular shape around it.

The data for the original assessment location, along with the individual step-out data must be reported on the step-out portion of the DSA form. The average of the step out data, denoted as SO #, should then be transferred into the lease vegetation assessment table in place of the original assessment point data and used when assessing the criteria requirements for that particular grid.

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	9/18/2013

Assessement Points	Plant				% Bare Area	Weeds			Comments/Anomolies Observed
	Species Type	Health	Height (cm)	Density		Species	Type	Density	
5 (original)	NONE (Bare)	Poor	0.0	0	100	Not Applicable		0	former well center, bare/sparse vegetation ~ 3 m x 3 m.
SO 5-1	Oats	Good	70.0	100	10	Not Applicable		0	stepped out 4m, vegetated area , growth is compatible with remaining grid
SO 5-2	Oats	Excellent	75.0	108	12	Not Applicable		0	stepped out 4m, vegetated area , growth is compatible with remaining grid
SO 5-3	Oats	Good	68.0	104	6	Not Applicable		0	stepped out 4m, vegetated area , growth is compatible with remaining grid
	Average of the 3 Step-Out Locations		71.0	104	9			0	

E. Access Sketch

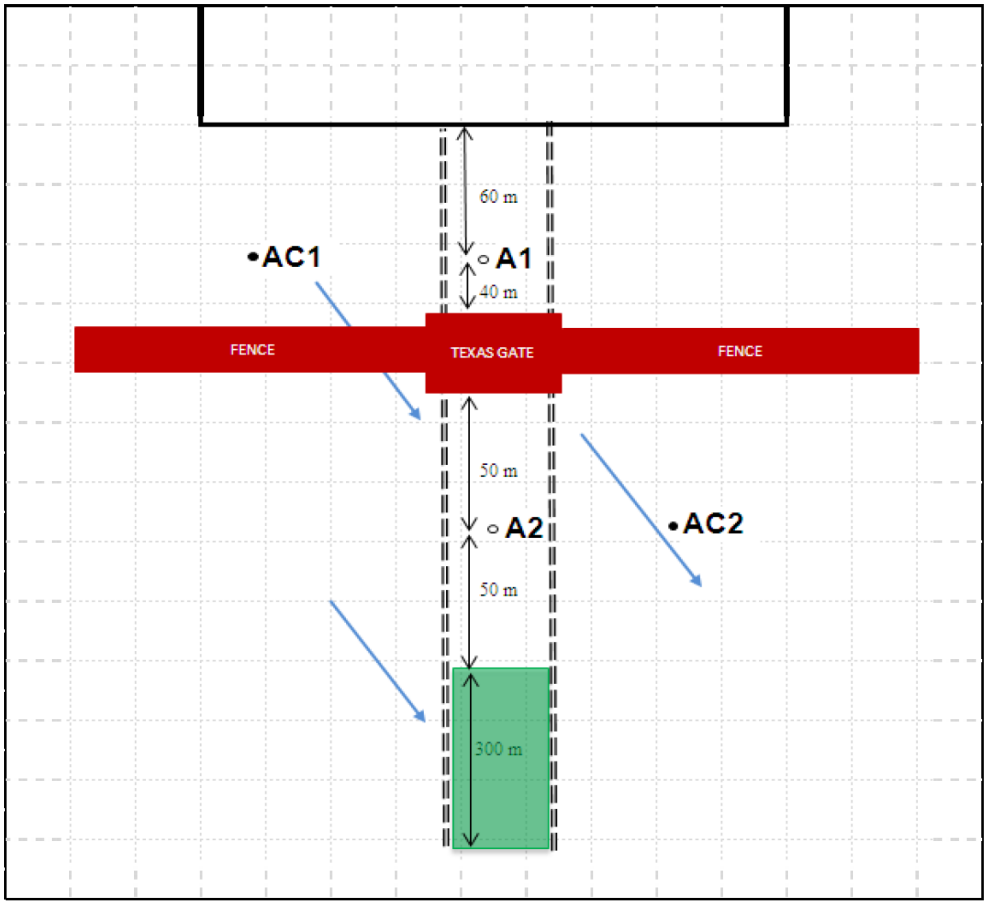
Licence # or Site Surface Location	Assessors Name	Assessment Date (mm/dd/yyyy)
99Q213	John Doe	09/18/2013

LEGEND				
Access Control Point	Access Assessment Point	Lease Boundary	Access Road Boundary	Drainage Direction
•AC#	○ A#	———	═══	→

LANDSCAPE CRITERIA		VEGETATION CRITERIA	SOIL CRITERIA	OTHER INFORMATION		
PD - Poor Drainage	E - Erosion	VS - Vegetation Stress	AD - Admixing		Improvement Feature Remaining Onsite	Approved Reclamation Exempted Area
WP - Water Pooling	C - Contour	PH - Poor Health Areas	PR - Profile Restriction	text	DEFINE	
G/R - Gravel/Rocks	D - Debris	BA - Bare Areas				
ST - Stability		W - Weeds				

Access Size	
Length (m)	500.0
Width (m)	20.0
Area (ha)	1.0

Land Use / Vegetation	
Access	Grassland
North	Grassland
East	Grassland
South	Grassland
West	Grassland



COMMENTS	
	Native Pasture Species comprised of Alfalfa, Fescue, Bromegrass is consistent on and offsite. An Exemption from Reclaimation was approved on May 23, 2002 as the south 300 m of access road is currently being used to access a wellsite in lsd 10-36-64-29 W2M (Licence # 00K123). Therefore, this DSA will only assess the 200 m of access that has been reclaimed. Texas Gate and portion of fence to remain on site as improvement authorized by the landowner.

F. Access Soil Assessment

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

	Topsoil					Soil Profile Assessment			
Assessement Points	Depth (cm)	Admixing (%)	Texture	Strength	Aggregate Size (cm)	Depth (cm)	Topsoil	Subsoil	Comments/Anomolies Observed
A1	12.0	0 to 30	CL	Friable	<2	50.0	NR	NR	Soil texture dropped one class compared to paired cotrol but the soil texture was actually an improvement.
AC1	11.0	0 to 30	C	Friable	<2	50.0	NR	NR	
A2	10.0	0 to 30	CL	Friable	<2	45.0	NR	R	Compaction noted at 45 m.
AC2	10.5	0 to 30	CL	Friable	<2	50.0	NR	NR	

G. Access Vegetation Assessment

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

The assessment method used on and offsite were consistent and is defined as follows:	Plant Vegetation	Bare Area	Weeds / Undesirable Plants
	% cover	% bare	% cover

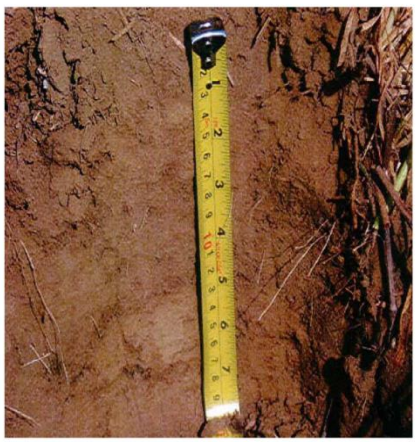
	Plant				%	Weeds			
Assessment Points	Species Type	Health	Height (cm)	Density	Bare Area	Species	Type	Density	Comments/Anomolies Observed
A1	Native Pasture	Good		88	12	Not Applicable		0	Alfalfa, Fescue, Bromegrass
AC1	Native Pasture	Good		89	11	Thistle	Nu	9	Alfalfa, Fescue, Bromegrass
A2	Native Pasture	Excellent		92	8	Not Applicable		0	Alfalfa, Fescue, Bromegrass
AC2	Native Pasture	Excellent		93	7	Not Applicable		0	Alfalfa, Fescue, Bromegrass

H. Photos

Photographs documenting the conditions observed on and off site during the landscape, soil and vegetation assessments must be included along with any visual signs of root restriction, reduced vegetation growth/density or disease, water pooling, visible salt crystals, etc.

ESG	Licence # or Site Surface Location	Detailed Site Assessment Photos Prepared by:
	99Q213	John Doe

PHOTO # 1	
Date Taken:	
09/18/2013	
Location:	
Taken from former well center area looking north.	
Description:	Good oat crop growth.

PHOTO # 2	
Date Taken:	 
09/18/2013	
Location:	
S5 (left) and SO S5-1 (right)	
Description:	Profile assessment showing limited rooting in original grid 5 location (on left) as the area was quite bare/sparse, step out assessments were conducted 4 m away and profile assessment included (on right) for comparison.

I. Summary

icence # or Site Surface Locatio	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

Landscape Assessment Criteria Summary	Lease & Access
1) Is the landscape on-site comparable to the adjacent lands offsite?	Yes; Site Passes (Summary and Justification provided in section A)

Soil Assessment Criteria Summary	Lease	Access
1) Has topsoil been adequatley replaced as per topsoil depth requirements?	Yes; Site Passes	Yes; Site Passes
2) Is the admixing onsite comparable to the admixing offsite?	Yes; Site Passes	Yes; Site Passes
3) Is the topsoil texture onsite comparable to offsite?	Yes; Site Passes	No; Site Passes (Justification Used)
4) Is the topsoil strength onsite comparable to offsite ?	Yes; Site Passes	Yes; Site Passes
5) Is the aggregate size onsite comparable to offsite?	Yes; Site Passes	Yes; Site Passes
6) Is there a restrictive layer in the topsoil or subsoil profile onsite?	No; Site Passes	Yes; Site Passes (Justification Used)

Vegetation Assessment Criteria Summary	Lease	Access
1) Is the vegetation species onsite comparable to the species found offsite?	Yes; Site Passes	Yes; Site Passes
2) Is the plant health (i.e. disease-free, appropriate colour, exhibits vigour, good height, etc.) onsite comparable to the plant health offsite?	Yes; Site Passes	Yes; Site Passes
3) Is the plant height onsite comparable to the plant height offsite?	Yes; Site Passes	Yes; Site Passes
4) Is the plant density onsite comparable to the plant density offsite?	Yes; Site Passes	Yes; Site Passes
5) Are the % bare areas onsite comparable to the % bare areas offsite?	No; Site Passes (Justification Used)	Yes; Site Passes
6) Is the weed species onsite comparable to the species found offsite?	No; Site Passes (Justification Used)	Yes; Site Passes
7 Were there any prohibited weeds found onsite?	No; Site Passes	No; Site Passes
8) Is the weed density onsite comparable to the weed density offsite?	Yes; Site Passes	Yes; Site Passes

COMMENTS OR JUSTIFICATION (in the space below provide additional information regarding soil/vegetation criteria and justification.
There is a 3m x 3m bare area on site, however, a step out was conducted 4 m away and no issues were found. It appears the bare area may be attributed to a low lying area with water ponding at the time of seeding. The landowner said it was not a concern an he will level it when seeding next year. The weed average on the lease is less than the control average, howvever, Lease grid 7 showed weeds slightly exceeding that found on the adjacent controls, we spoke with the landowner who said he will deal with it at the same time as he sprays the adjacent area C6 and C7 which showed comparable weed densities. A1 dropped one class in soil texture, however, the clay loam soil is actually an improvement to the clay soil seen offsite, therefore, it is not considered an issue. A2 showed a restriction in soil profile at 45 m, however, the vegetation at that point is actully better than that seen in the paired control, therefore, it is not considered an issue.

John Doe
Qualified Third Party Consultant Signature

July 16, 2013
Date

Third Party Consultant Qualifications

J. Conclusions and Recommendations

Licence # or Site Surface Location	Assessors Name	Assessment Date
99Q213	John Doe	09/18/2013

CONCLUSIONS	
1) Overall does any area on the site or access fail to meet landscape criteria where justification could not be provided?	No; Landscape DSA Passes
2) Overall does more than one grid fail to meet soil criteria where justification could not be provided?	No; Soil DSA Passes
3) Overall do any grids fail to meet vegetation criteria where justification could not be provided?	No; Vegetation DSA Passes
RECOMMENDATIONS (Based on the professional opinion of the qualified third party consultant, the DSA for the given site and access)	
PASSES	
ADDITIONAL WORK REQUIRED (provide details of the criteria that failed and what work should be carried out to correct any issue(s) prior to conducting a future DSA)	

K. Declaration

DSA Completeness Checklist

Please check off the appropriate boxes indicating the sections completed and included in this DSA.

- [X] Title Page
- [X] A. Landscape Assessment
- [X] B. Lease Sketch
- [X] C. Lease Soil Assessment
- [X] D. Lease Vegetation Assessment
- [X] E. Access Sketch
- [X] F. Access Soil Assessment
- [X] G. Access Vegetation Assessment
- [X] H. Photos
- [X] I. Summary
- [X] J. Conclusions & Recommendations
- [X] K. Declaration by Qualified Third Party Consultant

This Detailed Site Assessment was conducted on behalf of Rando Oil and Gas Company Inc. for the site, with surface located at NE 16-36-64-29 W2M.

I John Doe of Environmental Services Org certify that all applicable sections within this DSA form have been completed and, to the best of my knowledge, all of the aforementioned information is accurate and has been provided. I understand that all applicable sections within this form (and required attachments) are mandatory as part of the DSA submission to the Ministry of the Economy, and an incomplete submission will result in the application being rejected.

Qualified Third Party Consultant Signature | Date | Third Party Consultant Qualifications