Guide to Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities on Forested Land

Heather Tokay, Dean MacKenzie, and Kevin Renkema, Vertex Professional Services Ltd.

Chris Powter, Enviro Q&A Services

Bonnie Drozdowski, InnoTech Alberta Inc.

REPORT PREPARED FOR
PETROLEUM TECHNOLOGY ALLIANCE CANADA
Reclamation Remediation Research Committee

CONFIDENTIAL

18 /19– RRRC – 09_2

August 31, 2020

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This report may be cited as:

Tokay, H., D. MacKenzie, C.B. Powter, B. Drozdowski and K. Renkema 2020. Guide to Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities on Forested Land. Prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. Report 18/19-RRRC-09_2. 82 pp.

ACKNOWLEDGMENTS

The authors would like to acknowledge the financial contributions provided by the Alberta Upstream Research Fund (AUPRF) Program as well as the guidance and support provided by the technical project champions Sonia Glubish, Lisa Warren and Jason Desilets and the technical steering committee members Susan McGillivray and Nadia Cruickshank. We would also like to acknowledge the contributions from individuals who contributed to the project through consultation.

PREFACE

In 2018, the Petroleum Technology Alliance of Canada (PTAC) initiated a multi-stage project in response to challenges experienced by practitioners, regulators and industry stakeholders related to reclamation certification of sites that were constructed using imported mineral soil pads in peatlands, and upland sites that have had natural vegetation encroachment. These sites present one or more reclamation deficiencies according to the applicable wellsite criteria and cannot receive a reclamation certificate without additional scrutiny and justification under current regulatory criteria and policies. This document focuses on upland sites. The main question when dealing with these sites is whether to disturb existing vegetation on upland sites to modify soil and landscape features to meet reclamation criteria. The goals of this project are to assist industry and regulators in making decisions around appropriate management and certification of sites with reclamation deficiencies, and to ensure that functioning ecosystems are developed on these sites.

A main finding from the Stage 1 outreach program was that challenges related to certification of upland sites arise when vegetation parameters meet the Forested Land Criteria, but soil and landscape parameters do not. There has been inconsistency in how decisions about these sites have been made by practitioners and regulators, resulting in different levels of reclamation effort being applied/required, and in how reclamation criteria are interpreted and applied, creating ambiguity in terms of defining acceptable conditions for certification. Historically, industry and regulators have agreed that in certain site-specific circumstances, sites that have natural vegetation encroachment can be certified without removing existing vegetation and re-starting the traditional reclamation process. In these circumstances, reclamation can be certified if the Alberta Energy Regulator approves a variance request, which must be justified based on ecosystem function and include a comprehensive description of the site. However, limited guidance is available on what information is required for professional justification and there is a lack of clarity in the decision process to approve or reject variance requests. There is a need to identify site characteristics that industry and regulators can agree require no (or minimal) further disturbance on upland forested sites with reclamation deficiencies. The findings from Stage 1 are provided in *Evaluation of Reclamation Practices on Upland and Peatland Wellsites*.

This document was developed to provide guidance and consistency in applying for and approving variance requests for reclamation certification of upland sites from an ecological perspective. Specifically, this document is targeted at sites that meet equivalent land capability and are on a trajectory towards sustainable forest ecosystems but have one or more reclamation deficiencies and reclamation to correct these deficiencies would damage the developing forest ecosystem on the site (or its associated access road) to the extent that the impacts outweigh the reclamation benefits. This document is not intended to encourage or promote the use of variances to avoid doing reclamation, or to justify poor reclamation practices or lack of site history. Neglecting timely reclamation in favour of waiting for conditions to develop on-site that will justify deficiencies is not considered acceptable. Variances are to remain the exception and not the rule. The document will address common issues on upland sites but will not cover every single issue on every single site. The document will only apply to sites that can be certified through the *Alberta Framework for the Management of Contaminated Sites*.

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LIST OF TERMS AND ACRONYMS

Terms

Additional Review (OneStop)

Reclamation certificate applications submitted to the AER through OneStop may go through two levels of review: baseline review and additional review. Applications that have unresolved landowner or interest holder complaints, filed statements of concern, requests for variances from the standard criteria that have not been preapproved by the AER, or are more complex are sent for additional review. AER staff will undertake a more detailed review of the application, which may include conducting field inspections, before issuing a decision (Alberta Energy Regulator, 2019a). The Forested Land Criteria refers to applications in this stream as non-routine applications (Alberta Environment and Sustainable Resource Development, 2013a).

Baseline Review (OneStop)

Reclamation certificate applications submitted to the AER through OneStop may go through two levels of review: baseline review and additional review. The baseline review ensures that the application meet the validation rules (e.g., confirming the well has an abandoned status) and assessment rules (e.g., confirming that there are no outstanding landowner complaints). All applications go through the baseline review, and a notice of application is posted. If no statements of concern are received, then the certificate will be automatically issued. (Alberta Energy Regulator, 2019a). The Forested Land Criteria refers to applications in this stream as routine applications (Alberta Environment and Sustainable Resource Development, 2013a).

Compatible Species

Seeded species that were part of a seed mix that was appropriate to the time period in which the site was constructed/reclaimed or as outlined in historical agreements with the Land Manager (Alberta Environment and Sustainable Resource Development, 2013a).

Control

Refers to information collected off-site against which collected information from a reclaimed site will be compared. The control information is collected off-site from adjacent or representative land (Alberta Environment and Sustainable Resource Development, 2013a).

Desirable Species

Desirable species are native species that are appropriate to the representative off-site ecosite based on vegetation assessments at control locations and ecosite guides. Compatible species may be included in the definition of desirable species in some cases depending on the reclamation period of the site (Alberta Environment and Sustainable Resource Development, 2013a).

See also Compatible Species.

Deficiency (Reclamation Deficiency)

A feature or parameter that does not meet the Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013a).

Ecosite

Ecological units that develop under similar environmental influences (climate, moisture and nutrient regime) […] It is not tied to specific landforms or plant communities […], but is based on the combined interaction of biophysical factors that dictate the availability of moisture and nutrients for plant growth. Thus, ecosites are different in their moisture regime and/or nutrient regime (Beckingham and Archibald, 1996).

Ecosystem Function

The interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting, and flammability (Alberta Environment and Sustainable Resource Development, 2013a). Conceptually, other forest functions also include providing wildlife habitat, temperature regulation and carbon sequestration.

Equivalent Land Capability

The ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical (Alberta Environment and Sustainable Resource Development, 2013a, Government of Alberta, 1993).

Evidence-based Approach

Approach requiring the collection and presentation of concrete evidence as a rationale to justify reclamation deficiencies.

Forested Land

Forested land includes any treed land, whether or not the forest vegetation is utilized for commercial purposes. Treed (bush) lands in the White Area (deedable land) that is to be maintained as 'treed' shall

meet the Forested Criteria. Land in the White Area where a land use has been changed to cultivation must meet the cultivated criteria. In the Green Area (crown land), native meadows or range improvement areas in grazing dispositions may be assessed using the grasslands or cultivated lands criteria, with approval from the Land Manager (Alberta Environment and Sustainable Resource Development, 2013a).

Forested Land Criteria

The *2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands (Updated July 2013)* (Alberta Environment and Sustainable Resource Development, 2013a).

Incompatible Species

Species that are neither desirable species nor compatible species

See also Desirable Species and Compatible Species.

Invasive Species

The "invasive species" term has not often been formally codified as its usage is broad and subjective and can be used to refer to any number of aggressively colonizing species, particularly those that "displace the original structure of the plant community" (Powter, 2002). The "invasive" label is strongly context-dependent.

See also Problem Introduced Species and Undesirable/Problem Weed.

Land Manager

For Public Lands, this includes the Forest Officer, Lands Officer, Land Management Specialist, and/or Lands Approval Team Lead in Alberta Environment and Parks for a specific Region. For Provincial Parks and Protected Areas, it is an Alberta Environment and Parks staff member from the Parks Division. For Private Lands, this includes the landowner, their designate, or occupant (Alberta Environment and Sustainable Resource Development, 2013a).

Macro-contours

In the context of operability conditions in the Forested Land landscape criteria, macro-contours are contours that occur on a 30 to 100 m width scale (Alberta Environment and Sustainable Resource Development, 2013a).

Merchantable Timber

Merchantable timber size standards are defined by the harvesting ground rules that apply to the timber disposition. The *Alberta Timber Harvest Planning and Operating Ground Rules Framework for Renewal* (Government of Alberta, 2016) defines several standard options; the minimum diameter is typically >15 cm at stump height (30 cm).

Meso-contours

In the context of operability conditions in the Forested Land landscape criteria, meso-contours are contours that occur on a 10 to 30 m width scale (Alberta Environment and Sustainable Resource Development, 2013a).

Micro-contours

In the context of operability conditions in the Forested Land landscape criteria, micro-contours are contours that occur on a <10 m width scale (Alberta Environment and Sustainable Resource Development, 2013a).

Native Species

Plant species that are indigenous to the ecosite (Alberta Environment and Sustainable Resource Development, 2013a).

A plant species that is part of an area's original flora (Powter, 2002).

Plant species that are listed as native in the *Flora of Alberta: A Manual of Flowering Plants, Conifers, Ferns and Fern Allies Found Growing without Cultivation in the Province of Alberta, Canada* (Moss, 1993).

Natural Recovery Site

Site using a natural recovery strategy for revegetation. Natural recovery is the long term re-establishment of diverse native ecosystems (e.g., prairie, forest) by establishment in the short-term of early successional species. This involves revegetation from soil seedbank and/or natural encroachment and no seeding of non-native agronomic species (Alberta Environment and Sustainable Resource Development, 2013a).

Non-native Species

Species that are not native to Alberta.

See also Native Species.

Noxious Weed

Plant species designated as noxious weeds in the *Weed Control Regulation* (Government of Alberta, 2010). The *Weed Control Regulation* also provides authority for a municipality to designate plants that are not listed as weeds in the *Weed Control Regulation* as noxious weeds. Noxious weeds are problematic to reclamation areas due to their highly aggressive colonization potential, ability to decrease biodiversity, and in some instances the potential to be allelopathic (i.e., inhibit other species from germinating or growing).

OneStop

The online tool used in Alberta to submit reclamation certificate applications for upstream oil and gas sites to the AER.

Operability

The Forested Land Criteria defines operability as the effort required to implement management decisions and practices in order to achieve a desired level of return (Alberta Environment and Sustainable Resource Development, 2013a). On forested lands, operability refers to equipment operation (especially for forestry) and land management.

Problem Introduced Species

Most often, this label encompasses agronomic species that mount considerable invasion pressure in forested areas. Alberta Environment (2003) defines problem introduced plants as forage plants that were introduced for crop or forage production purposes, and either invade or persist in native plant communities. Examples of plants that have been identified as problematic in the Central Parkland and Foothills regions include, timothy, smooth brome, and reed canary grass (although the latter is actually a native species, it is used as a forage species).

See also Invasive Species and Undesirable/Problem Weed.

Professional Justification

Explanation of why the site should be permitted to vary from the criteria and still receive certification (Alberta Energy Regulator, 2019a) submitted to the AER with a variance request either in advance of (pre-approved justification) or as part of a reclamation certificate application. Justifications should provide a strong rationale as to why the deficiency is not expected to have adverse environmental impacts and how the site will still achieve equivalent land capability and ecosystem function despite not meeting the Forested Land Criteria, accompanied by detailed and comprehensive site-specific supporting information.

Professional Judgment

The application of training, knowledge and experience in making appropriate decisions.

Site

An upstream oil and gas wellsite and/or associated facilities (e.g., log deck, access road) required to meet Alberta's reclamation criteria to achieve reclamation certification. In this document, the term site is used to refer to a site on forested land (whether in the Green Area or the White Area) on which the well has been properly and fully abandoned, and where contamination is absent or has been remediated (risk managed sites are also out of scope). Furthermore, a site in this document has one or more reclamation deficiencies as per the Forested Land Criteria, but reclamation to correct these deficiencies would damage the developing forest ecosystem on the site (or its associated access road) to the extent that the impacts outweigh the reclamation benefits.

Sites with a Low Risk of Safety Hazards

Sites can be considered to have a low risk of safety hazards if they meet both of the following:

- Sites with an access road that is blocked by an access deterrent which may include (but is not limited to): large trees and/or shrubs, boulders, large soil mounds or coarse woody debris.
- Sites that are not currently within a grazing lease.

Undesirable/Problem Weed

The "undesirable/problem weeds" category, as with other weed labels, is context-dependent and based on the reclamation area's location, the species in question, the native plant community, and historical management practices. In the context of reclaiming a forested ecosystem, if an invading species is not listed as a prohibited noxious or noxious weed and is not agronomic in nature then the species can be

considered “undesirable” or a problem weed. Specific counties or regions can consider species to be undesirable/problematic weeds, even if they are not listed as noxious or prohibited noxious in legislation. Relevant native plant community guides and local authorities can be consulted to understand if the species of concern is labeled as undesirable in a specific area.

See also Invasive Species and Problem Introduced Species.

Third-party Impacts

Third-party impacts are those that occur as a result of activities conducted on the site by someone other than the operator (or their contractors) or the Regulator, who may not be known to the operator. Examples include recreational or traditional users (e.g., ATV/UTV trails, camping), other industrial traffic (e.g., seismic construction), the Land Manager or the Landowner (e.g., livestock grazing, hay bale storage), wildlife and any other unauthorized access (Alberta Environment, 1997).

Topsoil

Undistured forested soil profiles are comprised of organic forest floor horizons (L, F, H and O) above mineral Ae, Ahe or Ah horizons followed by the subsoil (mineral B horizons) as defined in the *Canadian System of Soil Classification – Third Edition* (Soil Classification Working Group, 1998). The Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013a) uses the terms topsoil and surface soil interchangeably and defines them as the “uppermost mineral material, valued as a growing medium” or the “uppermost mineral or organic material, valued as a growing medium” (these two definitions are found in different sections of the Forested Land Criteria). The Forested Land Criteria also specifically defines topsoil as the “A horizon, including the Ah, Ahe and Ae horizons.” It is this last definition of topsoil that is used in evaluating topsoil depth and distribution. The off-site average topsoil depth is assessed as the combined depth of Ah, Ahe and Ae horizons but does not include LFH. Depending on how the forest floor and topsoil horizons were salvaged during construction, the replaced layer of topsoil on-site after reclamation is often a combination of the LFH and A horizons.

Variance (Criteria Variance)

A deviation from the standard criteria or assessment process described in the relevant wellsite criteria document which must be approved by the AER. The term variance is used in SED 002 (Alberta Energy Regulator, 2019a) but not in the Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013a). A variance request containing a professional justification must be submitted to the AER to obtain a variance.

Variance Request

A formal request submitted to the AER for a deviation from the standard criteria or assessment process described in the Forested Land Criteria. A variance request must contain a professional justification. For sites that require a variance request, the application process is termed a “non-routine application” or “additional review” (unless pre-approval is obtained).

See also Additional Review.

Vegetation Override

A specific type of variance to the wellsite certification criteria, where reasonable forest cover (i.e., amount, species and distribution) is present, and where additional activities required to meet the conditions described in the criteria pose a risk to existing ecosystem function (Alberta Environment and Sustainable Resource Development, 2013a). The term vegetation override is used in the Forested Land Criteria but not in the SED 002 (Alberta Energy Regulator, 2019a).

Weed

Refer to definitions of noxious weed, invasive species, problem introduced species, undesirable/problem weed.

Acronyms

The following acronyms are used in this report or the cited references.

AAF	Alberta Agriculture and Forestry
AER	Alberta Energy Regulator
ATV	All-terrain Vehicle
AUPRF	Alberta Upstream Petroleum Research Fund
EPEA	*Environmental Protection and Enhancement Act*
CAT	Combined Assessment Tool
DSA	Detailed Site Assessment
LFH	Litter, Fibric, Humic
LSD	Legal Subdivision
PTAC	Petroleum Technology Alliance Canada
OSE	Oil Sands Exploration (operation)
RoO	Record of Observations
SED	Specified Enactment Direction
UTV	Utility Vehicle

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TOKAY, H., D. MACKENZIE, C.B. POWTER, B. DROZDOWSKI AND K. RENKEMA

1.0 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document has been developed to provide guidance and consistency in applying for and approving variance requests for reclamation certificate applications for forested upstream oil and gas wellsites (and associated facilities) that meet equivalent land capability and are on a trajectory towards sustainable forest ecosystems but have one or more reclamation deficiencies according to Alberta's Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013a).[1] This document is not intended to encourage or promote the use of variances to avoid doing reclamation, or to justify poor reclamation practices or lack of site history. Neglecting timely reclamation in favour of waiting for conditions to develop on-site that will justify deficiencies is not considered acceptable. Variances are to remain the exception and not the rule. The purpose of this document is to inform decisions on whether additional reclamation is required to correct deficiencies on sites that have had vegetation establishment and ensure that the decision to forego additional reclamation are based on sound ecological principles. If a need for additional reclamation is identified, this document is not intended to prescribe specific reclamation practices to correct deficiencies. Professional judgement must still be used by all parties (practitioners, companies, and regulators) to decide what should be done at a particular site.

This document is applicable to sites where **reclamation to correct these deficiencies would damage the forest ecosystem** that is developing on the site (or its associated access road) to the extent that the impacts outweigh the reclamation benefits. The focus is on sites that have had woody vegetation establishment, whether through a planned natural recovery revegetation strategy or in combination with tree planting, but also includes sites with seeded grasses (pre-2007 sites only[2]) if the site has had natural recovery of woody vegetation on portions of the site and/or their access roads. Common reclamation deficiencies[3] on these sites include subsidence, hill cuts, variable topsoil depths or a lack of topsoil, admixing, woody debris that has not been rolled back, sparse desirable herbaceous vegetation cover and noxious weeds and other problem species.

The main question when dealing with these sites is whether to disturb existing vegetation to modify soil and landscape features (and/or to control weeds) to meet the Forested Land Criteria or whether to seek

[1] Citations for government documents will be provided the first time the document is referenced but will not be repeated each subsequent time the document is mentioned as they are cited frequently in this report.
[2] As per the Forested Land Criteria, sites reclaimed prior to 2007 are permitted to meet modified vegetation criteria if they were seeded: a minimum of 80% compatible vegetation cover based on the seed mix.
[3] The definition of this and other terms are provided in the glossary.

Alberta Energy Regulator (the Regulator; AER) approval for a variance[4]. There has been inconsistency in how decisions about these sites have been made by practitioners and regulators, resulting in different levels of reclamation effort being applied/required, and in how reclamation criteria are interpreted and applied, creating ambiguity in terms of defining acceptable conditions for certification. There is a need to identify site characteristics that industry and regulators can agree require no (or minimal) further disturbance on upland forested sites with reclamation deficiencies. The ultimate goal is to ensure that functioning ecosystems are developed on these sites while also considering the net environmental benefit. There must be a balance between the potential for adverse effects that may result from leaving the deficiency in place and the ecological damage that may be caused by correcting the deficiency.

Industry and regulators concur, based on current regulatory guidance (Forested Land Criteria and *Specified Enactment Direction (SED) 002: Application Submission Requirements and Guidance for Reclamation Certificates for Well Sites and Associated Facilities* (Alberta Energy Regulator, 2019a)), that sites that do not meet the Forested Land Criteria can still receive a reclamation certificate if the assessment is justified based on ecosystem function and if a comprehensive description of the site is presented to the Regulator. However, to date there has been limited guidance available on what information is required to support professional justifications for variance requests.

The purpose of this document is to provide guidance on variance requests from an ecological perspective to streamline the process of preparing and approving reclamation certificate applications under the Forested Land Criteria. More specifically, this document will provide guidance on:

- How to determine if a site with deficiencies is eligible for a variance (such that equivalent land capability can be achieved and there are minimal adverse effects on ecosystem function in the long term, considering the construction and reclamation date of the site).
    - Both the practitioner and the Regulator can use this guidance to understand and decide if a variance is warranted or whether further reclamation is required.
- How to prepare a professional justification for a variance request, i.e., what information and what level of detail to provide.
    - The practitioner can use this guidance to ensure that their justification is complete.
    - The Regulator can use this guidance to gauge whether the appropriate information has been provided in the submission to enable the Regulator to approve the variance.

1.2 SCOPE

In the context of this guidance document, the term ‘site’ will refer to an upland upstream oil and gas wellsite (and the associated facilities) requiring certification that has one or more reclamation deficiencies as per the Forested Land Criteria, but reclamation to correct these deficiencies would damage the developing forest ecosystem on the site (or its associated access road) to the extent that the impacts outweigh the reclamation benefits. The focus is on sites that have had woody vegetation establishment,

[4] Note that the Forested Land Criteria uses the term “vegetation override” rather than the term “variance”, as discussed in Section 2.2 and in the glossary.

whether through a planned natural recovery revegetation strategy or in combination with tree planting, but also includes sites with seeded grasses (pre-2007 sites only), if the site has had natural recovery of woody vegetation on portions of the site and/or on their access roads. Sites included in this document are restricted to those that are subject to the Forested Land Criteria (whether in the Green Area or the White Area) on which the well has been properly and fully abandoned (contaminated sites that cannot be certified through the *Alberta Framework for the Management of Contaminated Sites* (Government of Alberta, 2019) are out of scope).

This guide is not limited to sites constructed or reclaimed in any particular timeframe. The Forested Land Criteria considers the reclamation expectations of the day through Table 1, which provides criteria for specific ranges of construction and reclamation dates. Sites constructed and reclaimed after June 2007 are expected to meet all aspects of the Forested Land Criteria while sites constructed and/or reclaimed before June 2007 are given more flexibility with regard to some aspects of the criteria based on approved conservation and reclamation practices within that era. **Sites constructed/reclaimed during any timeframe can be eligible for a variance; however, the expectation is that the need for variances should be reduced for sites constructed and reclaimed after June 2007 as reclamation practices are expected to have improved with the updated Criteria.**

Importantly, this document is not meant to replace SED 002, which provides the current reclamation certificate application submission requirements and guidelines, but rather to supplement and provide additional information in support of variance requests.

2.0 RECLAMATION CERTIFICATE APPLICATION PROCESS OVERVIEW

2.1 RECLAMATION CERTIFICATE APPLICATION SUBMISSION

A site becomes eligible for a reclamation certificate when it meets all the Forested Land Criteria for reclamation. Reclamation certificate applications are submitted to the Alberta Energy Regulator (AER) for approval, following the application procedures described in SED 002.

Sites that do not meet all the Forested Land Criteria may still be eligible for a reclamation certificate. According to SED 002:

> *A reclamation certificate application that includes a variance request in response to assessment parameters failing to meet the applicable criteria or guidelines may still be submitted if the application is accompanied by professional justification.*

The AER is entirely responsible for making decisions regarding certification, including those sites which require professional justification for a variance request[5]. Variance requests can be submitted to the AER in two ways (Alberta Energy Regulator, 2019a). **Option 1**: the variance request can be submitted to the AER for pre-approval prior to submitting the reclamation certificate application – a signed document confirming pre-approval is then submitted with the reclamation certificate application. **Option 2**: the variance request can be submitted with the reclamation certificate application. The option selected to submit a variance request has implications for the review stream that the application is subject to within the AER's online application submission system (OneStop); submitted applications may be subject to two levels of review (review streams) (Alberta Energy Regulator, 2019a):

- Baseline review – certificates are automatically issued if the online tool verifies all validation and assessment rules have been met and no statements of concern have been received. Option 1 applications go through this stream. The Forested Land Criteria refers to applications in this stream as routine applications.
- Additional review – more detailed review of the application by AER staff before the certificate is issued. Option 2 applications go through this stream. The Forested Land Criteria refers to applications in this stream as non-routine applications.

Figure 1 presents a flow chart for proceeding through the application process for sites that require a variance.

[5] Sites that require a land use change (i.e., a change in the assessment criteria used) have additional approval requirements; these sites are beyond the scope of this document.

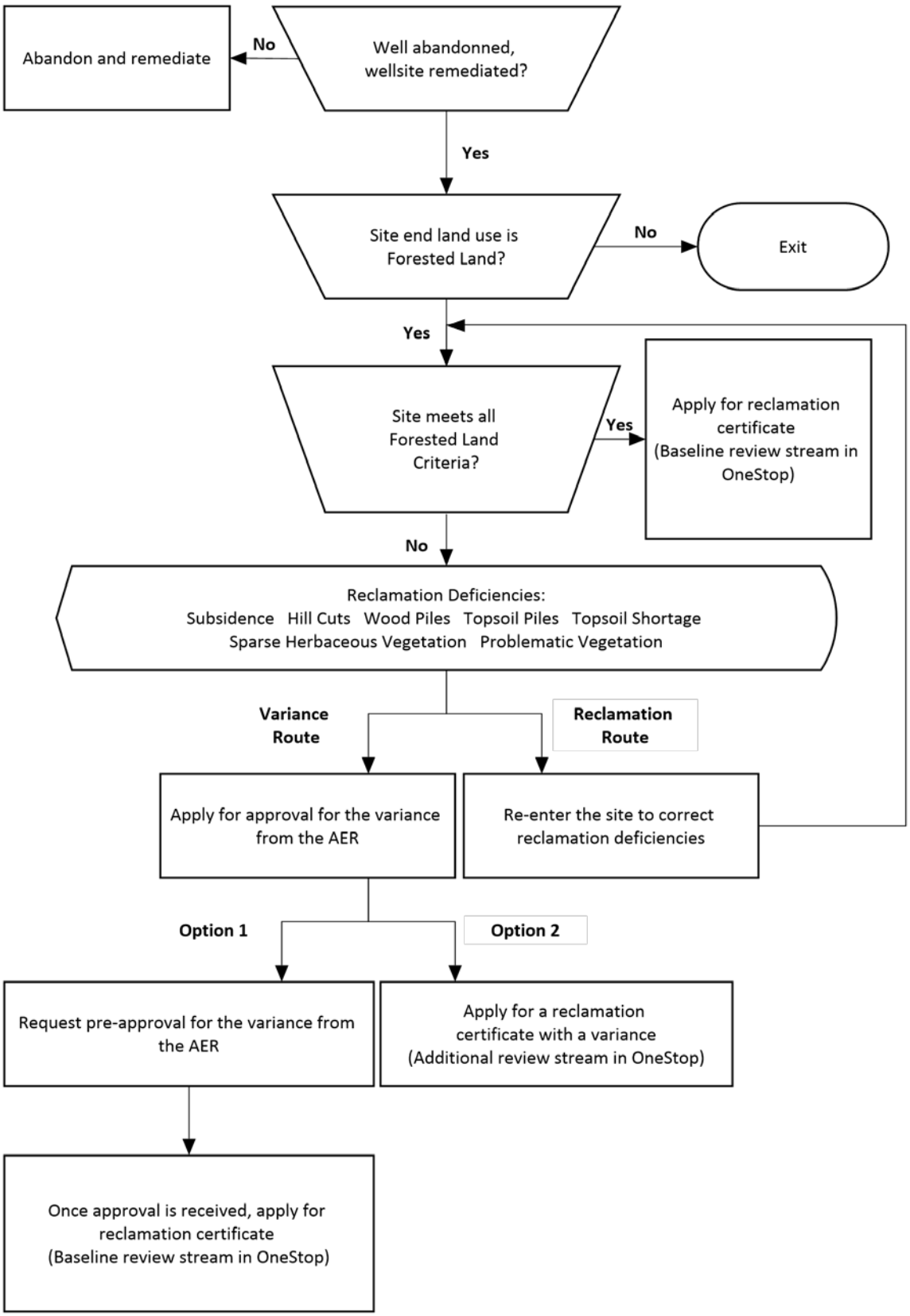

Figure 1. Reclamation certification application process.

2.2 PROFESSIONAL JUSTIFICATION FOR VARIANCE REQUESTS

Professional judgement is used to determine whether a site that does not meet the Forested Land Criteria is eligible for a variance, or whether additional reclamation work is required to correct reclamation deficiencies[6]. Section 3 of this document will discuss minimum requirements for a variance. Professional justifications submitted with a variance request must include a "rationale for [the] decision, supported by acceptable references" (Alberta Energy Regulator, 2019a)[7]. Section 4 will provide guidance on the content of professional justifications.

There are terminology differences between the Forested Land Criteria and SED 002 with regards to variances that create potential for confusion. In particular, SED 002 uses the term *variance* to refer to formal approval for deviations from the standard criteria, but this term is not used in the Forested Land Criteria. Instead, the Forested Land Criteria use the term *vegetation override* to describe a specific situation where the criteria may not be met, as follows; this term is not used in the SED 002:

> *Where reasonable forest cover (i.e., amount, species and distribution) is present, and where additional activities required to meet the conditions described in these criteria pose a risk to existing ecosystem function, a vegetation override may be appropriate. Equivalent capability for forested landscapes must be demonstrated.*

A vegetation override is just one type of variance. Several different types of variances can be selected for forested sites in OneStop (listed below; those that will be discussed in this document are highlighted in blue), including an option for vegetation override (AER, 2019b).

- Variance – Landscape
- Vegetation override – Forested
- Incompatible vegetation – Noxious weeds
- Incompatible vegetation – Invasive species
- Incompatible vegetation – Problem introduced species
- Incompatible vegetation – Undesirable/problem weeds
- Variance – Other
- Aerial Assessment – Forested; damage concerns
- Aerial Assessment – Forested; safety concerns
- Criteria waived due to development zoning
- Third party impact – Private lands
- Third party impact – Public lands

[6] Professional judgement is also used when adjacent lands cannot be used as representative controls for the assessment (e.g., in situations where access to off-site areas was restricted or representative controls were not available).

[7] SED 002 also recommends that "operators should first discuss options with the AER prior to conducting the detailed site assessment."

3.0 MINIMUM SITE REQUIREMENTS FOR VARIANCE APPROVAL

For a site that does not meet the Forested Land Criteria to be eligible for a variance, it must still achieve equivalent land capability, which has been defined in the Forested Land Criteria as:

> *The ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical.*

Ultimately, what this means is re-creating a functional ecosystem that is on a trajectory towards a forested ecosystem able to support forested land uses that may include wildlife utilization and habitat, recreational and traditional uses, and/or commercial forestry[8].

> Ecosystem function is defined in the Forested Land Criteria as "the interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting, and flammability." Conceptually, other forest functions also include providing wildlife habitat, temperature regulation and carbon sequestration.
>
> Forest ecosystems are made up of several structural vegetation layers, most notably the overstory tree canopy and a variety of understory strata (e.g., shrubs, herbaceous plants, mosses, lichens). Biodiversity in these layers and the interactions between vegetation layers and the forest soils they are supported by allow forests to be self-sustaining and resilient to stressors and disturbance (Pyper et al., 2013), both of which are cornerstones of functional ecosystems.

Assessment of ecosystem function considers the site as a whole. The presence of reclamation deficiencies (i.e., features/parameters that do not meet the Forested Land Criteria) on a site does not necessarily preclude the site from supporting a functioning ecosystem. Depending on the specific nature and scale of the deficiency, the occurrence and severity of impacts associated with the deficiency, the natural variability of the surrounding off-site areas, and the ecological damage that may be caused by correcting the deficiency, it may be deemed acceptable to allow the deficiency to remain in place.

The recommended requirements that a site must meet to be eligible for a variance, instead of being subject to further reclamation are:

- Site has a functional ecosystem that is on a trajectory towards a forested ecosystem[9] and thus meets the objective of equivalent land capability.
- Landscape and soil conditions are stable, non-eroding and non-hazardous (i.e., present a low risk to the safety of land users).

[8] Ecosystem function is considered a component of equivalent land capability, but the concept of equivalent land capability is broader. Ecosystem function represents the current ecological state of the site while equivalent land capability incorporates current, future and alternate land uses.

[9] This includes sites with seeded grasses (pre-2007 sites only), if the site has had natural recovery of woody vegetation on portions of the site and/or their access roads.

- Deficiencies left in place do not cause site limitations or have long term adverse environmental impacts (on-site or off-site) that exceed the natural range of variability in the surrounding off-site areas. These impacts include, but are not limited to:
    - Erosion
    - Slumping
    - Drainage issues
    - Fire hazard
    - Soil rooting restrictions
    - Restricted wildlife movement on the landscape scale (with the exception of features created specifically for caribou protection; e.g., features described in Bentham and Coupal (2015) or approved access management/restrictions)
- Deficiencies left in place do not prevent the site from passing the Forested Land woody species cover and/or density criteria appropriate for the site's construction age and revegetation strategy.

Additionally, sites that are impacted by third-party activity may also be eligible for a variance if an evidence-based approach is used to document the activities and show that the wellsite is not the cause of the impacts (third-party impacts are outside of the scope of this document, with the exception of weed-related variance requests).

3.1 DEFICIENCY TYPES

Common deficiencies encountered at forested sites include the following:

- Landscape
    - Subsided areas
    - Hill cuts
    - Soil stockpiles
    - Woody debris piles
- Soil
    - Topsoil depth and distribution
- Vegetation
    - Desirable herbaceous species cover
    - Problematic species

Refer to the individual Information Sheets in Appendix A for in-depth information on each deficiency, including the current Forested Land Criteria, and the minimum requirements and additional considerations for the deficiency to be eligible for a variance, so it can be left in place without further reclamation to correct it (in addition to the requirements described above in Section 3). **These**

Information Sheets must be read in conjunction with the common factors for all deficiencies in Section 3.2 below.

3.2 COMMON FACTORS FOR ALL DEFICIENCIES: NET ENVIRONMENTAL BENEFIT

3.2.1 *Site Re-entry and Reclamation Implications*

For all deficiencies, an important consideration is the environmental impact of re-entering the site and conducting reclamation activities to correct the deficiency. In some cases, reclamation can set the site back in terms of ecological recovery. For example, in Figure 2, a site that had natural woody vegetation recovery was reclaimed to correct landscape deficiencies and the result was a site that was dominated by grass and clover species. Several more years of recovery will be required to achieve a functional forest ecosystem on this site.

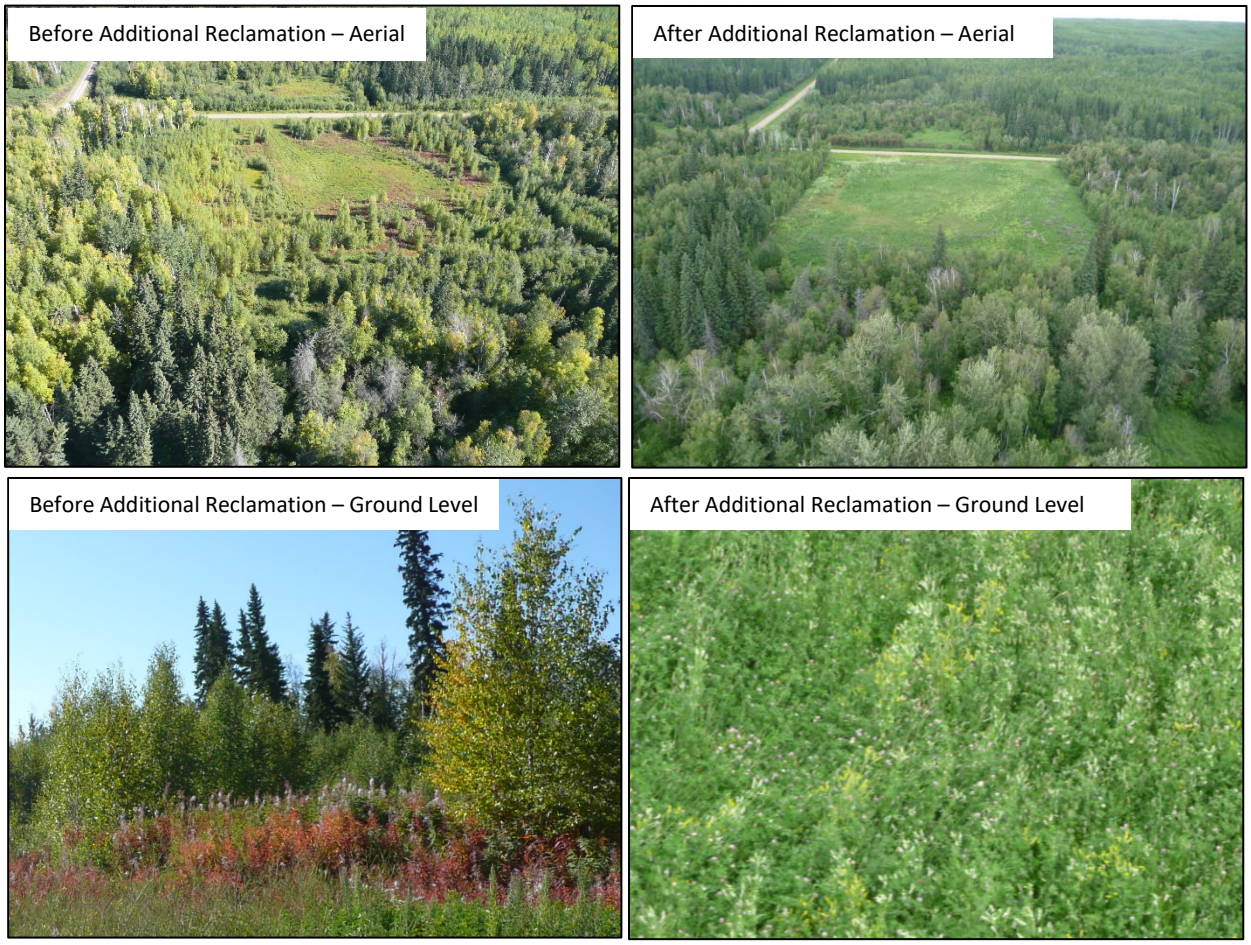

Figure 2. Implications of re-entering a site and conducting reclamation activities to correct deficiencies.
The photographs on the left show the site before addititional reclamation to correct deficiencies; site has woody vegetation infill. The photographs on the right show the same site after additional reclamation; site is now dominated by grass and clover species.

The environmental impacts of site re-entry and reclamation may include:

- Damage to existing vegetation on the access road, especially for sites that have:
  - Long access roads.
  - Access roads that cross through sensitive ecosystems (e.g., peatlands and wetlands).
  - Access roads that require creek crossings.
  - Access roads that have an established canopy of trees and shrubs.
- Damage/destruction of existing vegetation on-site and soil re-disturbance, resulting in delayed ecological recovery. The disturbance to correct deficiencies would represent the second disturbance that the site has undergone, the first being the original disturbance to construct and then reclaim site during which soils were salvaged, stockpiled and then replaced. Soil disturbance (and subsequent re-disturbance) degrades topsoil quality and vegetation propagule abundance. Recovery from a second disturbance may not be as rapid as the first (for further reading on this subject refer to Tokay et al., 2019). Sites that are more vulnerable to re-disturbance include:
  - Sites with lower total abundances of propagules.
  - Sites with more limiting site conditions (e.g., dry, nutrient poor sites).
  - Sites with a history of multiple disturbances.
  - Sites that require a larger disturbance area to correct the deficiency.

  Note that if topsoil had not been replaced during the original site reclamation (or if topsoil is not present on-site at all), soil re-disturbance is less of a deciding factor in the decision to leave a deficiency in place.

  Replacement of naturally recovered woody vegetation with planted ones can also be a factor in delayed ecological recovery, as planted trees are more subject to mortality.
- Rutting and compaction. Sites that are more impacted by this include:
  - Sites with wet soils.
  - Sites with fine-textured soils.
  - Sites that require a larger disturbance area to correct the deficiency.
- Re-opening of access to recreational users, resulting in increased frequency of disturbance and third-party impacts on the site.
- Use of imported topsoil material, resulting in introduction of weeds and diseases or a change in nutrient or moisture regime (e.g., if nutrient-rich agricultural soils are imported), in addition to creating further environmental disturbance at the donor site.

- Weed establishment and potential need for chemical weed control (i.e., noxious weeds and/or any weed that requires control to pass the Forested Land vegetation criteria). Sites that are more susceptible to weed establishment include:
    - Sites that are near active facilities, industrial traffic, agricultural areas or main roadways.
    - Sites with weeds or non-native species in the understory or that have a history of these species (i.e., these species are present in the seed bank).
    - Sites that require a larger disturbance area to correct the deficiency, as this will create a larger receptive seed bed for weeds to establish.
- Delayed certification
    - After re-disturbance, vegetation re-development to meet the Forested Land Criteria for vegetation can take several years.
    - Required one-year waiting period after herbicide application as per the Forested Land Criteria.
    - Required two-year waiting period after the addition of amendments[10] or fertilization as per the Forested Land Criteria.

3.2.2 *Potential for Low-impact Reclamation Work*

An additional factor to consider is the potential for the deficiency to be corrected with minor additional reclamation work, typically without the use of heavy equipment (i.e., by hand, or with small mobile equipment) or by working on a reduced area of the site (e.g., teardrop area). There is an expectation that opportunities to improve the site with minimal effort should be undertaken. Additionally, when heavy equipment is not required for reclamation, access to the site may be possible via helicopter, which results in less environmental damage.

[10] Note that amendments on forested lands do not include topsoil as per the Forested Land Criteria

4.0 PREPARING PROFESSIONAL JUSTIFICATIONS

Once the decision has been made to leave a deficiency in place and request a variance (as per the requirements and factors presented in Section 3 and the Information Sheets in Appendix A), a professional justification is then provided to the AER for approval. This section discusses the expected content of a professional justification and discusses additional data collection that may be required to develop an adequate and thorough professional justification.

4.1 HOW TO DEVELOP THE PROFESSIONAL JUSTIFICATION

According to SED 002:

> *an operator may provide justification as to why a site should be permitted to vary from the criteria and still receive certification.* […]*. If a variance is being requested, the operator must provide the rationale for its decision, supported by acceptable references.*

Professional justifications should provide a strong rationale as to why the deficiency is not expected to have adverse environmental impacts and how the site will still achieve equivalent land capability and ecosystem function despite not meeting the Forested Land Criteria. Justifications should be developed using an evidence-based approach and contain detailed and comprehensive site-specific supporting information.

As was discussed in Section 2.1, operators have the option to submit a justification for pre-approval prior to submitting a reclamation certificate application (Option 1), or they can submit the justification with the reclamation certificate application (Option 2). A justification form is available for use as part of the Combined Assessment Tool (CAT) and Record of Observations (RoO) (Alberta Energy Regulator, 2019c) used for a detailed site assessment (DSA); however, this form is not ideal for use as part of a pre-approval request for a variance because it does not include background site history and ecological information. The form presented in Appendix D is proposed as a standardized form for submitting variance requests.

The form details the comprehensive site information that may be required by the Regulator to make the decision to approve or reject the variance request including:

- Site overview, ecological and land use information and any overlapping dispositions
- Facility location and size
- Site history (dates and descriptions of activities and conditions)
- DSA information (if available)
- Justification rationale
- Site photographs (mandatory)

The justification portion of the form is divided into several sections:

- Deficiency type
- Current criteria requirements

- Description of the deficiency
    - The description of the deficiency should be as detailed as possible and include the dimensions and the location on the site (i.e., site diagram and coordinates).
        - For topsoil depth, the description should include the measured on-site and off-site topsoil depths (including both an average and the range).
        - For problematic species (e.g., weeds), the description should include the species, locations of patches or populations on-site, and number of plants or percent cover within the grid or site as a whole. Data from multiple years is encouraged to show trends over time.
    - All of the deficiencies that occur on the site must be described in this section, as the combined impacts of all deficiencies must be weighed together to determine if any one deficiency can receive a variance. Submission of a variance request for a site that has already received a variance for one deficiency is discouraged.
- Rationale for variance
    - The rationale for the variance must explain why the site still meets equivalent land capability and is on a trajectory towards a forested ecosystem even with the deficiency left in place; any current or potential impacts of the deficiency left in place must be explained and justified.
    - The rationale for the variance must include a discussion of whether the site has met all of the minimum requirements in Section 3 and the relevant Information Sheets and should also refer to any relevant additional considerations specified within the Information Sheets. Summary checklists of these factors for each deficiency type are provided in Appendix B.
    - The rationale should compare and contrast the impacts caused by the deficiency in comparison to those resulting from correcting the deficiency (i.e., environmental cost-benefits analysis).
    - The rationale should include a discussion of how the deficiency compares to off-site and/or regional conditions (if relevant). Comparable off-site conditions should be described in the same level of detail as the deficiency and locations should be provided on the site diagram (and/or as coordinates).
    - The rationale should include a discussion of why the deficiency occurred, why it was not corrected at the time of reclamation or why it was not identified in a more timely manner (e.g., through monitoring and maintenance of the site), and why these circumstances are not a regular occurrence (or are not going to become a regular occurrence).
    - Justifications related to third party activity should include all of the information and descriptions recommended by the *Conservation and Reclamation Information Letter: Third Party Impact on Reclamation* (Alberta Environment, 1997), including a description of the impact, details on actions taken to prevent the impact, a description of the operator's actions to mitigate any environmental damage that has occurred because of the third party and a description of the operator's efforts to deter any further impacts.

- Justifications can include data from the DSA to support explanations. For example, mentioning the woody and herbaceous cover and woody stem density in comparison to the criteria or referring to the specific vegetation species that are present on-site.
- When justifying multiple deficiencies, it is important not to provide contradictory evidence; a statement that supports one deficiency should not be disproven in the arguments for another deficiency. For example, a hill cut cannot be justified by a statement that it is well vegetated if the site is also failing for sparse desirable herbaceous cover throughout the site.
- Case studies and literature can be included as part of the rationale for the variance, if available (refer to Appendix C and Tokay et al., 2019).

The following information could be attached to the justification form to support the application:

- Site diagram (including overlapping dispositions)
- Survey plans
- DSA, including CAT and RoO datasheets and any supporting reports
- Aerial photos
- Construction records
- Pre-disturbance biophysical information
- Any other relevant information

4.2 ADDITIONAL DATA COLLECTION

When reclamation deficiencies are present on-site, additional data collection during site assessment is beneficial to develop more in-depth professional justifications for variance requests. Additional data collection helps to provide improved context for the reclamation goals than may be provided by the normal number of control points or other data requirements in the Criteria. Recommended data to collect beyond the data collected in the DSA could include the following, as applicable for the site:

- Dimensions (width, length and height), location and photographs of subsided areas, hill cuts, soil stockpiles and woody debris piles on-site and a description of any slumping, ponding and erosion.
- Evidence of depressions, windthrow or other natural analogs for subsided areas off-site, including dimensions, location (e.g., coordinates), photographs and a description of any slumping, ponding and erosion.
- Distance of woody debris piles from the edge of the site.
- On-site and off-site contour (i.e., slope class).
- Off-site vegetation measurements (i.e., herbaceous and woody species cover, leader length and height for trees and shrubs).
- On-site tree data to support mean annual increment assessment (as per the *Regeneration Standards of Alberta;* Alberta Agriculture and Forestry, 2018a).

- Off-site ecosite phase and photographs.
- Soil suitability data and samples for analysis (as per the *Soil Quality Relative to Disturbance and Reclamation*; Alberta Soils Advisory Committee, 1987).
- Topsoil pile samples for analysis of organic matter, nutrient and seed bank.
- Species, location, number of plants and patch size for each patch of noxious weeds, invasive species, problem introduced species and undesirable/problem weeds on-site and off-site.
- Percent cover of noxious weeds, invasive species, problem introduced species and undesirable/problem weeds by species (either in each grid or on the site as a whole).
- Evidence of ATV/UTV/snowmobile/light vehicle trails on-site and on the access road, including dimensions, location (e.g., sketch, coordinates) and photographs.
- Evidence of wildlife use of the site, including descriptions, locations (e.g., sketch, coordinates) and photographs.

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APPENDIX A: INFORMATION SHEETS

The following Information Sheets provide the current Forested Land Criteria as well as the minimum requirements and additional considerations for each of the common deficiencies to be eligible for a variance, so it can be left in place without further reclamation to correct it (in addition to the requirements described above in Section 3):

- Subsided areas
- Hill cuts
- Soil stockpiles
- Woody debris piles
- Topsoil depth and distribution
- Sparse desirable herbaceous vegetation cover
- Problematic vegetation

Each of the Information Sheets presents a single deficiency and the factors that may be used to justify a variance request. It is not uncommon for multiple deficiencies to exist on a site, in part because some of the deficiencies are correlated (e.g., Soil Stockpiles and Topsoil Depth and Distribution). In those cases, each of the deficiencies must be justified to obtain the variance. Sites with multiple deficiencies are more difficult to justify not doing additional reclamation.

SUBSIDED AREAS

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

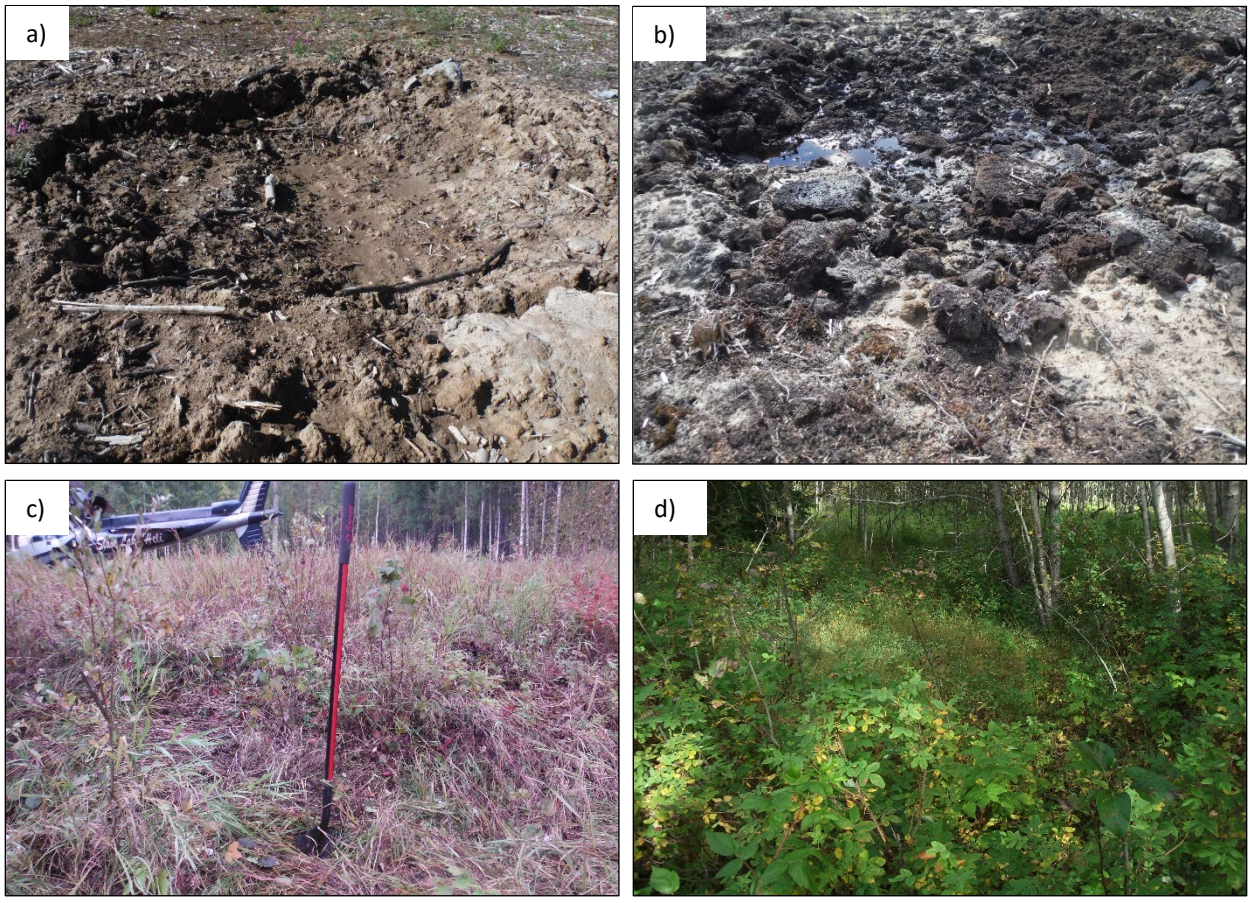

Figure 1. Examples of subsided areas. Requirements and factors presented in this Information Sheet are used to determine if these are eligible to be left in place.
a) and b) before vegetation encroachment; c) and d) after vegetation encroachment.

Subsidence is defined as "lowering of the soil surface due to a reduction in volume through settling or other means" (Powter, 2002) and occurs in localized areas where soil settling occurs unevenly (e.g., at well centre, or in association with cut and fill construction practices). Subsidence may result from settling of uncompacted fill materials, improper fill material placement during reclamation and/or the presence of snow mixed in with fill materials. Subsided areas (Figure 1) form as the result of subsidence; the amount of time over which a subsided area may continue to subside (i.e., becoming deeper or wider) will vary for different sites. Subsided areas can result in a change to the micro- or meso-contour of the site and present

themselves as areas on-site with lower elevation (i.e., depressions)[1]. Edges of deeper subsided areas can be subject to slumping and erosion, and subsided areas can result in ponding. Subsided areas typically range in size from 1 to 10 m^2 on well centres and greater than 10 m^2 on sumps or pits, and typically range in depth from 0.2 m to 0.6 m, although can be up to 1 m deep (Acden Vertex Limited Partnership, personal communication 2019). Slopes leading to subsided areas can range from gradual to abrupt.

Natural Analogs and Acceptable Reclamation Practices in Other Industries

There are two main categories of microtopographical equivalents to subsided areas that can be examined for comparison purposes: naturally occurring variation in micro-contour within forests in the region or creation of microtopographic heterogeneity on reclaimed/reforested sites in other industries to improve revegetation success (Tokay et al., 2019). The most common natural analogs to subsided areas are natural depressions, windthrow pits (Figure 2) or beaver/muskrat runs. Windthrow pits can range from 15 to 55 cm deep, depending on the forest type (Kuuluvainen and Juntunen, 1998; Lee and Sturgess, 2002).

Figure 2. Windthrow mound and pit microtopography.

There are several microtopographic features created during reclamation/reforestation in other industries that are comparable to subsided areas. Although some of these examples are not directly comparable to subsided areas visually, the concept of variations in elevation created in reclaimed areas is comparable. At coal and oil sands mines, surface roughness (or “rough and loose” microtopography) is created during soil replacement by spreading topsoil unevenly or after placement by progressively digging holes with an excavator bucket and dumping the material beside and partially inside the hole across a reclaimed area (Alberta Environment and Water, 2012; MacKenzie and Naeth, 2010; Osko et al., 2018b; Polster, 2011); resultant microtopographic features have been up to 1.5 m tall, 3.5 to 5 m wide and spaced 1 to 2 m apart in some cases (Melnik et al., 2018). Mounding in the forestry industry can create mounds that range from 30 to 40 cm tall and approximately 0.5 to 0.6 m^2 in size (DeLong et al., 1997; Gradowski et al., 2008).

[1] Note that depressions that occur at well centre which are typically referred to as subsided areas may actually be the result of incomplete fill replacement (i.e., not all of the fill material that was removed from the bell hole was replaced into the hole during abandonment and reclamation). It is impossible to delineate areas of subsidence from areas that were not completely filled and for the purposes of this document they are treated together.

Mounding during well pad, road, pipeline, or seismic line reclamation has resulted in a roughened surface with mounds 0.75 to 1 m tall (Bentham and Coupal, 2015; Shunina et al., 2016); note that mounds of this size are often meant to create an access deterrent, suggesting that the resultant terrain is not usable by recreational and traditional users. Site preparation guidance documents targeted at the oil and gas industry recommend that mounds have a final height after settling of 20 to 30 cm for mineral soil mounds and 40 cm for organic soil mounds (Natural Resources Canada, 2019).

Current Forested Land Criteria

Subsided areas that do not meet the Forested Land Criteria typically fail the stability and operability criteria as per sections 9.3.2 and 9.5 of the Forested Land Criteria and the Combined Assessment Tool ([CAT; Alberta Energy Regulator, 2019c]):

- Stability: Subsidence
    - Areas of subsidence are <4 m^2, stable and unlikely to risk the site's stability (note that stability is assessed by the absence of ongoing slumping and erosion).
    - >4 m^2 subsided areas occurring on-site are consistent with that observed off-site.
- Operability: Contour
    - Macro-, meso- and micro- contours[2] on-site are comparable to off-site.
    - Macro-, meso- and micro-contours are not affecting site management.
    - Macro- and meso-contours on-site should be integrated with adjacent off-site landscape features.
    - Macro- and meso-contours shall not result in excessive erosion, slumping/wasting or altered water flow patterns[3].

[2] Typically subsided areas would be considered micro-contours as they occur on the <10 m width scale. Subsided areas that are >10 m in size would be considered meso- or macro-contours depending on their size.
[3] There are specific criteria for these impacts (i.e., erosion, slumping and altered water flow patterns) in Sections 9.1, 9.2 and 9.3 of the Forested Land Criteria that subsided areas must also meet.

Minimum Requirements for a Variance

A subsided area can be left in place with a variance even if it is larger than 4 m^2 if it is not limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if all of the following requirements are met:

- The site passes the Forested Land Criteria for vegetation[4]:
  - If the site was reclaimed prior to June 1, 2007 and was seeded with grasses: Minimum 80% compatible vegetation cover based on the seed mix and the plants are healthy[5].
  - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
  - If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.
- The subsided area presents a low risk to the safety of wildlife, livestock or recreational and traditional users (including ATV/UTV/snowmobile users). As such, subsided areas can only be left in place if they have the following characteristics:
  - Edges of subsided area have gradual slopes (<3:1 or 33%) that are not prone to collapse (i.e., not abrupt or vertical slopes).
  - Not located on a trail or cutline that crosses through the site.

  There are a few exceptions to this based on a risk-management approach: The risk associated with a safety hazard has two components: probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence). Although the severity of an individual subsided area remains constant unless reclamation activities are conducted to remove it, the probability of occurrence is affected by the location of the site. Sites that have a low likelihood of land users encountering the safety hazard have a reduced level of risk and can be treated differently than sites with a greater likelihood of land users encountering the safety hazard. Sites can be considered to have a low risk of safety hazards (and therefore subsided areas can be left in place on these sites) if they meet both of the following:
  - Sites with an access road that is blocked by an access deterrent which may include:

[4] It is possible for a site to fail the vegetation criteria but still receive a variance for subsidence if, for example, the vegetation failure occurs on a different area of the site or if the vegetation failure is not caused by the subsidence (e.g., sparse desirable herbaceous vegetation due to the low productivity site conditions); professional judgment should be used in these cases to determine eligibility for a variance.

[5] Note that sites that are dominated by seeded grasses are not considered to have the same ecological value as sites that meet the natural recovery or planted vegetation criteria, and the rationale for a variance is weaker (i.e., redisturbance is less of a concern). The rationale is stronger if a portion of the site or the access road has forest vegetation and meets the natural recovery or planted vegetation criteria.

        - Large trees and/or shrubs.
        - Boulders.
        - Large soil mounds.
    - Sites that are not currently within a grazing lease.
- The subsided area is stable:
    - Not slumping.
    - Non-erosive.
    - Not increasing in size over time (i.e., no evidence of continuing subsidence during multiple assessments, if available).
- **Either**
    - a) the subsided area is comparable to surrounding off-site areas with similar micro- or meso-contour, such as natural analogs to subsided areas including depressions, windthrow pits or beaver/muskrat runs (Figure 2). When considering the contour of surrounding off-site areas, a large enough area must be assessed to make this determination. The assessment area should not be limited solely to areas directly adjacent to the site; representative areas up to 10 km away from the site could be considered. If the size and depth of any observed natural analogs are comparable to the size and depth of the subsided areas on-site, this can be used as a justification for leaving subsided areas in place. Photographs and documentation of the dimensions and location of observed natural analogs should be included in the justification submitted to the AER (as discussed in Section 4).
- **or**
    - b) the subsided area is not impacting drainage or hydrology for the site as a whole or off-site: if the subsided area is not comparable to surrounding off-site areas (option (a) above), it may still be left in place if it is not impacting drainage or hydrology for the site as a whole. As subsided areas are depressions, it is acceptable that they will have occasional or seasonal ponding (i.e., hold water), but the expectation is that the overall drainage patterns for the site as a whole and the surrounding forest are not impacted by subsided areas.
- The subsided area is not influencing operability of the site for current, future and potential land uses (or overlapping tenure holders). Subsided areas should not impede the operability of commercial forestry equipment. Operability of commercial forestry equipment is often most limited by steep slopes; stability of machinery is reduced on slopes >35% and the risk level is considered high on slopes >50% (BC Forest Safety Council, 2011). In forested areas, slopes of the subsided area should be <33% (i.e., <3:1).

Additional Considerations

Additional considerations for requesting/approving a variance for a subsided area include:

- Environmental impacts of re-entering the site to conduct reclamation activities to correct the subsided area.
    - Reclamation to correct a subsided area could first require that topsoil that was replaced during original reclamation be re-stripped to allow subsoil to be recontoured to match the grade to the remainder of the site. The disturbance area on the site can extend far beyond the subsided area if fill material needs to be sourced from an elevated area on-site. In some cases, imported material must be used if sufficient subsoil is not available on-site. Topsoil is then replaced after re-contouring is complete. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.
- Naturally occurring variation in micro-contour within forests in the region
    - Regardless of whether natural analogs of subsided areas (i.e., depressions, windthrow, beaver/muskrat runs) occur in areas adjacent to the site, these natural analogs may occur within the region. Literature values for the dimensions of these features may be cited as part of the justification (refer to Appendix C).
- Comparison with microtopographical features on other reclaimed/reforested sites that are similar in size to a subsided area (these microtopographical features are used as a means of improving forest species establishment and promoting ecological diversity). Examples include:
    - Surface roughness (microtopographical heterogeneity) created during soil replacement at coal and oil sands mines.
    - Mounding in the forestry industry.
    - Mounding during well pad, road, pipeline, or seismic line reclamation.

If the site is eligible for a variance, the “Variance – Landscape” category in OneStop is used.

HILL CUTS

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

Figure 1. Examples of hill cuts. Requirements and factors presented in this Information Sheet are used to determine if these are eligible to be left in place.

Cut and fill is a construction technique for wellsites and access roads located on slopes whereby soils are excavated from the upper slope portion of the site (after topsoil salvage) and used on the lower slope portion of the site to create a level surface for the drill rig and associated work areas or the access road. During reclamation it can be challenging to replace the excavated material correctly to match the surrounding off-site topography at the lease edge, particularly if snow gets mixed in with soils during replacement and settling (subsidence) of the placed material occurs. Best practice is to over build cut and fills during reclamation with the expectation that the over built material will settle (Cenovus Energy, 2016; Osko et al., 2018); however, it is difficult to predict actual settling rates. The resulting difference in elevation between on-site and off-site areas will hereafter be referred to as a hill cut, regardless of the

status of reclamation (Figure 1). The height of a hill cut varies with material type, but typically ranges from 0.2 to 1 m; in rarer cases it can be greater than 3 m and up to 10 m in mountainous regions (Acden Vertex Limited Partnership, personal communication 2019). Hill cuts are typically located on one edge (or possibly two edges) of the site or run parallel to the access road. Hill cuts are prone to slumping and erosion and may alter surface water flow patterns. Hill cuts may also have impacts on the trafficability/operability of the site (e.g., for forest harvesting equipment), restrict or alter wildlife movement and can be an aesthetic concern (appear unnatural) for recreational and traditional users. Topsoil replacement is often lacking on hill cut areas (or topsoil is buried below the hill cut) which results in bare areas or areas of sparse vegetation (topsoil deficiencies are discussed in the Topsoil Depth and Distribution Information Sheet).

Natural Analogs and Acceptable Reclamation Practices in Other Industries

There are two main categories of microtopographical features that can be compared to hill cuts, if not directly in terms of appearance, at least conceptually in terms of presenting variations in elevation on the site: naturally occurring variation in contour within forests in the region or creation of microtopographic heterogeneity on reclaimed/reforested sites in other industries to improve revegetation success (Tokay et al., 2019). Some potential natural analogs to hill cuts are steep slopes, stream banks, natural ridges, small eskers, windthrow pits or beaver/muskrat runs.

Reclamation practices in other industries to improve revegetation success such as the creation of microtopographic heterogeneity during reclamation in the mining and oil and gas industries and during site preparation in the forestry industry can have similar dimensions to hill cuts (Tokay et al., 2019). Although some of these examples are not directly comparable to hill cuts visually, the concept of variations in elevation created in reclaimed areas is comparable. At coal and oil sands mines, surface roughness (or “rough and loose” microtopography) is created during soil replacement by spreading topsoil unevenly or after placement by progressively digging holes with an excavator bucket and dumping the material beside and partially inside the hole across a reclaimed area (Alberta Environment and Water, 2012; MacKenzie and Naeth, 2010; Osko et al., 2018b; Polster, 2011); resultant microtopographic features have been up to 1.5 m tall, 3.5 to 5 m wide and spaced 1 to 2 m apart in some cases (Melnik et al., 2018). Mounding in the forestry industry can create mounds that range from 30 to 40 cm tall and approximately 0.5 to 0.6 m^2 in size (DeLong et al., 1997; Gradowski et al., 2008). Disc trenching is another comparable site preparation technique used in forestry that creates both elevated and depressed planting sites, typically in rows or strips across the site. Mounding during well pad, road, pipeline, or seismic line reclamation has resulted in a roughened surface with mounds 0.75 to 1 m tall (Bentham and Coupal, 2015; Shunina et al., 2016); note that mounds of this size are often meant to create an access deterrent, suggesting that the resultant terrain is not usable by recreational and traditional users. Site preparation guidance documents targeted at the oil and gas industry recommend that mounds have a final height after settling of 20 to 30 cm for mineral soil mounds and 40 cm for organic soil mounds (Natural Resources Canada, 2019).

Current Forested Land Criteria

Hill cuts that do not meet the Forested Land Criteria typically fail for the operability criteria as per Section 9.5 of the Forested Land Criteria and the Combined Assessment Tool:

- Macro- and meso-contours[1] on-site are comparable to off-site.
- Macro- and meso-contours are not affecting site management.
- Macro- and meso-contours on-site should be integrated with adjacent off-site landscape features.
- Macro- and meso-contours shall not result in excessive erosion, slumping/wasting or altered water flow patterns[2].

Minimum Requirements for a Variance

A hill cut can be left in place with a variance if it is not limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if the following requirements are met:

- The site passes the Forested Land Criteria for vegetation[3]:
  - If the site was reclaimed prior to June 1, 2007 and was seeded with grasses: Minimum 80% compatible vegetation cover based on the seed mix and the plants are healthy[4].
  - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
  - If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.
- The hill cut presents a low risk to the safety of wildlife, livestock or recreational and traditional users (including ATV/UTV/snowmobile users). As such, hill cuts can only be left in place if they have gradual slopes (<3:1 or 33%) that are not prone to collapse.

  There are a few exceptions to this based on a risk-management approach: The risk associated with a safety hazard has two components: probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence). Although the severity of an individual subsided area remains

[1] Hills cuts are typically considered at the macro- and meso- contour level as they tend to be >10 m long.
[2] There are specific criteria for these impacts (i.e., erosion, slumping and altered water flow patterns) as well as for bare areas in Sections 9.1, 9.2, 9.3 and 9.4 of the Forested Land Criteria that hill cuts must also meet.
[3] It is possible for a site to fail the vegetation criteria but still receive a variance for a hill cut if, for example, the vegetation failure occurs on a different area of the site or if the vegetation failure is not caused by the hill cut (e.g., sparse desirable herbaceous vegetation due to the low productivity site conditions); professional judgment should be used in these cases to determine eligibility for a variance.
[4] Note that sites that are dominated by seeded grasses are not considered to have the same ecological value as sites that meet the natural recovery or planted vegetation criteria, and the rationale for a variance is weaker (i.e., redisturbance is less of a concern). The rationale is stronger if a portion of the site or the access road has forest vegetation and meets the natural recovery or planted vegetation criteria.

constant unless reclamation activities are conducted to remove it, the probability of occurrence is affected by the location of the site. Sites that have a low likelihood of land users encountering the safety hazard have a reduced level of risk and can be treated differently than sites with a greater likelihood of land users encountering the safety hazard. Sites can be considered to have a low risk of safety hazards (and therefore hill cuts on these sites can be left in place) if they meet both of the following:

- Sites with an access road that is blocked by an access deterrent which may include (but is not limited to):
  - Large trees and/or shrubs.
  - Boulders.
  - Large soil mounds.
- Sites that are not currently within a grazing lease.

- The hill cut is stable:
  - Not slumping.
  - Non-erosive.
- **Either**
  - a) the hill cut is comparable to surrounding off-site areas with similar micro- or meso-contour, such as natural analogs to hill cuts including stream banks, ridges, eskers, windthrow pits or beaver/muskrat runs. When considering the contour of surrounding off-site areas, a large enough area must be assessed to make this determination. The assessment area should not be limited solely to areas directly adjacent to the site; representative areas up to 10 km away from the site could be considered. If the size and depth of any observed natural analogs are comparable to the size and depth of the hill cut on-site, this can be used as a justification for leaving hill cuts in place. Photographs and documentation of the dimensions and location of observed natural analogs should be included in the justification submitted to the AER (as discussed in Section 4).
- **or**
  - b) the hill cut is not impacting drainage or hydrology for the site as a whole or off-site.
- The hill cut is not influencing operability of the site for current, future and potential land uses (or overlapping tenure holders).
  - Forestry: Hill cuts should not impede the operability of commercial forestry equipment. Operability of commercial forestry equipment is often most limited by steep slopes; stability of machinery is reduced on slopes >35% and the risk level is considered high on slopes >50% (BC Forest Safety Council, 2011). In forested areas, slopes of the hill cut should be <33% (<3:1).

- Agriculture: If the site is in the White Area, there is potential for the site to be used for agriculture in the future. Hill cuts should not have micro- or meso-contours that would prevent the use of cultivation equipment if the site is in the White Area.

Additional Considerations

Additional considerations for requesting/approving a variance for a hill cut include:

- Environmental impacts of re-entering the site to conduct reclamation activities to correct the hill cut.
  - Reclamation to correct a hill cut may require re-stripping topsoil if the work area was previously partially reclaimed, to allow subsoil to be recontoured to match the grade to the remainder of the site and/or adjacent topography. The disturbance area on the site can extend far beyond the hill cut if fill material must be sourced from another area on-site. In some cases, imported material or material from off-site may be required if sufficient subsoil is not available on-site, which could create additional disturbance on the landscape. Topsoil is then replaced after re-contouring is complete. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.
- Naturally occurring variation in micro-contour within forests in the region.
  - Regardless of whether natural analogs of hill cuts (i.e., stream banks, natural ridges, eskers, windthrow pits, beaver/muskrat runs) occur in areas adjacent to the site, these natural analogs may occur within the region. Literature values for the dimensions of these features may be cited as part of the justification.
- Comparison with microtopographical features on other reclaimed/reforested sites that are similar in size to a hill cut (these microtopographical features are used as a means of improving revegetation success and promoting ecological diversity. Examples include:
  - Surface roughness (microtopographical heterogeneity) created during soil replacement at coal and oil sands mines.
  - Mounding or disc trenching in the forestry industry.
  - Mounding during well pad, road, pipeline, or seismic line reclamation.

If the site is eligible for a variance, the “Variance – Landscape” category in OneStop is used.

SOIL STOCKPILES

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

Soil stockpiles that are left in place (Figure 1) may include topsoil and subsoil stockpiles and are often less than 1 m tall but can range in height up to 3 m (Acden Vertex Limited Partnership, personal communication 2019). Soil stockpiles on wellsites are typically shaped as long, narrow windrows. Soil stockpiles left in place may alter drainage flow patterns, create barriers to wildlife movement on the landscape, have impacts on the trafficability/operability of the site (e.g., for forest harvesting equipment) and can be an aesthetic concern (appear unnatural) for recreational and traditional users.

Figure 1. Examples of topsoil stockpiles left in place. Requirements and factors presented in this Information Sheet are used to determine if these are eligible to be left in place.

Natural Analogs and Acceptable Reclamation Practices in Other Industries

There are two main categories of microtopographical features that can be compared to the topography of soil stockpiles: naturally occurring variation in contour within forests in the region or creation of microtopographic heterogeneity on reclaimed/reforested sites in other industries to improve revegetation success (Tokay et al., 2019). Some potential natural analogs to soil stockpiles are natural ridges, small eskers and hummocky terrain.

Reclamation practices in other industries to improve revegetation success such as the creation of microtopographic heterogeneity during reclamation in the mining and oil and gas industries and during site preparation in the forestry industry can have similar dimensions to soil stockpiles (Tokay et al., 2019). Although many of these examples are not directly comparable to soil stockpiles visually, the concept of variations in elevation created in reclaimed areas is comparable. At coal and oil sands mines, surface roughness (or "rough and loose" microtopography) is created during soil replacement by spreading topsoil unevenly or after placement by progressively digging holes with an excavator bucket and dumping the material beside and

partially inside the hole across a reclaimed area (Alberta Environment and Water, 2012; MacKenzie and Naeth, 2010; Osko et al., 2018b; Polster, 2011); resultant microtopographic features have been up to 1.5 m tall, 3.5 to 5 m wide and spaced 1 to 2 m apart in some cases (Melnik et al., 2018). Mounding in the forestry industry can create mounds that range from 30 to 40 cm tall and approximately 0.5 to 0.6 m^2 in size (DeLong et al., 1997; Gradowski et al., 2008). Disc trenching is another comparable site preparation technique used in forestry that creates both elevated and depressed planting sites, typically in rows or strips across the site. Mounding during well pad, road, pipeline, or seismic line reclamation has resulted in a roughened surface with mounds 0.75 to 1 m tall (Bentham and Coupal, 2015; Shunina et al., 2016); note that mounds of this size are often meant to create an access deterrent, suggesting that the resultant terrain is not usable by recreational and traditional users. Site preparation guidance documents targeted at the oil and gas industry recommend that mounds have a final height after settling of 20 to 30 cm for mineral soil mounds and 40 cm for organic soil mounds (Natural Resources Canada, 2019).

Current Forested Land Criteria

Soil stockpiles that do not meet the Forested Land Criteria typically fail the operability criteria as per Section 9.5 of the Forested Land Criteria and the Combined Assessment Tool:

- Macro- and meso-contours[1] on-site are comparable to off-site.
- Macro- and meso-contours are not affecting site management.
- Macro- and meso-contours on-site should be integrated with adjacent off-site landscape features.
- Macro- and meso-contours shall not result in excessive erosion, slumping/wasting or altered water flow patterns[2].

Soil stockpiles and windrows left in place can also result in the site failing to meet topsoil depth and distribution criteria (refer to the Topsoil Depth and Distribution Information Sheet).

[1] Soil stockpiles are typically considered at the macro- and meso- contour level as they tend to be >10 m long.
[2] There are specific criteria for these impacts (i.e., erosion, slumping and altered water flow patterns) in Sections 9.1, 9.2 and 9.3 of the Forested Land Criteria that soil stockpiles must also meet.

Minimum Requirements for a Variance

A soil stockpile can be left in place with a variance if it is not limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if all of the following requirements are met:

- The site passes the Forested Land Criteria for vegetation[3]:
  - If the site was reclaimed prior to June 1, 2007 and was seeded with grasses: Minimum 80% compatible vegetation cover based on the seed mix and the plants are healthy[4].
  - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
  - If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.
- **Either**
  - a) the site passes the Forested Land Criteria for topsoil depth and distribution.
- **or**
  - b) the topsoil depth and distribution are deemed acceptable, as described in the Topsoil Depth and Distribution Information Sheet.
- The soil stockpile presents a low risk to the safety of wildlife, livestock or recreational and traditional users (including ATV/UTV/snowmobile users). As such, soil stockpiles can only be left in place if they have gentle slopes that are <3:1 or 33%.

  There are a few exceptions to this based on a risk-management approach: The risk associated with a safety hazard has two components: probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence). Although the severity of an individual subsided area remains constant unless reclamation activities are conducted to remove it, the probability of occurrence is affected by the location of the site. Sites that have a low likelihood of land users encountering the safety hazard have a reduced level of risk and can be treated differently than sites with a greater likelihood of land users encountering the safety hazard. Sites can be considered to have a

[3] It is possible for a site to fail the vegetation criteria but still receive a variance for soil stockpiles if, for example, the vegetation failure occurs on a different area of the site or if the vegetation failure is not caused by the soil stockpile (e.g., sparse desirable herbaceous vegetation due to the low productivity site conditions); professional judgment should be used in these cases to determine eligibility for a variance.

[4] Note that sites that are dominated by seeded grasses are not considered to have the same ecological value as sites that meet the natural recovery or planted vegetation criteria, and the rationale for a variance is weaker (i.e., redisturbance is less of a concern). The rationale is stronger if a portion of the site or the access road has forest vegetation and meets the natural recovery or planted vegetation criteria.

low risk of safety hazards (and therefore soil stockpiles can be left in place on these sites) if they meet both of the following:

  - Sites with an access road that is blocked by an access deterrent which may include (but is not limited to):
    - Large trees and/or shrubs.
    - Boulders.
    - Large soil mounds.
  - Sites that are not currently within a grazing lease.

- The soil stockpile is stable:
  - Not slumping.
  - Non-erosive.
- **Either**
  - a) the soil stockpile is comparable to surrounding off-site areas with similar micro- or meso-contour, such as natural analogs to soil stockpiles including ridges, eskers and hummocky terrain. When considering the contour of surrounding off-site areas, a large enough area must be assessed to make this determination. The assessment area should not be limited solely to areas directly adjacent to the site; representative areas up to 10 km away from the site could be considered. If the size and depth of any observed natural analogs are comparable to the size and depth of the soil stockpile on-site, this can be used as a justification for leaving soil stockpiles in place. Photographs and documentation of the dimensions and location of observed natural analogs should be included in the justification submitted to the AER (as discussed in Section 4).
- **or**
  - b) the soil stockpile is not impacting drainage or hydrology for the site as a whole or off-site.
- The soil stockpile is not influencing operability of the site for current, future and potential land uses (or overlapping tenure holders).
  - Forestry: Soil stockpiles should not impede the operability of commercial forestry equipment. Operability of commercial forestry equipment is often most limited by steep slopes; stability of machinery is reduced on slopes >35% and the risk level is considered high on slopes >50% (BC Forest Safety Council, 2011). In forested areas, slopes of the soil stockpile should be <33% (<3:1).
  - Agriculture: If the site is in the White Area, there is potential for the site to be used for agriculture in the future. Soil stockpiles should not have micro- or meso-contours that would prevent the use of cultivation equipment if the site is in the White Area.

Additional Considerations

Additional considerations for requesting/approving a variance for a soil stockpile include:

- Environmental impacts of re-entering the site to conduct reclamation activities to remove the soil stockpile.
    - Reclamation to correct a soil stockpile left in place would require that the material within the pile be spread across the site. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.
- Weed seed bank present within the soil stockpile.
    - If the seed bank within the soil stockpile contains seeds from problematic species (e.g., noxious weeds), spreading the soil stockpile will also spread these species across the site, likely resulting in the need for weed control. Negative impacts of weed control are discussed in the Problematic Species Information Sheet.
- Naturally occurring variation in micro-contour within forests in the region.
    - Regardless of whether natural analogs of soil stockpiles (i.e., natural ridges, eskers and hummocky terrain) occur in areas adjacent to the site, these natural analogs may occur within the region. Literature values for the dimensions of these features may be cited as part of the justification.
- Comparison with microtopographical features on other reclaimed/reforested sites that are similar in size to a soil stockpile (these microtopographical features are used as a means of improving revegetation success and promoting ecological diversity). Examples include:
    - Surface roughness (microtopographical heterogeneity) created during soil replacement at coal and oil sands mines.
    - Mounding or disc trenching in the forestry industry.
    - Mounding during well pad, road, pipeline, or seismic line reclamation.

If the site is eligible for a variance, the “Variance – Landscape” category in OneStop is used.

WOODY DEBRIS PILES

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

Woody debris piles (also sometimes referred to as wood piles or log piles) left in place are often less than 1 m high but have been observed to range up to 2 to 3 m high (Acden Vertex Limited Partnership, personal communication 2019; Figure 1). Piles are typically along the edges of wellsites, on log decks or along the edge of access roads. Woody debris piles left in place can prevent vegetation establishment within the area occupied by the pile and can be considered a fire hazard if they encroach into the surrounding undisturbed forest and act as a ladder fuel (Alberta Environment and Parks, 2018a).

Figure 1. Examples of woody debris piles left in place. Requirements and factors presented in this Information Sheet are used to determine if these are eligible to be left in place.

Natural Analogs and Acceptable Practices in Other Industries

There are two main categories of equivalents to woody debris piles that can be examined for comparison purposes: naturally occurring windthrow within forests in the region or woody debris management practices on reclaimed or harvested sites in other industries. Naturally occurring windthrow can result in accumulation of woody debris on the soil surface.

In recent literature on OSE reclamation, windrows are proposed as an alternative to spreading for dealing with coarse woody debris at some sites (especially sites with high wood volumes) because windrows reduce the total area of soil in direct contact with coarse woody debris. Open soils are warmer which may stimulate soil productivity and aspen suckering (Frerichs, 2017; Frerichs et al., 2017).

The forestry industry is allowed to leave woody debris piles in place if they meet the *Debris Management Standards for Timber Harvest Operations* guidelines (Alberta Agriculture and Forestry, 2018b):

- Height is <2 m.

- Base diameter <3 m.
- Distance between piles is >15 m.
- Distance from standing timber is >25 m.

Note: the wildfire risk is lower for wellsites (and other non-linear associated facilities) than for cut blocks due to the smaller size of the woody debris piles typically associated with wellsites, and thus these guidelines may not be appropriate[1].

Woody debris management guidelines for fence line clearing for grazing dispositions advise that for clearings between 10 and 30 m wide, the woody debris pile should be located >5 m from the edge of the clearing and should be disposed of within 24 months, while for clearings <10 m wide, the woody debris pile can remain in place provided that the woody material is within the lease boundary, piled away from standing timber, and leaners are cut and made to lie flat to the ground (Powter, personal communication 2020). An 8 m break in woody debris windrows is required every 60 m to allow for movement of wildlife and livestock.

Current Forested Land Criteria

Woody debris piles left in place that fail to meet the Forested Land typically fail for debris as per Section 9.6.1 of the Forested Land Criteria and the Combined Assessment Tool:

- Coarse woody debris shall be spread over the site and may not be piled, windrowed or concentrated in one area as this may pose a fire hazard, particularly in areas near settlements.

Minimum Requirements for a Variance

From a reclamation perspective, a woody debris pile can be left in place with a variance if it is not limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if all of the following requirements are met:

- The site passes the Forested Land Criteria for vegetation[2]:
    - If the site was reclaimed prior to June 1, 2007 and was seeded with grasses: Minimum 80% compatible vegetation cover based on the seed mix and the plants are healthy[3].

[1] Note the following knowledge gap: The actual level of risk of wildfire presented by small woody debris piles (i.e., <1 m tall) left in place on wellsites has not been definitively determined. Risk-based approaches based on woody debris piles generated from forestry operations may not be required for smaller woody debris piles on facilities as small as wellsites, log decks, remote sumps, etc.

[2] It is possible for a site to fail the vegetation criteria but still receive a variance for a woody debris pile if, for example, the vegetation failure occurs on a different area of the site or if the vegetation failure is not caused by the woody debris pile (e.g., sparse desirable herbaceous vegetation due to the low productivity site conditions); professional judgment should be used in these cases to determine eligibility for a variance.

[3] Note that sites that are dominated by seeded grasses are not considered to have the same ecological value as sites that meet the natural recovery or planted vegetation criteria, and the rationale for a variance is weaker (i.e., redisturbance is less of a concern). The rationale is stronger if a portion of the site or the access road has forest vegetation and meets the natural recovery or planted vegetation criteria.

- If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
- If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.

- Vegetation is growing through the woody debris pile.
- Risk of wildfire is low.
  - Factors to consider in the determination of wildfire risk include:
    - Decomposition status: Wildfire risk is lower if the woody debris pile is old and rotting.
    - Location on the site: Wildfire risk is higher if the woody debris pile is located on the edge of the site as opposed to a more central location, especially if woody debris is leaning against trees in the undisturbed forest (Canadian Association of Petroleum Producers, 2008).
    - Surrounding forest type: Wildfire risk is higher if the surrounding forest is coniferous (Alberta Environment and Parks, 2018a).
    - Grass: Wildfire risk is higher if the vegetation on-site is grass dominated, particularly tall, dense grass populations as opposed to shorter and less dense grasses (Canadian Association of Petroleum Producers, 2008).
    - Facility type: Wildfire risk is higher if the woody debris pile is located on an access road as opposed to a wellsite as woody debris piles on linear features can act as a wick for wildfire, resulting in long distance spread of wildfire along linear features (Canadian Association of Petroleum Producers, 2008).

Additional Reclamation Considerations

Additional considerations for requesting/approving a variance include:

- Environmental impacts of re-entering the site to conduct reclamation activities to remove the woody debris pile.
  - Reclamation to correct a woody debris pile left in place would require that the wood within the pile be spread across the site, which may or may not require the use of heavy machinery depending on the volume of wood in the pile. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.
- Merchantability of the timber within the woody debris pile (diameter of the logs).
  - Merchantable timber is required to be salvaged and removed; however occasionally it is left in place. It is considered less acceptable to leave merchantable timber in place in woody debris piles than non-merchantable timber.

- Acceptable woody debris management practices in other industries:
  - Use of woody debris piles (or windrows) in reclamation on OSE sites.
  - Debris management guidelines for forestry.
  - Debris management guidelines for fence line clearing for grazing dispositions.
- Naturally occurring windthrow within forests in the region.
  - Observed windthrow near the site or examples from literature may be included as part of the justification.

Additional Regulatory Requirements

In addition to the requirements and factors discussed above, woody debris piles may be required to meet additional requirements through the following:

- *Master Schedule of Standards and Conditions* (Alberta Environment and Parks, 2018a).
- *Public Lands Act* (Government of Alberta, 2000c) and associated regulations.
- *Forest and Prairie Protection Act* (Government of Alberta, 2000b) and associated regulations.
- *Forests Act* (Government of Alberta, 2000a) and associated regulations.

If the site is eligible for a variance, the “Variance – Landscape” category in OneStop is used.

TOPSOIL DEPTH AND DISTRIBUTION

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

The Forested Land Criteria requires that the forest floor (LFH) and topsoil (A horizons) are salvaged and replaced on-site; however, there are several instances when forest floor and topsoil may not be replaced or when the soil that is replaced may not meet the definition of topsoil as it is admixed with subsoil horizons:

- Topsoil may not have been salvaged or stockpiled on sites constructed prior to April 30, 1994, and thus is not available for replacement.
- A mineral soil pad was constructed on top of undisturbed soils, and that mineral soil pad is to remain in place at closure. The pad would not have topsoil on it.
- Salvage of topsoil and subsoil in a single lift (i.e., salvaging topsoil and subsoil together) during construction resulted in an admixed soil with lower organic matter, altered soil texture and other modified properties no longer consistent with the original topsoil. Admixing may occur due to soil conditions and equipment limitations (e.g., topsoil in forested areas can often be less than 10 cm thick and salvaging a thin layer can be difficult or the site is only accessible in the winter and soil must be salvaged under frozen conditions).
- Soil salvage did not include the entire depth of the available topsoil horizons[1]; thus, there is insufficient topsoil for replacement.
- Topsoil was not replaced evenly such that portions of the site have minimal topsoil while other areas have an excess.
- No soil replacement occurred after well abandonment. While topsoil may have been salvaged and stockpiled, soil replacement did not occur prior to natural encroachment of forest vegetation; topsoil remains in place in a stockpile or windrow (refer to the Soil Stockpiles Information Sheet). This scenario is considered the least desirable and is the least likely to be eligible for a variance, although decisions should still consider all of the factors described below.

Impacts that may occur as a result of a shortage or lack of topsoil include delayed vegetation growth and establishment, reduced vegetation productivity, altered species composition or delayed successional pathways due to lack of propagules and/or lack of organic matter and nutrients to support plant growth.

[1] For example, in some cases only the LFH was salvaged and the Ae horizon was salvaged with the subsoil (or was left in place if no subsoil salvage occurred).

Current Forested Land Criteria

Undisturbed forested soil profiles are comprised of organic forest floor horizons (L, F, H and O) above mineral Ae, Ahe or Ah horizons followed by the subsoil (mineral B horizons) as defined in the *Canadian System of Soil Classification – Third Edition* (Soil Classification Working Group, 1998). The Forested Land Criteria uses the terms topsoil and surface soil interchangeably and defines them as the "uppermost mineral material, valued as a growing medium" or as the "uppermost mineral or organic material, valued as a growing medium"[2]. The Forested Land Criteria also specifically defines topsoil as the "A horizon, including the Ah, Ahe and Ae horizons." It is this last definition of topsoil that is used in evaluating topsoil depth and distribution. The off-site average topsoil depth is assessed as the combined depth of Ah, Ahe and Ae horizons but does not include LFH. Depending on how the forest floor and topsoil horizons were salvaged during construction, the replaced layer of topsoil on-site after reclamation is often a combination of the LFH and A horizons.

As per section 11.1.3.1 and Table 1 of the Forested Land Criteria and the Combined Assessment Tool, the following conditions must be met for topsoil depth and distribution:

- For sites in the Green Area, topsoil must be "adequately replaced as per topsoil depth and distribution requirements by construction date."
    - Sites constructed prior to April 30, 1994 are "encouraged but not required to comply with soil expectations" in the Forested Land Criteria (regardless of abandonment and reclamation date). Sites that do not meet the soil criteria do not require a variance and can still be submitted as a routine (baseline review) application.
    - Sites constructed between April 30, 1994, and June 1, 2007, are "expected to comply with the soil components" in the Forested Land Criteria but "extenuating soil situations may arise". Thus, for the site as a whole, topsoil depth should be 80% or greater than the average topsoil depth in off-site control areas, and generally, all assessment points should have at least 50% of the off-site average. Sites that do not meet the soil criteria must obtain a variance.
    - Sites constructed on or after June 1, 2007, are "required to comply with all aspects" of the Forested Land Criteria (as described in the previous bullet). Sites that do not meet the soil criteria must obtain a variance.
- For sites in the White Area, regardless of construction date, sites are "required to comply with all aspects" of the Forested Land Criteria with the following variation:
    - Sites constructed prior to April 30, 1994: "Topsoil depth replacement must have less than 40% variance between the lease mean and the control mean (i.e., Lease Mean ≥60% of Control Mean)". Sites that do not meet these criteria must obtain a variance.

[2] These two definitions are found in different sections of the Forested Land Criteria.

- Site constructed between April 30, 1994, and June 1, 2007: "Topsoil depth replacement must have less than 20% variance between the lease mean and the control mean (i.e., Lease Mean ≥80% of Control Mean)." Sites that do not meet these criteria must obtain a variance.

When topsoil depths in off-site control areas are less than 15 cm, topsoil "must include the topsoil plus the B-horizon up to a total depth of 15 cm unless the B-horizon is considered unsuitable," as per the Forested Land Criteria. Thus, in these instances the topsoil may be admixed but this is permissible. Despite being permissible, a variance must still be obtained because the current Record of Observation (RoO) datasheet automatically flags the parameter as a fail.

Minimum Requirements for a Variance

If topsoil depth and distribution do not meet the Forested Land Criteria, a variance for topsoil depth and distribution could be obtained if the reduction or lack of topsoil is not limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if all of the following requirements are met:

- The site passes the Forested Land Criteria for vegetation:
  - If the site was reclaimed prior to June 1, 2007 and was seeded with grasses: Minimum 80% compatible vegetation cover based on the seed mix and the plants are healthy[3].
  - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
  - If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.
- The site has at least five years of woody vegetation growth (based on the assessment requirements for forested land in the *Conservation and Reclamation Directive for Renewable Energy Operations*; Alberta Environment and Parks, 2018b).
- There are no rooting restrictions.
- The environmental impacts of re-entering the site to conduct reclamation activities to correct topsoil depth outweigh the benefits[4].
  - Reclamation to correct insufficient topsoil depth and distribution would require that any topsoil present in on-site soil stockpiles be spread across the entire site or the portions of the

[3] Note that sites that are dominated by seeded grasses are not considered to have the same ecological value as sites that meet the natural recovery or planted vegetation criteria, and the rationale for a variance is weaker (i.e., redisturbance is less of a concern). Sites dominated by seeded grasses can still be candidates for a variance if the access road has forest vegetation and meets the natural recovery or planted vegetation criteria.

[4] Though not included in the other Information Sheets as a requirement to be eligible for a variance, environmental impacts are included as a requirement for topsoil depth and distribution variances to align with a vegetation override as described in the Forested Land Criteria.

site that require additional topsoil. If no topsoil is available on-site, it would have to be sourced from an alternate location and transported to the site. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.

Additional Considerations

Additional considerations for requesting/approving a variance include:

- Evidence of limitations to woody vegetation growth/productivity in comparison to off-site or regional conditions.
    - One of the following metrics can be used to assess for limitations to woody vegetation growth/productivity:
        - Tree and shrub leader length indicates either sustainable growth (i.e., annual leader growth on-site is similar between years and does not significantly decrease) and/or leader growth on-site is comparable to off-site controls.
        - Mean annual increment of trees on-site in comparison to the appropriate mean annual increment standards (e.g., provincial standards defined by Stadt et al. [2014]), as per the requirements of the *Reforestation Standard of Alberta* (Alberta Agriculture and Forestry, 2018a). Note that the age of on-site trees may be variable if only a portion of the site was disturbed during reclamation; trees that established during site operation that were not disturbed during reclamation will be older than trees that established after reclamation. If on-site trees cannot be assigned a single age, examining an age range may be more appropriate (e.g., trees aged 9 to 14).
- Location of the site in terms of land designation (Green vs. White Area)
    - If the site is located in the White Area, there is potential for the site to be used for agriculture in the future. If the site does not have topsoil (or has not had topsoil replaced) this could limit its agriculture capability and thus it may not be acceptable to leave the site without topsoil (or without replacing available topsoil).
- Shallow off-site and pre-disturbance topsoil depth
    - As discussed above, the Forested Land Criteria allows admixing of topsoil with subsoil if the topsoil depth is less than 15 cm.
- Soil salvage limitations during construction
    - If soil had to be salvaged under non-ideal conditions (e.g., winter access only requiring soils to be salvaged when frozen) resulting in admixed or insufficient topsoil for replacement, the description of these extenuating circumstances supports the justification for a variance. More information on preparation of justifications for variances is provided in Section 4.
- Characteristics of the upper layer of soil on-site and comparison to off-site soil suitability criteria (e.g., *Soil Quality Relative to Disturbance and Reclamation* (Alberta Soils Advisory Committee, 1987)).

- If topsoil is not present, but soil quality characteristics on-site are comparable to off-site controls, this would support the justification that on-site soils have equivalent capability.

- Presence of soil stockpiles.
  - If topsoil was not replaced and stockpiles are present on-site, refer to Soil Stockpile Information Sheet for the minimum requirements to leave the stockpiles in place with a variance. If these criteria are not met, reclamation to spread the soil stockpiles is likely required.

- Availability of suitable topsoil for import
  - The characteristics of topsoil available for import must be carefully considered in terms of texture, nutrients, weed propagules and targeted ecosite. Use of imported topsoil should consider the trade-off between the value of increasing topsoil depth and the potential negative consequences of using topsoil that that is not consistent with the control soil conditions and that is not suited for forested reclamation (e.g., agricultural topsoil).

If the site is eligible for a variance, the “Vegetation Override – Forested” category in OneStop is used.

DESIRABLE HERBACEOUS SPECIES COVER

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

Desirable herbaceous species are defined in the Forested Land Criteria as grass and forb species that are appropriate for the representative ecosite (e.g., the off-site ecosite). Depending on the construction and reclamation date, desirable herbaceous species may include agronomic species that were part of the seed mix (i.e., compatible species). There are several reasons why a site may have sparse desirable herbaceous species cover, many of which are not related to reclamation practices such as naturally low productivity site conditions (dry and/or low nutrient sites such as a and b ecosites in the Central Mixedwood Natural Subregion (Beckingham and Archibald, 1996)); low levels of plant propagules; or, lack of or admixing of topsoil due to unsatisfactory reclamation practices. From a landscape perspective, the impact of sparse desirable herbaceous vegetation cover could be soil erosion, if there are no other types of vegetation present on site to mitigate this potential.

A sparse desirable herbaceous species cover deficiency occurs when one (or more) of the assessment grids, does not meet the Forested Land Criteria. The discussion in this Information Sheet does not refer to small sparse areas that are not representative of the assessment grid as a whole.

Current Forested Land Criteria

As per section 8.1 of the Forested Land Criteria, the following conditions must be met for desirable herbaceous species cover:

- If the site was reclaimed prior to June 1, 2007, and was seeded with grasses: A minimum of 80% compatible vegetation cover based on the seed mix and the plants are healthy. There are no additional requirements for woody vegetation.
- If the site was reclaimed prior to June 1, 2007 and was not seeded with grasses: A minimum of 25% canopy cover of herbaceous species and the plants are healthy, in addition to cover requirements for woody vegetation.
- If the site was reclaimed after June 1, 2007: A minimum of 25% canopy cover of herbaceous species and the plants are healthy, in addition to cover requirements for woody vegetation.

Minimum Requirements for a Variance

If desirable herbaceous species cover does not meet the Forested Land Criteria, a variance for desirable herbaceous species cover could be obtained if the sparse desirable herbaceous vegetation cover is not

limiting forest ecosystem function or equivalent land capability of the site as a whole (as discussed in Section 3) and if the following four requirements are met:

- The sites pass the Forested Land Criteria for erosion
- The site passes the Forested Land Criteria for woody vegetation cover and/or density:
  - If a Natural Recovery Site (regardless of reclamation date): a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
  - If a Planted Site (regardless of reclamation date): a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.
- Non-native or undesirable herbaceous species cover is less than half of the desirable herbaceous species cover.
- One or more of the following is true:
  - The combined percent cover of desirable herbaceous species and woody species is >25%.
  - The combined percent cover of desirable herbaceous species, mosses and lichens is >25%.
  - Percent cover of herbaceous species at representative off-site control points is <25% (i.e., low desirable herbaceous cover is comparable to control locations)[1], for example, in low productivity a or b ecosites in the Central Mixedwood Natural Subregion (Beckingham and Archibald, 1996).
  - The site was reclaimed after June 1, 2007, but interim reclamation including revegetation with a seed mix occurred prior to June 1, 2007. In this case, the pre-2007 criteria for seeded species, requiring 80% cover of compatible vegetation based on the seed mix, can be applied to the portion(s) of the site that were seeded prior to June 1, 2007; post-2007 criteria would still apply for the remainder of the site.

Additional Considerations

Additional considerations for requesting/approving a variance include:

- Environmental impacts of re-entering the site to conduct reclamation activities to correct sparse desirable herbaceous vegetation, noting that reclamation work in this case would predominantly be conducted by hand rather than with heavy equipment. Refer to Section 3.2 for factors to consider related to reclamation of deficiencies.

[1] This approach is similar to the native-infill species concept in the Native Grasslands Criteria (Alberta Environment and Sustainable Resource Development, 2013b); acceptable levels of total desirable herbaceous cover on forested sites can be defined by the abundance of herbaceous species in off-site controls.

- Availability of suitable seed mixes
    - Commercially available native seed mixes are often grass dominated, sourced from non-local origins, and lacking the most desirable native grass species for forested environments (e.g., hairy wild rye) as well as desirable native forb species (Powter et al., 2018). Use of seed mixes should consider the trade-off between increasing total herbaceous species cover, potentially without adding truly desirable herbaceous species, with the negative consequences of increased competition for naturally recovering vegetation.

If the site is eligible for a variance, the “Variance - Other” category in OneStop is used.

PROBLEMATIC SPECIES

Before proceeding through this Information Sheet, refer to Sections 1 and 3 to review the purpose and scope of the guidance document and the minimum requirements for variance approval. Variances are considered and accepted under exceptional circumstances and are not meant to provide an excuse or justification for not fulfilling reclamation obligations or lack of due diligence.

In addition to the more well-known noxious weeds (*Weed Control Regulation*; Government of Alberta, 2010), there are three other classifications of weeds that are used in OneStop to describe problematic vegetation (Alberta Energy Regulator, 2019b):

- Incompatible vegetation – noxious weeds.
- Incompatible vegetation – invasive species.
- Incompatible vegetation – problem introduced species.
- Incompatible vegetation – undesirable/problem weeds.

Sites with prohibited noxious weeds (as per the *Weed Control Regulation*) are not eligible for a variance and cannot be certified.

The four options could present some confusion, as the interpretation of the terms "invasive species," "problem introduced species," and/or "undesirable/problem weed" depends largely on the situational context of the reclamation area, its surrounding vegetation and land use, site history, natural region and subregion, previous management actions, and the species of concern. Noxious weeds, however, are a unique category in that they are defined by legislation (*Weed Control Regulation*). The other three terms were derived from previous provincial government guidance documents. Relevant literature and guidance documents pertaining to the natural subregion, county, or plant communities in question should be consulted to aid in the determination (refer to Appendix C). Ultimately the onus is on the reclamation practitioner applying for the variance to conduct due diligence to understand if and how problematic vegetation may be classified in terms of these definitions.

All four categories of species can be problematic to reclamation areas due to their highly aggressive colonization potential, ability to decrease biodiversity, and in some instances the potential to be allelopathic (i.e., inhibit other species from germinating or growing). Problematic species can compete with desirable vegetation onsite and slow vegetation recovery to targeted forest ecosystems and have the potential to spread off-site into adjacent undisturbed areas, necessitating control. Problematic vegetation species of any of the four categories should not be included in the RoO as desirable species cover, unless they can be considered compatible species as defined in the Forested Land Criteria

Noxious weeds

The *Weed Control Regulation* lists the plant species that are designated as noxious weeds in Alberta. The *Weed Control Regulation* also provides authority for a municipality to designate plants that are not listed as weeds in the *Weed Control Regulation* as noxious weeds (and to change the designation of noxious weeds to prohibited noxious weeds).

Invasive species

The "invasive species" term has not often been formally codified as its usage is broad and subjective and can be used to refer to any number of non-native aggressively colonizing species, particularly those that "displace the original structure of the plant community" (Powter, 2002). Practitioners should conduct due diligence in preparing their professional justification for a variance request to understand if a species of concern may be considered an invasive in the specific region and plant community.

Problem Introduced Species

Most often, this label encompasses agronomic species that mount considerable invasion pressure in forested areas. Alberta Environment (2003) defines problem introduced plants as forage plants that were introduced for crop or forage production purposes, and either invade or persist in native plant communities. Examples of plants that have been identified as problematic in the Central Parkland and Foothills regions include sweet clover, alsike clover, timothy, smooth brome, and reed canary grass (although the latter is actually a native species, it is used as a forage species).

Undesirable/Problem Weeds

In the context of reclaiming a forested ecosystem, if an invading species is not listed as a prohibited noxious or noxious weed and is not agronomic in nature then the species can be considered an undesirable/problem weed. Specific counties or regions can consider species to be undesirable/problem weeds, even if they are not listed as noxious or prohibited noxious in legislation. Practitioners are encouraged to consult relevant native plant community guides, as well as speak to local authorities, weed inspectors or public land managers to understand if the species of concern is labeled as undesirable in the area that they are seeking to reclaim.

Current Forested Land Criteria

For noxious weeds, both the requirements of the Forested Land Criteria (Section 10.4) and the *Weed Control Act* (Government of Alberta, 2008) must be met:

- Noxious weeds must be controlled on-site.
- Noxious weed ratings[1] on-site must be comparable to those off-site: the average rating on-site cannot be greater than the average rating off-site, and the difference in the average ratings between on-site and off-site must be <0. For example, if one off-site assessment point has a noxious weeds rating of 4, there could be noxious weeds present on-site but these must have ratings <4.

It is important to note that the *Weed Control Act* defines "control" differently than "destroy," as follows:

> 1(c)[2] "control" means
>
> > (i) to inhibit the growth or spread, or

[1] Ratings are used in the Forested Land Criteria to assess various parameters, including noxious and other weeds.
[2] Numbers and letters appearing at the start of the excerpt refer to a specific section of the referenced legislation.

(ii) to destroy;

(d) “destroy” means

(i) to kill all growing parts, or

(ii) to render reproductive mechanisms non-viable;

For the other weed categories, the following conditions must be met, as per Section 10.4 of the Forested Land Criteria:

- Invasive species, problem introduced species and undesirable/problem weeds must be controlled so that they do not impede operability, management or the functioning of the native plant community.
- Invasive species, problem introduced species and undesirable/problem weeds should not require a change in management practice on-site compared to off-site.
- There cannot be a difference >2 ratings categories between the lowest control rating and the lowest rating at any assessment point on the lease. The difference in average ratings between on-site and off-site must be <0.30 (or 0.15, depending on sample intensity).

The Forested Land Criteria provides an additional list of conditions that, if all are met, can allow a site to pass the assessment and the application can be submitted through the baseline review process, even if the site does not meet the previously stated criteria for noxious weeds or other weed categories:

- The site is on Public Lands (excluding Provincial Parks and Protected Areas).
- The site has met Criteria for all other parameters being assessed.
- The site fails the comparison for controlled[3] and/or undesirable problem weeds that are resulting from a single source of weeds from off-site.

Minimum Requirements for a Variance

If problematic species do not meet the Forested Land Criteria, or the three additional conditions specified in the Criteria, the site can be eligible for a variance to allow problematic species to be left in place without further reclamation, if all of the following requirements are met:

- The site is passing the Forested Land Criteria for vegetation (excluding weeds), which should be an indicator that the site is on a trajectory towards native species dominance:
  - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.

[3] While the Forested Land Criteria uses the term “controlled” weeds in this clause rather than “noxious” weeds, the application of this clause to noxious weeds is implied.

- If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and, a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.

- **Either** *a) the growth and spread of weeds is inhibited (as per the definition of control noted above)*. The following factors can be used to make this determination, keeping in mind that control does not require complete elimination:
  - Trends over time.
    - Spread of weeds can be considered to be inhibited if their abundance on-site is decreasing over time. Data from multiple assessments is needed to demonstrate trends in abundance over time.
  - Distribution of weeds and native vegetation on-site.
    - Weed populations are less likely to grow and spread if the plants on-site are present as scattered individuals among native vegetation, forming only small patches (<4 m^2). Weeds are also easier to control if the plants that are present on-site are not flowering and appear to have reduced vigour (e.g., leaves appear limp and/or reduced in size).
    - When native vegetation completely covers the site and there are no sparse or bare patches to provide a receptive seed bed for weeds to establish, the likelihood of weed populations colonizing and spreading on-site is reduced (Haeussler et al., 1999; Sumners and Archibold, 2007), likely by the competitive pressure exerted by the native vegetation.
  - Movement of noxious weeds into off-site areas (applies to noxious weeds only).
    - If there is evidence of the noxious weed population moving from the site into adjacent off-site areas, the growth and spread of noxious weeds cannot be considered to be inhibited. Literature has shown that non-native and invasive plants (i.e., noxious weeds) have typically not been observed, or have been found in low numbers, more than 20 to 30 m from boreal forest edges, suggesting that weed growth and development is not supported by the mature forested environment (Small et al., 2018).
    - Noxious weed populations located on or near linear features are considered more likely to spread (especially to non-forested areas) and are more difficult to justify leaving them in place.
  - Potential for third party activity to spread the weeds from the site to off-site areas (applies to noxious weeds only).
    - If there is no evidence of third-party activity in and around the site, the potential for the spread of the noxious weed into off-site areas is reduced.

- **Or** *b) The source of weeds is shown to be third-party activity*[4]. Weeds can be considered to be the result of third-party impacts if:
    - Weeds are present on a nearby public highway, on an access road on the way to the site or on other facilities that share the same access route (unless the source is a wellsite or access road that is owned by the same entity as the site seeking the variance), and there is a vector that could spread the weeds to the site (wind, water, animals, humans, etc.). Wind dispersal distances of species such as perennial sow-thistle and Canada thistle have been recorded in the literature as approximately 10 m (Becker et al., 2008; Moore, 1975; Sheldon and Burrows, 1973); however, helicopters can create wind currents that may spread these species further than reported in the literature, in addition to acting as a vector between sites in and of themselves.
    - Grazing activity is occurring on-site or nearby (e.g., within 100 m), acting as an ongoing source of weeds.
    - There is evidence of third-party or recreational traffic (e.g., ATV/UTV tracks) on the site which has resulted in the introduction of weeds.

    If third-party sources of weeds are not being controlled (whether due to unsuccessful past treatments or through lack of control efforts) it would be extremely difficult for the operator to reduce the impacts and the spread of the weeds onto the site seeking certification.

Additional Considerations

Additional considerations for requesting/approving a variance include:

- Whether the cover of weeds is expected to out-compete or adversely affect the growth and development of desirable native vegetation.
    - The phenology and ecology of the invading weed species affects its potential to impact the ability of a developing forest environment to meet equivalent land capability (refer to *Optimizing Weed Control for Progressive Reclamation: Literature Review* (Small et al., 2018) and associated references for a discussion of the nature of weed growth in forested ecosystems).
        - There are three questions to consider:

          Will the species adversely affect the growth and development of a forest canopy through aggressive growth and shading?

          Is the species known to have allelopathic properties that inhibit germination of forest understory species?

[4] Third party impacts are defined in the Terms and Acronyms section of this document. Further discussion of what constitutes third-party activity and the operator's responsibilities are described in the *Conservation and Reclamation Information Letter: Third Party Impact on Reclamation* (Alberta Environment, 1997).

What is the shade tolerance profile for the species – will it die off when shaded by a canopy?

For example, perennial sow-thistle and scentless chamomile are aggressive, shade-intolerant species that can quickly colonize large areas of land, despite herbicide application and other control efforts. However, these species are not known to suppress growth of tree seedlings or understory shrubs (MacFarlane, 2003, cited in Langor et al., 2014), and so although they are strong colonizers, they will eventually be outcompeted by the developing forest canopy of the reclamation area (Small et al., 2018). Conversely, species that grow very tall and in very thick, dense patches (such as white sweet clover, although not a noxious weed) show real potential to suppress growth of planted tree or shrub seedlings and therefore affect the development of equivalent land capability. Meeting target (planting) densities for woody species and abundance criteria for herbaceous species are both lines of evidence that forest development would not be impeded by a problematic species invasion.

- Site condition.
    - When there are poor soil conditions on-site (e.g., rooting restrictions, low nutrient and organic matter status), growth of forest vegetation may be reduced or limited, which may create an opportunity for weed species, many of which rely on shallow root systems, to take advantage of the lack of competition to establish themselves (Small et al., 2018); note that resource availability can change the competitive dynamics between species and impact the outcome of competition depending on the species involved (Buss et al., 2018).
- Previous weed control on the site.
    - Previous attempts at control demonstrate proactive efforts on the part of the operator to control weeds.
    - Weed populations that persist over time even with weed control can still be considered to be controlled as per the *Weed Control Act* if their growth and spread are inhibited, as discussed above.
- Negative consequences of continued weed control.
    - Damage and mortality of desirable native vegetation from herbicide overspray, particularly as a result of broadcast spraying.
    - Impacts to ecological recovery. Direct effects of herbicide include the reduction in cover and species richness of non-target vegetation species, impacts to soil microbial communities, and potential toxic effects to wildlife. The removal of native forbs, shrubs or trees impacts the composition, structure and function of the plant community and can alter the successional pathway of the site as a whole, which then has impacts on wildlife forage, habitat provision and biodiversity (Alberta Sustainable Resource Development, 2004; Helander et al., 2012; Miller and Miller, 2004;).

- Delay in reclamation certification application by at least one growing season as per the Forested Land Criteria.

- Damage to the access road required to re-enter the site to conduct weed control.
  - Damage to the access road is considered more severe if a forested vegetation community (tree and shrubs) has established on the access road or if the access road crosses sensitive environments (e.g., peatlands, wetlands or creeks).
  - Longer access roads require more disturbance then shorter access roads.
  - Damage to the access road can result in continued spreading of weed seeds via equipment used to access the site

In preparing the professional justification for a variance request for weeds, the applicant should include data, photos, historical weed management information, and any other supporting information that clearly indicates that the weeds originate from an off-site location, and that they were not associated with or introduced from the reclamation area itself, if applicable. More information on data required for a professional justification can be found in Section 4.

Knowledge Gaps

There are a few species that are designated as noxious weeds or undesirable/problem weeds that likely will not impede forest development or the establishment of equivalent land capability. These are weeds, such as scentless chamomile or perennial sow-thistle, that are not shade tolerant and do not grow thick enough to out-compete woody stems (Schoonmaker et al. 2018; Small et al. 2018). However, there are knowledge gaps surrounding the interaction and growth dynamics between these types of weeds and the developing forest on reclamation areas. Weed control is often heavily prescribed for all noxious weeds across the province, although the establishing forest canopy may act as a significant deterrent to weed invasion itself.

APPENDIX B: CHECKLIST OF KEY FACTORS BY DEFICIENCY TYPE

REQUIREMENTS AND FACTORS TO CONSIDER FOR LANDSCAPE DEFICIENCIES

Subsided Area, Hill Cuts, Soil Stockpiles

- ☐ On-site vegetation
- ☐ Dimensions and characteristics of deficiency
- ☐ Slopes of deficiency
- ☐ Level of risk to the safety of recreational and traditional land users, livestock and wildlife
    - ☐ Deterrents to access
- ☐ Stability of deficiency
- ☐ Comparison to off-site conditions and/or to typical regional conditions
- ☐ Impacts of deficiency on ecological function
- ☐ Current, future and potential land uses of the site
- ☐ Consequences of re-entering the site to conduct reclamation to correct the deficiency
    - ☐ Damage to existing vegetation
    - ☐ Soil re-disturbance
    - ☐ Delayed ecological recovery
    - ☐ Rutting and compaction
    - ☐ Potential for increased recreational use
    - ☐ Weed establishment and potential need for chemical weed control
    - ☐ Potential for use of low-impact reclamation options
    - ☐ Weed seed bank present within the soil stockpile (soil stockpiles only)
    - ☐ Size of the disturbance area to correct the deficiency
- ☐ Comparison to post-reclamation conditions and features in other industries

Woody Debris Piles

- ☐ On-site vegetation
- ☐ Vegetation growth within the woody debris pile
- ☐ Dimensions and characteristics of the wood pile
- ☐ Risk of wildfire
    - ☐ Age of wood pile and decomposition status
    - ☐ Type of forest
    - ☐ Dominance of grass on-site and growth habit of grass
    - ☐ Location of the pile relative to the edge of the site and presence of leaning logs
    - ☐ Facility type
- ☐ Consequences of re-entering the site to conduct reclamation to correct the deficiency

- ☐ Damage to existing vegetation
- ☐ Delayed ecological recovery
- ☐ Rutting and compaction
- ☐ Potential for increased recreational use
- ☐ Weed establishment and potential need for chemical weed control
- ☐ Potential for use of low-impact reclamation options
- ☐ Size of the disturbance area to correct the deficiency

☐ Merchantability of the timber within the woody debris pile

☐ Management and reclamation of woody debris piles in other industries (e.g., forestry, OSE)

☐ Comparison to off-site conditions and/or to typical regional conditions

REQUIREMENTS AND FACTORS TO CONSIDER FOR TOPSOIL DEPTH AND DISTRIBUTION DEFICIENCY

☐ On-site vegetation

☐ Age of the site

☐ Rooting restrictions

☐ Consequences of re-entering the site to conduct reclamation to correct the deficiency

- ☐ Damage to existing vegetation
- ☐ Delayed ecological recovery
- ☐ Rutting and compaction
- ☐ Potential for increased recreational use
- ☐ Weed establishment and potential need for chemical weed control
- ☐ Potential for use of low-impact reclamation options

☐ Woody vegetation growth and productivity

☐ Current, future and potential land uses of the site

☐ Comparison to off-site, pre-disturbance and/or typical regional conditions

☐ Soil salvage limitations during construction

☐ Soil suitability

☐ Presence of soil stockpiles

☐ Availability of suitable topsoil

REQUIREMENTS AND FACTORS TO CONSIDER FOR SPARSE DESIRABLE HERBACEOUS VEGETATION DEFICIENCY

☐ Erosion

☐ On-site woody vegetation density and cover

☐ Non-native or undesirable herbaceous species cover

☐ On-site percent cover of mosses and lichens

☐ Off-site percent cover of herbaceous species

☐ Interim reclamation of portions of the site

- ☐ Consequences of re-entering the site to conduct reclamation to correct the deficiency
    - ☐ Damage to existing vegetation
    - ☐ Delayed ecological recovery
    - ☐ Rutting and compaction
    - ☐ Potential for increased recreational use
    - ☐ Weed establishment and potential need for chemical weed control
    - ☐ Potential for use of low-impact reclamation options
- ☐ Availability of suitable seed mixes

REQUIREMENTS AND FACTORS TO CONSIDER FOR PROBLEMATIC SPECIES DEFICIENCY

- ☐ On-site vegetation (cover, density of woody plants, presence of sparse or bare areas)
- ☐ Trends over time
- ☐ Distribution of the weed population and native vegetation on-site
- ☐ Movement of noxious weeds into off-site areas
- ☐ Third party activity
    - ☐ As a dispersal agent of noxious weeds
    - ☐ As a source of weeds
- ☐ Problematic species, phenology and ecology
- ☐ Impacts of weeds on on-site vegetation and ecosystem development
- ☐ Site and soil conditions
- ☐ Previous weed control on the site
- ☐ Negative consequences of continued weed control
- ☐ Damage to the access road required to access the site to conduct weed control

APPENDIX C: ADDITIONAL READING

The following is a list of references, sorted by category, that may be helpful in understanding forest ecology and in justifying reclamation deficiencies from an ecological perspective.

Forest Dynamics

Chen, H.Y.H and R.V. Popadiouk. 2002. Dynamics of North American Boreal Mixedwoods. Environmental Reviews 10: 137-166.

Hart, S.A. and H.Y.H. Chen. 2006. Understory Vegetation Dynamics of North American Boreal Forests. Critical Reviews in Plant Sciences 25: 381-397.

Ecological Recovery in Forests

Alberta Environment. 2010. Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region, 2nd Edition. Prepared by the Terrestrial Subgroup of the Reclamation Working Group of the Cumulative Environmental Management Association, Fort McMurray, Alberta. 332 pp. Available at: https://open.alberta.ca/dataset/966069fc-7910-4fc5-85da-3a717bfbddc5/resource/1056c2a6-0815-4d0a-ab0c-80938e1e5bd1/download/8269.pdf.

Bergeron, Y., H.Y.H. Chen, N.C. Kenkel, A.L. Leduc and S.E. Macdonald. 2014. Boreal Mixedwood Stand Dynamics: Ecological Processes Underlying Multiple Pathways. The Forestry Chronicle 90: 202-213.

Macdonald, E., S. Quideau and S. Landhäusser. 2012. Rebuilding Boreal Forest Ecosystems after Industrial Disturbance. Chapter 7 In: Restoration and Reclamation of Boreal Ecosystems: Attaining Sustainable Development. Vitt, D.H. and J.S Bhatti (Editors). Cambridge University Press, New York. pp. 123-160.

Upland Wellsite and In-situ Reclamation

Tokay, H., C.B. Powter, B. Xu, B. Drozdowski, D. MacKenzie and S. Levy. 2019. Evaluation of Reclamation Practices on Upland and Peatland Wellsites. Prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. 221 pp.

Cenovus Energy. 2016. OSE Visual Reference Guide. Cenovus Energy, Calgary, Alberta. 24 pp. Available at: https://www.cenovus.com/news/docs/oil-sands-exploration-visual-reference-guide.pdf.

Frerichs, L.A., E.W. Bork, T.J. Osko and M.A. Naeth. 2017. Effects of Boreal Well Site Reclamation Practices on Long-Term Planted Spruce and Deciduous Tree Regeneration. Forests 8(201). Available at: https://www.mdpi.com/1999-4907/8/6/201/pdf.

Jones, C.E., S. Bachmann, V.J. Lieffers and S.M. Landhäusser. 2018. Rapid Understory Plant Recovery Following Forest Floor Protection on Temporary Drilling Pads. Restoration Ecology 26: 48–55.

MacKenzie, D. and K. Renkema. 2013. In-Situ Oil Sands Extraction Reclamation and Restoration Practices and Opportunities Compilation. Canada's Oil Sands Innovation Alliance, Edmonton, Alberta. 80 pp. plus appendices. Available at: https://www.cosia.ca/sites/default/files/attachments/COSIA_In-Situ_Extraction_Reclamation_and_Restoration _Compilation.pdf.

Osko, T. and M. Glasgow. 2010. Removing the Wellsite Footprint: Recommended Practices for Construction and Reclamation of Wellsites on Upland Forests in Boreal Alberta. University of Alberta, Department of renewable Resources, Edmonton, Alberta. 57 pp. plus appendices. Available at: http://www.biology.ualberta.ca/faculty/stan_boutin/ilm/uploads/footprint/Upland Recommendations - Final Revised - Small File.pdf.

Osko, T., M. Pyper and S. Odsen. 2018. Faster Forests: A Visual Guide to Improved Construction and Reclamation Practices on Oil Sands Exploration Sites. Prepared for the Faster Forests Program. 28 pp.

Plant Community and Natural Subregion Guides

Beckingham, J.D. and J.H. Archibald. 1996. Field Guide to Ecosites of Northern Alberta. Special Report 5. Canadian Forest Service Northwest Region Northern Forestry Centre, Edmonton, Alberta.

Beckingham, J.D., I.G.W. Corns and J.H. Archibald. 1996. Field Guide to Ecosites of West-Central Alberta. Special Report 9. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta.

Moisey, D., J. Young, D. Lawrence, C. Stone, M.G. Willoughby, A. Book. 2016. Guide to Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta. 8th Approximation. Alberta Environment and Parks, Boreal Rangeland Resource Stewardship Section. Available at: https://open.alberta.ca/publications/9781460129760

Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta. Pub. No. T/852. Comp. D.J. Downing and W.W. Pettapiece, Government of Alberta. Available at: https://www.albertaparks.ca/media/2942026/nrsrcomplete_may_06.pdf

Willoughby, M.G., J.D. Beckingham, J.H. Archibald, D. Moisey, J. Young, D. Lawrence, C. Stone and A. Book. 2019. Guide to Ecological Sites of the Dry Mixedwood Subregion. 2nd Approximation. Alberta Environment and Parks, Rangeland Resource Stewardship Section, Lands Division. Edmonton, Alberta. Available at: https://open.alberta.ca/publications/9781460146484

Willoughby, M.G., J.D. Beckingham, J.H. Archibald, D. Moisey, J. Young, D. Lawrence, C. Stone and A. Book. 2019. Guide to Ecological Sites of the Central Mixedwood Subregion. 2nd Approximation. Alberta Environment and Parks, Rangeland Resource Stewardship Section, Lands Division. Edmonton, Alberta. Available at: https://open.alberta.ca/publications/9781460 146477.

Willoughby, M.G., J.H. Archibald, G.D. Klappstein, I.G.W. Corns, J.D. Beckingham and T.L. France. 2020. Guide to Ecological Sites of the Lower Foothills Subregion. Third Approximation. Alberta Environment and Parks, Edmonton, Alberta. Available at: https://open.alberta.ca/publications/9781460147252

Windthrow

Some examples of papers that provide dimensions of windthrow mound and pit microtopography are listed below, organized by specific forest types.

Aspen-dominated boreal forests (28-year-old):

Lee, P. and K. Sturgess. 2002. The Effects of Logs, Stumps, and Root Throws on Understory Communities within 28-Year-Old Aspen-Dominated Boreal Forests. Canadian Journal of Botany 79: 905-916.

Black spruce-balsam fir boreal forest (eastern Canada):

Waldron, K. J.-C. Ruel and S. Gauthier. 2013. Forest Structural Attributes after Windthrow and Consequences of Salvage Logging. Forest Ecology and Management 289: 28-37.

Pine dominated boreal forests in Finland:

Kuuluvainen, T. and P. Juntunen. 1998. Seedling Establishment in Relation to Microhabitat Variation in a Windthrow Gap in a Boreal Pinus Sylvestris Forest. Journal of Vegetation Science 9: 551-562.

Microtopography (site preparation, mounding, etc.)

Bentham, P. and B. Coupal. 2015. Habitat Restoration as a Key Conservation Lever for Woodland Caribou: A Review of Restoration Programs and Key Learnings from Alberta. Rangifer 35: 123-148.

DeLong, H.B., V.J. Lieffers and P.V. Blenis. 1997. Microsite Effects on First-Year Establishment and Overwinter Survival of White Spruce in Aspen-Dominated Boreal Mixedwoods. Canadian Journal of Forest Research 27: 1452–1457.

Gradowski, T., D. Sidders, T. Keddy, V.J. Lieffers and S.M. Landhäusser. 2008. Effects of Overstory Retention and Site Preparation on Growth of Planted White Spruce Seedlings in Deciduous and Coniferous Dominated Boreal Plains Mixedwoods. Forest Ecology and Management 255: 3744-3749.

Melnik, K., S.M. Landhäusser and K. Devito. 2018. Role of Microtopography in the Expression of Soil Propagule Banks on Reclamation Sites. Restoration Ecology 26: S200-S210.

Natural Resources Canada. 2019. Site Preparation for Restoring Forest Cover on Oil and Gas Sites. Natural Resources Canada. 38 pp. Available at: https://cfs.nrcan.gc.ca/pubwarehouse/pdfs /39507.pdf

Schott, K.M., J. Karst and S.M. Landhäusser. 2014. The Role of Microsite Conditions in Restoring Trembling Aspen (Populus Tremuloides Michx) from Seed. Restoration Ecology 22: 292-295.

Woody Debris Management

Frerichs, L.A. 2017. Decadal Assessment of Successional Development on Reclaimed Upland Boreal Well Sites. M.Sc. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 144 pp. plus appendices. Available at: https://era.library.ualberta.ca/items/30fb8946-3f74-437d-9d4a-41622810385d/view/11e56e33-7c34-4899-bb65-eed88d69279c/Frerichs_ Laurie_A_201701_MSc.pdf.

Frerichs, L.A., E.W. Bork, T.J. Osko and M.A. Naeth. 2017. Effects of Boreal Well Site Reclamation Practices on Long-Term Planted Spruce and Deciduous Tree Regeneration. Forests 8(201). Available at: https://www.mdpi.com/1999-4907/8/6/201/pdf.

Vinge, T. and M. Pyper. 2012. Managing Woody Materials on Industrial Sites: Meeting Economic, Ecological, and Forest Health Goals Through a Collaborative Approach. University of Alberta, Department of Renewable Resources, Edmonton, Alberta.

Topsoil and Forest Recovery

Forest Landings in Northeastern British Columbia:

Bulmer, C.E. and M. Krzic. 2003. Soil Properties and Lodgepole Pine Growth on Rehabilitated Landings in Northeastern British Columbia. Canadian Journal of Soil Science 83: 465-474

Bulmer, C. E., M.G. Schmidt, B. Kishchuk, and C. Preston. 1998. Impacts of Blading and Burning Site Preparation on Soil Properties and Site Productivity in the Sub-boreal Spruce Zone of Central British Columbia. Inf. Rep. BC-X-377. Canadian Forest Service, Victoria, British Columbia.

Bulmer, C., L. Venner and C. Prescott, 2007. Forest Soil Rehabilitation with Tillage and Wood Waste Enhances Seedling Establishment but Not Height After 8 Years. Canadian Journal of Forest Research 37: 1894-1906.

Campbell, D.B., C.E. Bulmer, M.D. Jones, L.J. Philip and J.J. Zwiazek. 2008. Incorporation of Topsoil and Burn-Pile Debris Substantially Increases Early Growth of Lodgepole Pine on Landings. Canadian Journal of Forest Research 38: 257-267.

Capping studies in the oil sands:

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APPENDIX D: VARIANCE JUSTIFICATION FORM

This Variance Justification Form is proposed as a new standardized form for submitting variance requests. It is based the Combined Assessment Tool (CAT) and Record of Observations (RoO) forms used for detailed site assessments (DSAs) (Alberta Energy Regulator, 2019c) and uses many of the same terminology and definitions (refer to the Forested Land Criteria for definitions).

Variance Justification Form Instructions

All fields must be completed except for those listed as "if available" or "if applicable."

Fill in the header and footer text with site-specific details.

Site Overview

- For the Unique ID/License No, use the following based on the facility type:
  - Wellsite: Unique Well Identifier (UWI)
  - Pipeline: Line Number
  - Other Facility: License Number
  - Oil Sands Exploration Program: Exploration Number (OSE/CEP) Number
- For the Provincial Land Use Area, enter one of the following:
  - Green Area
  - White Area
- For the Provincial Land Use Type, enter one of the following:
  - Private Land
  - Public Land
  - Public Land – Provincial Park
- For the Surface Legal Land Location, do not provide a list of all of the legal subdivisions (LSDs) in which the sites occurs, only provide the LSDs for the furthest extent of all facilities.
- Multiple entries can be made for soil classification, as needed

Facility Information

- Facilities include wellsites, access roads, remote sumps, log decks, campsites, rights-of-way, etc. All facilities associated with the wellsite should be listed here.
- Multiple entries can be made for ecosite phase or soil series, as needed

Site History Information

- For Pre-existing Conditions, include any known trails or roads from recreational or traditional use, previous survey work or any other relevant third-party activity that occurred before the site was constructed.
- For Pre-existing Conditions and Pre-disturbance Biophysical Information, include any known pre-existing or pre-disturbance biophysical information that is not provided elsewhere on the form.
- For Level of Disturbance at Construction enter one of the following (refer to definitions in the Forested Land Criteria):
    - Full disturbance
    - Full disturbance; 2 lift
    - Full disturbance; 3 lift
    - Low/minimum disturbance
    - Padded
    - No disturbance
- For Level of Disturbance at Reclamation, enter one of the following (refer to definitions in the Forested Land Criteria):
    - Full disturbance
    - Minimum disturbance
    - Staged/progressive reclamation
- For Revegetation Approach, enter one of the following (refer to definitions in the Forested Land Criteria).
    - Natural recovery (use for all sites that were not seeded or planted)
    - Seeded Grasses Pre-2007
    - Planted
- Delete or add portions of the table as required based on the number of facilities.

Detailed Site Assessment Information

- For Additional Site Biophysical Information, include additional data that was collected that is not required by the Forested Land Criteria such as weed species data, additional landscape, vegetation, soils or wildlife information, etc. (refer to Section 4).
- For Evidence of Third-party Use, include any evidence of trails or roads from recreational or traditional use, grazing activity, hay bales or any other relevant third-party activity that is currently present/occurring on the site.

Justification

- Refer to Section 4 for instructions on completing the justification.
- Use the same box to discuss all deficiencies on all facilities.

Site Photographs

- Additional pages of photographs can be added to the form (using the same format). There is no limit to the number of photographs that can be included.

Sign-off

- Fill in the information in the Person Preparing Justification portion and sign the form.
- Leave the Name of Regulatory Official Approving Variance blank

Attached Supporting Information

- List additional supporting information that will be attached to the form in the “Other” boxes at the bottom of the table.

Variance Justification Form

Site Overview

Operator						**Criteria**	
Unique ID/ License #						Forested	
Facility and Disposition							
Land Use		**Surface Legal Land Locations(s)** (Furthest Extent)					
Provincial Land Use Area		**Qtr**	**LSD**	**Sec**	**Twp**	**Rng**	**Mer**
Provincial Land Use Type							
Grazing Lease (Yes/No)							

Ecological Land Classification		**Soil Classification**	
Natural Region		**Soil Order(s)**	
Natural Subregion		**Soil Great Group(s)**	

Nearby Populated Area(s)		**Overlapping Dispositions** (if applicable)
Name	**Distance (km)**	

Facility Information

Facility		**UTM Coordinates (NAD83)**			**Dimensions (m x m)**	**Ecosite Phase(s)**	**Soil Series**
		Zone	**Easting**	**Northing**			
1							
2							
3							
4							

Site History Information

Facility		Survey Date	Construction Date	Abandonment Date	Reclamation Date	Revegetation Date
1						
2						
3						
4						

Facility 1	
Pre-existing Conditions and Pre-disturbance Biophysical Information (if available)	
Level of Disturbance at Construction:	
Description of Construction Activities or Limitations (e.g., soil salvage limitations) (if available)	
Level of Disturbance at Reclamation:	
Description of Reclamation Activities and/or Amendments (if available)	
Description of Herbicide Application History (if applicable)	
Revegetation Approach:	
Description of Revegetation Activities	

Facility 2	
Pre-existing Conditions and Pre-disturbance Biophysical Information (if available)	
Level of Disturbance at Construction:	
Description of Construction Activities or Limitations (e.g., soil salvage limitations) (if available)	
Level of Disturbance at Reclamation:	

Description of Reclamation Activities and/or Amendments (if available)	
Description of Herbicide Application History (if applicable)	
Revegetation Approach:	
Description of Revegetation Activities	
Facility 3	
Pre-existing Conditions and Pre-disturbance Biophysical Information (if available)	
Level of Disturbance at Construction:	
Description of Construction Activities or Limitations (e.g., soil salvage limitations) (if available)	
Level of Disturbance at Reclamation:	
Description of Reclamation Activities and/or Amendments (if available)	
Description of Herbicide Application History (if applicable)	
Revegetation Approach:	
Description of Revegetation Activities	
Facility 4	
Pre-existing Conditions and Pre-disturbance Biophysical Information (if available)	
Level of Disturbance at Construction:	

Description of Construction Activities or Limitations (e.g., soil salvage limitations) (if available)	
Level of Disturbance at Reclamation:	
Description of Reclamation Activities and/or Amendments (if available)	
Description of Herbicide Application History (if applicable)	
Revegetation Approach:	
Description of Revegetation Activities	

Detailed Site Assessment Information (if available)

Facility		**Category Failed (Yes/No)**			
		Landscape	**Vegetation**	**Level 1 Soil**	**Level 2 Soil**
1					
2					
3					
4					

Landscape Assessment Date	**Soils Assessment Date**	**Vegetation Assessment Date**

Additional Site Biophysical Information
Evidence of Third-party Use

Justification

Deficiency Type	
Current Criteria Requirements	
Description of Deficiency (including location and extent/dimensions of the deficiency)	
Rationale for Variance	
Literature or Case Studies Cited	

Site Photographs

Photo 1. Photo caption

Photo Date: Month Day, Year

Photo 2. Photo caption

Photo Date: Month Day, Year

Site Photographs

Photo 3. Photo caption

Photo Date: Month Day, Year

Photo 4. Photo caption

Photo Date: Month Day, Year

Sign-off

Person Preparing Justification		
	Name (Print)	Title
	Signature	Date (mm/dd/yyyy)
Name of Regulatory Official Approving Variance		
	Name	Date (mm/dd/yyyy)

Attached Supporting Information

☐	Site diagram (including overlapping dispositions, location of deficiency, comparable condition off-site)
☐	Survey plans
☐	Detailed Site Assessment (DSA), including combined assessment tool (CAT) and record of observation (RoO) and any supporting reports (e.g., Phase I Environmental Site Assessments, previous DSAs)
☐	Aerial photographs
☐	Construction records
☐	Pre-disturbance biophysical information
☐	Other:
☐	Other:
☐	Other: