APPENDIX A: INFORMATION SHEETS

The following Information Sheets outline the current Forested Land Criteria, considerations prior to proceeding with a variance request and additional considerations for each of the common deficiencies to be eligible for a variance:

- 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. Variances should only be used if they result in the best possible ecological outcome.

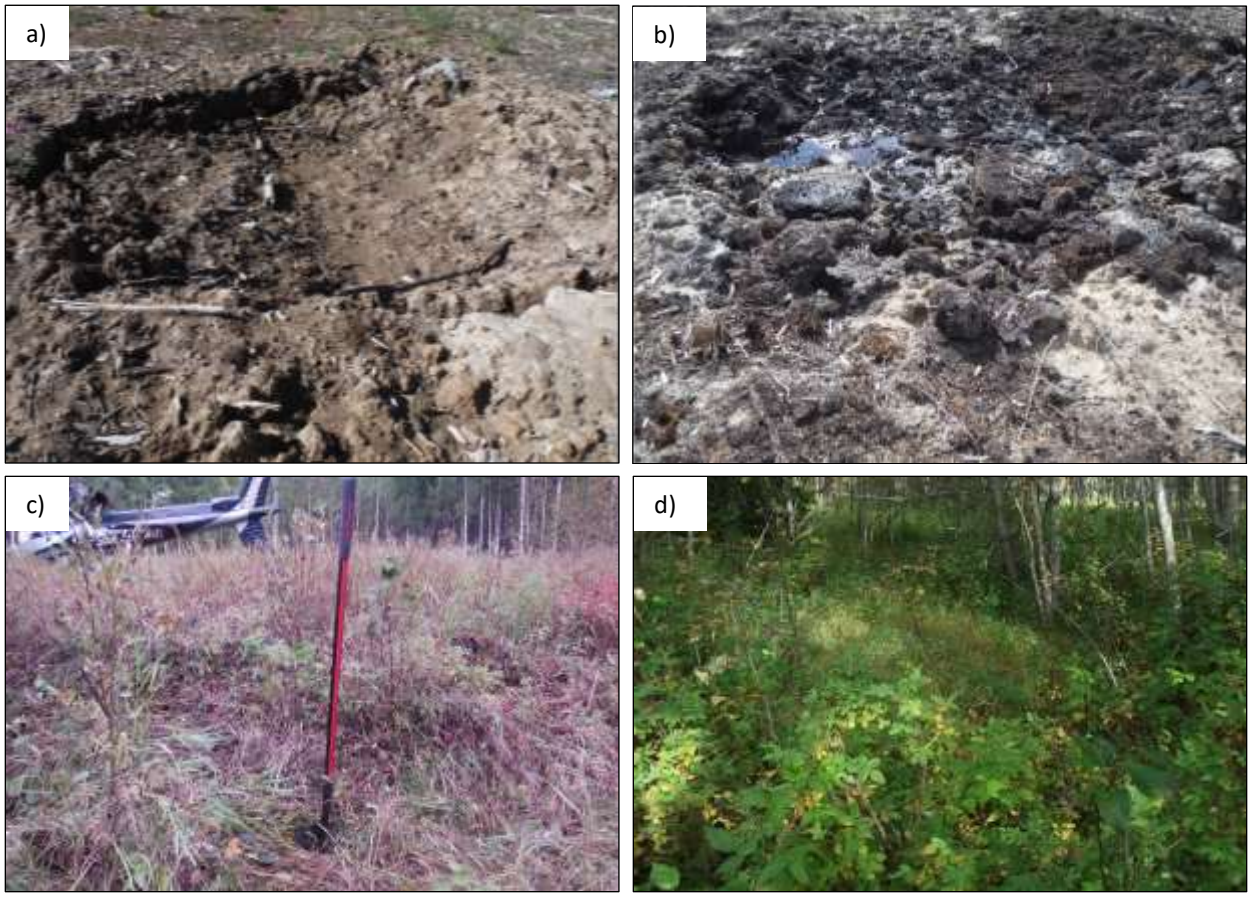

Figure 1. Examples of subsided areas. Requirements and factors presented in this Information Sheet are used to determine if these are eligible to be left in place.
a) and b) before vegetation encroachment; c) and d) after vegetation encroachment.

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 (Tokay et al., 2019):

- naturally occurring variation in micro-contour within forests in the region, or
- microtopographic heterogeneity on reclaimed/reforested sites in other industries created to improve revegetation success.

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. 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

[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.

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). 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.

Considerations For a Variance Request

A subsided area, including those larger than 4 m^2, may be left in place with a variance if the site has the following characteristics:

1. 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.

2. 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.

   The probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence) of the risk should be considered. 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:
     - large trees and/or shrubs,
     - boulders,

[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 soil mounds, and/or
- sites that are not currently within a grazing lease.

- The subsided area is stable, not slumping, non-erosive and not increasing in size over time (i.e., no evidence of continuing subsidence during multiple assessments, if available).

3. **Either**

   - 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

   - 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.

4. 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).

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

Additional Considerations

Additional considerations for subsided area variances 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 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,
    - mounding in the forestry industry, and
    - mounding during well pad, road, pipeline, or seismic line reclamation.

HILL CUTS

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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 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 (Tokay et al., 2019):

- naturally occurring variation in contour within forests in the region, or
- microtopographic heterogeneity on reclaimed/reforested sites in other industries created to improve revegetation success.

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. 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). The 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 which requires:

- 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].

Considerations For a Variance Request

A hill cut may be left in place with a variance if the site has the following characteristics:

1. 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].
   - 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.
   - 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.
2. 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 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

[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.

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 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, and
    - large soil mounds.
- Sites that are not currently within a grazing lease.
- The hill cut is stable, not slumping, and non-erosive.

3. **Either**

    - 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

    - The hill cut is not impacting drainage or hydrology for the site as a whole or off-site.

4. The hill cut is not limiting 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 eligible for a variance, the “Variance – Landscape” category in OneStop is used.

Additional Considerations

Additional considerations for hill cut variances 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 3.0 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,
    - mounding or disc trenching in the forestry industry, and
    - mounding during well pad, road, pipeline, or seismic line reclamation.

SOIL STOCKPILES[1]

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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 be up to 3 m in height (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.

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 (Tokay et al., 2019):

- naturally occurring variation in contour within forests in the region, or
- microtopographic heterogeneity on reclaimed/reforested sites in other industries created to improve revegetation success.

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. 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

[1] Working session feedback suggested that variance requests for soil stockpiles should not be considered as it is an indication that no attempts were made to reclaim the site (Renkema et al., 2022.

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[2] 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[3].

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).

Considerations For a Variance Request

A soil stockpile may be left in place with a variance if the site has the following characteristics:

1. 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].

[2] Soil stockpiles are typically considered at the macro- and meso- contour level as they tend to be >10 m long.

[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 soil stockpiles must also meet.

[4] 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.

[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.

- 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.

2. **Either**
   - The site passes the Forested Land Criteria for topsoil depth and distribution.

   Or
   - The topsoil depth and distribution are deemed acceptable, as described in the Topsoil Depth and Distribution Information Sheet.

3. 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 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, and
     - large soil mounds.
   - Sites that are not currently within a grazing lease.

4. The soil stockpile is stable:
   - not slumping, and
   - non-erosive.

5. **Either**
   - 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

- The soil stockpile is not impacting drainage or hydrology for the site as a whole or off-site.

6. 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.

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

Additional Considerations

Additional considerations for soil stockpile variances 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 3.0 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,
  - mounding or disc trenching in the forestry industry, and
  - mounding during well pad, road, pipeline, or seismic line reclamation.

WOODY DEBRIS PILES

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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, and

- 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. 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 Criteria typically fail to meet requirement outlined in 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.

Considerations For a Variance Request

From a reclamation perspective, a woody debris pile may be left in place with a variance if the site has the following characteristics:

1. 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].
    - 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.

[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 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.

2. Vegetation is growing through the woody debris pile.
3. 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 the wood is rotten.
    - 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 require the use of heavy machinery depending on the volume of wood in the pile. Refer to Section 3.0 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.
- 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.

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

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.

TOPSOIL DEPTH AND DISTRIBUTION

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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 if 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. The 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.

Impacts that may occur because 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.

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

[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).

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.
    - 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

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

being permissible, a variance must still be obtained because the current Record of Observation (RoO) datasheet automatically flags the parameter as a fail.

Considerations For a Variance Request

If topsoil depth and distribution do not meet the Forested Land Criteria, a variance for topsoil depth and distribution could be obtained if the site has the following characteristics:

1. 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.
2. 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).
3. There are no rooting restrictions.
4. 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 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.

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

[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.

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 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). Alternate measures of tree performance could be considered such as timber productivity rating (i.e., site index).
- Location of the site in terms of land designation (Green vs. White Area).
    - If the site is 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 topsoil replacement may be required.
- 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, additional reclamation activities including spreading of 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).

DESIRABLE HERBACEOUS SPECIES COVER

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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). A sparse desirable herbaceous species cover deficiency occurs when one (or more) of the assessment grids, does not meet the Forested Land Criteria. There are several reasons why a site may have sparse desirable herbaceous species cover, including:

- 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.

This Information Sheet does not apply to small sparse areas that are not representative of the assessment grid.

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.

Considerations For a Variance Request

If desirable herbaceous species cover does not meet the Forested Land Criteria, a variance for desirable herbaceous species cover could be obtained if the site has the following characteristics:

1. The sites pass the Forested Land Criteria for erosion.

2. 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.
3. Non-native or undesirable herbaceous species cover is less than half of the desirable herbaceous species cover.
4. 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.

If the site is eligible for a variance in desirable herbaceous cover, the "Variance - Other" category in OneStop is used.

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 3.0 for factors to consider related to reclamation of deficiencies.
- 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,

[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.

potentially without adding truly desirable herbaceous species, with the negative consequences of increased competition for naturally recovering vegetation.

PROBLEMATIC SPECIES

Before proceeding through this Information Sheet, refer to Sections 1 and 3. Variances should only be used if they result in the best possible ecological outcome.

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 Schedule 1 of the *Weed Control Regulation*) are not eligible for a variance and cannot be certified.

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 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 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.

Note that the *Weed Control Act* defines "control" differently than "destroy,":

> 1(c)[2] "control" means
> (i) to inhibit the growth or spread, or
> (ii) to destroy;
> (d) "destroy" means
> (i) to kill all growing parts, or
> (ii) to render reproductive mechanisms non-viable.

[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.

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.

It these conditions are met, the application must include data, photos, historical weed management and supporting information clearly indicating that the weeds are from an offsite location that is not owned or managed by the same operator.

Considerations For a Variance Request

If the site does not meet the Forested Land Criteria, and/or the three additional conditions specified in the Criteria, the site may be eligible for a variance to allow problematic species to be left in place without further reclamation, if the site has the following characteristics:

1. 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.
    - 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.

[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.

2. **Either**

- The growth and spread of weeds are 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:
    - Spread of weeds can be considered 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.
        - 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.
        - 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

- The source of weeds is shown to be third-party activity[4]. Weeds can 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.

If the site is eligible for a variance for problematic species one of the following categories are used in OneStop:

- Incompatible vegetation – Noxious weeds
- Incompatible vegetation – Invasive species
- Incompatible vegetation – Problem introduced species
- Incompatible vegetation – Undesirable/problem weeds

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:*

[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).

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:

1. Will the species adversely affect the growth and development of a forest canopy through aggressive growth and shading?
2. Is the species known to have allelopathic properties that inhibit germination of forest understory species?
3. 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). 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 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 achieving equivalent land capability. Meeting target (planting) densities for woody species and abundance criteria for herbaceous species are both evidence that forest development would not be impeded by a problematic species invasion.

- Previous weed control on the site that demonstrate proactive efforts on the part of the operator to control weeds.
- Negative consequences of continued weed control.
    - Damage and mortality of desirable native vegetation from herbicide overspray, particularly when 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).
    - Damage caused by repeated re-entry to the site to conduct weed control.
    - Risk of continual spreading of weed seeds via equipment used to access the site and conduct weed control.

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 (considered on a decade timescale)
  - ☐ 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 (considered on a decade timescale)
- ☐ 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 (considered on a decade timescale)
- ☐ 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 (considered on a decade timescale)
- ☐ 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 clarify forest ecology and in justifying reclamation deficiencies from an ecological perspective.

Forest Dynamics

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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.

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pp. plus appendices. 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. https://www.cclmportal.ca/resource/removing-wellsite-footprint-recommended-practices-construction-and-reclamation-wellsites.

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.

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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.

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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.

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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.

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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. 32 pp. https://era.library.ualberta.ca/items/4cf58549-d130-4540-85b7-6484b2694573/view/ed436469-4617-4057-8e6b-3d25a6204a62/WoodyDebrisFinal-Issuu.pdf

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.

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Stadt., K.J., T. Nunifu and D. Aitkin. 2014. Mean Annual Increment Standards for Crown Forest Management Units. Government of Alberta, Environment and Sustainable Resource Development, Edmonton, Alberta. 38 pp.

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Alberta Biodiversity Monitoring Institute. 2018b. Perennial Sow Thistle (*Sonchus arvensis*). https://www.abmi.ca/FileDownloadServlet?dir=WEB_GRAPH&filename=/reports/2019//VascularPlants/Sonchus-arvensis.pdf.

Alberta Biodiversity Monitoring Institute. 2018c. Common Tansy (*Tanacetum vulgare*). https://beta.abmi.ca/biobrowser/species-detail.html?tsn=99004514

Alberta Invasive Species Council. 2020. Noxious Species Fact Sheets. https://abinvasives.ca/invasive-species/fact-sheets/noxious-species/

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APPENDIX D: VARIANCE JUSTIFICATION FORM

Variance Justification Form Instructions

The first page of the form can be repeated for each facility and deficiency, and text boxes can be expanded to include additional information. If a section is "Not applicable", it is recommended to provide an explanation of why it is "Not Applicable". The following describes the sections of the form and the information to include:

- Facility(ies)
    - Include separate pages for each facility. In some instances, two or more facilities that are in close proximity and have the same deficiency could be grouped to avoid redundancy; however, information should be not be generalized.
- Deficiency Type(s)
    - All the deficiencies that occur on the site must be listed 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.
- 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. Data from multiple years is encouraged to show trends over time.
    - Describe when the deficiency was identified (or why the deficiency may not have been identified) and why it wasn't and corrected previously. Include information on any attempts to correct the deficiency in the section labelled "Actions Taken to Address Deficiency".
- Pre-existing Conditions and Pre-disturbance Biophysical Information
    - Review information from pre-disturbance assessments, environmental field reports or other documents, if available. Historical aerial imagery could provide coarse scale information if other sources of information are lacking.
    - Summarize and interpret this data to determine if the pre-disturbance conditions may have contributed to the deficiency and/or demonstrate how the pre-disturbance conditions were equivalent to the reclaimed conditions.
- Surrounding Area – Land Use(s) and Biophysical Information

- Review information on the current and historical land uses and biophysical conditions from field assessment data, historical aerial imagery, provincial databases or other sources.
- Summarize and interpret this data to determine if the surrounding land use may have contributed to the deficiency and/or demonstrate there are conditions comparable to the deficiency in the surrounding area (natural analogs).
    - Surrounding land use may also influence the risk caused by the deficiency; the risk can be described in the "Limitations or Hazards to Future Land Users Caused by Deficiency" section of the form .
- Provide the locations and sizes of any natural analogs and include photographs.
- Provide the names and distances to nearby populated areas (if relevant).

- Construction/Reclamation Limitations
    - Summarize information on the site's history of construction and initial reclamation and determine if there were any factors during construction and initial reclamation that may have caused the deficiency.
- Actions Taken to Address Deficiency
    - Summarize any work completed in attempt to address the deficiency in part or in full (e.g., low-impact reclamation work, herbicide application).
    - Describe the outcome of this work.
- Alternatives to Justification Considered
    - List the possible techniques that could be used to remedy the deficiency
    - Describe why leaving the deficiency "as-is" will result in the best ecological outcome (net-environmental benefit).
- Annual Monitoring Results and Current Site Conditions
    - Summarize the results of annual monitoring (e.g., detailed site assessment(s)) and describe the historical trajectory of the site and current state of the site.
- Limitations or Hazards Caused by Deficiency
    - List and describe the probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence) of any risks that not remedying the deficiency could cause to future land users and wildlife (including risk of wildfire).
    - Describe any steps taken to limit the risk.
- Rationale for Variance
    - Summarize information from the previous sections of the justification form to 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, and

        - leaving the deficiency “as-is” results in the best possible ecological outcome (i.e., environmental cost-benefits analysis).
    - Include data from the DSA to support explanations.
    - Include additional supporting information (refer to Section 4.2 and Appendix A).
    - When justifying multiple deficiencies, do not 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.
    - Support the rationale with relevant literature (Appendix C).

The following information should also be attached to support the justification:

- Photographs of each deficiency and for each facility
- 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

Background information that should be included if the variance justification form is not accompanied by a CAT and RoO includes:

- Site overview, ecological and land use information, and any overlapping dispositions
- Facility location and size
- Site history (dates and descriptions of activities and conditions)

Professional Justification

Facility(ies):	
Deficiency Type(s):	
Description of Deficiency (including location and extent/dimensions of the deficiency)	
Pre-existing Conditions and Pre-disturbance Biophysical Information (summarize causal factors/natural analogs)	
Surrounding Area - Land Use(s) and Biophysical Description (summarize causal factors/natural analogs)	
Construction/Reclamation Limitations (summarize causal factors – e.g. soil salvage/replacement limitations)	
Actions Taken to Address Deficiency (e.g. low-impact reclamation work, herbicide application)	
Alternatives to Justification Considered	
Annual Monitoring Results (e.g. current state of the site, vegetation trajectory, trends in weed population size)	
Limitations or Hazards Caused by Deficiency	
Rationale for Variance (summary of all available information and demonstrate equivalent land capability)	

Site Photographs

Photo 1. Photo caption

Photo Date: Month Day, Year

Photo 2. 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:

Background Information (Optional)

Site Overview

Operator						**Criteria**	
Unique ID/ License #						Forested	
Facility and Disposition							
Land Use		**Surface Legal Land Locations(s)** (Furthest Extent)					
Provincial Land Use Area	Choose an item.	**Qtr**	**LSD**	**Sec**	**Twp**	**Rng**	**Mer**
Provincial Land Use Type	Choose an item.						
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							

Background Information (Optional)

Site History Information

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

Detailed Site Assessment Information (if available)

Facilities		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
Other Comments