

## **Interpretation Guide Linking Soil and Natural Resource Information to GVI Site Types in the Northern Fescue Natural Subregion**

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The Grassland Vegetation Inventory uses a system with 32 site types classified into three Primary Classes: 22 site types in the Native/Natural Primary Class, two site types in the Water Primary Class, and eight site types in the Anthropogenic Primary Class.

A unique interpretation guide has been developed for each Natural Subregion in the Grassland Natural Region. Each interpretation guide identifies key properties and distinguishing features for the 22 Native-Natural and two water-related site types. Representative examples are also provided for the eight Anthropogenic site types.

For each Natural Subregion, the 24 site types in the Native/Natural and Water Primary Classes are divided into four groups based on their main defining features of landscape, soil features, type of wetland, soil textural groupings. Each guide contains the following information for each of the 24 site types:

- Definition
- Representative example
- Usual landscape position
- Common association with other GVI site types
- Differentiation from the most similar site type(s)
- Correlation with Soil Landscape Models
- Native vegetation
- Expression on colour infrared photography
- Examples in pilot areas, for Dominant, Co-dominant and Significant occurrences, based on available colour infrared aerial photography
- Example(s) of non-typical occurrence.

This Northern Fescue interpretation guide has two one-township pilot areas: i) in the Hand Hills centered on Little Fish Lake, in portions of Twp. 28 Rge. 16 and Twp. 28 Rge. 17-W4; and ii) in the Rumsey Block in Twp. 33 Rge. 19-W4.

## Site Types Defined Mainly by Landscape

### Badlands/Bedrock (BdL)

**Definition:** Nearly barren or barren lands with exposures of softrock, hardrock or surficial geologic materials. Includes steep valley walls.

**Representative example:** Softrock exposures in undulating landscapes north of Hanna, on Hwy. 36 near Garden Plain in Tp 34, Rg. 13 – W4.

**Usual landscape position:** Moderate to steep coulee or valley sides; also eroded bedrock plains.

**Common association with other GVI site types:** TB, Ov, Li.

**Differentiation from the most similar site type(s):** TB is characterized by fewer softrock exposures and less bare soil and hence has more vegetative cover.

**Correlation with Soil Landscape Models:** Applies to all inclined to steeply sloping landscapes with greater than 10% bedrock exposures of softrock or hardrock. Slopes generally range from 30% to 60% (in isolated cases 15% to 100%). Includes I4h and I5 landscape models from AGRASID 3.0.

**Native vegetation:** Very limited due to high proportion of bare soil.

**Expression on colour infrared photography:** Highly reflective, with most geologic formations appearing white or very light grey. Linear bands may also occur due to the continuity of exposed strata over distances.

#### Examples in pilot areas:

- **Dominant** ( $\geq 65\%$ ): Exposure NW of Thumb Hill in LSD 12, 10-28-17-W4, with significant TB.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Co-dominant association of Badlands and Thin Breaks occurs west of Thumb Hill, on colour infrared photograph AS5307F-37.
- **Significant** (one to three sites types, each covering 10 to 30%): Colour infrared photograph AS5307F-37, in northern portion of Section 18, Tp. 28, Rg. 17-W4, on both sides of an unnamed creek. 20 to 30% of unit. Badlands do not extend into neighbouring Section 20.

**Example(s) of non-typical occurrences:** Mud Buttes south of Monitor, in Twp 32 Rg 4-W4, where the softrock has been strongly contorted by glacial thrusting, otherwise known as Hill-Hole pairs.

## Overflow (Ov)

**Definition:** Areas that receive additional moisture from overland flow or increased snow catch. Typically occurs in valleys on gentle inclines, or on terraces subject to infrequent flooding.

**Representative example:** Fans and aprons in the Red Deer River valley from the Trochu area to Dorothy.

**Usual landscape position:** Occurs mainly in coulees or valley settings as fan or apron deposits. Also on mid- to upper-level terraces.

**Common association with other GVI site types:** Lo, BIO, SL, TB, BdL, and Lotic types.

**Differentiation from the most similar site type(s):** Swales in Lo areas; Lotic types occur on slightly lower to lower slope positions.

**Correlation with Soil Landscape Models:** Applies to non-saline Chernozemic (soils with A, B and C horizons) and/or Regosolic soils (soils that lack a B horizon >5 cm thick, and may lack an A horizon) on landscapes that are low-relief inclines in valley or basinal settings. Overflow sites are usually fan or apron deposits, where upslope streams enter lowland areas and experience a marked decrease in gradient. Slopes generally range from 2% to 9% (in isolated cases from 0.5% to 15%). Overflow occurs only on lower slope positions or adjacent to stream(s), and the percentage of eligible overflow ranges from 10% to 50% per SLM (specific rules within each SCA). Ov includes I31 and I41 landscape models from AGRASID 3.0 and may occur with IU1 and IUh landscape models.

**Native vegetation:** Variable herbaceous cover; may occur with Silver Sagebrush.

**Expression on colour infrared photography:** Generally a uniform dull pinkish green to olive tone if dominant and the soils are relatively mature. If the soils are immature then a mottled appearance is common.

### Examples in pilot areas:

- **Dominant** ( $\geq 65\%$ ): Southeast side of unnamed reservoir on the centre of AS5307F-37, in a relatively small polygon that an access road jogs across the apron. Approximately 70 to 80% Overflow occurs in this polygon, in association with Blowouts.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): In 3-28-17-W4 on AS5307F-38, where Ov is co-dominant with BIO, with significant Cy and Li.
- **Significant** (one to three sites types, each covering 10 to 30%): Valley trending SW from the unnamed reservoir in the center of photo AS5307F-37. This polygon is dominated by Thin Breaks, and also includes significant Ov, SL and BIO.

**Example(s) of non-typical occurrences:** Wide, broad, low-gradient flats in Bullpound Creek valley: i) about 5 km SW of the Sheerness coal mine, between Coleman and Oakland Lakes in Twp 28, on the Range line between R13 and R14-W4, in association with SL and BIO; ii) west of the Watts siding area west of Hanna, in 31-15 and 31-16-W4, in association with Cy, BIO, and LenT.

### **Thin Breaks (TB)**

**Definition:** Areas with soft or hard bedrock at or near the soil surface; partially vegetated; thin, eroded, and immature soils on gentle to steep landscapes, including slumped or failed slopes.

**Representative example:** Highlands of the Wintering Hills are frequently mantled with shallow deposits (Eg. till) over sandstone or other softrock.

**Usual landscape position:** Moderate to steep coulee or valley sides; or plains with thin surficial sediments overlying bedrock.

**Common association with other GVI site types:** BdL, Li, Ov.

**Differentiation from the most similar site type(s):** Both Li and TB usually exhibit immature soils (ie. Rego or Calcareous) but TB is usually distinguished by bedrock within 1 m. TB is a mid-point between Limy and Badlands. Badlands have negligible vegetation, while TB has moderate vegetation cover.

**Correlation with Soil Landscape Models:** Applies to: **1)** all steeply-sloping landscapes with less than 10% bedrock exposures; **2)** largely vegetated areas with bedrock at or near (within 5 m of) the surface; **3)** AGRASID 3.0 landscape models I3m, I3h or I4m.

**Native vegetation:** Usually graminoid with some bare soil; less vegetation on south facing slopes. Many north-facing slopes in the Northern Fescue have poplar and willow cover.

**Expression on colour infrared photography:** Light greenish gray to white tones, but red hues prevail in areas of tree or shrub cover.

#### **Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Thumb Hill escarpment to west, on the eastern portion of photo AS5307F-37
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Co-dominant association of Badlands and Thin Breaks occurs west of Thumb Hill escarpment, and west of the dominant Thin Breaks polygon noted above. Polygons in eastern portion of 9-28-17-W4.
- **Significant** (one to three sites types, each covering 10 to 30%): Exposures in McConnell and Willow Creeks east of Drumeller, in 30-17-W4 and 30-18-W4. Thin Breaks covers approximately 20 to 30% of the creek banks in some locations, where the dominant site type is Badlands.

**Example(s) of non-typical occurrences:** 1) Locations with gravel veneers overlying bedrock mainly in portions of the Hand Hills; 2) densely treed steep north facing slopes of the Hand or Wintering Hills; 3) Neutral Hills, Nose Hill and Mud Buttes which are composed of contorted softrock due to glacial thrusting.

## Ecological/Range Sites Defined Mainly by Soil Features

### Blowouts/Solonetzic Order (BIO)

**Definition:** Areas dominated by Solonetzic Order (hardpan) soils, which may or may not have the presence of eroded surface pits.

**Representative example:** Vast areas on the plain between Sheerness and Castor, and Hanna northeast to Consort.

**Usual landscape position:** Often swales within plains; also in slope inflections. Can be valley bottoms and inclined surfaces. Often associated with Bearpaw Shale <5 m from surface, or in areas of former groundwater discharge.

**Common association with other GVI site types:** Lo, Ov, TB; less with SL or Sy.

**Differentiation from the most similar site type(s):** There are very few areas of 100% BIO. BIO usually occur with Lo, and with Lo in the area between pits.

**Correlation with Soil Landscape Models:** Applies to all SLMs where soils from the Solonetzic order are dominant (>50%) or co-dominant (30 to 50%). Solonetzic soils have an impervious hardpan layer (Bnt horizon) in the subsoil that is caused by excess sodium ( $\text{Na}^+$ ). The land surface is often characterized by eroded pits.

**Native vegetation:** Usually with wheatgrasses, and increased bare ground compared with neighbouring site types (Eg. Loamy). BIO exhibits microtopography on a 1 to 5 m range laterally, and are usually 20 to 50 cm in depth.

**Expression on colour infrared photography:** Highly speckled or mottled.

#### Examples in pilot areas:

- **Dominant** ( $\geq 65\%$ ): 65 to 70% BIO in LSD 12-4-28-17-W4, with Lo and Li site types in significant to minor proportions, and north of a LenA polygon.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): About 40% BIO between sections 20 and 21 in 28-17-W4, with co-dominant Lo and significant Sy and Ov.
- **Significant** (one to three sites types, each covering 10 to 30%): 13-21-28-17-W4, with 20 to 30% BIO; occurs in a polygon dominated by Sy, with significant Ov.

**Example(s) of non-typical occurrences:** Solonetz in Sand plains, where the Bnt or hardpan occurs at depths greater than 50 cm.

### **Limy (Li)**

**Definition:** Eroded or immature soils with free lime ( $\text{CaCO}_3$ ) at the soil surface. Soil pH generally  $>7.5$ .

**Representative example:** Coulee side slopes. Eg. Tributaries to the Red Deer River, and the Red Deer River valley, but not including areas with bedrock exposures.

**Usual landscape position:** Eroded side slopes, upper and crest positions, moderate to steep coulee or valley sides, but not including areas defined as BdL or TB.

**Common association with other GVI site types:** TB, Lo, Cy.

**Differentiation from the most similar site type(s):** Lo represents a normally developed Orthic Dark Brown Chernozemic soil, while Li is usually an immature Rego or Calcareous Dark Brown Chernozemic. Li is also sometimes within the Regosolic Order.

**Correlation with Soil Landscape Models:** Applies to all immature or eroded soils with free lime (calcium carbonates) at the soil surface or in the B horizon. Free lime is detected by effervescence when soil is treated with 10% hydrochloric acid (HCl). Li soils include Rego or Calcareous Chernozemics, eroded phases, and subgroups from the Regosolic order if they are calcareous.

**Native vegetation:** Grasses, forbs and shrubs. Often tree cover on north-facing slopes.

**Expression on colour infrared photography:** Smooth gray to green tone.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): None identified in pilot area but may be dominant on some steep slopes of the Hand Hills escarpment.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Slopes below Thumb Hill off of the Hand Hills, in Section 2, 3 and 10, 28-17-W4, in association with TB.
- **Significant** (one to three sites types, each covering 10 to 30%): 10 to 20% occurs in the side slopes of un-named tributary coulees to Willow Creek and the Red Deer River in Sections 33 and 28 of 28-17-W4.

**Example(s) of non-typical occurrences:** Infrequent locations where groundwater discharge is occurring, but the groundwater is carbonated and not saline, thus creating soils with free lime at the surface.

## Subirrigated (Sb)

**Definition:** Water table is close to surface during growing season, but rarely above. The water table is relatively stable, and is not subject to strong seasonal fluctuations.

**Representative example:** High groundwater table in areas dominated by Sy and Sa site types, such as north of Esther, adjacent to Grassy Island Lake.

**Usual landscape position:** Almost always occurs in concave areas (regional depressions). Ranchers often locate dugouts within concave Sb portions of Sa or CS areas, due to the reliable shallow water table conditions.

**Common association with other GVI site types:** Sa, Sy, CS, Lentic wetlands, and to a lesser extent, Lo.

**Differentiation from the most similar site type(s):** LenT and Sb both typically represent gleyed subgroups. The water table is near the surface in the Sb site type, but water seldom ponds on the soil surface. In contrast, LenT has standing water for a short duration (typically less than a season), after which the water table may or may not be out of range for plant roots. LenT commonly occurs with medium and fine soil textures, whereas Sb commonly occurs with coarse and very coarse textures, and occasionally with medium textures.

**Correlation with Soil Landscape Models:** Sb best represents areas with the water table near the surface causing gleyed soils. Sb includes Gleyed, non-saline, very coarse to medium textured soils. Gleyed subgroups have faint to distinct mottles within 50 cm, or prominent mottles between 50 and 100 cm.

**Native vegetation:** May have a higher density of shrubs (eg. Thorny Buffaloberry, willow), but also may be dominated by herbaceous species.

**Expression on colour infrared photography:** Dark gray speckled appearance, with the darker areas having more groundwater enrichment.

### Examples in pilot areas:

- **Dominant** ( $\geq 65\%$ ): Possibly immediately NW of Little Fish Lake in 18-28-16-W4, or in 13-28-17-W4.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Possibly immediately NW of Little Fish Lake, in 18-28-16-W4, or in 13-28-17-W4.
- **Significant** (one to three sites types, each covering 10 to 30%): Possibly immediately north and east of Little Fish Lake in N<sup>1/2</sup> 23-28-17-W4. Associated with co-dominant Lo and Ov with significant Sb and LtcS.

**Example(s) of non-typical occurrences:** Portions of the Fish Creek Valley in the SW quadrant of Tp. 29-16-W4. There are numerous large wetlands with areas in between the wetlands strongly influenced by a high groundwater table.

## **Saline Lowland (SL)**

**Definition:** Native areas with negligible or limited vegetation due to electrical conductivity (salts) and/or sodium adsorption ratio limitations.

**Representative example:** Areas adjacent to Chain Lakes in Tp. 33 Rg 16 W4, northwest of Hanna.

**Usual landscape position:** Depressional; can be broad concave settings.

**Common association with other GVI site types:** WL, BIO, Ov, Lo.

**Differentiation from the most similar site type(s):** Distinguished from Lentic Alkali by the lack of a defined basin.

**Correlation with Soil Landscape Models:** Applies to all salt-enriched soils, including Saline phase Chernozemic, Saline phase Regosolic, and Saline phase Gleysolic soils. Saline phase soils have an electrical conductivity greater than 4.0 dS/m, which retards most plant growth.

**Native vegetation:** Wheatgrass, Saltgrass, Foxtail Barley, Red Samphire.

**Expression on colour infrared photography:** White when dry; can be red when a lush growth of salophytes is present.

### **Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): East side of unnamed reservoir, in the west center of 9-28-17-W4, in the centre of colour infrared photo AS5307F-37.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Southwest corner of the same unnamed reservoir noted above, near the centre of colour infrared photo AS5307F-37. SL is co-dominant with TB in this unit, and Ov represents about 25 to 30% of the unit.
- **Significant** (one to three sites types, each covering 10 to 30%): Several site-specific locations, mainly adjacent to Lotic channels, Lentic wetlands, or north of Little Fish Lake.

**Examples of non-typical occurrences:** Former active springs west of Thumb Hill. Some spring areas change in flow volume or location over time. When the water table drops in former saline spring areas the expected site type is SL.



## Site Types Defined as Wetlands

### ***Lotic Undifferentiated*** - Note: This is Not a Site Type

**Definition:** Any riparian habitat associated with a flowing stream, and represents the active floodplain. True riparian areas only include the valley floor portions that are prone to occasional flooding (Eg., 1 in 10 years). Lotics do not include fans, aprons, or mid to high elevation terraces in valley or coulee settings. A wide range of vegetation types occur, depending on moisture, and nutrient regime, soil chemistry (salinity and sodicity), texture, parent material, etc.

**Correlation with Soil Landscape Models:** AGRASID and soil surveys have a correlation to Lotic Undifferentiated. **The GVI interpreters are required to identify the appropriate Lotic site type.** Valley systems on AGRASID are often identified as undifferentiated Soil Landscape Models. The AGRASID 3.0 correlation includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0.

### **Lotic River (LtcR)**

**Definition:** Any river that is generally wider than 20 m, and conforms to the double-line base-features hydrography, representing water edge to water edge.

**Associated with other ecological range sites:** Any other Lotics; also Ov. Occasionally where a river borders a steep bank the bank may be BdL or TB. Islands in LtcR that are larger than 0.16 ha in size and are either partially or totally vegetated will be mapped and described as other Lotic polygons.

**Landscape Position:** Wide stream or river.

**Representative Example:** Oldman River.

**Non-typical Example(s):** Artificial channel.

**Native Vegetation:** None, due to permanent water.

**Expression on Colour Infrared Photography:** Blue.

### **Lotic Coniferous (LtcC)**

**Definition:** “Riparian wetlands” that border flowing water systems and where coniferous trees have a combined canopy cover of >25%.

**Representative example:** Tributary coulees to the Red Deer River, mainly west of Drumheller. Eg. Near the ghost hamlets of Beynon and Hesketh.

**Usual landscape position:** Slight terraces immediately above intermittent creeks. These creeks occur in deep sharp valleys, and the coniferous trees have encroached from the north-facing slopes.

**Common association with other GVI site types:** Ltc D, Ltc S, TB.

**Differentiation from the most similar site type(s):** Ltc D is dominated by deciduous trees. Eg. Balsam poplar. Steep hillsides with White Spruce are classified as TB.

**Correlation with Soil Landscape Models:** Applies to all stream channels and floodplains. Will require careful interpretation. Valley systems on AGRASID are identified as undifferentiated Soil Landscape Models. The AGRASID 3.0 correlation includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0. True riparian areas only include the valley floor (from bottom of bank to bottom of bank on the other side of the valley).

**Native vegetation:** Mainly White Spruce, and can occur with Horsetail and/or Red Osier Dogwood.

**Expression on colour infrared photography:** Very dark tones, and interpreter must ensure that the White Spruce located on steep hill sides is not interpreted as LtcC; rather only areas proximal to the channel are LtcC. Upslope areas are likely TB.

**Examples in pilot areas:** None in the Hand Hills pilot area. There are minor occurrences of LtcC in the Northern Fescue and Foothills Fescue Natural Subregions. Most occurrences are in the Montane Natural Subregion, with some occurrences in the Foothills Parkland Natural Subregion.

### **Lotic Deciduous (LtcD)**

**Definition:** “Riparian wetlands” that border flowing water systems and where deciduous trees have a combined canopy cover of >25% OR more than 25 trees per ha.

**Representative example:** Cottonwood stands along the Red Deer River, both upstream and downstream of Drumheller.

**Usual landscape position:** Terraces immediately above rivers or creeks.

**Common association with other GVI site types:** Mainly Ltc S.

**Differentiation from the most similar site type(s):** Ltc S with tall shrubs, including some willow species and Paper Birch, may present some difficulty in interpretation. However, shrubs have a high degree of canopy cover, and are shorter than the trees including Cottonwoods, Balsam Poplar, and Aspen Poplar.

**Correlation with Soil Landscape Models:** Applies to all stream channels and floodplains. Will require careful interpretation. Valley systems on AGRASID are identified as undifferentiated Soil Landscape Models. The AGRASID 3.0 correlation includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0. True riparian areas only include the valley floor (from bottom of bank to bottom of bank on the other side of the valley).

**Native vegetation:** Cottonwoods, Balsam Poplar, or Aspen Poplar plant communities, and other less common deciduous trees.

**Expression on colour infrared photography:** Very bright red colours, often as rings around a slightly less bright red feature, which may be Ltc S.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): In Section 25-28-17-W4, on colour infrared photo Line 2, AS5307F. Mainly occurs as Aspen groves that have established in scattered patches immediately adjacent to or encircling parts of what were originally Ltc H channels.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): In Section 25-28-17-W4, on colour infrared photo Line 2, AS5307F. Mainly occurs as Aspen groves that have established in scattered patches immediately adjacent to or encircling parts of what were originally Ltc H channels. Co-dominant with Ltc H.
- **Significant** (one to three sites types, each covering 10 to 30%): Locations where the Lotics are less than 1 ha in size, and are included in Lo or SwG dominated polygons. Eg. S $\frac{1}{2}$  36-28-17-W4.

### **Lotic Shrub (LtcS)**

**Definition:** “Riparian wetlands” that border flowing water systems and have a combined canopy cover of greater than 10% shrub species.

**Representative example:** Willow Creek east of Drumheller and immediately south of Secondary 576 in Tp. 29-17-W4.

**Usual landscape position:** Terraces immediately above rivers or creeks.

**Common association with other GVI site types:** Mainly Ltc D and Ltc H.

**Differentiation from the most similar site type(s):** Ltc S has varying shrub heights, of which the tall ones may be similar to short trees. However, Lotic Shrub usually has denser canopy and has a different appearance compared to Ltc D. Ltc S may also be confused with Ltc H in locations where the shrub cover is near 10%. If the shrub cover is interpreted as being less than 10%, then it is in the Ltc H site type.

**Correlation with Soil Landscape Models:** Applies to all stream channels and floodplains. Will require careful interpretation. Valley systems on AGRASID are identified as undifferentiated Soil Landscape Models. The AGRASID 3.0 correlation includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0. True riparian areas only include the valley floor (from bottom of bank to bottom of bank on the other side of the valley).

**Native vegetation:** A wide range of shrub species, from roses to willow to birch.

**Expression on colour infrared photography:** Bright red colours, usually inside very bright red rings or linear features that are LtcD.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Ltc S dominated channel between Sections 28 and 21 in 28-17-W4.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Association of LtcS and LtcH with channel between Sections 24 and 25-28-17-W4.
- **Significant** (one to three sites types, each covering 10 to 30%): i) Areas of Fish Creek (upper central portion of AS5307F-41) where Ltc S will be mapped in association with Ov and other site types. Eg. Sy. ii) North-facing Lotic channels too small to be mapped out on their own, but can be included in landscapes dominated by TB. Eg. NW 33-28-17-W4.

### Lotic Herbaceous (LtcH)

**Definition:** “Riparian wetlands” that border flowing water systems and are usually dominated by emergent herbaceous plants (Eg. sedges), but also can be dominated by bare ground indicative of newly formed features (Eg. gravel bars).

**Representative example:** Many segments of the Sounding Creek valley between Esther and Sounding (Eyehill) Lake, due to salinity, the reduced presence of shrubs and a dominance by salophytes.

**Usual landscape position:** Terraces immediately above rivers or creeks

**Common association with other GVI site types:** LtcS

**Differentiation from the most similar site type(s):** LtcS has a combined canopy cover of  $>10\%$ ; LtcH is  $<10\%$ .

**Correlation with Soil Landscape Models:** Applies to all stream channels and floodplains. Will require careful interpretation. Valley systems on AGRASID are identified as undifferentiated Soil Landscape Models. The AGRASID 3.0 correlation includes FP1, FP2, FP3, SC1-l, SC1-h, SC2, SC3 and SC4 landscape models from AGRASID 3.0. True riparian areas only include the valley floor (from bottom of bank to bottom of bank on the other side of the valley).

**Native vegetation:** Mainly grasses, forbs, reeds, rushes, and/or sedges, and can have up to 10% shrub canopy cover.

**Expression on colour infrared photography:** More uniform reddish or pinkish tones than with LtcS and LtcD. Lotic Shrub and Lotic Deciduous polygons have texture that indicate some height

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Site-specific spring habitats west of Thumb Hill. Eg., western and lower portions of AS5307F-38 in LSD11-4-28-17-W4.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Springs (LtcH) and TB in LSD 2-9-28-17-W4 west of Thumb Hill.

- **Significant** (one to three sites types, each covering 10 to 30%): Channel between Sections 28 and 21, in 28-17-W4, with 70% LtcS, 15% LtcH, and 15% TB.

**Example(s) of non-typical occurrences:** Sounding Creek incises softrock sediments between Oyen and New Brigden in the approximate area of Twp 30- Rge 3. Vegetation is scarce in some portions of this valley. In the active floodplain, the channel and sides are described as LtcH.

### ***Lentic Undifferentiated*** –*Note: This is Not a Site Type*

**Definition:** Typically low-lying or depressional positions subject to occupation by water ranging from temporary to permanent in duration. Also known as the lentic zone. AGRASID and soil surveys have a correlation to Lentic Undifferentiated. **The GVI interpreters are required to identify the appropriate Lentic site type.**

**Correlation with Soil Landscape Models:** Applies to all non-saline or weakly-saline soils of the Gleysolic and Organic orders. Gleysolic soils occur in seasonal to semi-permanent wetlands. They are typified by dull colours or prominent mottles within 50 cm, due to prolonged periods of intermittent or continuous saturation and the lack of oxygen in the soil. Organic soils are dominated by the accumulation of decomposing peat material derived mainly from sedges and reeds.

### **Lentic Temporary (LenT)**

**Definition:** Still-water wetland which only holds water for brief periods, usually in the spring. Characterized by low prairie and/or wet meadow vegetation.

**Representative example:** Shallow depressions in upland plain areas, such as between Drumheller and Munson (Twp 29 and 30, R20 W4).

**Usual landscape position:** Depressional.

**Common association with other GVI site types:** Other Lentic or other Native/Natural Site Types; edges may be Sb.

**Differentiation from the most similar site type(s):** LenS holds water seasonally rather than for a few days to weeks.

**Native vegetation:** Low prairie or wet meadow vegetation zones as described by Stewart and Kantrud (1971).

**Expression on colour infrared photography:** Usually a dull colour such as olive to slightly pink, and a contrasting tone compared to the neighbouring or surrounding upland.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): SE of Little Fish Lake in LSD 2, 4-28-16-W4.

- **Co-Dominant** (two or three site types each cover between 30 and 60%): LSD 6, 3-28-17-W4 on AS5307F-38, in association with LenS.
- **Significant** (one to three sites types, each covering 10 to 30%): LSD 2, 9-28-16-W4 on AS5307F-41, representing the willow ring portion of depressions with shallow marsh vegetation (LenS).

**Example(s) of non-typical occurrences:** Relict shoreline habitats of Little Fish Lake.

### **Lentic Seasonal (LenS)**

**Definition:** Still-water wetland that usually holds water for several weeks, usually in the spring. Characterized by shallow marsh vegetation in the deepest part, and wet meadow and low prairie vegetation at the edges.

**Representative example:** Many of the wetland in the Rumsey Block located midway between Drumheller and Stettler.

**Usual landscape position:** Depressional

**Common association with other GVI site types:** Other Lentic.

**Differentiation from the most similar site type(s):** LenT only holds water for a few days to a few weeks; LenSP holds water for most to all of most years.

**Correlation with Soil Landscape Models:** Applies to non-saline or weakly saline Gleysolic Order soils in depressions with shallow marsh vegetation. Usually applies to Gleysol soil series and ZGW soils. Usually L1 or L2 landscape models, but may occasionally be W1 or W2.

**Native vegetation:** Characterized by shallow marsh vegetation in the deepest part, and wet meadow and low prairie vegetation at the edges.

**Expression on colour infrared photography:** Pink tones.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Most of the small wetlands east of Little Fish Lake on the east side of image AS5307F-41.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): None observed.
- **Significant** (one to three sites types, each covering 10 to 30%): AS5307F-41 to the southeast of Little Fish Lake, in occasional wetlands dominated by LenA.

**Example(s) of non-typical occurrences:** Relict shoreline habitats of Little Fish Lake.

### **Lentic Semi to Permanent (LenSP)**

**Definition:** Still-water wetland that usually holds water for a few to several months, usually to late summer, and is usually wet in the majority of years. Diagnostic vegetation is deep and shallow marsh.

**Representative example:** Some of the wetlands between Morrin and Rumsey (north of Drumheller) in Twps 31 to 33, Rge 20-W4.

**Usual landscape position:** Depressions.

**Common association with other GVI site types:** LenW where the water is deeper and permanent, and LenS where the water is shallower.

**Differentiation from the most similar site type(s):** LenW where the water is deeper and permanent; LenS where the water is shallower and typically occurs for only a few months of the year.

**Correlation with Soil Landscape Models:** Applies to non-saline or weakly saline Gleysolic Order soils in depressions with deep marsh vegetation. Usually applies to Gleysol soil series, ZGW soils, or occasionally ZWA soils. Usually W1, W2 or W3 landscape models.

**Native vegetation:** Deep marsh vegetation (reeds, cattails) with shallow marsh edges. May have open water in deeper areas.

**Expression on colour infrared photography:** Usually bright red or reddish pink tones.

#### **Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Closest habitat encircling Little Fish Lake on AS5307F-41.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): None observed.
- **Significant** (one to three sites types, each covering 10 to 30%): SE 17-28-17-W4 on AS5307F-37. LenW is a solitary polygon. Surrounding the LenW is another polygon dominated by LenA, with significant LenSP, LenS and Ov.

**Example(s) of non-typical occurrences:** Artificial water bodies surrounded or partially surrounded by deep marsh habitat characteristic of LenSP.

## **Lentic Alkaline (LenA)**

**Definition:** Still water wetland that holds water for variable time periods ranging from a few weeks to several months and has a salt (saline) fringe. Vegetation types are variable to none.

**Representative example:** Dowling Lake in Twp. 32, Rge. 14-15 northwest of Hanna.

**Usual landscape position:** Depressions.

**Common association with other GVI site types:** LenSP, LenS, and SL.

**Differentiation from the most similar site type(s):** Saline Lowland does not have a defined basinal edge and is characterized by imperfectly drained soils (usually Saline Regosols). LenA is in a definite basin and is usually represented by poorly drained Saline Gleysolic soils.

**Correlation with Soil Landscape Models:** Applies to saline soils of the Gleysolic, Organic and Regosolic (if Gleyed) Orders.

**Native vegetation:** Dominated by bare ground, and salts if dry.

**Expression on colour infrared photography:** Usually white or grayish-white, but there can be darker tones if moist or with water <5 cm deep at the time of photography.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): LSD 2, 4-28-17-W4 on AS5307F-38.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Southeast of Little Fish Lake in LSD 7, 3-28-16-W4. LenA in centre, surrounded by LenSP (or LenS).
- **Significant** (one to three sites types, each covering 10 to 30%): None observed.

**Example(s) of non-typical occurrences:** Some large bodies such as Sullivan and Gough Lakes are LenA in the majority of years. However, if a wet cycle occurs at the time of imagery, these “lakes” would be best interpreted as LenW with surrounding site types based on the vegetation expression.



## **Lentic Open Water (LenW)**

**Definition:** Water bodies, either artificial or natural, that are typically characterized by standing water.

**Representative example:** Mudspring Lake north of Morrin, between Drumheller and Stettler.

**Usual landscape position:** Water bodies.

**Common association with and differentiation from other GVI site types:** LenSP where the water is shallower and not as permanent.

**Correlation with Soil Landscape Models:** Applies to ZWA soils and the W3 landscape model, but may occur less commonly with W1, W2, L2 and L3 landscape models.

**Native vegetation:** Dominated by open water, but may have some occurrences of deep marsh vegetation (reeds, cattails).

**Expression on colour infrared photography:** Usually blue or bluish-green tones.

### **Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Little Fish Lake, in centre of AS5307F-40.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): None observed.
- **Significant** (one to three sites types, each covering 10 to 30%): Wetland east of Little Fish Lake Provincial Park, in LSD10, 4-28-17-W4. The wetland is dominated by LenS, with a dugout (LenW) comprising 10 to 15% of the total polygon.

**Examples of non-typical occurrences:** Oxbow lakes or beaver ponds in river valleys are delineated as LenW.

## Ecological/Range Sites Defined Mainly by Textural Groupings

### Clayey (Cy)

**Definition:** Clayey-textured soils including silty clay, sandy clay, clay, and heavy clay. Generally >40% clay.

**Representative example:** Any remnant of native prairie >5 ha in the Drumheller clay basin.

**Usual landscape position:** Plains

**Common association with other GVI site types:** Lo, Li, BIO.

**Differentiation from the most similar site type(s):** Many clay-dominated areas are actually Li and typified by Rego or Calcareous Dark Brown Subgroups, due to the shallow depth of leaching in clay soils.

**Correlation with Soil Landscape Models:** Applies to all non-saline and non-gleyed Vertisolic soils; **OR** to fine or very fine Chernozemic soils (soils with A, B and C horizons), and **fine or very fine** non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) (E.g., clay and silty clay textural subgroups, >40% clay).

**Native vegetation:** Wheatgrasses.

**Expression on colour infrared photography:** Uniform green or can even be a dark green to purple colour.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): None.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): None.
- **Significant** (one to three sites types, each covering 10 to 30%): LSD 11, 3-28-17-W4 on AS5307F-38. Polygon is dominated by Ov (60%), with 20% BIO, 10% Li, and 10% Cy.

**Example(s) of non-typical occurrences:** Gilgai landscapes with a commonly hexagonal or polygonal pattern, uneven surface, and cracks at the edge of polygons due to swelling in moist conditions and shrinkage in dry cycles.

## Loamy (Lo)

**Definition:** Includes loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam.

**Representative example:** Lo is the main upland site type in the Rumsey Block north of Drumheller.

**Usual landscape position:** Plains.

**Common association with other GVI site types:** Li, Sy, BLO, Ov, Cy.

**Differentiation from the most similar site type(s):** Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **medium and moderately fine** textural subgroups (E.g., loam and clay loam).

**Correlation with Soil Landscape Models:** Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **medium and moderately fine** textural subgroups (E.g., loam and clay loam)

**Native vegetation:** Graminoid.

**Expression on colour infrared photography:** Smooth dull green tone to light pinkish tone.

### Examples in pilot areas:

- **Dominant** ( $\geq 65\%$ ): Thumb Hill plateau of Hand Hills, on AS5307F-39, with 70 to 80% Lo.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): AS5307F-38 in LSDs 3 and 6, 9-28-17-W4. Co-dominant Lo (40%) and BLO (35%), with significant TB (15%) and LtCH (10%).
- **Significant** (one to three sites types, each covering 10 to 30%): West of 21-28-17-W4 on AS5307F (Line 2). Significant Lo (25%) in polygon dominated by BLO.

**Example(s) of non-typical occurrences:** Stony till or locations where gravels are slightly less than 20% by volume. If >20%, then classed as SwG.

## Sandy (Sy)

**Definition:** Sandy-loam-textured soils.

**Representative example:** East side of the Bullpound Creek valley between 5 and 10 km south of Hanna.

**Usual landscape position:** Plains.

**Common association with other GVI site types:** Lo, Sa.

**Differentiation from the most similar site type(s):** Sa are more drought prone; Lo is more drought tolerant.

**Correlation with Soil Landscape Models:** Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with textures in the **moderately coarse** (sandy loam) textural subgroup.

**Native vegetation:** Graminoid, with frequent wild rose.

**Expression on colour infrared photography:** Generally smooth green tone.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): None observed.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Co-dominant with Lo (50%) and Sy (40%) (based on ELC mapping) and 10% BIO, in NE 22 and NW 23, 28-17-W4 in the Hand hills,.
- **Significant** (one to three sites types, each covering 10 to 30%): LSDs 9, 10, 11 and 12, 24-28-17-W4 in the Hand Hills, with dominant Lo and significant Sa and BIO (based on ELC mapping).

**Example(s) of non-typical occurrences:** Areas west of Kirkpatrick Lake in Twp 34-Rge 11-W4, with a mix of Sandy, Sandy over Gravels (SwG) and Sandy over Solonetzic Order soils (BIO).

## Sands (Sa)

**Definition:** Loamy sand and sand soils, and not with a duned surface.

**Representative example:** Areas north and south of Kirkpatrick Lake, on undulating landscapes in Twps. 34-10 and 33-10-W4.

**Usual landscape position:** Plains.

**Common association with other GVI site types:** Sy, CS, Sb.

**Differentiation from the most similar site type(s):**

- CS has open dunes, bare soil, and more shrubs, with shrubs particularly on north or east-facing slopes.
- Sy is more drought tolerant than Sa.

- Sb has a shallow water table, located in swales, with a high proportion of shrubs.

**Correlation with Soil Landscape Models:** Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **very coarse** (loamy sand) textural subgroup. Sa does not apply to duned landscapes.

**Native vegetation:** Graminoids and small shrubs.

**Expression on colour infrared photography:** generally smooth green and pink (due to some shrubs), grading to brown (more shrubs).

**Examples in pilot areas:** None.

**Example(s) of non-typical occurrences:** Areas with a mix of Chernozemic and Solonetzic soils on Loamy sand parent materials, but with a thick mantle of topsoil and subsoil (> 50 cm) overlying a Solonetzic Bnt. In these cases, allow for more Sa site type due to the relatively great depth of the Bnt horizon.

### Choppy Sandhills (CS)

**Definition:** Loamy sand and sand soils with a rough surface caused by wind, resulting in a duned landscape.

**Representative example:** NE corner of Twp. 33-4-W4, southeast of Consort.

**Usual landscape position:** sand plains with low to high relief dunes, of which some are active.

**Common association with other GVI site types:** Sa, Sb.

**Differentiation from the most similar site type(s):**

- Sa does not include active dunes.
- Sb has a shallow water table.

**Correlation with Soil Landscape Models:** Applies to all non-saline and non-gleyed Chernozemic soils (soils with A, B and C horizons), and non-saline and non-gleyed Regosolic soils (soils that lack a B horizon >5 cm, and may lack an A horizon) with soil textures in the **very coarse** (loamy sand) textural subgroup. CS applies to soils that occur on duned landscapes, including D11, D1m, D1h, D21, D2m and D2h in AGRASID 3.0. Applies to **other Sands range sites on duned landscapes**.

**Native vegetation:** Graminoid with shrubs including Rose and Chokecherry.

**Expression on colour infrared photography:** Assumed to be similar to neighbouring Natural Subregions, which is: Blotchy irregular pattern with pinkish-brown to pink colouration. Dunes may appear as blemishes and may be oriented in the direction of the prevailing wind (longitudinal) or U-shaped (parabolic).

**Examples in pilot areas:** None.

**Example(s) of non-typical occurrences:** Low-relief dunes (2 to 9% slopes) oriented NW to SE and located about 13 to 18 km NW of Hemaruka.

### **Gravel (Gr)**

**Definition:** Dominated by gravels or cobbles (>50% coarse fragments). May be covered by a mantle with few gravels, up to 20 cm thick.

**Representative example:** Scattered locations in : 1) Kneehills Creek valley west of Carbon to the former siding of Grainger; 2) Red Deer River Valley on higher elevation terraces, mainly NW of Drumheller.

**Usual landscape position:** Often on terraces and in valley bottoms.

**Common association with other GVI site types:** SwG, Sy, Lo.

**Differentiation from the most similar site type(s):**

- SwG: gravels not at surface but between 20 and 100 cm in depth.
- Sy: 0 to 20% gravels by volume, and textures are moderately coarse (sandy loam).
- Lo: 0 to 20% gravels by volume, and textures are medium (loam, silt loam).

**Correlation with Soil Landscape Models:** Applies to any soil with less than 20 cm of a surface mantle of any textural class over **very gravelly or very cobbly** (>50% gravel or cobbles) material.

**Native vegetation:** Graminoids and shrubs, with some bare soil.

**Expression on colour infrared photography:** Light green and light grayish to white tones. The lightest tones correlate to the locations with gravel at the surface.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Possibly SW of Little Fish Lake, in LSD 13, 32-27-16-W4.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): This situation may be more likely at LSD 13-32-27-16-W4 in association with SwG.
- **Significant** (one to three sites types, each covering 10 to 30%): May be significant gravels (Gr) associated with the eskers and crevasse fillings near little Fish Creek (Sections 15 and 16, 28-16-W4 on AS5307F-41).

**Examples of non-typical occurrences:** Eskers and crevasse filling near Little Fish Creek (Sections 15 and 16, 28-16-W4 on AS5307F-41).

## Shallow to Gravel (SwG)

**Definition:** Soil with 20 to 50 cm of a sandy or loamy surface overlying a gravel or cobble- rich substrate.

**Representative example:** Western portions of the high land of the Hand Hills.

**Usual landscape position:** Often on terraces and in valley bottoms, but includes the Hand Hills in the Northern Fescue Natural Subregion.

**Common association with other GVI site types:** Sy, Lo, Gr.

**Differentiation from the most similar site type(s):**

- Gr has gravels at the surface
- Lo does not have gravels between 20 and 100 cm from the surface.

**Correlation with Soil Landscape Models:** Applies to any soil with 20 to 50 cm of a surface mantle of any textural class overlying **gravelly or very gravelly or cobbly to very cobbly** (>20% gravel or cobbles) material.

**Native vegetation:** Graminoid with shrubs.

**Expression on colour infrared photography:** Generally a smooth green tone.

**Examples in pilot areas:**

- **Dominant** ( $\geq 65\%$ ): Surrounding the present-day gravel pit on Thumb Hill, in LSD 12, 2-28-17-W4 on AS5307F-39.
- **Co-Dominant** (two or three site types each cover between 30 and 60%): Possibly co-dominant with Gr at LSD 13, 32-27-16-W4, on AS5307F-40.
- **Significant** (one to three sites types, each covering 10 to 30%): Possibly only significant SwG in areas of the Hand Hills to the east from the escarpment (Eg., LSD 13, 31a-28-16-W4).

**Example(s) of non-typical occurrences:** Hand Hills gravels are non-typical, as they occur on a former peneplain surface that is much higher than the surrounding plains today.

## **Examples of Other GVI Site Types in the Northern Fescue Natural Subregion**

### **Crop Irrigated (CI)**

**Representative Example:** Uncommon to rare in the Northern Fescue, but some occurrences in: 1) Rockyford to Redland area (Twp 27-22 and 26-23-W4); 2) Severn Creek area south of Rosebud (Twp 26 Rg 22); 3) Sounding Creek near Esther (Twp 31-2 and 32-2-W4).

**Example(s) of non-typical occurrences:** None.

### **Crop Non-Irrigated (CN)**

**Representative Example:** Continuous crop production dominated by no-till and reduced tillage systems in the Drumheller area.

**Example(s) of non-typical occurrences:** Scattered crop production, some with recently abandoned cultivation. This non-typical occurrence is more common in eastern and southern areas of the Northern Fescue, particularly areas bordering the Dry Mixedgrass Natural Subregion, due to the greater frequency of droughts.

### **Tame Pasture or Hay - Irrigated (PI)**

**Representative Example:** Mainly in the Sounding Creek area near Esther (Twp 31-2 and 32-2-W4).

**Example(s) of non-typical occurrences:** None.

### **Tame Pasture or Hay - Non-Irrigated (PN)**

**Representative Example:** Pastures of crested wheatgrass and other introduced species, which are more common in the Special Areas.

**Example(s) of non-typical occurrences:** Introduced pastures that have reverted to native pastures over time. GVI interpreters will be viewing and assessing the relative percentage of native species. (PN applies if <50% native species and non-irrigated).



### **Pits Site Type and Examples of Modifiers**

- Pit Coal:** Eg., Sheerness Mine in western areas.
- Pit Sand:** Eg., Kneehills Creek west of Highway #21.
- Pit Gravel:** Hand Hills.
- Pit Clay:** May occur on plains in the Drumheller area.
- Pit Quarries:** Not expected in the Northern Fescue Natural Subregion.

### **Developed Site Type and Examples of Modifiers**

- Developed Confined Feeding Operations:** Eg., Feedlot east of Three Hills on the east side of Ghost Pine Creek.
- Developed Transportation:** No examples larger than the minimum scale.
- Developed Agricultural Research or Processing:** Drumheller Seed Cleaning Plant.
- Developed Industrial Processing:** No examples.
- Developed Lagoons:** Eg., Sewage treatment lagoons east of Carbon.
- Developed Oil or Gas Facilities:** Sharples gas plant in the Kneehills Creek valley.
- Developed Mining Facilities:** Sheerness Plant.

### **Urban Site Type**

**Representative Examples:** Drumheller, Hanna, Caster, Coronation, Drumheller Penitentiary.

### **Rural Site Type**

**Representative Examples:** Farmsteads and small hamlets. Eg., Endiang, Throne. Other examples include the Drumheller Exhibition, Handhills Lake Rodeo grounds, and the Michichi campground.

### **Literature Resources Applicable to this Guide**

- Adams, B.W., L. Poulin-Klein, D. Moisey and R.L. McNeil. In Preparation. Rangeland Plant Communities and Range Health Assessment Guidelines for the Northern Fescue Natural Subregion of Alberta. Rangeland Management Branch, Public Lands Division, Alberta Sustainable Resource Development, Lethbridge.
- Alberta Sustainable Resource Development (ASRD). 2004b. Draft Natural Subregions map and legend. Edmonton, Alberta.
- ASIC (Alberta Soil Information Centre) 2001. AGRASID 3.0: Agricultural region of Alberta Soil Inventory Database (Version 3.0). Edited by J.A. Brierley, T.C. Martin and D.J. Spiess. Agriculture and Agri-Food Canada, Research Branch; Alberta Agriculture, Food and Rural Development, Conservation and Development Branch. Available: <http://www.agric.gov.ab.ca/asic>
- Fehr, 1982. The candidate Rumsey Ecological Reserve: a biophysical inventory. Forestry, Lands and Wildlife. Edmonton, Alberta.
- GVI Committee and R.L. McNeil. Grassland Vegetation Inventory (GVI) Final Specifications Report. Alberta Sustainable Resource Development and LandWise Inc. Lethbridge, Alberta. 53 pages. Hand Hills, No Year, No Author.
- Hand Hills Ecological Reserve, Ecological Land Classification. Scale 1:10,000. Map and legend.
- Karpuk, E. 1995. Geomorphic unit physical land classification map of the Rumsey Ecological Reserve. Scale 1:20,000. Alberta Environment. Edmonton, Alberta.
- Kjearsgaard, A., J. Tajek, W.W. Pettapiece, and R.L. McNeil. 1986. Soil survey of the County of Warner, Alberta. Report #46, Alberta Soil Survey. Research Branch, Agriculture Canada. Ottawa, Ont. 108 pp. + maps.
- LandWise Inc. 2004. Soils tour of the Northern Fescue – Central Parkland. Prepared for Public Lands, Alberta Sustainable Resource Development. LandWise Inc., Lethbridge, Alberta. 64 pages.
- Soil Classification Working Group (SCWG). 1998. The Canadian system of soil classification. 3<sup>rd</sup> Edition. Research Branch, Agriculture and Agri-Food Canada. NRC Research Press, Ottawa. 187 pp.
- Stewart, R.E. and H. A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource Publication 92. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C.
- Stewart, R.E. and H. A. Kantrud. 1972. Vegetation of prairie potholes, North Dakota, in relation to quality of water and other environmental factors. Hydrology of prairie potholes in North Dakota. Geological Survey Professional Paper 585-D. Prepared by U.S. Bureau of Sport Fisheries and Wildlife, in collaboration with the U.S. Geological Survey. Washington, D.C. Posted April 15, 2004. Accessed April 25, 2005. <http://www.lib.ndsu.nodak.edu/govdocs/text/potholes/585d.html>

Grassland Vegetation Inventory Site Type Interpretation Guide in the Northern Fescue Natural Subregion. February 2007, LandWise Inc

Thompson, W.H., and P.L. Hansen. 2002. Classification and management of riparian and wetlands sites in Alberta's Grassland Natural Region and adjacent subregions. Bitterroot Restoration Inc. Prepared for the Alberta Riparian Habitat Management Program – Cows and Fish. Cows and Fish Report No. 018. 416 pp.

Wells, R.E., and W.L. Nikiforuk. 1988. Soil survey of the County of Paintearth, Alberta. Alberta Soil Survey Report No. 49. Terrain Sciences Dept., Alberta Research Council, Edmonton, Alberta. 54 pp. + maps.