

The Human Footprint Inventory (HFI) 2010

Version 2.0

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1 Overview

1.1 Summary

This dataset represents the Human Footprint Inventory 2010 Version 2.0 (HFI2010 (v2.0)). The HFI2010 (v2.0) maps human footprint features across Alberta, Canada. The dataset is intended to aid human footprint and land use inquiries.

1.2 Description

The Alberta Biodiversity Monitoring Institute (ABMI) uses existing available datasets (Alberta Base Features, Inventories, Road/Railway Networks, etc.) as the starting point for this product. These datasets are then further updated using imagery from the Satellite pour l'Observation de la Terre 6 (SPOT6) and other available information sources to interpret anthropogenic disturbances on the land surface. Thematic mapping or image interpretation requires professional judgment, skill, knowledge and expertise to create the human footprint dataset in a very complex land use environment. It is expected that the final dataset has an element of thematic accuracy. The list of expected thematic accuracies depending on data source is available in the Appendix of this document.

Representative human footprint polygons were delineated for 111 feature types, which were organized into 20 final sublayers.

Note that the HFI2010 (v2.0) dataset does not contain any linear feature sublayers representing HFI feature centrelines. These features in the HFI2020 dataset are largely undated (i.e., lacking a 'year of origin'), meaning that accurately extracting linear feature centrelines for 2010 conditions is not possible at this time. It should also be acknowledged that the previous, original HFI2010 (v2.0) dataset did not contain centreline features as these were a later addition to HFI datasets. Nevertheless, the ABMI continues to make efforts to date all features within its HFI datasets so that future products may be as complete as possible, and this multi-year process is ongoing.



1.3 Methods

The current version (version 2.0) of the HFI2010 dataset was compiled in order to provide a version in which a pipeline sublayer is included. The previous version of the dataset did not contain this layer because of proprietary data concerns. However, new pipeline data has since become available through the Alberta Human Footprint Monitoring Program (AHFMP).

The compilation of the current HFI2010 (v2.0) dataset comprised the combination of:

- 1) sublayers from the most recent HFI2020 dataset where all features in the HFI2020 sublayer have 'year of origin' information (i.e., a [YEAR] attribute). For these, all features with a [YEAR] attribute equal to or less than 2010 were extracted from the 2020 sublayer.
- 2) sublayers from the previous, original HFI2010 (version 1.0) dataset where HFI2020 sublayers are not fully attributed with [YEAR] (see Table 1); these include roads, verges, transmission lines, residentials, cultivation, and seismic lines.

The exception to this was the pipelines sublayer - the HFI2020 pipeline sublayer is not fully attributed with [YEAR] information, but is the only source for public pipeline information available. For this sublayer, all features with a [YEAR] attribute equal to or less than 2010 were extracted from the 2020 sublayer. It is important to acknowledge that as a consequence, the new 2010 pipeline sublayer will contain a higher level of inaccuracy and uncertainty because features that appeared on the landscape in 2010 or earlier but that do not yet have a [YEAR] attribute, will be missing from this dataset.

Table 1. HFI data sources used for compiling the various sublayers that comprise the current HFI2010 (v2.0) dataset.

Sublayer	Extraction Source
Reservoirs	HFI 2020
Borrow Pits, Sumps, Dugouts and Lagoons (BSDL)	HFI 2020



Roads	HFI 2010 (30.6% of HFI2020 roads have a [YEAR] attribute)
Railways	HFI 2020
Canals	HFI 2020
Verges	HFI 2010 (26.2% of HFI2020 verges have a [YEAR] attribute)
Mines	HFI 2020
Industrials	HFI 2020
Well Sites - Active	HFI 2020
Landfills	HFI 2020
Other Vegetated Surfaces	HFI 2020
Wind Generation Facilities	HFI 2020
Transmission Lines	HFI 2010 (97.3% of HFI2020 transmission lines have a [YEAR] attribute)
CFO and High Density Livestock	HFI 2020
Residential	HFI 2010 (12.0% of HFI2020 residential have a [YEAR] attribute)
Well Sites - Abandoned	HFI 2020
Cultivation	HFI 2010
Harvest Areas	HFI 2020
Pipelines	HFI 2020 (72.6% of HFI pipelines have a [YEAR] attribute)
Seismic Lines and Trails	HFI 2010 (45.7% of HFI2020 residential have a [YEAR] attribute)

Further details regarding the procedures and datasets used to compile the previous, original HFI2010 (version 1.0) dataset can be found here:



Human Footprint Inventory 2010, Version 1.0. Edmonton, AB: Alberta Biodiversity Monitoring Institute. March 2017

Further details regarding the procedures and datasets used to compile the HFI2020 dataset can be found here:

Alberta Biodiversity Monitoring Institute and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for Alberta 2020 (version 1.0). Geodatabase. Last modified June 30, 2023.

IMPORTANT: this version of the ABMI HFI2010 (v2.0) does not account for succession (or reclamation) of human footprint, but treats all types of human footprint on the landscape equally. Put another way, “successional” HF (HF in which natural vegetation regenerates after human disturbance has ceased) is treated the same as “alienating” HF (HF types which are maintained permanently with altered vegetation) despite the vegetation recovery that almost certainly will have occurred since the development. The current dataset does not present age of disturbance or the current habitat/vegetation cover within features such as harvested areas (former cut blocks) or seismic lines.

This product is not error free. We continuously work to improve the accuracy and precision of this product.

This GIS polygon layer is updated annually, and new versions will be released accordingly.

The ABMI Human Footprint Inventory is stored in ESRI File Geodatabase (ArcGIS 10.7.1) format.

1.4 Credits

In addition to the human footprint features, data originating from open sources and created by the ABMI, this dataset includes human footprint data collected and created by



the Alberta Human Footprint Monitoring Program and the Alberta Biodiversity Monitoring Institute, and support from members of the Oil Sands Monitoring program.

1.5 Acknowledgments

In 2014 the Alberta Biodiversity Monitoring Institute (ABMI) initiated work to create a group of organizations to collaborate in the development of human footprint information in a program called the Alberta Human Footprint Monitoring Program (AHFMP), a collaboration initiative between the Government of Alberta, the Alberta Biodiversity Monitoring Institute (ABMI), and non-governmental organizations. The intent was to bring the expertise and resources of various government and non-government organizations to create a common database of human footprint data. The AHFMP governance and organization structure are designed to promote relevancy, accessibility, and transparency of human footprint information. The AHFMP organization structure includes two Committees (Operations and Technical). The Technical Committee is directly involved in the assembling of the enhanced sub-layers (i.e., Roads, Railways, and Well Sites) and includes members from the GoA and the ABMI. Few of the sublayers used in the public version of the Human Footprint Inventory, e.g., the enhanced sub-layers for Roads, Railways, Well Sites, and Pipelines sub-layers were obtained from the Government of Alberta through the AHFMP.

1.6 Human Footprint Definition

The ABMI defines Human Footprint (HF) as:

the temporary or permanent transformation of native ecosystems to support residential, recreational or industrial land uses.

- Under this definition, HF includes the geographic extent of areas under human use that either have lost their natural cover for extended periods of time (**alienating HF**; e.g., cities, roads, agricultural land, and surface mines) or whose natural cover is periodically reset to earlier successional conditions by industrial activities (**successional HF**; e.g., forest harvest areas and seismic lines).



IMPORTANT: This dataset does not account for succession or reclamation of human footprint. It is a cumulative record of human disturbances resulting from direct, mechanical activity. The disturbances are in various states of recovery (natural and human-influenced) and the interpretation of whether a disturbance is still considered a footprint is left to the discretion of the user and their specific requirements.

- Successional HF is treated the same as alienating HF despite the vegetation recovery that almost certainly will have occurred since the development. Any GIS analysis or subsequent interpretation that does not account for succession or reclamation of alienating/successional HF should be done with caution.

Physical Footprint

Definition adopted from AHFMP (Source: AHFMP_Footprint Data Manual.docx):

For the purposes of the AHFMP, this includes any direct physical modifications, temporary or permanent, that humans make to the surface of private, public, or specified (i.e., allocated through Legislation) lands. This includes the pressure (boundary), and state (attributes) of the modifications including what type of activity (well pad, road, etc.) caused the disturbance. The boundary represents the original extent of the disturbance even if the full extent is not visible.

In some situations, the extent of the disturbance was assumed based on operational requirements to construct the feature. For example, the full extent of a well pad in native grasslands is not always visible. The extent of the original disturbance is estimated with reference to disposition boundaries or buffering to allow for the potential disturbance resulting from the equipment used in the construction of the well pad.

1.7 Contact Information

If you have questions or concerns about the data, please contact:



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CW 405 Biological Sciences Centre
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1.8 Keywords

Alberta, anthropogenic, human footprint, reservoirs, borrow pits, sumps, dugouts, lagoons, roads, rails, canals, mines, industrial, oil and gas well pads, landfills, recreation, wind generation facilities, transmission lines, CFO, residential, cultivation, harvested areas, pipelines, seismic lines

1.9 Citation

Alberta Biodiversity Monitoring Institute and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for Alberta 2010 (Version 2.0). Geodatabase. Last modified June 30, 2023.

1.10 Use Limitations

1.10.1 *Proprietary Sourced Data*

This dataset contains data originating from proprietary sources, which has subsequently been enhanced through active visual interpretation and computer processing. The Proprietary Sourced Data shall not be used or reproduced in whole or in part or in any form. By accessing the Proprietary Sourced Data, you agree to indemnify and hold harmless the ABMI and the ABMI's subsidiaries, affiliates, related parties, officers, directors, employees, agents, independent contractors, advertisers, partners, and co-branders, from any and all actions, proceedings, claims, demands, liabilities, losses, damages, and expenses which may be brought against or suffered by the ABMI or which it may sustain, pay or incur, arising or resulting from your violation of this clause.



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IMPORTANT:



1. SEISMIC LINES currently available in the ABMI's HFI2010 (v2.0) are not the complete representation of the seismic lines existing on the land surface. Low impact seismic lines might be missing from this dataset due to low detectability on SPOT imagery and due to the number of features that go beyond current capabilities of heads up digitization on the provincial scale HF dataset. The ABMI's sampling scale HF dataset (Temporal Human Footprint) within boundaries should be used for a more detailed representation of this sub-layer within sampling sites (dimensions: 3 km by 7km; distributed in 20 km by 20 km spacing grid).
2. New CULTIVATION features created by heads-up digitization ([SOURCE] attribute is either 'ABMI15', 'ABMI16', 'ABMI17', 'ABMI18', 'ABMI19 or 'ABMI20') were attributed based on visual interpretation of SPOT6 satellite natural color composite mosaics. HFI dataset has not included a reattribution of existing HFI_2014 cultivation Feature Types to status of circa 2020.
3. HARVEST-AREAS might include areas that have been cleared for another purpose than timber harvesting (i.e., agricultural use, residential, mine or industrial areas expansion, or fire hazard reduction).
4. HARVEST-AREAS [YEAR] value is the best estimation of the year when the area was harvested. It has been determined by:
 - heads up digitization for years 2014 to 2020,
 - combination of source data values and remote sensing analysis for years 1985 to 2013,
 - and source data based for years prior to 1985.
5. PIPELINES dataset is an ESTIMATE of the high-pressure pipelines in the province and is not suitable for locating pipelines on the ground! The data will also contain some low-pressure pipelines. A pipeline corridor is defined by the AHFMP as any linear disturbance created for the purpose of constructing and maintaining pipelines. The pipeline verge estimates the extent of the direct physical disturbance of the pipeline corridor whether it is visible or not on available imagery.



1.1.1 Other Data Limitations

The HFI2020 dataset from which the current HFIO SM1980s dataset is derived does not contain a 'year of origin' (i.e., [YEAR] attribute) for all features within the dataset. Completing this attribution for all features is an ongoing, multi-year effort by the ABMI that is continuing at the time of this data publication. There are seven polygonal sublayers that do not have complete [YEAR] attributes: Roads, Verges, Transmission Lines, Residential, Cultivation, Pipelines, and Seismic Lines. The percent completion for features in these sublayers varies from 12.0% to 97.3% (see Table a).

The impact of incomplete dating in the HFI2020 dataset on the current HFI2010 (v2.0) product largely applies to the pipeline sublayer, as it is in this sublayer in which nearly 30% of HFI2020 pipeline features do not possess a [YEAR] attribute. The resulting HFI2010 (v2.0) pipeline sublayer is likely to be missing some pipelines that appeared on the landscape in 2010 or earlier, but which were not dated in the HFI2020 dataset and were therefore not carried over to this current HFI2010 (v2.0) dataset.

2 Data Product Specification

1.1 Spatial Resolution

Dataset's scale denominator: 30,000

1.2 Processing Environment

Microsoft Windows 10 ; Esri ArcGIS 10.7.1

1.3 Resource Maintenance

Resource Maintenance updates frequency: as needed

1.4 Spatial Reference

NAD_1983_10TM_AEP_Forest

WKID: 3400 Authority: EPSG



Projection: Transverse Mercator
False Easting: 500000.0
False Northing: 0.0
Central Meridian: -115.0
Scale Factor: 0.9992
Latitude of Origin: 0.0
Linear Unit: Meter (1.0)
Geographic Coordinate System: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semi-major Axis: 6378137.0
Semi-minor Axis: 6356752.314140356
Inverse Flattening: 298.257222101

1.5 Lineage

The ABMI's HFI2010 (v2.0) was built using open sourced, proprietary, historical, and remotely sensed data. Remotely sensed data were used for visual interpretation and heads-up digitization of human footprint features. Assessment analysis was conducted to identify new and missing features, which were then digitized and added to the dataset. This dataset comprises 20 unique Human Footprint categories, i.e., sublayers. This dataset is representative of the visual interpretation of anthropogenic disturbances on the Alberta landscape as seen from various satellite image sources dated to circa 2020 or earlier.

3 Human Footprint Inventory Integrated Dataset

The HFI2010 (v2.0) Feature Dataset, is a product of multiple sub-layers that have been merged into a single layer. Each sub-layer is listed in the chapter "Sublayers", including



a detailed description of the layer contents, the data source, and modifications made by the ABMI.

The order of precedence applied during creation of the final HFI dataset, i.e., merging process of the sub-layers is provided in Table 1.

Table 1. The order of precedence applied during creation of the final HFI dataset, i.e., merging process of the sub-layers.

Order of Precedence	Sub-layer
1	Reservoirs
2	Borrow Pits, Sumps, Dugouts and Lagoons
3	Roads
4	Railways
5	Canals
6	Verges
7	Mine Sites
8	Industrial Sites
9	Well Sites Active
10	Landfill
11	Other Vegetated Surfaces
12	Wind Generation Facilities
13	Transmission Lines
14	CFO and other High Density Livestock
15	Urban and Rural Residential
16	Well Sites Abandoned
17	Cultivation
18	Harvest Areas
19	Pipelines
20	Seismic Lines and Trails



4 Human Footprint Inventory 2010 Version 2.0 Dataset

The Table 1 Dataset contains additional information about:

- the origin of each human footprint:
 - year of the origin - [YEAR],

5 Sublayers

5.1 01 RESERVOIRS

Feature type: RESERVOIR

Definition:

An artificial lake or storage pond resulting from human-made dam.

A body of water created by excavation or the man-made damming of a river or stream.

Interpretation Elements and Rules:

SIZE:

Different sizes: ranging from the small ones created by damming small streams for a purpose of watering livestock to large water bodies of hydro dams.

SHAPE:

Dam structure (straight or hyperbolic wall) must be visible on reservoirs created on streams and rivers. Sides of the water body are given by topology of the terrain.

Storage pond reservoir shape is given by engineers to fulfill specific needs. There is no front wall but all sides of the storage pond are artificially created.



SHADOW: no shadow

COLOR: may depend on water depth, but usually in gradients of blue and brown

TEXTURE: fine

ASSOCIATED RELATIONSHIP or CONTEXT:

Dams must be in valleys of streams and rivers.

Storm water storage ponds are located nearby residential areas.

Irrigation storage ponds are located nearby agriculture along with irrigation structures – canals, pumps.

5.2 02 BORROW PITS, SUMPS, DUGOUTS and LAGOONS (BPSDL)

Feature type: LAGOON

Definition:

An artificial holding or treatment ponds for agricultural or municipal wastewater. Human made water and sewage lagoons used for municipal purposes.

Interpretation Elements and Rules:

SIZE:

Smaller to medium sized water bodies.

SHAPE:



Usually a rectangular- or square-shaped structure, occasionally might be triangular or other shape –following terrain topography and engineering design. Structural walls are usually elevated above surrounding terrain.

SHADOW: Shadow might be visible as lagoons are usually elevated above surrounding terrain.

COLOR: may depend on water depth, but usually in gradients of blue and brown

TEXTURE: fine

ASSOCIATED RELATIONSHIP or CONTEXT:

Lagoons are municipal structures built as part of water treatment facilities, so they are usually located nearby residential areas and within industrial zones.

Many times there are more than two lagoons built by each other creating a cluster of water bodies.

Feature type: SUMP

Definition:

An artificial holding or treatment pond for industrial wastewater.

Drilling waste storage system – holding of drilling waste on well sites or remotely.

Either earthen excavation (in clayey soils) or sumps lined with a synthetic liner.

Interpretation Elements and Rules:

SIZE:

Smaller to medium size water bodies.

**SHAPE:**

Usually a rectangular or square-shaped structure, occasionally might be triangular or other shape –following terrain topography and engineering design. Structural walls might be elevated above surrounding terrain for lined sump.

SHADOW: Shadow might be visible if sump walls are elevated above surrounding terrain.

COLOR: may depend on water depth, but usually in gradients of blue and brown

TEXTURE: fine

ASSOCIATED RELATIONSHIP or CONTEXT:

Sumps are industrial structures built as part of the water treatment process, so they are usually located nearby industrial sites and well pads.

There is usually a single drilling waste storage structure built for a single well pad/industrial site.

Feature types:

FEATURE_TY	Feature Description
BORROWPITS	Includes pits dug to build forestry and well-site roads. They are usually associated with a road or another structure.
BORROWPIT-DRY	Includes pits dug to build forestry and well-site roads. They are usually associated with a road or another structure. No presence of water.
BORROWPIT-WET	Includes pits dug to build forestry and well-site roads. They are usually associated with a road or another structure. Presence of water confirmed by visual interpretation.
RIS-BORROWPITS	Identifies any area disturbed for the purpose of extraction of aggregate materials including gravel pits in oil sand mines area only.

**Definition:**

Excavation outside of the road right-of-way, made solely for the purpose of removing or providing borrowed material for the construction of the sub-base for a specific roadway project. It includes any other associated infrastructure such as access roads. (*ALBERTA TRANSPORTATION; GUIDE TO RECLAIMING BORROW EXCAVATIONS – 2013 Edition*).

Interpretation Elements and Rules:**SIZE:**

Usually smaller excavations, quite often smaller than 1 ha.

SHAPE:

A rectangular or square-shaped structure, occasionally might be triangular or other shape –following terrain topography and engineering design.

SHADOW: no shadows

COLOR: Depends whether they are dry or filled with water. Brown/Grey/Blue

TEXTURE: fine / coarser

ASSOCIATED RELATIONSHIP or CONTEXT:

Always located along roadways.

Feature type: DUGOUT

Definition:



Small water storage excavations that collect water from runoff from summer rains, as a surplus of surface water that occurs during snowmelt in the spring, or from groundwater. (*Alberta Agriculture and Rural Development, QUALITY FARM DUGOUTS*).

Interpretation Elements and Rules:

SIZE:

Usually smaller excavations, quite often smaller than 1 ha.

SHAPE:

A rectangular-, square- or elliptical-shaped structure.

SHADOW: no shadows

COLOR: Depends whether they are dry or filled with water. Brown/Grey/Blue

TEXTURE: fine / coarser

ASSOCIATED RELATIONSHIP or CONTEXT:

Usually located along pastures, farms and agriculture areas.

5.3 03 ROADS

Non-vegetated impermeable surfaces.

Feature types:

FEATURE_TY	Feature Description
AIRP-RUNWAY	An active landing facility for aircraft, usually associated with paved and lighted runways, an operating control tower, and services for aircraft and passengers.



INTERCHANGE-RAMP	A series of roadways (ramps) constructed to permit access to and from intersecting paved roads. These ramps are usually at different levels, and form an overpass / underpass.
RIS-AIRP-RUNWAY	Identifies operator owned landing facility for airplanes and related transportation in oil sand mines area only.
RIS-ROAD	Identifies roads that are not specifically part of other disturbed features in oil sand mines area only.
ROAD-GRAVEL-1L	A roadway surfaced with gravel, constituting a main access route. The road surface is about 6 metres in width, and the road clearing is about 20 metres or greater in width. The surface, ditches, bridges and intersections are in good condition.
ROAD-GRAVEL-2L	A roadway surfaced with gravel constituting a main access route. The road surface is 7 metres or greater in width, and the road clearing is 30 metres or greater in width. The surface, ditches, bridges and intersections are in good condition.
ROAD-PAVED-1L	A roadway, paved with asphalt or concrete, consisting of one (1) lane.
ROAD-PAVED-2L	A major roadway, which is paved with asphalt or concrete, and consists of two (2) roadbeds separated by a median. Each road bed usually consists of two (2) or more lanes.
ROAD-PAVED-3L	A major roadway, which is paved with asphalt or concrete, and consists of 3 roadbeds separated by a median.
ROAD-PAVED-4L	A major roadway, which is paved with asphalt or concrete, and consists of 4 roadbeds separated by a median.
ROAD-PAVED-5L	A major roadway, which is paved with asphalt or concrete, and consists of 5 roadbeds separated by a median.
ROAD-PAVED-6L	A major roadway, which is paved with asphalt or concrete, and consists of 6 roadbeds separated by a median.
ROAD-PAVED-7L	A major roadway, which is paved with asphalt or concrete, and consists of 7 roadbeds separated by a median.
ROAD-PAVED-DIV	A major roadway, which is paved with asphalt or concrete, and consists of two (2) roadbeds separated by a median. Each road bed usually consists of two (2) or more lanes.
ROAD-PAVED-UNDIV-1L	A roadway, paved with asphalt or concrete, consisting of one (1) lane, and usually found servicing rural acreages that are close to large urban centres.



ROAD-PAVED-UNDIV-2L	A roadway, paved with asphalt or concrete, and consisting of two (2) adjacent lanes, with no median to separate them.
ROAD-PAVED-UNDIV-4L	A roadway, paved with asphalt or concrete, and consisting of four (4) adjacent lanes, with no median to separate them.
ROAD-UNCLASSIFIED	A temporary coding for an unknown class of road, which will be updated after a field check or verification. (Source: road_album_2.ppt)
ROAD-UNIMPROVED	A roadway surfaced with dirt constituting a minor access route. The road surface is up to 7 metres in width, and the road clearing is up to 20 metres in width. The surface and ditches are poorly maintained, and the bridges are narrow.
ROAD-UNPAVED-1L	A roadway surfaced with dirt constituting a minor access route.
ROAD-UNPAVED-2L	A roadway surfaced with dirt constituting a minor access route.
ROAD-WINTER-ACCESS	A clearing that is vehicular accessible in winter only..
TRAIL-ATV	A trail primarily used for ATV (all-terrain vehicle) activities.
TRUCK-TRAIL	A roadway surfaced with dirt or low vegetation and constituting a minor access route.

Details of AHFMP processing steps and user guide are included in these documents:

AHFMP - Road Processing 2014 Footprint.pdf

AHFMP - Road User Guide 2014 Footprint.pdf

5.4 04 RAILWAYS

Rail lines, hard surface

Feature types:

FEATURE_TY	Feature Description
------------	---------------------



RLWY-ABANDONED	An abandoned road or track for trains, consisting of parallel steel rails, supported on wooden crossbeams that is no longer in use.
RLWY-DBL-TRACK	A road or track for trains, consisting of parallel steel rails, supported on wooden crossbeams. The Double track consists of two parallel sets of tracks.
RLWY-MLT-TRACK	A road or track for trains, consisting of parallel steel rails, supported on wooden crossbeams. A multiple track railway consists of many parallel sets of tracks.
RLWY-SGL-TRACK	A road or track for trains, consisting of parallel steel rails, supported on wooden crossbeams. The single track consists of one parallel sets of tracks.
RLWY-SPUR	A short length of railway leading off a main line, to a dead end. Spur lines usually lead to a commercial/industrial site, or may be used as a turnaround along a rail line.

5.5 05 CANALS

Feature type: CANAL

Definition:

A human-made watercourse built to convey water for irrigation. An irrigation canal is larger than a ditch, with reinforced banks that are usually well maintained.

A human-made drainage network channels built to prepare wetland areas for anthropogenic land use.

Interpretation Elements and Rules:

SIZE:

A linear feature usually up to 40 meters in width with reinforced banks that are usually well maintained.



SHAPE: Linear.

SHADOW: no shadows

COLOR: Depends whether they are dry or filled with water. Brown/Grey/Blue

TEXTURE: fine / coarser

ASSOCIATED RELATIONSHIP or CONTEXT:

Located along irrigated cultivation fields.



5.6 06 VERGES

Vegetated surfaces of roads, trails, and railways.

Feature types:

FEATURE_TY	Feature Description
VEGETATED-EDGE-ROADS	Disturbed vegetation alongside road edges
VEGETATED-EDGE-RAILWAYS	Disturbed vegetation alongside railway edges.

Definition:

Disturbed vegetation alongside road edges and railway edges including ditches.

Details of AHFMP processing steps and User Guide are included in these documents:

AHFMP - Road Processing 2014 Footprint.pdf

AHFMP - Road User Guide 2014 Footprint.pdf

Interpretation Elements and Rules:

SIZE:

Linear feature - various widths.

SHAPE: Linear.

SHADOW: no shadows

COLOR: shades of green,

TEXTURE: fine / coarser



ASSOCIATED RELATIONSHIP or CONTEXT:

Usually located along roads and railways.

5.7 07 MINE SITES

Feature types:

FEATURE_TY	Feature Description
GRVL-SAND-PIT	An area of surface disturbance for the purpose of extracting sand and/or gravel consistently open and/or expanding over multiple years, usually close to lakes or rivers.
MINES-COAL	Heavy industry use with bare and/or vegetated ground and low human density for the purpose of coal mining.
MINES-OILSANDS	Heavy industry use with bare and/or vegetated ground and low human density for the purpose of oil sands mining.
MINES-PITLAKE	Areas of ground where surface water is collected into the existing mine pit usually after mining activity is finished.
OPEN-PIT-MINE	An area of surface disturbance for the purpose of mining (with the exception of sand and/or gravel), consistently open and/or expanding over multiple years, usually close to lakes or rivers.
PEAT	An area of surface disturbance for the purpose of mining peat, consistently open and/or expanding over multiple years, usually in bogs or fens.
RIS-DRAINAGE	Identifies surface disturbance for the purpose of managing surface water features.
RIS-MINES-OILSANDS	Identifies areas where overburden removal has commenced for the purposes of preparing an area for open pit mining and all mine pit features.
RIS-OILSANDS-RMS	Identifies reclamation material stockpiles (RMS). Each RMS may have several material types and corresponding volumes.
RIS-OVERBURDEN-DUMP	Includes all areas where overburden and interburden is placed out-of-pit or in-pit for disposal.
RIS-RECLAIM-READY	Identifies areas where landform construction has been completed and the site is ready for clean cap, subsoil and surface soil



	placement. This definition is consistent with that used for annual reporting which identifies land "no longer required for mine or plant purposes and available for reclamation but where reclamation activities have not yet commenced.
RIS-RECLAIMED-CERTIFIED	Identifies polygons of reclaimed areas which have received a reclamation certificate.
RIS-RECLAIMED-PERMANENT	Identifies polygons which meet the definition of permanent reclamation - land is considered permanently reclaimed when landform construction and contouring, clean material placement (as required), reclamation material placement and revegetation has taken place.
RIS-RECLAIMED-TEMP	Identifies polygons which meet the definition of temporary reclamation – areas being managed where vegetation has been seeded, planted, or ingressed, where there is an expectation that future disturbance may occur at that location. This does not include cleared areas (planned for future disturbance) that have naturally revegetated through ingress.
RIS-SOIL-REPLACED	Identifies areas which have had subsoil or topsoil placed and which have not been revegetated.
RIS-SOIL-SALVAGED	Identifies areas where soil salvage is occurring but where overburden removal has not commenced.
RIS-TAILING-POND	Identifies all areas associated with tailings including toe berms, dykes, beaches, ponds and drying areas.
RIS-WASTE	Identifies all areas associated with waste and by-product storage on-site.
RIS-WINDROW	Includes areas where a line of reclamation material (soil or vegetation) is heaped up by a machine.
TAILING-PILE	An area used to store waste materials produced in mining processes.
TAILING-POND	Body of water on/in close proximity to an oil sands mine composed of acids, benzene, hydrocarbons, residual bitumen, fine silts, and water.

Note: "RIS" features were imported from the Reclamation Information System (GoA), based on the cross-reference table (Table 2.)





Table 2. Reclamation Information System (GoA) cross-reference table

RIS		ABMI HFI 2014	
LANDCOVER	FEATURE_TY	FEATURE_TY	Sublayer
CLEARED	Cleared other industry	RIS-CLEARING-UNKNOWN	08 Industrial Sites 08 Industrials
	<null>	RIS-CLEARING-UNKNOWN	08 Industrials
	Oil sands cleared	RIS-CLEARING-UNKNOWN	08 Industrials
DISTURBED	Aerodrome	AIRP-RUNWAY-ACTIVE	03 Roads
	Borrow pit	RIS-BORROWPITS	02 Borrow Pits, Sumps, Dugouts, Lagoons
	Camp housing	RIS-CAMP-INDUSTRIAL	08 Industrials
	Disturbed other industry	RIS-FACILITY-UNKNOWN	08 Industrials
	Disturbed unclassified	RIS-FACILITY-UNKNOWN	08 Industrials
	Drainage	RIS-DRAINAGE	07 Mines
	<null>	RIS-FACILITY-UNKNOWN	08 Industrials
	Mine pit	RIS-MINES-OILSANDS	07 Mines
	Operations	RIS-FACILITY-OPERATIONS	08 Industrials
	Other	RIS-FACILITY-UNKNOWN	08 Industrials
	Overburden dump	RIS-OVERBURDEN-DUMP	07 Mines
	Pipeline	RIS-PIPELINE	19 Pipelines
	Plant site	RIS-PLANT	08 Industrials
	Powerline	RIS-TRANSMISSION-LINE	13 Transmission Lines
	Ready to reclaim	RIS-RECLAIM-READY	07 Mines
	Reclamation material stockpile (RMS)	RIS-OILSANDS-RMS	07 Mines
	River water intake structure	RIS-RESERVOIR	01 Reservoir
	Road	RIS-ROAD	03 Roads
	Soil placed	RIS-SOIL-REPLACED	07 Mines
	Soil salvaged	RIS-SOIL-SALVAGED	07 Mines
	Tailings	RIS-TAILING-POND	07 Mines
	Tank farm	RIS-TANK-FARM	08 Industrials
	Utilities	RIS-UTILITIES	08 Industrials
	Waste	RIS-WASTE	07 Mines
	Wellsite	RIS-WELL	09 Well Sites Active



	Windrow	RIS-WINDROW	07 Mines
RECLAIMED	Certified	RIS-RECLAIMED-CERTIFIED	07 Mines
	<null>	RIS-RECLAIMED-UNKNOWN	07 Mines
	Permanent	RIS-RECLAIMED-PERMANENT	07 Mines
	Temporary	RIS-RECLAIMED-TEMP	07 Mines
	Temporary (dam safety)	RIS-RECLAIMED-TEMP	07 Mines

5.8 08 INDUSTRIAL SITES

Feature types:

FEATURE_TY	Feature Description
CAMP-INDUSTRIAL	Buildings used for temporary residence by employees on or in close proximity to an industrial activity such as mining, forestry, or oil and gas activities.
CLEARING-UNKNOWN	A human-made clearing with unknown purposes and contains no visible buildings, fences or equipment.
CLEARING-WELLPAD-UNCONFIRMED	Roughly square in shape clearing, roughly 90-120 meters wide (approximately 1 ha). Not confirmed as a well pad by available reference sources.
FACILITY-OTHER	Industrial facility(ies) characterized by large non-residential buildings most often surrounded by concrete for parking purposes. The purpose of the facility(ies) is not disclosed.
FACILITY-UNKNOWN	Industrial facility(ies) characterized by large non-residential buildings most often surrounded by concrete for parking purposes. The purpose of the facility is unknown.
MILL	Intense industrial and commercial development for the purpose of pulp or paper production.



MISC-OIL-GAS-FACILITY	Industrial facility used for the purpose of oil and gas. BATTERY SITE, COMPRESSOR SITE, FLARE STACK, METER STATION SITE, VALVE SITE
OIL-GAS-PLANT	Industrial facility used for oil production. REFINERIES, PLANTS, FACTORIES
RIS-CAMP-INDUSTRIAL	Identifies areas disturbed for the purposes of housing camp workers.
RIS-CLEARING-UNKNOWN	Identifies all areas where vegetation has been removed for the purposes of preparing the land for drainage, soil removal, overburden removal, mining, etc. but where soil has been left mostly intact and relatively undisturbed. May include any or all of: tree removal, shrub removal, and/or grubbing (stump removal). Identifies areas cleared for by other industries and not for the purposes of forest harvesting or for oil sands development.
RIS-FACILITY-OPERATIONS	Designated for areas which are not part of the plant site, e.g., may include laydown areas not integrated with the main plant site(s), tailings lines, water lines, compressor station, buildings away from the main plant site, flare stack, communications tower.
RIS-FACILITY-UNKNOWN	Identifies areas where the reclamation liability associated for the disturbance is currently held by another industry operator.
RIS-PLANT	Includes areas associated with extraction, processing, upgrader. Plant sites may have multiple non-contiguous polygons.
RIS-TANK-FARM	Identifies areas where products of extraction or upgrading are stored. Products stored for on-site use can be identified under plant site or operations.
RIS-UTILITIES	Identifies areas specifically disturbed for the purposes of utilities (power generation).
URBAN-INDUSTRIAL	An industrial facility within the boundary of an urban residence.

Note: “RIS” features were imported from the Reclamation Information System (GoA) based on the cross-reference table (Table 2).

5.9 09 WELL SITES ACTIVE



Feature types:

FEATURE_TY	Feature Description
RIS-WELL	Identifies areas disturbed for the purpose of establishing exploration, production or disposal wells.
WELL-BITUMEN	Well site - ground cleared for a bitumen well pad.
WELL-CASED	Well site - ground cleared and well cased.
WELL-CLEARED-DRILLED	Well site - confirmation of drilling and the boundary outline is provided by reference sources.
WELL-CLEARED-NOT-CONFIRMED	Well site - confirmation of the boundary outline is not provided by reference sources.
WELL-CLEARED-NOT-DRILLED	Well site - confirmation of the boundary outline is provided by reference sources.
WELL-DRILLED-OTHER	Well site - confirmation of drilling is provided by reference sources.
WELL-GAS	Well site - ground cleared for a gas well pad.
WELL-OIL	Well site - ground cleared for an oil well pad.
WELL-OTHER	Well site - clearing, purpose is unknown.

Note: "RIS" features were imported from the Reclamation Information System (GoA) based on the cross-reference table (Table 2).

Details of AHFMP processing steps and User Guide are included in these documents:

AHFMP - Well Pad Procedures for 2014 Footprint.pdf

AHFMP - Well Pad User Guide 2014 Footprint.pdf

5.10 10 LANDFILL

Feature types:



FEATURE_TY	Feature Description
LANDFILL	Larger area of raised land, indicating buried garbage. Some landfills have evidence of surface revegetation and garbage dispersed throughout designated extent. They may also have large perimeter berms or fences.
TRANSFER_STATION	Smaller area of land, less than one hectare, usually fenced with a U-shaped road and two entry ways. Used primarily for garbage drop-off and located close to municipalities or present in rural areas.

Interpretation Elements and Rules:

SIZE:

Various sizes, often larger polygons of landfills than transfer stations.

SHAPE:

Often a rectangular- or square-shaped structure.

SHADOW: no shadows

COLOR: various colours

TEXTURE: fine / coarser

ASSOCIATED RELATIONSHIP or CONTEXT:

Usually located in proximity to residential areas.



5.11 11 OTHER VEGETATED SURFACES

Human footprint related to vegetated facilities and recreation.

Feature types:

FEATURE_TY	Feature Description
CAMPGROUND	Disturbed vegetation with frequently changing facilities of RVs and tents used for overnight stay. Most often consists of several individual clearings surrounded by vegetation and gravel or asphalt roads connecting clearings.
GOLFCOURSE	Large recreational area comprising a series of grass patches surrounded by trees.
GREENSPACE	Greenspace used for recreation within a residential area including parks, schools, school yards and sport fields.
RECREATION	Urban/rural greenspace and recreation that does not fit into other categories (e.g. graveyards, baseball diamonds, parks, shelterbelts, ski hills, clearings from old industrial activity that is now vegetated). This layer was also used to identify green-space features that do not fit into other categories such as storage areas and parking lots.
RUNWAY	Vegetated runway.
SURROUNDING-VEG	Disturbed vegetation surrounding airport runways, highway ramps and other industrial features.

Interpretation Elements and Rules:

SIZE:

Various sizes, often larger polygons of landfills than transfer stations.

SHAPE:

Often a rectangular- or square-shaped structure.

SHADOW: no shadows



COLOR: various colours

TEXTURE: fine / coarser

ASSOCIATED RELATIONSHIP or CONTEXT:

Usually located in proximity of residential areas.

5.12 12 WINDMILLS

Feature types: WINDMILLS

Interpretation Elements and Rules:

SIZE: Various sizes.

SHAPE: Often a rectangular- or square-shaped structure for land cover disturbance. Turbine structure visible for finished facilities.

SHADOW: tower and turbine shadows.

COLOR: steel colours.

TEXTURE: individual structure of turbine visible.

ASSOCIATED RELATIONSHIP or CONTEXT:

Usually clustered into “wind energy farms.”

5.13 13 TRANSMISSION LINES

Feature types:



FEATURE_TY	Feature Description
TRANSMISSION-LINE	A utility corridor >10 m wide with poles, towers and lines for transmitting high voltage electricity (voltage greater than 69 kV).
RIS-TRANSMISSION-LINE	Include the right of way area designated for the power line.

Interpretation Elements and Rules:

SHAPE: Linear shape – corridor in landscape. Tower structure visible.

WIDTH:

Buffered to 19 m - each side from the centerline (38 m in total width of the corridor) for AHFMP and BASEFE features.

Buffered to measured width for ABMI14, ABMI15, ABMI16, ABMI17 features.

SHADOW: tower shadows

COLOR: shades of green or brown/grey depending on vegetation cover of the corridor

TEXTURE: usually finer texture as a result even vegetation on the corridor

ASSOCIATED RELATIONSHIP or CONTEXT:

Corridor connects energy users with energy providers.

5.14 14 CFO

Confined feeding operations and other high density livestock features.



Feature type: CFO

Interpretation Elements and Rules:

SIZE: Various sizes.

SHAPE: Often regular shape.

SHADOW: shadows of building and facilities associated with CFO

COLOR: various colours

TEXTURE: usually coarser texture

ASSOCIATED RELATIONSHIP or CONTEXT:

Usually in proximity of farm fields, residential or industrial features.

5.15 15 URBAN and RURAL RESIDENTIAL

Feature type: COUNTRY-RESIDENCE

Definition:

Country-residential developments with density of 10 - 100 buildings per quarter section.

Interpretation Elements and Rules:

SIZE:

Minimum size of the polygon should be 0.4 Ha (1 Acre) in case one country-residential property creates an acreage polygon. More often – multiple country-residential



developments are captured into one polygon therefore maximum size of polygon is not limited.

SHAPE:

Multi-vertices polygons, where boundaries follow property lines, fences, clearings of country-residential development.

SHADOW: no shadow

COLOR: no unique color

TEXTURE: no unique texture

ASSOCIATED RELATIONSHIP or CONTEXT:

Country residential areas are often grouped together with a road system as a backbone of such residential development.

Feature type: RURAL-RESIDENCE

Definition:

Rural-residential developments with density of less than 10 buildings per quarter section.

Interpretation Elements and Rules:

SIZE:

Various sizes. Usually one polygon per rural residence.

SHAPE:

Multi-vertices polygons, where boundaries follow property lines, fences, clearings of rural-residential development.



SHADOW: no shadow

COLOR: no unique color

TEXTURE: no unique texture

ASSOCIATED RELATIONSHIP or CONTEXT:

Rural residences are often isolated by other human footprint types (cultivation) or native landscape (lodges). They are connected to the other areas by access road.

Feature type: URBAN-RESIDENCE

Definition:

Residential areas in cities, towns, villages, hamlets and ribbon developments. Areas that are dominated by dwellings.

Interpretation Elements and Rules:

SIZE:

Various sizes. Usually one polygon per many urban residences.

SHAPE:

Multi-vertices polygons, where boundaries follow property lines, fences, clearings of urban -residential development.

SHADOW: no shadow

COLOR: no unique color

TEXTURE: no unique texture



ASSOCIATED RELATIONSHIP or CONTEXT:

Urban residences are often surrounded by other human footprint types (recreational – GREENSPACE, industrial – URBAN-INDUSTRIAL).

Feature type: RESIDENCE_CLEARING

Definition:

Areas cleared for building developments that do not yet have any buildings.

Interpretation Elements and Rules:

SIZE:

Various sizes. Usually one polygon per one residence clearing.

SHAPE:

Multi-vertices polygons, where boundaries follow property lines, fences, clearings of residential development.

SHADOW: no shadow

COLOR: no unique color

TEXTURE: no unique texture

ASSOCIATED RELATIONSHIP or CONTEXT:

Residence clearings are often in the vicinity of existing urban residences.



5.16 16 WELL SITES ABANDONED

Feature type: WELL-ABAND

Definition: Ground cleared for an oil/gas well pad where the well is currently abandoned.

Details of AHFMP processing steps and User Guide are included in these documents:

AHFMP - Well Pad Procedures for 2014 Footprint.pdf

AHFMP - Well Pad User Guide 2014 Footprint.pdf

5.17 17 CULTIVATION

Feature type: CULTIVATION

Definition:

Cultivated cropland or cropland planted with annual crop species, including farmlands that are in cultivation rotation.

Cropland includes: small grains (wheat, barley, oats and mixed grains), oilseeds (canola, flax), specialty crops (peas, lentils), row crops (potatoes, sugar beets, corn, vegetables).

Fallow describes areas used for the production of the crops that do not exhibit visible vegetation as the result of being cultivated.

Lands where the soil has been disturbed and planted to perennial grass species used primarily for grazing livestock.



Tame pasture represents areas of grasses, legumes or grass-legume mixtures planted for livestock grazing or hay collection.

Lands where the forest and/or shrubs have been removed so that native or introduced grasses can flourish for the grazing of livestock.

This pastureland has not been irrigated, fertilized and the soil has not been disturbed to improve productivity.

Crop, tame pasture and rough pasture are all included within CULTIVATION feature type, as there is not enough detail in SPOT5 BW 2.5m imagery used to visually interpret differences between these types of agricultural land uses in the original HFI2010 (version 1.0), which is the source for this sublayer.

Interpretation Elements and Rules:

SIZE: Variable size from smaller fields usually next to a rural residential areas up to the very large polygons covering multiple townships.

SHAPE: Often a rectangular, square or multi-vertex shape with distinct round corners as a result of active cultivation by agricultural equipment and machinery.

Circular shape for irrigated crop fields.

SHADOW: no shadows

COLOR: Variable - depending on type of the cropland and imagery acquisition date.

TEXTURE: Consistent smooth, fine texture for cropland / coarser texture for fallow.



STRUCTURE: Often visible tillage lines as a result of active cultivation by agricultural equipment (field cultivator, disk and plow).

ASSOCIATED RELATIONSHIP or CONTEXT: No evidence of grazing as livestock are restricted from these fields during the growing season.

Feature type: CULTIVATION_ABANDONED

Definition:

Agricultural land that has been formally seeded and tilled, but no evidence of present day production use. Landscape appears to have a heterogeneous mix of vegetation and closely resembles natural cover.

Details of AHFMP processing steps and User Guide are included in these documents:

AHFMP_Cultivation_User_Guide_Footprint_HFI_2014FTv2.pdf

AHFMP_Cultivation_User_Guide_HFI_2014.pdf

5.18 18 FOREST HARVEST AREAS

Feature type: HARVEST-AREA

Definition:

Areas where forestry operations have occurred (clear-cut, selective harvest, salvage logging, etc.).

**IMPORTANT:**

- HARVEST-AREAS might include areas that have been cleared for another purpose then timber harvesting (i.e. agricultural use, residential, mine and industrial areas expansion.)
- HARVEST-AREAS [YEAR] value is the best estimation of the year when the area was harvested. It has been determined by:
 - heads up digitization for years 2014 to 2020,
 - combination of source data values and remote sensing analysis for years 1985 to 2013,
 - source data based for years prior to 1985.

Interpretation Elements and Rules:

SIZE: Variable.

SHAPE: Variable

SHADOW: no shadows

COLOR: Usually shades of green - depending on imagery acquisition date.

TEXTURE: Coarser texture for new clearings, smoother for old ones.

STRUCTURE: There might be remains of cleared wood/shrub lands on new clearings—wood piles, timber.

ASSOCIATED RELATIONSHIP or CONTEXT: Usually still surrounded by forest or wooded/shrubby remains.

Feature type: HARVEST-AREA-WHITE-ZONE

**Definition:**

Areas in Alberta's unforested White Zone where woody vegetation (i.e. shrub, trees, etc.) have been removed and the purpose of the clearing may not yet be determined.

5.19 19 PIPELINES

Feature type: PIPELINE

Definition:

A line of underground and overground pipes, of substantial length and capacity, used for the conveyance of petrochemicals.

The physical clearing that contains underground and above-ground high pressure pipelines.

These clearings may contain one or multiple pipelines.

Data Source: The Pipeline Verge feature class was created by the Geographic Science Team (GScT) of Alberta Environment and Protected Areas for the Alberta Human Footprint Monitoring Program (AHFMP). The data is used to monitor the total area of pipeline corridors in the province of Alberta. The data is an ESTIMATE of the high-pressure pipelines in the province and is not suitable for locating pipelines on the ground. The data will also contain some low-pressure pipelines. A pipeline corridor is defined by the AHFMP as any linear disturbance created for the purpose of constructing and maintaining pipelines. The pipeline verge estimates the extent of the direct physical disturbance of the pipeline corridor whether it is visible or not on imagery. The verges were derived from the Digitally Integrated Dispositions (DIDs), Rural Cadastral pipeline right of ways and from manual digitizing using SPOT imagery. Some verges were also



buffered using the estimated pipeline centre lines within the pipeline centre line feature class. The Alberta Energy Regulator (AER) pipeline dataset was used as reference to locate the pipeline corridors. The data was designed specifically for monitoring human footprint and may not be suitable for some cartographic purposes.

Data created by Alberta Human Footprint Monitoring Program (AHFMP) was consequently modified by ABMI. Digitized pipelines interpreted from satellite imagery (year 2017) were added to the source dataset to create the final HFI sublayer that represents estimated status of pipelines up to year 2017.

Details of AHFMP processing steps and user guide are included in these documents:

AHFMP - Pipeline Procedures Manual for 2016 Footprint - Ver 3.pdf

AHFMP - Pipeline User Guide for 2016 Footprint - Ver 2.pdf

Interpretation Elements and Rules:

SIZE: Variable.

SHAPE: Variable

SHADOW: no shadows

COLOR: shades of green or brown/grey depending on vegetation cover of the corridor

TEXTURE: usually finer texture as a result even vegetation on the corridor

ASSOCIATED RELATIONSHIP or CONTEXT:

Corridor connects energy users with energy providers.

IMPORTANT:



- PIPELINES might include corridors that contain pipelines built for another purpose than the conveyance of petrochemicals, e.g. municipal water.

5.20 20 SEISMIC LINES and TRAILS

Feature types:

FEATURE_TY	Feature Description
LOW-IMPACT-SEISMIC	A polygon feature class derived from a 1.5-meter buffer (3 meter total width) of a pre-low-impact-seismic centerline.
PRE-LOW-IMPACT-SEISMIC	A polygon feature class derived from a 3-meter buffer (6 meter total width) of a pre-low-impact-seismic centerline.
TRAIL	A polygon feature class derived from a 2-meter buffer (4 meter total width) of a pre-low-impact-seismic centerline.

Buffered to:

TRAIL = 2m half width (**4m full width**)

CONVENTIONAL-SEISMIC = 3m half width (**6m full width**)

LOW-IMPACT-SEISMIC = 1.5m half width (**3m full width**)

Details of AHFMP processing steps and User Guide are included in these documents:

AHFMP - Seismic User Guide 2014 Footprint Ver3.docx

Disclaimer:

- Seismic lines currently available in the ABMI's Table 1 are not complete representation of the seismic lines existing on the land surface. The ABMI's sampling scale Temporal Human Footprint dataset (THF) should be used for a more detailed representation of this sub-layer.



- [YEAR] value is the best estimation of the year when the seismic line was created. It has been determined by visual interpretation based on available aerial/satellite imagery, and through comparisons to existing digital data provided by Pulse Seismic (www.pulseseismic.com). It is less accurate for the years prior to 2005 (the first year with higher spatial resolution mosaic available for the entire province of Alberta).

6 Appendix

6.1 6.1 Attribute List

6.1.1 *Mandatory Fields:*

"FEATURE_TY"

The category of human footprint.

"SOURCE"

The source of the feature in the dataset.

Values:

'ABMI' – data updated by ABMI prior to HFI_2014 update,

'ABMI00' – data updated by ABMI during HFI_2000 update,

'ABMI07' – data updated by ABMI during HFI_2007 update,

'ABMI10' – data updated by ABMI during HFI_2010 update,

'ABMI12' – data updated by ABMI during the HFI_2012 update,



'ABMI14' – data updated by ABMI during HFI_2014 update,

'ABMI15' – data updated by ABMI during HFI_2015 update,

'ABMI16' – data updated by ABMI during HFI_2016 update,

'ABMI17' – data updated by ABMI during HFI_2017 update,

'ABMI18' – data updated by ABMI during HFI_2018 update,

'ABMI19' – data updated by ABMI during HFI_2019 update,

'ABMI20' – data updated by ABMI during HFI_2020 update,

'ABMI37' – data updated by ABMI during temporal human footprint on sample scale update,

'AHFMP' – data updated by Alberta Human Footprint Mapping Program

'AVIE' – data derived from the Alberta Vegetation Inventory obtained from the Government of Alberta

'AVI' – data derived from the Alberta Vegetation Inventory obtained from the Government of Alberta

'BASEFE' – data obtained from the Government of Alberta under the Open Data License.
Data source: http://www.altalis.com/products/base/20k_base_features.html

'BUFF10' – data updated by ABMI during HFI_2010 update by the buffering of residential centroid points

'GVI' – data derived from the Grassland Vegetation Inventory obtained from the Government of Alberta



'GVled' – data derived from the Grassland Vegetation Inventory obtained from the Government of Alberta updated by ABMI

'NA' – data source not available

'PLVI' – data derived from the Primary Land and Vegetation Inventory obtained from the Government of Alberta

'PLVled' – data derived from the Primary Land and Vegetation Inventory obtained from the Government of Alberta updated by ABMI

'RIS' – Reclamation Information System (RIS) data obtained from the Government of Alberta, Alberta Environment and Parks

'SRDSPT' – Special Areas data obtained from the Government of Alberta, Alberta Environment and Parks

'SPAREA' – Special Areas data obtained from the Government of Alberta, Alberta Environment and Parks

"HFI_ID"

Unique identifier used for additional analysis

6.1.2 Optional Fields

"YEAR"

[YEAR] attribute contains a value of “year of origin”. This value is either introduced to the HFI dataset from other sources (along with original features) or it is being attributed by ABMI processes. When a feature is updated by ABMI, [YEAR] value is updated based on available imagery in ABMI mosaic catalogue – years of 1949-1951, 1999-2003, and 2004 to 2020.



Google Earth Timelapse was used as a reference tool for year of origin determination of some features.

Year value has not been determined for all polygons. The ABMI is constantly updating human footprint inventory dataset including filling in year values. It is expected that the next release of HFI dataset will contain more human footprint features than the current version with a known year of origin.

"NAME"

The name of the particular location.

"BNDRY_SOURCE"

The source of the feature boundary.

6.2 Data References

Table A.1: Data source references used in HFI 2010 creation.

Title	Association Type	Location/Reference
Alberta Vegetation Inventory (AVI)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Grassland Vegetation Inventory (GVI)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Primary Land and Vegetation Inventory (PLVI)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project



		(AHFMP), https://open.alberta.ca/opendata/ahfmp
Alberta Human Footprint Mapping Project (AHFMP)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Reclamation Information System (RIS)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Government of Alberta (SRDSPT)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Digitally Integrated Dispositions (DIDs)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Alberta Vegetation Inventory Enhanced (AVIE)	Source	Government of Alberta, 2016. Data provided by Alberta Human Footprint Mapping Project (AHFMP), https://open.alberta.ca/opendata/ahfmp
Special Areas (SPAREA)	Source	The Special Areas; specialareas.ab.ca
Land Use Classification in the Special Areas of Alberta	Source	Publication No. 731; technical Bulletin No.39; Issued: February. 1942
SPOT6, 2014	Source	Alberta Environment and Parks, 2020. Air, Biodiversity and Policy Integration Branch, Policy and Planning Division, Provincial coverage of pan sharpened and multispectral SPOT6, years 2010 to 2017. [Edmonton, AB: Alberta Environment and Parks, 2020].
SPOT6, 2017	Source	Alberta Environment and Parks, 2020. Air, Biodiversity and Policy Integration Branch, Policy and Planning Division, Provincial coverage of pan sharpened and multispectral SPOT6, years 2010 to 2017. [Edmonton, AB: Alberta Environment and Parks, 2020].
SPOT6, 2019	Source	Alberta Environment and Parks, 2020. Air, Biodiversity and Policy Integration Branch, Policy and Planning Division, Provincial coverage of pan sharpened and multispectral



		SPOT6, years 2017 to 2019. [Edmonton, AB: Alberta Environment and Parks, 2020]
SPOT6, 2020	Source	Alberta Environment and Protected Areas, 2021. Lands Planning Branch, Lands Division, Provincial coverage of pan sharpened and multispectral SPOT6, years 2018 to 2020. [Edmonton, AB: Alberta Environment and Protected Areas, 2021]
Valtus Orthophoto Mosaic cca 2000	Reference	Alberta Environment and Parks, 2016. Informatics Branch
IRS Satellite	Reference	Alberta Environment and Parks, 2016. Informatics Branch
Base Features (BASEFE)	Source	Government of Alberta, 2016. Open Data License, Retrieved from http://www.altalis.com/products/base/20k_base_features.html
Google Maps	Reference	https://maps.google.ca
Google Earth Timelapse	Reference	https://earthengine.google.com/timelapse/
Alberta Recycling Management Authority	Reference	http://www.albertarecycling.ca/collection-site-search-results
City of Calgary	Source	https://data.calgary.ca/Base-Maps/Land-Use-Polygons/gbpb-ymc5/about https://maps.calgary.ca/CalgaryImagery/
Alberta Environment and Sustainable Resource Development	Reference	Alberta Environment and Sustainable Resource Development, 2016. Informatics Branch, 1.5 m Colour SPOT 6 Mosaic. Retrieved from http://environment.alberta.ca/
Valtus Imagery Services	Reference	Valtus Imagery Services, 2010. Valtus Imagery. Retrieved from http://www.valtus.com/
Valtus Imagery Services	Reference	Valtus Imagery Services, 2011. Valtus Imagery. Retrieved from http://www.valtus.com/
Valtus Imagery Services	Reference	Valtus Imagery Services, 2012. Valtus Imagery. Retrieved from http://www.valtus.com/
Valtus Imagery Services	Reference	Valtus Imagery Services, 2013. Valtus Imagery. Retrieved from http://www.valtus.com/
Valtus Imagery Services	Reference	Valtus Imagery Services, n.d. Valtus Imagery. Retrieved from http://www.valtus.com/
Quality Farm Dugouts (3rd Edition)	Reference	http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/agdex15866



Alberta Vegetation Inventory Standards and Data Model Documents	Reference	https://www.agriculture.alberta.ca/app21/forestry?page?cat1=Vegetation%20Inventory%20Standards
Grassland Vegetation Inventory Standards	Reference	https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7BD3AB9031-8EC0-4589-9335-C1E50AE05992%7D
Primary Land and Vegetation Inventory Standards	Reference	https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7BF640CD9D-C232-481D-9CFF-7A7B66E51E49%7D
road_album_2.ppt	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
Alberta Transportation Guide to Reclaiming Borrow Excavations – 2013 Edition	Reference	www.transportation.alberta.ca/Content/docType245/Production/borrowguide.pdf
AHFMP_Footprint Data Manual.docx	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP),
AHFMP - Road Processing 2014 Footprint.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP),
AHFMP - Well Pad User Guide 2014 Footprint.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
AHFMP - Well Pad Procedures for 2014 Footprint.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
AHFMP - Well Pad User Guide 2014 Footprint.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
AHFMP_Cultivation_User_Guide_Footprint_HFI_2014FTv2.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
AHFMP_Cultivation_User_Guide_HFI_2014.pdf	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
ISO 19131_AAFC_Annual_Crop_Inventory_Data_Product_Specifications.pdf	Reference	Agriculture and Agri-Food Canada (AAFC); AAFC Crop Inventory, 2014



AHFMP - Seismic User Guide 2014 Footprint Ver3.docx	Reference	Government of Alberta document, provided by Alberta Human Footprint Mapping Project (AHFMP)
AAFC Annual Crop Inventory Data	Source	http://www.agr.gc.ca/atlas/data_donnees/agr/annualCropInventory/tif/
SENTINEL - 2	Reference	European Space Agency (ESA); The Copernicus Sentinel-2 mission; https://sentinel.esa.int/web/sentinel/missions/sentinel-2
Visible Infrared Imaging Radiometer Suite (VIIRS)	Reference	Image and Data processing by NOAA's National Geophysical Data Center. DMSP data collected by the US Air Force Weather Agency.
Pulse Seismic Inc.	Reference	Pulse Seismic Inc., pulsesismic.com
Historical Orthophotos ca 1980s	Reference	Alberta Environment and Parks, 2019. Provided by the Government of Alberta's Air Photo Library, through the Alberta Human Footprint Mapping Program (AHFMP)

6.3 Thematic and Spatial Accuracy

Table A.2: Known thematic accuracy of source data used in HFI 2010 creation.

SOURCE	Collection	Source Category	Accuracy [%]
External	Inventories	AVI - Photo Interpretation Audit	≥ 90%
		GVI	≥ 65%
		PLVI	≥ 90%

Table A.3: Known spatial (horizontal) accuracy of source data used in HFI 2010 creation.

SOURCE	Collection	Source Category	Accuracy [+ -m]
External	Base features	1:20 000 Provincial Digital Mapping Program	5
		Alberta 1:50 000 Access Mapping	50



		GPS field data	25
		IRS-1C/1D imagery	25
		NTDB data	100
		Federal hydrography	100
		Orthophoto imagery	10
		Aerial photography	10
		SRD regional investigation	25
		Ikonos imagery	10
		Derived from supplementary data	25
		SPOT imagery	2.5
	Inventories	Alberta Vegetation Inventory	20
		GVI upland	5
		GVI wetland	2
		PLVI	5
	Cadastral	Cadastral urban	0.15
		Cadastral rural	3
ABMI	ABMI	Heads-up digitization SPOT "green zone"	10 – 20
Buffer	Buffer	Calculated RMSE per feature type	