

The Human Footprint Inventory (HFI) for the Oil Sands Administrative (OSA) Region 1980s and 1950s

Version 1.3

March 2024

Prepared by: Scott Vegter

Alberta Biodiversity Monitoring Institute
University of Alberta



ABMI ALBERTA BIODIVERSITY
MONITORING INSTITUTE



The Human Footprint Inventory (HFI) for the Oil Sands Administrative (OSA) Region 1980s and 1950s

Version 1.3





Table of Contents

1. Overview	5
1.1 Summary	5
1.2 Description.....	5
1.3 Document History	7
1.4 Methods	8
1.5 Credits.....	11
1.6 Acknowledgments.....	11
1.7 Human Footprint Definition	12
1.8 Contact Information	13
1.9 Keywords	14
1.10 Citation.....	14
2. Use Limitations	15
2.1.1 <i>Proprietary Sourced Data</i>	15
2.1.2 <i>Open Sourced Data</i>	16
2.1.3 <i>Exclusive ABMI Sourced Data</i>	17
2.1.4 <i>Other Data Limitations</i>	19
3. Data Product Specification	25
3.1 Spatial Resolution.....	25
3.2 Processing Environment	25
3.3 Resource Maintenance	26
3.4 Spatial Reference	26
3.5 Lineage	26
4. Human Footprint Inventory Integrated Dataset	27
5. Oil Sands Monitoring Human Footprint Inventory 1950s and 1980s (HFIOSM1950s and HFIOSM1980s) Dataset	29



6. Sublayers	29
6.1 01 RESERVOIRS	29
6.2 02 BORROW PITS, SUMPS, DUGOUTS and LAGOONS (BPSDL)	31
6.3 03 ROADS.....	36
6.4 04 RAILWAYS.....	39
6.5 05 CANALS	40
6.6 06 VERGES.....	42
6.7 07 MINE SITES.....	43
6.8 08 INDUSTRIAL SITES.....	48
6.9 09 WELL SITES ACTIVE	51
6.10 10 LANDFILLS.....	51
6.11 11 OTHER VEGETATED SURFACES.....	53
6.12 13 TRANSMISSION LINES	54
6.13 14 CFO	56
6.14 15 URBAN and RURAL RESIDENTIAL	57
6.15 16 WELL SITES ABANDONED	61
6.16 17 CULTIVATION	61
6.17 18 FOREST HARVEST AREAS.....	71
6.18 19 PIPELINES.....	73
6.19 20 SEISMIC LINES and TRAILS.....	76
7. Appendix	78
7.1 Attribute List.....	78
7.1.1 1980s and 1950s Feature Attributes.....	78
7.2 Data References	84
7.3 Thematic and Spatial Accuracy.....	91



1. Overview

1.1 Summary

This dataset represents the Human Footprint Inventory 2021 for the Oil Sands Monitoring (OSA) Region with additions and edits of features specifically for circa 1980s and 1950s conditions. The HFIOSA1950s and HFIOSA1980s maps human footprint features within the OSA Region. The datasets are 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. In particular, it is derived from the ABMI's Human Footprint Inventory 2021 (HFI2021). The latter dataset was updated using imagery from the Satellite pour l'Observation de la Terre 6 (SPOT6) to interpret anthropogenic disturbances on the land surface. Thematic mapping or image interpretation requires professional judgement, 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.

The extraction of the HFIOSA1950s and HFIOSA1980s dataset from HFI2021 sublayers relies on knowledge of feature dates, or 'year of origin'. However, not all features within the HFI2021 dataset possess this information. For this reason, HFIOSA1950s and HFIOSA1980s cannot contain features from the HFI2021 sublayers that do not have this information.



Features in the ABMI's HFI products are attributed with a 'year of origin' date (i.e., a [YEAR] attribute) through manual comparisons with a variety of satellite and aerial image sources covering a range of dates, and in some situations, manual comparisons with existing digital data from contributors such as Pulse Seismic (www.pulseseismic.com), Digitally Integrated Dispositions, Historical Cadastral Cutlines and Trails, and 1950 linear features digitized from the Historical Planimetric Maps. Section 2.1.4 summarizes in more detail the ABMI's efforts to add 'year of origin' information to its products, and what percentage of features in the HFI2021 dataset sublayers have this attribution.

Further details and information regarding the updating and create the HFI2021 layer are found in:

Alberta Biodiversity Monitoring Institute and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for Alberta 2021 (version 1.0). Geodatabase. Last modified June 30, 2023.

Note that the HFIOSA1950s and HFIOSA1980s dataset does not contain any linear feature sublayers representing HFI feature centrelines. Other than o20_SeismicLines_and_Trails_CenterLines_HFI_2021 these features in the HFI2021 dataset are largely undated (i.e., lacking a 'year of origin'), meaning that accurately extracting linear feature centrelines for circa 1950s and 1980s conditions is not possible at this time. 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.



Representative human footprint polygons were delineated for 101 feature types, which were organized into 19 final sublayers.

1.3 Document History

Table 1. List of document versions and updates.

Update Date	Version	Section(s)	Description of Changes
2023-06-30	1.0	All	Initial full (final) version of HFIOSA1980s
2023-08-09	1.2	All	Updated formatting of documentation for HFIOSA1980s Updated document for Oil Sands Administrative Region for public use
2024-03-31	1.3	All 1.3 Document History	Updated dataset and document to include HFIOSA1950s Added Document History section for capturing versioning and changes Updated percent of features with 'YEAR' attribute in OSA.



		2.1.4 Other Data Limitations	Added section on limits of the dataset
--	--	------------------------------	--

1.4 Methods

The ABMI updates Human Footprint Inventory information annually. To do this, the entire province was examined at a 1:30,000 scale to delineate all detectable human footprints. All of the features are created and/or verified using heads-up digitizing at a 1:5,000 scale. All of the human footprint attributes are manually interpreted from satellite imagery. Government of Alberta Base Feature Datasets were a base layer.

This process was conducted for 2021 using SPOT6 satellite imagery. Dates were acquired from multiple imagery sources. Circa 1950 using orthorectified aerial imagery, circa 1980 using orthorectified aerial imagery, 2000 using orthorectified aerial imagery, 2001 and 2004 using IRS satellite imagery for each year, 2005-2012 using SPOT 5 satellite imagery for each year, 2013 -2021 using SPOT6 satellite imagery (Table A.1).

In 2023-2024 a concentrated effort was made to add ‘year of origin’ and ‘year source’ to HFI 2021 (Table 2) within the OSA region specifically for the 1950s and 1980s for the seismic lines sublayer. As a result we’ve produced the HFIOSA1950s and HFIOSA1980s datasets. This involved the same methodology as the Human Footprint Inventory using



circa 1980 and 1950 Historical Orthophotos along with a series of reference datasets including Digitally Integrated Dispositions, Historical Cadastral Cutline Trails, Pulse Seismic, and 1950 linear features digitized from the Historical Planimetric Maps.

The HFIOSA1950s and HFIOSA1980s was derived from the updated HFI2021 dataset by clipping the latter to the appropriate OSA region, and using ‘year of origin’ attributes to extract features that appeared within or before the 1980s (Section 2.1.4). These features were then brought together, quality-checked, and compiled into the HFIOSA1950s and HFIOSA1980s.

The [YEAR] attribute contains a value representing the ‘year of origin’ of a feature (Section 2.1.4). 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] values are updated based on available imagery in ABMI mosaic catalogue – years of 1949-1951, 1999-2003, and 2004 to 2021 (see Table A.1). Google Earth Timelapse was used as a reference tool for year of origin determination of some features, while Pulse Seismic (www.pulsesismic.com) digital datasets offered another source for information on ‘year of origin’.

A [YEAR] attribute value has not been determined for all polygons, see section 2.1.4 for a more detailed on the status of [YEAR] attribution in the OSA. The ABMI is constantly updating human footprint inventory dataset including filling in year values. Currently 14 of the total 20 polygonal sublayers have [YEAR] fully attributed (Table 2). It is expected that the next release of the HFI dataset will contain more human footprint features with known year of origin than the current version.



For more details on the status of [YEAR] attribution within the HFI refer to Section 2.1.4 and Table 2.

[YEAR_SOURCE] value provides context to how 'YEAR' is attributed. Data comes from multiple imagery sources: 1950 using orthorectified aerial imagery, 1985 using orthorectified aerial imagery, 2000 using orthorectified aerial imagery, 2001 and 2004 using IRS satellite imagery for each year, Google Earth Timelapse, 2005-2012 using SPOT 5 satellite imagery for each year, 2013 -2021 using SPOT6 satellite imagery. Years prior to 2005 will be less accurate and should be considered 'As of' we know the feature was on the landscape as of this date but it may have originated earlier. 'YEAR_SOURCE' can also be populated using manual comparisons with existing digital data such as Pulse Seismic (www.pulseseismic.com), Digitally Integrated Dispositions, Historical Cadastral Cutlines and Trails, and 1950 linear features digitized from the Historical Planimetric Maps are conducted. Like older imagery, older dates from these datasets should also be treated as 'As of' years not absolute years. There are gaps in the 'YEAR_SOURCE' attribution where it is not included but continued efforts are being made to update this field along with 'YEAR'.

IMPORTANT: this version of the ABMI HFIOSA1950s and HFIOSA1980s 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 ceases) 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 (previously 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.

1.5 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.

1.6 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 structures 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.

1.7 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.

1.8 Contact Information

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



Geospatial Centre
Alberta Biodiversity Monitoring Institute
CW 405 Biological Sciences Centre
University of Alberta
Edmonton, Alberta, Canada, T6G 2E9
Email: abmiinfo@ualberta.ca

1.9 Keywords

Alberta, oil sands, 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, confined feeding operations (CFS), residential, cultivation, harvested areas, pipelines, seismic lines

1.10 Citation

Alberta Biodiversity Monitoring Institute and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for the Oil Sands Region of Alberta 1980s (Version 1.3). Geodatabase. Last modified March 28, 2024.

Alberta Biodiversity Monitoring Institute and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for the Oil Sands Region of Alberta 1950s (Version 1.0). Geodatabase. Last modified March 28, 2024



2. Use Limitations

2.1.1 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.

The Proprietary Sourced Data is provided on an "As Is" and "As Available" basis and the ABMI does not guarantee that the Proprietary Sourced Data will be suitable for your purposes or requirements. The ABMI further states that the Proprietary Sourced Data is subject to change, and the ABMI gives no guarantee that the content is complete, accurate, error or virus free, or up to date. The ABMI disclaims all warranties, conditions, and other terms of any kind, whether express or implied, whether in contract, tort (including liability for negligence) or otherwise, including, but not limited to any implied term of satisfactory quality, fitness for a particular purpose, and any standard of reasonable care and skill.



2.1.2 Open Sourced Data

This dataset contains data originating from open sources, which has subsequently been enhanced through active visual interpretation and computer processing. The Open Sourced Data may be reproduced in whole or in part and in any form for educational, data collection or non-profit purposes without special permission from the ABMI provided acknowledgment of the source is made. No use of the Open Sourced Data may be made for resale without prior permission in writing from the ABMI.

By accessing the Open 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, co-branders, and Open Sourced Data sources 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.

The Open Sourced Data is provided on an "As Is" and "As Available" basis and the ABMI does not guarantee that the Open Sourced Data will be suitable for your purposes or requirements. The ABMI further states that the Open Sourced Data is subject to change, and the ABMI gives no guarantee that the content is complete, accurate, error or virus free, or up to date. The ABMI disclaims all warranties, conditions, and other terms of any kind, whether express or implied, whether in contract, tort (including liability for negligence) or otherwise, including, but not limited to any implied term of satisfactory quality, fitness for a particular purpose, and any standard of reasonable care and skill.



2.1.3 Exclusive ABMI Sourced Data

This dataset contains data created by the ABMI through active visual interpretation and computer processing. The ABMI Sourced Data may be reproduced in whole or in part and in any form for educational, data collection or non-profit purposes without special permission from the ABMI provided acknowledgment of the source is made. No use of the ABMI Sourced Data may be made for resale without prior permission in writing from the ABMI.

By accessing the ABMI 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.

The ABMI Sourced Data is provided on an "As Is" and "As Available" basis and the ABMI does not guarantee that the ABMI Sourced Data will be suitable for your purposes or requirements. The ABMI further states that the ABMI Sourced Data is subject to change, and the ABMI gives no guarantee that the content is complete, accurate, error or virus free, or up to date. The ABMI disclaims all warranties, conditions, and other terms of any kind, whether express or implied, whether in contract, tort (including liability for negligence) or otherwise, including, but not limited to any implied term of satisfactory quality, fitness for a particular purpose, and any standard of reasonable care and skill.

IMPORTANT:



1. SEISMIC LINES currently available in the ABMI's HFIOSA1950s and HFIOSA1980s are not the complete representation of the seismic lines that existed on the land surface. Low impact seismic lines might be missing from this dataset due to low detectability on SPOT or other satellite 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. 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.)
3. HARVEST-AREAS [YEAR] value is the best estimation of the year when the area was harvested. It has been determined by:
 - a combination of source data values and remote sensing analysis for years 1985 to 2013,
 - and source data based for years prior to 1985.
4. 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.



2.1.4 Other Data Limitations

The HFI2021 dataset from which the current HFIOA1950s and HFIOA1980s 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. Table 2 below summarizes the percent of features in each sublayer within the HFI2021 dataset that have a [YEAR] attribute. There are six polygonal sublayers that do not have complete [YEAR] attributes: Roads, Verges, Urban/Rural Residential, Cultivation, Pipelines, and Seismic Lines. The percent completion for features in these sublayers varies from 13.2% to 87.8%. Polygonal sublayers that are fully dated have not undergone the process of 'Heads-up Digitization' for the 1980s and 1950s orthophotos so some features may be missing.

Table 2. Percent of all features in each sublayer that have 'year of origin' information in their [YEAR] attribute in the HFI2021 dataset.

Sublayer	Percent of Total Features
01 - Reservoirs	100%
02 - Borrow Pits, Sumps, Dugouts, and Lagoons	100%
03 - Roads	53.4%
04 - Railways	100%
05 - Canals	100%



06 - Verges	55.6%
07 - Mine Sites	100%
08 - Industrial Sites	100%
09 - Well Sites (Active)	100%
10 - Landfills	100%
11 - Other Veg Surfaces	100%
12 - Win Gen Facility	100%
13 - Transmission Lines	100%
14 - CFO/High Density Livestock	100%
15 - Urban/Rural Residential	13.2%
16 - Well Sites (Abandoned)	100%
17 - Cultivation	71.8%
18 - Harvest Areas	100%
19 - Pipelines	87.8%
20 - Seismic Lines	86.7%

The impact of incomplete dating in the above seven sublayers in the HFI2021 dataset is that the equivalent sublayers within the HFIOA1950s and HFIOA1980s contain a higher level of inaccuracy and uncertainty than other layers. In particular, features that are not dated in the former dataset but did in fact exist in the 1980s are likely to be missing from the derived HFIOA1950s and HFIOA1980s dataset. This is particularly impactful



for Roads, Verges, and Urban/Rural Residential, where less than half of the features in these sublayers have a [YEAR] attribute in the HFI2021 dataset. In addition, the current HFIOSA1950s and HFIOSA1980s dataset does not contain a layer for landfill features, though they did exist on the Alberta landscape at this time period (1980s). While they are not currently captured in this version of the dataset, the ABMI and AHFMP is working on compiling this data for future versions of the data. A series of orthophotos dating to the 1950s and 1980s form two of the many reference data sources used during HFI updating (see Table A.1 in the Appendix), and new features added to the HFI dataset during updating that appear on this imagery will have been given a [YEAR] attribute. The coverage of these orthophotos over the Oil Sands Region watershed is shown in Figure 1 (1980s) and Figure 2 (1950s).

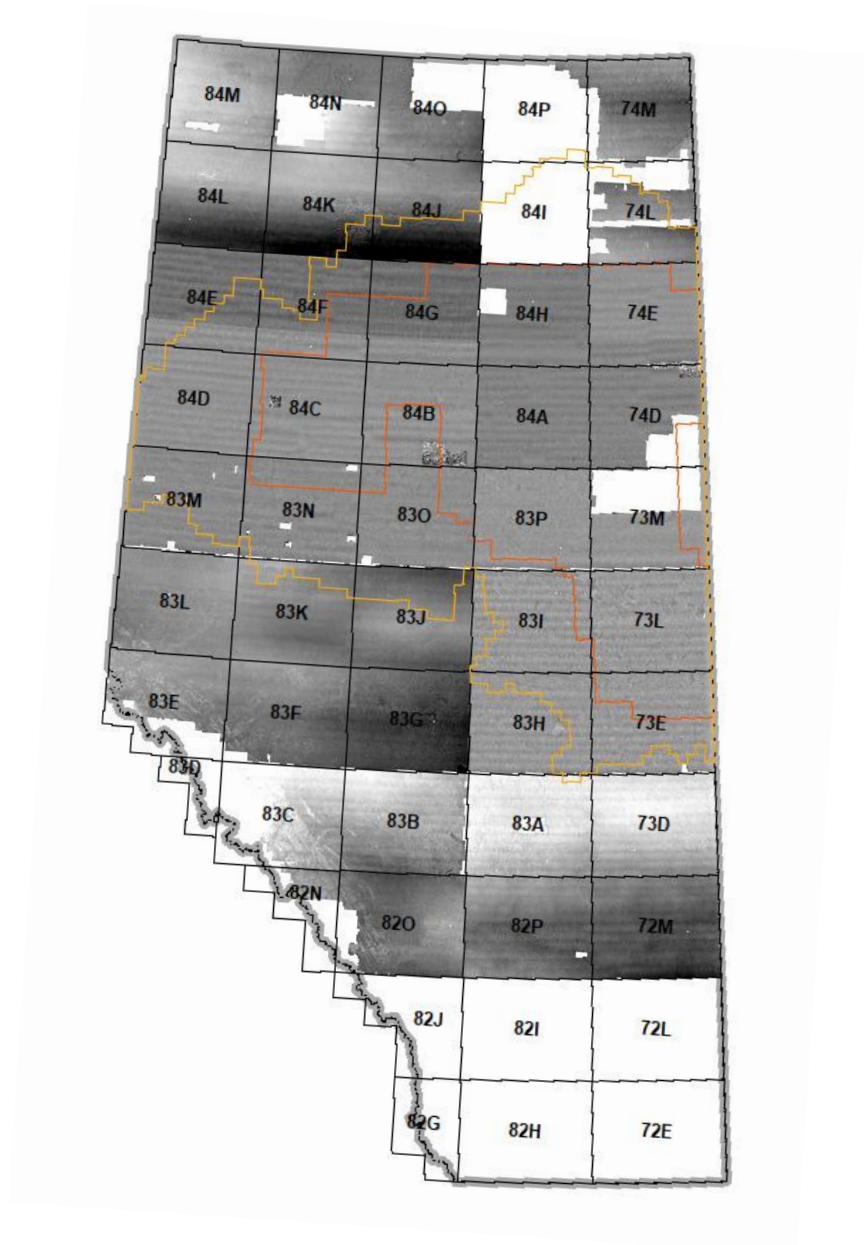




Figure 1. 1980s orthophoto-mosaics for Alberta showing coverage within the Oil Sands Region watershed boundary (blue); 1.25m resolution.

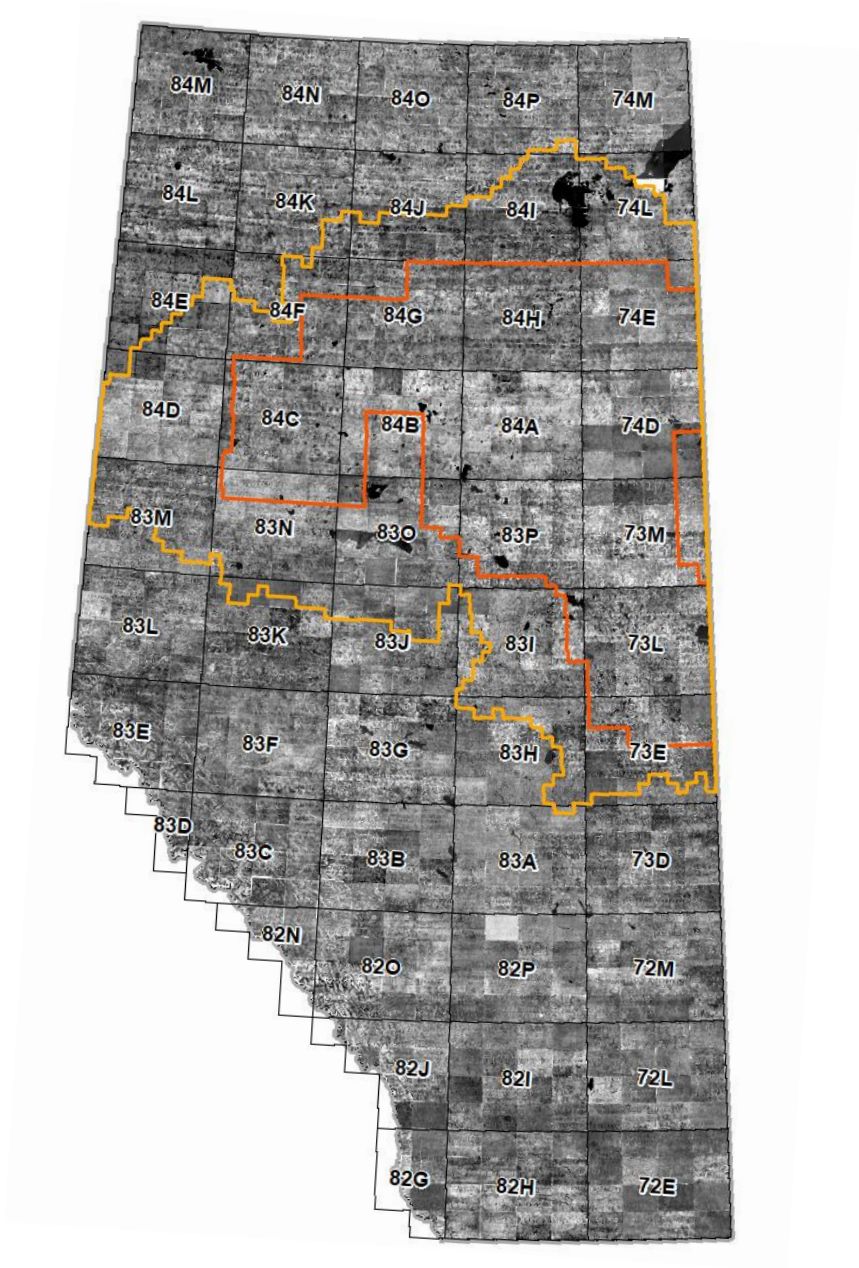




Figure 2. 1950s orthophoto-mosaics for Alberta showing coverage within the Oil Sands Region watershed boundary (blue); 1.25m resolution.

While incomplete dating within the HFI2021 polygonal sublayers has a notable impact on the accuracy and levels of uncertainty in equivalent HFIOSA1950s and HFIOSA1980s polygonal sublayers, it is important to note that the accompanying linear sublayers containing linear feature centrelines (e.g., pipelines, roads, seismic lines) contain significantly fewer data on ‘year of origin’ for these features than in the polygonal sublayers. For this reason, the current HFIOSA1950s and HFIOSA1980s dataset does not include centreline linear feature sublayers. There is insufficient [YEAR] attribution for linear centreline sublayers to be reasonably produced for a circa 1950s or 1980s HFI product at present.

Future versions of the HFIOSA1950s and HFIOSA1980s dataset are anticipated to be more rigorously checked, updated, and refined, and/or re-digitized using these available 1980s orthophotos. This work will form part of ongoing improvements to this dataset that are anticipated in future years.

3. Data Product Specification

3.1 Spatial Resolution

Dataset’s scale denominator: 30,000

3.2 Processing Environment

Microsoft Windows 10; Esri ArcGIS PRO 3.2.2



3.3 Resource Maintenance

Resource Maintenance updates frequency: as needed

3.4 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

3.5 Lineage

The ABMI's HFIOSA1950s and HFIOSA1980s 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 is comprised of 19 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 SPOT6 (circa 2021) satellite imagery mosaic and originating before 1990.

4. Human Footprint Inventory Integrated Dataset

The **HFIOSA1950s** and **HFIOSA1980s** 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 2.

Note that only 19 sublayers are included in the integrated dataset: sublayers containing landfills (sublayer 10) and wind generation facilities (sublayer 12) do not contain any features within the HFIOSA1950s and HFIOSA1980s, and are therefore not listed here and are not included in the dataset. Nevertheless, sublayer numbering for the existing sublayers is kept consistent with equivalent sublayers in other ABMI HFI products. Landfill features did exist on the Alberta landscape at this time period (1980s), but are not currently captured in this version of the dataset. The ABMI and AHFMP is working on compiling this data for future versions of the data.



Table 3. 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	Landfills
11	Other Vegetated Surfaces
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

5. Oil Sands Monitoring Human Footprint Inventory 1950s and 1980s (HFIOSA1950s and HFIOSA1980s) Dataset

The **HFIOSA1950s** and **HFIOSA1980s** Dataset contains additional information about:

1. the origin of each human footprint:
 - year of the origin - [YEAR],
 - year of origin source - [YEAR_SOURCE]

6. Sublayers

6.1 01 RESERVOIRS



Feature type: RESERVOIR

Definition:

An artificial lake or storage pond resulting from a humanmade dam.

A body of water created by excavation or the human-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 reservoirs; 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.

6.2 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 rectangular or square shape 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 rectangular or square shape 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:

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:

Rectangular, square or elliptical shape 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.

6.3 03 ROADS

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-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-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-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-2L	A roadway surfaced with dirt constituting a minor access route.
ROAD-WINTER	A clearing that is vehicular accessible in winter only.
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



6.4 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 set 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.



6.5 05 CANALS

Feature type: CANAL

Definition:

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

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

Interpretation Elements and Rules:

SIZE:

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.



6.6 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.

6.7 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-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.
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.
TAILING-POND	Body of water on/in close proximity to an oil sands mine comprised 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
	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
	Utilities	RIS-UTILITIES	08 Industrials
	Waste	RIS-WASTE	07 Mines
	Wellsite	RIS-WELL	09 Well Sites Active
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
--	------------------------	--------------------	----------

6.8 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 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(ies) 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-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-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.)



6.9 09 WELL SITES ACTIVE

Feature types:

FEATURE_TY	Feature Description
WELL-BIT	Well site - ground cleared for a bitumen well pad.
WELL-CASED	Well site - ground cleared and well cased.
WELL-CLEARED-NOT-DRILLED	Well site - confirmation of the boundary outline 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.

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

6.10 10 LANDFILLS



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 the proximity of residential areas.

6.11 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 concrete roads connecting clearings.
GOLFCOURSE	Large recreational area consisting of 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 to residential areas.

6.12 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 the BASEFE dataset (see Table A.1).

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.





6.13 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.



6.14 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.

6.15 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](#)

6.16 17 CULTIVATION

Feature type: CROP

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.

Interpretation Elements and Rules:

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

SHAPE: Often 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: TAME_PASTURE

Definition:

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.

Interpretation Elements and Rules:

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

SHAPE: Often 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 hay fields.

SHADOW: no shadows

COLOR: Variable - depending on the type of the pasture (grazing/hay) and imagery acquisition date.



TEXTURE: Coarser texture in comparison to a crop.

STRUCTURE: Often visible hay collection lines or hay bales.

ASSOCIATED RELATIONSHIP or CONTEXT: Evidence of grazing by livestock – trails, dugouts.

Feature type: ROUGH_PASTURE

Definition:

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 or fertilized and the soil has not been disturbed to improve productivity.

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. Quite often nearby existing farmland and crop/tame pasture fields.

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.

Feature type: FRUIT-VEGETABLES

Definition:

AAFC 2014 Crop Types: Vegetables, Tomatoes, Potatoes, Sugar beets, Other Vegetables, Fruits, Berries, Blueberry, Cranberry, Other Berry, Orchards, Other Fruits, Herbs.

HFI_2014 dataset cultivation Feature Types were based on AAFC 2014 classification (*ISO 19131 AAFC Annual Crop Inventory, Agriculture and Agri-food Canada, 2014*). AAFC 2014 classification crop types were overlaid onto HFI_2014 polygons and area



coverage of individual AAFC crop types within HFI polygon was computed. Cross-referencing all cultivation polygons to Crop Type values based on AAFC 2014 classification is displayed in Table 3.

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](#)

Details about AAFC 2014 processes are available in document:

[ISO 19131_AAFC_Annual_Crop_Inventory_Data_Product_Specifications.pdf](#)

IMPORTANT:

New cultivation features created by heads-up digitization ([SOURCE] either ABMI15, ABMI16, ABMI17, ABMI18, ABMI19, ABMI20 or ABMI21) were attributed based on visual interpretation of SPOT6 satellite natural color composite mosaics. Current HFIOA1950s and HFIOA1980s dataset has not included a reattribution of existing HFI_2014 cultivation Feature Types to status of circa 2021.

Table 3. Cross reference table used to convert the AAFC2014 labels into ten ABMI human footprint feature types for the HFI2014 product.



AAFC		ABMI [proposed]
Code	Label	Feature_Ty
10	Cloud	NA
20	Water	HYDRO
30	Exposed Land and Barren	NATIVE-NATURAL
34	Urban and Developed	URBAN-INDUSTRIAL
35	Greenhouses	NA
50	Shrubland	NATIVE-NATURAL
80	Wetland	WETLAND
110	Grassland	NATIVE-NATURAL
120	Agriculture	CROP
122	Pasture and Forages	TAME-PASTURE
130	Too Wet to be Seeded	CROP-WETLAND
131	Fallow	CROP
132	Cereals	CROP
133	Barley	CROP
134	Other Grains	CROP



135	Millet	CROP
136	Oats	CROP
137	Rye	CROP
138	Spelt	CROP
139	Triticale	CROP
140	Wheat	CROP
141	Switchgrass	TAME-PASTURE
145	Winter Wheat	CROP
146	Spring Wheat	CROP
147	Corn	CROP
148	Tobacco	CROP
149	Ginseng	AGRICULTURE-OTHER
150	Oilseeds	CROP
151	Borage	CROP
152	Camelina	CROP
153	Canola and Rapeseed	CROP
154	Flaxseed	CROP



155	Mustard	CROP
156	Safflower	CROP
157	Sunflower	CROP
158	Soybeans	CROP
160	Pulses	CROP
AAFC		ABMI [proposed]
Code	Label	Feature_Ty
162	Peas	CROP
167	Beans	CROP
174	Lentils	CROP
175	Vegetables	FRUIT-VEGETABLES
176	Tomatoes	FRUIT-VEGETABLES
177	Potatoes	FRUIT-VEGETABLES
178	Sugarbeets	FRUIT-VEGETABLES
179	Other Vegetables	FRUIT-VEGETABLES
180	Fruits	FRUIT-VEGETABLES
181	Berries	FRUIT-VEGETABLES



182	Blueberry	FRUIT-VEGETABLES
183	Cranberry	FRUIT-VEGETABLES
185	Other Berry	FRUIT-VEGETABLES
188	Orchards	FRUIT-VEGETABLES
189	Other Fruits	FRUIT-VEGETABLES
190	Vineyards	AGRICULTURE-OTHER
191	Hops	AGRICULTURE-OTHER
192	Sod	AGRICULTURE-OTHER
193	Herbs	FRUIT-VEGETABLES
194	Nursery	AGRICULTURE-OTHER
195	Buckwheat	CROP
196	Canaryseed	CROP
197	Hemp	CROP
198	Vetch	TAME-PASTURE
199	Other Crops	AGRICULTURE-OTHER
200	Forest	NATIVE-NATURAL
210	Coniferous	NATIVE-NATURAL



220	Broadleaf	NATIVE-NATURAL
230	Mixedwood	NATIVE-NATURAL

6.17 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 2019,
 - 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. The purpose of the clearing may not yet be determined.



6.18 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 a 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 corridor that contain pipelines built for another purpose than the conveyance of petrochemicals, e.g. municipal water.



6.19 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.
CONVENTIONAL-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 HFIOSA1950s and HFIOSA1980s 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 from multiple imagery sources. 1950 using orthophotos, 1980 using orthophotos, 2000 using orthophotos, 2001 and 2004 using IRS satellite imagery for each year, 2005-2012 using SPOT5 satellite imagery for each year, 2013 -2021 using SPOT6 satellite imagery. As well as a series of reference datasets including Digitally Integrated Dispositions, Historical Cadastral Cutline Trails, Pulse Seismic, and 1950 linear features digitized from the Historical Planimetric Maps.



7. Appendix

7.1 Attribute List

7.1.1 1980s and 1950s Feature Attributes

The following tables list and describe the various attributes or fields that accompany features 1980s and 1950s dataset. They are organized by: mandatory attributes (all features are required to have these filled), and optional attributes (some features have these filled). Note that not all features have YEAR and YEAR_SOURCE because these attributes became mandatory only in the last few years.

Table 4. Mandatory attributes or fields that must be filled for all features in the OSA 1980 and 1950 dataset.

Attribute	Description	List of Valid Values
HFI_ID	Alpha-numeric identifier sometimes used for additional analysis	E.g. '{F5CDF76F-40E7-4651-8739-AA028F1CA4D0}'
FEATURE_TYPE	The type or category of human footprint feature	See the sublayer sections for lists of valid values. E.g., 'WELL-BITUMEN', 'LOW-IMPACT-SEISMIC', 'CFO', 'GREENSPACE'
SOURCE	The data source for the feature in the dataset.	'ABMI' – data updated by ABMI prior to HFI_2014 update 'ABMI00' – data updated by ABMI during HFI_2000 update 'ABMI10' – data updated by ABMI during HFI_2010 update 'ABMI12' – data updated by ABMI during the HFI_2012 update



		<p>'ABMI14' – data updated by ABMI during HFI_2014 update</p> <p>'ABMI15' – data updated by ABMI during HFI_2015 update</p> <p>'ABMI16' – data updated by ABMI during HFI_2016 update</p> <p>'ABMI17' – data updated by ABMI during HFI_2017 update</p> <p>'ABMI18' – data updated by ABMI during HFI_2018 update</p> <p>'ABMI19' – data updated by ABMI during HFI_2019 update</p> <p>'ABMI21' – data updated by ABMI during HFI_2021 update</p> <p>'ABMI80' - data updated by ABMI during the HFI_1980 and HFI_1950 update</p> <p>'ABMI37' – data updated by ABMI during temporal human footprint on sample scale update,</p> <p>'AHFMP'– data updated by Alberta Human Footprint Mapping Program</p> <p>'AVIE' – data derived from the Alberta Vegetation Inventory obtained from the Government of Alberta</p> <p>'AVI' – data derived from the Alberta Vegetation Inventory obtained from the Government of Alberta</p> <p>'BASEFE' – data obtained from the Government of Alberta under the Open Data License. Data source:</p>
--	--	---



		<p>http://www.altalis.com/products/base/20k_base_features.html</p> <p>'BUFF10' – data updated by ABMI during HFI_2010 update by the buffering of residential centroid points</p> <p>'GVI' – data derived from the Grassland Vegetation Inventory obtained from the Government of Alberta</p> <p>'GVled' – data derived from the Grassland Vegetation Inventory obtained from the Government of Alberta updated by ABMI</p> <p>'NA' – data source not available</p> <p>'PLVI' – data derived from the Primary Land and Vegetation Inventory obtained from the Government of Alberta</p> <p>'PLVled' – data derived from the Primary Land and Vegetation Inventory obtained from the Government of Alberta updated by ABMI</p> <p>'RIS' – Reclamation Information System (RIS) data obtained from the Government of Alberta, Alberta Environment and Parks</p> <p>'SRDSPT' – Special Areas data obtained from the Government of Alberta, Alberta Environment and Parks</p> <p>'SPAREA' – Special Areas data obtained from the Government of Alberta, Alberta Environment and Parks</p>
--	--	--



YEAR	<p>A year integer number representing a feature’s “year of origin”. This value is either introduced to the 1980s and 1950s datasets from other sources (along with original features) or it is being attributed by ABMI processes. When a feature is updated by ABMI, the YEAR value is updated based on available imagery in the ABMI mosaic catalogue – years of 1949-1951, 1999-2003, and 2004 to 2021.</p> <p>A Google Earth Engine Timelapse App was used as a reference tool for year of origin determination of some features (https://earthengine.google.com/timelapse/).</p>	E.g. 1950, 1980, 2000, 2001, 2004, 2005, etc.
YEAR_SO URCE	The source from which a feature’s YEAR attribute (i.e. ‘year of origin’) was determined	<p>‘Historical CAD’ - Historical Cadastral Outline Trails data</p> <p>‘DIDs’ - Digitally Integrated Dispositions</p> <p>‘GEE-Timelapse’ – Google Earth Engine Timelapse app</p> <p>‘IRS 2001-2004’ – IRS satellite imagery from 2001 to 2004</p> <p>‘L7’ – Landsat 7 imagery</p>



		<p>'Landsat 1984' – Landsat imagery from 1984</p> <p>'ortho 1950' – 1950s orthophotography</p> <p>'ortho 1980' or 'Ortho_1980' – 1980s orthophotography</p> <p>'PSC' - Linear features digitized from 1950 Planimetric Maps</p> <p>'Pulse Seismic' – data from Pulse Seismic (www.pulseseismic.com)</p> <p>'SPOT 2005-2012' – SPOT satellite imagery from 2005 to 2012</p> <p>'SPOT 2013-2019' – SPOT satellite imagery from 2013 to 2019</p> <p>'valtus 2000' – orthomosaic imagery accessed through Valtus Imagery Services (www.valtus.com)</p>
OBJECTID	Automatic, geodatabase-specific unique ID number generated by ArcGIS for each row in an attribute table	---
Shape_Length	Feature geometry shape length value automatically generated by ArcGIS, in units of the selected coordinate system	---
Shape_Area	Feature geometry shape area value automatically generated by ArcGIS, in	---



	units of the selected coordinate system	
--	---	--

[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, 1980-1985, 1999-2003, and 2004 to 2021 (Table A.1).

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 (Table 2, Section 2.1.4). The ABMI is constantly updating human footprint inventory dataset including filling in year values. It is expected that the next release of an HFI dataset will contain more human footprint features with known year of origin than the current version.

6.1.2 Optional Attributes:

Attribute	Description	List of Valid Values
NAME	The name of the particular location	



BNDRY_S OURCE	The source of the feature boundary	
------------------	---------------------------------------	--

7.2 Data References

Table A.1. Data source references used in HFI2020 (and therefore HFIOSA1950s and HFIOSA1980s) dataset 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	Ministry of Alberta Environment and Parks, 2019. 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, 2019].
SPOT6, 2017	Source	Ministry of Alberta Environment and Parks, 2019. 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, 2019].
SPOT6, 2019	Source	Ministry of 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	Ministry of 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 Parks, 2021]
SPOT6, 2021	Source	Alberta Environment and Protected Areas, 2022. Lands Planning Branch, Lands Division, Provincial coverage of pan sharpened and multispectral SPOT6, years 2020 to 2021. [Edmonton, AB: Alberta Environment and Protected Areas, 2022]
Valtus Orthophoto Mosaic cca Reference 2000		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/gbbp-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/eptdocs.nsf/all/agdex15866
Alberta Vegetation Inventory Standards and Data Model Documents	Reference	https://www.agriculture.alberta.ca/app21/for-estrypage?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)
Historical Orthophotos ca 1950s	Reference	Alberta Environment and Parks, 2019. Provided by the Government of Alberta's Air Photo Library, through the Alberta



Human Footprint Mapping Program (AHFMP)

Historical Cadastral Cutlines and Trails (CAD)	Reference	Alberta Environment and Parks, 2017. Provided by the Government of Alberta's Air Photo Library, through the Alberta Human Footprint Mapping Program (AHFMP)
1950 linear features from Historical Planimetric Maps (PSC)	Reference	Alberta Environment and Parks, 2023. Provided by the Government of Alberta's Air Photo Library, through the Alberta Human Footprint Mapping Program (AHFMP)

7.3 Thematic and Spatial Accuracy

Table A.2. Known thematic accuracy of source data used in HFI2021, and therefore in HFIOSA1950s and HFIOSA1980s.

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 HFI2021, and therefore in HFIOSA1950s and HFIOSA1980s.

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	
--------	--------	----------------------------------	--

