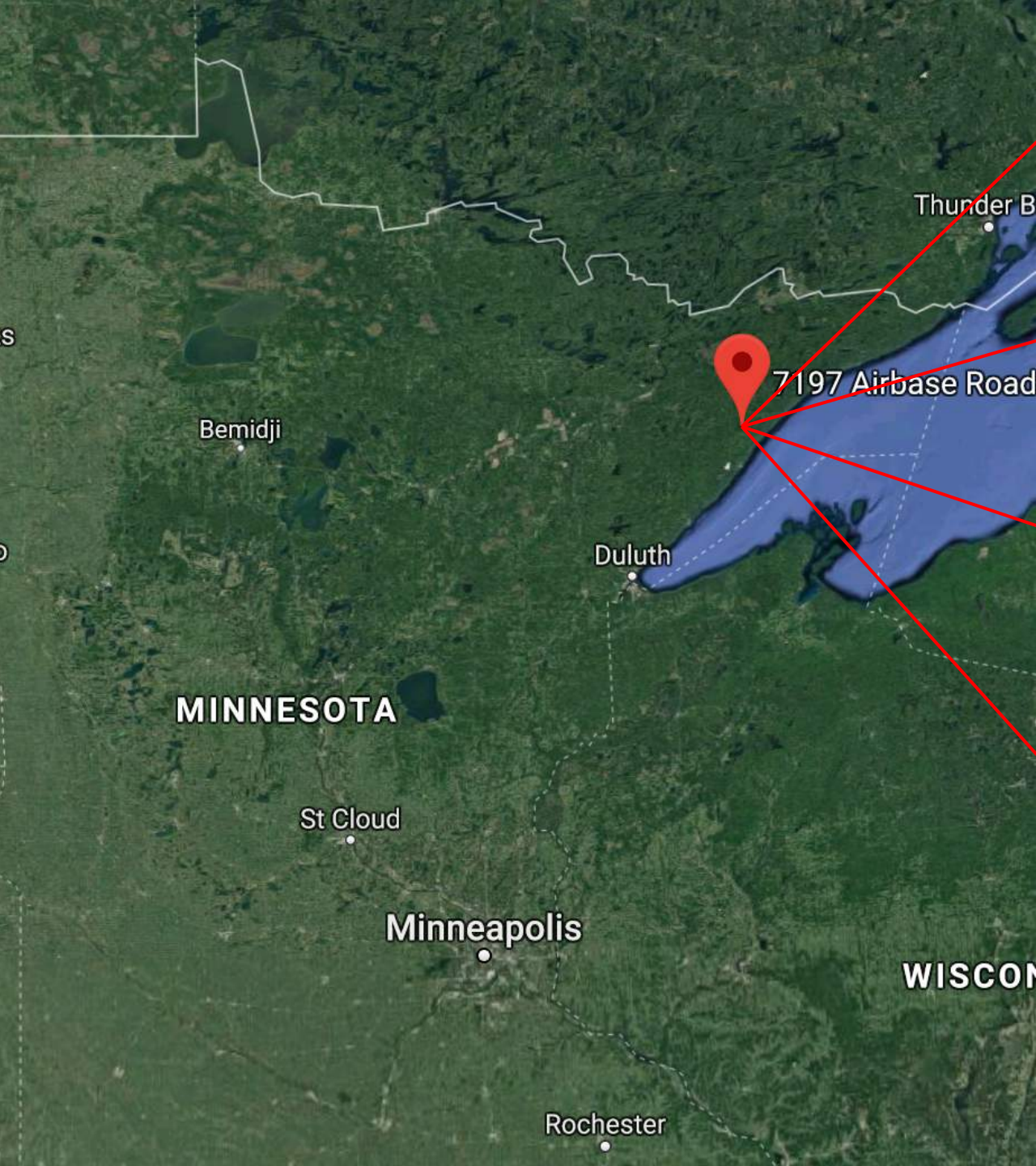




Finland Air Force Base

Historical Photographic Analysis

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GEOG 480 – GISc and Environmental Hazards



Located a few miles away from Finland, MN (pop. 195)
on the Northern Shore of Minnesota

Introduction

Finland Air Force Base was commissioned in 1951, the same year as the base in Chandler, MN; and others around the nation. It was a part of the Semi-Automatic Ground Environment (SAGE) system during the Cold War era. This station reports to a larger Duluth station, about 65 miles away.

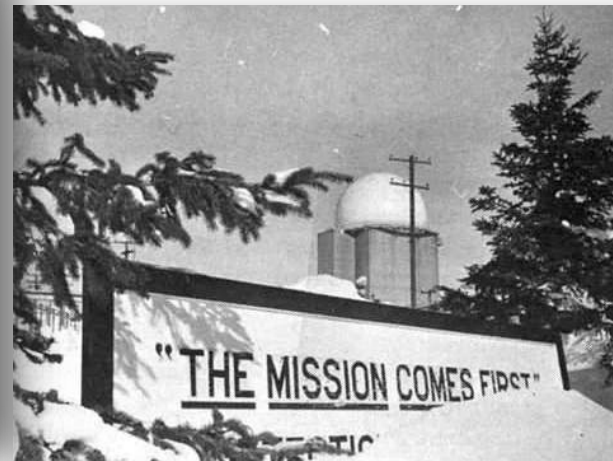
The station was decommissioned in 1980, becoming abandoned. Multiple projects were proposed, including a tourist resort called Finlandia. With that project falling through, it is now a religious retreat location. The Site is listed on the Federally Used Defense Sites (FUDS), as well as a Superfund site. It is listed as having underground tanks, radioactive, and hazardous waste.



Concerns

Looking at historical imagery, and air photos, the goal is to interpret and mark possible locations of hazards on site. This data will be used for further investigation and field studies of the site. Possible contamination could be from possible asbestos insulation, automotive related wastes, solvents, and other hazards wastes from heating and power plants.

Because it is marked does not mean it is a confirmed hazard, but brings forth enough reason for it to be further looked into, and tested.



Methodology

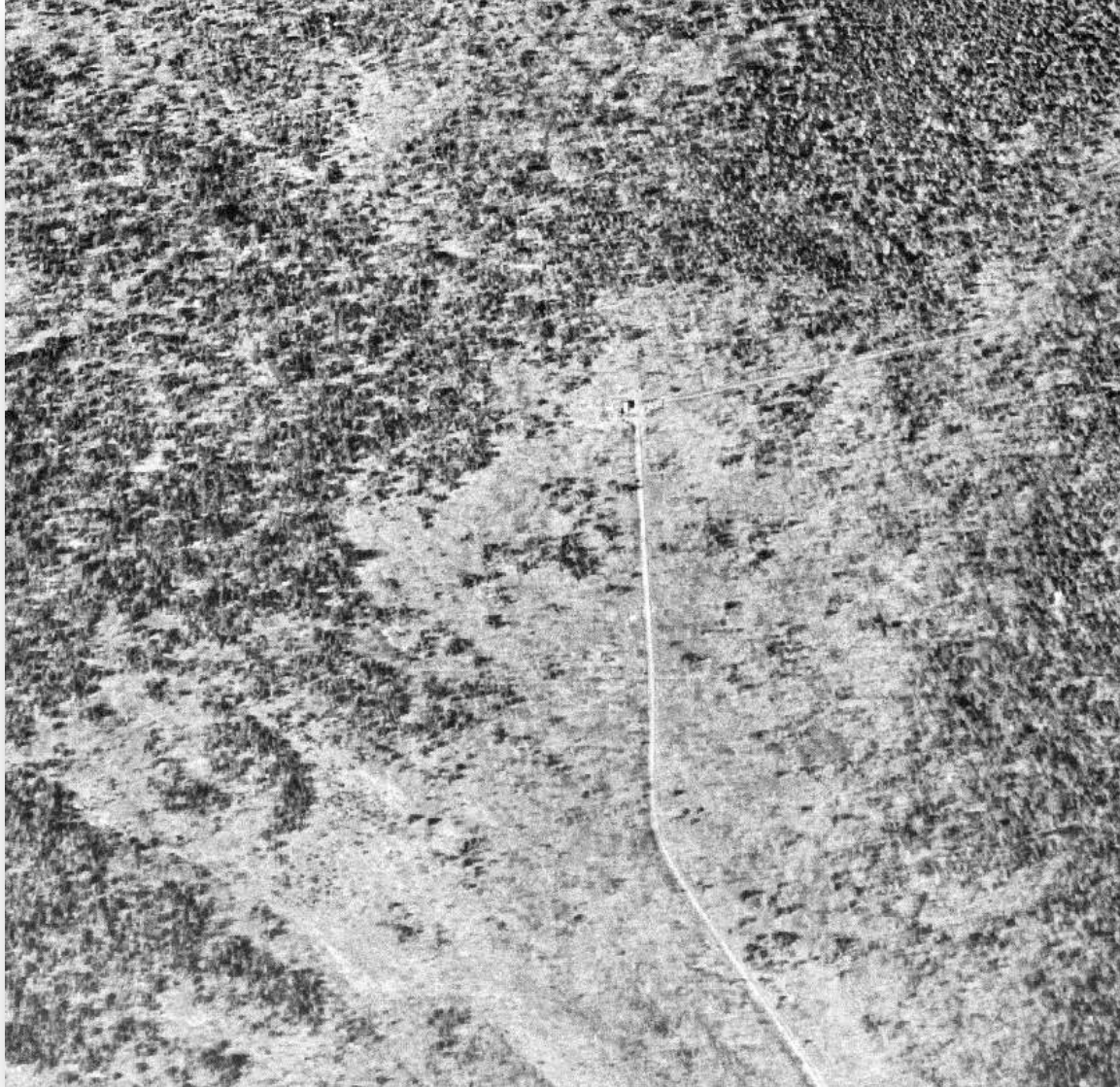
ArcGIS Pro was used to georeferenced aerial photos, digitize and mark areas of hazards, and derive products from the LAS file. With this information, 3D models of the known buildings (buildings that are intact as of 2012) can be created, and visualized.

ERDAS Image was used to compose 3D stereo pairs to better visualize some of the marked environmental hazards.

Data

Data used for this project were aerial photos from USGS's Earth Explorer, LiDAR LAS file from MnTOPO, and images and information about the site from radomes.org, and fortwiki.com.

1951 v. 1954



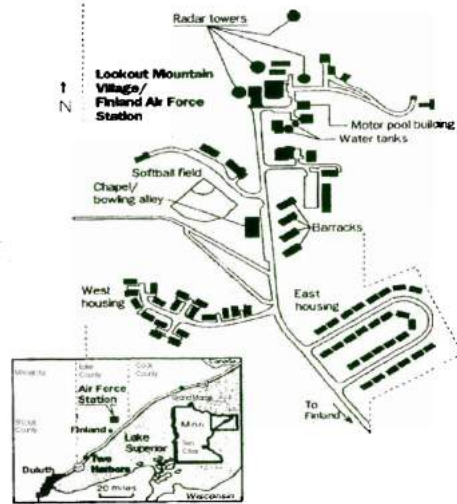
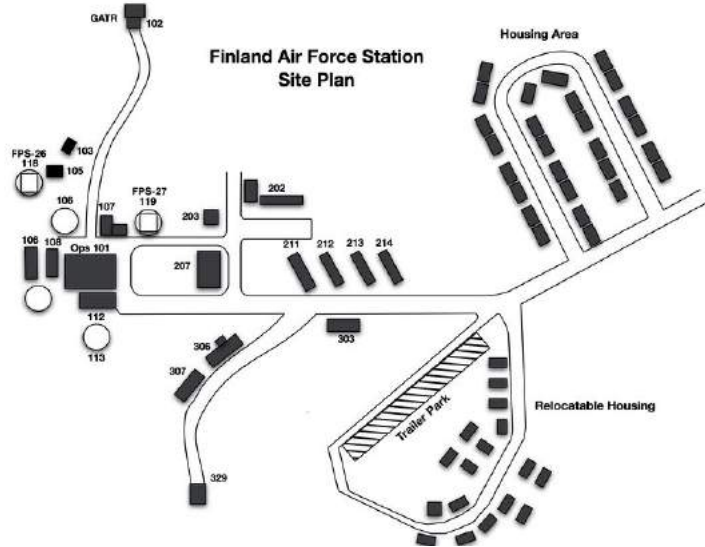
1977 v. 2018



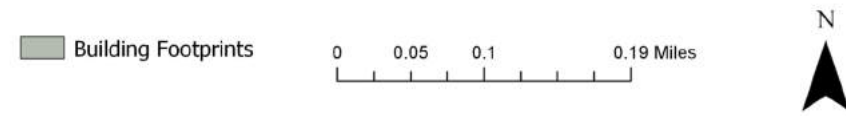
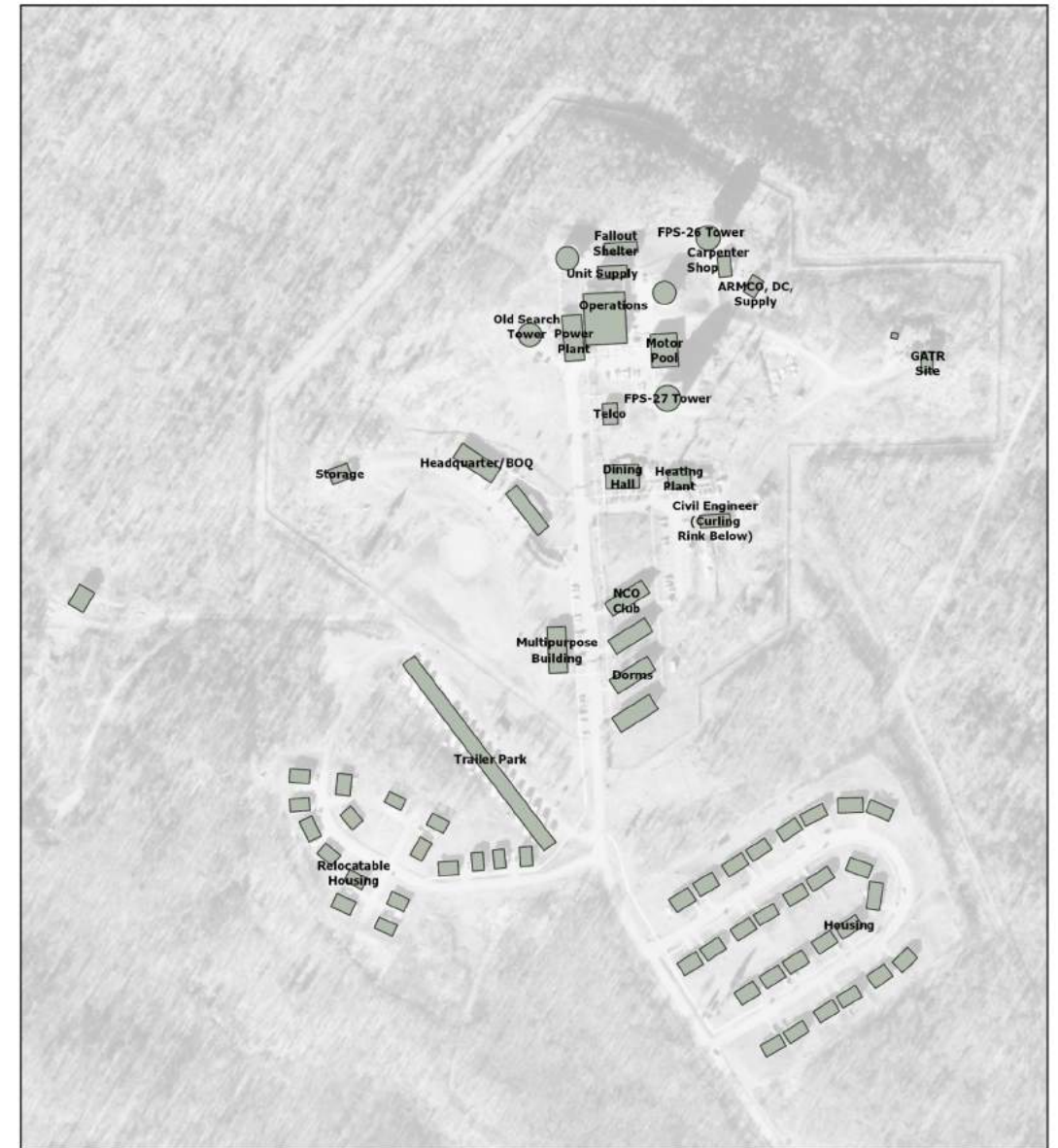
Building Usage

A site plan of the air force station was found on fortwiki.com. This contained both the map and key. Some of the items were missing, but much of the site was able to be classified.

Using ArcGIS Pro, digitizing and attributes were able to be created to form this map.

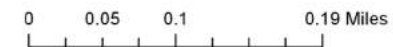
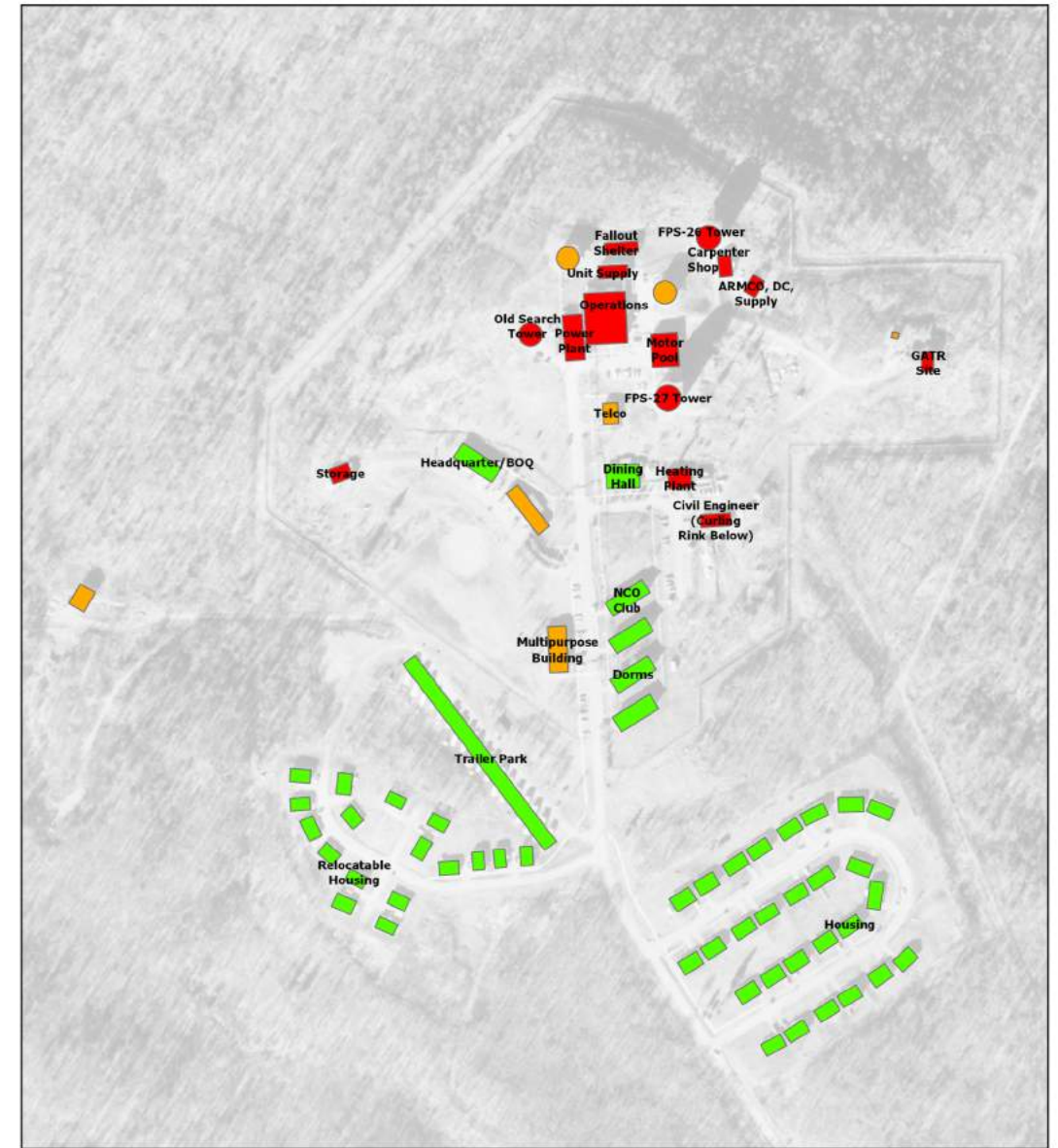


Building Usage of Finland AFS



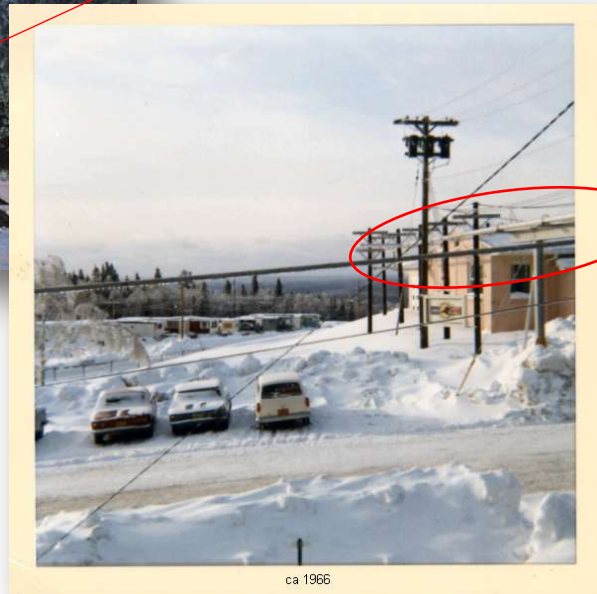
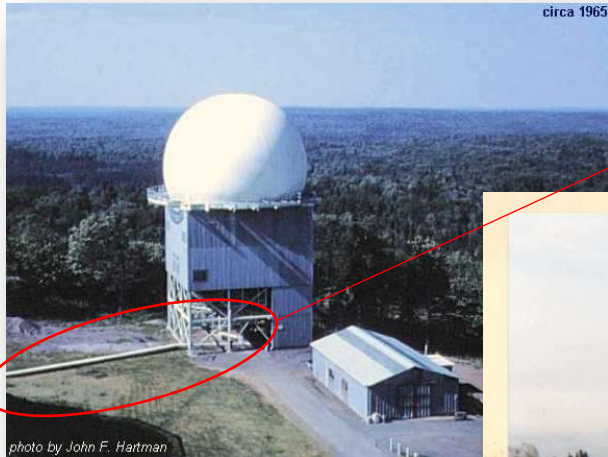
Building Hazards

Based off of the previous building usage map, an assessment of whether a building would have any sort of hazard was completed. This is confirmed, but is able to give an idea of points of interest to conduct further testing.

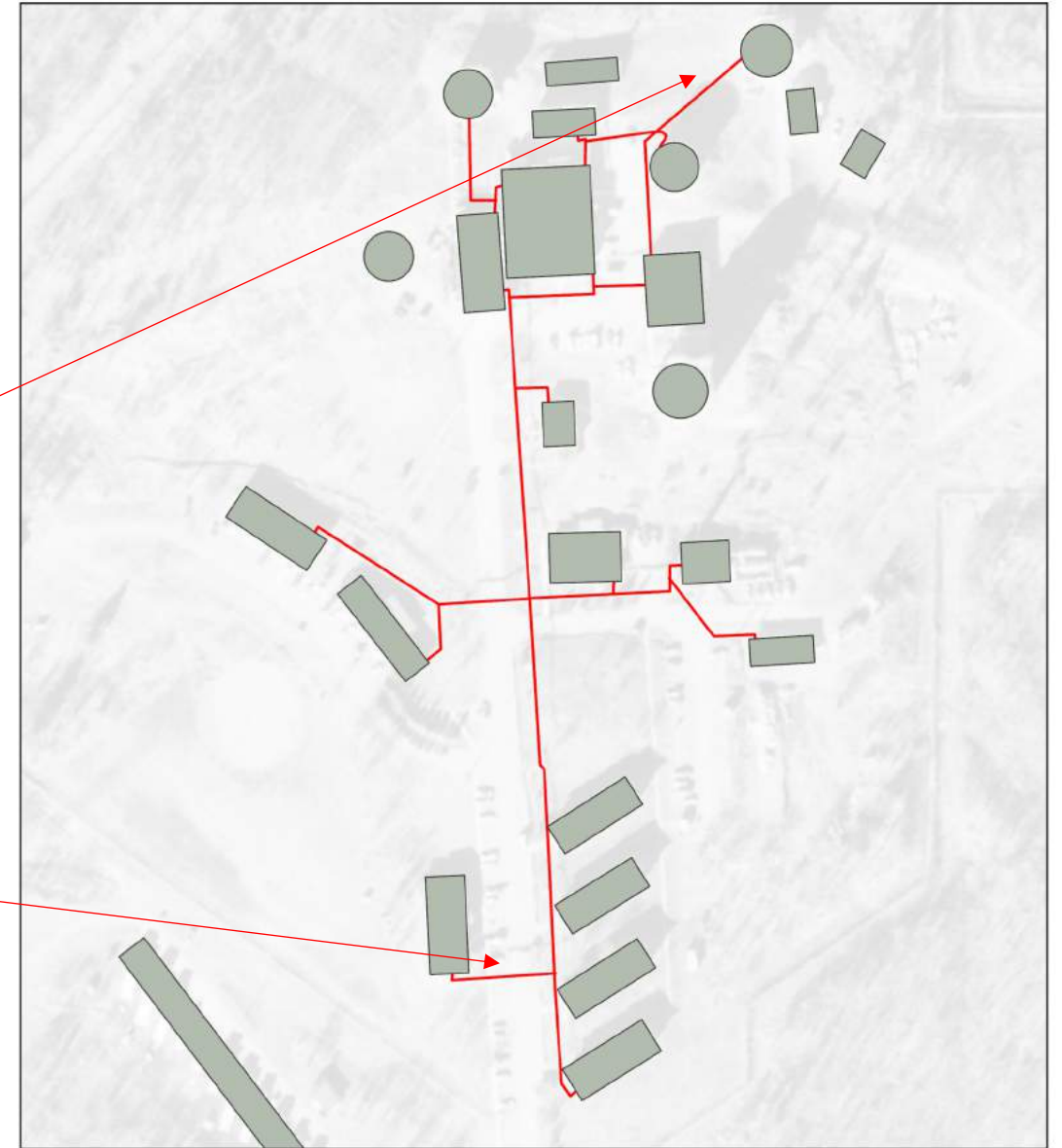


Pipelines

The site has pipes running around the base, which due to the time of construction, there could be a chance of asbestos contamination.



Possible Pipe Contamination Source

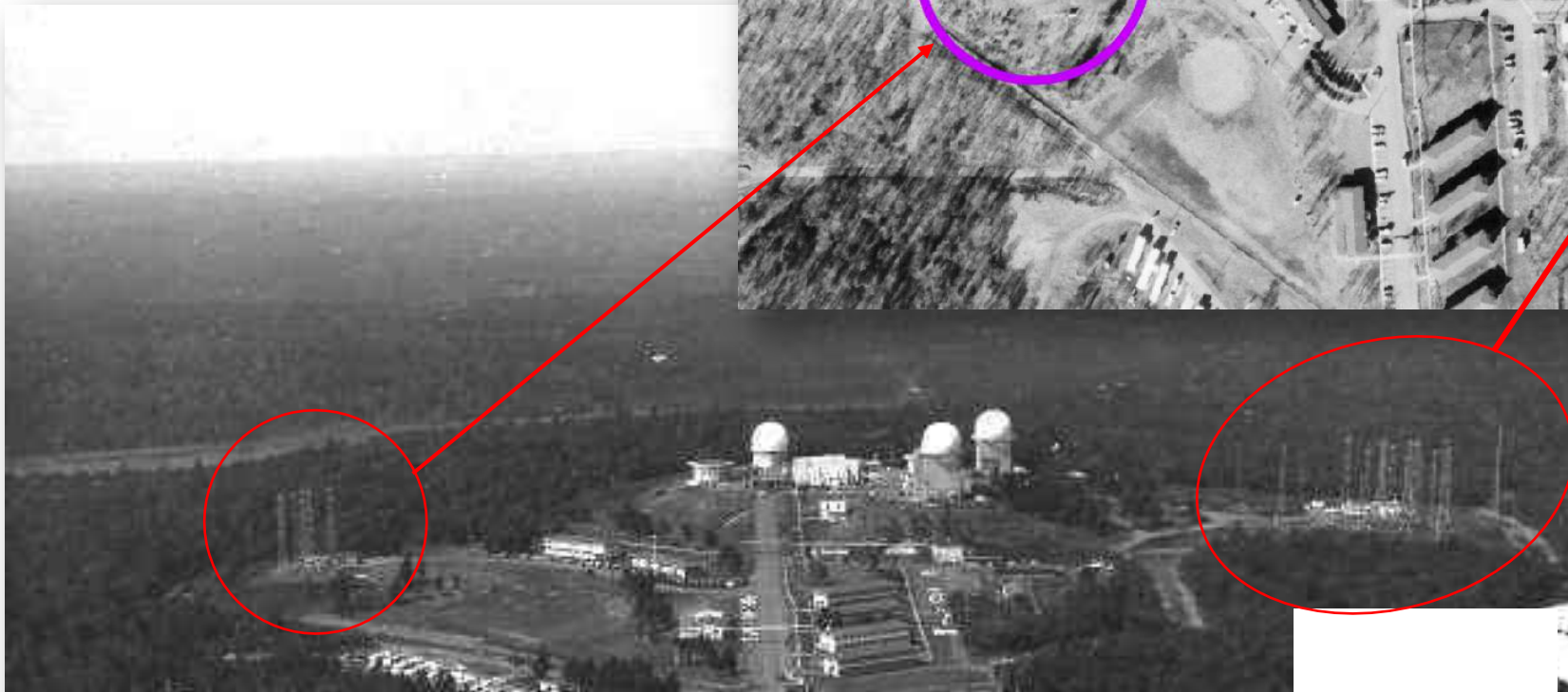
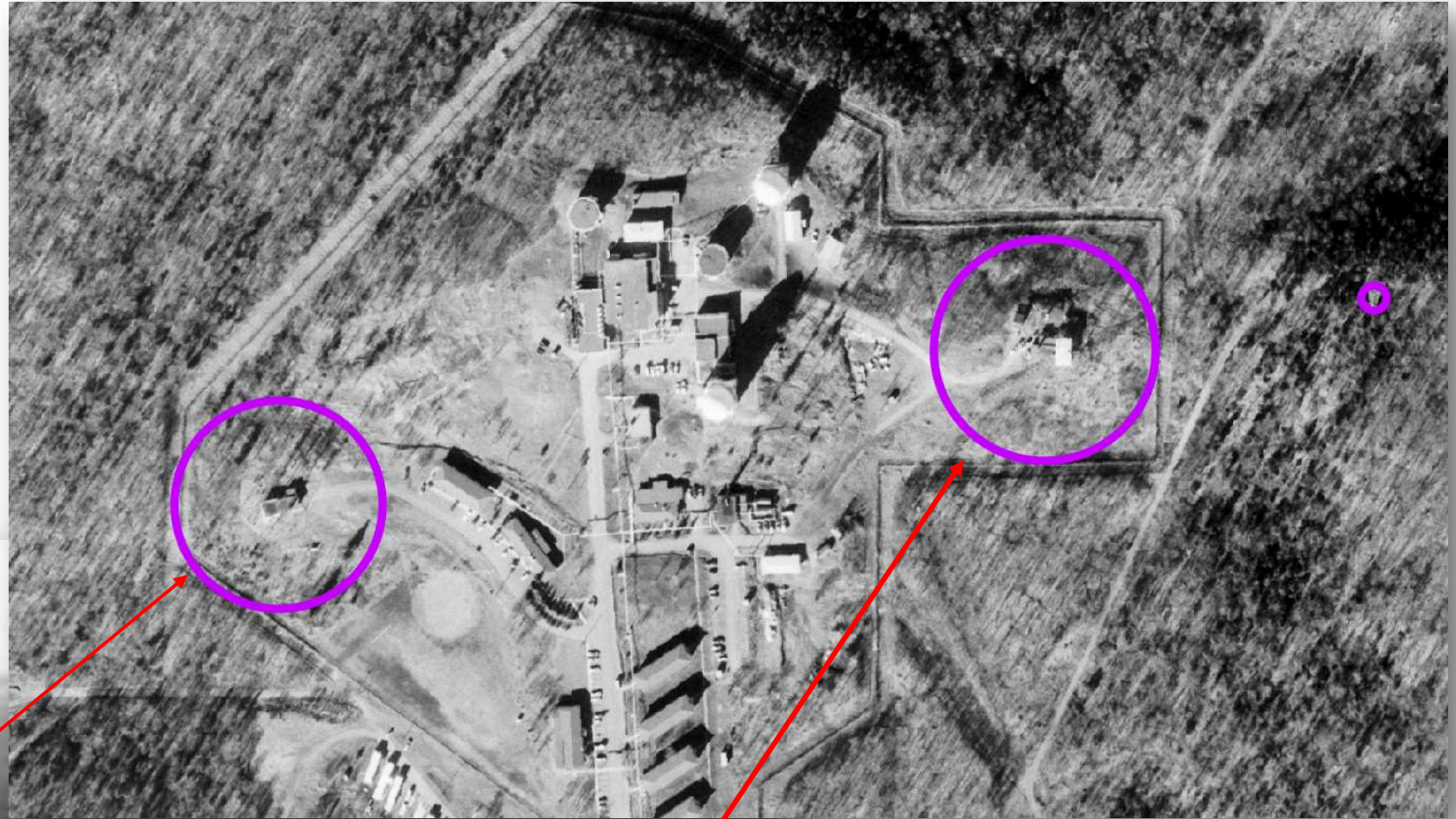


0 0.02 0.04 0.09 Miles



Antennas

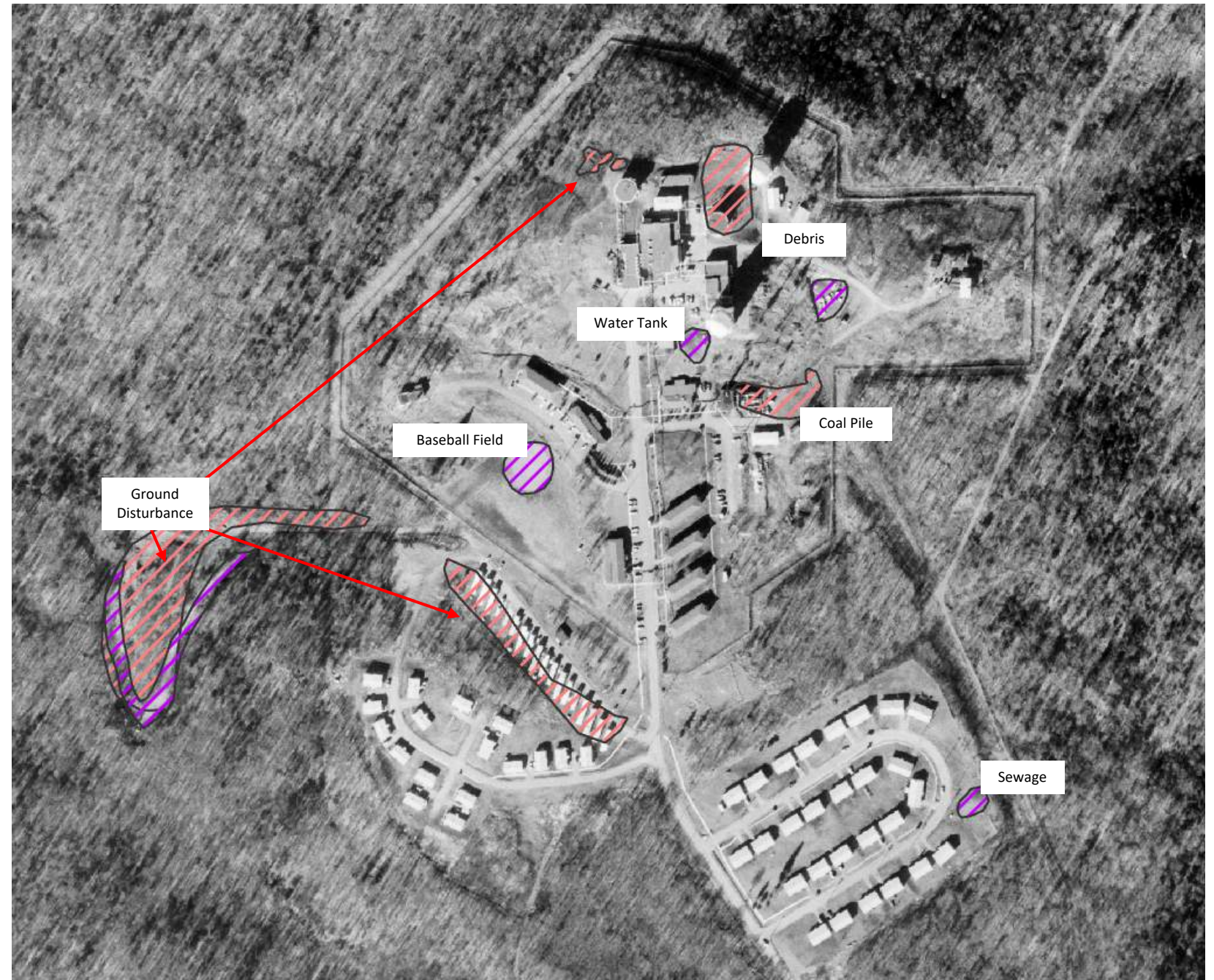
There are two main locations where there are many antenna towers in one spot. One of these spots is the Ground Air Transmit Receive (GATR) location.



Ground Disturbance and Debris

Suspicious locations of ground disturbance or debris were mapped from 1954 and 1977 air photos. Locations can be seen better in stereo pairs in the subsequent slides.

-  Disturbances_1954
-  Disturbances_1977



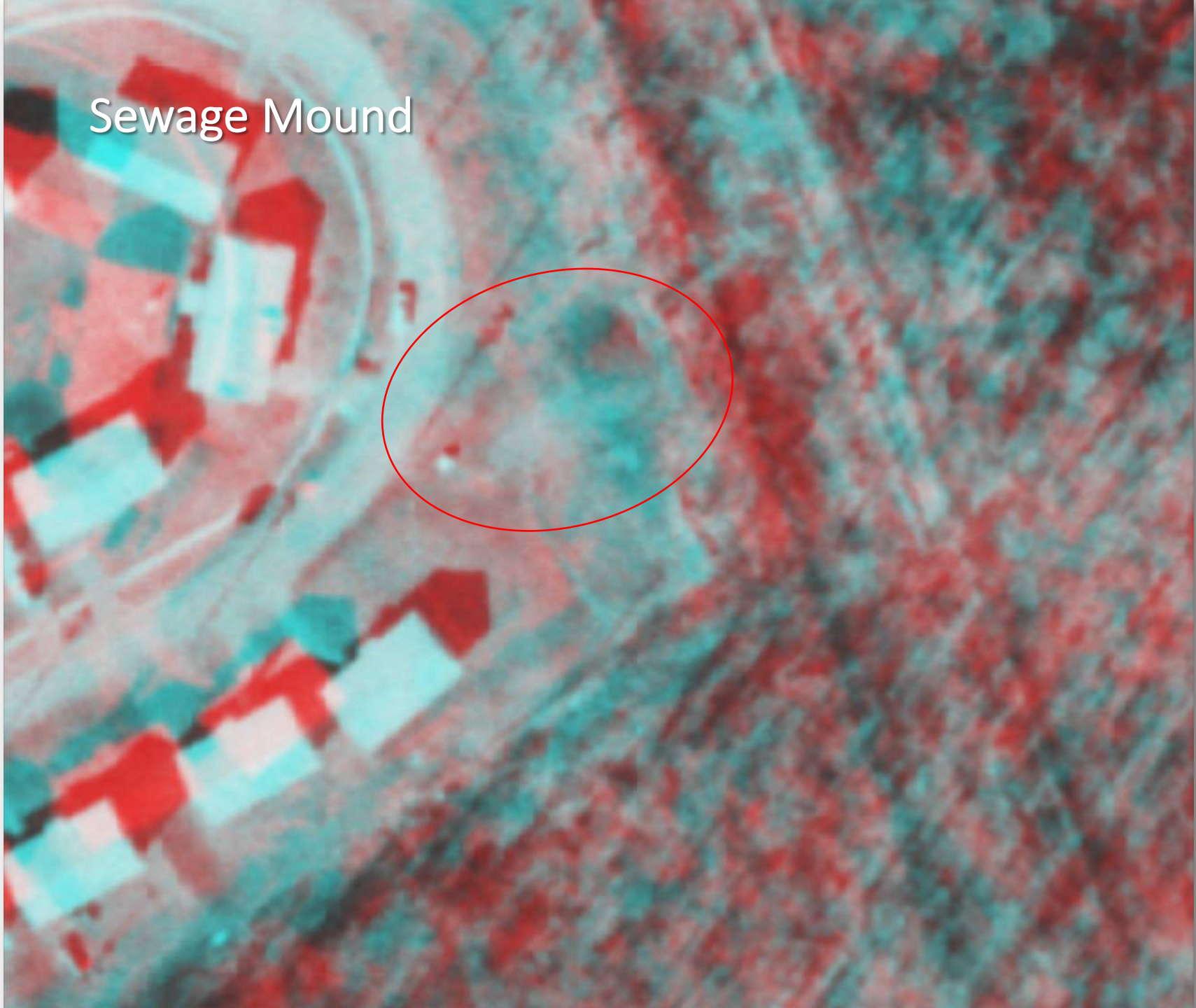
+ Stereo Photos of Heating Plant



Stereo Photo of
Water Tank



Sewage Mound



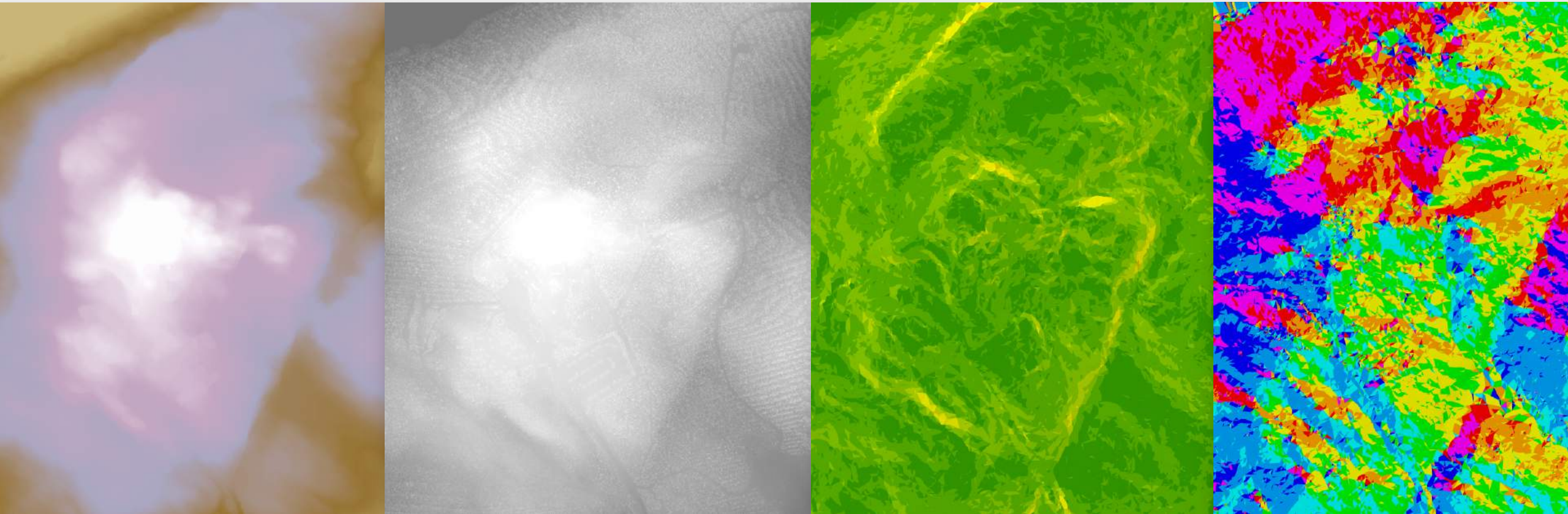
Issue for Present/Future

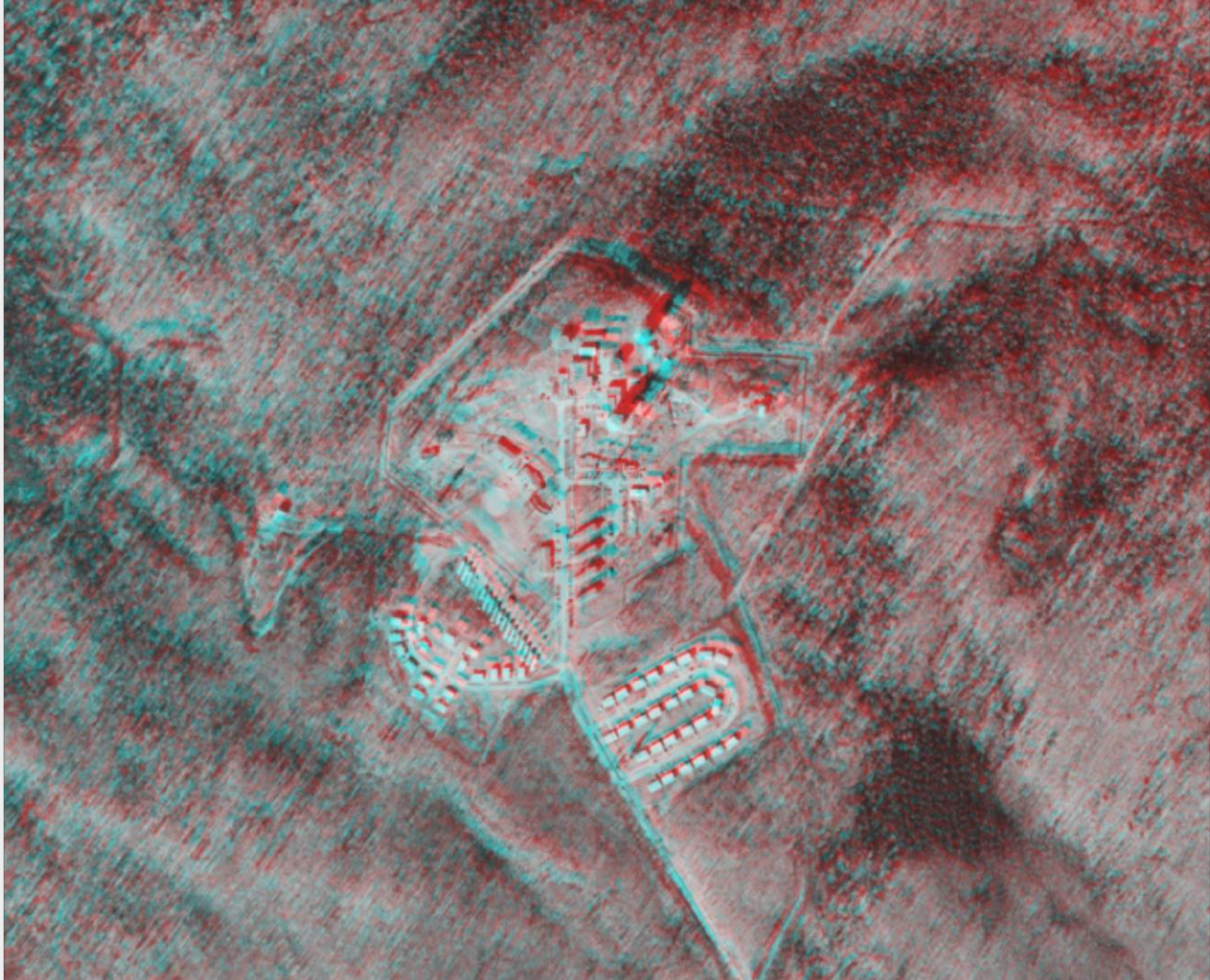
There appears to be
natural gas tanks
supplying energy to all the
eastern most households.

Should be kept in mind for
the future, as to not have
any other issues like
previously.



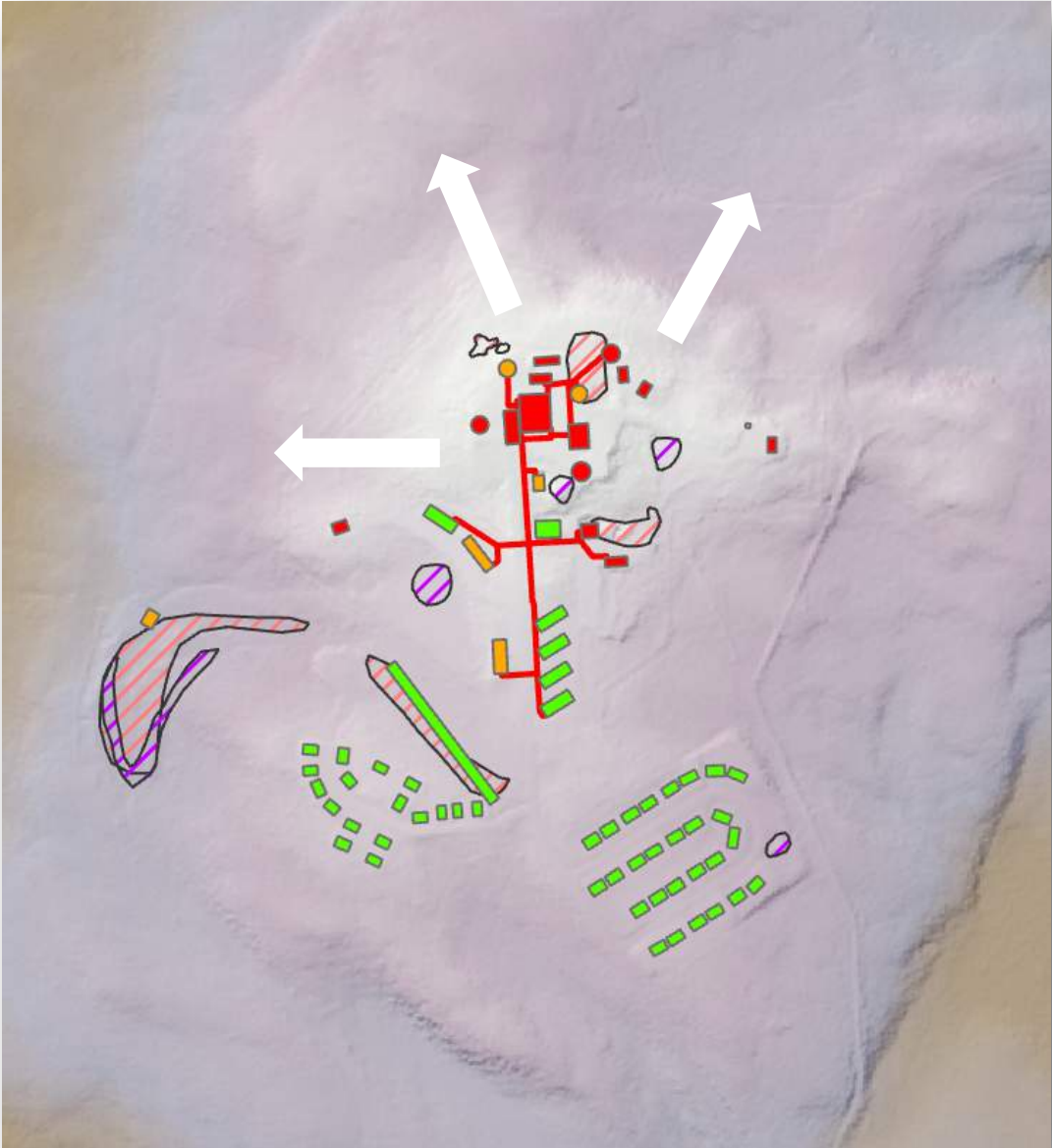
DEM, DSM, Slope, and Aspect





Elevation in Relation to Hazards

The Air Force Base is located on a peak of elevation, which could bring possible issues with downhill runoff from possible contaminates or leakages.



- Pipes
- Hazard
 - No
 - Unknown
 - Yes
- ▨ Disturbances_1954
- ▨ Disturbances_1977

Elevation in Relation to Hazards

— Pipes

 Disturbances_1954

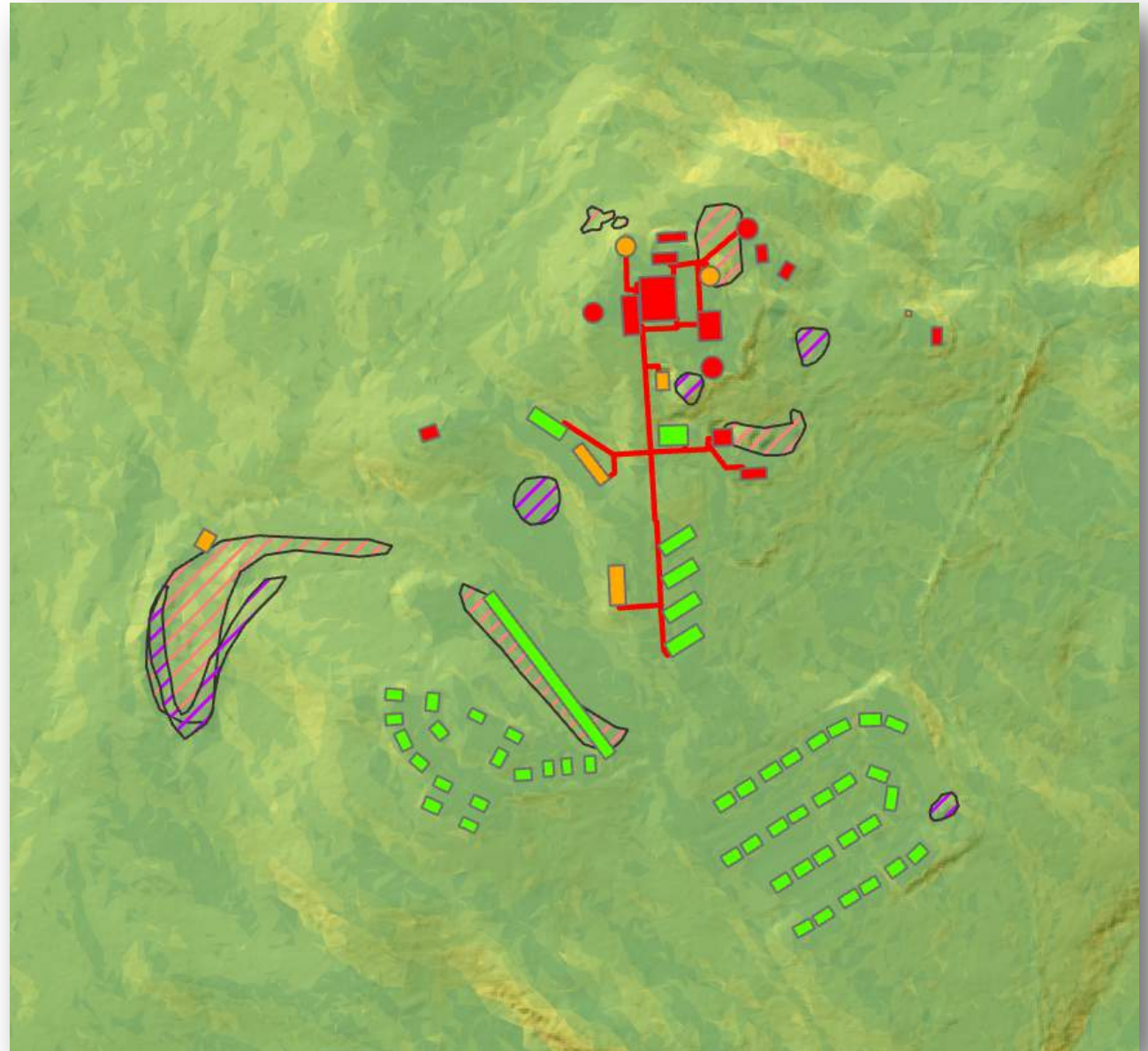
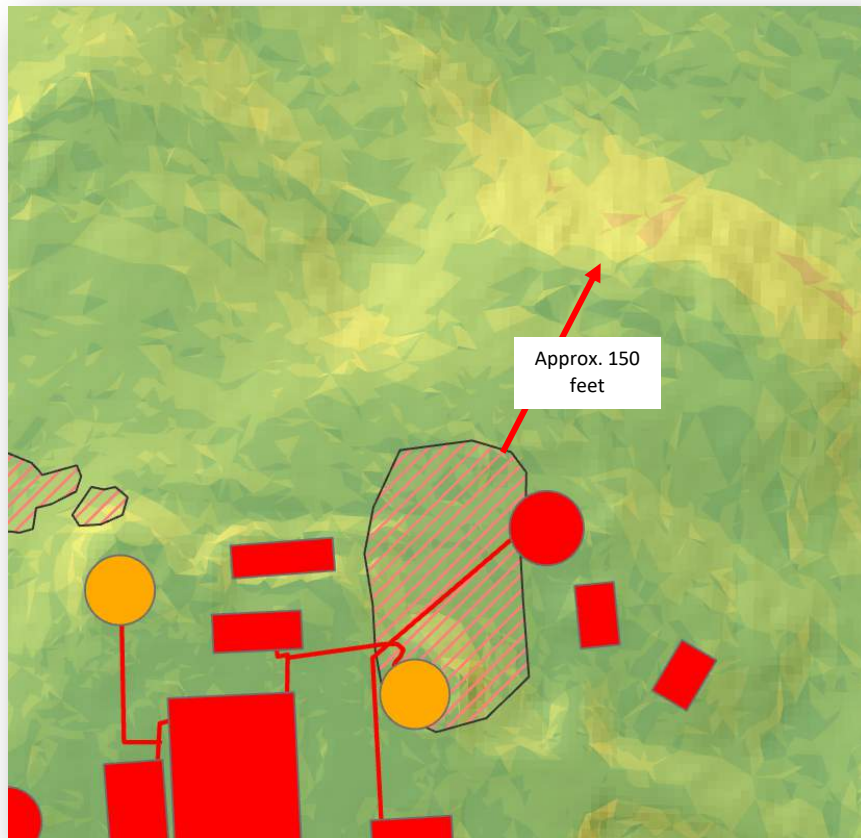
 Disturbances_1977

Hazard

 No

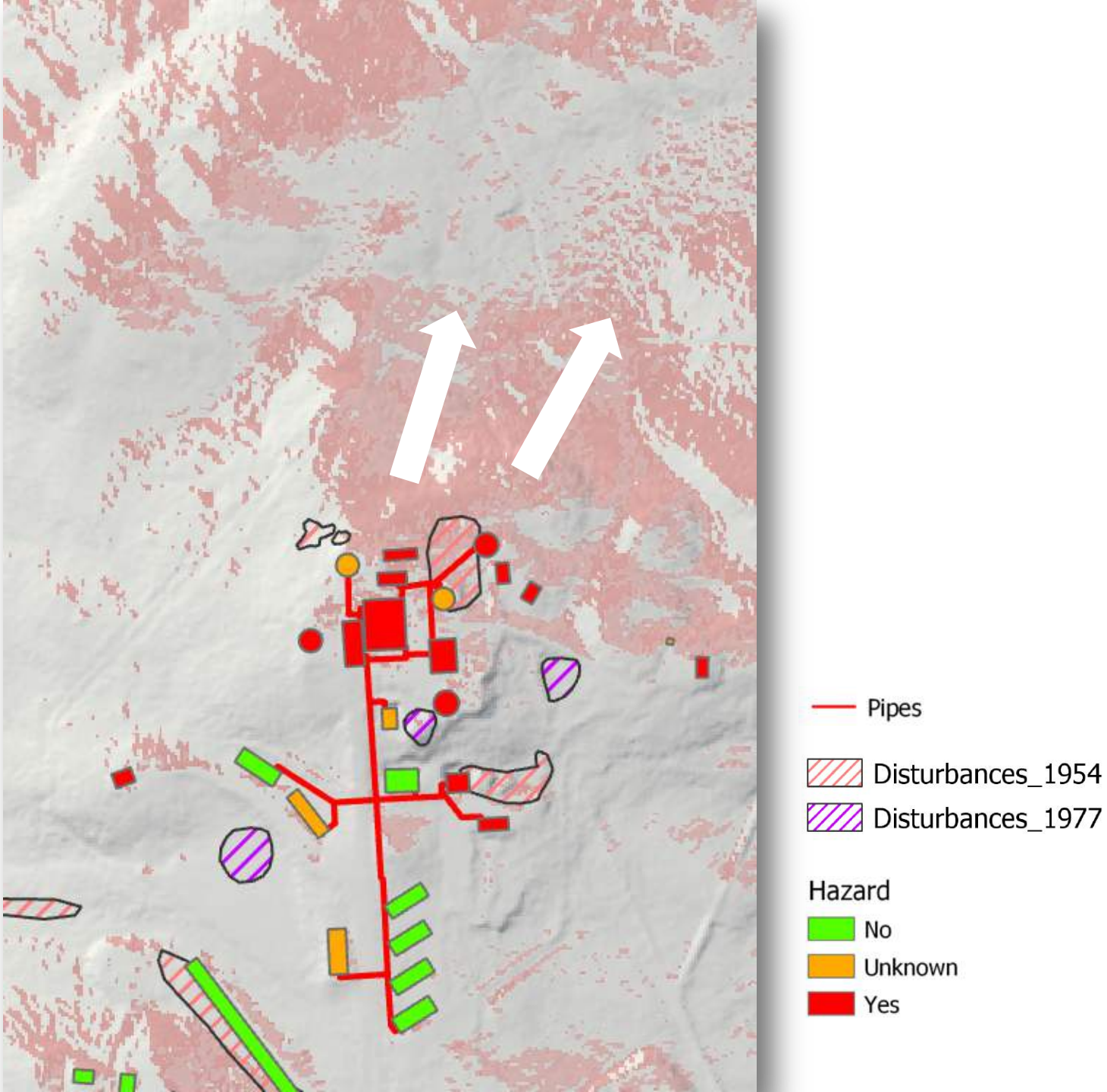
 Unknown

 Yes



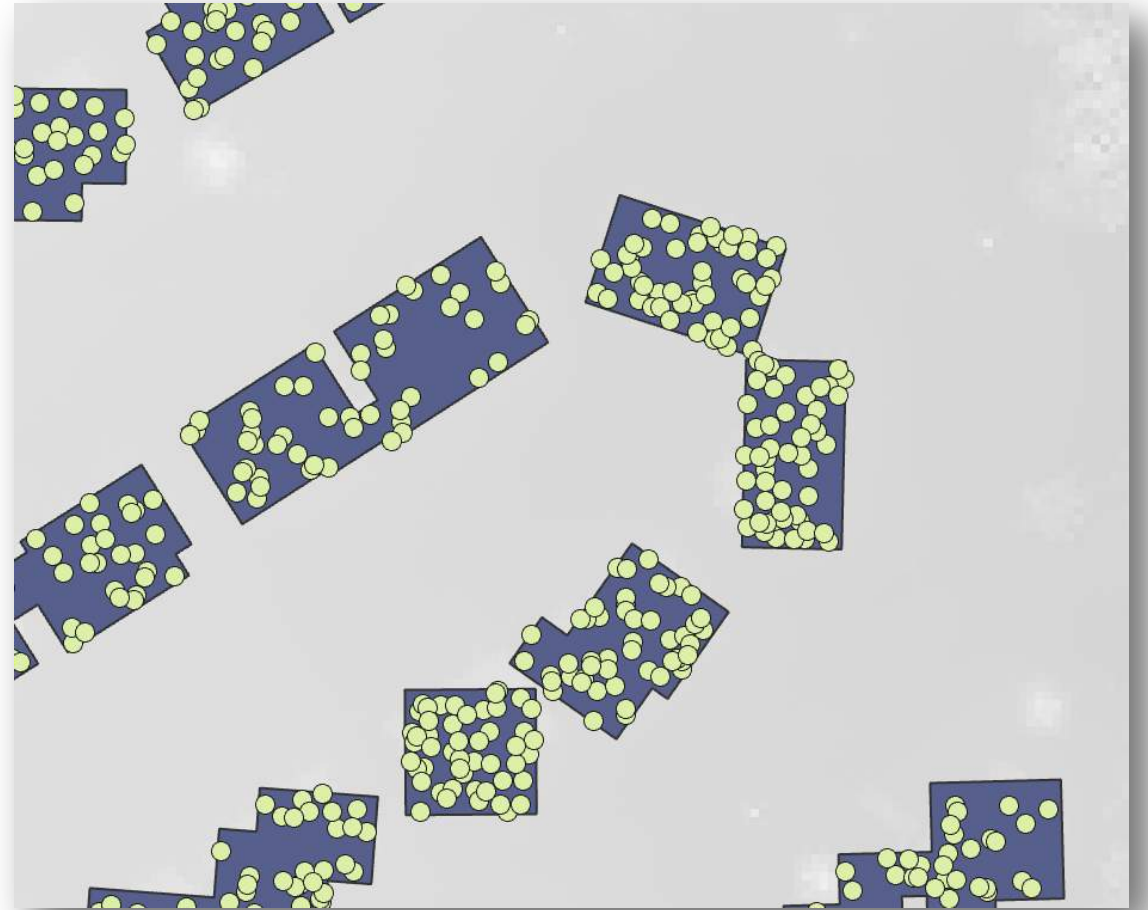
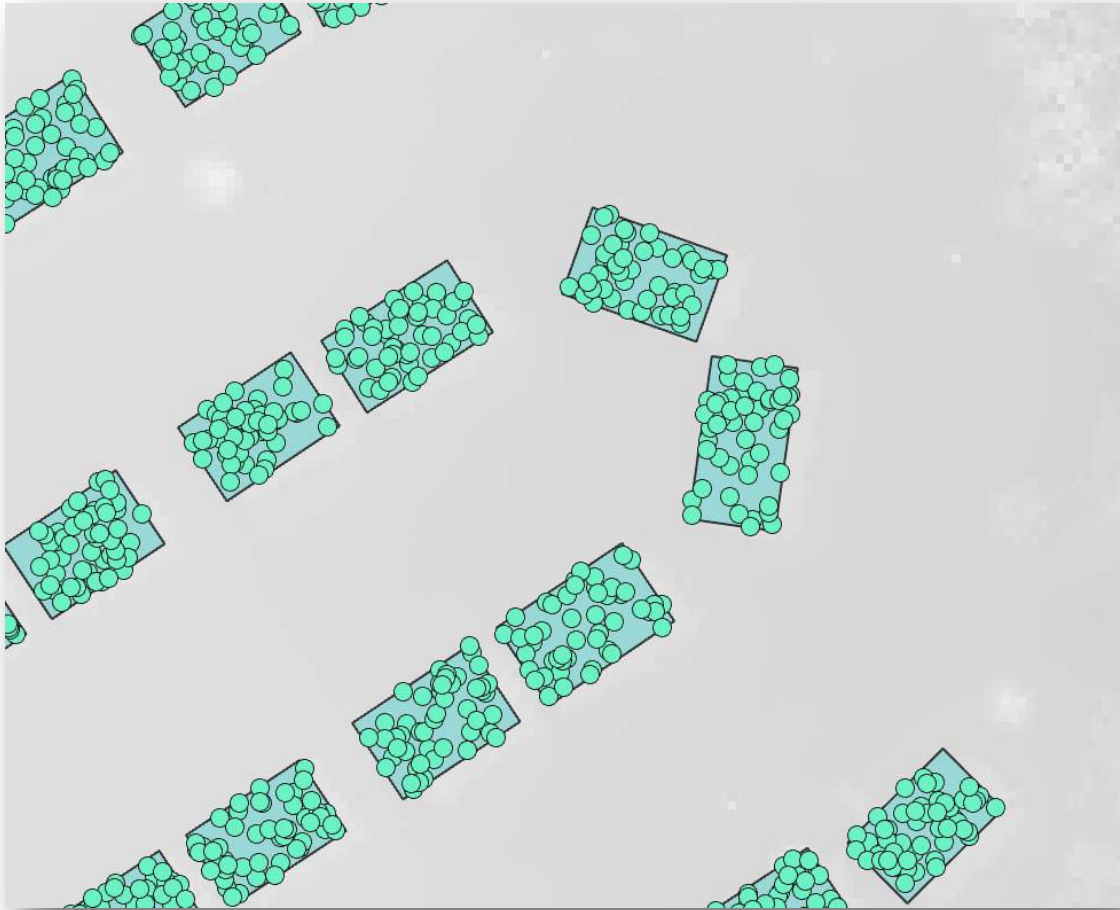
Elevation in Relation to Hazards

The red raster are aspects facing NW, N or NE. With the base being located at a peak in elevation, and with the concentration of concern being next the slopes, this aspect map confirms a it could have impacts downhill.



Automated v. Manual Building Footprints

Extrusion (Random Points, and Summary Statistics)



Automated v. Manual Building Footprints

Two methods were used to extract building footprints, one being hand digitizing of known buildings (mainly from 1977 aerial photo), and the second being using building returns from 2012 LiDAR data, and exporting them to rasters, and then to regularized polygons.

Both methods found an average height of the building by creating random points in the polygon and doing summary statistics with the points in relation to the DSM derived from the 2012 LiDAR data.



Automated v. Manual Building Footprints

3D Visualization w/ DEM and 3D Buildings



After the fact....

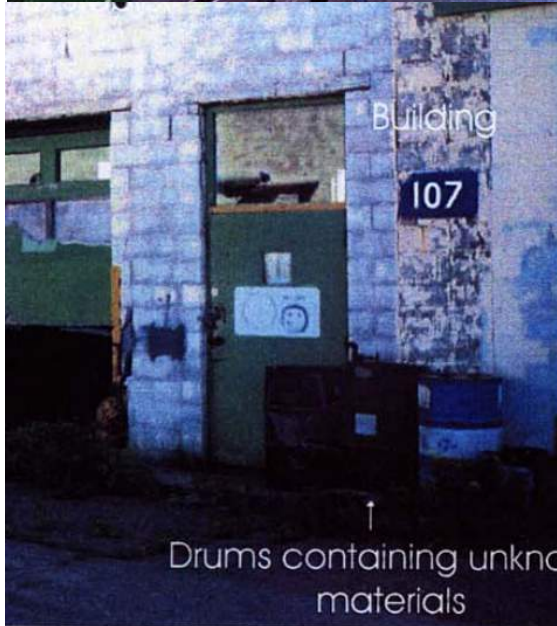
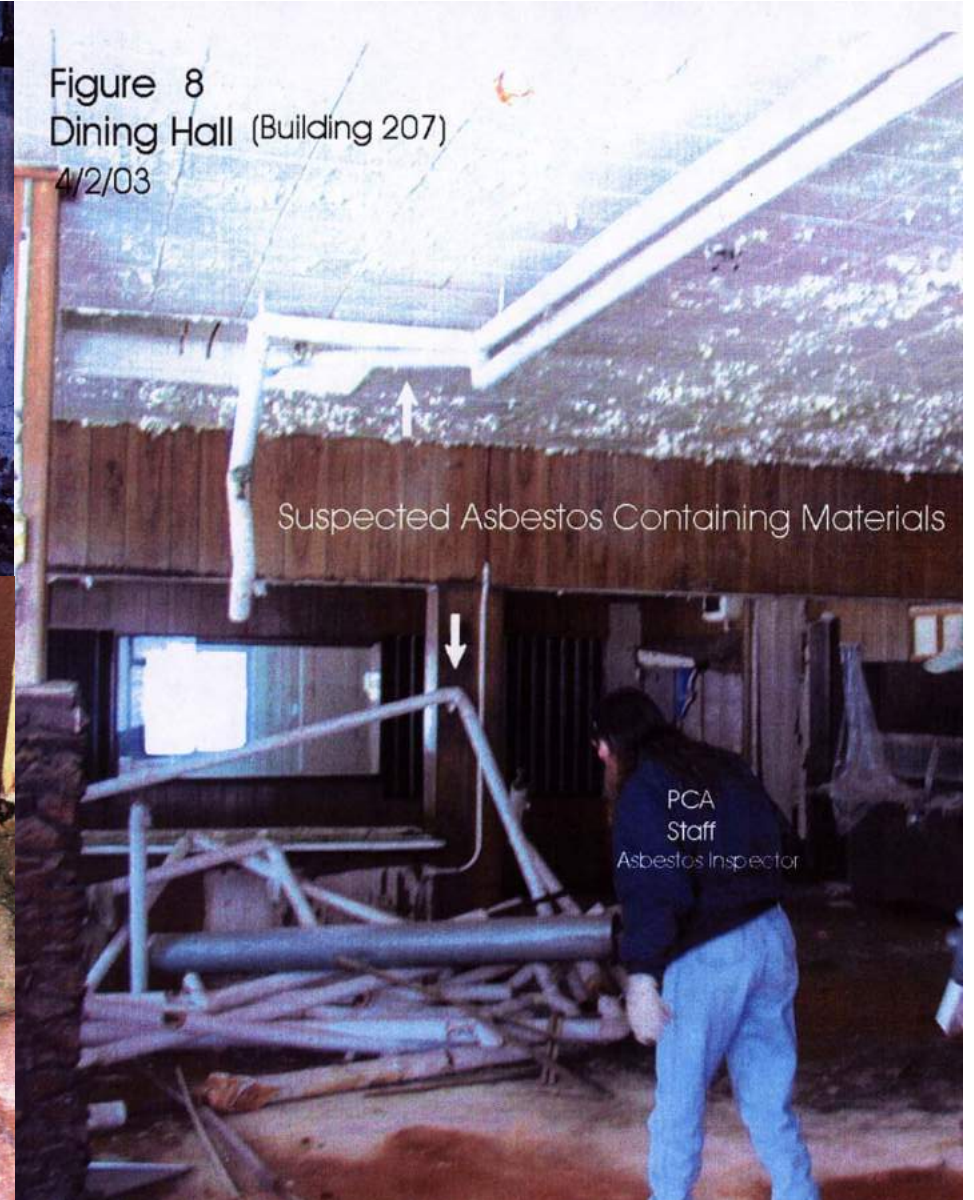
Figure 4 Building 203 (Heating Plant)
Suspected Asbestos (April 2002)



Figure 6 Building 203 (Heat Plant)
Suspected Asbestos From Boiler
(9/4/03)



Figure 8 Dining Hall (Building 207)
4/2/03

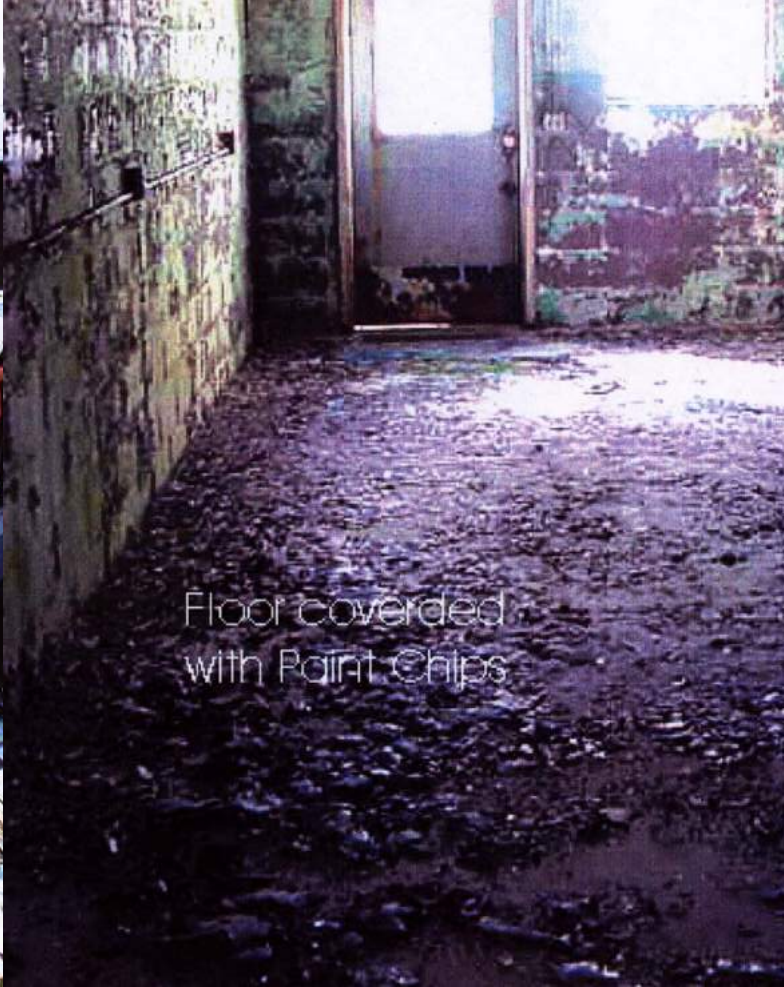


↑
Drums containing unknown materials

Building 107
Suspected
Asbestos
Containing
Floor Tiles

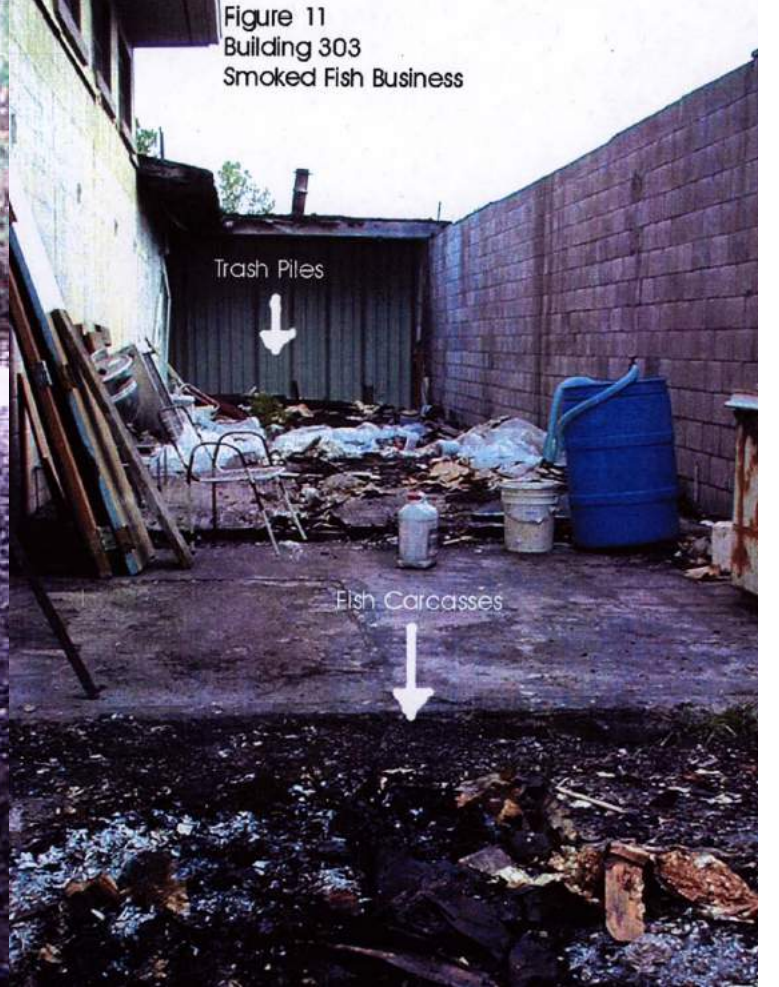
After the fact....

Figure 13 Solid Waste Pile (6/9/03)



Floor covered with Paint Chips

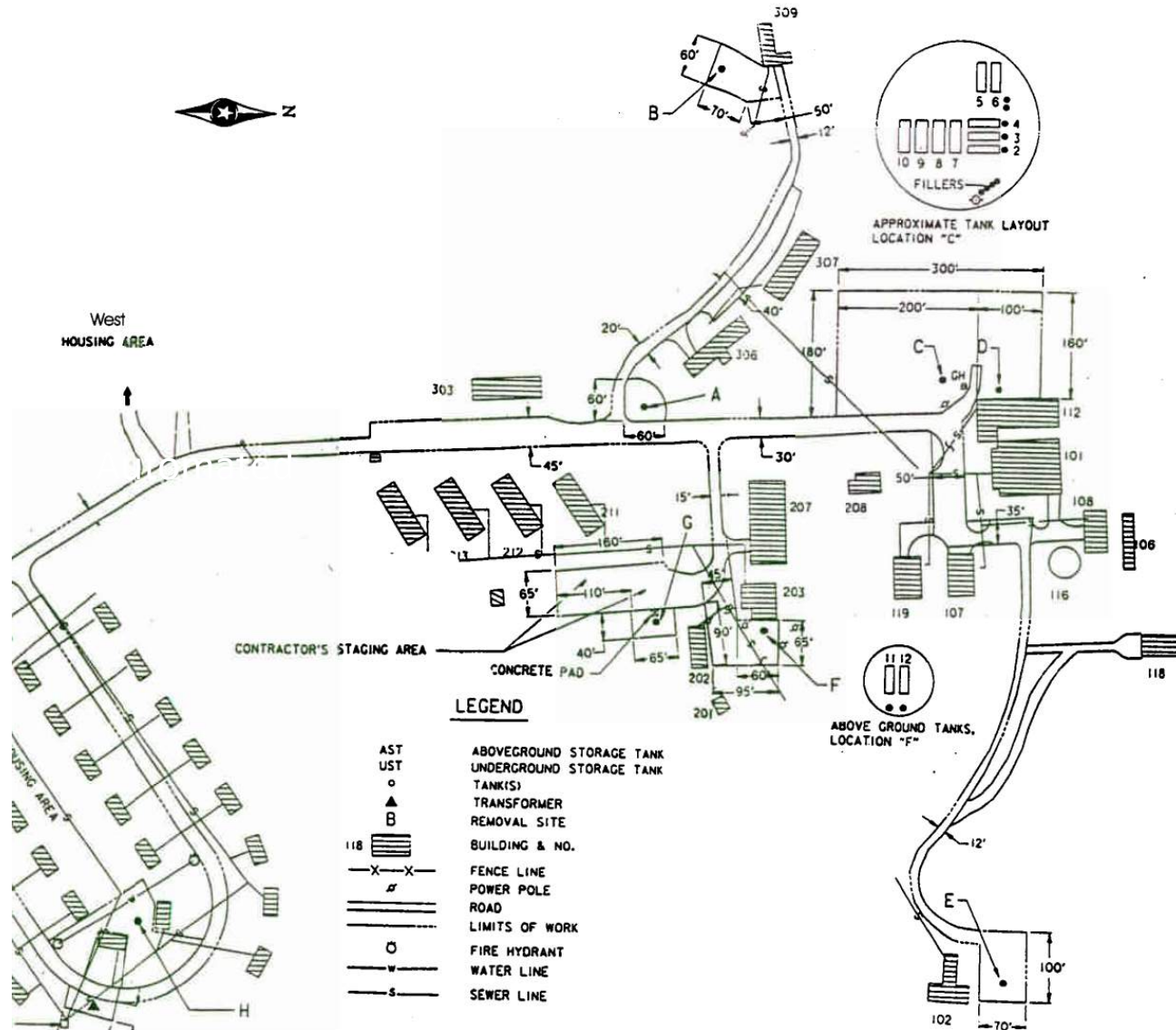
Figure 11 Building 303 Smoked Fish Business



Trash Piles

Fish Carcasses

After the fact....



Sources

- <https://www.radomes.org/museum/documents.php?site=Finland+AF+S,+MN>
- [http://www.fortwiki.com/Finland Air Force Station](http://www.fortwiki.com/Finland_Air_Force_Station)
- <https://earthexplorer.usgs.gov/>
- <http://arcgis.dnr.state.mn.us/maps/mntopo/>