US Army Corps of Engineers®
Buffalo District

DERP-FUDS Fact Sheet

Former Lake Ontario Ordnance Works
Niagara County, New York

Historical Aerial Photograph Analysis

October 2002

This fact sheet was compiled to present information about the historical aerial photograph analysis of the former Lake Ontario Ordnance Works (LOOW) located in Niagara County, New York.

What is the Lake Ontario Ordnance Works?

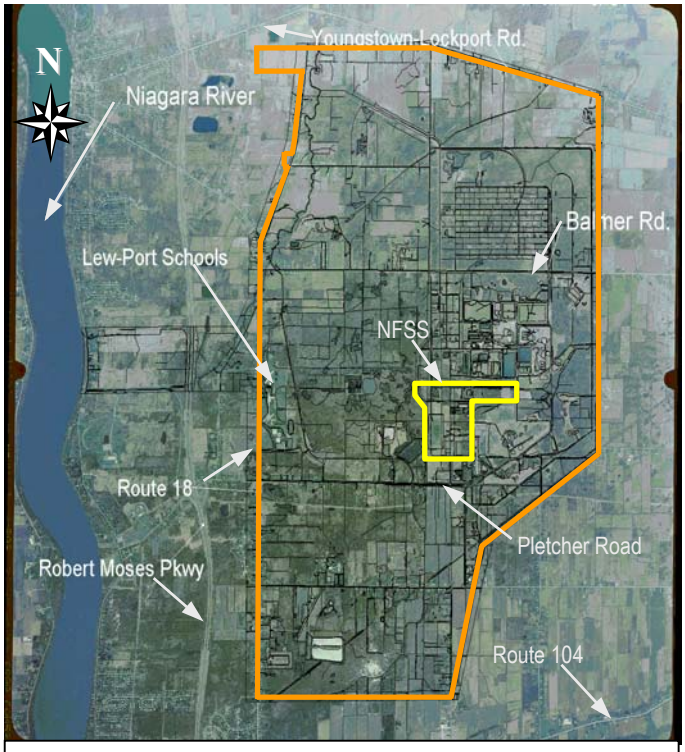
The former LOOW is a 7,500-acre Formerly Used Defense Site (FUDS) located in the towns of Lewiston and Porter, New York. The former LOOW was built for the purpose of manufacturing trinitrotoluene (TNT) during World War II. The TNT production, production support, and storage areas were constructed on approximately 2,500 acres. The remaining 5,000 acres, located to the west of the production area, were left undeveloped. Since the 1940s, the government and private landowners have used the 2,500-acre former TNT production and storage area for various activities, including: borane fuel plants (Air Force Plant [AFP]-68), a Navy Interim Pilot Production Plan (IPPP), jet engine testing facilities (AFP-38), a Nike missile facility, chemical and radioactive waste storage facilities (Niagara Falls Storage Site [NFSS]), municipal and hazardous waste landfills, and the testing of experimental communications equipment. As Department of Defense (DOD) operations decreased, the property was sold. Environmental investigations have confirmed Department of Defense-related contamination in several areas. Current owners of the site include local and federal government, individual private residents, and private corporations.

The Manhattan Engineer District and its successor, the Atomic Energy Commission (AEC), used portions of the former LOOW for storage of radioactive wastes from approximately 1946 to 1974. These wastes were primarily residues from uranium processing operations. A 191-acre portion of the site is currently owned by Department of Energy and radioactive waste is stored there. This facility is known as the Niagara Falls Storage Site (NFSS), and is being addressed under the Formerly Utilized Sites Remedial Action Program.

What are aerial photographs?

Simply stated, aerial photographs are photos taken from above the Earth's surface. Attempts to photograph the surface of the Earth date from the 1800's, when photographers attached cameras to balloons, kites, and even pigeons. Today, aerial photographs taken from airplanes and satellite images are commonplace.

The majority of aerial photography is used for cartographic (mapping) purposes. Image distortion is minimized when photographs are taken looking straight down or vertically. Aerial photographs are sometimes taken by looking out the side of an aircraft at an angle to the ground surface. These types of photos are known as oblique aerial photographs or obliques. Obliques are typically acquired at a much lower altitude than vertical aerial photographs and, as such, often show much greater detail over a smaller area.



Former LOOW Boundary, 1997 – U.S. Geological Survey, aerial mapping photograph

What aerial photographs exist and where can they be found?

The United States Geological Survey (USGS) maintains the National Land Remote Sensing Data Archive which includes some 8 million aerial photographs of the United States, some dating to the 1940's. More recent photos are standardized under the National Aerial Photography Program (NAPP) in which the entire country has been photographed every five to seven years since 1980.

The National Archives and Records Administration (NARA) holds an extensive number of historical records. NARA makes these records available to the general public, government officials, and scholars. Among the records in the Cartographic and Architectural Branch of NARA, College Park, Maryland, are over 15 million maps, charts, aerial photographs (civilian and military-flown), and other types of cartographic documents.

NARA holds and preserves aerial photography flown by the U.S. military. These holdings are researched through the use of a geographically based finding aid. Flightline indexes are "pulled" and examined for available coverage of either vertical mapping photography and/or oblique reconnaissance photography. Canisters of aerial film containing rolled film negatives are then located, identified, and pulled for later examination by the researcher. If required, photo reproductions are ordered through a NARA-approved contractor.

How are aerial photographs analyzed?

The analysis of aerial photographs should be performed by individuals specifically trained to do so. These individuals know how to look at aerial photographs, using appropriate devices and technologies, to determine: natural and man-made surface features, areas of disturbed ground (i.e., ground scars), evidence of vehicle tracks and other activities, changes to a given area over time, and land use patterns.

A primary tool used in analysis are historical aerial photographs. These are viewed in stereo or "3-D" in order to see trenches, pits, impact craters, structures, sinkholes, etc. Analysts often look at hundreds to thousands of photos for a site (depending on site size and years of coverage). Maps and documents (such as the Corps' Archives Search Report or ASR) are also reviewed to support the analysis.

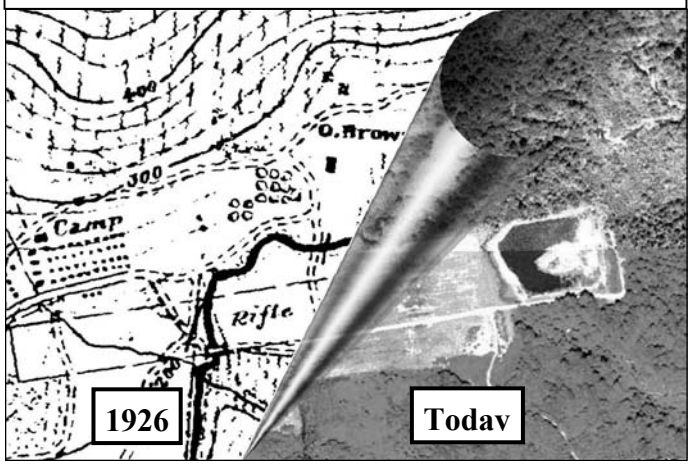
Stereoscope

One very effective method to determine the effects of humans and nature is to compare aerial photographs of an area taken at different times. This can reveal surface features such as new roads, pipelines, and structures, the expansion or reduction of open/wooded areas, ground scars, changes to creeks and streams, earthmoving activities, and property boundaries.

The use of Geographic Information Systems or GIS is a primary component of the work and allows customers to view multi-layer "time-sequenced" data in a digital environment. Features or possible areas of concern (AOC) are mapped on the historical aerial photos and then transferred to a digital, historical aerial photo map. Existing current, digital aerial photo maps (orthophotos) are used to register all of the data.

Using the tools of a GIS, the historical features can now easily be superimposed onto a current orthophoto of the site. Mapped features will have a high degree of relative accuracy (i.e. an object is within a few feet relative to an adjacent object). Geographic positional accuracy will vary according to the orthophoto source.

"Discover the Past"



Several factors can affect the time required to conduct research on historical aerial photography at NARA. Some of these factors include: 1) size of the project area, 2) identification of frames required to completely cover the project area, 3) the desired scale of photography, and 4) loss of aerial photographic coverage due to cloud cover.

What are the limitations to aerial photograph analysis?

Aerial photographs are useful for illustrating large-scale surface features and for showing how those features may change over time. However, an aerial photograph, like any other photograph, is just that – a snap shot in time. Activities such as movement of people or vehicles, or storage of materials that do not significantly alter the ground surface, that occurred between the time photographs were taken will not be evident. Only those activities that were occurring at the moment the photograph was taken will be revealed.

A second limitation of aerial photography analysis is that even though ground scars and other areas of disturbed ground can be identified, it is not always obvious what caused them or what their purpose was.

The scale of the photograph often limits determining surface features from aerial photographs. Since most aerial photographs are taken from a high altitude, the scale of the photos is usually quite large. This makes it difficult to enlarge the photo to zoom in on a specific surface feature without losing the picture quality.

The current use of buildings and other structures may not be evident from aerial photographs. It usually cannot be determined from aerial photographs whether a building is occupied or vacant, used for storage or empty.

Former LOOW Administrative Buildings, 1944 (Oblique) – National Archives, CAB

What aerial photograph analyses have been performed? What were the results?

***History Search Report*, EA Engineering, Science, and Technology, August 1998**

In 1997, the USACE initiated a site-wide remedial investigation/feasibility study (RI/FS) at the former LOOW. The purpose of the project was to assess potential environmental impacts to the former LOOW site resulting from DOD use of the area. The history search was performed to develop an understanding of the types and locations of past operations, which occurred on the former LOOW. The information gathered in the History Search Report formed the basis for identifying possible areas of DOD concern that would be investigated during the RI/FS.

An interpretation of aerial photographs was included as part of the history search of the former LOOW. Aerial photographs obtained from the National Archives and Records Administration (NARA), U.S. Geological Survey (USGS), and private companies were assessed from representative time periods between 1938 and 1997. These included an aerial photographic survey of the former LOOW which was flown in 1997 under contract with the USACE.

Former LOOW water tower (silo), 1944 (Oblique – National Archives, CAB)

This aerial photograph analysis focused mainly on the 2,500 acres of the former LOOW that had been developed and actively used. The aerial photographs showed that prior to construction of the TNT plant in 1942, the study area consisted of agricultural fields, orchards, and woodlands. The clearing and development of the TNT plant and support areas are evident in 1944 aerial photographs. The western and southern portions of the 7,500-acre area appeared to have remained relatively unchanged during the same period, after which the remaining acreage was sold or transferred. Aerial photographs from subsequent years illustrated the construction and/or removal of structures and roads associated with the various major facilities operating on the developed area. A detailed description of the aerial photograph analysis can be found in Chapter 6 of the History Search Report located on our website, and also in the Administrative Record.

Former LOOW water treatment plant, 1944 (Oblique – National Archives, CAB)

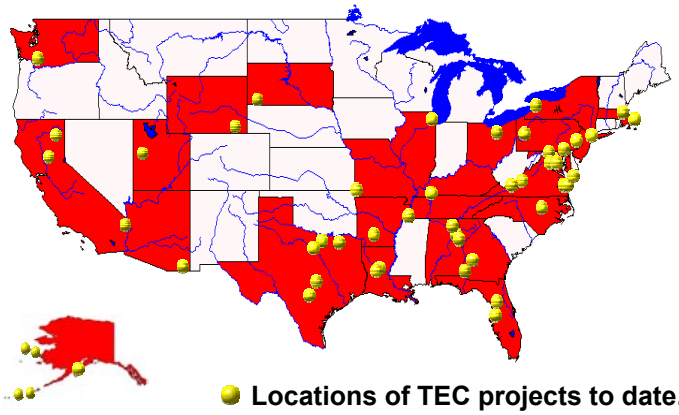
***Historical Photographic Analysis*, USACE Engineer Research and Development Center (ERDC), Topographic Engineering Center (TEC)**

As a result of information obtained from Restoration Advisory Board (RAB) meetings and community members, the USACE is conducting a comprehensive historical photographic analysis of the former LOOW site. The primary focus of this analysis is the undeveloped area of the former LOOW known as the buffer zone, and other areas currently under investigation.

The U.S. Army Engineer Research and Development Center (ERDC), Topographic Engineering Center (TEC), Hydrologic and Environmental Analysis Branch conducts GIS-based Historical Aerial Photographic Analyses of current, closing, and former U.S. Military installations. TEC also analyzes aerial photography to provide information for sites with other environmental concerns. These include riparian analysis, groundwater contamination, historical wetland evaluation, shoreline changes, and land use mapping.

The Topographic Engineering Center is located in Alexandria, Virginia. Their stated mission is to provide the Warfighter with a superior knowledge of the battlefield, and support the Nation's civil and environmental initiatives through research, development, and the application of expertise in the topographic and related sciences. For more information about TEC, visit their website at http://www.tec.army.mil/.

Because of TEC's authority and experience with historical aerial photograph analysis, they were able to obtain previously classified oblique aerial photographs of the former LOOW from 1944, examples of which are shown on page 3.



Preliminary results from their analysis indicate evidence of activities in the undeveloped area during the period of DOD ownership of that area. Small ground scars and signs of other earthmoving activities were revealed, some of which were indistinguishable on the vertical aerial photographs.

What is the USACE doing to address these issues?

Further investigations of these areas will be performed based on the results of this analysis. The USACE has begun to conduct field reconnaissance to locate some of the surface features found during the photographic analysis, which may have remained undisturbed. Work plans for the investigation and sampling of these features are currently being prepared so the investigation may be conducted as funding becomes available. The USACE will continue to provide full disclosure of information as it becomes available.

Where can I get more information?

The USACE Buffalo District has established an administrative record for this site. This record contains reports of past investigations and other pertinent site data. As new information becomes available, it will be added to the record. This record is available for viewing by the public at the following sites:

Lewiston Public Library ● 305 South Eighth Street ● Lewiston, New York

Youngstown Free Library ● 240 Lockport Street ● Youngstown, New York

U.S. Army Corps of Engineers (USACE) ● 1776 Niagara Street ● Buffalo, New York

To get more information about LOOW or other DERP-FUDS issues, or to be added to the program's mailing list, contact:

U.S. Army Corps of Engineers, Buffalo District
Public Affairs Office
1776 Niagara Street
Buffalo, NY 14207
(716) 879-4124

You may also call the district toll-free telephone number: **1-800-833-6390** or e-mail at **derpfuds@usace.army.mil**
The USACE Buffalo District Web page is: **http://www.lrb.usace.army.mil/derpfuds/loow**