2021 Hazardous Waste Scanning Project

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Love Canal
Inactive Hazardous Waste Site:
A History Of The Remediation By Operable Unit

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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3.0 ENVIRONMENTAL SETTING

The existing environment is defined as the setting for a project (the proposed site, surrounding community and regional area) as it exists prior to the initiation of any developmental activity.

The SEQR Handbook, promulgated for the 1978 Regulations, states the need for a discussion of the environmental setting as follows:

"In order to identify potential environmental effects of a project, the existing environmental setting of the area affected by the project must first be described. A comparison of environmental characteristics with and without the project leads to a determination of environmental impact." (SEQR Handbook, B-22).

This section serves to identify the environmental base as it relates to the proposed action discussed in FGEIS Section 2.0.

3.1 Geology

During the Pleistocene epoch, Western New York State experienced several periods of glaciation. As a result, the Love Canal area exhibits features that are characteristic of glacial erosion and deposition (USEPA 1982).

3.1.1 Subsurface Geology

Bedrock in the vicinity of the Love Canal consists of the Lockport Dolomite type, *a rock formation* composed of calcium *magnesium* carbonate. The Lockport Dolomite was encountered during well drilling activities at a depth of approximately 20 to 45 feet below the land surface and ranges in thickness from approximately 160 feet to 180 feet. The Lockport Dolomite can be described as a dark gray to brown, massive to thin bedded dolomite, locally containing small, irregularly shaped masses of gypsum and calcite. The Lockport Dolomite was found to dip towards the south at a rate of approximately 30 feet per mile (USEPA 1982).

Underlying the Lockport Dolomite is a relatively impermeable rock type referred to as Rochester Shale. The Rochester Shale is a dark-gray calcerous shale (USEPA 1982).

3.1.2 Surficial Geology

In the vicinity of the Love Canal, the Lockport Dolomite is overlaid by a deposit of glacial till ranging in thickness from 5 to 20 feet. The glacial till consists of an unsorted mixture of clay, sand and rock *fragments that was* deposited on the Lockport Dolomite by the advance and retreat of glaciers. EPA field testing found the glacial till was relatively impermeable (USEPA, 1982).

Layers of clay, silt and fine sand exist above the glacial till and were found to vary in thickness from approximately 6 to 29 feet. These materials were deposited in the area by lakes that were formed by the melting and retreat of glaciers during the late Quaternary period (USEPA 1982). Two glacial lakes were chiefly responsible for these deposits. The older glacial lake, Lake Dana, deposited reddish sediments, which had eroded from bedrock to the north, on top of the till. The lacustrine deposits attributable to Lake Dana were found to vary from approximately 2 to 20 feet thick, and were characterized as very moist to wet, very plastic, very sticky, silty-clay to clay. The permeability of these materials was found to be relatively low (USEPA 1982).

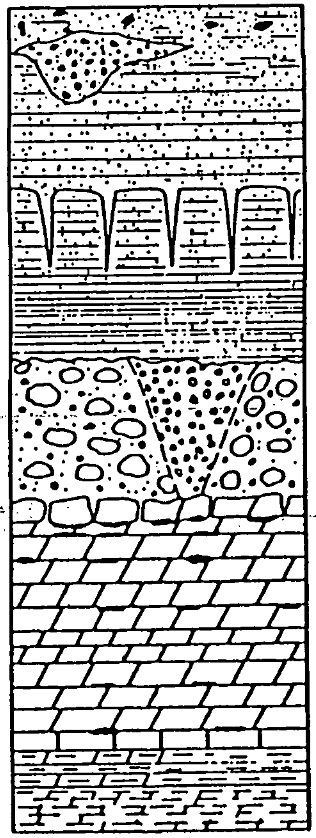
Above the Lake Dana deposits were the deposits of Lake Tonawanda, which ranged in thickness from approximately 3 to 8 feet. The materials deposited by Lake Tonawanda tended to be coarser, reddish brown to gray sediments that were characterized as somewhat moist, firm, varved, silty-clay to clay. At a depth of approximately 5 to 8 feet below surface levels the lacustrine deposits were found to be extremely firm to very firm silty-clay, and vertical dessication cracks have sometimes been noted as present. *The primary permeability of Lake Tonawanda deposits (flow between the individual grain boundaries) has been found to be very low. Areas of secondary permeability (along dessication cracks and other discontinuities) has been found to be very much higher (NYSDEC, 1990).*

Above the Lake Tonawanda deposits are layers of silty sand, clayey silt and other fill materials varying in thickness from but a few inches to approximately 3 feet in the general Love Canal area. The permeability of these materials was found to be greater than the underlying clays. Also present in the lacustrine sediments were random deposits of more sandy materials occurring in the form of sand lenses. These more permeable sandy zones were found to occur neither in considerable thickness nor to extend over large areas. Rather these features were found to occur as typically small, generally disconnected deposits as is characteristic of heterogeneous lacustrine material (USEPA 1982). Figure 17: GEOLOGIC UNITS IN LOVE CANAL, graphically describes the above formations and their approximate depths. Furthermore, refer to Section 4.1.4, Development Constraints, for development characteristics of site soils.

LOVE CANAL AREA MASTER PLAN

FIGURE-17: Geologic Units in Love Canal

Source: Love Canal Environmental Monitoring Report, USEPA, 1982.



NOT TO SCALE

System		Formation Unit	Thickness (Feet)	General Geologic and Hydrologic Characteristics
Quaternary	Late	Fill	0.1-3	- Covers nearly entire study area - Varies from local soil material to construction rubble and industrial wastes
		Lacustrine Deposits	6-29	- Sand lenses randomly occur as elongated lacustrine deposits throughout region and consist of loamy to sandy clay; sometimes exposed at surface in undisturbed areas - Total thickness of former glacial lake deposits increases from north to south in vicinity of canal - Upper sequence deposited in former Lake Tonawanda (3-8 feet thick) is reddish brown to gray, moist, firm to very firm, varved, silty-clay to clay; dessication cracks reported in selective areas within sequence - Lower sequence (2-20 feet thick) attributable to former Lake Dana is reddish brown, very moist to wet, very plastic, very sticky, silty-clay to clay - Permeability of lacustrine deposits is generally low
		Glacial Till	1-25	- Reddish brown, moist, firm, silty to sandy clay with gravel and cobbles; sandy zones, well-sorted gravel - Two or three ridges of till oriented NE-SW are in Canal Area - Generally low permeability - Approximately 5-20 feet thick in Canal Area
Silurian	Middle	Lockport Dolomite	160-180	- Dark gray to brown, massive to thin bedded dolomite dipping at low angle to south; secondary deposits of sulfides, sulfates, and carbonates occur throughout the formation - Principal aquifer in Niagara Falls area; major producing zones in upper part of formation - Artesian and unconfined water table conditions exist associated with vertical fracture zones, cavities formed by solution of minerals and between bedding planes - Vertical joint system hydraulically connected to Niagara River
	Lower	Rochester Shale	60	- Dark-gray calcareous shale; relatively impermeable

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3.1.3 Soils

The soil at the Love Canal EDA is characteristic of those formed in Lake-laid Clays and Silts (Soil Conservation Service, 1972). This type of soil is nearly level to gently sloping, deep and somewhat poorly drained to very poorly drained. They have a moderately fine textured or fine textured subsoil. This type of soil has a medium to low value for farming.

Typical of the Lake-laid Clays and Silts are soil associations such as the Rhinebeck-Ovid-Madalin Association and the Odessa, Lakemont-Ovid Association. However, since the Love Canal EDA is located in the City of Niagara Falls, much of the area is comprised of fill material which varies from local soil material to construction rubble and industrial wastes and can be found 0 to 1-3 feet below surface (USEPA, 1982). Identification of the above soil types becomes difficult in highly urbanized areas and soil types can only be discussed in general terms as is the case above.

3.1.4 Development Constraints

Natural drainage and *low* permeability are the major limitations to use for development purposes at the Love Canal site unless adequate sanitary sewers and surface drainage are provided (Soil Conservation Service, 1972). Since the Love Canal EDA is a highly developed area these limiting factors will not deter rehabitation efforts or other development uses such as commercial and industrial activities.

3.1.5 Topography

The general area in which the Love Canal EDA exists is relatively flat and is dominated by three major features: the United States and Canadian Falls; the Niagara Gorge and the Niagara Escarpment (USEPA 1982).

The Niagara Escarpment, a steep cliff marking the end of highland, extends in a easterly direction from the Niagara River immediately south of Lewiston, NY to well beyond the general Love Canal area. At the Niagara River, the escarpment is approximately 200 feet high and gradually diminishes toward the east into a broad, gently sloping incline. North of the escarpment the land slopes gently toward the Upper Niagara River (USEPA 1982).

The Love Canal site is located adjacent to the Niagara River within the eastern limit of the City of Niagara Falls, NY. The eastern border of the EDA adjoins and is partially located in the Town of Wheatfield, NY. The Love Canal area is *characterized with a generally level topography (USEPA 1982). As a result, surface water run-off has been historically poor. During rainy periods, areas of ponded water and marshy ground formed, typically to the southwest and southeast of the Love Canal (USEPA 1982).*

Prior to the early 1970's, a number of surface soil features, sometimes referred to as swales, existed in the general Love Canal area. Swales were generally shallow depressions (less than 10 feet deep) that presumably served to preferentially drain the area of surface water run-off.

At the present time, however, surface water drainage principally occurs in the Love Canal area through an extensive system of storm sewers. Since the area is serviced by a stormwater sewer system and is a highly urbanized area, any impacts due to flooding and drainage are minimal thereby greatly lessening the impact of future rehabilitation and development at the site.

3.2 Water Resources

When referring to groundwater at the Love Canal EDA, it is important to differentiate between primary and secondary permeabilities. Primary permeability refers to the flow between individual grain boundaries found in soil. Secondary permeability refers to the dessication cracks and other discontinuities found in soils.

3.2.1 Groundwater

Groundwater was found to occur in the Lockport Dolomite in three types of openings. These are listed below (USEPA 1982):

1. Bedding planes: horizontal planes that separate individual layers of rock.

2. Vertical joints: fractures that interrupt the horizontal continuity of the rock unit.

3. Solution cavities: cavities in the rock from which gypsum and calcite have been dissolved.

Most of the water moving through the upper portion of the Lockport Dolomite was found to move through the horizontal bedding planes contained in the top 10 to 16 feet. Groundwater flow in the upper portion of the Lockport (the top 20 feet) was found to be affected by the major trends of vertical fractures connecting the bedding planes. The lower portion of the Lockport (145 to 170 feet thick) was characterized by seven distinct water-bearing zones having well developed bedding plane separations. Flow in the lower portion of the Lockport Dolomite was found to generally follow the inclination of the formation (USEPA 1982).

Field tests conducted on the bedrock aquifer yielded the following *conclusions* (USEPA 1982):

1. The Lockport Dolomite *formation contains several distinct aquifers.*

2. The upper portion of the *formation has significant permeability in the vertical (as well as horizontal) directions, through zones of secondary permeability.*

3. The primary water bearing zones are in the upper part of the aquifer.

4. Fractures have a substantial effect on the rate and direction of groundwater movement in the upper portion of the bedrock.

5. The upper portion of the bedrock aquifer is hydraulically connected to the Niagara River.

6. The bedrock aquifer in the vicinity of the Love Canal is confined below by the Rochester Shale and above by the glacial till and is artesian.

The deposits above the Lockport Dolomite (the overburden material) were found not to be significant sources of water for the area. The unconfined water-table aquifer existing in the overburden material (shallow ground-water) was found to be bounded by Bergholtz and Black Creeks on the north, Cayuga Creek on the west, and the Little Niagara and Niagara Rivers on the south. In general, the glacial till and the two silty-clay units were found to be of low permeability with small areas of sandy layers occurring within where groundwater could move more readily (USEPA 1982).

The Lockport Dolomite aquifer maintains a steady state of flow on a regional basis by recharge from the topographic highpoint occurring near the Niagara Escarpment. Discharge generally occurs along the Niagara Escarpment, along the gorge wall of the Lower Niagara River, towards the covered conduits of the Niagara River Power Project, and along parts of the Upper Niagara River (USEPA 1982). In relation to the Love Canal area, the gradient of groundwater movement in the dolomite is south and southeasterly towards the Upper Niagara River (USEPA 1982).

Based upon bedrock aquifer tests conducted by EPA at Love Canal, it was estimated that if contaminants were to enter the Lockport Dolomite at the southern end of Love Canal and assuming no attentuation, the average length of time required to reach the Upper Niagara River would be approximately 1000 days (USEPA 1982).

In terms of the shallow groundwater system (that found in the overburden material), water surface elevations suggest a general southwesterly gradient with a possible groundwater mound near the north end of the landfill and a slight depression near the south end of the landfill (USEPA 1982).

In most locations, the computed hydraulic heads of the shallow system were found to be nearly equal to the hydraulic head in the dolomite. Therefore, it is likely that the hydraulic heads measured in the shallow system are dependent on highly local variations in permeability, in recharge in evapotranspiration and in discharge to the creeks and rivers (USEPA 1982). Due to the low permeability and hetergeneous nature of the overburden, groundwater movement in the overburden is generally very slow except in highly localized areas of more permeable material (USEPA 1982).

3.2.1.1 Groundwater Monitoring Results

The EPA groundwater monitoring program revealed no evidence of contamination attributable to Love Canal in the bedrock aquifer and only very localized contamination in the shallow system (USEPA 1982). Generally, evidence of contaminated groundwater that was directly attributable to the migration of substances from the former canal was found only in a few shallow system wells located immediately adjacent to Love Canal in the residential lots of some Ring I houses. *The shallow system wells refer to the flow through the surficial geology.* Clear evidence of groundwater contamination directly attributable to Love Canal was not found outside of the area around Ring I houses or *throughout the rest of the* EDA (USEPA 1982).

Based upon tests in the monitoring wells and a groundwater flow model, it was determined that the barrier drain system was functioning effectively (USEPA 1980). The EPA findings suggest that the barrier drains were operating to intercept chemicals which might be migrating laterally from the canal, to lower the hydraulic head in the canal (to reduce overflow) and to move nearby groundwater towards the drains for collection and subsequent treatment (USEPA 1982).

The studies conducted for the 1988 habitability decision confirm the findings in the 1980 EPA study. The NYSDEC has assessed the effectiveness of the barrier drain by gathering extensive data from groundwater monitoring wells placed in the vicinity of the Love Canal. DEC reports that measurements of groundwater *elevation* and *groundwater* chemical quality indicate the followiing (Decision on Habitability, September 1988):

1. In the overburden soils (upper 20 - 40 feet) groundwater under the cap flows toward the barrier drain both laterally and upward from beneath the drain.

2. Overburden and bedrock groundwater outside the fenced area has been analyzed for more than 100 chemicals, mostly chlorinated hydrocarbons. Most chemicals are reported as less than the detection limit.

3. Some chemicals have been consistently reported from a number of monitoring wells. However, with one exception (BHC's), no LCIC's have been reported. The BHC's were identified in one well in the last round of testing at levels which could not be quantified. This finding will be investigated further as part of the continuing monitoring program.

3.2.2 Surface Water

3.2.2.1 Surface Water Bodies Near the Love Canal EDA

Surface water bodies include Bergholtz Creek, forming the northern boundary of the EDA, and flowing east to west. Black Creek, flowing east to west, is located north of Colvin Boulevard in the EDA, below grade, in a culvert between 102nd Street and 98th Street, and joins ~~Bergholtz~~ Creek near 96th Street. The Upper Niagara River, which also flows from east to west, is located approximately 1/4 mile south of the EDA. A tributary known as the Little Niagara River circles to the north of Cayuga Island. Bergholtz Creek joins Cayuga Creek approximately 1/4 mile northwest of the EDA at a point near the intersection of Cayuga Drive and 88th Street. Cayuga Creek, which flows from north to south, joins the Little Niagara River near South 87th Street. The Little Niagara River joins the Niagara River on the west side of Cayuga Island. Because of the gentle slopes to the beds in Black, Bergholtz and Cayuga Creeks, waterflow is known to occasionally experience gentle reversals due to certain weather-dependent conditions (USEPA 1982).