GEOLOGIC SUMMARY FOR THE SEAWAY GROUP

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Prepared for

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By

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OUTLINE

1.0 GENERAL

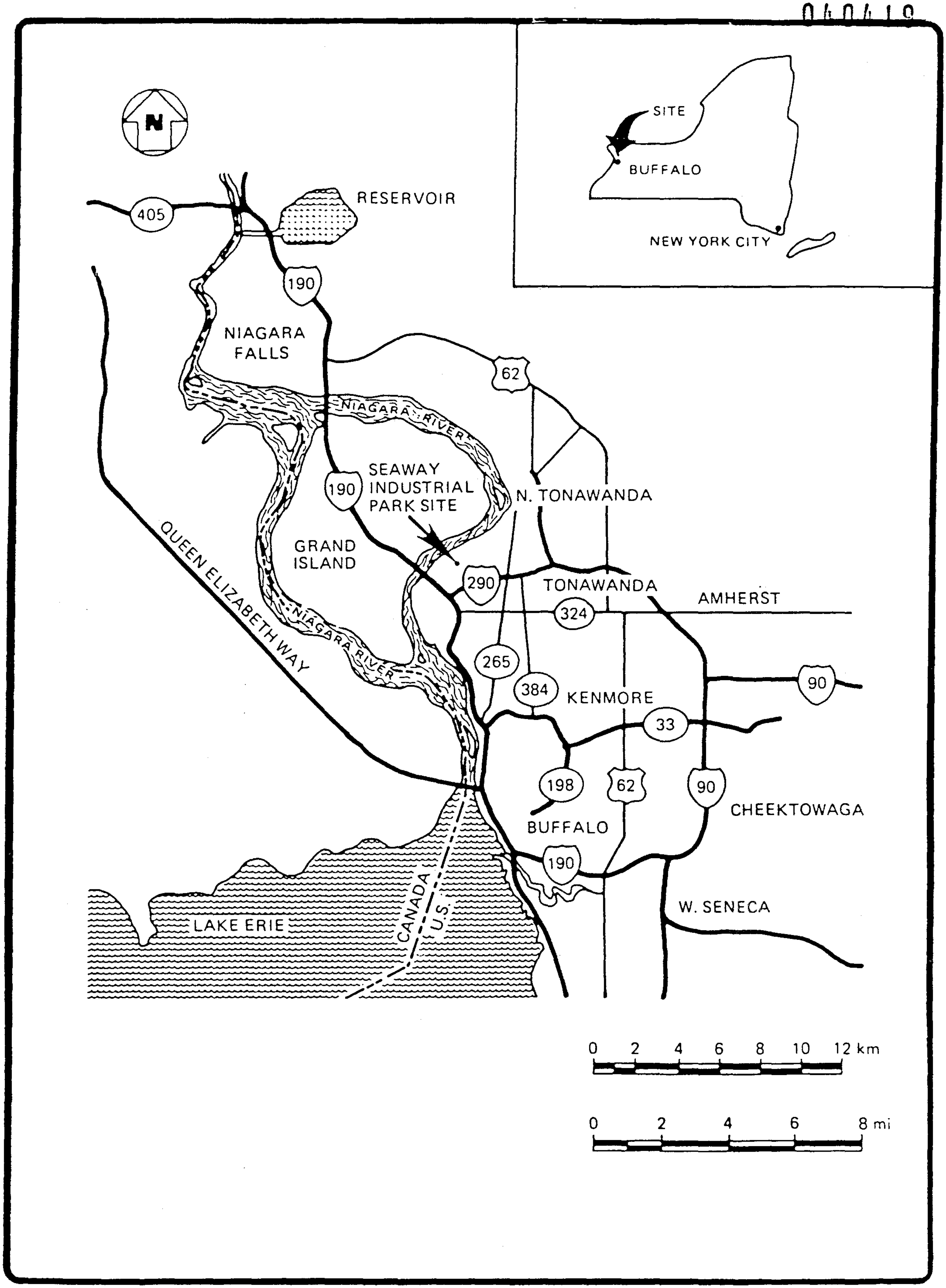
1.1 LOCATION

The Seaway Group consisting of the Seaway Industrial Park, Ashland Oil #1 and Ashland Oil #2, is located near the right bank of the Niagara River, Tonawanda Channel, along the south side of River Road and near the west boundary of the city of Tonawanda, New York (Figure 1). The three sites adjoin each other with Seaway being the center site. The Seaway site is elongate and approximately rectangular and measures about 4500 feet by 1060 feet. The long axis is nearly perpendicular to River Road and runs approximately east northeast and west southwest. Ashland Oil #1 and Ashland Oil #2 are adjacent to the Seaway site and are owned by the Ashland Oil Company.

1.2 HISTORY

Wastes generated by wartime activities related to the Manhattan Engineer District were stored at the Ashland #1 site, located just west of the Seaway site. During expansion of a petroleum refinery operation on the Ashland #1 site, some of the wastes stored there were moved to the Seaway site, some to the Ashland #2 site, while some remained on the Ashland #1 site.

The wastes moved to the Seaway site are known to have been placed in at least three areas on that property. Previous investigations have given designations to those areas where the wastes are located: Area A, Area B and Area C as shown in Figure 2. Area A is nearest the front (north) end of the site, covers an area of approximately 10 acres and extends from about the lateral midpoint of the site



FROM: FORD, BACON & DAVIS UTAH, 1981

FIGURE 1 SITE LOCATION MAP

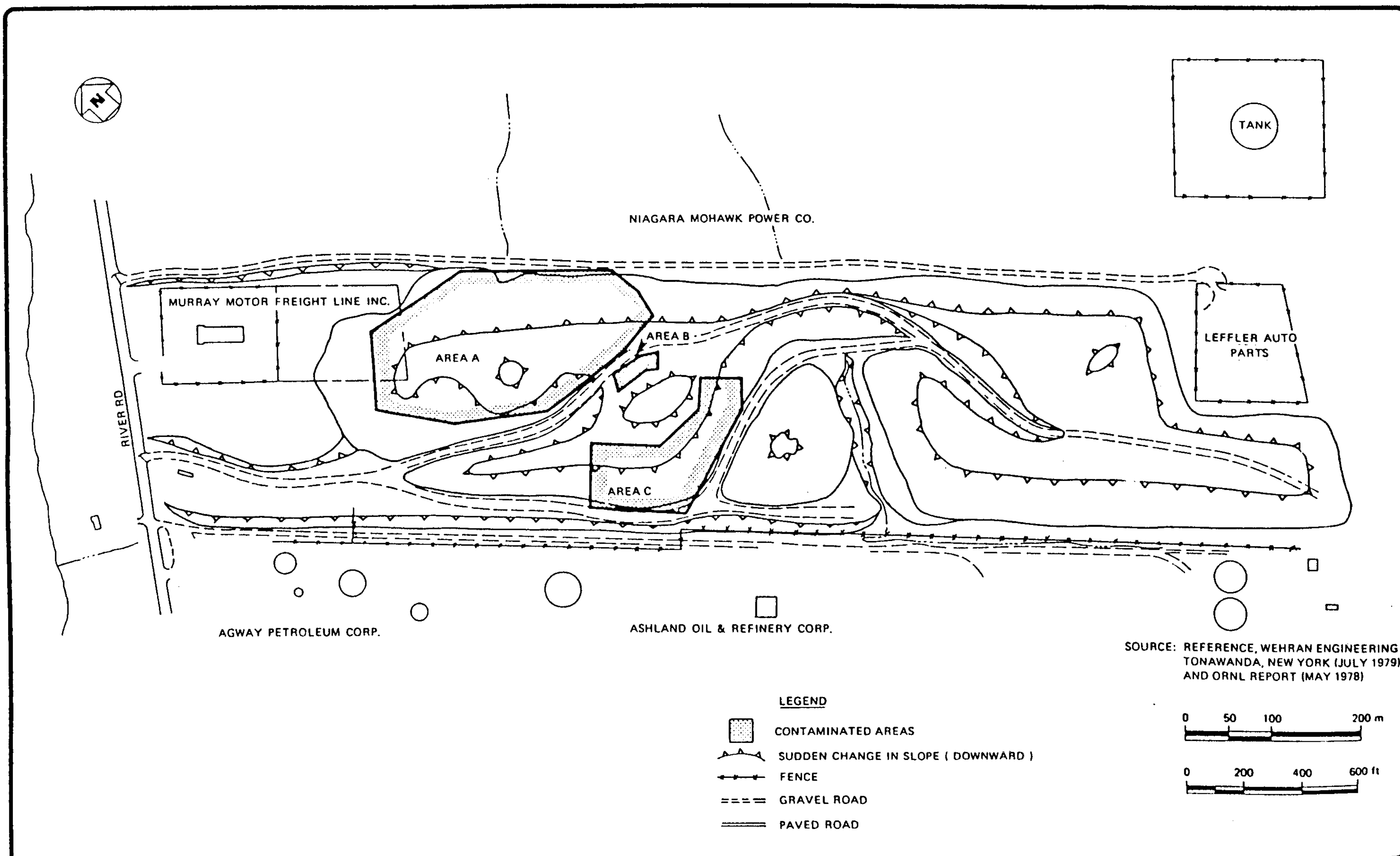


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FIGURE 2 SITE DESCRIPTION MAP AS OF JULY 1979 almost to the east boundary. Area B is a small area, about 1/2 acre, laterally central on the site and directly south of Area A. Area C covers an area of about 1-1/2 acres in a narrow arcuate configuration with one leg approximately parallel with the west site boundary and concave northwest. (Ref. 1)

The wastes in Area A are near the present land surface while those in Areas B and C are buried beneath the landfill.

The Ashland Oil #1 site consists of 10 acres, and the Ashland Oil #2 site consists of 29 acres, only 2 acres of which have been identified as being radiologically contaminated.

1.3 PRESENT USE

The Seaway site is located on an active landfill. The landfill operation has been continued in a way to minimize disposal over the known radioactive wastes stored there. However, locations of the radiologic wastes are only known generally so some landfill disposal has occurred there, particularly over Areas B and C.

The Ashland Oil #1 site is an active oil storage tank farm and the Ashland Oil #2 site is no longer utilized.

1.4 DATA AVAILABLE

Physical and geologic descriptions of the Seaway Group are given in reports prepared for the landfill operators as a part of the study to assess "the extent of any environmental impact," (Ref. 1).

The highest part of the landfill ridge was about 95 feet above the surrounding area when it was surveyed in April, 1986.

2.0 DESCRIPTION

2.1 TOPOGRAPHY

The present topography of the Seaway site reflects the current use of the site by the present owner. A small hill about 95 feet high has been constructed on the site. The hill constructed of various kinds of industrial wastes, slopes steeply to either side and at the back (south) end of the site. At the front (north) end, the constructed hill slopes more gently and incorporates a series of ascending benches. The more gentle slope facilitates maintenance of a road to the hill top for access by truck traffic.

The site topography, before emplacement of the wastes, is estimated to have been nearly level at an elevation of about 585 feet msl. A stream channel several feet deep crossed the center of the site and was fed by smaller tributary stream channels which intersected the central stream course. It is not known whether the site surface was graded or otherwise modified before emplacement of the first waste began.

2.2 ACCESS

Vehicular access to the Seaway site is via the landfill operators entry road located near the north center of the site, from River Road. The landfill operations require frequent changes of the on-site road system to maintain the desired fill configuration. In general, however, there is a central roadway with branches opened to the various fill sites as the need arises.

The Ashland Oil #1 and Ashland Oil #2 sites are separated from the Seaway site by a fence. Access to these sites is via existing roads through the Ashland Oil Refinery.

3.0 GEOLOGY

3.1 REGIONAL SETTING AND POST-GLACIAL DEPOSITIONAL CYCLE

The Niagara River and its immediate drainage area is often called the Niagara Frontier (Ref. 2). The Niagara Frontier is relatively flat except for the Niagara Gorge and two north-facing escarpments. The most northerly of these, the Niagara Escarpment, is just north of the city of Niagara Falls, and the other, called the Onandaga Escarpment, passes through the City of Buffalo. These two features defined the north and south limits of the area once occupied by post-glacial Lake Tonawanda.

The Niagara Frontier area was ice covered during the most recent glacial advances but some areas may have been exposed during interglacial ice retreats. In any case, as the ice retreated, unsorted sands and gravels containing considerable volumes of silt were deposited over bedrock as a till near the ice front. As ice retreat continued, meltwater accumulated along the ice front to form small ponds and lakes in which varved clays interbedded with fine grained sands and silts were deposited. As the small lakes expanded and coalesced, the large lake called Tonawanda was formed. This body of water covered most of the area between the two escarpments in the area. The lake provided a very low energy environment in which basin-wide clay disposition occurred. Eventually Lake Tonawanda drained, and the glaciolacustrine clay was exposed to erosion and a new depositional energy environment. A heterogeneous clayey till deposit of sand, gravel, and silt accumulated over the clay. More recently, small streams have covered local areas of the till with alluvium.

3.2 STRATIGRAPHY

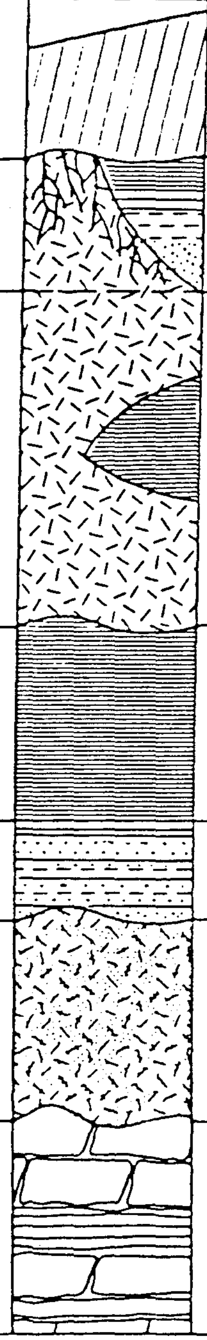
The natural, unconsolidated, near surface materials at the Seaway Group are sediments that accumulated during and soon after the most recent glacial advance. Some of the sediments (clays) accumulated in low energy environments while others represent deposition under higher energy conditions. The surface sediments near stream channels are recent alluvium. A geologic column taken directly from the RECRA RESEARCH - WEHRAN ENGINEERING report of 1979, (Figure 3) (Ref. 1) shows the sequence of strata identified during the field work conducted during their investigations.

Camillus Shale

The most shallow consolidated stratum found beneath the Seaway Group is Silurian age, thin bedded to massive, limey-shale-mudstone. Generally, this stratum is gray to brownish-gray with red or green found in some beds. Permeability of the formation is principally secondary via the joints and fractures in the rock.

Lower, Sandy, Glacial Till

Directly overlying bedrock and apparently continuous across the site area is a glacial till deposit composed of unsorted materials ranging from clay and silt size to medium size gravel. The character of the till varies from place to place so the range of particle sizes is highly variable. The till thickness also varies considerably across the site. Some gypsum nodules have been noted near

PERIOD	EPOCH	FORMATION	COLUMNAR SECTION	APPROXIMATE THICKNESS IN FEET	CHARACTER
QUATERNARY	RECENT	FILL		0-60	SOLID WASTE, FLY ASH, DEMOLITION DEBRIS, INDUSTRIAL WASTES; PERMEABLE
		UNCONFORMABLE			
		ALLUVIUM		0-17	ORGANIC SILT, AND SILT AND CLAY GRADING TO C/F SAND AT BASE; SAND IS PERMEABLE
		DISCONFORMITY			
	PLEISTOCENE (WISCONSIN)	UPPER CLAYEY GLACIAL TILL		0-65	CLAYEY GLACIAL TILL, WITH MINOR AMOUNTS OF SAND AND GRAVEL, LENTICULAR BODY OF LAMINATED CLAY ALONG NORTHERN PERIMETER; DESICATION CRACKS IN UPPER 10-12 FEET, HIGHLY IMPERMEABLE.
		UNCONFORMABLE			
		GLACIOLACUSTRINE CLAY UNIT		5-45	LAMINATED CLAY WITH OCCASIONAL LAMINAE OF SILT, SOFT; HIGHLY IMPERMEABLE
		CONFORMABLE			
		BASAL GLACIOLACUSTRINE UNIT		0-7	LAMINATED CLAYEY SILT AND SAND, SOFT-LOOSE; MARGINALLY PERMEABLE
		UNCONFORMABLE			
		LOWER, SANDY GLACIAL TILL		1-19	SANDY GLACIAL TILL, WITH VARIABLE AMOUNTS OF SILT, CLAY AND GRAVEL, SECONDARY GYPSUM; MARGINALLY PERMEABLE
		UNCONFORMABLE			
UPPER SILURIAN		CAMILLUS SHALE		200±	GRAY SHALE; GRAY OR BROWN DOLOMITE; VERY THIN BEDS OF GYPSUM; PERMEABLE ALONG BEDDING PLANES AND VERTICAL JOINTS

FROM: RECRA RESEARCH, INC. &
WEHRAN ENGINEERING CORPORATION, 1979

FIGURE 3 GEOLOGIC COLUMN

the till-Camillus Shale contact. The sandy till permeability is described as "not particularly high" (Ref. 1).

Basal Glaciolacustrine Deposits

Uncomformably overlying the Sandy Glacial Till are the lacustrine sediments deposited in an "extinct glacial lake." These have been labeled the Basal Glaciolacustrine Deposits. The basal lacustrine sediments are interbedded fine sands and silts with a higher horizontal than vertical permeability. The sediments grade upward into the overlying finer grained materials without an erosional break. Therefore, the change in grain size indicates a decrease of depositional energy.

Glaciolacustrine Clay

The Glaciolacustrine Clay is a continuation of the stratigraphic sequence deposited in the glacial lake that once covered the Seaway Group area. These lacustrine clays are continuous across the site but variable in thickness. Clay thickness, measured in holes drilled during the Wehran-RECRA investigation, varies from 5 feet to 45 feet across the site with the thickness increasing toward the south side of the site. Permeability of the Glaciolacustrine Clay, as determined in laboratory tests, is about 1.6×10^{-8} cm/sec (Ref. 1).

Upper, Clayey Glacial Till

The Upper, Clayey Glacial Till forms the natural ground surface over nearly all of the Seaway Group. The only areas where the till is not exposed at the ground surface are those near streams where alluvium has been deposited in a thin veneer over the till. Organics have accumulated in the upper one to two feet of the till as a result of plant activity so a recognizable horizon exists there.

The till is formed primarily of silt and clay with varying amounts of sand and gravel. No bedding is apparent so the deposit is relatively heterogeneous except for local lenses of clay or sand as would have been deposited in small ponds or lakes.

Typical of this material, is evidence of desiccation cracking. The cracks extend 10 to 12 feet down from the surface and all were found to be filled with a gray clay and silt (Ref. 1). Previous investigators surmise that presence of the cracking, now filled, has not appreciably altered the permeability of the till. However, new cracks as might be expected to occur during long periods of low precipitation, would greatly increase the till permeability to the depth of the openings. Permeability of the till measured in the laboratory, was found to be about 1.6×10^{-8} cm/sec, equal to that measured for the underlying Glaciolacustrine Clay.

Thickness of the glacial till was found to be as great as 65 feet and is shown by the Wehran-RECRA report (Ref. 1) to be as little as 0, although that absence of the material is not explained.

Recent Alluvium

Alluvium is only found associated with the present stream system on the site. Width of the alluvial cover is variable with a reported maximum of 400-500 feet. The greatest alluvium thickness was found along and in the stream channels. Alluvium thickness up to 17 feet is reported for the stream channels. However, the present channel configuration, width, length, and gradient do not indicate sufficient stream volume or velocity to cut a channel to 17 feet. Therefore, the alluvium has accumulated in a relic channel developed during some prior environment.

Fill

The site is covered by refuse (wastes) of various sorts to a height as much as 95 feet above the surrounding ground surface. The wastes have been placed so as to maintain a steep but stable side slope.

3.3 STRUCTURE

No geologic structure is evident in the recent sediments at the site. It is likely that some residual stress remains in the competent bedrock as a result of ice loading during the most recent glacial advance. Nearby excavations in rock have experienced residual stress related movements (Ref. 2).

3.4 GROUNDWATER

Three ground water regimes are reported to exist at the site. The upper system is the groundwater that has accumulated in the stored wastes and is perched above the original ground surface. The perched water discharges along the boundaries of the waste and some portion may enter the joints and/or move adjacent to the culvert that crosses the site.

The middle ground water system is that water which is "largely immobilized, interstitial water within the composite aquiclude represented by the Upper, Clayey Glacial Till and the Glaciolacustrine Unit," (Ref. 1).

The lower ground water is in the "confined aquifer within the Camillus Shale."

The present site owner has constructed a cutoff wall entirely around the site to intercept groundwater moving in the unconfined aquifer and discharged from the perched groundwater in the waste pile. The cutoff wall was planned to be tied into the Glaciolacustrine Clay, and that is believed to have been generally accomplished during wall construction. The actual condition of the wall and its effectiveness are not known. Groundwater is collected by a drain system installed inside the cutoff wall and directed to a single manhole where samples are collected for testing. The collected water is discharged to the local sewer system.

3.5 SEISMICITY

The site is near the seismically active St. Lawrence region and thus is subject to strong earthquake motion (Ref. 3).

4.0 RECOMMENDATIONS

The Seaway Group must be investigated together with the surrounding area to clearly understand the geologic conditions and relationships that exist there. The following recommendations are presented:

1. Perform a canvas of the existing wells for an area within a two mile radius of the Seaway Group.
2. Determine the areas within the two mile radius well canvas where anomalous ground water conditions exist.
3. If a groundwater anomaly is not likely to affect or be affected by activities on the site, take no further action relative to it. If it will affect the site, then develop an investigative plan to explain the cause and affect.

4. Drill a minimum number of geologic bore holes on-site to verify data collected by previous investigators, to shorten the distances between data points, and to construct additional monitoring or observation wells.

5. Collect samples of the subsurface materials for testing to determine distribution coefficients, cation exchange capacities, permeabilities (measured in situ if possible), gradations, Atterberg limits, and mineralogy.

6. Collect ground and surface water samples from existing wells and from streams and ponds to determine present quality of the water in each aquifer and surface water source.

5.0 CONCLUSIONS

The data presently available regarding site specific and regional geologic conditions for the Seaway Group indicate that the area has some characteristics desirable in the design of a long-term disposal facility for radioactive wastes. For example, a low-permeability clay stratum at a depth of about 0 to 65 feet apparently extends across the entire area. Shallow groundwater, above the clay layer occurs in low volume and in a low permeability stratum so utilization of that water for any purpose is unlikely. Groundwater in the more permeable sediments below the clay stratum and in the fracture system near the upper surface of bedrock has a naturally occurring high content of degrading materials, i.e. chlorides, and sulfates, so its use as a household supply is unlikely.

REFERENCES

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