FORT DRUM, NEW YORK

TERRAIN ANALYSIS

PREPARED BY

THE TERRAIN ANALYSIS CENTER

US ARMY ENGINEER TOPOGRAPHIC LABORATORIES

FORT BELVOIR, VIRGINIA 22060

OCTOBER 1977

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
OCT 1977		**00-10-1977 to 00-10-1977**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Terrain Analysis. Fort Drum, New York	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **The Terrain Analysis Center,U.S. Army Engineer Topographic Laboratories,Fort Belvoir,VA,22060**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**33**	

FORT DRUM, NEW YORK

TERRAIN ANALYSIS

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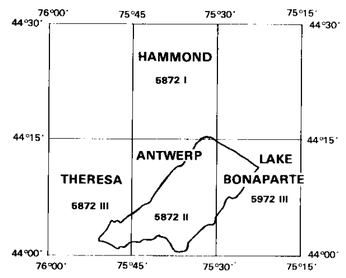

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I INTRODUCTION

BACKGROUND

The requirement for this terrain analysis of Fort Drum was stated in message P241854Z, Oct 75, from the Commander, FORSCOM to the Office Chief of Engineers (OCE), Department of Army, subject: "Terrain Analysis of Selected FORSCOM Installations." The FORSCOM requirement identified 13 installations (later amended to include a total of 17) including Fort Drum, and cited topical coverage to be included in the studies. Responsibility for management and supervision of the program developed in response to the FORSCOM requirement was assigned by OCE to the Terrain Analysis Center (TAC), US Army Engineer Topographic Laboratories. At FORSCOM request, TAC responsibility also includes technical supervision and direction of FORSCOM troop units assigned to the program.

Scope and content of the topical coverage included in the FORSCOM requirement were developed jointly between representatives of TAC and FORSCOM Headquarters. Analytical and cartographic specifications for the studies were developed by TAC, coordinated with OCE and concurred in by FORSCOM Headquarters.

PURPOSE

In stating the requirement for terrain analyses of selected installations, FORSCOM indicated that the purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes among many other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies.

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These things are also treated in the studies.

Since the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. While some of the information contained in the studies may be useful as environmental base line data, the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and man-made features of the reservation and an evaluation of their effects on tactical military operations. The program does not include basic research to fill gaps in these data although some short-term field investigations were performed to obtain ground truth and a general overall appreciation of terrain elements. Therefore, the scope of the analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by senior terrain analysts for topics such as cross-country movement, cover and concealment and water resources.

The terrain analysis preparation process has necessarily involved analytical judgement in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetative cover and man-made features including roads, airfields, and facilities constructed outside of the cantonment areas.

LIMITATIONS

The study naturally reflects limitations in the quality, amount, and currency of the source data on which it is based. Numerous field interviews and selective use of remote sensing were employed in an effort to assure presentation of the latest and best information. Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under Scope, the study effort was not designed to include basic research as a means of filling gaps in data.

By design, the presentation is cast at a level of data coverage consistent with stated objectives. Users interested in deeper pursuit of data are referred to the List of Sources in the back of the study.

PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis. Supporting text is, as far as practicable, in tabular format keyed to the related graphics which follow. The primary map scale is 1:50,000. For Urban Areas (Cantonment Area) the scale of the map is 1:11,500 and for Off-Post Features the map scale is 1:1,000,000.

STUDY AREA

The Fort Drum military reservation covers 107,265 acres (168 square miles) in Jefferson and Lewis Counties of northwestern New York State, just east of Lake Ontario; approximately 90% of the reservation is in Jefferson County. The cantonment area is about 9 miles northeast of Watertown, the largest city in the immediate area with an estimated 1975 population of 32,280. The installation can be reached by paved roads connecting to US 11, State Routes 3 and 26, and Interstate 81 nearby; also, there is Wheeler-Sack Army Airfield on the post and the Watertown International Airport nearby.

The configuration of surface features is predominantly flat to moderately rolling plains with numerous, narrow northeast-southwest trending hillocks in the upper third of the reservation; elevations range from 420 feet above sea level in the southwestern part of the post to 902 feet in the northwest. About 60% of these plains are covered by open to dense deciduous and coniferous forests and scrub concentrated mainly in the eastern and southern parts of the reservation. Short grasses cover about 27% of these surfaces, particularly in the western and central parts. Numerous swamps and marshes, some small lakes, barren areas and built-up areas cover the remainder of the reservation. These forested and grassy plains are drained primarily by several small streams that flow generally northwestward and eventually flow into the St. Lawrence River. Only a small area around the cantonment area drains into Lake Ontario through the largest stream, the Black River, on the southern edge of the reservation. These streams, during the long, cold winter, are snow covered and frozen with ice thicknesses up to several inches. Snow cover is persistent, generally between 1 and 2 feet deep from early December through March; in the severe winter of 1976-77, snow cover accumulated to depths over 4 feet. During the spring thaw, the streams are at flood stage for a short period and then resume their normal flow during the short, warm summer period; the lowest water is during late summer and early fall.

II DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Drum lies between Lake Ontario and the Adirondack Mountains in two major physiographic provinces, the Lake Erie-Ontario Lowlands and the Adirondack Uplands. The southwestern two-thirds of the reservation is part of the Eastern Ontario Hills and the Black River Valley physiographic subdivisions, both areas part of the larger Lake Erie-Ontario Lowlands province. The two subdivisions typically include recessional moraines, small sand plains, drumlin fields, swamps, and disrupted drainage patterns resulting from ancient continental glaciation. The northeastern third of the reservation falls in the Western Adirondack Hills, a subdivision of the larger Adirondack Uplands province and is characterized by a broad zone of foothills partly covered by lacustrine deposits laid down in old glacial lakes. This portion of the reservation includes several large lakes, widespread rock outcrops, and numerous linear, steep-sided northeast-southwest trending hillocks.

MAP UNIT	LANDFORM TYPE	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATIONS
1	Low Plains	Predominantly flat to moderately rolling surfaces covering about 98% of the reservation with slopes largely between 0 and 8% and local relief of inter-stream areas generally from 18 to 40m (60 to 130 ft) above adjacent valley bottoms. Large areas of flat to gently rolling surfaces in the central and southwestern parts of reservation with slopes mainly between 0 and 3%; steepest slopes along upper reaches of streams largely between 8 and 15% and, in places, up to 30%; local relief of interstream areas largely from 6 to 18 m (20 to 60 ft) above adjacent valley bottoms. Remainder of surfaces mainly gently to moderately rolling with slopes generally between 3 and 8%, except along numerous streams, particularly in upper reaches, where slopes are largely between 8 and 15% and, in places, reach 30%; local relief of interstream areas is mainly between 18 and 40 m (60 and 130 ft) above adjacent valley bottoms; numerous, narrow, short to long, northeast-southwest trending hillocks, some up to 3 km (2 miles) long, concentrated in central and northwestern part of upper third of reservation; hillock slopes mainly between 8 and 30% with tops commonly 24 to 49 m (80 to 160 ft) above adjacent valley bottoms. Numerous scattered boulders, occasional rock outcrops and denuded hillocks typical in north half of reservation and along eastern border between Black River and Indian Lake; short and low cuts and fills common along most roads and railroad lines.	Mostly between 150 and 210 m (492 and 689 ft) above sea level. Lowest elevation, 128 m (420 ft), south of Evans Mills along western edge of reservation. Highest elevation, 275 m (902 ft), north of Lake Bonaparte near Benton Pond.
2	High Plains	Predominantly gently rolling to hillocky surfaces covering two small areas, one on the south-central edge of the reservation and the other on the northeastern edge. On the south-central high plains, slopes are largely between 3 and 15%; steepest slopes, 15%, on sides of three prominent, round-topped hillocks (Barr Hill, Ward Hill and Ney Hill); small areas of flat to gently rolling surfaces with slopes 0 to 3% surrounding Ward Hill in western half of unit; local relief of hillock tops and adjacent valley bottoms reach 52 m (171 ft). In the northeastern area, slopes are largely between 3 and 8% on gently rolling to rolling surfaces interspersed with numerous, narrow and scattered hillocks with slopes 8 to 15%; two northeast-southwest trending hillocks, one adjacent to Indian Lake and the other stretching between Indian Pond and Burnt Pond, with slopes largely between 15 and 30% and, in places, in the more eastern hillock up to 45%; flattest areas usually adjacent to ponds and in swampy areas; differences between the highest hillock tops and adjacent valley bottoms 58 m (192 ft). Some scattered boulders in both small areas.	Mostly between 225 and 260 m (738 and 853 ft) above sea level in both areas. In south-central area, lowest elevation 205 m (672 ft), northwest of Barr Hill; highest elevation, 263 m (862 ft), top of Barr Hill. In northeastern area, lowest elevation 225 m (738 ft) and highest elevation 274 m (900 ft).

B. SURFACE DRAINAGE

Almost all of the surface drainage features on Fort Drum flow into the Indian River, either on post or just a short distance northwestward. This stream eventually joins the Oswegatchie and Saint Lawrence Rivers. Several small streams in the extreme northern portion of Fort Drum flow directly into the Oswegatchie River. The one exception to this pattern is the Black River, a major stream, which flows westward into Lake Ontario. This river crosses a small area on the southern edge of the post, but has practically no perennial streams draining into it from Fort Drum.

There are no streamflow gaging stations on the Fort Drum reservation, but there are two nearby. The nearest station is on the West Branch Oswegatchie River near Harrisville, New York, about 4 km (2.5 mi) east of the extreme northeast boundary. The portion of the West Branch above this station runs nearly parallel to the upper reaches of the Indian River and drains a roughly similar watershed. Discharge figures from this gaging station were used as indications of drainage trends in the Indian River watershed. The other gaging station is on the Black River at Watertown, New York, 23 km (14 mi) downstream of the Fort Drum boundary. A table is included below for mean monthly and annual discharge measurements for the period of record for both gaging stations.

Although precipitation is fairly uniform throughout the year, stream discharges vary considerably. April is the high discharge month when spring snowmelt on still frozen, nearly impermeable ground, supplies a great deal of runoff to the drainageways of Fort Drum; the thawing of snow and ice cover is generally from late March to mid-May. From 1921 to 1968, there were 74 peak discharges of above 481 m^3/sec (17,000 ft^3/sec) on the Black River at the Watertown gage; 62 (or 84%) occured in the high-water months of March through May and only 4 (or 5%) in the low-water months of June through October.

There are numerous dammed beaver ponds on the reservation; most are fairly small and have silty bottoms. These small water bodies are often adjacent to the wet areas of the post and contribute to the existing swampy or marshy conditions. In recent years, the wet areas on Fort Drum seem to have increased in number and size, possibly from increased beaver activity.

There are no designated fords on Fort Drum and those previously used are being closed. Minor drainageways can be crossed throughout the maneuver areas, but all traffic is encouraged to use bridges over the larger streams, as fording often damages game fish spawning grounds.

Very few of the figures used in the Drainage Characteristics and Lakes, Ponds and Reservoirs tables are supported by accurate field measurements. Except for the discharge measurements from the two USGS gaging stations and width measurements from aerial photographs, most of the figures have been derived from reported estimates by staff members of the Directorate of Facilities Engineering.

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORIES	GENERAL	REGIME	WIDTHS	DEPTHS	VELOCITY AND DISCHARGE	BANKS	BOTTOMS
Watercourses							
Black River	Major perennial stream flows westward for a short distance through southern edge of reservation in a somewhat restricted valley. Some islands in upper reaches and high bluffs along right bank.	High water, late March through May. Low water, June through October. Surface largely frozen late November to late March; maximum ice thickness of about 0.8 m (2.5 ft). Lower banks may be inundated during highest water in April.	Varies considerably but largely ranges from about 69 m (225 ft) to 122 m (400 ft) wide; maximum width of 332 m (1090 ft) at grid coordinate 457773.	About 2.3 m (7.5 ft) to 2.7 m (9 ft) deep at normal water; maximum depths of about 5 m (16 ft) during highest water periods in April.	Estimated velocity of 1.5 m/sec (5 ft/sec) to 2.1 m/sec (7 ft/sec) at normal water. Downstream at Watertown gage, the maximum discharge for period of record (1921-1976) is 1040 m^3/sec (36,700 ft^3/sec) on 5 April 1963; minimum discharge is 0.28 m^3/sec (10 ft^3/sec) on 2 September 1934; average discharge is 110.5 m^3/sec (3902 ft^3/sec); see table below for mean monthly discharges. Discharge is modified by upstream dams.	Mostly unconsolidated sand with some gravel, often underlain by silts and clays. Right bank ranges from about 3 m (10 ft) to over 30 m (100 ft) high bluffs. Left bank from about 1.5 m (5 ft) to 6 m (20 ft) high. Both banks generally quite steep.	Mostly bedrock with some sand and gravel. Gradient largely <1%.
Indian River	Large perennial stream winds northwesterly across northern half of reservation through flat to moderately rolling plains. Long stretches of smoothly flowing water are followed by successions of rapids and pools. Extensive swamps and marshes border both banks in upper reaches and part of middle reaches. Flows into and out of Indian and Narrow Lakes.	Same as above except stream generally in flood for about 2.5 weeks in April.	Varies considerably but generally about 6 m (20 ft) wide in upper reaches to a range of about 14 m (45 ft) to 30 m (100 ft) in lower reaches with a maximum width of 78 m (255 ft) at grid coordinate 531939.	From about 0.15 m (0.5 ft) deep in rapids to 2 m (7 ft) in pools at normal water; may reach depths of 3.7 m (12 ft) during flood stage in April.	Estimated velocity of 0.9 m/sec (3 ft/sec) to 3 m/sec (10 ft/sec) at normal water. Average discharge in lower reaches estimated to be 7.0 m^3/sec (247 ft^3/sec). Indian River low flow discharge modified by dam at outlet of Mud Lake.	Mostly rock and sand in upper reaches; silt and clay in middle and lower reaches. Organic materials in swamps and marshes. Banks generally steep and ranging from 0.6 m (2 ft) to 4.6 m (15 ft) high. May exceed 15 m (50 ft) in height where stream borders resistant rock outcrops primarily in middle reaches.	Mostly bedrock and gravel in rapids; silty sand in upper reaches; much sandy clay and silt elsewhere. Gradient generally <1% except in rapids.
Black Creek	Perennial stream flows through relatively flat plains northwesterly across southern half of reservation. Swamps and marshes border upper reaches of stream. Some rapids and pools in middle and lower reaches.	Same as above except stream generally in flood for about 2.5 weeks in April.	Generally ranges from about 4 m (13 ft) wide in upper reaches to 12 m (40 ft) in lower reaches.	Ranges from 0.15 m (0.5 ft) deep in rapids to 1.8 m (6 ft) in pools. May reach depths of 3 m (10 ft) during flood stage in April. Usually less than 0.15 m (0.5 ft) deep in upper reaches.	Estimated velocity of 0.6 m/sec (2 ft/sec) to 2.1 m/sec (7 ft/sec) at normal water. Average discharge is estimated at about 1.7 m^3/sec (60 ft^3/sec) in lower reaches.	Mostly sand in upper reaches with organic materials in swamps and marshes. Middle reaches are mostly silt and clay; mostly clay in lower reaches. Some exposed rocks throughout. Banks generally steep and range from about 0.6 m (2 ft) high to occasionally 3 m (10 ft) in lower reaches.	Mostly sand and silt in upper reaches; bedrock, sandy clay and silt in lower reaches. Gradient generally<1%; up to 5% in rapids.
West Branch	Perennial stream flows northwesterly across relatively flat plains into Black Creek. Narrow strips of swamps and marshes border most of middle and lower reaches. Contains a few small rapids and many pools.	Same as above except stream generally in flood for about 2.5 weeks in April.	Generally ranges from about 3 m (10 ft) to 7.6 m (25 ft) wide.	Mostly about 0.6 m (2 ft), except very shallow in scattered rapids. May reach 2 m (7 ft) during flood stage in April.	Estimated velocity of 0.6 m/sec (2 ft/sec) to 1.2 m/sec (4 ft/sec) at normal water. Average discharge is estimated at 0.6 m^3/sec (20 ft^3/sec) in lower reaches.	Mostly sand with organic material in swamps and marshes. Some silt and clay in lower reaches. Most banks steep and less than 0.6 m (2 ft) high.	Mostly sand and silt, except lower reaches with clayey sand, silt and some bedrock. Gradient generally <1%.
Rockwell Creek	Perennial stream with source on post flows westerly in a broad valley through moderately rolling plains into the Indian River. Small swamps and marshes border parts of upper reaches and two large swamp and marsh areas drain into the lower reaches of the stream from the south.	Same as above except lower reaches generally subject to minor flooding for about 2.5 weeks in April.	Generally ranges from about 3 m (10 ft) to 6 m (19 ft) wide in middle and lower reaches; >3 m (10 ft) wide in upper reaches.	Averages about 0.6 m (2 ft) deep in middle and lower reaches; 0.6 m deep in upper reaches.	Estimated velocity of 0.5 m/sec (1.5 ft/sec) to 1 m/sec (3.5 ft/sec) at normal water. Average discharge is estimated at 0.6 m^3/sec (23 ft^3/sec) in lower reaches.	Mostly rock and sand with organic material in swamps and marshes. Most banks steep and less than 0.6 m (2 ft) high; scattered bluffs on both banks in upper reaches.	Mostly bedrock and sand with some silt. Gradient generally<1%; steeper in upper reaches.
Bonaparte Creek	Perennial stream, originating at Mud Lake on post, flows southwesterly through bordering hillocks into the Indian River. Scattered rapids and pools throughout course and some bordering swamps and marshes, particularly in upper reaches.	Same as above, except flooding minimal.	Generally ranges from about 4 m (13 ft) to 9 m (30 ft) wide.	Averages about 0.8 m (2.5 ft) deep.	Estimated velocity of 0.9 m/sec (3 ft/sec) to 2.2 m/sec (7 ft/sec) at normal water. Average discharge is estimated at 2.5 m^3/sec (90 ft^3/sec) in lower reaches. Low flow discharge increased at dam on outlet of Mud Lake.	Mostly rock and sand with organic material in swamps and marshes. Most banks are steep and less than 0.6 m (2 ft) high.	Mostly bedrock and sand with some silt. Gradient generally<1%; up to 5% in rapids below Mud Lake outlet.
Other streams	Perennial streams flowing across flat to moderately rolling plains; mostly trending in a northwesterly direction. Some streams with bordering swamps and marshes, particularly in eastern half of reservation.	Same as above, except low-lying areas along Sawyer Creek subject to flooding for about 2.5 weeks in April. Minor flooding along several other streams.	Widths vary, but streams generally less than 3 m (10 ft). Lower Cold Creek and several stretches of Matoon, Pleasant, Beaver Meadow Creeks and Trout Brook sometimes exceed 3 m (10 ft) in width.	Mostly less than 0.5 m (1.5 ft) deep; some pools up to 0.9 m (3 ft).	Estimated velocities for most streams less than 0.9 m/sec (3 ft/sec) at normal water; Cold Creek up to 1.8 m/sec (6 ft/sec). Average discharge estimated at 0.3 m^3/sec (10 ft^3/sec) to 0.6 m^3/sec (20 ft^3/sec) for Pleasant, Buck, Deerlick, Cold and Sawyer Creeks; others less than 0.3 m^3/sec (10 ft^3/sec).	Generally sandy in south and southeast; silty and clayey in southwest, central part and northwest; and, rocky and sandy in northeast. Organic materials on banks adjacent to swamps and marshes. Most banks steep and less than 0.6 m (2 ft) high, except in swampy areas.	Silty sand in east and south. Much silt and clay in central part and west. Scattered bedrock stretches in most streams, except less in northwest. Gradients mostly <1%; greater in rapids and in headwaters.
Standing Bodies of Water							
(See Lakes, Ponds and Reservoirs table below)							
Wet Areas							
Swamps and Marshes	Mostly perennial swamps containing more than 50% trees and shrubs; few marshes containing over 50% in grasses. Heaviest concentration in northeast; very few in southwest. In northeast, located mostly on bedrock in shallow depressions and bordering streams. In south-central area, along streams with low gradients. Beaver dams contribute to size of wet areas.	Same as above, except wet areas near flood prone streams subject to flooding for about 2.5 weeks in April.	Areas vary from a few square meters to several square kilometers (see map); dimensions will vary during the high and low-water periods.	Water generally less than 1 m (3.3 ft) deep.	Water movement is usually imperceptible and discharge is seldom measurable.	Wet areas usually merge gradually into higher terrain.	A layer of organic material, often many feet thick on top of mostly silty sand; some silty clay in central area of reservation.

LAKES, PONDS AND RESERVOIRS

MAP NO.	NAME	GRID COORDINATES	AREA (APPROXIMATE) HECTARES (ACRES)	MAXIMUM DEPTH (APPROXIMATE) METERS (FEET)	BANK HEIGHTS (APPROXIMATE) METERS (FEET)	BOTTOMS	REMARKS
1	St. James Lake	388780	6 (15)	5 (15)	0-1.5 (0-5)	Silty	Also known as Remington Pond. Earth dam with concrete spillway and removable board gate.
2	Indian Lake	638874	79 (195)	11 (35)	0-2.4 (0-8)	Silty	
3	Indian Pond	636857	19 (47)	4 (12)	0-3 (0-10)	Silty	About 20% off-post. On-post acreage listed.
4	Quarry Pond	603842	1.2 (4)	14 (45)	0-15 (0-50)	Rock	
5	Narrow Lake	360869	17 (41)	4 (12)	0-9 (0-30)	Silty	
6	Mud Lake	667896	37 (92)	3 (10)	0-1.5 (0-5)	Silty	Flow from lake into Indian River controlled by 1.2 m (4 ft) high concrete dam with concrete spillway and removable board gate.
7	Burnt Pond	657874	2.1 (7)			Silty	About 25% off-post. On-post acreage listed.
8	Dority Pond	598892	9 (23)	2.7 (9)	0-1.5 (0-5)	Silty	
9	Marsh Pond	666888	1.2 (4)	1.5 (5)		Silty	A second 0.8 ha (2 acre) pond at grid coordinates 659888 is sometimes known by the same name.
10	[Buck Creek Campsite Pond]	503808	1.5 (5)	2.4 (8)	0-1.2 (0-4)	Silty	Earth dam with concrete spillway. Not maintained; spillway deteriorating.
11	Benton Pond	679904	1.5 (5)	1.5 (5)		Silty	
12	[Firing Range Pond]	484900	1.4 (3.5)	1.5 (5)	0-0.9 (0-3)	Clay	Dammed by firing range revetment.
13	[Philadelphia Water Supply Reservoir]	818448	0.4 (1)	2.4 (8)	0-1.2 (0-4)	Clay	1.5 m (5 ft) high concrete dam with concrete spillway. Reported volume of 11.355 m^3 (9.2 acre/ft). Banks adjacent to dam with concrete revetment.
14	[Leray Mansion Pond] upstream pond	390773	0.08 (0.2)	0.9 (3)	0-0.9 (0-3)	Silty	Earth and laid up stone dam with stone spillway and removable board gate.
	[Leray Mansion Pond] downstream pond	389774	0.3 (0.7)	2.4 (8)	0-0.6 (0-1.5)	Silty	Concrete dam with removable board gate. Dams for No. 14 not shown on map.

MEAN MONTHLY AND MEAN ANNUAL DISCHARGE

MONTH	WEST BRANCH OSWEGATCHIE RIVER NEAR HARRISVILLE, NY (1917-1976) M^3/SEC	(FT^3/SEC)	BLACK RIVER AT WATERTOWN, NY (1921-1976) M^3/SEC	(FT^3/SEC)
January	13.6	(481)	108.4	(3832)
February	11.4	(405)	98.1	(3467)
March	23.5	(830)	160.7	(5679)
April	38.4	(1358)	278.8	(9851)
May	20.1	(710)	157.7	(5571)
June	9.4	(333)	76.0	(2687)
July	6.1	(215)	55.6	(1963)
August	4.4	(154)	44.9	(1586)
September	5.2	(184)	56.0	(1980)
October	9.4	(333)	75.9	(2682)
November	14.9	(527)	109.2	(3861)
December	15.3	(540)	115.5	(4081)
Mean Annual	14.2	(502)	110.5	(3902)

FORT DRUM, NEW YORK
TERRAIN ANALYSIS

SURFACE CONFIGURATION

1. **Low Plains** — Predominantly flat to moderately rolling surfaces; local relief generally from 18 to 40 meters; slopes mainly between 0 and 8%.

2. **High Plains** — Predominantly rolling to hillocky surfaces; local relief generally from 50 to 58 meters; slopes mainly between 3 and 15%.

SURFACE DRAINAGE

Bank to bank gap width*

- > 25 m
- 15-25 m
- 10-15 m
- 3-10 m
- < 3 m

43.6 (141.6) — Bank to bank gap width, m (ft)*.

Wet area (swamps and marshes).

W2 — Lake, pond or reservoir; number refers to entry in text.

B — Bridge or culvert capable of obstructing high-water flow.

Dam; masonry.

Dam; earth fill.

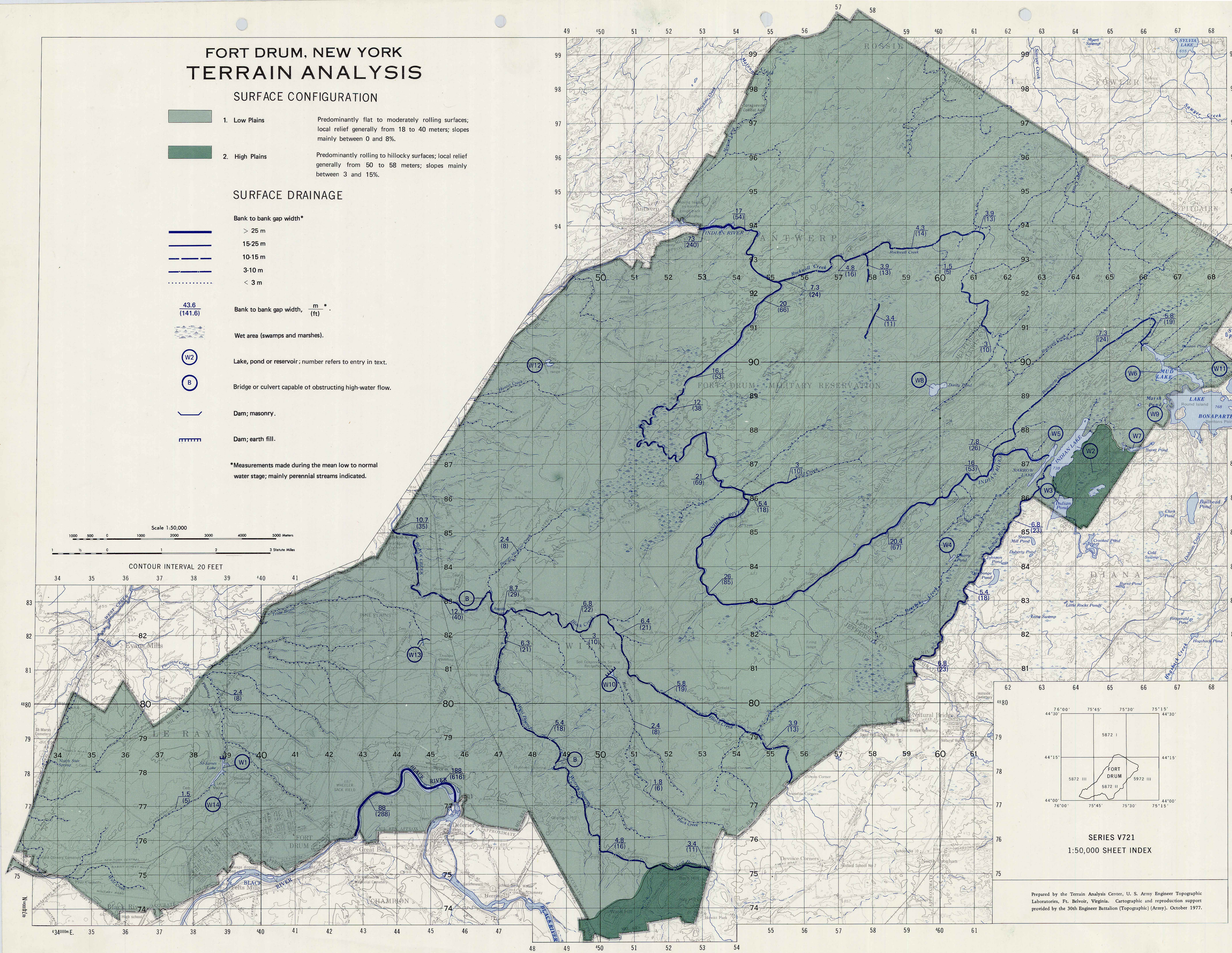
*Measurements made during the mean low to normal water stage; mainly perennial streams indicated.

Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET



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Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

C. WATER RESOURCES

1. SURFACE WATER

Very few measurements are available on quantity and quality of waters in the streams and lakes on Fort Drum. Estimates of average depths were obtained from the Directorate of Facilities Engineering at the post, and widths of streams were scaled from aerial photographs. These values were used as a basis for estimating most of the quantities of available water which are presented in the table below. Low and high extremes of discharge may occasionally exceed the ranges given in the table.

The New York State Department of Environmental Conservation designates waters of the state according to the following classes--N, "A" "AA", B, C and D (see bottom of table below for an explanation of each class). This classification system appears to be a "use" classification rather than a "quality" classification, although use of water does give an indication of its relative quality. Several of the "fishing" (Class C) streams, however, are believed to be of suitable quality as a source for drinking water although they are not presently being used for that purpose. The stream classifications have been included under "Quality" in the table. Any other known information on water quality is also included. Data on chemical analyses of water from the Black and Indian Rivers are also presented. Waters from other streams and lakes on Fort Drum are more likely to have characteristics similar to the Indian River than the Black River.

Except for the Black River, there are no significant sources of municipal or industrial pollution to the streams on Fort Drum. Domestic animals and farming are prohibited on the reservation, so there is little chance of agricultural pollution except for two or three streams that originate off the post and flow several kilometers before entering the reservation.

Generalized USGS maps relating to water quality indicate the following prevalent conditions of streams in the vicinity of Fort Drum: (a) dissolved-solids concentration of less than 100 parts per million, (b) predominant chemical type is calcium-magnesium, and (c) sediment concentration is less than 300 parts per million. The low concentration of dissolved solids of "calcium-magnesium type" water indicates that the water is soft.

Almost all of Fort Drum is drained by the Indian River and its tributaries. The Indian River crosses the reservation east to west, but it zig-zags considerably as it is strongly controlled by rocky hillocks which extend in a northeast-southwest direction. The village of Antwerp gets its water supply from the Indian River between Antwerp and the western edge of the post; chlorination is the only treatment before the water is delivered to the consumer. Water quality is generally good for the Indian River and its tributaries on the reservation, as there is very little industrial or municipal waste discharged into the streams above Antwerp. Usually the waters are clear but have a dark amber color. There should not be much agricultural pollution as most of these streams originate within the boundaries of the post; exceptions are Black Creek, West Branch and Indian River. Indian River has the opportunity to "settle" in Indian and Narrow Lakes. There is another Indian River and Indian Lake about 100 km (70 mi) east where USGS has obtained data, which must not be incorrectly applied to this area.

The Black River is the largest stream on or near Fort Drum, but it has been relatively unimportant to the reservation as a source of water or a drainageway. It loops into the post for about 3 km (2 mi) a short distance above the cantonment area and also flows very close outside the southern boundary for about 15 km (9 mi); however, it drains very little of the post as the northern limit of its drainage area is only about 1.5 km from the Black River in the vicinity of Fort Drum. For many years, much municipal and industrial wastes have been discharged into the Black River. In the last five years, however, there has been a significant improvement in the quality of its water, a result of the state's Pure Waters Program. Watertown is the only municipality which uses the Black River as its source of water, which is processed through a rapid sand filtration plant and given extensive chemical treatment to combat odor, taste, and color problems. Fort Drum gets its water supply from wells, but enormous quantities of water are available from the Black River if there should be any need to utilize it.

The northern edge of the post is drained by several small streams which are branches of Sawyer Creek. Sawyer Creek flows northwestward off the northern edge of the reservation and empties into the Oswegatchie River. Waters in these streams are expected to have characteristics that are similar to the waters in the Indian River.

Maximum runoff at Fort Drum generally occurs from late March through May; stream flows are lowest in the summer and early fall (June through October). There is some regulation of flow in the Black and Indian Rivers; primary purpose is to be able to provide additional water to maintain a desired minimum flow during the drier months. From late November to late March, ice on the surfaces of streams and lakes may be as much as 30 inches thick, and snow may be several feet deep; water can be very difficult to obtain under these circumstances.

SOURCE	QUANTITY	QUALITY	DEVELOPMENT OF SOURCES [1]
STREAMS			
Black Creek--flows northwestward across south-central part of reservation joining the Indian River near the village of Philadelphia.	Enormous* quantities of water, exceeding 40,000 lpm (15,000,000 gpd), downstream of West Branch. Volume decreasing upstream; very large quantities, between 4,000 and 40,000 lpm (1,500,000 and 15,000,000 gpd) in middle reach and large to moderate quantities most of year in upper reach.	Class C(t)s** stream. Source about 4 km southeast of post boundary, could contribute some agricultural pollution before entering reservation; no other pollution problems expected.	Access to stream largely restricted by forests in lower and middle reaches; upper reach mostly lined by swamps. Banks throughout largely steep, up to 3 m (10 ft) high. Flooding during April, up to 2 m (7 ft) above normal water in lower course.
Black River--widest and deepest stream on reservation; flows across about 3.2 km (2 mi) of southern part of post just east of cantonment area.	Enormous quantities of water available at all times. Regulated flow; attemps to maintain minimum flow of 1,000 ft³/sec (1,698,000 lpm). Average measured discharge at Watertown is 6,626,000 lpm (2,521,000,000 gpd).	Class A stream. Much municipal and industrial wastes are discharged into Black River. Conditions much improved in last 4 years as result of Pure Waters Program. Suitable for domestic use with adequate filtration and chemical treatment to combat color, taste, and odor. (See table below for chemical analyses.)	Except for a few places, access to stream would be restricted by forests. Both banks generally quite steep; bluffs over 30 m (100 ft) high on right bank.
Bonaparte Creek--entire course on northeastern part of reservation; drains Mud Lake into Indian River.	Enormous quantities of water available. Estimated flow is over 40,000 lpm (15,000,000 gpd). Gates at Mud Lake allow flow to be regulated.	Class C stream. Quality should be good; no significant sources of pollution.	Access largely limited by dense, mixed scrub and some dense conifers; outlet near Mud Lake lined by swamps. Banks generally steep, and less than .6 m (2 ft) high.
Indian River--winds across northern part of reservation. Including its major tributaries in the southern half of the reservation, the stream drains almost all of reservation.	Enormous quantities of water available, usually exceeding 40,000 lpm (15,000,000 gpd). Average measured discharge in 1966 was 625,000 lpm (238,000,000 gpd) at an unknown location. Low flow is in August and September. Flow from Mud Lake is regulated to maintain flow into Bonaparte Creek and Indian River during the low-flow periods.	Class AA stream. Very little municipal or industrial pollution above Antwerp. Antwerp gets its water from Indian River at western edge of post; only treatment is chlorination. In 1966, coliform bacterial count at Antwerp was less than 2.2 per 100 ml of sample. (See table below for chemical analyses.)	Except for a few grassy areas, access to the stream would be largely restricted by forests and dense scrub. Densely forested swamps line both banks in lower, middle and upper reaches. Banks generally steep, .6 to 4.6 m (2 to 15 ft) high; locally up to 15 m (50 ft) on right bank of middle reach. Flooding, commonly in April, may reach 2.4 m (8 ft) above normal water in lower reach.
Beaver Meadow Creek--short creek flowing southwestward into lower reach of Black Creek.	Very large quantities of water, up to 20,000 lpm (7,500,000 gpd) in lower reach; decreasing to small quantities available seasonally in upper reach.	Class C stream. No known sources for pollution.	Access to water points restricted mainly in lower and upper reaches by forests.
Buck Creek--short creek flowing northwestward into middle reach of Black Creek; lower reach dammed to form small SCS recreation lake.	Very large quantities of water generally available; discharge between 4,000 and 20,000 lpm (1,500,000 and 7,000,000 gpd).	Class C(t)s stream. Entire course is on post; should be no pollution problems.	Access restricted along most of course by forests; banks in middle reach swampy.
Cold Creek--short creek flowing southwestward into Indian River from Main Impact Area.	Very large quantities of water available; estimated discharge is between 10,000 and 40,000 lpm (4,000,000 and 15,000,000 gpd).	Class C stream. Explosives impacting in area could be a pollution source.	Access restricted mainly by dense scrub; swampy banks near mouth.
Deerlick Creek--short creek in east-central part of reservation flowing northward into Indian River.	Very large quantities of water available; estimated flow from 10,000 to 40,000 lpm (4,000,000 to 15,000,000 gpd) in lower reach. Decreasing quantities in upper reaches.	Class C stream. There should be no significant sources of pollution since entire course is on post.	Access restricted along most of course by swamps; some dense scrub in lower reach.
Matoon Creek--short creek in northwestern part of reservation flowing northward off post into the Oswegatchie River.	Very large quantities of water, 4,000 to 30,000 lpm (1,500,000 to 12,000,000 gpd); decreasing quantities in upper reaches.	Class C stream. Should be no pollution sources on post.	Access to water points restricted in some places along the lower and upper reaches by dense forests.
Pleasant Creek--short creek in the southwestern part of reservation flowing northward off post into West Creek and Indian River. Middle reach dammed to form St. James Lake (Remington Pond).	Very large quantities of water available; discharge from 4,000 to 20,000 lpm (1,500,000 to 7,500,000 gpd).	Class C(t)s stream. Upper reach is near cantonment area, suggesting some possible pollution sources.	Access to water points restricted in many places by forests.
Rockwell Creek--winds westward across northern part of reservation and joins lower reach of Indian River; entire creek on reservation.	Very large quantities of water available at all times, generally 20,000 to 40,000 lpm (7,500,000 to 15,000,000 gpd); decreasing quantities in upper reaches. Enormous quantities estimated at times in lower reach.	Class C stream. Flows partially through impact area, suggesting possible pollution source from impacting explosives.	Access to streams largely restricted by forests in lower reach and dense scrub in upper reach. Lower reach subject to minor flooding in April.
Trout Brook--short stream in the southwestern part of the reservation flowing westward off post into the Indian River; upper reach dammed to form Philadelphia water supply reservoir.	Very large quantities of water available; estimated flow between 4,000 and 25,000 lpm (1,500,000 and 10,000,000 gpd).	Class C(t)s stream. Water from spring-fed reservoir on upper reach is used by the village of Philadelphia without treatment. No known source of pollution.	Access to water points restricted in many places, particularly in upper reach, by forests.
West Branch--flows northwestward across south-central part of reservation joining the lower reach of Black Creek on the left bank.	Very large quantities of water available, generally 4,000 to 20,000 lpm (1,500,000 to 7,500,000 gpd).	Class C(t)s stream. Originates about 5 km off the post, which allows some possible agricultural pollution.	Access to water points restricted by dense forests in extreme lower reach and by swamps along most of lower and middle reaches. Upper reach restricted by forests. Flooding common in April, may reach 1.5 m (5 ft) above normal water in middle and lower reaches.
West Creek--short creek in the southwestern part of reservation flowing northwestward off post into Indian River; fed by springs near reservation boundary.	Very large quantities of water; low flow estimate at Evans Mills is 5,000 lpm (2,000,000 gpd).	Class C(t)s stream. Evans Mills gets its water supply from West Creek; treatment process includes pre-sedimentation, diatomaceous earth filtration, and post chlorination. Can probably be reclassified "A."	Access to water points restricted in the lower and parts of upper reaches by dense forests.
Hunter Creek--short creek in the west-central part of reservation flowing westward off post into Indian River near the village of Philadelphia.	Generally large quantities of water available, up to 4,000 lpm (1,500,000 gpd); decreasing quantities in upper reaches.	Class C stream. No anticipated sources of pollution since creek originates on post.	Access to water points restricted in many places by forests.
[Shingle Creek]--short stream flowing southwestward into lower reach of Indian River; entire creek on reservation.	Large quantities of water available, generally 400 to 4,000 lpm (1,500,000 to 15,000,000 gpd) except less in summer; decreasing quantities in upper reaches.	Class C stream. Since entire course is on post, there should be no pollution problems.	Access to water points largely unrestricted.
LAKES, PONDS AND RESERVOIRS			
Indian Lake--adjoins Narrow Lake in northeastern part of reservation. Indian River flows into this lake and exits to the west through Narrow Lake.	Very large quantities of water available without recharge. 79 hectares (195 acres). Estimated volume 2,935,000 m³ (762,400,000 gal).	Class C. Receives water from the upper Indian River, which might have some agricultural pollution. Indian Lake acts as settling basin which improves water for the lower Indian River.	Access to water points largely restricted by dense scrub; in northwest swamps border shore.
[Philadelphia Reservoir]--located in south-central part of reservation; exits over concrete dam into upper reach of Trout Brook.	Very large quantities of water considered to be available. 0.4 hectares (1 acre). Reported capacity is 11,500 m³ (3,000,000 gal), plus an adjacent reservoir of the same capacity which is utilized when the spring is being cleaned. Spring is reported to discharge 8000 lpm (3,000,000 gpd). Supplies water to the village of Philadelphia.	In 1966 bacterial count ranged from 1 to more than 5000 per ml, while coliform bacterial count was consistently less than 2.2 per 100 ml. In1968 Philadelphia distributed water from spring-fed reservoir without any treatment.	Access to water points largely restricted by dense forests.
Indian Pond--located in northeastern part of reservation; discharge flows into Indian Lake from the south.	Large quantities of water available without recharge. 24 hectares (59 acres). Estimated volume 430,000 m³ (115,000,000 gal). About 12 acres are off post.	Class C. No known source of pollution.	Access to water points largely restricted by dense scrub and swamps.
Mud Lake--located in the northeast part of reservation. Exits to west into Bonaparte Creek over low dam.	Large quantities of water available without recharge. 37 hectares (92 acres). Estimated volume 570,000 m³ (150,000,000 gal). Connected with the much larger Bonaparte Lake to the east. Dam regulates volume in summer to enhance flow of Indian River.	Class C. Possible agricultural pollution from streams which first flow into Lake Bonaparte, which acts as a settling basin, and then enter Mud Lake.	Access to water points largely restricted by dense scrub, marshes and swamps.
Narrow Lake--adjoins Indian Lake to the west in northeastern part of reservation. Indian River enters this lake through Indian Lake and exits to the west.	Large quantities of water available without recharge. 17 hectares (41 acres). Estimated volume 360,000 m³ (93,500,000 gal).	Class C. Possibly some agricultural pollution from upper Indian River. However, water first passes through Indian Lake, which acts as a settling basin.	Access to water points largely restricted by dense scrub and dense forests.
Benton Pond--located in northeastern corner of reservation. Discharge flows into Mud Lake to the southwest.	Moderate quantities of water available without recharge. 2 hectares (5 acres). Estimated volume 25,000 m³ (6,500,000 gal).	No known source of pollution.	Access to water points largely restricted by dense scrub.
Burnt Pond--located in the northeastern part of reservation. Discharges into Indian Lake to the west.	Moderate quantities of water available without recharge. 4 hectares (9 acres). Estimated volume 55,000 m³ (14,000,000 gal). About 2 acres are off post.	Class C.	Access to water points largely restricted by dense scrub.
Dority Pond--located in the west-central part of the reservation.	Moderate quantities of water available without recharge. 9 hectares (23 acres). Estimated volume 145,000 m³ (37,500,000 gal).	Class C. No known source of pollution.	Access to water points largely restricted by dense scrub and dense forests.
St. James Lake (also known as Remington Pond)--located in the southwest part of the reservation, northwest of the cantonment area. Pleasant Creek enters the lake from the south and exits over the spillway of an earth dam to the north.	Moderate quantities of water available without recharge. 6 hectares (15 acres). Estimated volume 115,000 m³ (30,000,000 gal).	Class BC(t).	Some restriction of access to water points by forests in the north and east; dense forests in the south.
Quarry Pond--located in the western part of the reservation. Abandoned limestone quarry.	Moderate quantities of water available without recharge. 2 hectares (4 acres). Estimated volume 175,000 m³ (45,600,000 gal).	Class C(t). No known source of pollution.	Access to water points restricted by dense scrub and very high, steep banks in the west; swamps in the east.
[SCS Recreation Lake] (also known as Buck Creek Campsite Pond)--located in the south-central part of the reservation. Buck Creek enters the lake from the southeast and exits over the spillway of an earth dam to the northwest.	Moderate quantities of water available without recharge. 2 hectares (5 acres). Estimated volume 25,000 m³ (6,500,000 gal).	No known source of pollution.	Access to water points restricted by dense forests.

C. WATER RESOURCES (continued)

1. SURFACE WATER (continued)

*Definitions of underlined terms are as follows:

Volume Terms	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Enormous	>40,000	>15,000,000
Very large	4,000-40,000	1,500,000-15,000,000
Large	400-4,000	150,000-1,500,000
Moderate	40-400	15,000-150,000
Small	4-40	1,500-15,000
Meager	<4	<1,500

USER NOTE:
For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM 5-700, July 1967, paragraph 19, or other applicable manuals or regulations.

** New York State Department of Environmental Conservation classification of waters:

Class N	-Streams are high quality, unpolluted water in their natural state with no present or planned development.
Class "A" "AA"	-Streams are used for drinking supply.
Class B	-Streams are used for bathing or other contact recreational activity.
Class C	-Streams used for fishing and fish propagation.
Class D	-Streams refer to other waters in which data are insufficient to permit a different classification.

Streams inhabited by Trout may be further classified with the letter (t) following the major classification, ex., AC(t) classified stream indicates that fish are present and that Trout inhabit the water. AC(t)s stream indicates a stream inhabited by Trout, and successful spawning of Trout occurs.

1/ Development of water intake points becomes more difficult from late November to late March when ice, up to 30 inches in thickness, and deep snow cover streams and lakes.

CHEMICAL ANALYSES - BLACK AND INDIAN RIVERS

CONSTITUENTS		BLACK RIVER AT WATERTOWN MAY 1967	BLACK RIVER AT WATERTOWN AVERAGE FOR 1975	INDIAN RIVER AT ANTWERP (NO DATE; PRIOR TO 1968)
pH	--	6.90	7.30	7.10
Nitrite N	mg/l	0.019	0.01	0.066
Color	units	12	25	25
Hardness	mg/l	74.00	38.00	38.00
Calcium	mg/l	56.00	13.00	24.00
Alkalinity	mg/l	64.00	27.00	33.00
Iron	mg/l	0.22	0.53	0.14
Manganese	mg/l	0.00	0.056	0.00
Sulfate	mg/l	30.00	9.10	33.00
Nitrate N	mg/l	0.037	0.60	0.022
Chlorides	mg/l	3.75	2.10	1.40
ABS	mg/l	0.010		0.050
Silica	mg/l	4.00	5.50	2.60
Total Solids	mg/l	132.00		610.00
Turbidity	units	<1	4	<1
Potassium	mg/l	0.93	0.80	0.47
Sodium	units	<5	2.7 (mg/1)	<5
Conductivity	Micromhos	285	85 (spec cond)	110
Phosphate	mg/l	0.95		0.95
Phenols	PPB	0.90		1.00
Ammonia Nitrogen	mg/l	0.20	0.10	0.22
Chem Ox Demand	mg/l	3.17	18.00	2.88

2. GROUND WATER

Much of Fort Drum is underlain by prolific aquifers and all the rocks and unconsolidated materials contain water. Principal aquifers at Fort Drum are fine and medium sands of deltaic deposits from Pleistocene glacial streams emptying into proglacial lakes; permeable zones in Paleozoic sandstone, one of which lies immediately upon porous igneous and metamorphic rocks which were heavily weathered before deposition of the sandstone; joints, bedding planes, and solution openings in Paleozoic limestones; and joints, fractures, and possible solution openings in preCambrian igneous and metamorphic rocks.

Deltaic deposits are the primary ground water source on the reservation, and the site of all drilled wells; the underlying sandstone and limestones contribute to the high yields. The other principal aquifers are reliable, generally year-round sources, but quantities available are much less than from the deltaic and underlying materials. Unconsolidated water-bearing deposits make up relatively thin surficial veneers over much of the reservation and yield little more than minimum domestic supplies. Floodplain deposits, usually good sources of fresh water, are infrequent and thin along major streams on Fort Drum, and are not delineated on the accompanying Ground Water map.

Ground water at Fort Drum occurs both as water-table aquifers and as artesian aquifer systems. The deltaic sand deposits contain a water-table aquifer, in which a zone of saturation extends from several meters below the surface to an impermeable substratum (clay, till, or bedrock), and an artesian aquifer, in which water moves between impermeable layers at depth under positive hydraulic pressure. Perched water, a localized occurrence in which limited volumes of water are held up by impermeable layers above the zone of saturation, probably occurs at many places on the reservation. While recharge to water-table aquifers is from precipitation, recharge to artesian systems is from both precipitation and stream inflow.

Most ground water is recharged during fall, winter, and spring; spring recharge is more rapid than fall, and generally exceeds that of the fall. Soil-moisture deficiencies are wholly or partly fulfilled from the fall recharge, and evapotranspiration water losses are minimal during the winter; hence, melt water in the spring soon exceeds the field capacity of the soil and percolates down to the water table.

The chemical quality of ground waters on Fort Drum is generally excellent. Water from the water-table aquifer in the deltaic sand deposit is of a low calcium-bicarbonate type. The low mineral content of the shallower waters reflects the relatively short time that the water is in contact with the sediments, and the dominance of resistant quartz grains in the sandy aquifer. Water from the artesian system in the same area is slightly different, particularly higher in magnesium and sulfate; the general tendency in well waters on the reservation is an increase in mineral content away from the Black River. Water from glacial-deposits aquifers is commonly objectionably high in iron and manganese content. The quality of water from the igneous and metamorphic rocks resembles that of water in overlying deposits. Pollution of ground-water supplies is not significant--which is surprising in view of the thin surficial cover in many places and the probability of drainage from many old barnyards.

The accompanying Ground Water map and the table below include evaluations of the development potential of only those aquifers which are most likely to be tapped for military requirements.

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES
1	Large* quantities available from water-table aquifers and from underlying artesian aquifer system. Water-table aquifers: Yields from individual wells presently developed range from 340-565 lpm (liters per minute) or 90-150 gpm (gallons per minute) with a 9-12 m (30-40 ft) drawdown which is maximum available without lowering the level below cased portions; specific capacity is 11-19 lpm (3-5 gpm) per foot of drawdown; fine sands have assumed 40% porosity and 10% specific retention, and a probable maximum 30% specific yield of the aquifer; about 10 inches of water is derived from annual recharge (25% of average annual precipitation). Total capacity of three present wells in water-table aquifer is 1360 lpm (360 gpm) or 2 million lpd (518,400 gpd); there has been no significant change in the water-table level since the wells were installed. Geologic source is 46 m (150 ft) maximum thickness of layered Pleistocene deltaic fine to medium sands, some silts, and occasional clays. Artesian aquifer System: Yields from individual wells presently developed range from 570-1780 lpm (150-470 gpm) with 3.5-38 m (10-110 ft) drawdown (safe yields); specific capacity is 7.5-26 lpm (2-7 gpm) per foot of drawdown with two wells reaching up to 21 gpm; transmissivity 1600-9000 m^3pd/m^2 (40,000-220,000 gpd/ft^2). Total capacity of nine present wells tapping the artesian aquifer system, including some infiltration from the water-table aquifer, is 9700 lpm (2580 gpm) or 14,000 m^3pd (3.7 million gpd); all wells are in hydraulic contact, and show pressure changes related to stages of the Black River, the principal recharge source. Geologic source is upper Potsdam sandstone, sandy dolomitic Theresa Formation, and limestone, all of Paleozoic age; possible weathered basement igneous and metamorphic rocks; and, perhaps, overlying deltaic sands. Seasonal variation in yields from deeper water-table aquifers is minimal; in yields from artesian aquifer system, reflects pressure differences caused by varying levels of the Black River. Three springs (Nos. 2, 6, 7 on accompanying map and table) flow year-round; source is the water-table; quantities are moderate to large, varying little seasonally. All 12 deep wells on Fort Drum, for which data are available, are located in this map unit in the vicinity of the cantonment area.	Water table generally about 12 m (40 ft) below the surface; seasonal fluctuation about 0.6 m (2 ft). Hydrostatic (piezometric) levels in artesian-system wells 3-24 m, average 18 m (11-78 ft, average 60 ft) below the surface; artesian pressures lowest in July. Thickness of unconsolidated deltaic sand deposit 15-46 m (50-150 ft); commonly over glacial materials, particularly till, <3-20 m (<10-65 ft) thick; maximum of 23 m (75 ft) of underlying Paleozoic sedimentary rocks penetrated in existing wells. Because water flows in only a limited number of zones in bedrock, a deeper well does not insure a greater yield.	Water-table aquifers: Quality excellent. Total dissolved solids 52-74 ppm (parts per million); hardness 37-59; pH averages 6.8, maximum probably 7.4; color value very low. Water is low-calcium-bicarbonate type. Artesian-aquifer system: Quality very good. Total dissolved solids 71-158 ppm; hardness 56-88; pH averages 7.6, maximum probably 7.9; color value very low. Water is somewhat higher in magnesium and sulfate than water-table water. Except for recent seepage of leachate from landfill entering Well No. 2, no noticeable pollutants in present wells. Water from present wells is chlorinated, and small amount of silicate of soda is introduced.	Additional shallow wells constructed to the water table would be limited only by the recharge from precipitation, and would produce good quality water. Slightly deeper wells producing twice as much water with only slightly poorer chemical quality could be constructed adjacent to the Black River and have a very efficient specific capacity from the limestones; the supply would be limited only to the baseflow of the river. Relatively shallow wells in selected areas should produce several hundred gallons per minute in either the water-table or artesian aquifers. Access to drill sites is easy, and surface configuration and soils present no problems to positioning drill rigs. Wells in unconsolidated materials should be drilled over size, casing placed in the center, gravel-packed to fill the remaining space, screened for the lower ten feet, and developed by flushing. In bedrock, casing should not seal the well from the productive first 15 feet or so of weathered igneous and metamorphic rocks and the gravelly layer which often lies on them.

C. WATER RESOURCES (continued)

2. GROUND WATER (continued)

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES
2	Moderate quantities available from wells tapping a single aquifer; large quantities from wells intersecting two or more of the five known major waterbearing bedrock zones. Known zones: Joints and fractures in pre-glacially weathered preCambrian igneous and metamorphic rocks; basal part of Paleozoic Potsdam sandstone (possibly with lowermost gravel stratum); upper part of Potsdam; weathered sandy dolomitic Paleozoic Theresa Formation; and, solution-widened joints, fractures, and bedding planes in Paleozoic limestones (see Engineering Geology map for distribution of rock types). Maximum yields--750-1900 lpm (200-500 gpm)--probably only from wells in westernmost occurrence of Map Unit 2, where all five zones may occur in a vertical section. Yields less in larger area of Map Unit 2 because limestones are lacking, glacial scouring thinned Potsdam and Theresa Formations, probably removed permeable weathered zone from igneous and metamorphic rocks along west-central edge of the reservation, and because unconsolidated overburden is thin to lacking. Recharge in the artesian bedrock systems is predominantly from Indian River. There are no drilled wells in Unit 2 and no springs of significance other than Nos. 8 and 10.	No ground-water hydrologic data are available. There is no actual continuous water table in most of Map Unit 2 because water is in permeable zones confined by impermeable strata. Thickness of the Potsdam sandstone south of Indian River is about 4.5-7.5 m (15-25 ft); the Theresa Formation is 9-10.5 m (30-35 ft) thick one mile northwest of Woods Mills. The basement igneous and metamorphic rocks, however, are unevenly ridged, with a subsurface relief of as much as 30 m (100 ft); thickness of the Potsdam and Theresa Formations vary accordingly.	Quality probably very good. No analyses available, but chemical characteristics will be similar to those of Map Unit 1 artesian-aquifer system water which is derived largely from same geologic formations. If a permeable stratum is at the surface, it would be susceptible to contamination because the generally thin overburden is an inadequate filter.	Ground water is available everywhere in Map Unit 2 but quantity available at any given site is unpredictable. Recharge to the bedrock is predominantly from the Indian River, so wells sited near the river and drilled into any available aquifer sloping down from the river and open to inflow would provide reliable year-round supplies of good quality water. Quantities would depend upon characteristics of the available aquifer; should be at least moderate amounts available. Casings must be perforated at proper depth; minimal development necessary. Wells into igneous and metamorphic bedrock along the west-central edge of the reservation must be 30-60 m (100-200 ft) deep to produce even a few gallons per minute. Access to drill sites is easy, and surface configuration and soils present no problem to positioning drill rigs.
3	Moderate quantities available from sandy or gravelly glacial deposits more than 10 m (30 ft) thick. Yields everywhere commonly adequate for domestic supplies. If coarse materials of buried channel-fill are tapped, yields from wells 30 m (100 ft) deep can produce 75-380 lpm (20-100 gpm). The glacial deposits comprise kames, kame terraces, till, and randomly distributed heterogeneous morainal materials. Kames and kame terraces can yield moderate quantities of water if they are extensive enough for adequate recharge from precipitation or stream inflow. Sandy till provides small to moderate quantities; clayey till provides little water, and may inhibit percolation into underlying permeable materials, resulting in perched water, or swamps. Till, except in stream valleys, often is above the water table and unimportant as a groundwater source. Heterogeneous morainal associations are unpredictable sources and often unreliable. Thin glacial deposits not available to recharge from perennial streams will produce poorly in the summer. Gravelly channel-fills have not been identified on Fort Drum. There are no drilled wells in Map Unit 3 and the only spring of significance is North Star Spring (No. 1).	No ground-water hydrologic data are available. Depth of water table will be erratic because of random distribution of materials of widely differing permeabilities, local layers or lenses of impermeable clayey till, possibly with perched water or swamps, and local permeable channel sands or gravels. Glacial deposits probably average less than 15 m (50 ft) thickness. Drawdown of shallow wells often excessive except if recharged adequately from nearby streams. Local hydrostatic levels high in the spring, significantly lower in the summer.	Quality probably good. By analogy with chemical analyses of water from wells and springs in areas just off the reservation, it is inferred that dissolved-solids concentration generally 30-100 ppm, lowest in predominantly quartz sediments recharged entirely from precipitation; hardness 20 ppm from non-carbonate sediments to 100 ppm from carbonate sediments. Iron and manganese concentrations can be problems in water from glacial deposits; iron may range from 0-10 ppm (0.3 ppm recommended maximum), manganese 0-0.35 ppm (0.05 ppm recommended maximum). Contamination from surface pollutants likely in shallow perched-water bodies.	Geohydrologic field investigations are necessary to define high-yield zones in generally heterogeneous deposits. Access and well-siting is hindered in many places by wet ground, dissected topography, and vegetation. Well-drilling easy; large-diameter wells are most efficient in till, by presenting more surface for outflow. Wells should be properly screened, developed by flushing, and sealed at the surface to prevent possible contamination.
4	Small quantities available from clays and silts deposited in Pleistocene glacier-impounded lake. Because the materials are fine-grained, they are poorly permeable; flow of water through them is very slow. Recharge is poor. Drawdown in wells will be excessive and rebound slow. Wells may go dry in summer. Poorly permeable clays and silts may cause artesian pressures in underlying permeable layers. Underlying materials probably are till and basement sandstone and limestone similar to rocks of artesian-aquifer system of Map Unit 1. There are no drilled wells in Map Unit 4. One spring (No. 9) occurs near Five Corners.	The lacustrine clays and silts average about 5 m (15 ft) in thickness; maximum probably is about 9 m (30 ft). Maximum yields will be from large-diameter wells penetrating entire deposit.	Quality probably good. No analyses available, but streams flowing across the map unit are of good quality. Surface pollutants entering the deposits will be flushed out very slowly.	Large-diameter wells are most efficient, by presenting more surface for outflow. Wells should be properly screened, developed by flushing, sterilized, and sealed at the surface to prevent possible contamination. Access to drill sites is easy; wet soils may hinder movement.
5	Small quantities available from preCambrian igneous and metamorphic rocks (and minor Cambrian sandstone and dolomite) covered by glacial deposits of varying compositions and thicknesses. Ground-water source is primarily the fractured, jointed, little-weathered rocks; the glacial materials contribute to that source by storing precipitation and streamflow for recharge to openings in the rocks. Wells into the rocks must be 30-60 m (100-200 ft) deep to produce even a few gallons a minute. Yields are lower where till plasters bedrock ridges, and possibly moderate in larger valleys with glaciofluvial and recent sandy sediments. The poorly permeable till holds up numerous swampy areas; recharge in such areas is poor. There are no drilled wells in Map Unit 5 and no springs of significance.	The water table is near the surface of valleys and slightly higher under ridges and hillocks; the level varies with seasonal precipitation. Beaver dams in many narrow valleys raise the level locally. Maximum yields from wells are directly dependent upon maximum penetration of rocks. Permeability of the rocks is low to moderate; recharge is low; drawdown will be rapid, rebound slow to moderate.	Quality probably good. No analyses available. Chemistry of water in the rocks resembles generally that in covering materials. In thinly covered rocks, dissolved-solids concentration probably is 50-100 ppm; hardness 15-70 ppm. Fluoride is commonly derived from solution of rock containing hornblende and mica; fluoride content of waters from igneous and metamorphic rocks should be measured. Iron and manganese concentrations can be problems in water from glacial deposits.	Near-vertical fractures are the most common, and are filled with water from overlying unconsolidated materials. Well sites on thinly covered ridges or hillock tops, therefore, will generally yield little to no water; sites in sediment-filled valleys and basins will yield more. Extensively fractured zones, as along some faults, if identifiable, may yield moderate to large amounts. Wells must be drilled, casings perforated; surface at well openings in valleys should be sealed to prevent possible contamination. Access to drill sites commonly hindered by steep ridge-and-valley topography, wet ground, and vegetation.
6	Small quantities available from preCambrian igneous and metamorphic rocks, minor Cambrian sandstone and dolomite, both with little or no cover of unconsolidated materials; there is only minimal recharge to the rocks. Wells must be 30-60 m (100-200 ft) deep to produce even a few gallons a minute. Slightly greater yields are likely in the narrow linear valleys in the southeastern part of the unit. Yields from wells in the wider valleys in the northwestern part of the unit will not be significantly greater because the valley-fill is predominantly poorly permeable clayey silts. There are no drilled wells in Map Unit 6. There are four springs; three (Nos. 3, 4, 5) close together supply the town of Antwerp, and No. 11 in the extreme northwest.	The water table is near the surface of valleys and slightly higher under ridges and hillocks; the level varies with seasonal precipitation. Beaver dams in many narrow valleys raise the level locally. Maximum yields from wells are directly dependent upon maximum penetration of rocks; the contribution of water from glacial deposits to the wells is not significant. Permeability of the rocks is low to moderate, drawdown will be rapid, rebound slow to moderate.	Quality probably very good. No analyses available. Dissolved-solids concentration probably generally less than 75 ppm, somewhat higher in minor carbonate-rock occurrences; hardness less than 50 ppm. Fluoride is commonly derived from solution of rock containing hornblende and mica; fluoride content of waters from igneous and metamorphic rocks should be measured.	Near vertical fractures are the most common, and are filled with water predominantly from precipitation. Well sites on bare or thinly covered ridges or tops of hillocks, therefore, will generally yield little or no water; sites in the narrow valleys will yield slightly more. Extensively fractured zones, as along some faults, if identifiable, may yield moderate amounts. Wells must be drilled, casings perforated; surface at well openings in valleys should be sealed to prevent possible contamination. Access to drill sites commonly hindered by steep ridge-and-valley topography, wet ground and vegetation.

* Definitions of underlined terms are as follows:

Volume Terms	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Large	400-4,000	150,000-1,500,000
Moderate	40-400	15,000-150,000
Small	4-40	1,500-15,000

CHARACTERISTICS OF WELLS AT FORT DRUM

	WATER-TABLE AQUIFER			ARTESIAN AQUIFER SYSTEM								
WELL NO.	4	6	8	1	2	3	5	7	9	10	11	12
Depth (m/ft)	28/93	36/119	28/92	107/350	34/111	36/119	70/228	33/107	58/190	31/103	69/227	38/126
Source Deposits*	sand	sand	sand	ss	ss, till	ss, sg, till	ss, till	ls	ss, till	ss, ls, till	?	?
Interval Exposed (ft)	80-90	83-93	67-77	173-350	65-110	105-118	155-228	97-107	101-190	45-83	?-227	?-126
Thickness (ft)	10	10	10	177	45	13	73	10	89	58	?	?
Length of Casing (ft)	80	83	67	173	65	105	155?	97	101	558	?	?
Amount of Flow (1965) (gpm)	90	150	120	150	470	160	470	300	230	200	300	300
Specific Capacity (gpm/ft of drawdown)	3	4	5	2	21	3	4	20	5	7	?	?

* ss =sandstone
sg = sandy gravel
ls = limestone

Capacity of the wells system (1965) at maximum available drawdown: 4.2 million gallons per day (2,940 gallons per minute)

Maximum usage at Fort Drum (summers 1965-1969) (usually half days): 4.0 million gallons per day

Data from Geohydrology of the Glacial-Lake Iroquois, Pine Plains Delta Area at Camp Drum, New York (unpublished) 1969.
R. M. Waller, US Geological Survey, Water Resources Division, Albany, New York.

NOTE: There are many dug wells throughout Fort Drum, which provided domestic supplies to early farms.
All are being filled in by the Army as they are located.

SPRINGS AT FORT DRUM

NUMBER	GRID COORDINATES	COMMENTS
1	340782	North Star Spring. Enters West Creek, which supplies town of Evans Mills. Estimated quantity: 1.5 mgpd.
2	448816	Supplies town of Philadelphia; enters Trout Creek. Quantity: 3.0 mgpd.
3,4	514923	Supply town of Antwerp.
5	517923	Supplies town of Antwerp.
6	434801	No information.
7	395787	No information.
8	378773	Formerly used to cool dairy milk supplies.
9	344750	No information.
10	392774	Formerly supplied Leray Mansion.
11	558995	Supplies two farms.

Water quality at all springs is good. Analyses made of water from Spring No. 2 in 1965-66 showed a total bacterial count ranging from 1 to more than 5000 per milliliter, while coliform bacterial counts are consistently less than 2.2 per 100 milliliters.

C. WATER RESOURCES (continued)

2. GROUND WATER (continued)

CHEMICAL ANALYSIS OF GROUND WATER FROM WELLS AT FORT DRUM (1958-1961)
(in parts per million except for specific conductance, pH, color and temperature)

	WATER-TABLE AQUIFER			ARTESIAN AQUIFER SYSTEM								
WELL NO.	4	6	8	1	2	3	5	7	9	10	11	12
Depth (m/ft)	38/93	36/119	28/92	107/350	34/111	36/119	70/228	33/107	58/190	31/103	69/227	38/126
Source Deposits*	sand	sand	sand	ss	ss, till	ss, sg, till	ss, till	ls	ss, till	ss, ls, till	?	?
Sampling Date	11-13-61	11-13-61	2-11-60	12-08-58	2-11-60	12-08-58	1-12-61	12-08-58	1-12-61	2-11-60	1-12-61	11-13-61
Silica (SiO_2)	10	9.4	9.4	10	8.1	7.5	8.2	7.8	9.1	8.5	8.1	7.4
Iron (Fe)	0.08	0.04	0.07	0.49	0.06	0.19	0.08	0.03	0.45	0.04	0.36	0.19
Manganese (Mn)	0	0	0.01	0	0.11	0	0	0	0	0.03	0.2	0
Calcium (Ca)	21	16	12	18	13	15	15	23	19	19	22	17
Magnesium (Mg)	1.5	1.1	1.6	3.1	6.4	4.7	4.5	6.7	4.0	3.2	8.0	6.6
Sodium (Na) Potassium (K) (calculated)	0.9	2.1	0.5	11	3.2	4.1	2.1	6.4	4.4	4.4	21	3.7
Bicarbonate (HCO_3)	60	44	34	67	60	64	56	83	69	67	66	71
Carbonate (CO_3)	0	0	0	0	0	0	0	0	0	0	0	0
Sulfate (SO_4)	8.7	7.6	4.4	19	12	11	11	20	13	13	24	17
Chloride (Cl)	1.5	1.2	1.2	3	1.8	1.0	0.9	5.0	1.0	0.2	37	1.0
Fluoride (F)	0	0.2	0.1	0.5	0.4	0.2	0.1	0.1	0.5	0.4	0.5	0.2
Nitrate (NO_3)	0.3	3.9	3.9	0.2	1.3	0.3	1.4	2.8	0.5	0	0.7	0
Dissolved solids (residue at 180° C)	74	64	52	98	75	86	71	113	88	85	158	89
Hardness as $CaCO_3$:												
Calcium, Magnesium	59	45	37	58	59	57	56	85	64	61	88	70
Noncarbonate	10	9	9	3	10	5	10	17	8	6	34	12
Specific conductance (micromhos at 25° C)	129	102	77	155	137	127	120	194	147	146	158	161
pH	6.5	6.6	7.4	7.6	7.8	6.9	7.8	7.5	7.8	6.9	7.9	7.8
Color**	1	1	3	5	3	5	3	5	3	4	2	1
Temperature (°F)	49	46	46	47	48	--	46	47	46	47	47	48

* ss = sandstone
sg = sandy gravel
ls = limestone

** comparison with standard platinum-cobalt color chart of Hazen

FORT DRUM, NEW YORK
TERRAIN ANALYSIS
WATER RESOURCES

SURFACE WATER

FRESH WATER PERENNIALLY PLENTIFUL

Enormous* quantities available from the Black River, Indian River, Bonaparte Creek, and the lower reach of Black Creek.

Very large quantities available, generally in the lower reaches of the main tributaries of Indian River, possibly enormous quantities from late March through May.

Large quantities during most of the year; quantities increase from late March through May.

Moderate quantities of water available all year from lakes.

FRESH WATER SEASONALLY PLENTIFUL

Moderate quantities available most of the year, generally in the upper reaches of streams; greater late March through May; may be less during short periods from June through October

FRESH WATER SCARCE

Small quantities available most of year, but may be dry during August and September; only representative streams depicted.

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. Large* quantities from thick deposit of deltaic sands and underlying sandstone and limestone.

FRESH WATER LOCALLY PLENTIFUL

2. Moderate to large quantities from limestone, sandstone, and underlying weathered igneous and metamorphic rocks.
3. Moderate quantities from glacial deposits more than 10m thick.

FRESH WATER SCARCE

4. Small quantities from thin glacio-lacustrine deposits.
5. Small quantities from thin glacio-fluvial and morainal deposits and underlying fractured igneous and metamorphic rocks.
6. Small quantities from fractured igneous and metamorphic rocks and thin fluvial deposits in narrow valleys.

O[1] Wells Q[1] Springs

Number refers to entry in table

*NOTE —Definitions of underlined terms are as follows:

Volume Term	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Enormous	> 40,000	> 15,000,000
Very Large	4,000-40,000	1,500,000-15,000,000
Large	400-4,000	150,000-1,500,000
Moderate	40-400	15,000-150,000
Small	< 40	< 15,000

USER NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM 5-700, July 1967, paragraph 19; or other applicable manuals or regulations.

Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

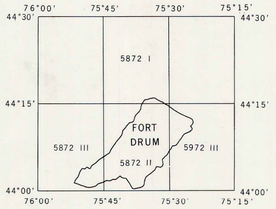
1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET

ROSSIE · FOWLER · ANTWERP · PITCAIRN · DIANA · WINNA · LERAY · CHAMPION · FINE PLAINS · HERMON · FORT DRUM MILITARY RESERVATION

Indian River · Black River · Sawyer Creek · Mingle Creek · Philadelphia Reservoir · Deferiet · Great Bend · Evans Mills · Natural Bridge · Devoice Corners · Bonaparte Lake · Indian Lake · Narrow Lake · Mud Lake · Snake Pond · Sylvia Lake · Burnt Pond · Crooked Pond · Bullhead Pond · Fitzgerald Pond · Hogsback Pond

SERIES V721
1:50,000 SHEET INDEX



Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

D. ENGINEERING SOILS

SOIL CHARACTERISTICS AND SELECTED EVALUATIONS

Engineering soils data presented on the map and in this table have been extracted from several miscellaneous sources - mainly agricultural oriented publications and maps. These materials plus topographic maps and aerial photography at a scale of 1:52,000 and dated October 1974, constitute the framework for this study. Unfortunately, detailed soil surveys employing modern soil nomenclature and a new soil classification system have not been made of the Fort Drum Reservation. However, the Soil Conservation Service, US Department of Agriculture, is currently conducting a soil survey of Jefferson County and hopefully, the reservation will be included. Until the completion of this survey, knowledge of the kinds of soil and their distribution on the reservation remains generalized and tentative.

The data included in this study should be helpful in planning for land use, construction operations and certain military training exercises covering large areas. For information on a specific site or otherwise small area, on-sight inspection and testing is required.

Soils on the reservation have been grouped into seven map units. Each unit is more or less homogeneous from an engineering or construction standpoint. The soils range from those comprised of gravels and sands developed in glacial till (Map Unit 1) to highly organic soils in swamps and marshes (Map Unit 7). In the northeastern part of the reservation, soil cover is very thin and many flat areas or ledges of rock are exposed (Map Unit 3). Exposures of rock also occur locally in other parts of the reservation, usually along drainageways where dissection is more pronounced and on low hillocks.

Very sandy porous soils cover extensive areas in the south (Map Unit 2). These sands were deposited by the Black River, mainly in a deltaic environment when glacial Lake Iroquois covered much of the Fort Drum area. In sharp contrast to the sand plains are clayey soils formed in glacio-lacustrine sediments (Map Unit 4). These clayey soils occur mainly along the western boundary.

Most soils have moderate to severe limitations for engineering or construction uses. The major limitations are wetness due to a seasonal high water table, excessive slopes and stoniness or shallow soils. In wintertime, limitations are compounded by deeply frozen soil and snow cover.

More detailed information concerning the distribution, characteristics and behavior of different kinds of soil can be obtained from the local Soil Conservation Service, US Department of Agriculture. The office is located in Watertown, New York.

MAP UNIT	MAJOR SOIL SERIES[1]	GEOGRAPHIC SETTING	TYPICAL SOIL PROFILE-layers, thickness and color of layers, depth to rock and Unified engineering classification[2] (Profile diagram not to scale).	HIGH-WATER TABLE-depth (meters) and duration (months)	PERMEABILITY-centimeters/hour or (inches/hour)	SHRINK-SWELL POTENTIAL	RATING AND MAJOR KINDS OF LIMITATIONS FOR: SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFICABILITY	BIVOUAC SITES	REMARKS
1	CHARLTON COLTON	Nearly level to steep upland plains and low hills and ridges; most slopes between 6 and 30 percent. Soils mainly developed in glacial till derived from schists and granites. Map unit includes some glacial outwash and morainic material.	cm 0: SM, SP, GP; 56: GP, SP, SM; 180+. Dark brown to yellowish brown silty sand and poorly graded sand and gravel; contains varied amounts of cobbles and small boulders. Grayish brown poorly graded gravel, poorly graded sand and silty sand. High content of cobbles and small boulders.	1.0-1.8m Jan-Mar	1.5-15 cm/hr (0.6-6.0 in/hr)	Low	Severe (s,h)	Slight to Moderate (r,h)	Slight to Moderate (h)	Slight to Severe (h)	Moderate to Severe (r)	Slight to Severe (h)	Slight to Moderate (h,r)	Soils developed in water-sorted material, mainly outwash, contain large percentages of gravel.
2	ADAMS WINDSOR CROGHAN	Nearly level to gently sloping sand plains; slopes generally between 1 and 5 percent. Soils developed in deltaic and outwash sediments deposited in or near lake basins. Internal drainage well to excessive.	cm 0: SM, SP-SM; 66: SP-SM, SW-SM; 180+. Pinkish gray to reddish brown silty sand. In some places grading to poorly graded sand. Grayish brown, loose, fine sand.	None (More than 1.8 m)	15.0-50 cm/hr (6.0-20 in/hr). More than 50 cm/hr (20 in/hr) below 66 cm	Low	Severe (s)	Slight	Slight	Slight	Moderate to Severe (c)	Slight to Moderate (l)	Slight	This map unit includes small areas of dunesand or so-called "blowouts". These are loose, windblown sands commonly devoid of vegetation. Total thickness of soil may exceed 45 meters (approximately 150 feet).
3	ROCKLAND[3] HOLLIS	Nearly level to steep uplands with many rock outcrops. Topography controlled by bedrock, modified by glacial action. Slope gradients range from 0 to 45 percent; most below 10 percent.	cm 0: SM; 38: Bedrock, mainly granite or schist. Grayish brown to dark yellowish brown silty sand. Generally contains many rock fragments. Bedrock, mainly granite or schist.	None (More than 1.8 m)	1.5-15 cm/hr (0.6-6.0 in/hr)	Low	Severe (r,s)	Severe (r)	Moderate to Severe (r)	Severe (r)	Severe (r)	Slight to Severe (h)	Slight	Rockland consists of scattered flat areas or ledges of bare rock. In some parts of the reservation, particularly in the northeast, rockland covers as much as 60 percent of the ground surface.
4	KINGSBURY VERGENNES HUDSON	Dominantly nearly level to gently sloping, deep, clayey soils on lake plains. Slopes mostly between 2 and 6 percent; locally steeper due mainly to stream dissection. Soils formed in glacio-lacustrine sediments. Somewhat poorly to moderately well drained.	cm 0: CL, CH; 20: CH, MH; 74: 180+. Dark brown clays of medium to high plasticity. Dark grayish brown clays of medium to high plasticity; commonly mottled.	0.3-1.0 m Dec-May	0.15-0.5 cm/hr (0.06-0.2 in/hr). Less than 0.15 cm/hr (0.06 in/hr) below 20 cm	High to Moderate	Slight to Moderate (h)	Severe (p,w)	Severe (t,x)	Moderate to Severe (t,z)	Severe (x,w)	Severe (w,t)	Moderate (w)	In some places a thin veneer of silty or sandy material cover the clays.
5	COLLAMER NIAGARA	Nearly level to moderately steep soils on glacial lake plains and on till plains that have moderately thick mantles of lake sediments. Slopes mostly below 10 percent. Soil somewhat poorly to moderately well drained.	cm 0: ML; 20: ML, CL; 71: ML, SM, CL; 180+. Dark grayish brown clayey silt. Brown clayey silt and clay of low plasticity. Stratified layers of clayey silt, silty sand and clay of low plasticity; strata vary in thickness and sequence.	0.5-0.8 m Mar-May	1.5-5.0 m/hr (0.6-2.0 in/hr). 0.5-1.5 m/hr (0.2-0.6 in/hr) below 20 cm	Low	Slight to Moderate (h)	Severe (p,w)	Slight to Moderate (w)	Moderate (t)	Moderate (w)	Moderate (w,t)	Slight to Moderate (w)	
6	RUMNEY SACO	Nearly level floodplains and low terraces. Occurs discontinuously along some streams, mainly in southern part of reservation. Areas are poorly drained and wet for considerable part of year.	cm 0: ML, SM; 30: ML; 81: SP, SM, GP; 180+. Dark grayish brown clayey silt and silty sand. Gray, mottled, clayey silt. Thin strata of poorly graded sand, silty sand and poorly graded gravel; strata vary in thickness and sequence.	0-0.5 m Nov-Apr	5.0-15 cm/hr (2.0-6.0 in/hr). More than 15 cm/hr (6.0 in/hr) below 30 cm	Low	Severe (f,w,s)	Severe (f,w)	Severe (z,w,f)	Severe (z,w,f)	Severe (f,w,c)	Severe (f,w,t)	Severe (f,w)	Substatum contains 5 to 40 percent gravel in individual stata. Small areas of permanently wet, mucky soils included in this map unit.
7	CARLISLE PALMS	Very poorly drained swamps and marshy lowlands.	cm 0: OL, OH, Pt; 180+. Undifferentiated organic soils; mostly muck but also some peat. Organic material in all stages of decomposition.	At the surface nearly all the time		Low	Severe (w,f,o)	Severe (w,f,o)	Severe (w,f,t,o)	Severe (w,f,t,o)	Severe (w,f)	Severe (w,f,t)	Severe (w,f,t)	Thickness of peat and muck varied from place to place. In some places, several meters thick; in other places fraction of a meter thick overlying beds of sand and clay. Surface may be thinly covered with washed-in silty material.

[1] Soils that have profiles almost alike make up a soil series. The series is the common name of the soil. Each series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. The soil series listed for each map unit are only the major ones; other soils of lesser areal extent than those described, may occur within each map unit.

[2] The Unified Soil Classification System. Technical Memorandum No. 3-357, U. S. Army Corps of Engineers, March 1953.

[3] Rockland is not a soil series name but a miscellaneous land type.

Data for the Engineering Soils Map and this table come from various sources, published and unpublished. Major source items include the following:

(1) M. Carr, B. Gilbert, et al. Soil Survey of Jefferson County, New York, Bureau of Soils, U. S. Department of Agriculture. 1913.

(2) Cline, M. G. Soils and Soil Associations of New York, Cornell Extension Bulletin 930. Ithaca, New York. 1961.

(3) C. Hodnett and R. Feuer. Jefferson County Soils, Soil Association Leaflet 9. New York State College of Agriculture. Revised, 1959.

(4) LTC Paul W. Long. Preliminary Report on the Geology of Camp Drum, New York. Prepared for the City College of New York Honors I, II and III. 1959 (Unpublished).

(5) C. Pearson, M. Cline, et al. Soil Survey of Lewis County, New York. Soil Conservation Service, U. S. Department of Agriculture, in cooperation with Cornell University of Agricultural Experiment Station. 1960.

(6) U. S. Department of Agriculture, Soil Conservation Service. Major Soil Associations in Jefferson County. Map and data contained in Land Use and Development Guide, Jefferson County, prepared by Jefferson County Department of Planning, Watertown, New York. 1973.

DEFINITION OF RATING TERMS

SLIGHT - relatively free of limitations or limitations are easily overcome.
MODERATE - limitations can be overcome with good planning and/or careful design.
SEVERE - limitations are serious and are difficult to overcome.

SOIL RELATED PROPERTIES AFFECTING LIMITATIONS

c - cutbanks cave
f - floods
h - slope
l - loose sand
o - high in organic matter
p - percs slowly
r - stony or shallow soils
s - seepage
t - low strength
w - wetness
x - too clayey
z - frost action


FORT DRUM, NEW YORK
TERRAIN ANALYSIS
ENGINEERING SOILS
COARSE-GRAINED SOILS
1. Sandy and gravelly soils developed mainly in glacial till.
2. Very sandy soils developed in deltaic or outwash sediments.
3. Silty sands commonly very shallow and intermingled with many rock outcrops.
FINE-GRAINED SOILS
4. Dominantly clayey soils developed in glacio-lacustrine sediments.
COARSE-AND FINE-GRAINED SOILS
5. Silty and clayey soils over stratified sands, silts and clays; developed mainly in glacial lake sediments.
6. Clayey silts and silty sands underlain by thin strata of varied coarse- and fine-grained soils; occur mainly on flood plains and low terraces.
ORGANIC SOILS
7. Dominantly muck and peat; developed in swamps and marshy lowlands.
Map unit numbers refer to text.
Scale 1:50,000
CONTOUR INTERVAL 20 FEET
FORT DRUM MILITARY RESERVATION
ANTWERP
FORT DRUM
SERIES V721
1:50,000 SHEET INDEX
Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

E. ENGINEERING GEOLOGY

The engineering suitability of geologic materials depends upon their abundance, distribution, accessibility, and workability, as well as upon properties inherent in their composition, texture, and structure. Igneous rocks such as granite and diorite are widespread and accessible on Fort Drum, but their topographic irregularity, difficulty of crushing, generally foliated gneissic texture, and wide textural variability over short distances give them only a secondary importance to engineering use in an area where flat-lying, more tractable, more uniform limestones are also available. Whereas kames, very limited in individual extent and often difficult of access, provide relatively clean sand and gravel, making them important sources of borrow material. The accompanying Engineering Geology map and table consider location, composition, and texture in rating the engineering suitabilities of geologic materials on Fort Drum.

Northeast of an approximate line from north of Natural Bridge and along Indian River and Coolidge and Dixon Roads, tightly folded preCambrian crystalline metamorphic and igneous rocks of the Western Adirondack Hills crop out as narrow linear, southwest-trending ridges and hillocks, or are thinly veneered with ground moraine, glacial stream and lake deposits, and recent waterlaid sediments.

Indian River, in its zig-zagging effort to reach the St. Lawrence Lowland, skirts the southwestern margin of the exposed preCambrian crystalline rocks from just below Lewisburg, past Woods Mill, and northerly until it turns sharply northeastward again. The river along this part of its course is intrenched against Cambrian and Ordovician flat-lying sandstones and limestones which are exposed to the southwest as an irregular band no more than three miles wide.

Limestones surface again in the southwesternmost part of Fort Drum. They are particularly noticeable as a prominent terrace northwest of the Cantonment area between Pearl Street and Bedlam Road.

East of the terrace to the band of Cambrian and Ordovician rocks fringing Indian River, glacial sediments of differing thicknesses form three diverse terranes. Along the southwestern boundary of the post to about Black Creek, nearly bisected by Pleasant Street, the gently sloping surface is underlain by silty clays deposited in a Pleistocene lake impounded against glacial ice to the north. Similar silty clays, some winnowed by wave action along the southern shores of the lake, shallowly cover bedrock along a belt about two miles wide northeastward past Antwerp to the Fort boundary, and extend eastward a few miles from Strickland Corners.

The many small creeks draining westward across the surface near the southwestern boundary begin as springs flowing upon the clays from under a generally level-surfaced, higher deposit of fine sands to the southeast, which was formed as a delta into the glacial lake. The delta apex, and source, was at the Black River. The Cantonment area and Wheeler-Sack Airfield are on these deltaic sands.

The remainder of Fort Drum--the topographically irregular basin of upper Black Creek and around Deerlick Creek--comprises mixed deposits of uncertain glacial and recent fluvial origin.

The Engineering Geology map was compiled from detailed interpretation of airphotos flown 1959 and 1975, at scales of 1:16,500 and 1:60,000, respectively, correlated with regional geologic maps. Map-unit boundaries are shown as solid lines, but actual field contacts are transitional and commonly muted.

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1	Predominantly broad flat to gently rolling (0%-3%) surfaces 6 m to 18 m (20 ft to 60 ft) higher than adjacent valley bottoms; commonly bounded along larger drainageways by moderately steep scarps. Widely spaced, shallow dissection on upper surfaces, gullied at scarps; few to no streams. Occasional rock outcrops. No landsliding or flooding; solution caverns or sinks not evident but possible locally.	Impure sandy and dolomitic limestone, sandy dolomite, and limy sandstone; commonly thin-bedded, occasionally massive, with shaly members, weathered zones, and fossils. Joints common, often reticulate, widened by groundwater solution and filled with muds. Regional dip 1°-2° west-southwest; local folds to 20° dip; minor local faults, apparently inactive. Colors, white through dove-gray and bluish to nearly black; reddish or brownish where weathered. Sandstone cementation predominantly calcareous. Limestone and dolomite comprise parts of Ordovician Chaumont, Lowville, Pamelia, and Theresa Formations. Sandstone (other than interbeds in limestones) is Upper Cambrian Potsdam Formation.	Extensive level areas of easy access; long straight alinements possible with minor cut-and-fill requirements except at some steeper grades at bordering scarps. Bearing capacity adequate for moderately heavy structures and heavy-duty roads. Drainage good, little channeling, no flooding, minor seasonal ponding along widely spaced drainageways. Infrequent layers of massive, relatively pure and unweathered limestone are principal materials of active quarries; good for base and wearing courses, ballast, rip-rap, and concrete aggregate (if not cherty), and for ornamental stone if evenly thin-bedded and unstained. Predominantly thin-bedded, impure limestone, dolomite, and calcareous sandstone poorly suited for engineering uses because of weathering and high calcium carbonate and organic content. Occasional layers of white sandstone or quartzitic conglomerate suitable for base course and some other uses; blocky, sandy dolomite suitable for base course.	Overburden predominantly thin (commonly less than 1 m) silt and sand deposits; easily removed by hand or power equipment. Trenching for pipelines and drilling for power poles will occasionally encounter bedrock. Excavation of massive, relatively unweathered bedrock requires light blasting; thin-bedded and weathered bedrock can be ripped and removed with power equipment. Walls of open excavations stable to near-vertical; tunneling requires light shoring. Shallow excavations will collect some water. Minor possibility of solution caverns along joints at depth.	Possible quarry sites in limestone abundant along scarps, easily accessible, little overburden, natural working faces moderately sloping, no drainage problems; small-volume development on upper surfaces of unit easy from occasional outcrops with moderate blasting required. Other sites likely in many places--require field examination by dozer slotting. Presently used small-volume pits common along roads.
2	Linear bedrock ridges, ribs, and hillocks south and northeast of Antwerp, 5 m - 50 m (15 ft - 160 ft) above adjacent silty lowlands; sideslopes to 30%, ridge lengths commonly continuous for 1 km (½ mi) to as much as 3 km (2 mi). In northeastern two-thirds of the reservation, isolated, less noticeably linear hillocks 1.2 km (¾ mi) in longest dimension, 30 m (100 ft) above adjacent lowlands, slopes to 30%. Where bare, rocks show striations and rounding (roches moutonnees, "whalebacks") from scouring by glacial ice; discontinuous veneer of gravelly clay ground moraine (till) on northeastern hillocks. Discontinuous, minor ephemeral drainageways parallel outcropping ribs within ridges; ridges rarely crossed by major drainageways. No landsliding or flooding.	Predominantly folded gneissic quartz diorite intruded by granitic sheets and thin pegmatitic veins and lenses; fine-grained to porphyritic oligoclase-diopside and biotite-garnet granites, often gneissic; fold axes trend southwesterly. Stock-like granitic bodies form Unit 2 in the northeast part of the reservation (other such bodies probably present are included in Unit 9). Massive, hard and tough diorite and granite resistant to weathering, wear, and disintegration; gneissic varieties less resistant. Joints common. Rocks are preCambrian age.	No level areas; access easy only parallel with ridges; difficult to infeasible across ridges except where they are breached by drainageways; possible alinements tortuous, much difficult cut-and-fill required. Unit is classed as suitable for some uses only because the rocks are hard and resistant; there are no good sites for cantonments, roads, airfields, or railroads. Heavy blasting required to provide good rip-rap; difficulty of crushing minimizes other uses in view of availability of limestone; gneissic textures and intruded sheets, veins, and lenses diminish strengths unpredictably.	Very thin overburden in minor drainageways and hollows among predominant bedrock outcrops; easily removed by hand and power equipment. Excavation of rock requires heavy blasting and construction of access roads if sites are not at margins of trafficable lowlands. Walls of open excavations stable to vertical except where exfoliation plates at surface slope toward excavation. Tunneling may require rock bolts or shoring; no excessive drainage problems.	Possible quarry sites abundant south and northeast of Antwerp; accessible horizontally into ridges from adjacent trafficable plains; natural working faces facilitate blasting and loading; no drainage problems if quarry floors are not excavated downward. Sites in Unit 2 hillocks in the northeastern part of the reservation generally inaccessible without extensive hauling or road construction; local small-volume quarries in similar rocks available in other units near roads.
3	Essentially a lobate, flat to gently rolling (0%-3%) terrace of deltaic sediments extending about 8 km (5 mi) northward from an apex at the Black River near Herring and sloping at the northern edge and dissected around West Branch and Buck Creeks; recent dune sands common on the east, and near Lewisburg Corners and Natural Bridge. Well drained, no streams heading in flat parts, few through-flowing; some swampy ground where sandy materials are underlain at relatively shallow depth by bedrock, clay, or till, particularly along West Branch Creek. Flooding possible (1 chance in 100) along West Branch Creek and in swamp 1½ km (1 mi) northwest of Natural Bridge.	Unconsolidated fine sand and gravel, minor coarser sand and gravel locally; occasional bedrock outcrops and till in major streams; dune sand locally. Sands relatively clean, very porous and permeable; 16 m to 23 m (50 ft to 75 ft) thick in Cantonment area. Composition of sand fragments varied.	Extensive level areas of easy access with long straight alinements possible except in dissected areas and lowlands. Bearing capacity adequate for moderately heavy structures and heavy-duty roads. Drainage excellent, no channeling or flooding on higher areas. Cleared, unvegetated areas may be dusty; sand is firmest when wet. Abundant sand and very limited quantity of gravel available for construction; sand suitable for fill, poor for mortar or aggregate; dune sand probably suitable as blending material if composition is appropriate.	Overburden negligible, unit all sandy. Excavation easy by hand or power equipment. Materials unstable in cuts, particularly if dry; deeper trenches and pits require shoring; ditches require rip-rap or lining for stability and protection from wind erosion. Cut slopes 1:1 to 2:1. No drainage problems.	Borrow pit sites abundant, others easily developed and easily accessible; no drainage problems; fine sand blown and drifted by winds but amenable to stabilization by planting grasses; most stable when wet.
4	Generally clayey, glacial-lake materials sloping west-southwest at 20 ft per mi; frequent thin covering sands. Closely spaced dissection by numerous broad swales and several incised streams fed by springs seeping from under sands of Unit 3. Minor flooding and landsliding possible along incised streams.	Unconsolidated silty clays of former glacial lake, some sand from winnowing along shores of lake; occasional minor clay and gravel lenses and deposits of Units 7 and 8.	Extensive gently sloping areas; easy access; possible alinements mostly straight and long; some fill, culverts, and bridges required. Bearing capacity variable; generally suitable for light structures and medium-duty roads; drainage fair to poor with shallow water table and probable perched water; chance of minor local flooding along major drainageways; surface may become soft and rutted during wet season use. Except for soft fill, no suitable construction materials available.	Overburden thin, commonly includes organic material and sand. Excavation easy by hand or power equipment. Drainage fair to poor; depth of excavations may be limited, dewatering required. Steep slopes unstable when wet, some slumping likely; require rip-rap or shoring on deeper cuts. Materials locally sticky, adhere to equipment.	Not rated; materials generally least suitable of all units.
5	Predominantly broad flat to gently rolling (0% to 3%) surfaces sloping west-southwest at 20 ft per mi. Widely spaced dissection by broad swales, parallel and trending west-southwest along Antwerp Road; no major drainageways. Occasional rock outcrops. No landsliding or flooding.	Flat-lying limestone and sandstone under shallow silty clay, some sand; minor undifferentiated glacial and recent fluvial deposits. Bedrock depth relatively consistent; predominant joint trends suggested by surface configuration and drainageways. Sandstone bedrock of the Potsdam Formation predominant along Antwerp Road; unidentified sedimentary bedrock elsewhere. Limestone mostly thin-bedded, impure, with dolomitic and shaly members; sandstone cemented with calcium carbonate, often loosely, and weathered.	Extensive level areas; long straight alinements possible with minimal amounts of cut and fill required. Bearing capacity adequate for moderately heavy structures and heavy-duty roads. Drainage fair to poor; water table shallow; little channeling; no flooding but minor seasonal ponding in low areas. Underlying sandstone generally poor for construction use because of high carbonate and organic content, loose cementation, and weathering. Limestone (and dolomites) generally poor for engineering uses because of thin bedding, shaly members, and weathering; some possibility of solution channels along joints at depth in limestone. Overlying unconsolidated materials poorly suited for all uses other than fill.	Overburden predominantly thin (<1 m to 3 m), silty clay; minor sand deposits; easily removed by hand or power equipment. Trenching for pipelines or drilling for power poles will occasionally encounter bedrock. Excavation into bedrock generally feasible with power equipment; may require light blasting if rock is massive or locally silca-semented. Walls of open excavations into bedrock stable to near vertical; inflow of groundwater probably at shallow depths; tunneling requires shoring and sealing. Some possibility of solution channels along joints in limestone at depth.	No sand or gravel borrow pits; limited quantities of silty coarse sand and gravel available locally from overlying unconsolidated materials; easily accessible; possible ponding. No quarries; sound unweathered rock available locally, particularly from occasional outcrops; power equipment or light blasting required.
6	Flat to gently rolling (0% to 3%) west-southwest-sloping surface along the reservation boundary southwest of Antwerp; narrow linear inter-ridge valleys and lowlands northeast of Antwerp. Widely spaced dissection by broad swales and a few incised drainageways in the southwest part of the unit. Minor dissection in valleys and lowlands in the northeast part of the unit. Occasional rock outcrops. No landsliding or flooding.	Metamorphic and igneous rocks under shallow silty clay; some sand and minor glacial and recent fluvial deposits. Bedrock predominantly gneissic quartz diorite with pegmatitic bands; fine-grained to porphyritic oligoclase-diopside and biotite-garnet granites, often gneissic; minor porphyritic hornblende-biotite syenite. Surface of bedrock irregular; rolling in southwest part of the unit; linear ridges and ribs in northeast part (buried equivalent of Unit 2 in this area). Occasional bedrock outcrops. Massive diorite and granite hard and tough; resistant to weathering, wear, and disintegration; gneissic varieties less resistant; joints common. Rocks are preCambrian age.	Extensive gently rolling areas southwest of Antwerp with easy access; long, straight alinements available parallel with west-southwest slope, but interrupted in other orientations by some incised drainageways. Access and alinements northeast of Antwerp available only along linear valleys. Hard, resistant diorite and granite available from occasional outcrops, but difficulty of crushing precludes most uses in view of availability of limestone; heavy blasting provides good rip-rap; some limited local development for stabilizing road culverts. Gneissic textures and intruded rocks diminish strengths unpredictably. Silty clay and sandy covering deposits generally poorly suited for all uses other than fill.	Overburden silty clay, some sand deposits; predominantly thin but variable. Easily removed by hand or power equipment. Trenching for pipelines or drilling for power poles will occasionally encounter bedrock ridges or ribs. Excavations into bedrock require heavy blasting; drainage problems seasonally if excavations penetrate buried inter-ridge valleys. Tunneling may require rock bolts or shoring.	No sand or gravel borrow pits. Limited quantities available of silty coarse sand and gravel locally from overlying unconsolidated materials; easy access limited to linear valleys; no ponding. No quarries, but small bedrock outcrops developed for local rip-rap; blasting required; shoring required in deeper excavations in unconsolidated materials.
7	Irregularly shaped, isolated, often steep-sided low hillocks and knobs of sandy or gravelly glacial debris; low (< 10 m) mounds and hummocks on plains southwest of Antwerp. Most conspicuous individual glacial features, but still often indeterminant in areas of mixed glacial landforms and materials.	Generally poorly sorted, stratified gravel and coarse sand with some clay; deposited by subglacial streams near the terminus or against the margins of a melting glacier (kames and kame terraces). Associated and often underlain by clayey, gravelly till and other ground moraine. Rock fragments composed of more resistant materials from along the course of glacial travel; relatively little weathered.	Only source of considerable quantities of relatively clean gravel and coarse sand; common borrow pit material on plains southwest of Antwerp, and exploited elsewhere. Gravels are sound, hard, and tough survivors of long glacial grinding and transport. Generally suitable for base and wearing course, ballast, and concrete aggregate (if not cherty); easily crushed. No areas extensive enough to provide favorable sites for cantonments, roads, airfields, or railroads.	Overburden thin on deposits on plains southwest of Antwerp, may be thicker elsewhere because of later glacio-fluvial outwash sediments; easily removed with power equipment. Cuts unstable; little ponding unless excavation floor reaches poorly permeable till or rock.	Low mounds and hummocks on plains southwest of Antwerp extensively exploited in the past; small borrow pits occasionally elsewhere. Access easy on plains, more difficult elsewhere; possible pit sites limited in number and must be sampled in the field. Convenient natural working faces result from isolated, hillocky form of deposits.
8	Linear ridges and hillocks in the area between Bonaparte Creek on the southeast, the lower reaches of Rockwell Creek on the northwest, and northeast of the Indian River; diverse landforms around the upper reaches of Black Creek; and isolated hillocks in the southwestern part of the reservation. Many small streams, many wet lowlands or swamps, several ponds; drainage generally parallel to ridges, but deranged at many places as a result of glaciation. Predominant narrow linear valleys northeast of the Indian River, often with beaver dams. Minor landsliding and flooding possible at many places.	Generally thin till and other ground moraine plastered on folded linear ridges and hillocks of metamorphic and igneous bedrock; glacio-fluvial and recent fluvial sediments in valleys and lowlands; undifferentiated morainal (commonly till) and glacio-fluvial deposits on isolated hillocks in the southernmost and southwestern parts of the reservation. Assignment of areas to Unit 8 based on masking of bedrock by glacial deposits, and/or heterogeneous association of glacial deposits; underlying bedrock similar to that of much of Units 9 and 5.	Few areas extensive enough for the construction of cantonments, roads, airfields, or railroads. Glacial materials heterogeneous, erratically distributed, generally fine-grained; access difficult at many places, locally swampy; generally poorly suited for all construction uses except fill, but some gravel from ground moraine (till) and limited quantities of sand and gravel from narrow stream valleys. Bearing capacity of thick clayey, gravelly till adequate for moderately heavy structures; other materials variable.	Great variation in thickness and composition of glacial materials, topography, drainage conditions, and composition of bedrock. Excavation generally easy with power equipment; thick clayey, gravelly tills more difficult, and subject to ponding. Cuts commonly unstable, require shoring; tunneling requires dewatering in lowlands, and shoring.	Some local borrow pits present, particularly near Rices Corners. Detailed field investigations necessary to locate new borrow pit sites; distribution of deposits of usable materials spotty, continuity interrupted. Ponding likely at many places.

E. ENGINEERING GEOLOGY (continued)

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
9	Rocky linear ridges and hillocks with narrow valleys and inter-ridge lowlands. Ridges commonly continuous for long distances, with side slopes to 30% and 25 m to 50 m (80 ft to 160 ft) above adjacent lowlands. Where bare, rocks show striations and rounding (roches moutonnees, "whalebacks") from scouring by glacial ice. Many streams, including Indian River, a few lakes, and some swamps. Beaver dams on smaller streams. Minor local flooding possible, no landsliding.	Predominantly folded metamorphic and igneous rocks; fold axes trend southwesterly; joints common. Metamorphic crystalline limestone and crystalline dolomite and some marble locally along eastern part of the unit; intrusive pegmatitic and basic igneous rocks occasionally everywhere. Massive diorite and granite hard and tough, resistant to weathering, wear, and disintegration; gneissic varities less resistant; limestone, dolomite, and marble relatively hard. Rocks are preCambrian age. Unit 9 is based on general occurrence of bedrock at the surface, without masking of structure by later unconsolidated materials; bedrock similar to much of Units 8 and 5.	Few level areas; access generally only parallel with ridges, difficult to infeasible across ridges except where breached by drainageways; possible alinements curving and cut-and-fill frequently required and difficult. No sites suitable for the construction of cantonments, major roads, airfields, or railroads. Massive diorite and granite requiring heavy blasting; provide good rip-rap, but difficulty of crushing minimizes other uses in view of availability of more tractable rocks; gneissic textures and intruded rocks diminish strengths unpredictably. Some intruded basic igneous rocks, particularly amphibolites, suited for many uses. Dolomite good for base and wearing courses, ballast, rip-rap, and concrete aggregate; limestone and marble suited for some uses, if relatively pure and massive.	Overburden thin on ridges and hillocks, variable in valleys and lowlands; generally easily removed by hand or power equipment. Excavation of rock requires blasting, and construction of access roads in most of the Unit. Walls of excavations stable to vertical. Tunneling may require rock bolts or shoring; no excessive drainage problems above lowland water tables.	Possible quarry sites abundant, but reasonably accessible only in eastern part of the Unit. Old quarry at Quarry Pond is flooded; marble in spoil pile being used to surface nearby roads. Blasting required for massive igneous rocks and massive dolomite. Cuts stable to vertical; tunneling may require rock bolts or shoring. Ponding probable in lowlands.
10	Lakes, ponds, and very poorly drained swamps and marshy lowlands. Possible flooding, no landsliding.	Undifferentiated organic materials; mostly muck, some peat. Organic materials in all stages of decomposition. Underlying deposits commonly glacial till and clayey materials in valleys.	Unsuited for engineering uses.	Unsuited.	Unsuited.

F. SPECIAL PHYSICAL PHENOMENA

Fort Drum's proximity to an active fault system along the St. Lawrence River places the reservation just within Zone 3 as portrayed on the national Seismic Risk Map compiled by the U. S. Geological Survey; this map is based on past earthquake activity. Zone 3 is the highest-risk category, with a probable maximum severity roughly equivalent to VII - VIII (major damage) on the Modified Mercalli ground-intensity scale--a possible acceleration of 0.2 - 0.3 g's upon building foundations. Minor earthquakes are felt infrequently at Fort Drum, but no damage to structures has been recorded. Damage is possible, however: in about 1939, for example, brick chimneys in the Watertown area were thrown down.

FORT DRUM, NEW YORK
TERRAIN ANALYSIS

ENGINEERING GEOLOGY

MANY ENGINEERING USES

1. Flat-lying limestone and sandstone at or near surface.

SOME ENGINEERING USES

2. Granitic and dioritic hillocks and low ridges.
3. Fine sand, some fine gravel, principally of deltaic deposits.
4. Lacustrine silty clays, some sand.
5. Flat-lying limestone and sandstone under shallow silty clay, some sand, and glacial and recent fluvial deposits.
6. Metamorphic and igneous rocks under shallow silty clay, some sand, and glacial and recent fluvial deposits.

FEW ENGINEERING USES

7. Glacial sandy gravel, some gravelly till.
8. Undifferentiated glacial and recent fluvial deposits.
9. Metamorphic and igneous hillocks and low ridges, minor limestone, dolomite, quartzite, intrusive igneous bodies.

UNSUITED

10. Wet areas (swamps and marshes)

Active quarries.

Borrow pits (sand and gravel) and quarries, status unknown (many limited-volume, short-term-use pits not shown)

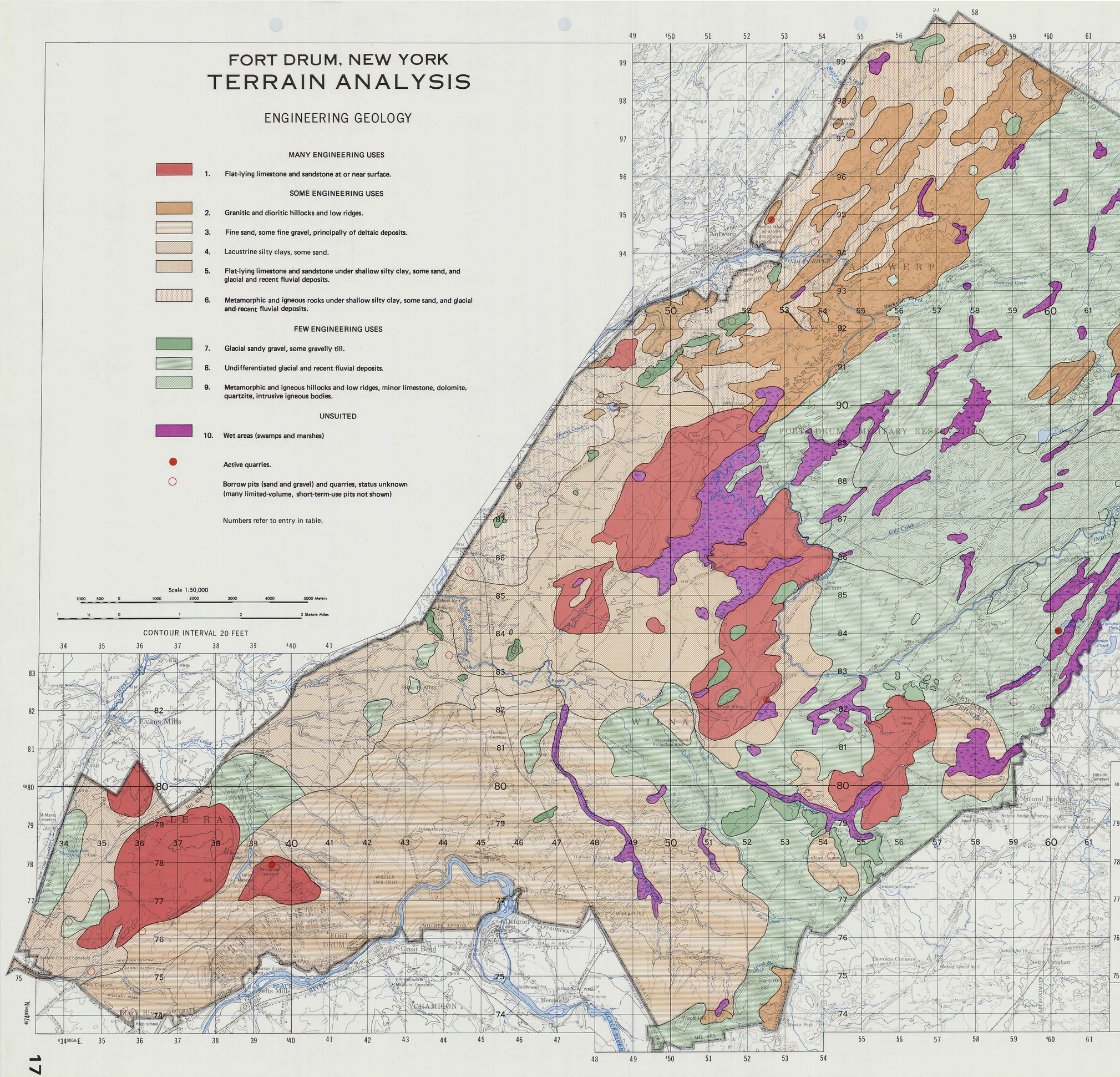
Numbers refer to entry in table.

Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET



SERIES V721

1:50,000 SHEET INDEX

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

G. VEGETATION

On Fort Drum, there are four major vegetation types; forests, scrub, grasslands, and wetlands, which are significant to military training or operations.

Forests, comprising the largest portion of the vegetation types, cover about 46% of the reservation. Of this 46%, nearly 31% is mixed coniferous and deciduous forest, with the remaining 15% being either pure coniferous or pure deciduous stands. The Fort Drum forests have been under intensive management since 1957, and have returned over $170,000 (1972 data) through timber sales. Different management techniques are required for the coniferous and deciduous species.

The major coniferous timber producing species are white pine, red pine, and eastern hemlock; management of the coniferous species is primarily that of harvesting the mature and over-mature trees in selected areas. The sale of coniferous timber is of minor importance to Fort Drum.

The major deciduous timber producing species, sugar maple, red and white oak, and black cherry, are of great value to Fort Drum. Management of the deciduous species consists of timber stand improvement (TSI) and selection cutting on a 15 to 20 year cutting cycle. Timber harvesting is conducted during the troop-free period which generally extends from the first of October to the middle of April.

Scrub vegetation covers approximately 15% of the reservation. The scrub on Fort Drum is extremely dense, predominantly deciduous, with dominant species being soft maples, and occurs generally on old fields, pastures, and in the impact area. Most of the scrub exists in a large continuous stand in the northeastern hillocky portion of the reservation.

Grasslands make up about 27% of the vegetation on Fort Drum. The grasses are generally less than 1 meter high and occur throughout the reservation except in the northeastern portion. The grasslands may include some scattered coniferous and deciduous trees.

Wetlands, consisting of marshes and swamps, cover about 6% of the reservation. Marshes are of minor importance, making up only 1% of the area. Marshes are wet areas with over 50% in grasses. Swamps, which make up the other 5%, are wet areas with over 50% in trees, brush, and shrubs. Wetlands occur in depressions along streams and lakes mainly in the northern portion of the reservation.

Open areas (4%) and open water (2%) cover the remainder of the reservation. The open areas either are barren or contain built-up areas.

The vegetation types that afford the best cover and concealment possibilities for foot troops and vehicles are denser stands of forests. The denser coniferous stands, scattered throughout the reservation, afford year-round cover and concealment possibilities, while the scattered mixed and deciduous stands have the best conditions when the deciduous species are in leaf, mid-May through mid-October.

The location and extent of vegetation by types and sub-types are shown on the accompanying vegetation map. Descriptive details of each map unit are included in the table below.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1	Coniferous trees; predominantly white pine; other common species include eastern hemlock, red pine, northern white cedar, scotch pine, and small amounts of balsam fir, jack and pitch pine, and red, white, and Norway spruce; average height about 15 m; trunks usually 30 to 33 cm in diameter; 50 to 100% crown cover density; trunks generally spaced 1 to 3 m apart; branches to ground level on younger trees; generally grow on higher slopes; some dense plantation areas with trees up to 5 m high; generally dense deciduous undergrowth; 75% or more of each stand composed of coniferous species. Some small scattered plantation areas, primarily of scotch and red pine, up to 5 m high and 10 to 15 cm in diameter; usually no undergrowth; generally planted about 2 m apart.	Stands scattered throughout the post; larger stands occur in the northern portion of the reservation, stands cover approximately 9% of the reservation.	Management of coniferous stands consists of harvesting mature and over-mature trees in or near impact area, northern part of reservation; scotch pine planted in sandy areas; red pine planted on selected sites.	Cover from flat-trajectory fire of small arms for foot troops good in dense stands and fair in stands where trees are less closely spaced. Plantation areas unsuited for cover.	Concealment from aerial and ground observation largely good year round for foot troops and vehicles. In plantation areas, limited concealment for foot troops only.
2	Coniferous trees; predominantly white pine; other common species include eastern hemlock, red pine, northern white cedar, scotch pine, and small amounts of balsam fir, jack and pitch pine, and red, white, and Norway spruce; trunks generally less than 30 cm in diameter; 10 to 50% crown cover density; trees generally spaced more than 3 m apart; branches to ground level on younger trees; some deciduous undergrowth; 75% or more of each stand composed of coniferous species. Some small scattered plantation areas, generally scotch or red pine, up to 2 m high and less than 10 cm in diameter; generally planted 2 m apart; size precludes cover and concealment possibilities.	Small stands widely scattered throughout the reservation except in extreme north and northeast parts; stands cover approximately 1% of the reservation.	Scotch pine planted in open sandy areas; red pine planted on selected sites.	Cover from flat-trajectory fire of small arms generally poor for foot troops.	Concealment from aerial observation largely poor for foot troops and vehicles; concealment from ground observation generally fair year round for foot troops and poor for vehicles.
3	Deciduous trees; mainly sugar maple; other common species include American elm, red and white oak, red maple, gray and paper birch, speckled alder, trembling aspen, basswood, black locust, and a mixture of hickories and wild cherries; maximum height about 15 m; trunks average 30 cm in diameter; 50 to 100% crown cover density; larger trunks spaced 1 to 3 m apart; branches to within 2 m of ground level; moderate to dense undergrowth of brush and shrub up to 4 m high; leafless period generally mid-October through mid-May; 75% or more of each stand composed of one or more deciduous species.	Small stands scattered throughout the post; primarily on the lower, more moist areas in the central and southern parts of reservation; stands cover approximately 3% of the reservation.	Management consists of timber stand improvement and selection harvest cut; planting not necessary for deciduous regeneration; American elm declining due to Dutch elm disease.	Cover from flat-trajectory fire of small arms for foot troops good in stands with large trees and poor elsewhere.	Concealment from aerial and ground observation largely good from mid-May through mid-October for foot troops and vehicles when trees in leaf, and largely poor the rest of the year.
4	Deciduous trees; mainly sugar maple; other common species include red and white oak, red maple, gray and paper birch, speckled alder, trembling aspen, basswood,black locust, and a mixture of hickories and wild cherries; maximum height generally less than 10 m; trunks average 10 to 20 cm in diameter; 10 to 50% crown cover density; trees generally spaced 3 m or more; branches to within 1 m of ground level; leafless period generally mid-October through mid-May; 75% or more of each stand composed of one or more deciduous species.	Small size stands widely scattered throughout the reservation generally on lower moist sites; stands cover approximately 2% of the reservation.	Timber stand improvement is major management technique; little or no American elm due to Dutch elm disease.	Cover from flat-trajectory fire of small arms largely poor for foot troops.	Concealment from aerial and ground observation largely poor for foot troops and vehicles; some concealment available in more dense stands when trees in leaf mid-May through mid-October.
5	Mixture of coniferous and deciduous trees; consisting primarily of white pine, eastern hemlock, red pine, northern white cedar, scotch pine, sugar maple, American elm, red and white oak, red maple, gray and paper birch, speckled alder, trembling aspen, basswood, and black locust; maximum height approximately 15 m; trunks usually 25 to 33 cm in diameter; 50 to 100% crown cover density; trunks generally spaced 1 to 3 m apart; branches to within 1 m of ground level; moderate to dense undergrowth of brush and shrub up to 4 m high; each stand contains roughly equal distribution of coniferous and deciduous species.	Large continuous stands throughout the reservation; stands cover up to 22% of the reservation.		Cover from flat-trajectory fire of small arms good in dense stands and fair in stands where trees are less closely spaced.	Concealment from aerial and ground observation largely good for foot troops and vehicles from mid-May through mid-October when deciduous trees in leaf, and largely fair the rest of the year.
6	Mixture of coniferous and deciduous trees; consisting primarily of white pine, eastern hemlock, red pine, northern white cedar, scotch pine, sugar maple, red and white oak, red maple, gray and paper birch, speckled alder, trembling aspen, basswood, and black locust; maximum height generally less than 10 m; trunks generally 15 to 25 cm in diameter; 10 to 50% crown cover density; trees generally spaced 3 m or more with some undergrowth and some open grass areas; branches from ground level to 4 m from ground level; each stand contains roughly equal distribution of coniferous and deciduous species.	Small to narrow sometimes continuous stands widely scattered throughout the reservation; stands generally on flatter areas; stands cover approximately 9% of the reservation.		Cover from flat-trajectory fire of small arms largely poor for foot troops.	Concealment from aerial and ground observation largely poor year round for foot troops and vehicles.
7	Scrub; extremely dense, predominantly deciduous species of maples, birches, hickories, wild cherries, willows, and some pines; generally less than 4.6 m high; branches to ground level; dense undergrowth; 50 to 100% crown cover density; leafless period generally mid-October through mid-May; up to 75% of each stand probably soft maples.	Large continuous stand of scrub in northeast hillocky portion of reservation; several smaller stands scattered throughout reservation; stands cover approximately 15% of the reservation.	Scrub areas generally transitional from old field or pasture; also, use as impact area helps keep in transitional stage; little or no commercial value.	Cover from flat-trajectory fire of small arms largely poor for foot troops.	Concealment from aerial and ground observation for foot troops fair from mid-May through mid-October and poor remainder of the year; poor year round for vehicles.
8	Short grasses; less than 1 m high; common species include fescue, timothy, blue grass, goldenrod, American beachgrass, cordgrass, sedges, orchard grass, clovers, and some weeds; may include scattered coniferous and deciduous trees not to exceed 10% crown cover density.	Short grasses common throughout except in the northeast portion of the reservation; short grasses cover approximately 27% of the reservation.	Some small areas are planted in grass species for wildlife forage.	No cover for foot troops.	Concealment from aerial and ground observation for foot troops and vehicles is largely non-existent in short grasses.
9	Marsh grasses; wet areas with grasses less than 1 m high; commom species include reed canary-grass, hydrangea, and blueberries; generally perennial wet areas; floating vegetation in some areas; growth open to sparse, over 50% in grasses; some open water.	Marshes found in depressions primarily in northern portion of reservation; marshes cover approximately 1% of the reservation.		No cover from flat-trajectory fire of small arms for foot troops.	Limited possibilities for concealment from aerial and ground observation for foot troops if access to drier areas possible; generally non-existent for vehicles.
10	Swamps; wet areas with predominantly deciduous species and some conifers; common species include tag alder, red maple, speckled alder, black willow, red stem maple, red stem dogwood, and northern white cedar; closely spaced trees, brush, and shrubs; some open water areas; both perennially and seasonally wet areas with over 50% in trees.	Swamps occur in depressions mainly in the northern portion of reservation; swamps cover approximately 5% of the reservation.		Cover from flat-trajectory fire of small arms generally poor for foot troops; extremely wet areas may preclude use by foot troops.	Limited possibilities for concealment from aerial and ground observation for foot troops and vehicles from mid-May through mid-October if access to drier area possible; concealment generally non-existent rest of year for vehicles.

FORT DRUM, NEW YORK
TERRAIN ANALYSIS

VEGETATION

FORESTS

1. Coniferous trees; medium to dense spacing.
2. Coniferous trees; nearly open to medium spacing.
3. Deciduous trees; medium to dense spacing.
4. Deciduous trees; nearly open to medium spacing.
5. Mixed coniferous and deciduous trees; medium to dense spacing.
6. Mixed coniferous and deciduous trees; nearly open to medium spacing.

SCRUB

7. Deciduous scrub; medium to dense spacing.

GRASSLANDS

8. Short grasses.

WETLANDS

9. Marshes; wet areas with over 50% in grasses.
10. Swamps; wet areas with over 50% in trees, brush and shrubs.

OPEN

OPEN

Built-up areas; sand dune areas; barren areas; and, heavily used areas. Vegetation is not a significant factor.

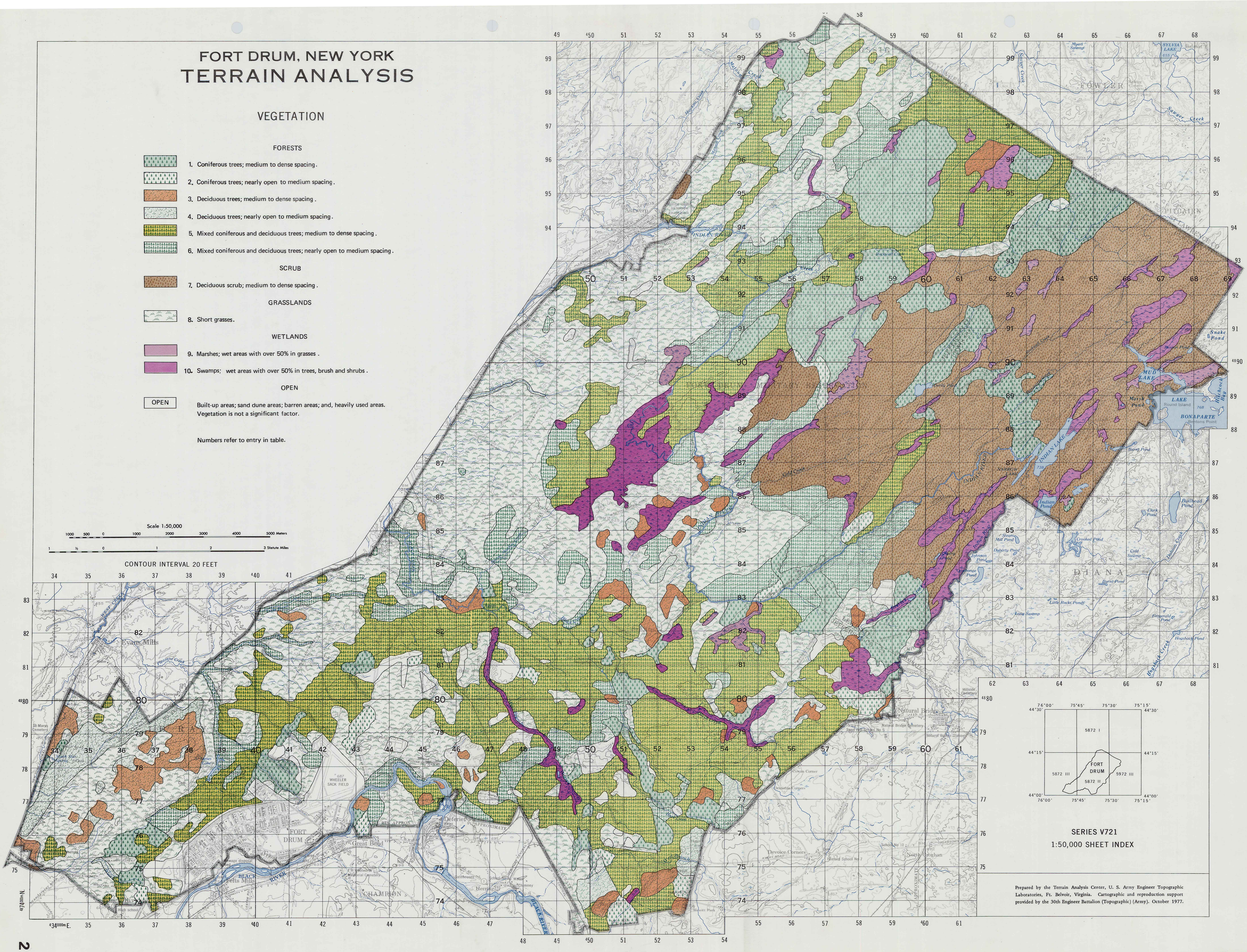
Numbers refer to entry in table.

Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET



SERIES V721

1:50,000 SHEET INDEX

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

H. CLIMATE

The climate at Fort Drum is primarily continental in character with fairly long, cold winters and short, warm summers that are comparatively moist and humid. Lying on the route of the St. Lawrence storm tracks, Fort Drum has prevailing westerly winds and is affected by nearly all the cyclonic storms moving from the interior of the country through the St. Lawrence Valley. The whole military reservation extends nearly 32 km (20 miles) north and east of the cantonment area, which is about 16 km (10 miles) northeast of Watertown and 24 km (15 miles) east of Lake Ontario. With slightly higher elevations and with greater distance from the moderating effects of Lake Ontario, the northeast part of the reservation has winter temperatures averaging some 1 or 2 C° (about 2 - 4 F°) lower than those recorded in the cantonment area and at adjoining Wheeler-Sack AAF, which is the location principally used in the present description and tables. Fort Drum, in fact, lies midway between the "Northern Plateau" and the "Great Lakes" climatic sub-regions of New York State, and partakes of some of the characteristics of each.

The average annual temperature at the Fort Drum cantonment is about 7.2° C (45° F). This compares to an annual figure of 4.4° C (40° F) at a typical Northern Plateau location such as Lake Placid, 96 km (60 miles) northeast of the post, and an annual average of 8.9° C (48° F) at Sodus, a town 96 km (60 miles) southeast of the post in the Great Lakes sub-region. January is the coldest month, closely followed by February and December; on average, temperatures fall below - 17.8° C (0° F) on about 26% of the days in these three months. While the record low temperature - 39.4° C (-39° F) occurred on a December day, the long-staying character of winters in this area may be seen from the fact that below-freezing temperatures occur on an average of 28 days in March, exceeding the 27 such days in December. According to records kept for the past 9 years by the Directorate of Facilities Engineers at Fort Drum, annual heating degree days have ranged between 7770 and 9247 (F°), with a median total of about 8200 (F°). This figure reflects the somewhat colder temperatures here, as compared to those shown in the following table, which are for Syracuse, 112 km (70 miles) to the southwest.

The warmest months are June, July and August with mean daily maximum temperatures between 24.5 and 27.3° C (76.1 and 81.1° F). In the warmest month, July, the highest temperature ever recorded is 37.7° C (98° F). In the summer, temperatures fall rapidly in the evening, making for cool and comfortable nights. The average length of growing season in the Fort Drum area ranges from about 155 days in the cantonment area to 128 days in the higher northeastern part of the reservation. The average date for the last killing frost is May 12 and October 1 for the first killing frost, with variations of as much as a month on either side of these dates in exceptional years.

Winter temperatures of course constitute a severe hazard to personnel exposed to the outdoor cold. Mean daily minimum temperatures during the coldest months, December through February, are between - 8.3 and - 11.2° C (17.1 and 11.8° F). The wind chill or "equivalent chill" temperature does not often fall much below the all time record low of - 39.4° C, since wind speeds tend to be lowest both on the coldest days and at the coldest hours of the day. But with a wind chill of - 40°, exposed flesh may freeze within one minute of exposure. Cold waves moving in from the west can last 3 days, while the more bitter ones arriving from Hudson Bay usually last less than a day.

Wind velocities are moderate, averaging 8 knots. The most violent winds are those which may accompany thunderstorms in late spring, but severe winds of 40 - 50 knots average perhaps one a year (out of a normal average of about 25 thunderstorms annually). Tornadoes rarely occur, there being only one on record (in 1912) in nearby Syracuse. In the winter months there are numerous days with sufficient wind to cause blowing snow and drifting.

Precipitation is well distributed throughout the year, and is relatively reliable. In fact, over a 73-year period of record at Syracuse there has not been a single month with no rainfall recorded. The record annual precipitation of 1307.4 mm (55.4 in) occured in 1972, and the record annual minimum of 684.8 mm (26.96 in) occured in 1908. It is interesting to note that the months with least precipitation, on average, are the late winter months when snowfall is greatest.

Snowfall is fairly heavy, with an annual average of 2900 mm (114 in) at Fort Drum. Snowfall is, however, quite variable not only from year to year but also from place to place even within the same region, as a result of slope, elevation and other factors. Records are not available on snow cover at Fort Drum, but at nearby Watertown, during the ten year period 1966-1976, the ground was covered by one inch or more of snow on an average of 99 days of the year. Also at Watertown, annual snowfall has ranged from a record low of 1123 mm (44.2 in) in 1952-53 to a record high of 4173 mm (164.3 in) in 1962-63. During the winter of 1899-1900, however, 5273 mm (225.3 in) of snowfall were reported. Unofficial measurements recorded over 1295 mm (51 in) of snow cover accumulation on Fort Drum during the severe winter of 1976-77.

Cloudiness and snow squalls are a characteristic feature of winter weather in the Fort Drum area. Sunshine is rather low in the winter months, about a third of the possible amount, while in summer it is about two-thirds of the possible amount.

The following table depicts principal climatological parameters for the Fort Drum cantonment area, although it may be noted that the source data are of rather uneven quality, and in some cases the period of record is shorter than ordinarily acceptable as a reliable base. Data for some of the parameters included in this table were available only for Syracuse, which is 70 miles distant, although having a climate that is sufficiently analogous for most planning purposes.

CLIMATIC SUMMARY

Fort Drum / Wheeler - Sack AAF Latitude 44°03'N Longitude 75°43'W Elevation 680 ft (207.3 m)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Absolute maximum temperature	°C	18.9	16.1	27.2	29.4	30.6	35.6	37.7	35.0	35.6	29.4	24.4	18.9	36.7	30
	°F	66	61	81	85	87	96	98	95	96	85	76	66	98	30
Mean daily maximum temperature	°C	-1.0	-0.4	4.4	11.9	19.0	24.5	27.3	26.3	21.9	15.3	7.8	0.7	13.2	30
	°F	30.3	31.2	40.2	53.5	66.2	76.1	81.1	79.3	71.5	59.5	46.0	33.2	55.7	30
Mean daily minimum temperature	°C	-11.2	-10.9	-5.2	1.4	7.6	13.2	15.9	14.9	11.0	4.9	-0.4	-81	2.8	30
	°F	11.8	12.4	22.6	34.5	45.6	55.8	60.7	58.8	51.8	40.9	31.2	17.1	37.0	30
Absolute minimum temperature	°C	-35.6	-32.8	-28.3	-15.6	-4.4	-1.1	5.0	2.2	-2.8	-9.4	-19.4	-39.4	-39.4	30
	°F	-32	-27	-19	4	24	30	41	36	27	15	-3	-39	-39	30
Mean number of days with maximum temperature > 90° F (32.2° C)		0	0	0	0	0	#	2	1	1	0	0	0	4	10
Mean number of days with minimum temperature < 32° F (0.0° C)		30	26	28	11	2	0	0	0	1	8	16	27	149	10
Mean number of days with minimum temperature < 0° F (-17.8° C)		10	4	0	0	0	0	0	0	0	0	0	9	23	5
* Normal cooling degree days		0	0	0	4	18	103	212	164	54	2	0	0	557	12
* Normal heating degree days		1302	1164	1002	583	289	67	12	23	147	411	728	1139	6867	20
Mean dew point temperature	°C	-8.3	-7.8	-3.9	1.1	7.2	12.8	15.0	15.0	11.1	5.6	0	-6.1	3.3	23
	°F	17	18	25	34	45	55	59	59	52	42	32	21	38	23
Mean relative humidity--percent		74	74	71	67	66	68	68	71	73	72	73	75	71	23
Mean monthly precipitation	mm	79.5	64.0	72.6	78.7	80.8	69.3	81.8	80.0	98.3	97.3	103.6	95.0	999.7	30
	in	3.13	2.52	2.86	3.10	3.18	2.73	3.22	3.15	3.87	3.83	4.08	3.74	39.36	30
Mean number of days with precipitation > 0.1 in (2.54 mm) or snowfall > 1.5 in (38.1 mm)		9	7	8	8	8	8	6	5	7	8	10	10	94	30
* Absolute maximum monthly and annual precipitation	mm	149.1	136.7	173.7	193.3	157.2	404.4	241.8	213.6	223.8	210.6	197.6	166.4	1307.4	73
	in	5.87	5.38	6.84	7.61	6.19	15.92	9.52	8.41	8.81	8.29	7.78	6.55	55.41	73
* Absolute minimum monthly and annual precipitation	mm	25.4	19.3	16.0	20.1	4.8	14.0	7.6	16.8	13.0	5.3	8.1	21.6	684.8	73
	in	1.00	0.76	0.63	0.79	0.19	0.55	0.30	0.66	0.51	0.21	0.32	0.85	26.96	73
* Absolute maximum 24-hour precipitation	mm	37.3	50.5	34.0	61.5	79.5	98.6	103.4	108.5	105.2	91.4	53.1	55.4	108.5	26
	in	1.47	1.99	1.34	2.42	3.13	3.88	4.07	4.27	4.14	3.60	2.09	2.18	4.27	26
Mean number of days with thunderstorms		#	#	1	2	4	6	6	4	2	0	0	0	25	30
Mean monthly snowfall	mm	657.9	569.0	401.3	68.6	#	0.0	0.0	0.0	#	17.8	254.0	932.2	2900.7	30
	in	25.9	22.4	15.8	2.7	#	0.0	0.0	0.0	#	0.7	10.0	36.7	114.2	30
Maximum monthly snowfall recorded	mm	2016.7	988.1	1366.6	203.2	20.3	0	0	0	T	127.0	1137.9	1869.4	2016.7	15
	in	79.4	38.9	53.8	8.0	0.8	0	0	0	T	5.0	44.8	73.6	79.4	15
* Absolute maximum monthly and annual snowfall	mm	1803.4	1844.0	944.9	304.8	30.5	0.0	0.0	0.0	0.0	111.8	561.3	1333.5	3992.8	74
	in	71.0	72.6	37.2	12.0	1.2	0.0	0.0	0.0	0.0	4.4	22.1	52.5	157.2 (in 1970-71)	74
* Absolute maximum 24-hour snowfall	mm	622.3	543.6	373.4	180.3	30.5	0.0	0.0	0.0	0.0	61.0	307.3	393.7	622.3	26
	in	24.5	21.4	14.7	7.1	1.2	0.0	0.0	0.0	0.0	2.4	12.1	15.5	24.5	26
* Absolute minimum monthly and annual snowfall	mm	35.6	119.4	30.5	T	0.0	0.0	0.0	0.0	0.0	0.0	T	1e2.1	955.0	74
	in	1.4	4.7	1.2	T	0.0	0.0	0.0	0.0	0.0	0.0	T	5.2	37.6 (in 1932-33)	74
Mean number of days with precipitation > 0.01 in (0.25 mm) or snowfall > 0.15 in (3.8 mm)		18	16	17	16	13	11	11	11	10	11	16	18	169	23
Mean number of days with snowfall > 0.1 in (2.5 mm)		16	14	11	3	#	0	0	0	0	#	5	14	63	23
Mean pressure altitude	m	164.0	171.3	183.8	189.9	187.8	194.8	192.6	182.0	171.3	164.6	167.3	169.5	178.3	
	ft	538	562	603	623	616	639	632	597	562	540	549	556	585	
Percent frequency of surface wind speed ≥ 28 knots (32 miles per hour or 51.5 kilometers per hour)		1.3	0.9	2.2	1.4	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.9	0.6	8
Percent frequency of surface wind speed ≥ 17 knots (20 miles per hour or 32.2 kilometers per hour)		9.1	10.4	17.7	13.4	9.7	3.3	5.7	4.2	4.6	4.1	3.1	12.8	8.2	8
Mean number of days with surface wind speed ≥ 17 knots (20 mph or 32.2 kmph) and no precipitation	at 1900 LST	2.3	2.2	5.5	2.9	2.2	0.7	1.0	0.4	1.4	0.5	0.6	1.9	21.6	9
	at 0100 LST	1.1	2.0	3.7	3.5	2.1	0.0	0.0	0.0	0.5	0.5	1.1	3.2	17.7	5
	at 0700 LST	2.1	2.5	4.0	4.5	1.9	0.5	0.5	0.0	0.3	1.0	0.6	2.6	20.5	9
	at 1300 LST	3.5	3.4	7.8	5.2	4.7	2.0	5.1	3.3	2.0	2.6	1.2	2.0	42.8	9
Mean number of days with surface wind 4-10 knots (4.6-11.5 mph or 7.4-18.5 kmph) and temperature 33-89° F (0.6- 31.7° C) and no precipitation	at 1900 LST	3.0	2.5	8.5	17.0	15.3	18.2	16.1	15.6	15.0	11.7	12.1	2.8	137.8	9
	at 0100 LST	3.9	0.6	6.4	15.6	17.8	16.0	17.0	15.1	12.0	14.9	7.2	0.6	127.1	5
	at 0700 LST	2.8	2.2	6.2	11.9	16.8	19.1	19.1	19.8	15.8	16.5	6.2	2.2	138.6	9
	at 1300 LST	4.2	4.0	8.8	13.3	13.6	15.5	13.3	14.9	12.7	15.5	9.4	2.8	128.0	9
Prevailing surface wind direction		WSW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	S	W	WSW	WSW	W	23
Mean wind speed	knots	9	9	9	10	8	7	7	6	7	7	9	8	8	23
	mph	10	10	10	12	9	8	8	7	8	8	10	9	9	23
	kmph	17	17	17	19	15	13	13	11	13	13	17	15	15	23
Extreme wind speed	knots	56	50	56	52	50	49	47	43	52	63	59	52	63	23
	mph	65	58	64	60	58	56	52	50	60	73	68	60	73	23
	kmph	104	93	104	96	93	91	87	80	96	117	109	96	117	23
Mean number of days with an occurrence of visibility < 0.5 mile (0.8 kilometer)		6.1	4.3	5.0	1.0	1.6	1.8	1.1	1.2	1.3	1.5	3.0	6.5	34.4	8
Percent frequency ceiling < 5,000 ft (1524 m) or visibility < 5 miles (8 kilometers)		56.7	54.8	43.4	43.4	44.1	40.5	34.3	32.5	51.0	36.6	55.9	58.0	45.9	8
Percent frequency ceiling < 1,500 ft (457.2 m) or visibility < 3 miles (4.828 km)	for 0000-0200 LST	19.2	15.7	11.1	13.3	11.2	11.5	7.1	5.4	16.1	3.8	21.2	21.5	13.1	6
	0300-0500 LST	20.3	17.3	10.5	17.8	15.8	13.6	10.4	10.2	20.8	5.4	17.2	25.8	15.4	8
	0600-0800 LST	22.0	17.0	12.5	20.0	17.0	13.8	10.6	15.4	14.6	7.0	27.2	28.9	17.2	9
	0900-1100 LST	26.8	20.5	14.7	19.4	16.7	11.5	7.3	13.0	9.8	6.5	29.4	31.9	17.3	9
	1200-1400 LST	27.0	19.9	12.6	16.7	13.7	7.6	5.7	10.9	10.0	7.0	27.2	29.1	15.6	9
	1500-1700 LST	29.4	17.7	14.4	14.5	10.9	7.2	3.3	7.5	8.1	5.4	22.8	27.9	14.1	9
	1800-2000 LST	28.0	17.5	13.2	14.5	12.1	6.8	3.9	3.9	7.7	2.9	20.0	28.0	13.5	8
	2100-2300 LST	26.3	15.1	11.3	12.3	13.8	7.4	6.1	3.1	12.8	2.7	24.4	27.4	13.6	6
Percent frequency ceiling < 300 ft (91.4 m) or visibility < 1 mile (1.609 km)	for 0000-0200 LST	4.2	5.3	3.1	1.1	1.1	2.2	1.1	1.2	2.8	2.2	3.4	9.1	3.1	6
	0300-0500 LST	5.4	6.6	1.5	1.7	2.9	3.9	2.7	3.0	5.5	1.1	6.1	8.6	4.1	8
	0600-0800 LST	5.5	3.5	5.4	1.1	3.5	2.5	1.5	1.7	1.6	0.5	11.7	11.1	4.1	9
	0900-1100 LST	11.0	3.8	4.0	3.3	1.5	0.2	1.1	1.1	0.3	1.6	7.2	16.1	4.3	9
	1200-1400 LST	12.6	6.6	5.0	2.8	0.3	0.0	0.5	0.6	0.3	0.0	6.1	13.3	4.0	9
	1500-1700 LST	9.8	6.0	3.6	2.8	0.6	0.0	0.4	0.4	0.7	1.1	5.6	15.6	3.9	9
	1800-2000 LST	8.3	6.4	1.4	1.7	1.3	0.3	0.0	0.0	1.0	0.5	4.4	10.2	3.0	8
	2100-2300 LST	7.1	5.5	3.2	1.1	1.1	0.7	0.0	0.0	3.3	1.6	5.0	8.6	3.1	6
Mean number of days with ceiling > 1,000 ft (304.8 m) and visibility > 3 miles (4.828 km)	1900 LST	24.0	24.0	38.1	29.0	29.2	28.9	30.2	29.8	27.9	29.5	25.5	23.9	330.0	9
	0100 LST	26.3	24.6	27.7	29.0	29.6	27.3	29.3	29.9	25.5	29.5	25.0	26.0	329.7	6
	0700 LST	25.6	24.0	28.1	26.0	28.4	26.9	28.3	27.7	26.3	30.5	24.0	24.0	319.8	9
	1300 LST	23.3	24.3	28.1	28.5	29.8	29.0	30.0	28.7	28.9	30.0	26.0	21.6	328.2	9

H. CLIMATE (continued)

CLIMATIC SUMMARY (continued)

Fort Drum / Wheeler - Sack AAF Latitude 44°03'N Longitude 75°43'W Elevation 680 ft (207.3 m)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Mean number of days with ceiling > 2,000 ft (609.6 m) and visibility > 3 miles (4.828 km) and surface wind < 10 knots (11.5 mph or 18.5 kmph)	1900 LST	15.6	16.0	15.1	14.0	18.8	19.8	19.2	19.3	18.5	24.0	16.5	15.5	212.3	9
	0100 LST	18.4	16.9	17.8	9.3	19.7	22.3	23.7	25.2	22.0	24.0	17.0	18.0	234.5	6
	0700 LST	17.9	15.8	16.1	9.0	15.7	19.5	19.6	20.2	19.8	22.0	15.0	14.3	204.9	9
	1300 LST	15.9	11.9	8.7	7.0	10.4	11.9	9.6	12.8	12.2	13.0	12.0	13.6	139.0	9
Mean number of days with ceiling > 2,500 ft (762.0 m) and visibility > 3 miles (4.828 km)	1900 LST	19.4	20.8	23.0	19.0	24.3	24.5	28.7	28.3	25.1	28.5	21.0	19.0	281.6	9
	0100 LST	21.9	20.6	24.4	20.5	25.0	25.0	27.0	28.1	24.5	27.5	20.0	20.5	285.0	6
	0700 LST	20.8	19.8	24.0	21.5	22.9	24.6	26.2	25.8	23.2	27.0	16.5	18.0	270.3	9
	1300 LST	20.0	18.5	22.3	20.0	23.8	25.2	27.2	25.0	22.9	24.0	18.5	18.3	265.7	9
Mean number of days with ceiling > 6,000 ft (1828.8 m) and visibility > 3 miles (4.828 km)	1900 LST	14.3	12.8	17.6	16.5	19.1	19.6	22.2	22.2	20.6	20.5	15.5	13.4	214.3	9
	0100 LST	13.3	12.1	19.0	17.0	19.0	18.7	23.1	23.8	18.5	21.0	14.5	11.5	211.5	6
	0700 LST	10.7	8.2	16.5	17.5	17.3	20.7	21.8	21.8	17.8	21.0	11.5	11.3	196.1	9
	1300 LST	14.1	11.6	16.5	16.0	16.2	18.1	19.0	18.1	15.3	18.5	12.0	13.0	188.4	9
Mean number of days with ceiling > 10,000 ft (3048.0 m) and visibility > 3 miles (4.828 km)	1900 LST	11.8	10.4	16.3	14.5	14.2	17.1	19.6	19.9	19.2	18.0	14.0	10.5	185.5	9
	0100 LST	10.8	11.1	17.8	16.0	16.0	17.6	20.1	22.3	16.0	18.5	12.5	8.5	187.2	6
	0700 LST	9.9	7.1	14.9	14.5	15.0	16.6	16.7	18.4	15.3	16.0	8.5	6.7	159.6	9
	1300 LST	11.2	9.0	12.4	13.0	12.2	15.8	16.9	15.7	11.6	14.0	10.0	9.0	150.8	9

* Data derived from Syracuse, N. Y. station records, not from Fort Drum/Wheeler-Sack AAF

\# Less than 0.5 day or 0.05 inch as applicable

EPHEMERIS FOR FORT DRUM, NEW YORK
(Eastern Standard Time)

DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET
January 1	0629	1745	0738	1635	July 1	0300	2113	0423	1950
January 11	0628	1754	0737	1645	July 11	0308	2107	0430	1946
January 21	0624	1805	0731	1658	July 21	0320	2057	0439	1939
February 1	0616	1818	0721	1713	August 1	0336	2041	0450	1927
February 11	0604	1831	0708	1727	August 11	0350	2025	0501	1914
February 21	0551	1843	0654	1740	August 21	0405	2006	0513	1858
March 1	0538	1853	0641	1751	September 1	0420	1945	0525	1839
March 11	0521	1906	0623	1804	September 11	0433	1925	0537	1821
March 21	0502	1919	0605	1816	September 21	0446	1905	0548	1803
April 1	0441	1933	0545	1829	October 1	0458	1847	0600	1744
April 11	0422	1947	0527	1842	October 11	0510	1827	0612	1727
April 21	0402	2002	0510	1854	October 21	0522	1813	0625	1710
May 1	0344	2017	0455	1906	November 1	0535	1758	0639	1653
May 11	0328	2032	0442	1917	November 11	0547	1747	0652	1641
May 21	0313	2046	0431	1928	November 21	0558	1739	0705	1632
June 1	0302	2100	0423	1939	December 1	0609	1734	0717	1626
June 11	0256	2109	0419	1946	December 11	0618	1734	0727	1625
June 21	0255	2114	0420	1949	December 21	0625	1737	0735	1627

I. CROSS-COUNTRY MOVEMENT

Cross-country movement (CCM) refers to movement by military vehicles and foot troops away from roads and trails. It differs from the somewhat nebulous term "trafficability" which to some is synonymous with cross-country movement but to others, refers to the soil component as it affects movement or the capacity of roads to support traffic.

This analysis of CCM conditions has been derived primarily from the vegetation and engineering soils topics of this report supplemented by interpretations of aerial photography, topographic maps, climatic data, and miscellaneous textual material.

At Fort Drum, the major direct factors affecting movement are vegetation and soils. Excessive slopes are only a local factor. Vegetation varies from open, mostly grass-covered areas to forests with closely-spaced trees. Soils range from sands and gravel to fine-textured plastic clays; many depressional areas contain organic soils.

Generally, the best areas for vehicular cross-country movement occur in the southern part of the reservation. Large tracts have been cleared and the soils are sandy or gravelly and well drained. In contrast, large areas in the northeast are impractical for movement due to many rock outcrops and dense, scrubby vegetation. In winter, movement in much of the reservation is very difficult or altogether precluded, especially for wheeled vehicles, due to deep snow.

Predictions of movement conditions are considerably complicated by the capricious nature of the winter, especially in winter. In some years, heavy snows come early in the season and more or less, uniformly cover the ground until onset of spring. In other years, snow may be severely drifted causing unprotected areas to be almost free of snow, whereas other more sheltered areas harbor deep drifts. There are also large variations in the compaction of snow and depth to which soil is solidly frozen. Intervals of thaw during the winter season may cause ground surfaces to become temporarily slippery, sticky, or the soil to become soft and miry. In late winter and early spring, degraded movement conditions resulting from thaw are the rule, especially on silty or clayey soils.

The map and the movement evaluations should be used only as a guide in planning military training activities. For exact movement routes, reconnaissance on the ground is required.

MAP UNIT	GENERALIZED TERRAIN CONDITIONS [1]	MOVEMENT OF TRACKED VEHICLES [2]	MOVEMENT OF WHEELED VEHICLES [3]	MOVEMENT OF FOOT TROOPS
1	Open cleared areas, soils dominantly very sandy or gravelly. Areas mainly grass-covered and utilized for military exercises and training activities. Most slopes between 2 and 6 percent; near drainageways and on hillocks, slopes tend to be steeper. Locally, some sands in the southeast subject to being windblown. Loose sand also common in areas largely bare of vegetation or where ground surface disturbed through intensive use.	Easy in any direction for both tank and APC; movement limited only by the natural boundaries of the open areas. Local obstructions easily bypassed. Near drainageways and on hillocks, movement somewhat slower due to steeper slopes. Movement slowed in wintertime due to snow-cover, particularly in areas containing deep drifts.	Fairly easy most of year except in winter when movement generally impractical due to deep snow. Upslope movement difficult in areas of loose sand, especially when sands are dry.	Generally unrestricted except severely slowed by deep snow in winter months. Local obstructions easily bypassed.
2	Open cleared areas; soils dominantly clayey or silty. Vegetation mainly grasses as in Map Unit 1. Dominant landform consists of nearly level to gently sloping plains with a few wet depressions. Plains crossed by a few, mostly ephemeral streams. Soils generally have good bearing strength except after heavy soaking rains and during late winter or early spring thaws. During this period soils are either slippery, sticky or miry. These unfavorable soil conditions may only persist for a day or so during summer but last considerably longer in winter and spring.	Generally easy when soils firm; wet depressions can be bypassed with little difficulty. After soaking rains or during the spring thaw period, movement difficult due to soft and miry soils. The lighter-weight APC can frequently move in areas where tank cannot move. When ground snow-covered, risk of "bogging down" tank are high, particularly so in situations when an early snow covers ground still unfrozen. During the spring thaw period, risk of immobilizing tank remain high.	Fairly easy when soils firm. Severely slowed or stopped for a day or two after soaking rains. Drainageways can normally be crossed except during very brief periods of high water. Wet depressions easily bypassed. In wintertime and during thaw periods, movement generally precluded by deep snow or soft, miry soil. Movement also impaired by slippery or sticky soils during periods when rains are light. However, these conditions usually last only for a few hours.	Generally the same as for Map Unit 1 although movement is somewhat slower when soils are sticky or slippery. Severely slowed in deep snow.
3	Wooded areas consisting of nearly open to medium spaced trees. Slopes less than 8 percent except steeper near streams. Soils generally firm. On silty and clayey soils, soils soft and miry after rains and during thaws. Boggy spots common along some drainageways. Most trees spaced more than 3 m(10 ft) apart; trunk size ranges from 10 to 25 cm(4 to 10 in) in diameter.	Moderately slowed by randomly-spaced trees; sharp turns and occasional maneuvering necessary in order to avoid larger trees. Many of the smaller trees can be pushed over. Soft, boggy spots along drainageways require bypassing. On-the-ground reconnaissance helpful in locating these boggy soil areas. During winter months and including the spring thaw period, movement generally precluded, although APC may under certain favorable circumstances move with relative ease.	Severely slowed by forest vegetation. Locally, in areas where vegetation relatively open and trees widely spaced, movement feasible when soils firm. Movement precluded during winter months and spring thaw due to adverse interacting factors such as deep snow, forest vegetation and soft, miry soils.	Moderately slowed by wooded vegetation. Severely slowed in deep snow. Impeded in silty and clayey soil areas when ground soft, sticky or slick.
4	Wooded terrain with many scattered rock outcrops. Trees mainly deciduous, closely spaced and scrubby. Topography controlled by bedrock modified by glacial action. Rock outcroppings estimated to cover as much as 40 to 55 percent of the area. Slopes range up to 25 percent but most between 2 and 8 percent. Soils very shallow where rock outcrops not present; most soils coarse-grained. Trunks of trees commonly less than 15 cm (6 in) thick; spacing less than 3.6 m (12 ft). Dense undergrowth.	Feasible but difficult and slow due to combined adverse affects of avoiding rock outcrops and closely spaced trees. Visibility also impaired by dense undergrowth. Movement generally precluded for both tank and APC during winter months when snow deep and many rock outcrops are obscured.	Not practical for long distances due to many rock outcrops and closely spaced trees. Risk of damage to vehicles by rocks unacceptably high.	Slow but not difficult. Movement slowed by dense, often scraggly vegetation. Easy to lose sense of direction or bearing course. Severely slowed in winter by deep snow.
5	Wooded areas consisting of medium to closely spaced trees. Trees both deciduous and coniferous. Slopes fairly gentle except quite steep adjacent to some streams; slopes seldom exceed 15 percent. Most trees spaced less than 3 m (10 ft) apart; diameter of trunks commonly within limits of 20 and 30 cm (8 to 12 in). Undergrowth medium to dense. Stumps and fallen trees common.	Precluded by medium to closely spaced trees, stumps and logs. Movement for short distances feasible when soils firm.	Generally precluded by large and closely spaced trees.	Generally the same as Map Unit 4.
6	Swamps, marshes and other very poorly drained areas. Most areas either ponded or have a high water table at or very near the surface. Soils mainly organic-dominantly muck and some peat; soft and boggy throughout year.	Generally precluded throughout year by soft, saturated or ponded soils. Bogs treacherous to cross even in winter when soil may appear to be solidly frozen.	Infeasible due to perennially soft soils.	Feasible but not practical. In winter, snow may obscure soft, boggy conditions of soils, particularly when not deeply frozen.

[1] Seasonal aspects of terrain conditions; applicable to all map units:

(a) Period from late March or early April through mid-December. Soils dominantly firm. Movement conditions on silty or clayey soils degraded for a day or two following soaking rains. Sandy or gravelly soils on uplands generally maintain their bearing strength during this period.

(b) Period from about mid-December through late March or early April. Large variations in soil strength. Ground frozen and snow-covered most of period; snow may be drifted. Depth of snow highly varied; commonly 60 to 90 cm (2 to 3 ft). Late in period, silty and clayey soils become soft and miry due to snowmelt and ground thaw. Sandy or gravelly soils generally maintain their bearing strength at all times. Maximum depth of frozen soil approximately 1.2 to 1.5 m (4 to 5 ft).

[2] Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).

[3] Comments apply to the M-35, 2½ ton truck and the M-151, ¼ ton truck.

FORT DRUM, NEW YORK

TERRAIN ANALYSIS

CROSS-COUNTRY MOVEMENT

This map deals with cross-country movement, or movement away from roads and is primarily intended for use in planning operations. For determining exact driving routes, reconnaissance on the ground is required. Many areas of minor areal extent such as small tracts of forest, localized areas of steep slopes, swamps, etc., have not been shown. The predicted movement ratings are those believed to prevail most of the time. Variations in these evaluations may occur from year to year and even within a season due to abnormal weather conditions. Since winter and early spring conditions are markedly different from those prevailing in summer and fall; the ratings have been provided for two periods of the year. Impact areas are normally off-limits to vehicles and foot troops due to safety reasons. Note also that the cantonment area has not been evaluated.

EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

MAP UNIT	TERRAIN UNIT	PREDICTED MOVEMENT RATINGS FOR:									
		TANK(M-60)		APC (M-113)		2½t TRUCK (M-35)		¼t TRUCK (M-151)		FOOT TROOPS	
		A	B	A	B	A	B	A	B	A	B
1	Open cleared areas; soils dominantly very sandy or gravelly.	Good	Fair	Good	Fair	Fair	Unsuited	Good	Unsuited	Good	Poor
2	Open cleared areas; soils dominantly clayey or silty.	Good	Poor	Good	Fair	Good	Unsuited	Good	Unsuited	Good	Poor
3	Wooded areas consisting of nearly open to medium spaced trees.	Fair	Unsuited	Fair	Poor	Poor	Unsuited	Poor	Unsuited	Fair	Poor
4	Wooded areas; tree growth dense but scrubby. Many rock outcroppings.	Poor	Unsuited	Poor	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Fair	Poor
5	Wooded areas consisting of medium to closely spaced trees.	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Fair	Poor
6	Swamps, marshes and other very poorly drained ground.	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Poor	Poor

A. Period from about late March or early April through mid-December.

B. Period from about mid-December through late March or early April.

EXPLANATION OF RATING TERMS

Good — Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns or crossing of tracks) at one location.

Fair — Conditions moderately hinder progress or moderately restrict choices of direction for movement. Terrain will permit 3 to 12 passes in trace of an M-60 but maneuvering will be difficult.

Poor — Conditions severely hinder progress or greatly restrict choice of movement routes. Terrain will probably permit up to 3 passes in trace of an M-60. Very cautious driving required. Movement in trace should be avoided.

Unsuited — Conditions preclude all but local movement. Engineer work required for vehicular movement.

Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET

MAIN IMPACT AREA

IMPACT AREA

IMPACT AREA

FORT DRUM MILITARY RESERVATION

SERIES V721

1:50,000 SHEET INDEX

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

J. LINES OF COMMUNICATION

The Lines of Communication on Fort Drum consists of roads, railroads, an airfield, two pipelines and 14 helicopter landing zones.

The existing road network includes hard surfaced roads, tank trails and improved and unimproved dirt roads. The road system is used primarily during the summer training period and has very little traffic during winter; most roads are snowbound generally from mid-November through March and snow is removed from only a few roads. The roads shown on the map do not represent the complete network since many minor unimproved dirt roads have been omitted. Those unimproved dirt roads that are shown have been selected to depict prevailing patterns and system connections. The total length of the road system depicted on the map is approximately 632 kilometers (393 miles). Hard surface roads total approximately 85 kilometers (53 miles) in length. The total length of tank trails is approximately 87 kilometers (54 miles), while the total length of dirt roads, both improved and unimproved, is approximately 460 kilometers (286 miles). Because of their similar characteristics, tank trails, improved and unimproved dirt roads have been treated in groups rather than individually. Data on military road classification and road shoulder characteristics were not available. There are 43 road bridges within the reservation, most of which cross Indian River, Black Creek and their tributaries. Most of the bridges are deck type and considered in good condition.

The railroad system at Fort Drum consists of US Government and privately owned tracks. The Federally owned rails serve the cantonment area and the ammunition storage area east of the airfield. The privately owned (Conrail) lines run nearly north-south through the southwestern part of the reservation and enter and exit the post in three areas in the northwest. Together, they provide Fort Drum approximately 33 kilometers (20.3 miles) of tracks which are in good condition. The one railroad bridge on the reservation crosses Black Creek.

Wheeler-Sack Army Airfield is the only airfield on the reservation and it is used regularly for fixed-wing aircraft. Located northeast of the cantonment area, the airfield has the capability of serving military aircraft up to and including the C-130. There are no operational airstrips on the reservation; several landing strips have been abandoned (see Non-Urban Culture Features).

Antwerp and Philadelphia, two communities in the vicinity of Fort Drum, are supplied water by pipelines from sources on post. Antwerp receives its water through a pipeline from three springs located just inside the reservation along the northwestern boundary. Philadelphia receives its water by pipeline from a reservoir located approximately 3.2 kilometers (2 miles) inside the north-central boundary.

There are 14 designated helicopter landing zones on the reservation, four of which are located within the cantonment area, while ten are positioned on or near abandoned airstrips throughout the reservation.

For detailed data on Lines of Communication, see the following summary tables.

1. ROADS

ROUTE NUMBER OR NAME	ROUTE LOCATION GRID REFERENCE FROM-TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDERS		REMARKS
					CONSTRUCTION MATERIALS	WIDTH/ CONDITION	CONSTRUCTION MATERIALS	WIDTH/ CONDITION	
Bedlam Road	331757-368793	5.3 km (3.3 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.1 m (10 ft); poor	No data		
County Road 52	347745-377742	3 km (1.9 miles)	No data	All weather; snow not removed	Concrete	6.1 m (20 ft); fair	No data		
Dixon Road	515897-534874	3.7 km (2.3 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.1 m (10 ft); poor	No data		Abandoned.
Felts Mills Road	385748-385749	0.1 km (0.1 miles)	No data	All weather	Asphaltic concrete	6.7 m (22 ft); good	No data		
Felts Mills Road	386746-385748	0.3 km (0.2 miles)	No data	All weather	Portland Cement concrete	7.3 m (24 ft); good	No data		
Great Bend Road	378801-408770	4.3 km (2.7 miles)	No data	All weather	Portland Cement concrete	7.3 m (24 ft); good	No data		
Great Bend Road	408770-418762	1.1 km (0.7 miles)	No data	All weather	Asphaltic concrete	6.1 m (20 ft) & 6.1 m (20 ft); good	No data		4 lanes-divided.
Great Bend Road	418763-422760	0.5 km (0.3 miles)	No data	All weather	Asphaltic concrete	7.3 m (24 ft); good	No data		
Main Street Road	367740-370747	0.8 km (0.5 miles)	No data	All weather; snow not removed	Asphaltic concrete	6.1 m (20 ft); good	No data		
Munns Corner Road	415765-465765	6.4 km (3.9 miles)	No data	All weather; snow not removed	Portland Cement concrete	7.3 m (24 ft); good	No data		
Nash Boulevard	378743-417764	4.4 km (2.8 miles)	No data	All weather	Asphaltic concrete	6.7 m (22 ft); good	No data		
Oneida Avenue	385749-379757	0.9 km (0.6 miles)	No data	All weather	Asphaltic concrete	6.1 m (20 ft); good	No data		
Oneida Avenue	379757-408770	3 km (1.9 miles)	No data	All weather	Portland Cement concrete	7.3 m (24 ft); good	No data		
Ontario Avenue	385749-380756	0.8 km (0.5 miles)	No data	All weather	Asphaltic concrete	6.1 m (20 ft); good	No data		
Ontario Avenue	380756-408770	3.2 km (2 miles)	No data	All weather	Portland Cement concrete	7.3 m (24 ft); good	No data		
Philadelphia Road	434776-437841	6.7 km (4.1 miles)	No data	All weather; snow not removed	Asphalt	6.1 m (20 ft); poor	No data		
Rockwell Creek Road	540927-624936	9.5 km (5.9 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.1 m (10 ft); poor	No data		Abandoned.
State Highway 3A	486757-533756	4.6 km (2.8 miles)	No data	All weather; snow not removed	Asphaltic concrete	7.3 m (24 ft); good	No data		
State Route 26	537763-514927	18 km (11.2 miles)	No data	All weather	Bituminous	11.9 m (39 ft); poor	No data		No longer state route, controlled by Fort Drum.
Town Line Road	534874-576847	5.1 km (3.2 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.1 m (10 ft); poor	No data		Abandoned.
Unnamed road	395769-390775	0.9 km (0.6 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.7 m (12 ft); good	No data		
Unnamed road	423787-428808	2.2 km (1.3 miles)	No data	All weather; snow not removed	Asphaltic concrete	3.7 m (12 ft); fair	No data		
Tank trails		87 km (54 miles)	No data	All weather; snow not removed	Dirt	9.1 m (30 ft); good	No data		
Improved dirt roads		215.9 km (134.2 miles)	No data	Fair weather	Dirt	Generally 1 or 2 lanes; good to poor	No data		
Unimproved dirt roads		243.8 km (151.5 miles)	No data	Fair weather	Dirt	Generally 1 or 2 lanes; fair to poor	No data		

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION			DIMENSIONS	CLEARANCE	TYPE/CONSTRUCTION MATERIAL	CONDITION	REMARKS
					W	T					
1	Carr Road	529939	Indian River	(1)*	70	50	Total length: 20.1 m (66 ft) Length of main span: 10.4 m (34 ft) Overall width: 5.8 m (19 ft) Roadway width: 5.3 m (17.5 ft)	Unlimited vertical	Deck; concrete and steel	Fair	Approach in poor condition.
2	Fuller Road	546938	Indian River	(1)	30	30	Total length: 13.4 m (44 ft) Overall width: 6.1 m (20.2 ft) Roadway width: 5.5 m (18 ft)	Unlimited vertical	Deck; steel stringer with concrete deck	Good	
3	Rockwell Creek Road	553923	Indian River	(1)	40 (est)		Total length: 18.3 m (60 ft) 2 Spans Overall width: 6.2 m (20.2 ft) Roadway width: 5.5 m (18.2 ft)	Unlimited vertical	Deck; steel beam with concrete deck	Good	
4	Rockwell Creek Road	560924	Tributary of Rockwell Creek	(1)	80	60	Total length: 5.7 m (18.8 ft) Length of main span: 4.4 m (14.4 ft) Overall width: 5.5 m (18 ft) Roadway width: 4.9 m (16 ft)	Unlimited vertical	Deck; reinforced concrete slab	Good	Bypass difficult.
5	Rockwell Creek Road	571931	Rockwell Creek	(1)	75	55	Total length: 7.8 m (25.5 ft) Roadway width: 6.1 m (20.1 ft)	Unlimited vertical	Deck; reinforced concrete T beam	Good	Bypass easy.
6	Rockwell Creek Road	598935	Rockwell Creek	(1)	100	70	Total length: 7.6 m (25 ft) Overall width: 6.9 m (22.7 ft) Roadway width: 6.1 m (20 ft)	Unlimited vertical	Reinforced concrete T beam	Good	Bypass impossible.
7	Rockwell Creek Road	611933	Rockwell Creek	(1)	70	50	Total length: 8.2 m (26.8 ft) Overall width: 6.9 m (22.8 ft) Roadway width: 6.2 m (20.3 ft)	Unlimited vertical	Reinforced concrete T beam	Good	Bypass difficult.
8	Fusa Boulevard	643947	Tributary of Sawyer Creek	(1) (2)	55 No data	50	Total length: 4.3 m (14.3 ft) Roadway width: 7.3 m (24.1 ft)	Unlimited vertical	Timber trestle	Good	Bypass difficult.
9	Fusa Boulevard	644945	Tributary of	(1) (2)	55 No data	50	Total length: 4.9 m (16 ft) Roadway width: 7.3 m (24.1 ft)	Unlimited vertical	Timber trestle	Good	Bypass difficult.
10	Fusa Boulevard	658911	Bonaparte Creek	(1)	90	80	Total length: 10.4 m (34 ft) Overall width: 4.9 m (16 ft) Roadway width: 4.3 m (14 ft)	Unlimited vertical	Deck; steel beam with concrete deck	Fair	Bypass difficult, abutments eroded.
11	Dixon Road	523889	Indian River	(1)	No data		Total length: 4.2 m (13.8 ft) Roadway width: 6.1 m (20 ft)	Unlimited vertical	Deck; steel beam with concrete deck	Poor	Bypass easy; due to shell fire, the masonry has 3 major cracks in the upper section and the outside stringer at the southeast corner has been destroyed, causing a 1.5 m × 1.1 m (5 × 3.5 ft) hole in the deck.
12	Rock Road	615872	Bonaparte Creek	(1)	30		Total length: 8.3 m (27.3 ft) Overall width: 4.3 m (14.3 ft) Roadway width: 4.1 m (13.3 ft)	Unlimited vertical	Concrete & steel	Fair/Good	Bypass impossible, approaches need fill.
13	Nauvoo School	537854	Indian River	(1)	60	40	Total length: 17.1 m (56 ft) 2 Spans; length, 8.5 m (28 ft) each Roadway width: 6.1 m (20 ft)	Unlimited vertical	Deck; steel beam with concrete deck	Fair	Bypass impossible.
14	Russell Turnpike & Lewisburg Road	583849	Indian River	(1)	80	60	Total length: 12.4 m (40.8 ft) Overall width: 8.2 m (27 ft) Roadway width: 6.9 m (22.5 ft)	Unlimited vertical	Deck; steel beam with timber deck	Good	
15	Rock Road	609860		(1)	40		Total length: 3.7 m (12 ft) Overall width: 4.9 m (16 ft) Roadway width: 3.4 m (11 ft)	Unlimited vertical	Concrete & steel		Bypass difficult.
16	Rock Road	611866	Indian River	(1)	35	30	Total length: 13.7 m (45 ft) Overall width: 4.9 m (16 ft) Roadway width: 3.4 m (11 ft)	Unlimited vertical Horizontal: 3.4 m (11 ft)	Steel beam, timber wood trestle	Good	Bypass impossible. Underbridge clearance, 3.4 m (11 ft).
17	Birch Road	469838	Beaver Meadow Creek	(1)	60		Total length: 9.8 m (32 ft) Roadway width: 6.7 m (22 ft)	Unlimited vertical Horizontal: 6.7 m (22 ft)	Timber trestle	Good	Bypass impossible. Underbridge clearance, 2.1 m (7 ft).
18	Purcell Road	485843	Tributary of Beaver Meadow Creek	(1)	150	150	Total length: 5.8 m (19 ft) Main span length: 2.7 m (9 ft) Overall width: 4.9 m (16 ft) Roadway width: 4.3 m (14 ft)	Unlimited vertical Horizontal: 4.3 m (14 ft)	Deck; concrete slab	Fair	Bypass impossible. Underbridge clearance, 0.9 m (3 ft).
19	Woods Mill Road	529841	Indian River	(1)	60	40	Total length: 18.3 m (60 ft) 2 Spans; length, 8.5 m (28 ft) each Roadway width: 6.1 m (20 ft)	Unlimited vertical	Deck; steel beam with concrete deck	Poor/Fair	Bypass impossible.

* (1) or (2) indicates number of lanes; a lane is considered 3.5 m (11.5 feet) wide for bridges.

J. LINES OF COMMUNICATION (continued)

ROAD BRIDGES (continued)

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	W	T	DIMENSIONS	CLEARANCE	TYPE/CONSTRUCTION MATERIAL	CONDITION	REMARKS
20	Lewisburg Road	535830	Indian River	(1)	50	45	Total length: 20.7 m (68 ft) Overall width: 5.8 m (18.9 ft) Roadway width: 5.5 m (18 ft)	No data	Through Steel Truss concrete & steel	Good	
21	Great Bend Road	439828	Trout Brook	(1) (2)	80 No data	60	Total length: 6.1 m (20 ft) Overall width: 7.9 m (26 ft) Roadway width: 7.3 m (24 ft)	No data	Reinforced concrete slab	Good	
22	Antwerp Road	449832	Black Creek	(1) (2)	60 No data	60	Total length: 19.0 m (62 ft) 3 Spans; length of main span, 4.6 m (15 ft) Roadway width: 7.3 m (24 ft)	Unlimited vertical	Timber trestle	Good	Bypass difficult.
23	Alexandria Road	472824	West Branch	(1)	30		Total length: 7.0 m (23 ft) Length of main span: 3.5 m (11.4 ft) Overall width: 4.9 m (16.1 ft) Roadway width: 3.5 m (11.6 ft)	No data	Timber, wood & concrete	Good	
24	Doolins Road	470826	Black Creek	(1)	60	60	Total length: 20.4 m (67 ft) 2 Spans; length, 7.6 m (25 ft) each Overall widh: 6.2 m (20.5 ft) Roadway width: 5.6 m (18.5 ft)	Unlimited vertical	Concrete	Good	
25	Reedville Road	465831	Black Creek	(1)	55	40	Total length: 15.6 m (51 ft) Length of main span: 14.6 m (48 ft) Roadway width: 5.4 m (18 ft)	Unlimited vertical Horizontal: 5.4 m (18 ft)	Steel & concrete	Fair	Underbridge clearance, 2.7 m (9 ft).
26	Lake School Road	508812	Black Creek	(1)	65		Total length: 13.7 m (45 ft) Length of main span: 7.6 m (25 ft) Roadway width: 4.9 m (16 ft)	Vertical: 9.1 m (30 ft) Horizontal: 5.5 m (18 ft)	Wood beam & concrete	Good	Bypass impossible. Underbridge clearance, 2.1 m (7 ft).
27	Hargrave Road	541829	Indian River	(1)	150	150	Total length: 11.0 m (36 ft) Roadway width: 3.4 m (11 ft)	Unlimited vertical Horizontal: 5.5 m (18 ft)	Steel & concrete slab	Good	Bypass impossible. Underbridge clearance, 3 m (10 ft).
28	River Road	592809	Indian River	(1)	No data		Total length: 7.1 m (23.3 ft) Length of main span: 3.7 m (12 ft) Overall width: 8.4 m (27.7 ft) Roadway width: 5.9 m (19.4 ft)	No data	Deck; steel truss with concrete deck	Good	
29	Borland Road	387802	Pleasant Creek	(1)	40	40	Total length: 13.7 m (45 ft) Overall width: 5 m (16.3 ft) Roadway width: 4.5 m (14.8 ft)	Vertical: 9.1 m (30 ft) Horizontal: 4.5 m (14.8 ft)	Deck; timber trestle	Poor	Bypass impossible.
30	Tank trail	487783	West Branch	(1)	50	50	Total length:10.1 m (33 ft) 2 Spans: length, 4.7 m (15.5 ft) each Overall width: 7 m (23 ft) Roadway width: 4.9 m (16 ft)	Unlimited vertical	Deck; timber trestle	Good	Bypass easy.
31	Reedville Road	468830	Black Creek	(1)	No data		Total length: No data Length of main span: 14.6 m (48 ft) Roadway width: 6.4 m (21 ft)	Unlimited vertical Horizontal: 6.4 m (21 ft)	Deck; timber trestle	Good	Underbridge clearance, 1.8 m (6 ft).
32	Tank trail	512788	Unnamed stream	(1) (2)	65 No data	45	Total length: 8.2 m (27 ft) Length of main span: 7.9 m (26 ft) Roadway width: 7.3 m (24 ft)	No data	Deck; timber		
33	Route 26	537797		(1)	65	55	Total length: 16.8 m (55 ft) Length of main span: 4.4 m (14.3 ft) Overall width: 7.4 m (24.2 ft) Roadway width: 6.8 m (22.2 ft)	Unlimited vertical	Timber trestle	Good	Bypass impossible.
34	Route 26	539794	Black Creek	(1)	70	50	Total length: 12.2 m (40 ft) Length of main span: 9.1 m (30 ft) Roadway width: No data	Unlimited vertical	Timber & concrete		
35	Russell Turnpike	549787	Black Creek	(1)	150	150	Total length: 9.8 m (32 ft) Length of main span: 4.9 m (16 ft) Overall width: 6.1 m (20 ft) Roadway width: 5.2 m (17 ft)	Unlimited vertical Horizontal: 5.2 m (17 ft)	Reinforced concrete	Good	Bypass impossible. Deck, 10.2 cm (4 in) thick dirt surface. Underbridge clearance, 1.5 m (5 ft).
36	Unnamed dirt road	384775	Tributary to St. James Lake	(1)	75		Total length: 4.9 m (16 ft) Length of main span: 4.3 m (14 ft) Overall width: 7.1 m (23.3 ft) Roadway width: 6.7 m (22 ft)	Unlimited vertical	Deck; timber truss, wood deck	Good	Bypass impossible. Underbridge clearance, 4.6 m (15 ft).
37	Tank trail	508788	Buck Creek	(1)	60	60	Total length: 7.9 m (26 ft) Overall width: 7.3 m (24 ft) Roadway width: 6.1 m (20 ft)	Unlimited vertical Horizontal: 7.3 m (24 ft)	Timber trestle	Good	Bypass easy. Underbridge clearance, 0.9 m (3 ft).
38	Lake School Road	520751	West Branch	(1)	150	150	Total length: 6.7 m (22 ft) Overall width: 5.8 m (19 ft) Roadway width: 5.8 m (19 ft)	Unlimited vertical Horizontal: 5.8 m (19 ft)	Deck; concrete & steel	Fair	Bypass impossible. Underbridge clearance, 3.7 m (12 ft).
39	State Route 26	541789	Tributary of Black Creek	(1) (2)	No data No data		Total length: 6.8 m (22 ft) Length of main span: 4.6 m (15 ft) Roadway width: 7.8 m (25.5 ft)	Unlimited vertical	Deck; steel beams with concrete deck	Good	
40	Reedville Road	504823	Black Creek	(1)	30		Total length: 7.9 m (26 ft) Length of main span: 7 m (23 ft) Roadway width: 3.7 m (12 ft)	Unlimited vertical Horizontal: 4.2 m (14 ft)	Deck; timber trestle	Good	Bypass easy. Underbridge clearance, 2.3 m (7.5 ft).
41	State Route 26	512905	Tributary of Indian River	(1)	140	150	Total length: 6.8 m (22 ft) Roadway width: 6.0 m (20 ft)	Unlimited vertical	Deck; reinforced concrete slab	Good	
42	Unnamed road	590809	Tributary of Indian River	(1) (2)	80 No data	80	Total length: No data Roadway width: 7.9 m (26 ft)	No data	Deck; reinforced concrete slab	Good	
43	Reedville Road	447835	Black Creek	(1) (2)	60 No data	55	Total length: 16.0 m (53 ft) Roadway width: 9.1 m (30 ft)	Unlimited vertical	Deck; timber trestle	Good	

2. RAILROADS

IDENTIFICATION NUMBER	GRID REFERENCE FROM-TO	LENGTH OF TRACK OR TRACK SEGMENT	OWNERSHIP AND CONDITION	TRACK AND BED CHARACTERISTICS	CROSSOVERS	SIDINGS AND WYES	TRAFFIC VOLUME	SERVICE FACILITIES
Line 1	326753-407770	7.5 km (4.7 miles)	US Government owned and maintained; good condition.	Single track, standard gage (1.44 m or 4 ft 8½ in); maximum grade 1.3% on southwest-northeast direction; minimum radius of curvature 177.7 m (583 ft); ballast material, crushed stone; weight of rails, 47.6 Kg (105 lbs).	Crossover 1: grid reference 328753; length 41 m (135 ft).	Siding 1: grid reference 326755-333750; length 495.3 m (1625 ft). Siding 2: grid reference 378754-378743; length 1266 m (4152 ft). Siding 3: grid reference 404770; length 279.5 m (917 ft). Siding 4: grid reference 406770; length 92.9 m (305 ft). Wye 1: grid reference 327753; length 692.5 m (2272 ft). Wye 2: grid reference 377757; length 801 m (2628 ft).	Combined traffic in fiscal year 1976, 86 cars in and 41 cars out.	Storage yard for railcar storage, grid reference 378750; total length of trackage 3700 m (12,138 ft); total storage capacity 201 cars. Freight yard for "end" car unloading and reloading, grid reference 379750; total length of trackage 2957 m (9701 ft); total yard capacity 176 cars. Team yard for gasoline storage and engine maintenance, grid reference 382760; total length of trackage 2191 m (7188 ft); total yard capacity 126 cars.
Line 2	478769-447862	10 km (6.2 miles)	Conrail owned and maintained, except for Siding 5 which is US Government owned and maintained; both main line and siding in good condition.	Single track, standard gage (1.44 m or 4 ft 8½ in); maximum grade 8% - 15% on northwest-southeast direction; minimum radius of curvature 889 m (2917 ft) on main line and 228.6 m (750 ft) on Siding #5; ballast material, crushed stone.	None	Siding 5: grid reference 470770-478769; length 825.4 m (2708 ft).		Trackage leading into ammunition storage area.
Line 3	527954-533960 (southern segment) 537967-539970 (central segment) 543979-546985 (northern segment)	825 m (2708 feet) 317 m (1042 feet) 724 m (2375 feet)	Conrail; in good condition.	Single track, standard gage (1.44 m or 4 ft 8½ in); maximum grade less than 1% on southwest-northeast direction; ballast material, crushed stone.	None	None		None

J. LINES OF COMMUNICATION (continued)

IDENTIFICATION NUMBER	GRID REFERENCE	FEATURE CROSSED	NUMBER OF TRACKS	ROADBED WIDTH	CLEARANCE		DECK MATERIAL	OVERALL LENGTH	TYPE OF STRUCTURE
					HORIZONTAL	VERTICAL			
1	453832	Black Creek	Single	4.3 m (14.1 ft)	4.3 m (14.1 ft)	Unlimited	Wood	24.2 m (79.3 ft)	Deck type

3. AIRFIELDS

MAP NUMBER AND/OR NAME; GRID REFERENCE; TYPE; AND CLASSIFICATION	STATUS AND ELEVATION	RUNWAY DESCRIPTION	TAXIWAY, PARKING, APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATION AIDS
1. Wheeler-Sack Army Airfield; 425776; military airfield; Army.	Operational. Highest point on landing surface, 207 m (680 ft) above sea level. Top of control tower elevation, 223.5 m (733 ft). Top of water tower near western end of Runway 3258 m (847 ft) above sea level.	Runway 1: 1524 m (5000 ft) long and 45.7 m (150 ft) wide; azimuth 150°-330°; weight bearing capacity S-41, T-123, ST-156, TT-185*; concrete surface in good condition. Runway 2: Same characteristics as above, except azimuth 30°-210°. Runway 3: 1371.6 m (4500 ft) long and 45.7 m (150 ft) wide; azimuth 80°-260°; weight bearing capacity S-41, T-123, ST-156, TT-185; concrete surface in good condition.	Seven taxiways; 1) 14.9×188.7 m (49×3900 ft); 2) 18.3×365.8 m (60×1200 ft); 3) 33.5×91.4 m (110×300 ft); 4) 15.2×579.1 m (50×1900 ft); 5) 44.8×792.5 m (147×2600 ft); 6) 30.5×91.4 m (100×300 ft); 7) 31.1×121.9 m (102×400 ft). Taxiways 1 through 4 are asphaltic concrete and taxiways 5 through 7 are concrete; in fair to good condition. Aprons: Warming apron 18,394 m² (198,000 ft²) and entrance apron 2858 m² (30,775 ft²); concrete surfaces.	Hangar (Bldg #P-2059) 49.1×61 m (161×200 ft): floor space, 3022.96 m² (32,540 ft²); asbestos protected metal siding with built-up roof. Administration building (Bldg #T-2053): 7.6×21.3 m (20×70 ft); floor space, 162.6 m² (1750 ft). Night lighting building (Bldg #S-2058): 4.3×9.1 m (14×30 ft); floor space, 39 m² (420 ft²); constructed of wood and concrete. Boiler house (Bldg #S-2060): 7.6×9.1 m (25×30 ft); floor space, 69.67 m² (750 ft²); asbestos protected metal siding with built-up roof. Fire station (Bldg #T-2061): three bats-6.1×17.1 m (20×56 ft), 9.8×14.9 m (32×49 ft) and 2.4×5.2 m (8×17 ft); constructed of wood and concrete.	Fuel: JP4 stored in two 18,925 liter (5000 gal) trucks. Dispensing facilities consist of one, 9084 liter (2400 gal) tanker and six 18,925 liter (5000 gal) tankers.	Navigation and communication facilities: control tower, Flight service station Watertown (direct line contact), instrument landing system (VOR and TACAN), nondirectional radio beacon and scheduled weather broadcasts. Lighting facilities: rotating beacon, runway lights to include flashing white, green and white, split beacon and other types; operate on prior request only.

*Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT, TDT. Runway weight bearing capacity given is for unlimited operations. Aircraft weight higher than given requires prior permission from aerodrome controlling authority.

S - Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F-100).
T - Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).
ST - Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT - Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135).
TDT - Runway weight bearing capacity for aircraft with twin-delta tandem landing gear (C-5).

For futher information, see DOD Flight Information Publication (enroute IFR-Supplement United States).

4. PIPELINES

MAP NUMBER	GRID REFERENCE FROM-TO	STATUS	OWNERSHIP	PIPELINE CHARACTERISTICS	TANK CROSSING SITES
1	517934-517925	Operative; supplies water to Antwerp from three springs on the reservation.	Town of Antwerp	Two threaded, black iron water pipes, 10.2 cm (4 in) in diameter, are approximately 1.6 km (1 mi) long. Pipes are buried below frost line.	None
2	436847-448817	Operative; supplies water to Philadelphia from a reservoir on the reservation.	Town of Philadelphia	Cast iron water pipe, 25.4 cm (10 in) in diameter, are approximately 3.2 km (2 mi) long. Pipe is buried below frost line.	None

5. HELICOPTER LANDING ZONES

MAP NUMBER AND/OR NAME	GRID REFERENCE	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	RESTRAINTS
1 (Serves Post Headquarters)	384747	14×14 m (45×45 ft)	No data	192 m (630 ft)	Concrete	Buildings, powerlines, towers, etc., in cantonment area.
2 (Serves Health Clinic)	408758	Dimensions not available	No data	195 m (640 ft)	Pierced steel planking	Buildings, powerlines, towers, etc., in cantonment area.
3 Division Hill	401759	Dimensions not available	No data	195 m (640 ft)	Concrete	Buildings, powerlines, towers, etc., in cantonment area.
4 Le Ray	396778	Dimensions not available	No data	174 m (570 ft)	Grass	Nearby tall trees surround site.
5	365767	24×457 m (80×1500 ft)	140°-320°	174 m (570 ft)	Grass	Tall trees to north of site.
6	512746	16×305 m (54×1000 ft)	163°-343°	218 m (720 ft)	Sand	Nearby tall trees surround site.
7	503851	15×457 m (50×1500 ft)	75°-255°	192 m (630 ft)	Grass	Tall trees to north and southeast.
8	442840	24×244 m (80×800 ft)	108°-288°	162 m (530 ft)	Grass	None.
9	476876	32×762 m (75×2500 ft)	105°-285°	174 m (570 ft)	Grass	None.
10	509921	18×305 m (60×1000 ft)	100°-280°	168 m (550 ft)	Grass	Isolated, tall tree just south of landing site.
11	575805	18×305 m (60×1000 ft)	10°-190°	240 m (790 ft)	Grass	Tall trees nearby to north and east; small grove adjacent to southern end of site and isolated trees to west.
12	538804	18×457 m (59×1500 ft)	170°-350°	210 m (690 ft)	Sand	Adjacent low trees, except to southwest.
13	549986	12×518 m (40×1700 ft)	45°-225°	157 m (515 ft)	Grass	Tall trees to northwest, open on west, low trees elsewhere.
14	638948	18×457 m (59×1500 ft)	45°-225°	204 m (670 ft)	Gravel	Nearby low trees surround site.

FORT DRUM, NEW YORK

TERRAIN ANALYSIS

LINES OF COMMUNICATION

ROADS

- Hard surface, divided, 4 lanes
- Hard surface, 2 or 3 lanes
- Hard surface, 1 lane
- Improved dirt
- Unimproved dirt
- Tank trail
- Tank crossing

BRIDGE DATA
(Measurements in meters)

- A Bridge number
- B Vertical clearance
- C Length
- D Roadway width
- E/F Military load classification, one-way for wheeled (W) and tracked (T) vehicles
- ∞ Unlimited vertical clearance

RAILROADS

- L1 Single track, standard gage
- S5 Siding
- Y2 Wye
- C1 Crossover

RAILROAD BRIDGE DATA
(Measurements in meters)

- A Bridge number
- B Vertical clearance
- C Horizontal clearance
- D Length
- ∞ Unlimited vertical clearance

AIRFIELDS

- 1 Airfield

PIPELINES

- 2 Pipeline

HELICOPTER LANDING ZONES

- H 12 Landing zone

Number on map symbol refers to entry in text.

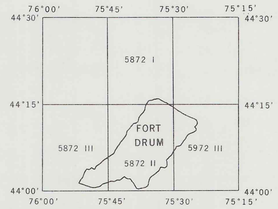
Scale 1:50,000

1000 500 0 1000 2000 3000 4000 5000 Meters

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 FEET

FORT DRUM MILITARY RESERVATION



SERIES V721

1:50,000 SHEET INDEX

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

K. URBAN AREAS (CANTONMENT AREA)

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
Permanent	1	99	Excellent	A new building, no. 30.
Temporary	285	12,290	Poor	Some of these buildings, all constructed in 1941, have been renovated to varying extents, but practically all of them should be considered inadequate. A new 300-man barracks, as well as a 600-man mess hall, are planned for completion in FY 78. Demolition of at least an equivalent capacity of temporary barracks will be accomplished simultaneously.

QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY AND CURRENT OCCUPANCY	CONDITION	REMARKS
Officer Family Quarters	23	23 Families	Excellent	The officer and enlisted family housing area of 88 units in the western part of post is a new one; 2 other houses, are in the southeast and 1 in the north.
Enlisted Family Quarters	68	68 Families	Excellent	
Bachelor Officer Quarters	46	1250 Persons	Fair	Old buildings, not adequate by current standards.
Bachelor Enlisted Quarters	2	46 Persons	Fair	Old buildings, used by E-7, E-8 and E-9 ranks, not adequate by current standards.
Guest House	1	64 Persons	Fair	Building no. 2340.
VIP Temporary Quarters	1	4 Persons	Good	Building no. 4702.

UTILITIES

	CAPACITY AND CURRENT LOAD	REMARKS
Electric Power: Fort Drum substation is served from the Niagara Mohawk Power Corporation, by 22,000 volt transmission feeders in two circuits. The transformer bank consists of 3 transformers at 3,000 KVA each for a total of 9,000 KVA. Voltage is here reduced from 22,000 to 4,800 delta. Five circuits of 4,800 each feed from the substation towards parts of the post. Only one of these circuits, which serves the permanent base facilities, is used to capacity. Maximum usage (measured over 15-minute intervals) has not exceeded 3,600 KW up to the present time.	The presence of two transmission circuits permits greater flexibility in emergency conditions. Usage of electric power is directly related to heating degree days and to the camp population. The former is highest in winter, the latter in summer. Maximum usage in the recent past has occurred in winter. The wooden power line poles, installed in 1940, are requiring replacement, and 25% of them have been replaced at the end of 1976. New barracks and health clinic construction by 1980 will require modifications to beef up or supplement the one circuit which is already utilized at a near-capacity level.
Water Supply: Water is supplied by 12 wells on the post. Pumping capacity is 4.0 million gallons per day (mgd). There are two elevated steel water tanks, each with 500,000 gallons capacity, and a ground level emergency storage reservoir with 750,000 gallons capacity. Current normal use is about 300 gallons per person per day (with permanent camp population of 600) in winter, and 90 gallons per person per day (with training population of as many as 16,000) in summer. A normal 24-hour use is 1.3 mgd, well below the pumping capacity. 63 miles of 4 in. to 16 in. cast-iron, concrete asbestos, and steel water lines are on the post, with a pressure of 66 lb. per square inch.	The pumping capacity has been exceeded only on rare occasions in summer when the National Guard troops in training wash all 8,000 of their vehicles at the same time. All 12 wells feed water through a central metering point where it is chlorinated and fluoridated. 9 wells can be controlled through a single control station point, while the remaining three are manually controlled. There are no major problem areas. A new vehicle wash rack facility to be completed by July 1978 should reduce water usage by the National Guard.
Communications: The official system consists of an automatic (XY) dial exchange with 1200 lines. There are 10 AUTOVON trunks to Tulley, NY; 17 city (FX) trunks to Watertown, NY; and, 2 trunks to Carthage, NY. Estimated usage is 78% of capacity except during summer training, when it is 100% of capacity. The family housing area is separately served by the New York Telephone Company.	There are 35 miles of cable in the cantonment area, and 100 miles of cable throughout the training area, ranging from 6-pair to 100-pair cable. There is an AUTODIN terminal, but no MARS facility. A recent communication traffic study of Ft. Drum has recommended additional AUTOVON lines, 9 additional FX trunks to Watertown, and two more FX trunks to Carthage. Requests for additional lines have not been approved in past years, but are again being made on the basis of this study.

	CAPACITY AND CURRENT LOAD	REMARKS
Heating Fuels: The family housing area and the new barracks are electrically heated. Including these, a total of 1400 buildings are equipped for space heating and water heating. The number of these buildings being used at any given time depends upon the number of National Guard or other troops in training, and this number fluctuates widely both at different times of the year and from year to year, in an essentially unpredictable fashion, the only limiting factor being that the post cannot accommodate more than 16,000 men at one time. Propane gas, oil, and coal are all used for both space and water heating, in many cases with two different fuels in use in the same building. Although the Directorate of Facilities Engineering has updated inventory data on the fuel(s) currently used in each of the 1400 buildings, they do not believe it to be possible to make even gross estimates as to the percentage of use of each type of fuel, nor of the total usages.	The present situation is a fluid and ambiguous one with respect to official guidelines pertaining to maximizing or minimizing the use of one or another of the various types of fuel. Many of the coal-fired heating plants are 36 years old, and are developing serious deficiencies (holes resulting from sulphurous or other caustic residues).
Sewerage: There is a primary treatment plant with a capacity of 4.5 million gallons per day (mgd), effluent from which is processed through a secondary plant with a capacity of 1.1 mgd. The current load is usually well under the capacity, although on special occasions and when the post is filled to its capacity of 16,000 personnel, the secondary plant capacity may be exceeded for short periods.	Since it is 120-day flow, rather than day-by-day usage, which is considered in respect to meeting EPA regulations, the present treatment plants have adequate capacity. Contact stabilization is utilized on those occasions when daily use exceeds 1.1 mgd, and this process meets current standards. The Fort Drum treatment plants have been inspected in order to obtain NPDES (National Pollutant Discharge Elimination System) permits. A separate permit is also required in order to operate wash racks, but this effluent does not pass through the sewage treatment plants. In order to meet the 1977 EPA standards, some modifications will need to be made in the sewage treatment plants.

SCHOOLS AND MEDICAL FACILITIES

TYPE	CAPACITY	REMARKS
Schools	No schools on post.	In 1976-77, a total of 106 children were bused to Carthage, N. Y. from the family housing area.
Medical Facilities	Strictly speaking, there is no hospital. Temporary building 2407 is a health clinic, with no beds for in-patient care. X-ray and other emergency care facilities exist. There is a dental clinic with 10 chairs. Total medical personnel authorized: 22 (including one physician, one dentist, and one pharmacist).	Building T-2407 is single story, constructed in 1942. Patients requiring hospitalization are taken to one of the two hospitals (a 400-bed and a 260-bed) in Watertown. During summer training, when up to 16,000 National Guard personnel may be in training, one or more medical companies augment the permanent base medical staff. At this time, two buildings (T-2425 and T-2426) may be utilized as holding-type wards with a limited bed capacity. Construction is expected to begin in summer 1977 on a new health clinic with two 10-bed wards, plus two bedrooms for isolation cases.

RECREATION FACILITIES

TYPE	NUMBER	REMARKS
Softball Fields	14	All unlighted
Little League Field	1	Unlighted
Volleyball Courts	48	
Tennis Courts	6	Enclosed, unlighted
Golf Driving Range	12 stands	Lighted, about 400 yds. length
Bowling Alley	4 lanes	Located in post gymnasium
Remington Pond: swimming beach and picnic area		
		12 basketball courts are projected by 1978.
		There is a lack of recreation facilities such as softball fields and tennis courts adjacent to the new family housing area.

URBAN AREAS (CANTONMENT AREA)

APPROXIMATE SCALE 1:11,500

200 0 200 400 600 800 1000 Meters

1000 0 1000 2000 3000 4000 Feet

AREA FEATURES

- Family Housing, Officers
- Family Housing, NCO
- Barracks
- Bachelor Officer Quarters
- Guest Houses, Temporary Quarters
- Parade Ground
- Recreation Facilities

SITE FEATURES

1. Post Headquarters
2. Officers Open Mess
3. Post Exchange
4. Commissary
5. Post Dispensary
6. Health Clinic
7. Post Office
8. Chapel
9. Directorate of Facilities Engineering
10. Telephone Exchange
11. Sewage Treatment Plant
12. Electric Power Substation
13. Standby Generator Plant
14. Reservoir Pump House
15. Potential Hazard to Aerial Navigation

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

L. NON-URBAN CULTURE FEATURES

On the Fort Drum Reservation, there are over 200 manmade features outside the cantonment area, which could either positively or negatively affect military training or operations. Most of these features, depicted on the accompanying map and described below, consist of various types of buildings, revetments, and towers which are associated with the various ranges on the reservation. The manmade features included are those that existed as of November 1976.

MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	623913	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
2	621935	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
3	636950	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
4	635940	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
5	642950	Landing Strip; abandoned, length 237 m (780 ft), width 14 m (46 ft), dirt surface, used as a helicopter landing zone
6	632948	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
7	643949	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
8	642952	Sentry Station; 5.57 sq m (60 sq ft)
9	594990	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
10	574794	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
11	575803	Landing Strip; abandoned, length 285 m (934 ft), width 34 m (110 ft), grass surface, used as a helicopter landing zone
12	576816	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
13	586821	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
14	586823	Range House; single story, 96.15 sq m (1035 sq ft), wood construction
15	588827	Revetment; protects moving target track on Range 25-14, length 640 m (2100 ft)
16	589829	Revetment; on Range 25-14, length 823 m (2700 ft)
17	588833	Revetment; protects moving target track on Range 25-14, length 1189 m (3900 ft)
18	589835	Revetment; on Range 25-14, length 457 m (1500 ft)
19	583835	Cemetery
20	566957	Cemetery
21	563965	Observation Post; single story, 7.52 sq m (81 sq ft), concrete construction
22	566967	Observation Post; single story, 7.52 sq m (81 sq ft), concrete construction
23	577978	Range House; single story, 33.44 sq m (360 sq ft), wood construction
24	578977	Range House; single story, 33.44 sq m (360 sq ft), wood construction
25	578984	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
26	572994	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
27	578815	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
28	577817	Observation Tower
29	576820	Target Shed; 29.72 sq m (320 sq ft)
30	578821	Observation Tower
31	588820	Latrine Building
32	587824	Range Tower
33	563980	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
34	560984	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
35	591991	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
36	575979	Range tower
37	578979	Range Tower
38	583983	Range Tower
39	586828	Target House; 37.16 sq m (400 sq ft)
40	563979	Two Silos
41	538768	Cemetery
42	553783	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
43	538803	Airstrip; abandoned, two runways, east-west runway: 457 m (1500 ft) long, 18 m (59 ft) wide; north-south runway: 268.2 m (880 ft) long, 15.2 m (50 ft) wide; grass surface, used as a helicopter landing zone
44	541792	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
45	556804	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
46	531809	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
47	533813	Range House; single story, 34.55 sq m (372 sq ft), wood construction
48	559817	Revetment; on Range 23-14, length 392.2 m (1287 ft), width 11.7 m (38 ft)
49	540854	Cemetery; Woods Mill
50	533871	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
51	531876	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
52	531947	Moving Target; on narrow gage track
53	553964	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
54	549987	Airstrip; abandoned, length 518 m (1700 ft), width 12 m (40 ft), grass surface, used as a helicopter landing zone
55	557976	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
56	538798	Range Tower
57	537799	Range House; 37.16 sq m (400 sq ft)
58	535798	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
59	556803	Range House; 37.16 sq m (400 sq ft)
60	556806	Range Tower
61	534813	Target Storage; 34.37 sq m (370 sq ft)
62	555953	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
63	556804	Target House; 55.74 sq m (600 sq ft)
64	536800	Target House; 57.04 sq m (614 sq ft)
65	536800	Range Tower
66	530875	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
67	511744	Airstrip; abandoned, length 305 m (1000 ft), width 16 m (54 ft), dirt surface, used as a helicopter landing zone
68	521756	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
69	515757	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
70	517768	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
71	513783	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
72	506789	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
73	513785	Cemetery
74	503815	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
75	518815	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
76	524824	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
77	514833	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
78	529832	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
79	528835	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
80	500849	Landing Strip; abandoned, length 457 m (1500 ft), width 15.2 m (50 ft), grass surface, used as a helicopter landing zone
81	523839	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
82	526843	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
83	505854	Range House; single story, 59.45 sq m (640 sq ft), wood construction
84	505855	Cable House; single story, 3.34 sq m (36 sq ft), concrete construction
85	507855	Target Structure; single story, 139.35 sq m (1500 sq ft), wood construction
86	508855	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
87	505854	Range House; single story, 185.8 sq m (2000 sq ft), block construction
88	523860	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
89	530875	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
90	529876	Observation Post; single story, 8.36 sq m (90 sq ft), concrete construction
91	512889	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
92	513907	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
93	513911	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
94	518924	Latrine Building; single story, 12.07 sq m (130 sq ft), block construction
95	522752	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
96	509788	Range Tower
97	526815	Range House; 37.16 sq m (400 sq ft)
98	526814	Range House; 37.16 sq m (400 sq ft)
99	526818	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
100	527815	Control Tower
101	529834	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
102	529834	Range Tower
103	527840	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
104	502853	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
105	505875	Range Tower
106	517889	Range House; 37.16 sq m (400 sq ft)
107	511899	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
108	512894	Range Tower
109	513891	Range Tower
110	511903	Latrine Building
111	513905	Range Tower
112	515909	Range Tower
113	517923	Range Tower
114	529929	Control Tower
115	522932	Range House; 37.16 sq m (400 sq ft)
116	524933	Latrine Building
117	500876	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
118	523823	Cable House; 3.34 sq m (36 sq ft)
119	546783	Cable House; 3.34 sq m (36 sq ft)
120	505818	Control Tower
121	504875	Latrine Building
122	511894	Target Shed; 55.74 sq m (600 sq ft)
123	488763	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
124	485782	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
125	475783	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
126	475830	Cable House; single story, 9.29 sq m (100 sq ft), concrete construction
127	484900	Revetment; length 653.7 m (2145 ft), width 7 m (23 ft)
128	476886	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
129	487913	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
130	474784	Control Tower
131	476824	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
132	474828	Range Tower
133	475834	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
134	499848	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
135	473782	Cable House; 3.34 sq m (36 sq ft)
136	477815	Cemetery
137	470770	Ammunition Storage Site: ten magazines (igloo), each 74.9 sq m (807 sq ft); sixteen general purpose magazines, one 217.3 sq m (2340 sq ft), twelve 144.9 sq m (1560 sq ft) and three 96.6 sq m (1040 sq ft); sentry station, 12.6 sq m (136 sq ft); fork lift garage, 35.6 sq m (384 sq ft); two inert storehouses, one 89.1 sq m (960 sq ft) and the other 111.4 sq m (1200 sq ft); small arms building, 225.7 sq m (2430 sq ft); general storehouse, 111.4 sq m (1200 sq ft); and, a fence surrounding area, 3 m (12 ft) high, 2164 m (7100 ft) long
138	470768	Flammable Material Storage Building; single story, 27.8 sq m (300 sq ft), steel construction
139	467769	Ammo Inspection Shed; single story, 141.2 sq m (1520 sq ft), construction unknown
140	463773	Ammo Administration Building; single story, 34.1 sq m (368 sq ft), wood construction
141	465772	General Storehouse; single story, 17.8 sq m (192 sq ft), wood construction
142	463772	General Storehouse; single story, 37.1 sq m (400 sq ft), wood construction
143	464772	Ammo Administration Building; single story, 95.5 sq m (1029 sq ft), wood construction
144	463767	Latrine Building; single story, 17.2 sq m (186 sq ft), wood construction
145	467773	Inert Storehouse; single story, 13.3 sq m (144 sq ft), block construction
146	467775	Sentry Station; single story, 12.0 sq m (130 sq ft)
147	466776	Sentry Station; single story, 21.8 sq m (235 sq ft)
148	449786	Range House; single story, 92.9 sq m (1000 sq ft), wood construction
149	441784	Target Structure; single story, 72.2 sq m (778 sq ft), wood construction
150	441788	Target Structure; single story, 72.2 sq m (778 sq ft), wood construction
151	442788	Target Structure; single story, 72.2 sq m (778 sq ft), wood construction
152	443788	Target Structure; single story, 72.2 sq m (778 sq ft), wood construction
153	444788	Range House; single story, 66.8 sq m (720 sq ft), wood construction
154	468794	Range House; single story, 11.1 sq m (120 sq ft), wood construction
155	464809	Target Structure; single story, 15.6 sq m (168 sq ft), wood construction
156	461810	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
157	457826	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
158	442821	Cemetery
159	447831	Cemetery
160	456849	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
161	467853	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
162	467868	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
163		10 Revetments; as follows
	441788	147 m (481 ft) long, 7 m (23 ft) wide
	441787	154 m (504 ft) long, 10 m (32 ft) wide
	443787	182 m (596 ft) long, 10 m (32 ft) wide
	443786	168 m (550 ft) long, 14 m (46 ft) wide
	443785	182 m (596 ft) long, 7 m (23 ft) wide
	445787	91 m (298 ft) long, 14 m (46 ft) wide
	445785	77 m (252 ft) long, 10 m (32 ft) wide
	445786	265 m (871 ft) long, 14 m (46 ft) wide
	444786	265 m (871 ft) long, 14 m (46 ft) wide
	442787	265 m (871 ft) long, 14 m (46 ft) wide
164	440776	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
165	448777	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
166	465790	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
167	454788	Latrine building; single story, 16.72 sq m (180 sq ft), wood construction
168	449785	Range Tower
169	441786	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
170	466797	Control Tower
171	469797	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
172	464814	Range Tower
173	466817	Range Tower
174	467817	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
175	461769	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
176	447778	Store House; 26.75 sq m (288 sq ft)
	447778	Store House; 26.75 sq m (288 sq ft)
177	466817	Target Shed; 57.04 sq m (614 sq ft)
178	435775	Range House; single story, 43.4 sq m (468 sq ft), wood construction
179	439776	Range House; single story, 41.8 sq m (450 sq ft), wood construction
180	437777	Range House; single story, 26 sq m (280 sq ft), wood construction

L. NON-URBAN CULTURE FEATURES (continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION
181	435789	Range House; single story, 34 sq m (365 sq ft), wood construction
182	428794	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
183	432801	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
184	437821	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
185	435811	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
186	432807	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
187	431798	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
188	421797	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
189	439775	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
190	438777	Range Tower
191	414775	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
192	421795	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
193	425798	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
194	439778	Training Course Structure
195	439780	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
196	433775	Sentry Station; 6.31 sq m (68 sq ft)
197	444785	Range Tower
198	428796	Loading Dock
199	426797	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
200	414820	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
201	416826	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
202	421831	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
203	404793	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
204	391783	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
205	383783	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
206	403807	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
207	398779	Cemetery
208	388773	Cemetery
209	378779	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
210	379775	Cemetery
211	363770	Airstrip; abandoned, 457 m (1500 ft) long, 24 m (80 ft) wide, grass surface, used as a helicopter landing zone
212	357743	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
213	365746	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
214	356761	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
215	355795	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
216	345774	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
217	338761	Latrine Building; single story, 16.72 sq m (180 sq ft), wood construction
218	348744	Navigation Aids Building; single story, 9.29 sq m (100 sq ft), block construction
219	346782	Cemetery
220	376797	Silo
221	360789	Silo
222	From 467795 To 464773	Electric Power Lines: 4800 V; pole mounted transformers located at 467795, 473782, 468777, 464773
	From 464773 To 473769	4800 V; pole mounted transformers located at 467773, 469773, 473769
	From 465773 To 464765	4800 V; pole mounted transformer located at 466770
	From 458882 To 503818	13.2 KV; pole mounted transformer located at 503818 - spacing between poles not able to be determined - all lines are aluminum cable steel reinforced - height (no data)
223	From 587814 To 546781	Underground Telephone Cables: 12 pairs of cables
	From 546781 To 486758	25 pairs of cables
	From 479770 To 473830	50 pairs of cables
	From 433778 To 473782	12 pairs of cables
	From 473782 To 433777	100 pairs of cables
	From 476829 To 506853	50 pairs of cables
	From 506855 To 529873	12 pairs of cables
	From 523865 To 538854	pairs unknown
	From 533807 To 547781	50 pairs of cables
224	From 486758 To 479770	Overhead Telephone Cables: 50 pairs of cables
	From 533806 To 623914	50 pairs of cables
	From 519832 To 533856	12 pairs of cables
	From 529875 To 533870	pairs unknown

FORT DRUM, NEW YORK
TERRAIN ANALYSIS

III OFF-POST FEATURES

A. URBAN AREAS

There are 7 urban areas with populations greater than 2500 within a radius of 50 miles from the cantonment area of Fort Drum. The largest urban area, Watertown, is about 14 kilometers (9 miles) southwest of the post; it had an estimated 1975 population of 32,280. The other 6 urban areas range in size from 2955 to 14,553 (estimated in 1975). Within this 50-mile radius, there are no airfields that can accept a C-130A or larger troop transport other than the Wheeler-Sack Army Airfield (see Lines of Communications) at Fort Drum.

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATIONAL FACILITIES	MEDICAL FACILITIES	RECREATIONAL FACILITIES	PUBLIC UTILITIES
Camden,NY 43°21'N; 75°46'W	2936 (1970) 2966 (est. 1975) 3300 (est. 1980)	Number of houses, 800. Number of rental houses, 400; average monthly rent, $225; average percent vacant, 1%. Number of new houses started, 2; average sale price, $20,000. Average number of house sales per year, 20. Number of apartments, 25; average monthly rent, $125; Average percent vacant, 1%. (1976 data)	1 Elementary school: enrollment capacity, 600; 1975 enrollment, 600; 1980 projected enrollment, 550. 1 Junior High school: enrollment capacity, 850; 1975 enrollment, 850; 1980 projected enrollment, 850. 1 High school: enrollment capacity, 950; 1975 enrollment, 950; 1980 projected enrollment, 950. (1976 data)	2 doctors and 2 dentists (1976 data)	2 Parks 3 Athletic fields 2 Tennis courts (1976 data)	Water supply: spring-fed wells; consumption average, 640,000 gpd; 4,000,000 gallon reservoir for extra storage. Sewerage: 1 plant with secondary-extended aeration; flow capacity of 1,000,000 gpd with actual flow of 520,000 gpd. Electric power: source, Niagra Mohawk Power Corporation. Heating fuels: oil, propane gas, coal, wood and electric available. (1976 data)
Canton, NY 44°36'N; 75°10'W	6398 (1970) 8300 (est. 1975) 8500 (est. 1980)	Number of houses, 1320. Number of rental houses, 300; average monthly rent, $225; average percent vacant, 0%. Number of new houses started, 15. Number of house sales, 53; average sales price, $29,500. Number of apartments, 239; average monthly rent, $250; average percent vacant, 0%. (1976 data)	1 Elementary school: enrollment capacity, 1500; 1975 enrollment, 1200; 1980 projected enrollment,1200. 1 Junior High school: enrollment capacity, 1500; 1975 enrollment, 800; 1980 projected enrollment, 800. 1 High school: enrollment capacity, 9000; 1975 enrollment, 4200; 1980 projected enrollment, 5000. (1976 data)	8 doctors and 3 dentists (1976 data)	1 Park 3 Athletic fields 20 Tennis courts 1 Golf course (1976 data)	Water supply: source, Grasse River. Source is adequate. Sewerage: 1 activated sludge treatment plant with flow capacity of 2,000,000 gpd and actual flow of 1,000,000 gpd. Electric Power: source, Niagra Mohawk Corporation. Heating Fuels: oil, natural gas, and electric are available. (1976 data)
Carthage, NY 43°59'N; 75°37'W	3889 (1970) 4000 (est. 1975) 4500 (est. 1980)	Number of houses, 1065. Number of rental houses, 350; average monthly rent,$125; average percent vacant, 5%. Number of new houses started, 10; average sales price, $12,000 to $17,000. Number of apartments, 275; average monthly rent, $140; average percent vacant, 4%. (1976 data)	6 Elementary schools: enrollment capacity, 1650; 1975 enrollment, 1639; 1980, projected enrollment, 1575. 1 Junior High school: enrollment capacity, 900; 1975 enrollment, 844; 1980 projected enrollment, 825. 1 High school: enrollment capacity, 1250; 1975 enrollment, 1156; 1980 projected enrollment, 1100. (1976 data)	12 doctors and 6 dentists 1 hospital, 78 beds with a coronary and intensive care unit planned. (1976 data)	1 Park 1 Athletic field 6 Tennis courts (1976 data)	Water Supply: source, spring; supply greater than village demands. Sewerage: 1 secondary-type treatment plant with flow capacity of 3,500,000 gpd and actual flow of 2,500,000 gpd. Electric Power: source, Niagra Mohawk Power Corporation. Heating Fuels: oil, gas and electric, available from independent dealers in area. (1976 data)
Gouverneur, NY 44°20'N; 75°29'W	4574 (1970)	Number of houses, 1568. Number of rental houses, 475; median rent asked, $66. Number of houses for sale, 13; median sale price asked, $11,300. Vacant year round, 65. (1970 data)	5 Elementary schools: enrollment capacity, 1600; 1975 enrollment, 1292; 1980 projected enrollment, 1264. 1 Junior High/High school: enrollment capacity, 1400; 1975 enrollment, 1350; 1980 projected enrollment, 1245. (1976 data)	8 doctors and 5 dentists 1 hospital with 63 beds, includes intensive care and coronary care unit with 3 beds. Also attached to the hospital are 40 nursing homes. (1976 data)	1 Park 3 Athletic fields 1 Tennis court 2 Golf courses (1976 data)	Water Supply: municipal water system capable of supplying approximately 800,000 gpd. Electric Power: source, Niagra Mohawk Power Corporation. Heating Fuels: coal, wood, and oil available from 4 or 5 local distributors. (1976 data)
Lowville, NY 43°47'N; 75°30'W	3671 (1970) 3800 (est. 1975) 3900 (est. 1980)	Number of houses, 1400. (1976 data) Number of rental houses, 409; median rent asked, $62. Average number of sales, 11; median sales price asked, $11,300. Vacant year round, 31. (1970 data)	4 Elementary schools: enrollment capacity, 1344; 1975 enrollment, 1036; 1980 projected enrollment, 945. 1 High school: enrollment capacity, 1000; 1975 enrollment, 1010; 1980 projected enrollment, 900. (1976 data)	No Data	2 Parks 2 Athletic fields 4 Tennis courts (1976 data)	Water Supply: source, springs and surface water; 90% adequate. Sewerage: aeration system (lagoon) with flow capacity of 3,000,000 gpd and actual flow of 1,200,000 gpd. Electric Power: source, Niagra Mohawk Power Corporation. (1976 data)
Ogdenburg, NY 44°42'N; 75°29'W	14,554 (1970) 14,554± (est. 1975) 14,554± (est. 1980)	Number of houses, 4036. Number of rental houses, 71; average monthly rent, $165; average percent vacant, 25%. Number of new houses, 28. Number of house sales, 168; average sale price, $13,324. Number of apartments, 204; average monthly rent, $130; average percent vacant, 56%. (1976 data)	5 Elementary schools: enrollment capacity, 1800; 1975 enrollment, 1455; 1980 projected enrollment, 1214. 1 Junior High school: enrollment capacity, 1000; 1975 enrollment, 878; 1980 projected enrollment, 627. 1 High school: enrollment capacity, 1000; 1975 enrollment, 771; 1980 projected enrollment, 680. (1976 data)	25 doctors and 4 dentists 1 hospital with 174 beds; an intensive care unit and a coronary care unit each with 6 beds. (1976 data)	11 Parks 7 Athletic fields 4 tennis courts (1976 data)	Water Supply: source, St. Lawrence River. Adequacy of source is excellent. Sewerage: 1 chemical type treatment plant with a flow capacity of 6,500,000 gpd and an actual flow of 3,500,000 gpd. Electric Power: source, Niagra Mohawk Power Corporation. Heating Fuels: #2, #4, #6 oil and kerosene. (1976 data)
Watertown, NY 43°58'N; 75°55'W	30,787 (1970) 32,280 (est. 1975) 31,000 (est. 1980)	Number of houses, 10,570. Number of rental houses and apartments, 4700; average rent for homes, $250; average rent for apartments, $127 to $138; average percent vacant, 3%. Number of new homes started, 3; average sale price, $31,000 to $35,000. (1976 data)	13 Elementary schools, 9 public and 4 Catholic (grades 1-8): enrollment capacity, 4182 (public) and 1600 (Catholic); 1975 enrollment, 2909 (public) and 1318 (Catholic); 1980 projected enrollment, 2389 (public). 2 Junior High schools: enrollment capacity, 1680, 1975 enrollment, 1460; 1980 projected enrollment, 1053. 2 High schools, 1 public and 1 Catholic (grades 9-12): enrollment capacity, 1480 (public) and 600 (Catholic); 1975 enrollment, 1419 (public) and 542 (Catholic); 1980 projected enrollment, 1161 (public). (1976 data)	84 doctors and 27 dentists 2 hospitals, 400 and 258 beds;an intensive care unit and a coronary care unit at each hospital. (1976 data)	1 Park 16 Athletic fields 17 Tennis courts 2 Golf courses (1976 data)	Water Supply: source, Black River; 100% adequate. Sewerage: primary sedimentation treatment plant with a flow capacity of 8,000,000 gpd; actual flow of 9,160,000 gpd. Electric Power: source, municipal power plant of the Niagra Mohawk Power Corporation. Heating Fuels: gas, oil, and electric available. (1976 data)

B. PORTS

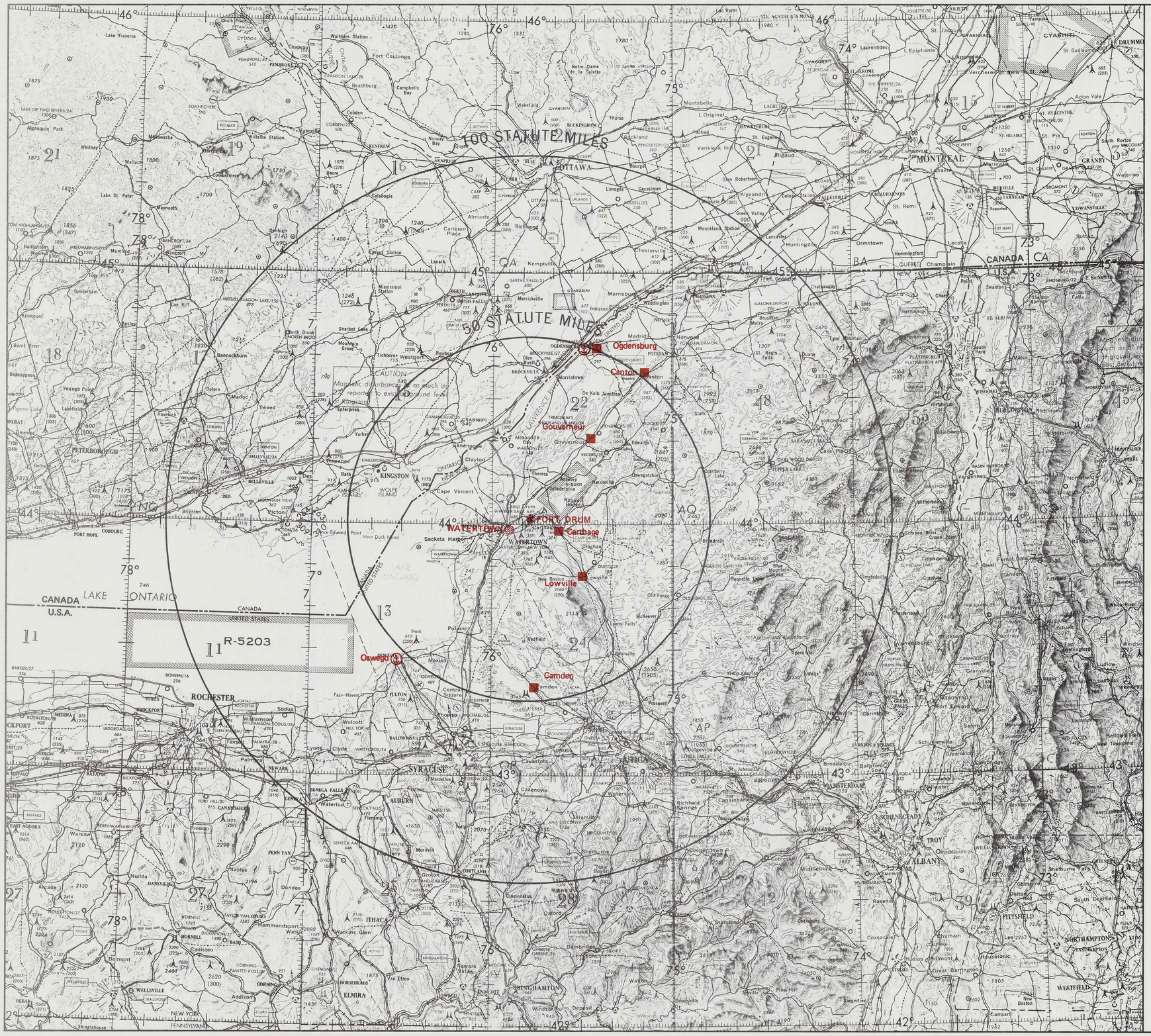
Two commercial ports that can support ocean-going vessels are within a 100-mile radius of the cantonment area. One, Odensburg, about 80 kilometers (50 miles) to the north, is on the St. Lawrence River and is operated by the Ogdensburg Bridge and Port Authority, Ogdensburg, NY 13669. The other, Oswego, about 97 kilometers (60 miles) to the southwest, is on the eastern end of Lake Ontario; it is operated by the Port of Oswego Authority, Oswego, NY 13126. Both ports are served by highways and railroads. Navigation ceases during the winter period.

NAME AND LOCATION	TYPE AND GENERAL CONDITION	FACTORS LIMITING LARGEST VESSEL	HYDROLOGIC AND UNUSUAL GEOPHYSICAL CONDITIONS	PIERS AND WHARVES	MECHANICAL HANDLING FACILITIES	STORAGE FACILITIES	PORT CLEARANCE FACILITIES	REMARKS
Ogdensburg, NY 44°42'N; 75°29'W	Improved dredged harbor 2.69 Km (1.67 mi) in length fronting Ogdensburg on the St. Lawrence and Oswegatchie Rivers. Cargo handled: 194,997 MT (214,944 ST) in 1974.	Upper west entrance channel has a minimum depth of 5.78 m (19 ft) and is 212.8 m (700 ft) wide. Lower east entrance channel has a minimum depth of 5.78 m (19 ft) and is 76 m (250 ft) wide. Minimum depth in a basin along the lower wharf frontage is 6.08 m (20 ft). Width of entrance to basin is 1064 m (3500 ft). City front channel depth is 5.78 m (19 ft) and 106.4 m (350 ft). Minimum berth depth is 6.08 m (20 ft) and maximum length of berthing is 608 m (2000 ft).	The season of navigation is approximately 1 April to 18-20 December. No tide.	Port terminal facility on side of lower east entrance channel-- 182.4 m (600 ft) berth; 8.21 m (27 ft) deep alongside. Deck height of 2.13 m (7 ft). Wharf constructed of pilings capped with concrete (east side is tapered fill). Used for general cargo. Port terminal facility on lower basin-- 608 m (2000 ft) in length (3 berths); 6.08 m (20 ft) to 6.38 m (21 ft) deep alongside. Deck height of 3.04 m (10 ft). Wharf constructed of wood pilings capped with earth (black-topped area of about .404 hectares, 1 acre, next to a warehouse foundation on the dock). Bulk and stockpile berthing area.	Mobile truck crane of 22.68 MT (25 ST). Cranes to 181.44 MT (200 ST) capacity locally available for leasing. Forklift of 10,192.5 Kg (22,500 lb) capacity. 544A Deere Payloader of 2.74 m# (3 yd) capacity.	Transit shed of 2944 m^2 (32,000 ft^2). Open storage of 3.23 hectares (8 acres) at marine terminal; and 6.06 hectares (15 acres) at bulk-stockpile area. No refrigerated storage. No petroleum products storage (however there is a dual pipeline at the south end of the main berth which goes to the George Hall Corporation's tank farm).	OB and PA (Ogdensburg Bridge and Port Authority) Railroad goes to Norwood, NY where it connects with Conrail, Inc. State highways connect to nearby U. S. Route 11 which leads to Interstate 81 or 87.	

B. PORTS (continued)

NAME AND LOCATION	TYPE AND GENERAL CONDITION	FACTORS LIMITING LARGEST VESSEL	HYDROLOGIC AND UNUSUAL GEOPHYSICAL CONDITIONS	PIERS AND WHARVES	STORAGE FACILITIES	MECHANICAL HANDLING FACILITIES	PORT CLEARANCE FACILITIES	REMARKS
Oswego, NY 43°28'N; 76°31'W	Improved dredged harbor on Lake Ontario comprised of an outer breakwater harbor of refuge, and an inner terminal harbor in the mouth of the Oswego River. Cargo handled: 818,606 MT (902,-343 ST) in 1974.	The approach from deep water is 8.21 m (27 ft) deep and 167.2 m (550 ft) wide between breakwaters at the entrance to the outer harbor. Depth of shipping channel through the outer harbor is 7.6 m (25 ft) deep and 243.2 m (800 ft) wide. In alongside berths, minimum depth is 6.08 m (20 ft); maximum length is 516.8 m (1700 ft); and minimum clearance is 15.2 m (50 ft).	The season of navigation is approximately from the middle of April to the end of November. No tide.	East side terminal wharf outer section is 364.8 m (1200 ft) long with a 7.3 m (24 ft) depth; inner section is 182.4 m (600 ft) long with a 6.38 m (21 ft) depth. Minimum width is 121.6 m (400 ft) for the channel. There are 3 berths. Deck height is 2.43 m (8 ft). Wharf construction is cellular; 12.16 m (40 ft) diameter cells, rock filled, placed next to each other and capped with concrete. Used for general and some bulk cargo. The west side terminal wharf is 304 m (1000 ft) long by 45.6 m (150 ft) wide. The channel on the easterly side is 6.38 m (21 ft) deep and 21.28 m (70 ft) wide. The channel on the westerly side is 6.08 m (20 ft) deep and 24.32 m (80 ft) wide. Wharf constructed of pilings capped with concrete. Deck height is 2.43 m (8 ft). There are 4 berths (two on each side). Used for off loading of petroleum products. The former Erie-Lackawana RR coal dock is now owned by the Oswego Authority. It is 243.2 m (800 ft) long by 36.48 m (120 ft) wide. It has an available depth on its east side of 5.47 m (18 ft) for a length of about 212.8 m (700 ft) and an 18.24 m (60 ft) to 21.28 m (70 ft) channel width. Wharf constructed of sheet steel pilings on one side with earthen top. It is presently not being used by the Oswego Port Authority and is being temporarily leased to a contractor.	Drott cranes (hydraulic) of 27.22 MT (30 ST) capacity immediately available for lease within 48.27 Km (30 miles) of port. Payloaders up to 3.2 m (3.5 yds). Forklifts up to 18,120 Kg (40,000 lbs).	Main transit shed of 9200 m^2 (100,000 ft^2). Other buildings used for covered storage of 8372 m^2 (91,000 ft^2). Open storage of 6.06 hectares (15 acres). No refrigerated storage. No petroleum storage facilities under Authority control.	Conrail, Inc. Goods shipped by rail via Syracuse, NY. State highways connect to nearby Interstate 81 and 90.	Port expects to add a couple of special bulk warehouses (round, conical type made of wood--mainly to handle storage of caustics).

FORT DRUM, NEW YORK
TERRAIN ANALYSIS



OFF-POST FEATURES

- Urban Area
- Port
- Cantonment Area
- International Boundary

Scale: 1:1,000,000

20 0 20 40 60 Statute Miles

20 0 20 40 60 80 Kilometers

Prepared by the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Ft. Belvoir, Virginia. Cartographic and reproduction support provided by the 30th Engineer Battalion (Topographic) (Army). October 1977.

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