Appendices

Cortland Homer Preble Aquifer System

Support Document

Cortland and Onondaga Counties New York

June 1988

I. Introduction

A. Statement of Section 1424 (e)

The Safe Drinking Water Act (SDWA), Public Law 93-523, of December 16, 1974 contains a provision in Section 1424(e), which states that:

> If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

This section allows for the specific designation of areas which are dependent upon ground water supplies. Following designation, the review process will ensure that federal agencies will not commit funds toward projects which may contaminate these ground water supplies.

B. Receipt of Petition

On September 15, 1987 the Cortland County Legislature petitioned the U.S. Environmental Protection Agency (EPA) Administrator to declare the Cortland-Homer-Preble Aquifer System, as defined in the petition (Appendix A), a sole source aquifer (SSA) under the provisions of the SDWA.

C. Area of Consideration

The boundary of the area specified in the petition submitted by the Cortland County Legislature was defined as portions of five valleys that meet in the vicinity of the City of Cortland. The entire petitioned area is within Cortland County, New York. However, based on EPA's review of the hydrogeologic information, the final SSA designation area has been extended into Onondaga County. The Agency has amended the area for designation because the aquifer extends into Onondaga County. It has beenAgency policy to designate sole source aquifers based on hydrogeologic criteria rather than political boundaries whenever possible, because contamination of a portion of the aquifer can affect the down gradient portion of the aquifer.

D. Topography

The Cortland-Homer-Preble area is located within the Allegheny Plateaus Province of central New York State (Miller, 1982). Altitudes range from approximately 1,100 to 2,000 feet above sea level.

The entire area was affected by the Wisconsin Stage glaciation (Buller et.al., 1978), ending approximately ten-thousand years (10,000 yrs.) ago (Muller, 1965). The glaciers altered the existing topography and surface water drainage patterns. The resulting terrain consists of relatively flat, sedimentfilled valleys bounded by tillmantled bedrock hills that rise up to nine-hundred (900) feet above the valley floors (Buller et.al., 1978; Miller, 1982).

E. Climate

Precipitation in the Cortland-Homer-Preble area averages approximately forty inches (40") per year (Buller et.al., 1978), evenly distributed throughout the year (McFarlandJohnson Engineers, Inc., 1982). Winters are harsh, with an average temperature of approximately twenty-four degrees degrees Fahrenheit (McFarlandJohnson Engineers, Inc., 1982) and average snowfall of sixty inches (60") (Buller et.al., 1978). Temperatures in summer average approximately sixty-six degrees Fahrenheit (McFarland Johnson Engineers, Inc., 1982).

II. Hydrogeology

A. Geologic Framework

The bedrock of the Cortland-Homer-Preble area is predominantly shale, with minor siltstone and fine grained sandstone (Corner and Harsh, 1978; Miller, 1982). These rocks are part of the Genesee Group (Reynolds, 1985) and are Upper Devonian in age (Buller et.al., 1978). The beds are nearly flatlying, with a less than one degree to the southsouthwest (Bul..al.. 1978).

Depth to bedrock ranges from zero to five-hundred feet (0-500') below the land surface (Corner and Harsh, 1978; Miller, 1982). The bedrock is nearest the surface in the hills and deepest in the valleys. When exposed at the surface, the shale is weathered and jointed (Corner and Harsh, 1978). Joints and bedding planes provide the only storage areas for significant amounts of water in the bedrock. Because the size and number of joints decrease with depth (Corner and Harsh, 1978) and are open to depths less than one-hundred feet (100') below land surface (McFarlandJohnson Engineers, Inc., 1982), wells drilled into the bedrock are lowyielding (generally ten to fifty gallons per minute (Buller, 1978: McFarlandJohnson Engineers, Inc., 1985)).

B. Geologic Setting

The area was subjected to glaciation to glaciation during the Wisconsin Stage Pleistocene Epoch. Much of the bedrock is concealed under the glacial deposits. These deposits are thickest in the valleys.

Several types of deposits were left by the glaciers. Each is described below (descriptions from McFarlandJohnson Engineers, Inc., 1982):

Stratified Drift: The aquifers that can support public water supply wells are composed of stratified drift and outwash deposits. Stratified drift is the fairly wellsorted sand and gravel found along the valley walls. It was deposited by streams flowing between the glacier and the bedrock hills.
Outwash Deposits: Outwash is sand and gravel deposited by streams flowing from the face of the melting glacier. It is extensive in the Cortland-Homer-Preble area, filling the valleys with continuous deposits up to two-hundred feet (240') thick. Outwash deposits comprise the most productive aquifers in the area.
Till: The most widespread glacial deposit is till, an unsorted mixture of silt, clay, sand, gravel, and rock fragments. In Cortland County, the till is mainly silt and clay, and has low permeability. The till therefore enhances runoff from the upland areas and limits recharge to the bedrock. Till is exposed in the uplands portion of the area.
Moraine: Material pushed in front, or to the side of the advancing glacier forms a moraine. Moraines generally represent the furthest advance of a glacier. In the Cortland-Homer-Preble area, moraines are found at valley heads. They are comprised of the redeposited material left by previous glacialactivity, and consist of stratified sand and gravel interbedded with poorly sorted silt and clay. Because of low permeability, the moraines act as ground water divides.
Glacial Lake: Glacial lakes were formed in the valleys as the glacier retreated, because the existing drainage outlet had become closed by moraine deposition. Lake sediments, consisting of finegrained sand, silt and clay were deposited. These sediments, which range from ten to three-hundred feet (10-300') thick, have low permeability and act as a confining unit between aquifers.

C. Ground Water Hydrology

Ground water moves through inter-granular openings in the unconsolidated deposits and through cleavage planes, joints and fractures in the consolidated rocks of the area. As stated above, the yield from bedrock wells in the Cortland-HomerPreble area is low. However, the yield is sufficient for domestic supplies and upland wells are completed into bedrock (Buller, 1978).

The most productive aquifers in the area are the outwash sands and gravels found in the major stream valleys. In the HomerPreble valley, it is the surficial outwash aquifer that provides the majority of drinking water. Its saturated thickness averages fifty-five feet (55') (Buller et.al., 1978) and yields may exceed one-thousand gallons per minute (1,000 gpd) (Miller, 1982). The base of the aquifer is defined by a lacustrine clay layer at a depth of approximately sixty feet (60') below the land surface (Buller, 1978). There is a thin layer of sand between the clay and bedrock; its potential as a source of water is unknown (Miller, 1982).

In the southern portion of the area, there is a confined outwash aquifer as well as a surficial outwash aquifer. Both are present within the City of Cortland and the valleys of the East and Main Branches of the Tioughnioga River (Reynolds, 1987). Current well yields are as high as four-hundred gallons per minute (400 gpm) (McFarlandJohnson Engineers, Inc., 1985).

Southwest of the City of Cortland, the sands and gravel of the aquifer have been interpreted to represent kame terraces and icedisintegration deposits (Miller, 1982).

The water table in the Cortland-Homer-Preble area generally occurs at depths less than twenty-five feet (25') below the land surface in the major stream valleys (Buller, 1978; Buller et.al., 1978; Miller, 1982; McFarlandJohnson Engineers, Inc. 1985). In the upland areas, the water table may be as deep as one-hundred feet (100') below the land surface (McFarlandJohnson Engineers, Inc., 1985), although this is still well above the valley floors.

Although the relatively impermeable till limits infiltration, recharge to the upland ground water system is derived from precipitation (McFarland-Johnson Engineers, Inc, 1985). In the valleys, the surficial aquifer is recharged by infiltration of precipitation, infiltration from losing streams, and upland sources (Buller et.al., 1978), such as runoff and streams from the hills (McFarlandJohnson Engineers, Inc., 1985; Reynolds, 1987) and very minor recharge from the bedrock (Buller et.al., 1978; Miller, 1982. According to Reynolds (1987), the confined aquifer (where present) is recharged by the surficial aquifer wherever they are in hydraulic contact. This occurs through the stratified drift deposits along the valley walls, which connect the two aquifers, and wherever the confining lacustrine unit is absent.

In the upland areas, the ground water flow is toward and into the streams (Buller et.al., 1978; McFarlandJohnson Engineers, Inc., 1985). Upland streams are gaining (i.e., they act as ground water sinks) (McFarland-Johnson Engineers, Inc., 1985). Once they reach the valley floors, however, some of the water recharges the aquifer (Buller et.al., 1978).

In the major valleys, ground water flows toward the center from the valley walls (Buller et.al., 1978). There is also flow in the river's downstream direction (Buller et.al., , 1978; 1978; Corner and Harsh Inc., 1985; Reynolds, 1987). After the valleys meet near the City of Cortland, flow is southeast, following the Tioughnioga River valley out of the area (Buller et.al., 1978).

1. Recharge

The recharge area is delineated by the designated valleys and the upland area which drain into them. All precipitation within these boundaries has the possibility of recharging the aquifer system.

2. Discharge

Discharge from the aquifer system is by seepage into gaining reaches of streams, evapotranspiration, flow to pumping the area wells and flow out of the area (Buller et.al., 1978; McFarlandJohnson Engineers, Inc., 1985; Reynolds, 1987).

3. Streamflow Source Zone

The streamflow source zone is the upstream area of losing streams which flow into the recharge area. For the Cortland-Homer-Preble Aquifer System, this area is defined as the portion of the Tioughnioga River basin upstream of the southeastern end of the designated area (near Blodgett Mills), as shown on Figure 1. The project review area is coincident with the designated aquifer area, its recharge area, and streamflow source zone.

D. Ground Water Quality

Data provided by the Cortland County Health Department (CCDH) in the petition indicate that all of the ground water in the area contains less than three-hundred milligrams per liter (300 mg/l) total dissolved solids and ranges in temperature from three to nine degrees Centigrade. The pH ranges from slightly acidic to slightly alkaline water varies from moderately to very hard (6.5 to 8.0). The water varies from moderately to very hard (85 to 250 mg/l).

The overall quality of the ground water is good, although there has been contamination of several private wells in the southwestern portion of the area by organic solvents (up to (200 parts per billion). All public water supply wells meet or exceed the appropriate State and Federal drinking water standards.

E. Designated Areas

The area that has been designated as the Sole Source Aquifer is defined as the stratified drift and glacial outwash within the valleys. This area is coincident with that identified as a Primary Water Supply Aquifer by New York State Department of Health (1981) and New York State Department of Environmental Conservation (1987). The aquifer service area is the same as the aquifer area. Figure 1 shows the location and boundaries of the designated area.

F. Ground Water Use

Table 1 shows the population served and the amount of water withdrawn by public water suppliers within the Aquifer Service Area (ASA). Table 2 shows the estimated population within the ASA relying on private wells. Water use for the population using private wells is estimated based on one hundred gallons per day per person. All information was provided by the Cortland County Health Department.

Table 3 highlights the dependence of the SSA on the petitioned aquifer system. As shown, the area obtains 100% of its drinking water (5,599,813 gallons per day) from the Cortland-Homer-Preble Aquifer System.

III. Susceptibility to Contamination

The Cortland-Homer-Preble Aquifer System is highly vulnerable to contamination, due to highly soil permeability and shallow depth to ground water. The following is a discussion of potential sources of contamination, many of which may receive Federal financial assistance through agencies such as the Federal Highway Administration and the Department of Housing and Urban Development.

Transportation Routes and Facilities

A major interstate highway runs through the proposed designation area. The potential exists for accidental spills on the land overlying the aquifer which could result in serious contamination of the water supply.

On-site Septic Disposal

There are many areas that depend upon on-site septic-systems for waste disposal. These systems, depending on design and soil conditions, may lead to the contamination of the ground water.

Storm Water Runoff

Rain and snowmelt runoff can carry potential contaminants as it enters the aquifer. These include deicing salts, animal excrement, pesticides, fertilizers, petroleum products, bacteria and particulates from air pollutants.

Commercial and Industrial Facilities

There are various commercial and industrial facilities located within the aquifer system borders. Several of these facilities make, use or store chemicals and substances that could be hazardous if allowed to enter the ground water system. A common example is the storage of heating oil and gasoline, often in underground tanks. Leakage and/or accidental spills from tanks is not uncommon. Dense commercial, industrial, or residential development may also present a potential source of contamination to the aquifer.

Agricultural Practices

Much of the land in the designated area is used for agricultural purposes. Agricultural practices, such as chemical fertilizer application, pesticide and herbicide use, and disposal of animal wastes, can contribute to ground water contamination. This can occur through direct recharge or surface runoff.

Future Development

Future commercial, industrial, and residential development is also a potential source of contamination to the aquifer. The Cortland-Homer-Preble area is under intensive development pressure. It is unlikely to ease in the future. Therefore, projects should be designed to avoid significant increases in contaminant loading to the aquifer system.

IV. Alternative Sources of Drinking Water

There are no alternate sources that can provide the same quantity of drinking water as the Cortland-Homer-Preble Aquifer System at a reasonable cost. Nearby surface water sources are the Tioughnioga River System (including several lakes north of the Town of Preble) and Skaneateles Lake. The Tioughnioga River System is hydraulically connected to Cortland-Homer-Preble Aquifer System, and therefore is not a potential alternate source.

According to a letter received from the City Engineer of Syracuse, the City of Syracuse has the legal authority to use Skaneateles Lake as a water supply. During critical dry periods the lake is not able to meet the needs of Syracuse. Due to these institutional and capacity restrictions, Skaneateles Lake cannot be considered an alternate source of drinking water to the petitioned aquifer system.

There are four community water supply systems within Cortland County that are outside the petitioned area. Each uses ground water. Capacity (McFarlandJohnson Engineers, Inc., 1982) and current use information were used to determine the quantity of water potentially available from each. This is shown in Table 4. As seen, the total excess capacity of these systems (622,700 gpd) is inadequate to replace the water supplied by the petitioned aquifer (approximately 5.6 Mgpd).

In addition, there are two public water suppliers west of the petitioned area in Tompkins County that can be considered potential alternate sources. The Village of Dryden obtains drinking water from ground water and the Village of Groton utilizes both ground water and surface water. Data supplied by John Anderson of the Tompkins County Department of Health (shown in Table 5) indicate that the excess capacity of these systems (330,000 gpd) is also inadequate to replace the water from the petitioned aquifer system.

To summarize, the total excess capacity of nearby public water supply systems is approximately 950,000 gpd. This volume is insufficient to supply drinking water for the ASA should the Cortland-Homer-Preble Aquifer System become contaminated.

V. Summary

Based upon the information presented, the Cortland-Homer-Preble Aquifer System meets the technical requirements for SSA designation. More than fifty percent (50%) of the drinking water for the aquifer service area is supplied by the Cortland-Homer-Preble Aquifer System. In addition, there are no economically feasible alternative drinking water sources which could replace the Cortland-Homer-Preble Aquifer System. It is therefore recommended that the Cortland-Homer-Preble Aquifer System be designated a SSA. Designation will provide an additional review of those projects for which Federal financial assistance is requested, and will ensure ground water protection measures, incorporating state and local measures whenever possible, are built into the projects.

VI. Selected References

1. Buller, W. (1978). Hydrologic Appraisal of the Water Resources of the HomerPreble Valley, New York. U.S. Geological Survey Water Resource Investigation OpenFile Report 7894. 31 pp.

2. Buller, W., W.J. Nichols and J.F. Harsh (1978). Quality and Movement of Ground Water in Otter Creek-Dry Creek Basin, Cortland County, New York. U.S. Geological Survey Water Investigation Open-File Report 78-3. 63pp.

3. Corner, Oliver J. and J.F. Harsh (1978). Digital-model Simulation of the Glacial Outwash Basin, Cortland County, New York. U.S. Geological Survey Water Resource Investigation Open-File Report 78-71. 34 pp.

4. McFarlandJohnson Engineers, Inc. (1982). Central New York Ground Water Management Program for Cortland County - Task I Report on Ground Water Resources. 99 pp.

5. Miller, Todd S. (1982). CortlandHomerPreble Area, in Atlas of Eleven Selected Aquifers in New York State (R. Waller and A. Finch, compilers). U.S. Geological Survey Water Resource Investigation OpenFile Report 82553. pp. 149172.

6. Miller, Ernest (1965). Quaternary Geology of New York, in Quaternary Geology of the United States (H.E. Wright and E.G. Frey, eds.). Princeton University Press, Princeton, New Jersey. 922 pp.

7. New York State Department of Environmental Conservation (1987). Upstate Ground Water Management Program. 232 pp.

8. New York State Department of Health (1981). Report of Ground Water Dependence in New York State. 49 pp.

9. Reynolds, Richard J. (1987). Hydrogeology of the Surficial Outwash Aquifer at Cortland, Cortland County, New York. U.S. Geological Survey Water Resource Investigation Report 85-4090. 43 pp.

VII. Tables

Table 1. Community Water Suppliers Within Cortland-Homer-Preble Aquifer System

Supply	Population Served	Water Usage (gallons per day)
City of Cortland	20,100	3,792,000
Cortlandville	2,700	413,600
Homer	4,250	717,800
McGraw	1,300	87,900
Scott	154	9,341
Preble	51	3,200
Green Acres MHP	32	2,000
McBride MHP	54	3,400
Mountainview MHP	86	5,400
Parker Manor MHP	64	4,000
Pine Hill MHP	253	16,000
Ripley Hill MHP	64	4,000
Tully MHP	333	13,672
TOTAL	**29,441**	**5,072,313**

MPH = Mobil Home Park
Source: Cortland County Health Department.

Table 2. Private Well Information within Cortland-Homer-Preble Aquifer System

Town	Estimated Population	Estimated Water Usage (gal/day)
Cortlandville	2,700	270,000

Homer	1,575	157,500
Preble	860	86,000
Scott	140	14,000
TOTAL	**5,275**	**527,500**

Estimate of water usage based on 100 gallons per day per person.
Source: Cortland County Health Department.

Table 3. Current Drinking Water Sources for the Cortland-Homer-Preble Aquifer System Service Area and Percentage of Water Obtained from Each Source

Source \ Use	**Public Water Supply**	**Private and Other**	**Total**
Petitioned Aquifer System	90.4	9.6	100%
Other Aquifers	----	----	----
Surface Water	--	----	----
Transported from the Outside	----	----	----
Total	90.4	9.6	100%

Table 4. Alternate Water Sources within Cortland County

(All volumes are gallons per day)

Supplier	**Capacity ***	**Current Usage #**	**Excess Capacity**
Cincinnatus	270,000	189,500	80,500
Harford	100,000	4,000	96,000
Marathon	490,000	203,800	286,200
Greek Peak	170,000	10,000	160,000
TOTAL	**1,030,000**	**407,300**	**622,700**

* McFarland-Johnson Engineers, Inc., 1982, Table 6-6.
# Source: Cortland County Health Department.

Table 5. Alternate Water Sources within Tompkins County

(All volumes are gallons per day)

Supplier	**Capacity**	**Current Usage**	**Excess Capacity**
Dryden	300,000	200,000	100,000
Groton	610,000	380,000	230,000
TOTAL	**910,000**	**580,000**	**330,000**

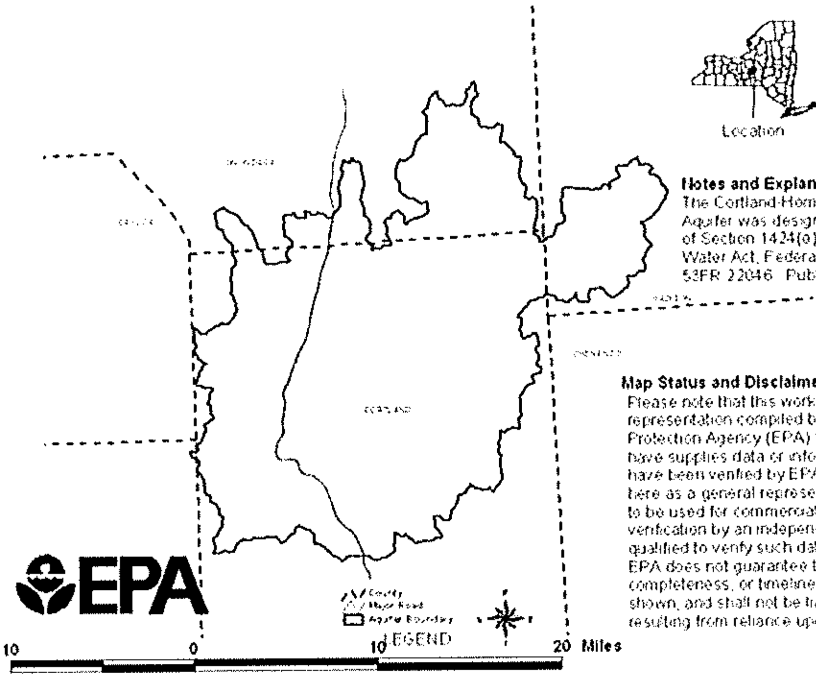
Source: John Andersson, Tompkins County Department of Health.

VIII. Figure

Figure 1. Cortland-Homer-Preble Aquifer System Designated Area

(Displayed USGS 7.5 Minute Quadrangle Sheets)

Cortland - Homer - Preble Sole Source Aquifer



Notes and Explanation:
The Cortland-Homer-Preble Sole Source Aquifer was designated under the authority of Section 1424(e) of the Safe Drinking Water Act. Federal Register Citation: 53FR 22046. Publication Date 06/13/88

Map Status and Disclaimer:
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