**WELLHEAD AREA SURVEY**
**FLINTSTONE SCHOOL**
**ACHD SITE NO. 62**
**Flintstone, Allegany County, Maryland**

**ALWI Project No. AL7N001**

## 1.0 INTRODUCTION

Advanced Land and Water, Inc. (ALWI) was retained by the Allegany County Health Department (ACHD) to prepare a Wellhead Area Survey for Flintstone High School (the School), a public facility of the Allegany County Board of Education located on the south side of Old National Pike (Scenic U.S. Route 40), and immediately north of an unnamed tributary of Town Creek in northern Allegany County, Maryland. This site, designated No. 62 by ACHD, is served by one production well completed in the local bedrock aquifer.

The draft Maryland Department of the Environment (MDE) "Transient Water Systems Operations Guidance" manual (herein termed the "Guidance Manual") defines a Non-Transient Non-Community (NTNC) Water System as one that "...serves at least 25 regular consumers over 6 months per year." An informal interview with the chief custodian suggested that the number of students (400) combined with school being in session over three-fourths of the year, but not a primary residence suggest that this system is a non-transient non-community system (NTNC).

### 1.1 PURPOSE

The Safe Drinking Water Act (SDWA) of 1974 required the U.S. Environmental Protection Agency (EPA) to develop enforceable drinking water quality standards to protect the public health. In 1986, amendments made to the SDWA strengthened provisions for the protection of underground sources of drinking water. These amendments included provisions for establishing Wellhead Protection Programs by individual states under "umbrella" EPA oversight. The EPA approved a statewide Wellhead Protection Program developed by MDE in June 1991.

The MDE program originally applied to community water supplies, only. A newly proposed broadening of the federal Clean Water Act will have the result of expanding the MDE Wellhead Protection Program to encompass non-community supplies both transient and non-transient in nature. ACHD, in cooperation with MDE, established this program to bring existing non-community supplies into compliance with the coming regulations.

### 1.2 SCOPE

ALWI prepared this Wellhead Area Survey following ACHD requirements, which followed MDE guidelines for transient system operation and wellhead protection.

1. **Site Reconnaissance, Photographic Documentation and Interviews** – ALWI observed the on-site wellhead, storage, treatment, and distribution infrastructure to the degree exposed without excavation or exposure to personal hazards. ALWI used an ACHD-owned digital camera to photograph conditions surrounding the wellhead at the time of the field reconnaissance. Said photographs are stored on ACHD's computer system. ALWI interviewed the owner/operator and/or employee(s) to document information on the use patterns, history, and problems associated with the supply.

2. **Baseline Water Quality Assessment** - ALWI purged the water system and collected samples for analysis in the ACHD laboratory that is affiliated with the Maryland Department of Health and Mental Hygiene (DHMH). ALWI performed this fieldwork in accordance with MDE potable water sampling criteria including in-field measurements of turbidity, chlorine, and pH. ACHD selected the analyte list based on countywide experience with potability concerns and the capabilities of the aforementioned laboratory. The analytes included total and fecal coliform bacteria, nitrates, nitrites, iron, sulfur and manganese (Appendix A).

3. **Contamination Hazard Assessment** – ALWI identified existing and potential contaminant hazards within the delineated area based on visual observations and the techniques enumerated above. ALWI ranked these hazards in term of relative risk and provided concrete suggestions for their appropriate address. More generally, herein ALWI provides specific recommendations for source reduction measures, contingency plans, and other methods that may help better protect against occurrences of groundwater contamination.

## 2.0 HYDROGEOLOGIC FRAMEWORK

ALWI used published information from the United States Geological Survey and the Maryland Geological Survey to identify and describe the characteristics of the local hydrogeologic setting.

### 2.1 BEDROCK GEOLOGY

The School is situated within the Valley and Ridge physiographic province and is underlain by limestone of Devonian age. The Keyser and Helderberg formations (undifferentiated) underlie the site and mainly consist of limestone (Glaser, 1994). These rocks have been folded and faulted, resulting in synclines (concave-upward folds) and anticlines (convex-upward folds). The Keyser and Helderberg formations consist mainly of limestone. Such carbonate aquifers can be subject to dissolution in the presence of groundwater. Limestones can dissolve in the presence of groundwater resulting in the formation of sinkholes, caves and other topographic features. These features termed karst topography store and transmit unusual large quantities of groundwater that is often non-potable due to microbial contamination or high concentrations of particulates. The absence of karst features despite the favorable lithology may be explained by the intense structural deformation of the rocks.

In three dimensions, the local rock formations dip at right angles to the direction of plunge of the fold system. In general, dip directions may help govern groundwater (and contaminant) movement directions in the bedrock but plunge directions have less relation. At this location, the bedding planes dip to the east, which suggests that the gentle southwesterly plunge may exert greater-than-usual control on deep groundwater flow directions. Reported local well yields are sparse but range from 10 to 45 gpm (Slaughter and Darling, 1962).

### 2.2 Saprolite and Soil Mantle

Natural chemical weathering of the shallow portion of the bedrock, due to percolating water, has chemically altered many of the original rock-forming minerals to clays and other secondary minerals. This has resulted in the development of shallow saprolite (weathered bedrock) and the overlying soil mantle. The thickness of the soil and saprolite varies considerably over short distances depending on the thickness of Quaternary alluvial deposits and other factors. In highly fractured zones, enhanced groundwater storage and movement has accelerated the breakdown of the rock-forming minerals and has caused formation of a thicker saprolitic deposit.

### 2.3 Aquifer Recharge

Precipitation infiltrating through the soil and Quaternary alluvium on site and/or in up-gradient areas is the primary source of aquifer recharge to the on-site supply well. Generally, overlying soil horizons act to absorb and then slowly release infiltrating precipitation. However, in areas where fracture zones have formed, percolating groundwater can reach the water table quickly. A portion of the precipitation percolates downward through the soil mantle and then migrates through narrow, interconnected joints, fractures, faults, and cleavage planes in the bedrock. Such downward percolation could occur rapidly through dissolution zones (if present).

### 2.4 Geology-Controlled Groundwater Flow

Generally, bedding plane partings and cross-bedding fracture and dissolution zones (where present) function as both downward and lateral water conduits. Consequently, such zones receive and transmit water at a rate higher than would otherwise be achievable and, accordingly, are preferential conduits for groundwater flow and contaminant transport.

## 3.0 WATER QUALITY ASSESSMENT

Slaughter and Darling (1962) reported the groundwater quality from the Keyser and Helderberg formations as locally variable (iron concentrations range from 0.02 to as much as 0.4 micrograms per liter [mg/l]; hardness ranges from 54 to 480 mg/l; and pH ranges from 7.3 to 8.1).

At this location, ALWI collected baseline groundwater samples on December 15, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. ALWI collected raw water samples as specified in COMAR 26.04.01.14. Treated water sample were also collected after the water had been run through a chlorinator and a softener. However, the samples collected came from a storage tank too big to purge for sampling.

ACHD's laboratory analyzed the samples for those constituents of countywide concern. These included total coliform bacteria as specified in COMAR 26.04.01.11A-C (alkalinity, color, conductance, hardness, iron, manganese, nitrate-nitrite nitrogen (COMAR 26.04.01.14(4)(a)), nitrite nitrogen (COMAR 26.04.01.14(4)(b)), pH, and total dissolved solids.

The results are included as Appendix A, and suggest potability relative to the samples collected. However, the proximity of the well to the nearby stream and it's location in a carbonate aquifer places it at "high risk" for surface water influence as defined in the MDE guidance document. This risk would be better quantified with better information on subsurface borehole conditions (e.g., depth of casing) and the potential for variance in surface water indicator parameters (raw water bacteria; temperature and turbidity) with differing precipitation regimes. Ultimate decisions regarding possible filtration retrofits are appropriately driven by economic considerations (the capital and operational costs of domestic-scale filtration vs. the daily consumption of water).

## 4.0 DELINEATION

ALWI delineated a surveyed area surrounding this site's well using generalized criteria developed by MDE for non-community supplies, as modified by ALWI (with ACHD consent) based on the specific topographic setting of the site. The resultant delineation is shown on the "Water Plant Information" survey form (Appendix B). ALWI used a fixed radius of 1,000 feet around the well, which creates an area of approximately 72 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), slightly more than 43,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest demand of this well (3,000 gpd, based on reported flowmeter readings) is more than the total available in the surveyed area, lending a high degree of conservatism to this analysis.

Negligible nitrate-nitrogen concentrations were detected in the sample ALWI collected. This obviated the need for a nitrate balance assessment.

## 5.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed a site reconnaissance on December 15, 1998. During the reconnaissance, local land use conditions were observed with emphasis on the potential use, storage and disposal practices of hazardous materials and petroleum products. Such conditions may have included visual evidence for present or former spills, stained or discolored ground surfaces, stressed vegetation, unusual odors, or visible underground storage tank (UST) facilities. Adjacent and nearby properties were also visually scanned for such evidence from the property and nearby public right-of-ways. Off-site properties were not entered. ALWI relied on the accuracy of interviews for this information.

## 5.1 Potential Hazards At the Wellhead

Design, construction and present condition are important factors in determining a well's susceptibility to contamination. Even though ALWI was able to locate a well tag, no completion report was available. Accordingly, ALWI could not assess the initial design nor present condition of the casing or grout seal. ALWI observed that the portion of the casing exposed at ground surface appeared intact and was equipped with a conventional pitless-style cap of the type that can sometimes allow insects to enter the well. An upgrade to a more modern cap would provide greater protection against microbial contamination. A watertight cap would also provide greater protection from the occasional flooding of the nearby stream.

## 5.2 Other Local Contamination Risks

On December 16, 1998, ALWI observed several potential contamination sources in the delineated area, none of which appeared present to a grave or immediate concern. ALWI identified the following potential sources of contamination: an on-site UST and the probable fertilization of the ballfield at the school and roadway and parking lot deicing practices. USTs at various commercial establishments in Flintstone are a possible but more distant concern. No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed.

## 6.0 CONCLUSION AND RECOMMENDATIONS

ALWI found that the supply is potable relative to the analyses performed. No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed. ALWI has ranked its observation in decreasing order of overall relative risk. ALWI provides specific recommendations at the conclusion of each respective observation or interpretation.

1. **Underground Storage Tank -** Fuel oil is used as a heating source at this facility. School personnel indicated that the fuel is presently stored in an on-site 10,000 gallon underground storage tank (UST) located to the south of the wells. An interview with the custodian suggested that the UST is constructed out of steel and lacks any kind of corrosion protection. Given the proximity of the UST to the wells and its understood long history of use, one-time analytical testing to confirm the absence of fuel oil constituents[1] (e.g., naphthalene, and total diesel-range petroleum hydrocarbon compounds) in the water seems appropriate. Periodic monitoring and other corrective actions as necessary should then be considered based on the findings.

---

[1] Any finding of petroleum-contaminated groundwater must be reported to the MDE Oil Control Program. Such a report would open (or reopen) an Oil Program case file. MDE Oil Control Program representatives may order additional sampling, UST tightness testing, UST removal(s), monitoring well drilling, and/or other investigative and remedial measures. ALWI suggests that site ownership and ACHD interests consult legal counsel before taking any action that could have adverse financial or environmental liability consequences.

2. **Surface Water Influence -** Property ownership interests should collect and analyze groundwater samples for indicators of groundwater under the direct influence of surface water (e.g., turbidity, temperature, and bacteria analyses performed daily for four consecutive days immediately after a 0.5-inch rainfall event).

3. **Ball Field Fertilization -** ALWI observed that the wells are located adjacent to ball fields. Fertilization methods, if practiced, may degrade the water quality through the introduction of pesticides, nitrates, or other compounds to the groundwater. Accordingly, ball field fertilization should be minimized.

4. **Subsurface Disposal Facilities** – Various homes and businesses in Flintstone doubtlessly have septic systems varying in age and condition. Though the low nitrate concentrations detected in the groundwater sample collected indicate no present release, property ownership interests should embark on a regularly scheduled program of pump-outs. Perhaps a consortium of neighbors could join to negotiate more favorable pricing from septic contractors. When the on-site septic system needs replacement, the tank should be replaced with a seamless model and no facilities should be relocated uphill or within 100 feet of the well.

5. **Parking Area Deicing** –Highway Parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. However, consideration should be given to using non-chemical abrasives on the parking lot for deicing to the degree possible. Baseline and bi-annual sampling for sodium and chlorides should be considered

## 7.0 SELECTED REFERENCES

Glaser, John D., 1994, Geologic Map of the Flintstone Quadrangle, Allegany County, Maryland: Maryland Geological Survey, 1:24,000.

MDE Public Drinking Water Program, 1998, Transient Water System Operations Guidance; Guidance For Counties With Delegated Responsibilities (Draft), 45p.

Slaughter, Turbit H. and John M. Darling, 1963, The Water Resources of Allegany and Washington Counties: Maryland Department of Geology, Mines, and Water Resources, Bulletin 24, p. 408.

# NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Flintstone High School

2. WAS: 62

3. System Information:

Address: Main Street

Flintstone, Maryland

Phone No.: (301) 478-2434

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

| | |
|---|---|
| Transient | None |
| Regular | 25 |
| Total | 25 +/- |

7. Property Information:

Owner's Name: Donald May

Address: Main Street

Flintstone, Maryland

Phone No. (301) 478-2434 (301) 759-2000

8. No. Service Connections:

9. Type of Facility:

| | |
|---|---|
| Food Service | |
| Church | |
| Campground | |
| Daycare | |
| Other (specify) | School |

10. Contact Person:

Name: Donald May

Phone No. (301) 759-2000

11. Operator:

Name: Donald May

Cert. No.

12. Sample History (Has the system had any violations?):

Bacteria: None apparent or reported

Nitrate: None apparent or reported

## SURVEY RESULTS

13. Comments on System, Recommendations:

1. **Underground Storage Tank -** Fuel oil is used as a heating source at this facility. School personnel indicated that the fuel is presently stored in an on-site 10,000 gallon underground storage tank (UST) located to the south of the wells. An interview with the custodian suggested that the UST is constructed out of steel and lacks any kind of corrosion protection. Given the proximity of the UST to the wells and its understood long history of use, one-time analytical testing to confirm the absence of fuel oil constituents (e.g., naphthalene, and total diesel-range petroleum hydrocarbon compounds) in the water seems appropriate. Periodic monitoring and other corrective actions as necessary should then be considered based on the findings.
2. **Surface Water Influence -** Property ownership interests should collect and analyze groundwater samples for indicators of groundwater under the direct influence of surface water (e.g., turbidity, temperature, and bacteria analyses performed daily for four consecutive days immediately after a 0.5-inch rainfall event).
3. **Ball Field Fertilization -** ALWI observed that the wells are located adjacent to ball fields. Fertilization methods, if practiced, may degrade the water quality through the introduction of pesticides, nitrates, or other compounds to the groundwater. Accordingly, ball field fertilization should be minimized.
4. **Subsurface Disposal Facilities** – Various homes and businesses in Flintstone doubtlessly have septic systems varying in age and condition. Though the low nitrate concentrations detected in the groundwater sample collected indicate no present release, property ownership interests should embark on a regularly scheduled program of pump-outs. Perhaps a consortium of neighbors could join to negotiate more favorable pricing from septic contractors. When the on-site septic system needs replacement, the tank should be replaced with a seamless model and no facilities should be relocated uphill or within 100 feet of the well.
5. **Parking Area Deicing** –Highway Parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. However, consideration should be given to using non-chemical abrasives on the parking lot for deicing to the degree possible. Baseline and bi-annual sampling for sodium and chlorides should be considered.

14. Inspected by: Mark W. Eisner

15. Date inspected: 12/15/98

16. System Vulnerability

Protected ______ Vulnerable yes (see report)

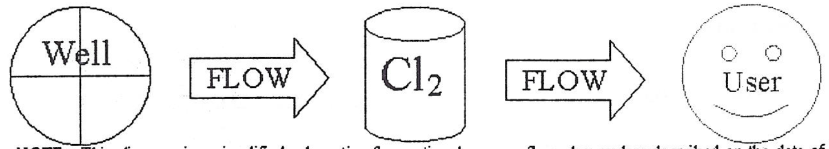
## WATER PLANT INFORMATION

**17. Type of Treatment:**
(Check all that apply)

Disinfection
- Gas Chlorine: ______
- Sodium Hypochlorite __x___
- Ultraviolet Radiation ______

Iron Removal ______
Nitrate Removal ______
PH Neutralizer ______
Other ______
Unknown ______

**18. System Schematic (Process Flow):**




NOTE: This diagram is a simplified schematic of operational process flow observed or described on the date of the reconnaissance. Many water systems possess malfunctioning, disconnected and/or occasionally/regularly-bypassed equipment. Actual treatment processes may differ, therefore, from those shown herein.

**19. System Storage:**

Ground Storage ______
Elevated Storage ______
Hydropneumatic Tank ___x___
Other ______

**20. Storage Capacity:**

Typical Domestic

**21. Untreated water sampling tap?**

Yes _x___ No _____

## WELL INFORMATION

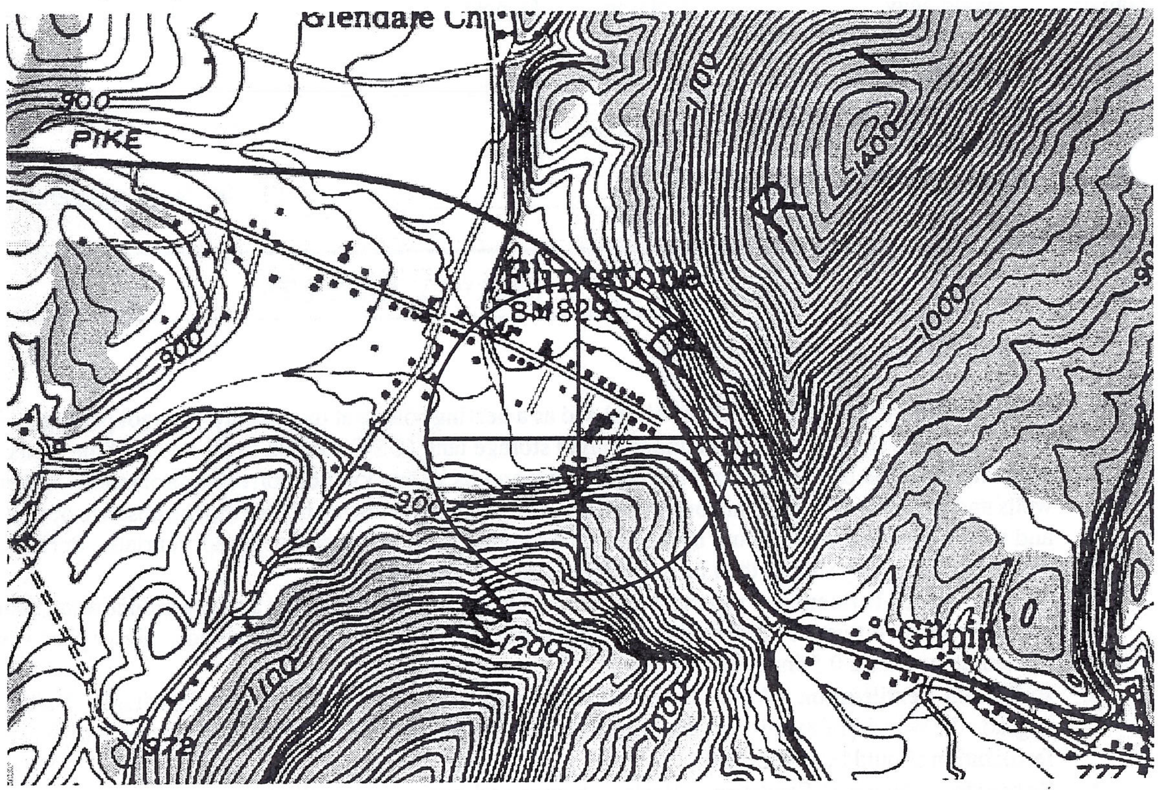
**22. Well Information:**

Tag Number: AL-73-0934
(report unavailable)
Year Drilled: ______
Casing Depth: ______
Well Depth: ______
Well Yield: ______
Casing Height: ______
Grout Depth: ______
Pitless Adapter? yes_
Wiring OK? ______
Pump OK? ______

**23. Well Type:**

Drilled __x___
Driven ______
Dug ______

**24. Well Location Diagram (1 in. = 1250 ft.) with Approximate Distances from Potential Contaminant Sources (i.e. septic, sewer lines, structures, petroleum storage, surface water bodies, etc.):**




**25. Aquifer:**

Name: Keyser/Helderberg
GAP #: ____________
Confined ______
Unconfined ___x__
Semi-confined ______

**26. Quantity Used:**

Daily Avg (gpd) 600
Pumping Rate (gpm) ______
Hours run per day ______

**27. Well Cap:**

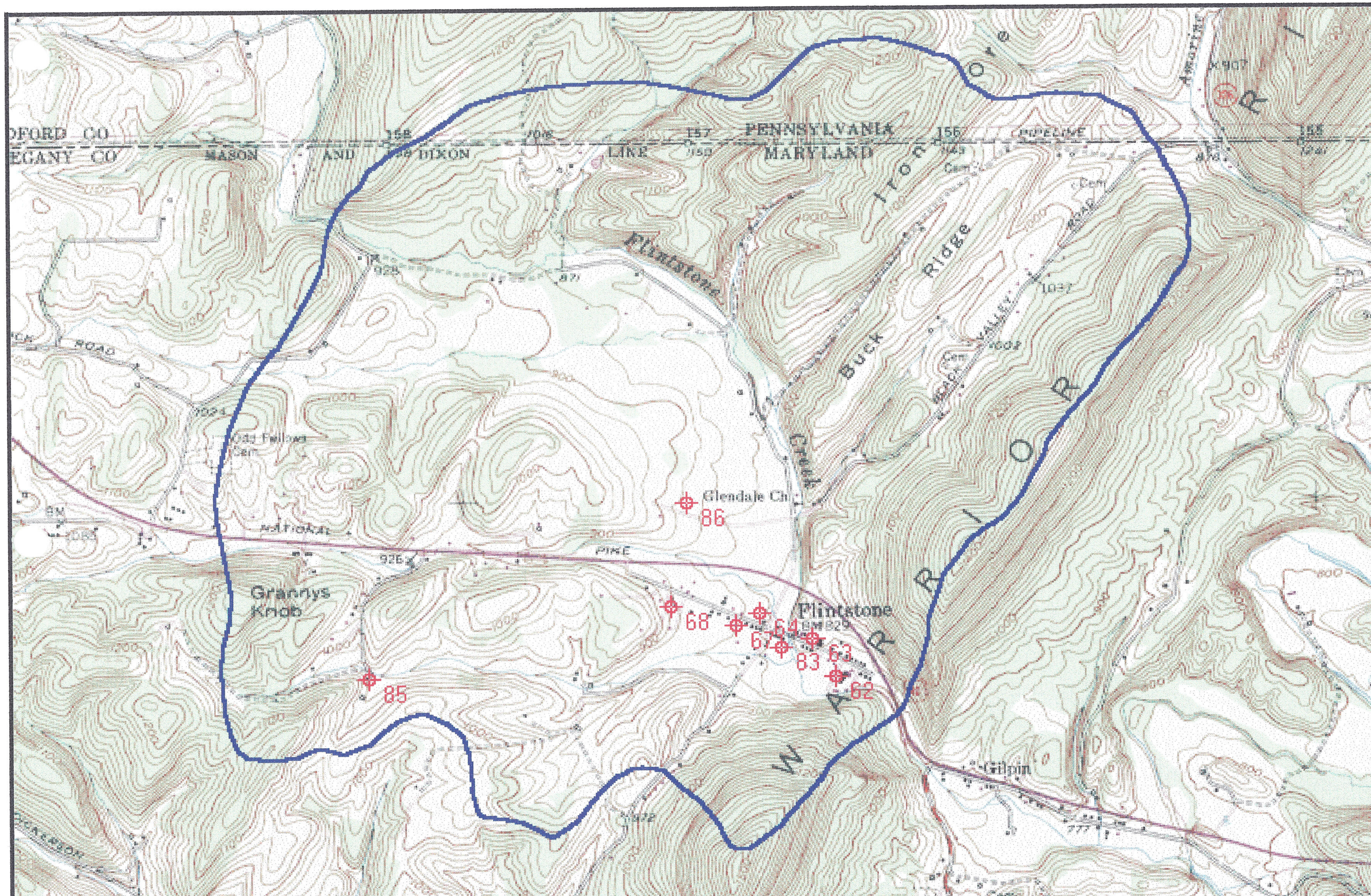
Type? pitless
Seal Tight? O.K.
Vented? O.K.
Screened? No
Conduit OK? O.K.

**28. Casing Diameter:**

2" ______
4" ______
6" __x___
Other ______

**29. Casing Type:**

PVC ______
Metal __x___
Concrete______




*Preliminary Draft*
*Subject to Revision*

N

**EXPLANATION:**

⊕ **TNC or NTNC well**

62 → Flintstone High School
63 Flintstone VFD
64 Dawn's
67 Helmick's Grocery
68 National Pike Sunoco
83 Vanmeter's Gas & Grocery
85 Mt. Valley Farm Bed & Breakfast
86 Alpine Pantry

topographically-constrained sourced water protection area [includes areas within 1,000 feet of each surveyed well unless clear hydrogoelogic evidence suggested a need for a site-specific modificaiton of this MDE criterion.

***APPROXIMATE SCALE 1"=3000'***

0 3000 6000

Notes:

1 Base map imported from digital USGS topographic quadrangle maps for Flintstone, MD (1974 revision), provided to ALWI under liscence by Maptech, Inc.
2 This figure is integral to a written report and should only be used in that context.
3 This figure is solely intended to facilitate regulatory review and is not intended to be used for boundary verification, well location or survey control purposes.

Client:

**ALLEGANY COUNTY HEALTH DEPARTMENT**

ADVANCED Land and Water, Inc. — Global Environmental Solutions

Project:

**NON-COMMUNITY GROUNDWATER SOURCE ASSESSMENT PROGRAM**

Prepared Pursuant to the Requirements of:
**MD DEPT. OF THE ENVIRONMENT**
**PUBLIC DRINKING WATER PROGRAM**

**Figure 3. Composite Source Water Protection Area for Flintstone**

October, 1999