WELLHEAD AREA SURVEY
LILL-AARON STRAUS TRAINING COMPLEX
ACHD SITE NOS. 69-71, 84 and 103
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 Lill-Aaron Straus Training Complex (the Complex). The complex is located on the south side of Zeigler Road, between High Germany Hill and the mouth of Sideling Hill Creek, approximately 0.5 miles west of the Washington County line in southeastern Allegany County, Maryland. ALWI evaluated and sampled five separate though closely spaced well water supplies at the Complex, as follows:

ACHD Site No.	Locally Used Name	Well Tag No.	Disinfection Mode
69	Old Lodge	AL-94-0538	chlorination
70	Rangers Cabin	AL-91-0227	chlorination
71	Allegany Site	No tag visible	Chlorination
84	Baker Building	AL-94-0064	chlorination/UV
103	New Lodge	AL-94-0539	chlorination

Each well penetrates the local bedrock aquifer as "open hole completion." The wells are not interconnected, through from time to time temporary water lines have been used between buildings and service areas to address short-term needs and deficiencies.

The draft 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." ALWI obtained limited usage data by interviewing the on-site manager, summarized as follows:

ACHD Site No.	Locally Used Name	Typical No. Days/Year Used	Typical Population During Usage Period
69	Old Lodge	140	10
70	Rangers Cabin	365	4
71	Allegany Site	45	15
84	Baker Building	45	50
103	New Lodge	Unknown (new)	Unknown (new)

In general, the infrequent and occasional use of the wells suggest that they are appropriately designated transient non-community systems (TNCs).

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 each wellhead at the time of the field reconnaissance. Said photographs are stored on ACHD's computer system. ALWI interviewed the on-site ranger/manager to document information on the use patterns, history and problems associated with the supplies.

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 B).

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 recommendations for source reduction measures, contingency plans, and other methods that may 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 Complex is situated within the Appalachian Valley and Ridge physiographic province and is underlain by sedimentary rocks of late Devonian age. The Foreknobs and Hampshire formations underlie the site and consist of red-colored sandstones and lesser amounts of shale (Glaser, 1994). These rocks have been intensely folded and faulted, resulting in alternating synclines (concave-upward folds) and anticlines (convex-upward folds).

In three dimensions, the rock formations of such folds dip at right angles to the direction of plunge of the entire fold system. In general, dip directions may help govern groundwater (and contaminant) movement directions in the bedrock but plunge directions have little or no relation. At this location, the bedding planes dip moderately steeply to the east-southeast (Glaser, 1994). Deep groundwater flow directions likely follow, whereas shallow flow directions likely mirror land surface topography.

Reported well yields within the Foreknobs and Hampshire formations are sparse but range from 2 to 8 gpm. Wells completed within sandstone layers generally have a higher yield because the greater competence of the rock allows the development of longer and wider fractures both along and across bedding planes.

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 is generally 2 to 10 feet, but it varies considerably over short distances. 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 on site and/or in topographically up-gradient areas is the primary source of aquifer recharge to the on-site supply wells. 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.

2.4 GEOLOGY-CONTROLLED GROUNDWATER FLOW

Generally, bedding plane partings and cross-bedding fracture 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.

Despite the bedrock's overall hardness and resistance to erosion, hydraulic permeabilities in bedding planes and fracture zones within the Hampshire Formation may be several times greater than in surrounding less-fractured rock. This intrinsic characteristic portends the possibility for the existence of specific zones with higher-than-normal (1) well yields, (2) groundwater flow velocities, and (3) susceptibility to groundwater contamination.

3.0 WATER QUALITY ASSESSMENT

Slaughter and Darling (1962) reported the regional water quality as slightly irony (0.01 to as much as .12 micrograms per liter (mg/l), soft (19 to 77 mg/l), and slightly acidic to moderately alkaline (pH range of 6.3 to 8.7). ALWI interpreted that the slight reddish colors of the local rock exposures as likely attributable to the trace presence of iron.

At this location, ALWI collected baseline groundwater samples on December 28, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. Both pre- and post treatment samples were collected from four of the five on-site water systems. For the system at the Allegany site (ACHD No. 71), only a post-treatment sample was collected. ALWI collected, preserved and transported each of the samples in accordance with COMAR 26.04.01.14. 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.

3.1 Elevated Turbidity levels At the Allegany Site (Site No. 71)

The presence of high turbidity concentrations (103 NTU) suggests well bore instability and/or incomplete development of the well. However, turbidity analyses in excess of approximately 20 NTU typically correlate with water that is noticeably occluded. ALWI did not note such occlusion and speculates that the laboratory finding may be in error. However, any elevation in turbidity concentrations can be associated with transient bacteriologic and/or pathogenic influxes to the water supply, particularly if correlated with precipitation events and/or shallow sources.

For turbidity-laden well water with low and infrequent use, ALWI often recommends bottled sources for potable uses. However, the highly infrequent and largely unmanned nature of operations at the Allegany site suggests that exclusive use of bottled supplies may be infeasible to provide and maintain. ALWI suggests resampling after extended purging to confirm turbidity findings. If elevated turbidity levels are verified, either the cause should be determined and corrected, filtration provided, or the users of the Allegany site should be forewarned about possible water quality concerns and advised to bring their own bottled supplies before using that area.

3.2 Nitrate Concentrations in the Old Lodge Supply (Site No. 69)

Nitrate concentrations in the Old Lodge supply ranged between 3.5 and 4.0 mg/l. Nowhere in Allegany County did ALWI detect higher nitrate concentrations. Considering the largely wooded area surrounding the old lodge, ALWI interprets the source of nitrate as being from wastewater disposal rather than from agricultural practices. ALWI recommends continued semi-annual monitoring of nitrate concentrations. If concentrations should exceed 5 mg/l, an evaluation of the design and function of the septic disposal system at the Old Lodge should be considered.

3.3 Surface Water Influence Susceptibility

Finally, the supplies appear at low (Site Nos. 69 and 103) to moderate (Site Nos. 70, 71, and 84) risk for surface water influence as defined in the MDE guidance document. According to the guidance document, for the moderate risks sites two sets of wet weather samples are required to confirm the absence of surface water pathogens from those supplies at moderate risk.

4.0 DELINEATION

ALWI delineated a composite surveyed area encompassing all areas south and topographically upgradient from each well, using generalized criteria developed by MDE for non-community supplies, as modified by ALWI (with ACHD consent) based on the site's rugged topographic setting. ALWI began by using a fixed radius of 1,000 feet around each well. From this radial area, ALWI then included all remaining upgradient areas controlled by the site owner and excluded downgradient areas more than 100 feet from the wellhead as well as areas unlikely to

contribute recharge to the well based on intervening streams and/or drainage divides. Because of the rugged topography, ALWI also excluded steeply-sloping cross-gradient areas.

The resultant delineation is shown on the "Water Plant Information" survey forms (Appendix B) and encompasses approximately 185 acres. Within an assumed 300 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37, with a 50% correction factor applied by ALWI for the unusually steep slopes), over 55,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest annualized demands of the wellfield (less than 1,000 gpd) is more than one full order of magnitude smaller than 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 28, 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 upon the accuracy of historical interview information provided by the on-site manager to provide context for some of its observations.

5.1 POTENTIAL HAZARDS AT THE WELLHEADS

Design, construction and present condition are important factors in determining a well's susceptibility to contamination. Though four of the five wells had tags, ALWI was not provided completion reports. Accordingly, ALWI could not assess the initial design nor present condition of the casing or grout seal. ALWI observed that the portion of each casing exposed at ground surface appeared intact. They were 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.

4.2 OTHER LOCAL CONTAMINATION RISKS

On December 28, 1998, ALWI observed several potential contamination sources in the delineated area. Each well runs some risk from recirculation of septic effluent though the low nitrate concentrations detected seem to suggest that this risk is not presently severe. Other specific contamination risks ALWI noted were as follows:

- **69 (Lodge)** – ALWI understands that this well was replaced with Well No. 103. Any unneeded well is a potential short-circuit pathway for groundwater contamination. If no longer in use, this well should be abandoned and sealed pursuant to COMAR 26.04.04.11D(1 and 2)[1]. The moderately elevated nitrate concentration detected in this well suggests that the well acts as a conduit for the downward migration of nitrates.

- **70 (Ranger's Cabin)** – This well is located in a steeply sloping ravine. It could become submerged during a heavy rainfall or sudden snowmelt event. Consideration should be given to raising the casing and/or furnishing a watertight cap with a vent to an elevation above the 100-year flood stage for the unnamed ravine in question.

- **71 (Allegany Site)** – The casing of this well is unusually low to the ground where it may be susceptible to submergence during heavy rainfall events. Consideration should be given to raising the casing and/or furnishing a watertight cap with a vent to standard casing heights.

- **84 (Baker Building)** - Fuel ASTs are maintained outdoors near this wellhead. ALWI recommends regular maintenance of this fuel storage and delivery system, including development of specific protocols to be employed in case of a leak or overfill. At minimum said protocols should meet the requirements of COMAR 26.10.01.12. On discovery of any evidence of a release or potential release, groundwater monitoring for petroleum hydrocarbons should occur on a regularly repeating basis until the release is disproved or mitigated.

5.0 CONCLUSION AND RECOMMENDATIONS

ALWI did not find acute conditions suggesting non-potability of a type warranting immediate reporting, resampling, or other emergency corrective action. ALWI developed the recommendations herein following MDE guidelines but also in light of site-specific practicalities. ALWI recommends the following key contaminant source reduction measures:

1. **Abandon Well 69** – If the lodge building can operate solely reliant on Well 103, permanent abandonment of Well 69 should provide a side benefit of reducing the risk of nitrate contamination of the deeper aquifer materials at this location. If Well 69 remains in use, ALWI recommends continued periodic monitoring of nitrate concentrations. Whether or not Well 69 remains in use, the design and adequate function of the lodge's septic system wards seem to require evaluation, particularly if nitrate concentrations rise above 5 mg/l.

[1] These regulations specify well abandonment in cases where (1) the well may "act as a channel for the interchange of waters of undesirable quality with those whose quality is desirable" and/or (2) the well may be a "...potential source of pollution of waters of the State."

2. **Discontinue Use of Well 71 for Potable Purposes** – If resampling verifies the continued presence of elevated turbidity concentrations, site owners may find greater cost-effectiveness in converting to hand-carried temporary bottled sources of potable water than in any other corrective measure. Retrofitting the existing groundwater supply with filtration or other costly treatment measures, if warranted by the supplemental analyses recommended herein, may not be cost-effective considering the nature and frequency of on-site uses. Provision of permanent and stationary bottled water service may be infeasible given the highly infrequent and transient use of this camping area. If site management interests concur, appropriate placarding should be provided so as to warn against use of this source for potable purposes. If continued potable reliance upon Well 71 is to be considered, at minimum ALWI would recommend more comprehensive sampling, verification of well bore integrity, and raising the casing.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

6.0 SELECTED REFERENCES

Glaser, John D., 1994, Geologic Map of the Bellegrove Quadrangle, Allegany and Washington Counties, 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: Lill-Aaron Straus Lodge

2. WAS: 69

System Information:

Address: 219 W. 29th Division Street

Baltimore, MD

Phone No.: (410) 574-6064

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ____
Regular 10
Total 10

7. Property Information:

Owner's Name Maryland Military Department

Address: 219 W. 29th Division Street

Baltimore, Maryland

Phone No. (410) 576-6064

8. No. Service Connections:

9. Type of Facility:

Food Service ____
Church ____
Campground x
Daycare ____
Other (specify) ____

10. Contact Person:

Name: ____

Phone No. ____

11. Operator:

Name: ____

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:

Nitrate concentrations in the Old Lodge supply ranged between 3.5 and 4.0 mg/l. Nowhere in Allegany County did ALWI detect higher nitrate concentrations. Considering the largely wooded area surrounding the old lodge, ALWI interprets the source of nitrate as being from wastewater disposal rather than from agricultural practices. ALWI recommends continued semi-annual monitoring of nitrate concentrations. If concentrations should exceed 5 mg/l, an evaluation of the design and function of the septic disposal system at the Old Lodge should be considered.

69 (Lodge) – ALWI understands that this well was replaced with Well No. 103. Any unneeded well is a potential short-circuit pathway for groundwater contamination. If no longer in use, this well should be abandoned and sealed pursuant to COMAR 26.04.04.11D(1 and 2). The moderately elevated nitrate concentration detected in this well suggests that the well acts as a conduit for the downward migration of nitrates.

Abandon Well 69 – If the lodge building can operate solely reliant on Well 103, permanent abandonment of Well 69 should provide a side benefit of reducing the risk of nitrate contamination of the deeper aquifer materials at this location. If Well 69 remains in use, ALWI recommends continued periodic monitoring of nitrate concentrations. Whether or not Well 69 remains in use, the design and adequate function of the lodge's septic system wards seem to require evaluation, particularly if nitrate concentrations rise above 5 mg/l.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

14. Inspected by:

Mark W. Eisner

15. Date inspected:

12/28/98

16. System Vulnerability

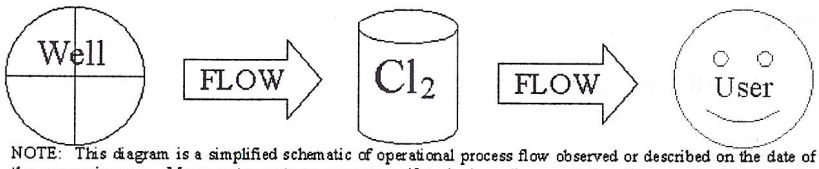
Protected ____ Vulnerable Yes (see report)

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-94-0538

Year Drilled: 1998

Casing Depth: 60

Well Depth: 465

Well Yield: 50

Casing Height: 1

Grout Depth: 59

Pitless Adapter? yes

Wiring OK? unknown

Pump OK? unknown

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.):

23. Well Type:

Drilled	x
Driven	____
Dug	____

25. Aquifer:
Name: Foreknobs
Hampshire
GAP #: ____

Confined	____
Unconfined	x
Semi-confined	____

26. Quantity Used:

Daily Avg (gpd)	< 1000
Pumping Rate (gpm)	unknown
Hours run per day	unknown

27. Well Cap:

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

28. Casing Diameter:

2"	____
4"	____
6"	____
Other	8"

29. Casing Type:

PVC	____
Metal	x
Concrete	____

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Lill-Aaron Straus Rangers Cabin

2. WAS: 70

System Information:

Address: 219 W. 29th Division Street
Baltimore, MD

Phone No.: (410) 576-6064

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ____
Regular 4
Total 4

7. Property Information:

Owner's Name Maryland Military Department

Address: 219 W. 29th Division
Baltimore, MD

Phone No. (410) 576-6064

8. No. Service Connections:

9. Type of Facility:

Food Service ____
Church ____
Campground x
Daycare ____
Other (specify) ____

10. Contact Person:

Name: ____

Phone No. ____

11. Operator:

Name: ____

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:

70 (Ranger's Cabin) – This well is located in a steeply sloping ravine. It could become submerged during a heavy rainfall or sudden snowmelt event. Consideration should be given to raising the casing and/or furnishing a watertight cap with a vent to an elevation above the 100-year flood stage for the unnamed ravine in question.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

14. Inspected by:

Mark W. Eisner

15. Date inspected:

12/28/99

16. System Vulnerability

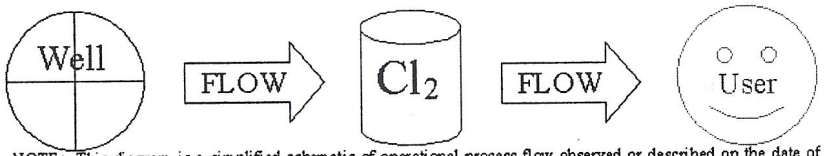
Protected ____ Vulnerable Yes (see report)

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-81-0227

Year Drilled: 1984

Casing Depth: 65

Well Depth: 594

Well Yield: 9

Casing Height: 1

Grout Depth: 65

Pitless Adapter? 4

Wiring OK? unknown

Pump OK? unknown

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.):

23. Well Type:

Drilled	x
Driven	_____
Dug	_____

25. Aquifer:

Name: Foreknobs Hampshire

GAP #: _____

Confined	x
Unconfined	_____
Semi-confined	_____

26. Quantity Used:

Daily Avg (gpd)	< 1000
Pumping Rate (gpm)	unknown
Hours run per day	unknown

27. Well Cap:

Type?	_____
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	_____

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Lill-Aaron Straus Wild. Area-Allegany Site

2. WAS: 71

3. System Information:

Address: 219 W. 29th Division Street

Baltimore, MD

Phone No.: (410) 576-6064

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ____
Regular 15
Total 15+/-

7. Property Information:

Owner's Name Maryland Military Department

Address: 219 W. 29th Division Street

Baltimore, Maryland

Phone No. (410) 576-6064

8. No. Service Connections:

9. Type of Facility:

Food Service ____
Church ____
Campground x
Daycare ____
Other (specify) ____

10. Contact Person:

Name: MD Military Department

Phone No. (410) 576-6064

11. Operator:

Name: ____

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:

71 (Allegany Site) – The casing of this well is unusually low to the ground where it may be susceptible to submergence during heavy rainfall events. Consideration should be given to raising the casing and/or furnishing a watertight cap with a vent to standard casing heights.

Discontinue Use of Well 71 for Potable Purposes – If resampling verifies the continued presence of elevated turbidity concentrations, site owners may find greater cost-effectiveness in converting to hand-carried temporary bottled sources of potable water than in any other corrective measure. Retrofitting the existing groundwater supply with filtration or other costly treatment measures, if warranted by the supplemental analyses recommended herein, may not be cost-effective considering the nature and frequency of on-site uses. Provision of permanent and stationary bottled water service may be infeasible given the highly infrequent and transient use of this camping area. If site management interests concur, appropriate placarding should be provided so as to warn against use of this source for potable purposes. If continued potable reliance upon Well 71 is to be considered, at minimum ALWI would recommend more comprehensive sampling, verification of well bore integrity, and raising the casing.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

14. Inspected by:	15. Date inspected:	16. System Vulnerability
Mark W. Eisner	12/28/98	Protected ____ Vulnerable Yes (see report)

WATER PLANT INFORMATION

of Treatment:
eck all that apply)

- **fection**
- **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?

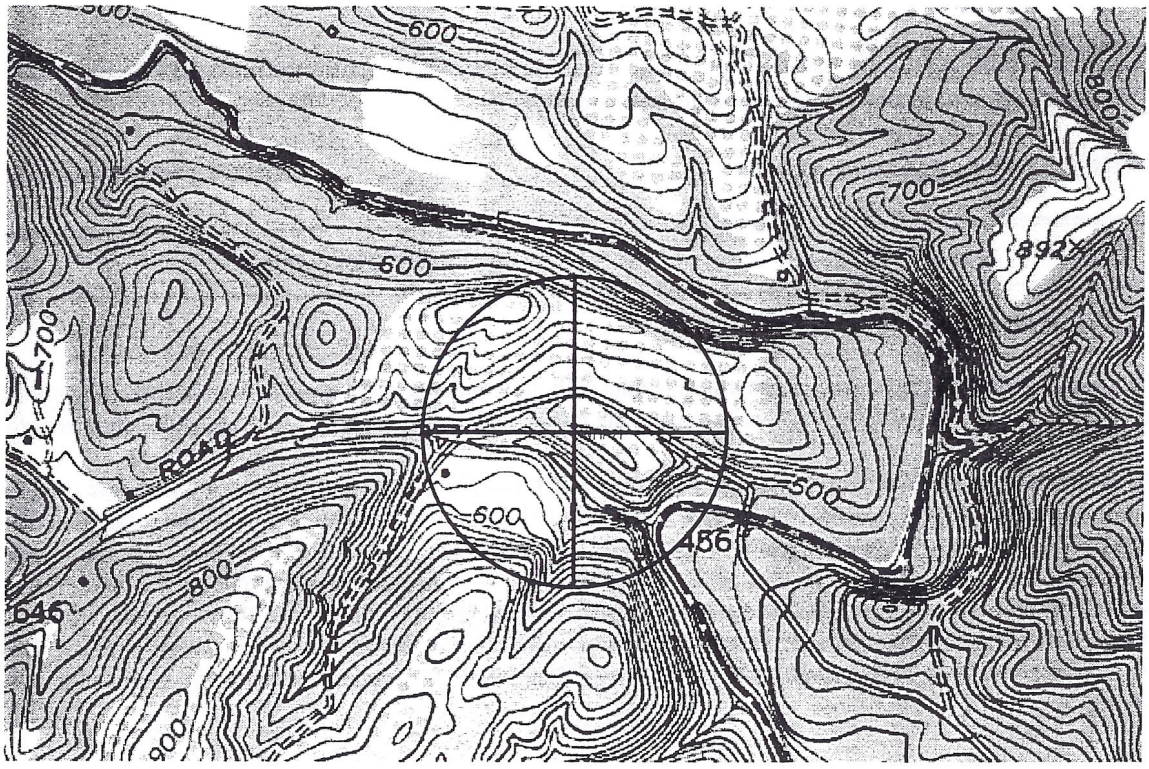
Yes _____ No _x_

WELL INFORMATION

22. Well Information:

- Tag Number: not visible
- Year Drilled: _____
- Casing Depth: _____
- Well Depth: _____
- Well Yield: _____
- Casing Height: _____
- Grout Depth: _____
- Pitless Adapter? _____
- Wiring OK? unknown
- Pump OK? unknown

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.):



23. Well Type:

- Drilled __x__
- Driven _____
- Dug _____

25. Aquifer:

- Name: Foreknobs Hampshire
- GAP #: _____
- Confined _____
- Unconfined __x__
- Semi-confined _____

26. Quantity Used:

- Daily Avg (gpd) < 1000
- Pumping Rate (gpm) unknown
- Hours run per day unknown

27. Well Cap:

- Type? _____
- 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 _____

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Lill-Aaron Straus, Baker Building

2. WAS: 84

. System Information:

Address: 219 W. 29th Division Street

Baltimore, Maryland

Phone No.: (410) 576-6064

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient 50
Regular
Total 50 +/-

7. Property Information:

Owner's Name Lloyd May

Address: 219 W. 29th Division Street

Baltimore, Maryland

Phone No. (410) 576-6064 (301) 678-6912

8. No. Service Connections:

9. Type of Facility:

Food Service x
Church
Campground
Daycare
Other (specify)

10. Contact Person:

Name: Lloyd May

Phone No. (301) 678-6912

11. Operator:

Name:

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:

84 (Baker Building) - Fuel ASTs are maintained outdoors near this wellhead. ALWI recommends regular maintenance of this fuel storage and delivery system, including development of specific protocols to be employed in case of a leak or overfill. At minimum said protocols should meet the requirements of COMAR 26.10.01.12. On discovery of any evidence of a release or potential release, groundwater monitoring for petroleum hydrocarbons should occur on a regularly repeating basis until the release is disproved or mitigated.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

14. Inspected by:

Mark W. Eisner

15. Date inspected:

12/28/98

16. System Vulnerability

Protected

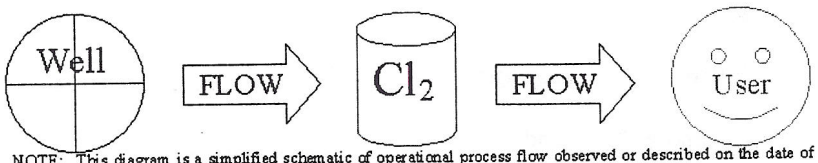
Vulnerable Yes (see report)

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-94-0064

Year Drilled: 1994

Casing Depth: 73

Well Depth: 298

Well Yield: 6 gpm

Casing Height: 1

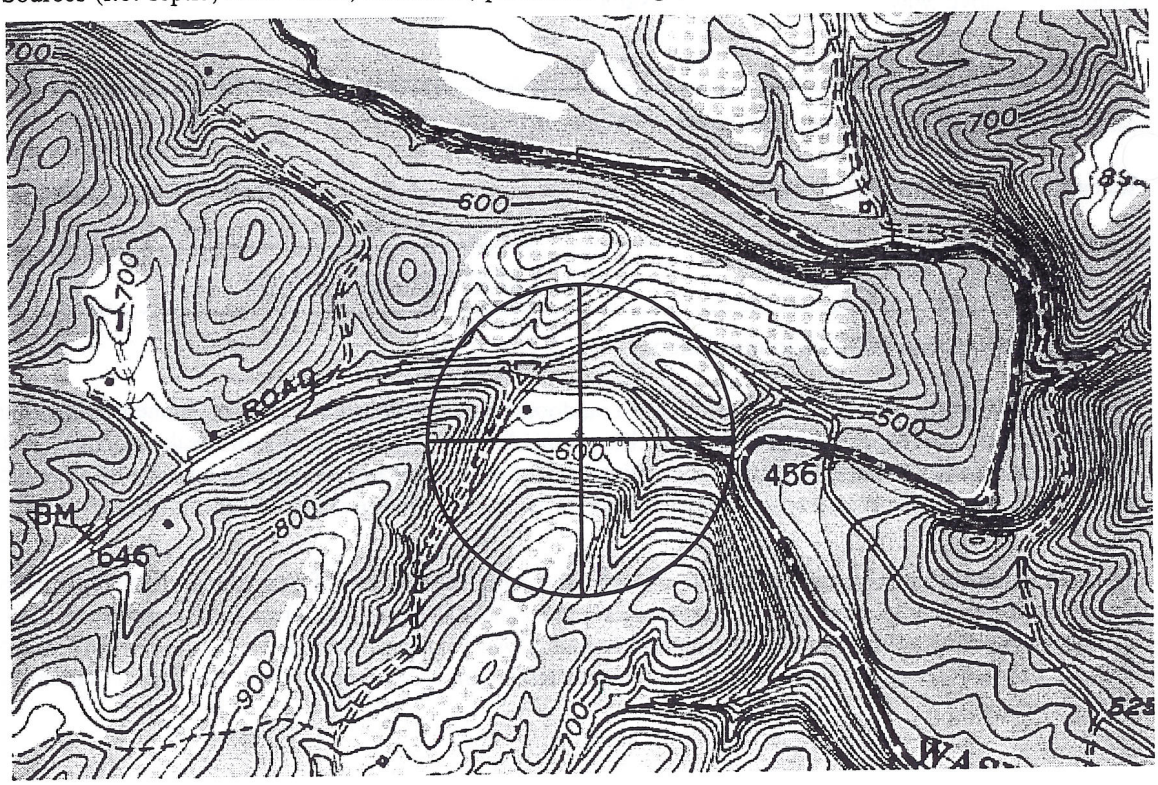
Grout Depth: 73

Pitless Adapter? O.K.

Wiring OK? unknown

Pump OK? unknown

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.):



23. Well Type:

Drilled	__x__
Driven	_____
Dug	_____

25. Aquifer:

Name: Foreknobs
Hampshire
GAP #: _____
Confined ____
Unconfined __x__
Semi-confined ____

26. Quantity Used:

Daily Avg (gpd)	< 1000
Pumping Rate (gpm)	unknown
Hours run per day	unknown

27. Well Cap:

Type?	____
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	_____

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Lill-Aaron Straus – New Lodge

2. WAS: 103

3. System Information:

Address: 219 W. 29th Division Street

Baltimore, MD

Phone No.: (410) 576-6064

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient _____
Regular _____
Total unknown

7. Property Information:

Owner's Name Maryland Military Department

Address: 219 W. 29th Division

Baltimore, MD

Phone No. (410) 576-6064

8. No. Service Connections:

9. Type of Facility:

Food Service _____
Church _____
Campground x
Daycare _____
Other (specify) _____

10. Contact Person:

Name: _____

Phone No. _____

11. Operator:

Name: _____

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:

Abandon Well 69 – If the lodge building can operate, solely reliant on Well 103, permanent abandonment of Well 69 should provide a side benefit of reducing the risk of nitrate contamination of the deeper aquifer materials at this location. If Well 69 remains in use, ALWI recommends continued periodic monitoring of nitrate concentrations. Whether or not Well 69 remains in use, the design and adequate function of the lodge's septic system may be considered, particularly if nitrate concentrations rise above 5 mg/l.

Property ownership interests may wish to consider the long-term benefit of subsurface system interconnections. These could be used for emergency purposes (e.g., fire fighting; temporary supply shortfalls; pump failures; potable service to the Allegany site; etc.) and to help meet peak demands during military and police training sessions. ALWI understands that temporary, overland interconnections have been constructed in the past. Properly designed and installed permanent interconnections would lessen the risk of contaminant entrance into overland pipes of uncertain integrity.

14. Inspected by:	15. Date inspected:	16. System Vulnerability

Mark W. Eisner	12/28/99	Protected_____ Vulnerable Yes (see report)

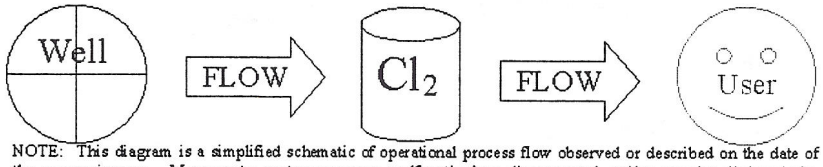
WATER PLANT INFORMATION

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?

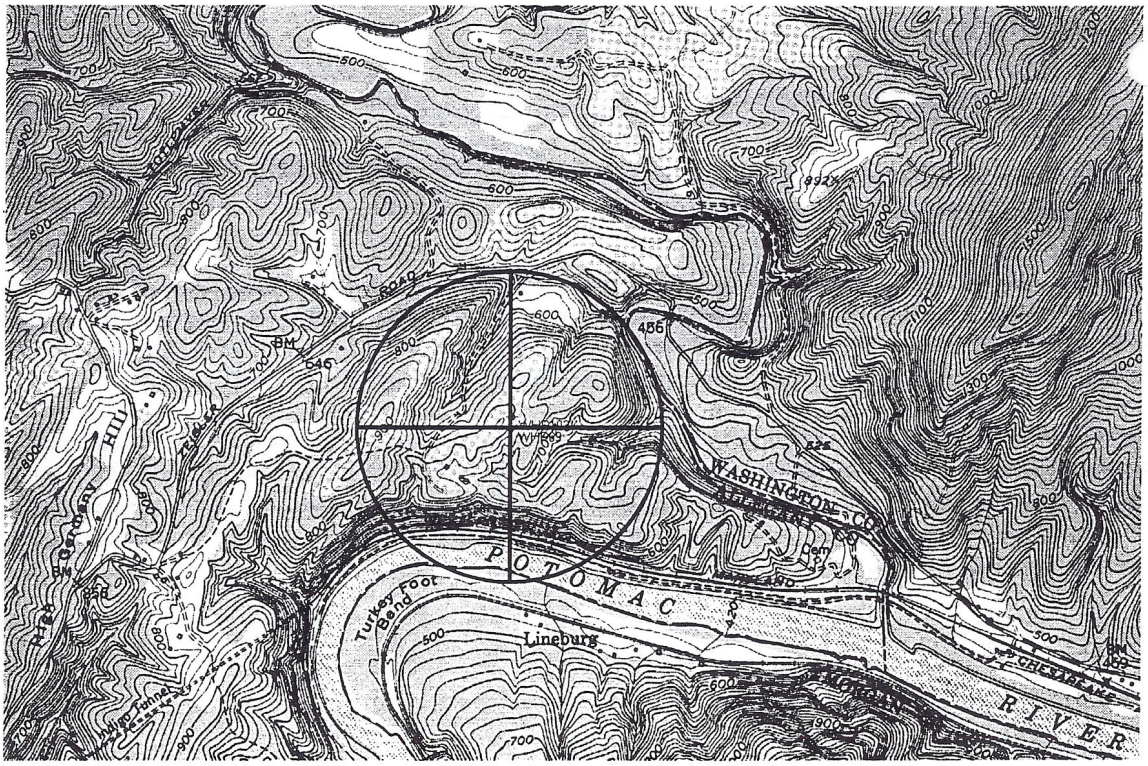
Yes _x_ No _____

WELL INFORMATION

22. Well Information:

Tag Number: AL-94-0539
Year Drilled: 1998
Casing Depth: 100
Well Depth: 385
Well Yield: 100
Casing Height: 1
Grout Depth: 99
Pitless Adapter? Yes
Wiring OK? unknown
Pump OK? unknown

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.):



23. Well Type:

Drilled _x_
Driven _____
Dug _____

25. Aquifer:

Name: Foreknobs/Hampshire
GAP #: _____
Confined _____
Unconfined _x_
Semi-confined _____

26. Quantity Used:

Daily Avg (gpd) 300
Pumping Rate (gpm) unknown
Hours run per day unknown

27. Well Cap:

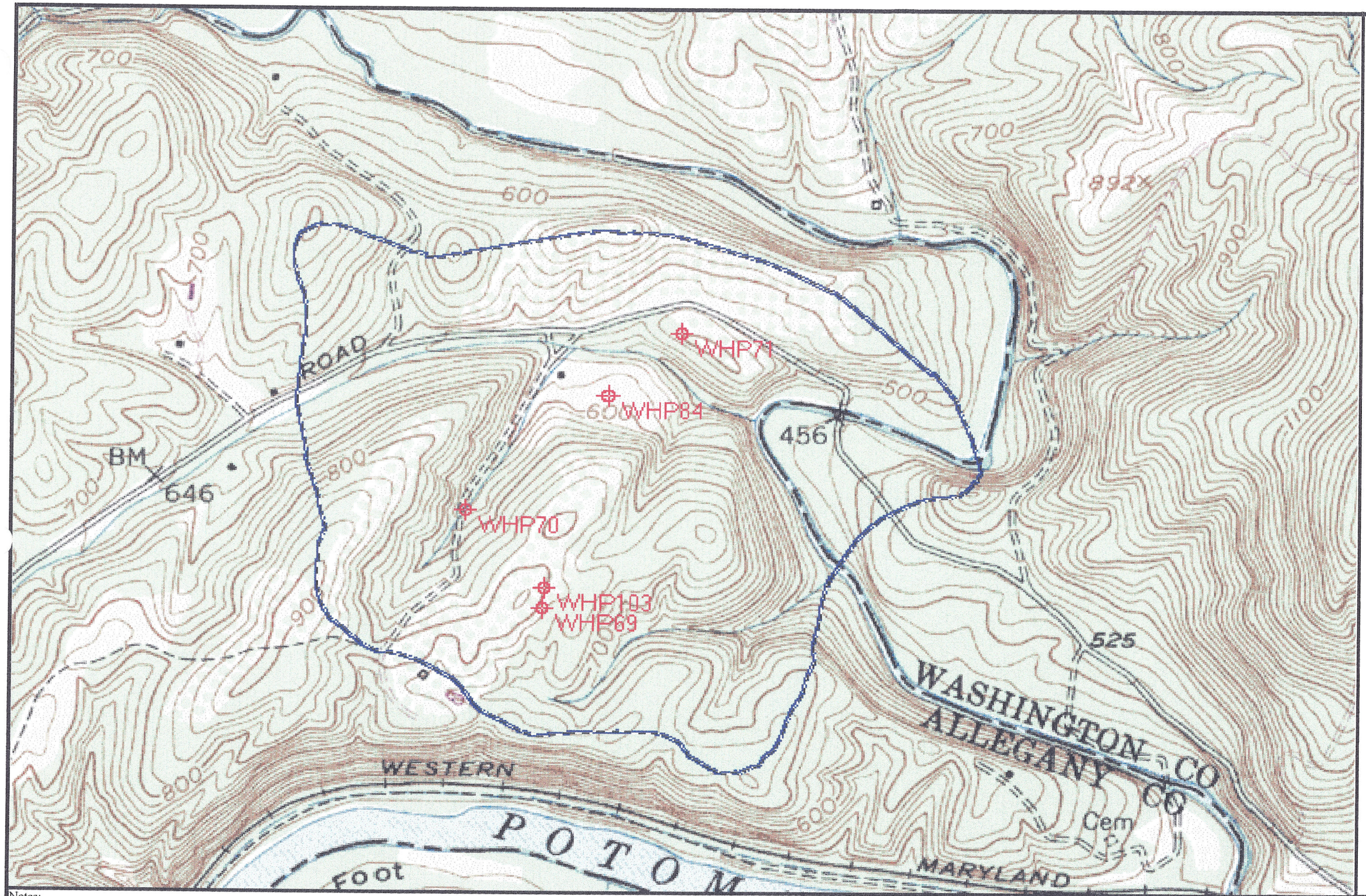
Type? _____
Seal Tight? O.K.
Vented? O.K.
Screened? No
Conduit OK? O.K.

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
69 →	Lill-Aaron Straus Lodge
70	Lill-Aaron Straus Rangers Cabin
71	Lill-Aaron Straus Wild. Area
84	Lill-Aaron Straus Baker Building
103	Lill-Aaron Straus New Lodge

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"=1600 FT

0 — 1600 — 3200

Notes:

1 Base map imported from digital USGS topographic quadrangle maps for Bellegrove, 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 4. Composite Source Water Protection Area for Lill-Aaron Straus

October, 1999