

Nitrate Groundwater Contamination from an Elementary School - A Case Study

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On-Site Wastewater Section
NCDENR



Gray's Creek Elementary

- ∞ **Located in Cumberland County**
- ∞ **950 Student Elementary School**
- ∞ **Cafeteria, no gymnasium**
- ∞ **Treatment system designed for 11,400 gpd**
- ∞ **Drainfield designed for 8,550 gpd**



Treatment and Disposal System

- ∩ **2 Grease Traps - total capacity 7,000 gallons**
- ∩ **12,000 gallon septic tank**
- ∩ **14,000 gallon equalization tank**
- ∩ **Three cell recirculating sand filter**
- ∩ **8,000 gallon final pump tank**
- ∩ **8,000 linear feet drainlines divided into four fields (pressure manifold)**

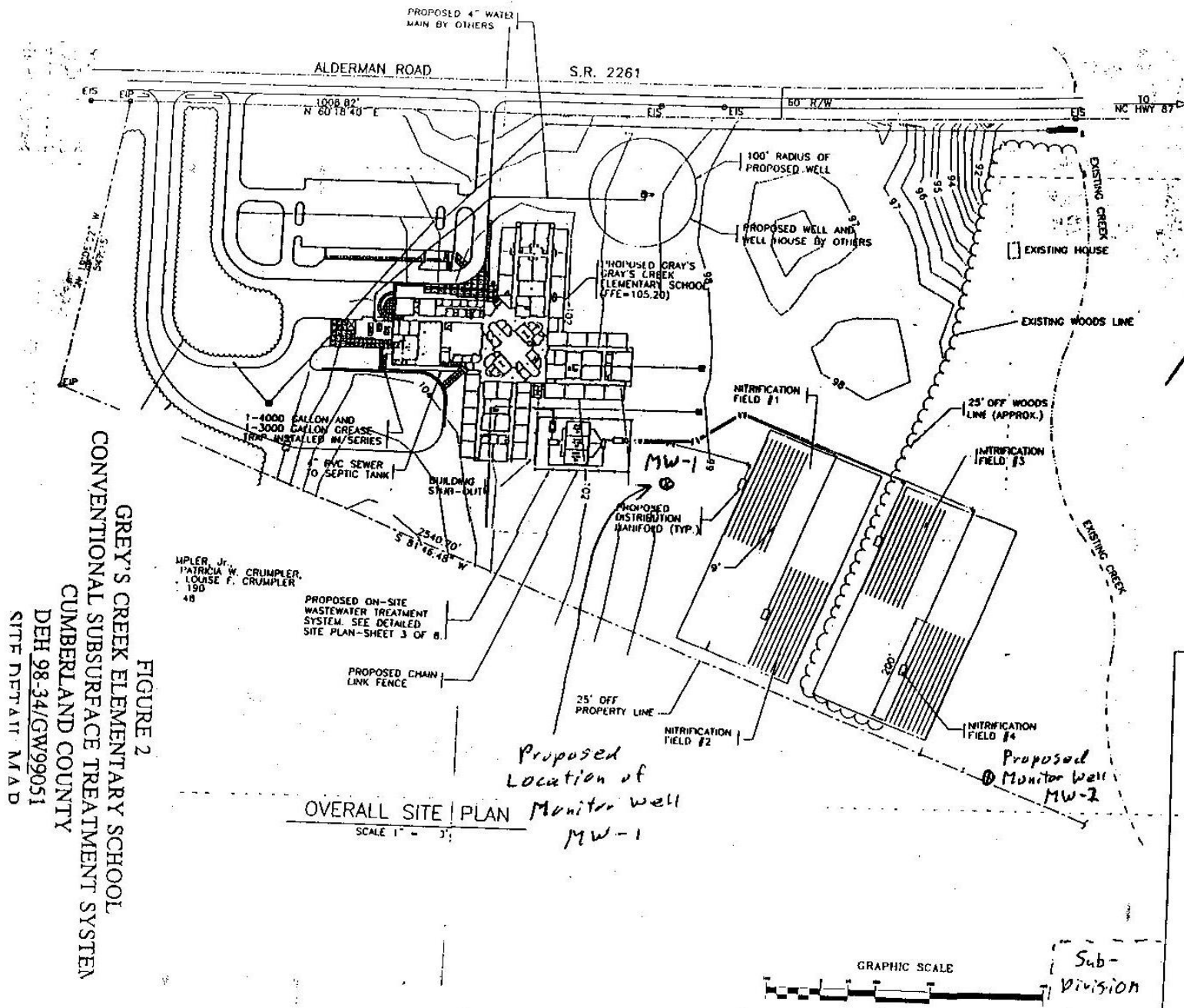
DWQ Review

Ω DWQ Groundwater Section reviewed the plans and made the following comments:

- Computer modeling did not show that mounding beneath the drainfields would be a concern
- House located approximately 500 to the north of the drainfields - determine if on water supply well, if so, well should be abandoned or monitoring well installed half way between the water supply well and drainfield

DWQ Review (cont)

- Ω DWQ Groundwater Section reviewed the plans and made the following comments:
- Subdivision with water supply wells located 400 to 500 feet east of Nitrification Field No. 4, monitoring well should be located between Field No. 4 and subdivision and upgradient of drainfield



LEGEND

- EXISTING CREEK
- PROPOSED SEWER
- EXISTING BUILDING
- EXISTING DITCH
- EXISTING PROPERTY
- PROPOSED FENCE
- EXISTING FENCE
- EXISTING TREE LINE
- EXISTING DRAINAGE
- ⊙ EXISTING POWER P
- EXISTING TREE
- ⊕ EXISTING SHRUBS
- ⊠ EXISTING CATCH BAS


FIGURE 2

GREY'S CREEK ELEMENTARY SCHOOL
 CONVENTIONAL SUBSURFACE TREATMENT SYSTEM
 CUMBERLAND COUNTY

DEH 98-34/GW99051
 SITE DETAIL M.A.D.



Ω System went on-line in 2001



Ω Spring 2003, the operator called the Section to let them know that one of the groundwater monitoring wells was coming up “hot”

Notice of Groundwater Standards Exceedance

Ω **Issued June 19, 2003**

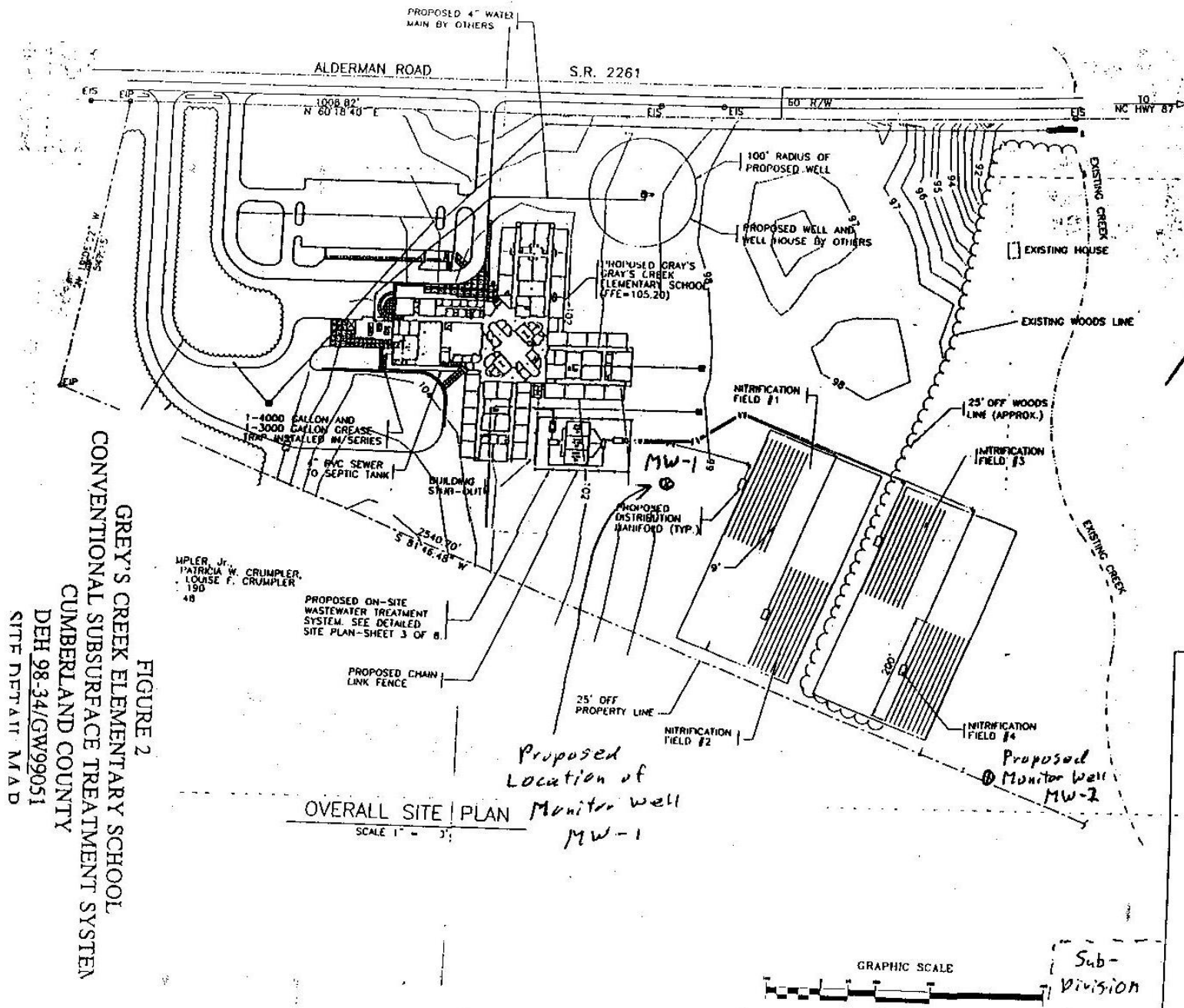
Ω **Monitoring well #2**

- **Nitrate - 33.4 mg/l - 4/15/03**
- **Nitrate - 61.2 mg/l - 6/2/03**
- **Nitrate - 37.26 mg/l - 6/16/03**

Ω **Samples were taken at some of the wells**

Ω **Sand filter effluent samples taken**

- **Nitrate - 84.4 mg/l - 5/12/03**



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Suggested Actions by the Section or Health Department

- Ω Modify the permit to require a groundwater Comprehensive Site Assessment report**
- Ω Suspend the operation permit**
- Ω Require pump and haul until the system has been repaired**

Actions Taken by School BOE

- Ω Hired Environmental Hydrogeological Consultants, Inc to conduct the Comprehensive Site Assessment report**
- Ω Requested Bob Deweese with DPI to revise the plans for the existing sand filter and drainfields**

Results of Comprehensive Site Assessment Report

- ⌚ **Groundwater flow direction appears to be nearly due east, toward southeastern corner of property**
- ⌚ **High concentrations of Nitrate-N are down gradient from the wastewater distribution field in the estimated direction of groundwater flow**

3. OWNER: Cumberland Co. School System
 Address 810 Gillespie St
 (Street or Route No.)
Fayetteville NC 28306
 City or Town State Zip Code
(910)-678-2651
 Area code- Phone number

4. DATE DRILLED 30 JUN 03
 5. TOTAL DEPTH: 23-FT
 6. DOES WELL REPLACE EXISTING WELL? YES NO
 7. STATIC WATER LEVEL Below Top of Casing: 16 FT.
 (Use "+" if Above Top of Casing)
 8. TOP OF CASING IS 2.5 FT. Above Land Surface*
 *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
 9. YIELD (gpm): > 1gpm METHOD OF TEST bailey
 10. WATER ZONES (depth):

11. DISINFECTION: Type none Amount _____
 12. CASING: Wall Thickness _____

From	Depth	To	Diameter	or Weight/Ft.	Material
From <u>2.5'</u>	Depth <u>13'</u>	To <u>13'</u>	Diameter <u>2-in</u>	or Weight/Ft. <u>Sch 40</u>	Material <u>PVC</u>
From _____	Depth _____	To _____	Diameter _____	or Weight/Ft. _____	Material _____
From _____	Depth _____	To _____	Diameter _____	or Weight/Ft. _____	Material _____

13. GROUT: Method _____

From	Depth	To	Material	Method
From <u>surf</u>	Depth <u>6</u>	To <u>6</u>	Material <u>Portland No 1</u>	Method <u>Pour</u>
From <u>6</u>	Depth <u>11</u>	To <u>11</u>	Material <u>Bentonite Pellets</u>	Method <u>Pour</u>

14. SCREEN: Material _____

From	Depth	To	Diameter	Slot Size	Material
From <u>13'</u>	Depth <u>23'</u>	To <u>23'</u>	Diameter <u>2-in</u>	Slot Size <u>0.010 in.</u>	Material <u>PVC</u>
From _____	Depth _____	To _____	Diameter _____	Slot Size _____	Material _____

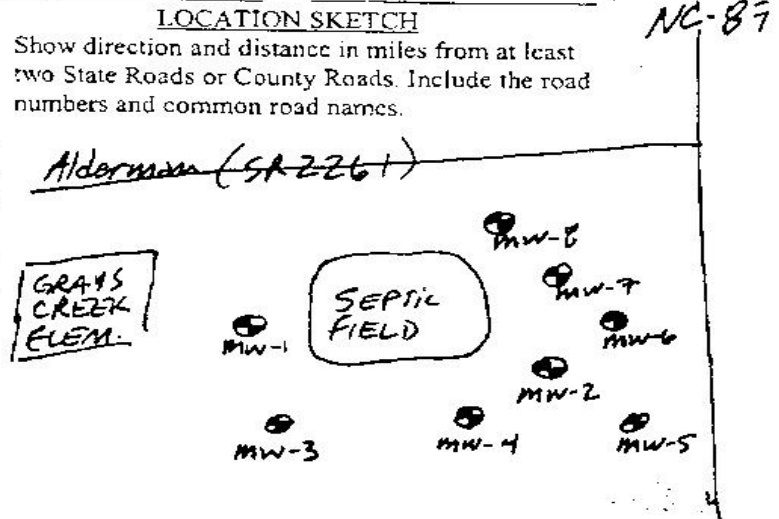
15. SAND/GRAVEL PACK: Material _____

From	Depth	To	Size	Material
From <u>11'</u>	Depth <u>23'</u>	To <u>23'</u>	Size <u>Med</u>	Material <u>Qtz Sand</u>
From _____	Depth _____	To _____	Size _____	Material _____

16. REMARKS: _____
 I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER
Kenneth Brown 22 JUL 03
 SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Latitude/longitude of well location
N34° 53' 43.5" x W78° 51' 24.7"
 (degrees/minutes/seconds)
 Latitude/longitude source: GPS Topographic map
 (check box) computer program
 DEPTH DRILLING LOG

From	To	Formation Description
0'	3'	Brown Clay/Silt/fine sand
3'	2'	lt Tan/yellow mottled
		fn sandy SILT/CLAY
9'	17'	lt Tan/yellow mottled
		fn-MD-CSE SAND
		(variable text.)
17'	23'	white fn-MD SAND.
		23' Boring terminated



Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC
 27699-1636 Phone No. (919) 733-3221, within 30 days. GW-1 REV. 07/2001

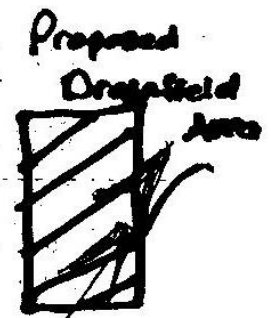
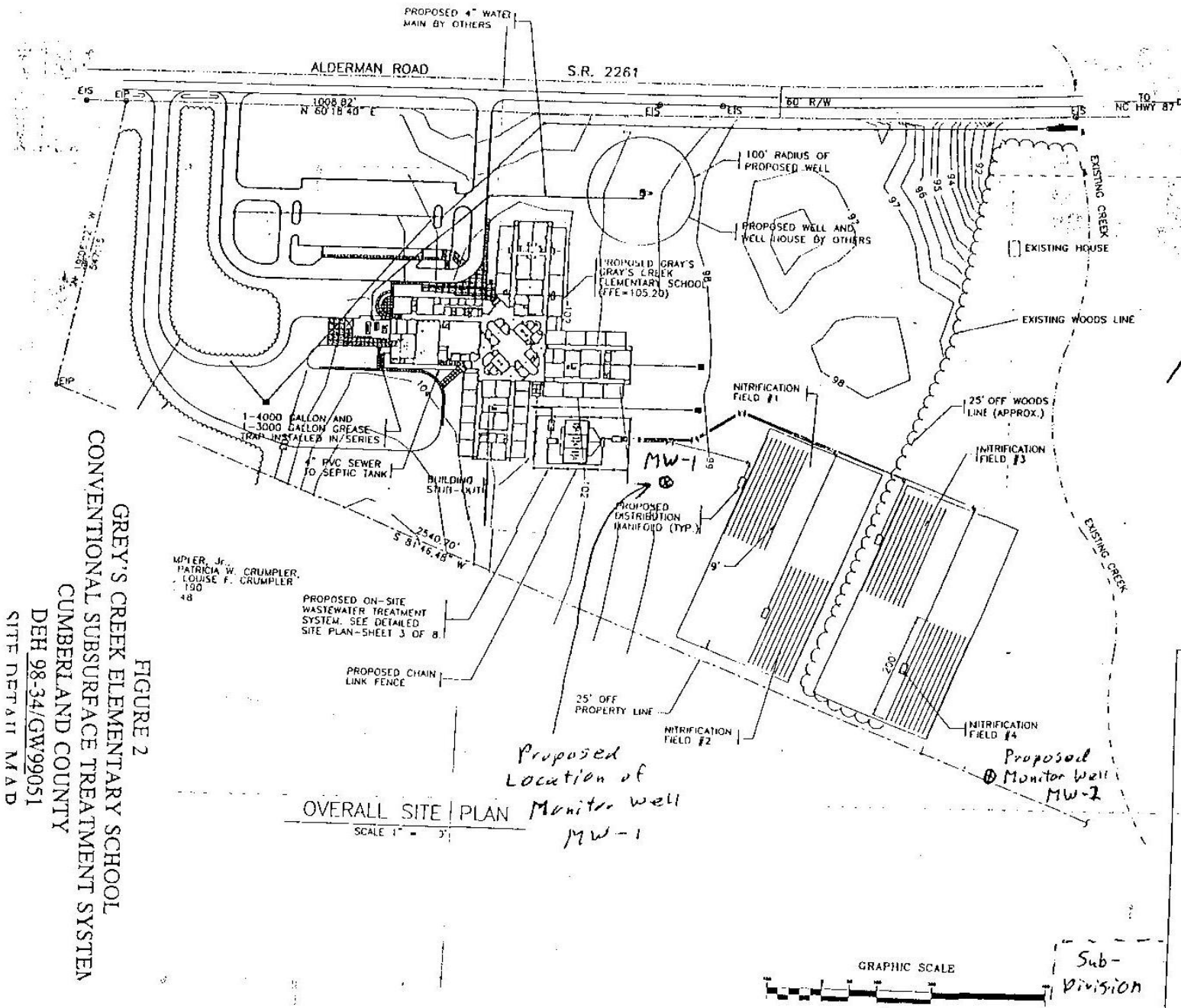
Modifications to Recirculating Sand Filter

- ∞ **Increasing storage in the underdrain collection system**
- ∞ **Increase storage in the recirculation tank**
- ∞ **Add a new recirculation line from the sand filter dosing pump to the effluent end of the septic tank**
- ∞ **Results - no significant reduction in nitrate in sand filter effluent**



Next Step

- Ω **Find a new location for the drainfields**
- Ω **Use a low pressure pipe distribution method for the new drainfields**



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SITE DEPT. I M.A.D.

Current System Performance

- Ω **System was installed in Summer 2005**
- Ω **Had to rebuild existing sand filters**
 - **wrong size sand**
 - **only 4 inches of gravel in bottom of filter**
- Ω **Just started recirculating effluent through sand filters middle of October**
- Ω **First sampling in November**

Lessons Learned

- ⌚ **Everything was done correctly during review: pretreatment, groundwater mounding analysis, etc**
- ⌚ **Pretreatment doesn't always work as well as anticipated**
- ⌚ **Pressure distribution of effluent (not with a pressure manifold) should be considered for large systems**