



FINAL TECHNICAL REPORT 4002011
May 1998 – February 1999

FIELD EVALUATION OF THE IONIX STATIC ELIMINATOR

PREPARED BY

PARESH PUROHIT, Project Engineer

CONDUCTED BY

GREG KONWINSKI, Project Coordinator
PARESH PUROHIT, Project Engineer

NICOR TECHNOLOGIES
1784 FERRY ROAD
NAPERVILLE, IL 60563
(630) 983-8676

INTRODUCTION

The natural gas industry has long realized the benefits associated with the use of polyethylene pipe in their distribution systems. In the 1990's nearly 30,000 miles of new plastic pipe is installed yearly by natural gas companies in the continental United States. In addition to being easier to join and handle, the use of plastic pipe eliminates the need for controlling corrosion, which can deteriorate steel and cast iron pipes. Because of these advantages, local gas companies have installed more than 500,000 miles of plastic pipe out of a national gas distribution piping system comprised of 1.6 million miles. Although other plastic materials are available, the predominant choice across the nation remains polyethylene (PE) for mains and services.

One disadvantage, however is that PE piping systems are susceptible to problems caused by static electricity. The buildup of static electricity on the inside walls of PE pipe occurs when the gas and particulate matter flow through the PE pipe. Electrons are displaced from one molecule to another due to friction. Because PE pipe possesses a high electrical resistivity, these charges accumulate in varying degrees at locations down the length of the pipe.

Research results seem to indicate that under impressed voltages, the dielectric strength of the materials tend to break down. If sufficiently high voltages are impressed, the break down occurs rapidly and manifests itself as a pinhole through the wall thickness of the pipe. If smaller voltages are impressed over a longer period of time, there is a progressive breakdown, which also tends to create a pinhole through the pipe wall.

Current technologies and guidelines are aimed at minimizing static buildup near open trenches and points where excavation damage occurs. However, static electricity still presents a serious threat to safety, since inside wall static charges can cause arc-induced ignitions, especially in environments where the gas is escaping to the atmosphere.

Consequently, UMAC, Inc., in collaboration with Ionix Technologies, Inc., developed a device, which eliminates static electricity on the inside walls. The Ionix membrane technology reduces the surface resistivity of both the gas and pipe wall, thus preventing static buildup on the inside walls of the pipe during operation. Consequently, since there is no accumulation of electrons on the interior wall, the likelihood of arcing will be greatly reduced or entirely eliminated.

FIELD TEST DESCRIPTION

The field test was devised to take place in two separate phases. The first phase involved installing the Ionix unit on a plastic distribution system supplied by a single regulator station to determine whether the filter would be able to eliminate the static build up on the inside of the pipe. The second phase allowed co-mixing to occur, by allowing one regulator station to supply "treated" gas, while the second regulator station supplied "untreated" gas. For both tests a 6" nozzle Ionix filter was used. This specific unit is capable of handling flows up to 950,000 SCFH.

The Nicor Gas distribution systems selected for this particular field evaluation was comprised of 0.5 miles of 1" PE, 10 miles of 2" PE and, 4.63 miles of 4" PE. Two system regulator stations, operating at 60 psi previously fed the system (see Figure 1 & 2). For the first phase of testing the secondary regulator station was backed off to an outlet pressure of 45 psi, in order to ensure a one way feed and that the Ionix membrane "treated" the entire gas volume entering the distribution system. The filter was installed down stream of the primary regulator station at a point where the distribution system transitioned from steel to PE.

Initial readings were taken at four sites selected downstream of the filter installation site. The exact locations of the four test sites, with respect to the filter installation site, are illustrated in Figure 2. The initial readings were taken on the service riser, where the service exits the ground, just before the tie-in to the customer's meter. The service riser was first thoroughly wiped clean with a rag and an anti-static solution to dissipate any charges that may have been built up on the outside of the service riser. The

voltage built up on the inside of the PE pipe were measured using an Anderson Electronics Model DCA 120 voltmeter.

Natural gas was allowed to flow thorough the filter assembly for two days to purge the distribution system of “untreated” gas, which ensured the gas contained in the system had passed thorough the Ionix unit. Daily readings were taken at each of the four test sites for a period of two weeks. Thereafter, monitoring continued on a weekly basis for a period of 60 days.

After the completion of the first phase, the secondary regulator station, previously backed off to feed at an outlet pressure of 45psi, was re-set to feed at its normal 60psi outlet. Natural gas was allowed to flow through the selected PE pipe distribution system for a period of four days, to allow for sufficient co-mixing of the “treated” and “untreated” gas to take place. Daily readings were taken at each of the four test sites for a period of two weeks. Thereafter, readings were taken on a weekly basis for a period of 30 days.

DESCRIPTION OF UNIT INSTALLATION

The 6" nozzle size Ionix unit (SGFTJR6) was initially assembled at Nicor Gas' Crystal Lake facility (See Photograph 1). Once the assembly was completed and pressure tested for leaks, the prefabricated unit assembly was taken out to the installation site. At the time of the installation, two stops were dropped on either side of the existing 4" PE distribution pipe and the existing section of PE main was removed. Next, the unit assembly was electro-fused in the place of the old pipe (see Photograph 2). After allowing sufficient time for cooling, the bypass valve was opened and the gas allowed to flow through the new pipe, bypassing the Ionix unit. At this point, the Ionix filter membrane was placed within the casing (see Photograph 3), after which the inlet and outlet valves were opened and bypass valve closed, to initiate gas flow through the Ionix Anti Static Unit.



Photograph 1



Photograph 2



Photograph 3

FIELD TEST RESULTS AND DISCUSSION

Phase I Results

Results of the first phase are listed in Table 1, below. The initial readings, taken on May 27, 1998, indicate a static voltage reading of -500V, -400V, -300V and -300V, respectively at each of the four test sites. As shown in Chart 1, the static electricity was dissipated within approximately 4 days of the Ionix filter installation. The time frame in which the charges were dissipated was anticipated, due in part to relatively low flow rates through the distribution system of approximately 20,000 SCFH, during the summer months.

The installation of the Ionix Static Filter reduced the resistivity of the gas flowing through the unit, effectively preventing static build up on the inside of the PE pipe wall. This reduction in static build up may reduce the chance of pinholing and arc-induced ignition at excavation sites and during repair of a hit PE mains, thus reducing the potential of unintended natural gas ignition, risk to personnel working on site and potential property damage.

Date	Site 1 Rdg. (V)	Site 2 Rdg. (V)	Site 3 Rdg. (V)	Site 4 Rdg. (V)
		Initial Reading		
5/27/98	-500	-400	-300	-300
		Daily Reading		
6/4/98	-400	-100	-300	-400
6/5/98	-400	-200	-100	-100
6/8/98	0	0	0	0
6/9/98	0	0	0	0
6/10/98*	-200	-100	-100	-100
6/11/98*	-100	-100	-100	-100
6/12/98	0	0	0	0
6/15/98	0	0	0	0
6/16/98	0	0	0	0
6/17/98	0	0	0	0
6/18/98	0	0	0	0
6/19/98	0	0	0	0
6/22/98	0	0	0	0
6/29/98	0	0	0	0
7/7/98	0	0	0	0
7/10/98	0	0	0	0
7/20/98	0	0	0	0
7/27/98	0	0	0	0
8/4/98	0	0	0	0

Table 1: Daily readings taken at test sites

- * This static build up may have been a result of one of two factors. The service risers could not be completely dried due to rain. The secondary regulator station, previously backed off to a pressure of 45 psi, may have kicked on due to the upstream pressure dropping below 45 psi.

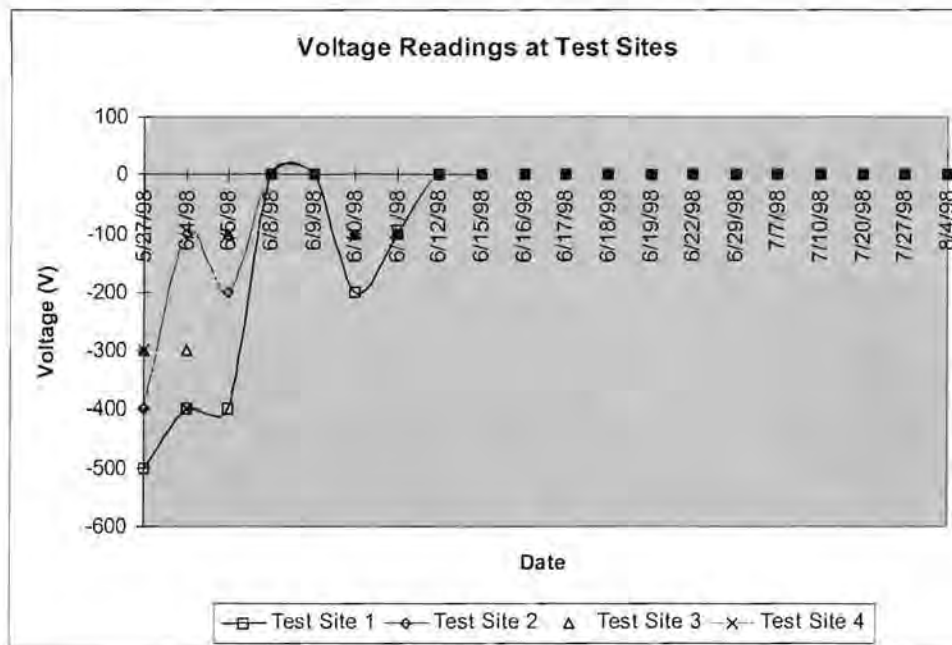


Chart 1: Daily voltage readings at test sites by date

Phase II Results

Results of the second phase of testing are listed in Table 2, below. The initial readings, taken on August 4, 1998, at the conclusion of the first phase of testing, indicated readings of 0V at all four of the test sites. As table 2 indicates, static readings increased to values close to initial readings, recorded prior to the filter being installed during the second phase of the test (-500V, -400V, -300V and -300V, respectively at each of the four test sites).

Based on these results it may be concluded that in order to effectively eliminate static build up on a PE pipe distribution system, an Ionix Static Filter must be installed down-stream of every regulator station feeding the individual distribution system. It must also be noted that, during the winter months the secondary regulator is the primary feed to the selected PE distribution system. That is, as the load increased during the colder months, sufficient pressure drop takes place within the northern part of the distribution system, fed by the primary regulator, forcing the secondary regulator to feed the remaining system in the southern part of the system, which has a smaller load.

Date	Site 1 Rdg. (V)	Site 2 Rdg. (V)	Site 3 Rdg. (V)	Site 4 Rdg. (V)
		Initial Reading**		
5/27/98	-500	-400	-300	-300
		Initial Reading***		
8/4/98	0	0	0	0
		Daily Readings		
10/9/98	-100	-200	-100	-100
10/12/98	-100	-100	-300	-200
10/13/98	-100	-300	-300	-200
10/14/98	-200	-100	-100	-100
10/15/98	-100	-400	-100	-200
10/16/98	-300	-400	-400	-300
10/19/98	-200	-300	-400	-400
10/20/98	-100	-200	-300	-300
10/21/98	-400	-400	-200	-400
10/22/98	-300	-400	-400	-400
10/23/98	-300	-300	-400	-400
10/29/98	-400	-400	-200	-300
11/6/98	-300	-300	-400	-400
11/16/98	-200	-300	-400	-400
11/20/98	-200	-400	-300	-400
11/25/98	-300	-300	-400	-400

Table 2: Daily Voltage (V) readings taken at test sites

** Initial readings at test points on distribution system taken before the installation of the Ionix Static Filter (see Table 1).

*** Initial reading at test points on distribution system taken at the conclusion of the first phase of testing.

CONCLUSION

The field testing of the Ionix Static Eliminator was conducted to answer two particular questions:

- Will the installation of an Ionix Static Filter membrane eliminate static build up on an existing PE distribution system, fed by a single regulator station?
- Will the installation of an Ionix Static Filter membrane eliminate static build up on an existing PE distribution system, fed by multiple regulator stations?

As results in Table 1 indicate, the Ionix Static Filter membrane effectively eliminated any existing static on the PE distribution system. It is also worth noting that, installed on a single-feed distribution system, the Ionix static filter membrane also prevented any future build up of static electricity on the existing PE distribution system.

However, the results in Table 2 indicate that when the Ionix Static Filter membrane is installed down stream of only one of the multiple regulator stations that are supplying gas to the distribution system, the static again increased to levels observed at the beginning of the test. That is, on a PE distribution system that is fed by multiple regulator stations, the Ionix Static Filter membrane must be installed down stream of every regulator station, so as to treat the gas, in order to eliminate static build up on the PE distribution system.

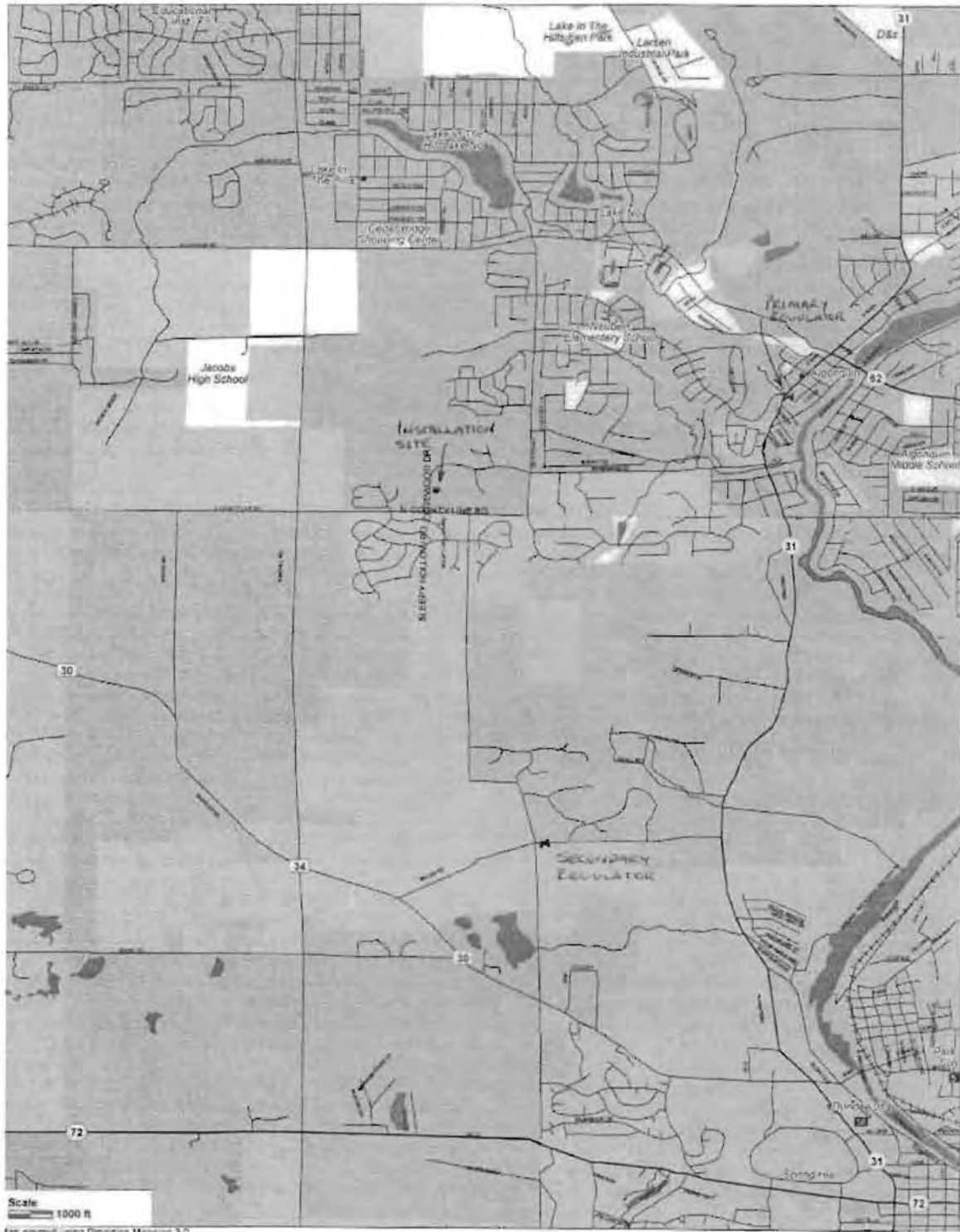
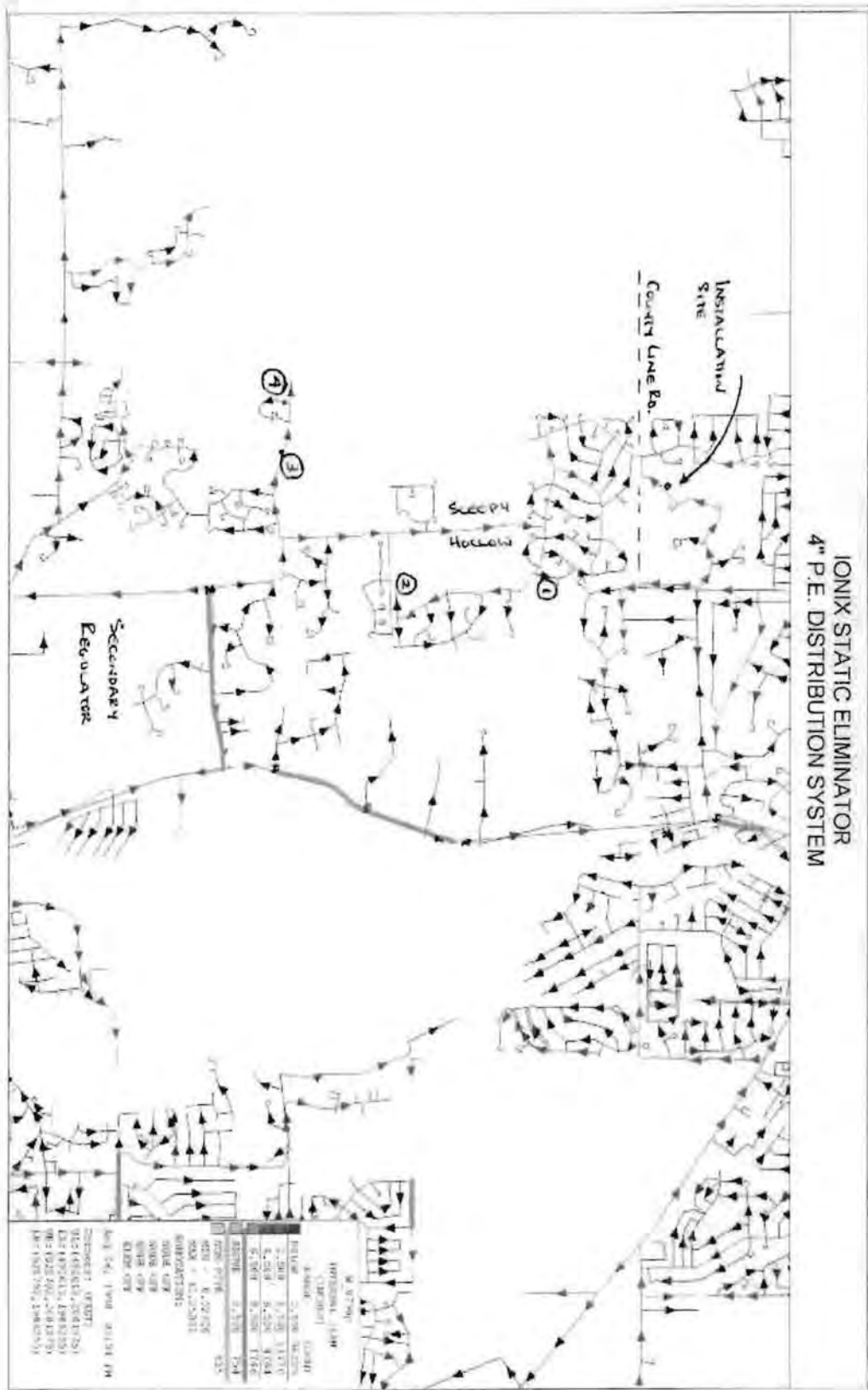


Figure 1: Area map of site selected for testing the Ionix Static Filter



IONIX STATIC ELIMINATOR 4" P.E. DISTRIBUTION SYSTEM

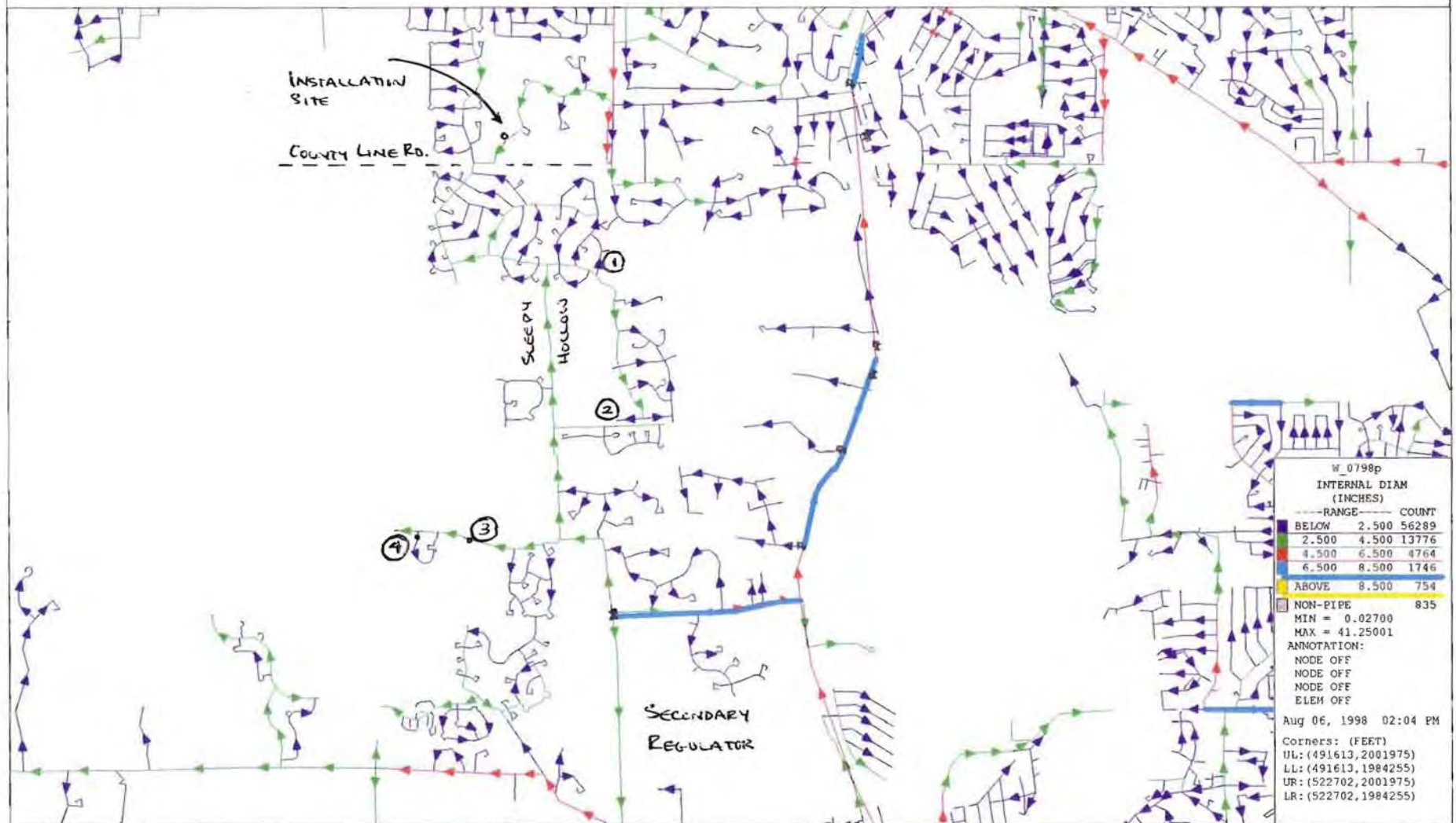


FIGURE 1

