

**COMPUTER GENERATED STATION LOCATION AND
RESPONSE MAPPING
FOR THE NANTUCKET FIRE DEPARTMENT**

Computer Response Mapping

Computer response mapping is provided to illustrate the road distances reached by responding apparatus traveling from the current fire station and four additional, possible sites at average speeds of 25 mph, 30 mph, and 40 mph. Insurance Services Office (ISO) recommendations also are provided.

The following technical information provides further understanding of the computer-generated response maps:

The computer maps are based on digitized representations of streets and roads within the Island of Nantucket area as prepared for the United States Census Bureau ("Tiger Maps").

The mapping is generally precise for the purposes at hand. In some cases, there may be newer build out areas not covered in the Census material. In the Tiger Map system, the original computerization divided all streets and roads into segments of specific lengths (called "links"). In some cases these links are not necessarily directly useable in the fire mapping program. At times, either when determining ISO distances or speed-time calculations, the computer-mapping program for fire coverage analysis may utilize a whole link where it should be using only a part. This is especially true when there are long "links", such as on major roads and highways where there tend to be fewer intersecting streets. In these instances, there can be occasional distance or time errors. These occur because the original links cannot be re-divided by the fire coverage area mapping software except in cases where the consultant recognizes these obvious errors, and make the adjustment manually. The errors are not significant in this Nantucket analysis of fire coverage and distance/time maps, because the distance and time segments typically used in the mapping are relatively short, with many intersecting streets, and normally coincide quite closely with Tiger Map links. Small errors may occur, and generally happen randomly and across the entire mapping area. The overall result is that the errors tend to be canceled out, and there is little, if any, effect on the main analysis. In the case of larger distances and/or time intervals, or the utilization of long links when only short distance/time intervals are desired, a certain amount of manual adjustment can and does occur. The effect is that all mapping distances and times are approximate; but for the most part, and based on our experience with many applications, the impacts of any discrepancies which might occur are considered to be insignificant.

- The U.S. Census Feature Classification Code describes street and road characteristics, and a mathematical matrix (ArcView Network Analyst) enables a calculation for driving time on each segment of a road-street network. For example, a primary, limited access road indicates 45 mph. A secondary connecting road indicates 35 mph, and local neighborhood roads indicate 25 mph.

Considering local street speed limits, the size and weight of fire vehicles, and accident liability considerations, careful review of response speed limits is essential. Very little research, if any, demonstrates that a few mph results in significantly less fire loss.

- ISO calls for an engine company within 1.5 miles of every “built-upon” area, and a ladder company within 2.5 miles of any area with five or more buildings of three stories or 35 feet or more in height. Typically, structures more than five miles from a fire station and areas without fire hydrants have extra insurance costs assigned to them
- NFPA Standard 1710 (“Standard for the Organization and Deployment of Fire Suppression Operation, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments”, 2010 edition) calls for a travel time of no more than 240 seconds for the fire due engine company and four responders, plus the entire first alarm assignment (approximately 15 personnel minimum) within 480 seconds, to 90% of annual fire calls.

Methodology Used for the Nantucket Project

On a base map of the island, the Emergency Response Locations were identified. I assigned them numbers only to shorten their titles on the map. The numbering was done clockwise and can be changed with no effect on the mapping project.

The following sites (Fire Department, Hospital, Police Department, Sheriff, and Water Works) were then located. From each of these five sites I did response distances covered in two, four, six, eight, ten, and greater than 10 minutes at averages of 25 mph, 30 mph, and 40 mph. ISO distance maps were also generated for the five sites. The following chart shows the percent of links covered for each of those times, for each of the five sites.

It was no trouble to run the distances for the ISO maps, even though they were not required.

The US Tiger files for my Nantucket maps contained 3239 links.

A Summary of the Percentage of Links Covered by Each of the Five Sites

Specific Location	NFD	Hospital	NPD	Sheriff	WWCO
Distance to farthest point in miles	12.36	13.01	12.37	13.40	12.20

Area Covered	# links	percent								
25mph 2 min	348	10.7	489	15.1	231	7.1	540	16.7	149	4.6
4 min	1057	32.6	1075	33.2	980	31.3	928	28.7	842	26.0
6 min	1577	48.7	1528	47.2	1529	47.2	1263	39.0	1471	45.4
8 min	1764	54.5	1822	56.3	1734	53.5	1701	52.5	1716	53.0
10 min	2077	64.1	1993	61.5	2047	63.2	1965	60.7	2015	62.2
30mph 2 min	484	14.9	638	19.7	349	10.8	619	19.1	227	7.0
4 min	1318	40.7	1246	38.5	1279	39.5	1080	33.3	1107	34.2
6 min	1698	52.4	1700	52.5	1676	51.7	1523	47.0	1658	51.2
8 min	2034	62.8	1968	60.8	1993	61.5	1943	60.0	1948	60.1
10 min	2391	73.8	2245	69.3	2367	73.1	2192	67.7	2393	73.9
40mph 2 min	792	24.5	849	26.2	699	21.6	783	24.2	474	14.6
4 min	1627	50.2	1580	48.8	1587	49.0	1332	41.1	1554	48.0
6 min	2034	62.8	1968	60.8	1993	61.5	1943	60.0	1948	60.1
8 min	2507	77.4	2381	73.5	2475	76.4	2295	70.9	2492	76.9
10 min	3027	93.5	2835	87.5	2995	92.5	2738	84.5	3060	94.5

In the above table, red indicates the highest percent of links covered from that specific location at the indicated average speed and time segment. A higher percent indicates more links covered.

My comments on these numbers, realizing that I have never visited Nantucket Island, may be skewed:

- The entire section of links above #4 Emergency Response Location (ERL) is included in the total number of links. No site can reach that general location in less than ten minutes.
- The low initial percentages from the Water Works are probably because of the several links needed to get out to Milestone Road.
- However, once out on the highway, being furthest east and closest to the links north of #4 ERL gave the Water Works higher percentages for the eight to ten minute runs at 30 mph and 40 mph.
- The initial high zero to two minute percentage from the Sheriff location is probably because of the high number of very short links in the immediate vicinity
- The Police Department site does not appear to offer any better coverage than the current Fire Department site.

The following addresses were used for the Emergency Response Locations:

- | | |
|----------------------------|-----------------------------|
| #1 ERL - 26 Gosnold Road | #6 ERL - 27 Wanoma Way |
| #2 ERL - 1 Henry Street | #7 ERL - 166 Surfside Road |
| #3 ERL - 12 North Road | #8 ERL - 326 Madaket Road |
| #4 ERL - 120 Wauwinet Road | #9 ERL - 137 Eel Point Road |
| #5 ERL - 115 Baxter Road | |

Two sets of the following 21 maps were generated for Nantucket Fire Department. (Numbers are on the back of each map.)

1. Nantucket Fire Department Base Map with water, named streets, sites of the 9 Emergency Response Locations, plus the Fire Department, the Hospital, the Police Department, the Sheriff Department, and the Water Works locations.
2. Response Coverage at avg 25 mph from the **Fire Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
3. Response Coverage at avg 30 mph from the **Fire Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
4. Response Coverage at avg 40 mph from the **Fire Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
5. **ISO Distances from the Fire Department Site.**
6. Response Coverage at avg 25 mph from the **Hospital Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
7. Response Coverage at avg 30 mph from the **Hospital Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
8. Response Coverage at avg 40 mph from the **Hospital Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
9. **ISO Distances from the Hospital Site**
10. Response Coverage at avg 25 mph from the **Police Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
11. Response Coverage at avg 30 mph from the **Police Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
12. Response Coverage at avg 40 mph from the **Police Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)
13. **ISO Distances from the Police Department Site**

14. Response Coverage at avg 25 mph from the **Sheriff Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

15. Response Coverage at avg 30 mph from the **Sheriff Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

16. Response Coverage at avg 40 mph from the **Sheriff Department Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

17. ISO Distances from the **Sheriff Department Site**

18. Response Coverage at avg 25 mph from the **Water Works Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

19. Response Coverage at avg 30 mph from the **Water Works Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

20. Response Coverage at avg 40 mph from the **Water Works Site** (0 to 2 minutes, 2 to 4 minutes, 4 to 6 minutes, 6 to 8 minutes, 8 to 10 minutes, and greater than 10 minutes)

21. ISO Distances from the **Water Works Site**

Nantucket Fire Department Base Map

Map Layers

— Streets

Water Area

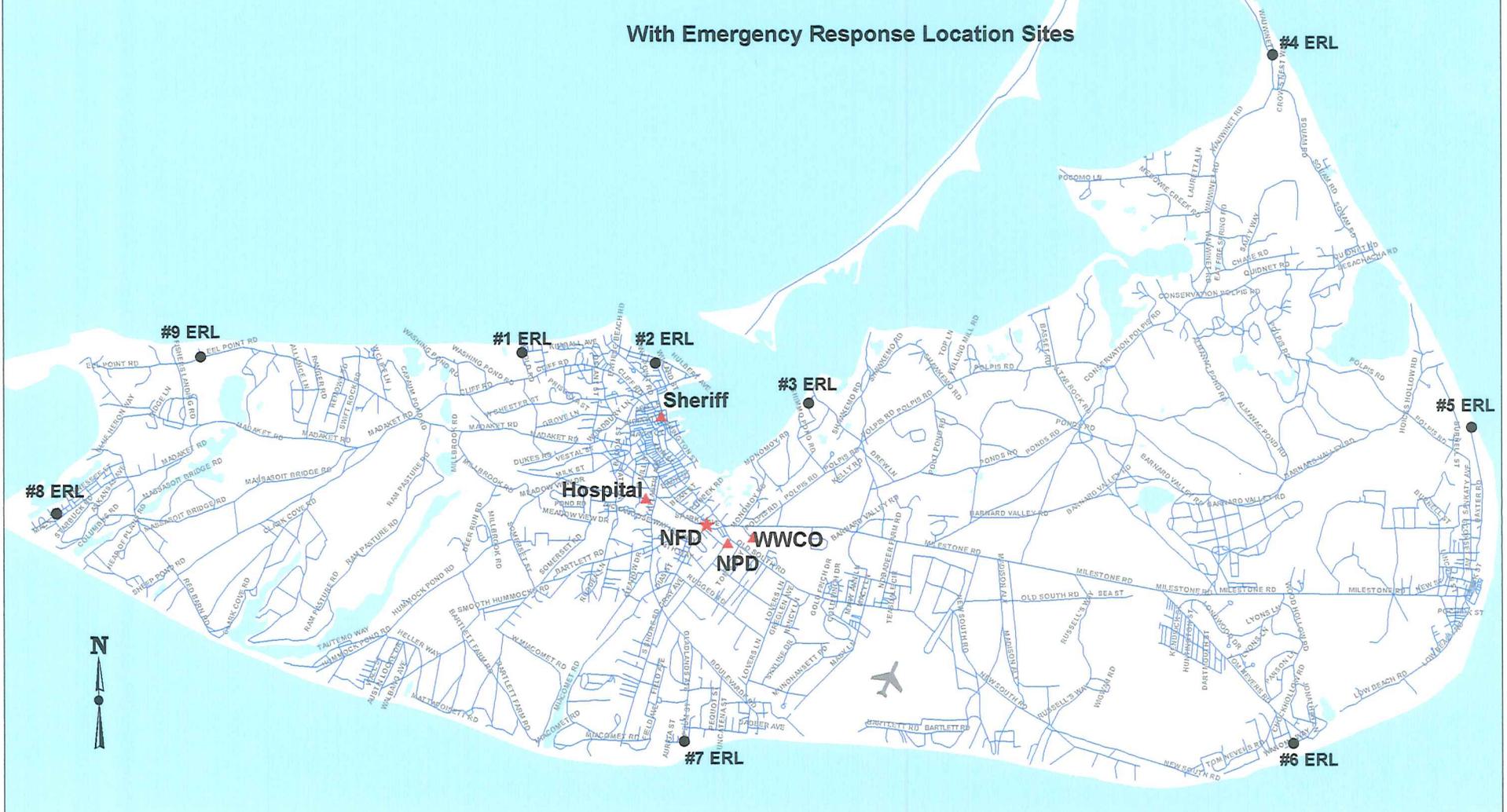
0 .90 1.8 2.7

Miles

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Nantucket Fire Department Base Map

With Emergency Response Location Sites



**Response Coverage at avg 25 mph
From Nantucket Fire Department**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

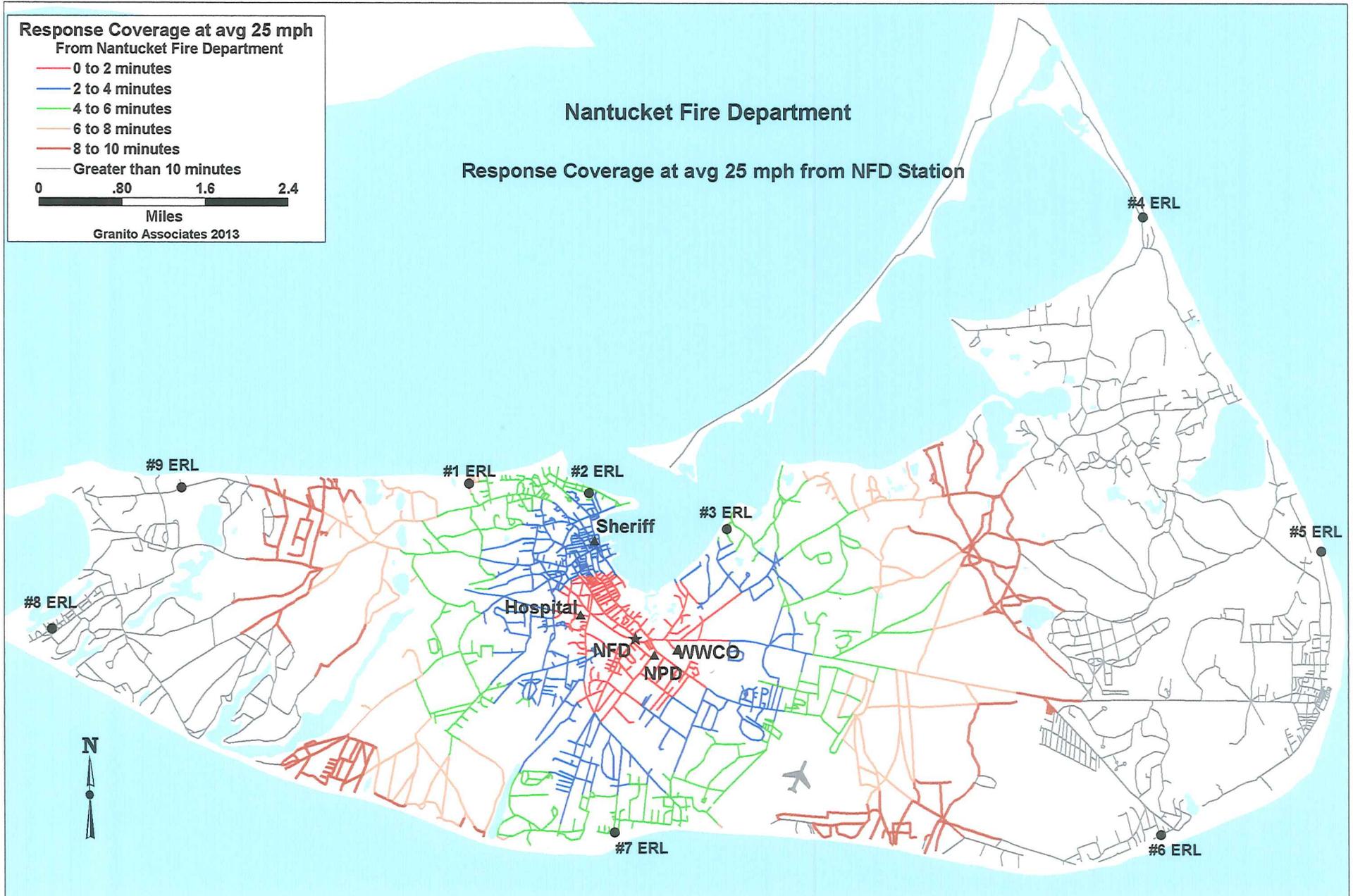
0 .80 1.6 2.4

Miles

Granito Associates 2013

Nantucket Fire Department

Response Coverage at avg 25 mph from NFD Station



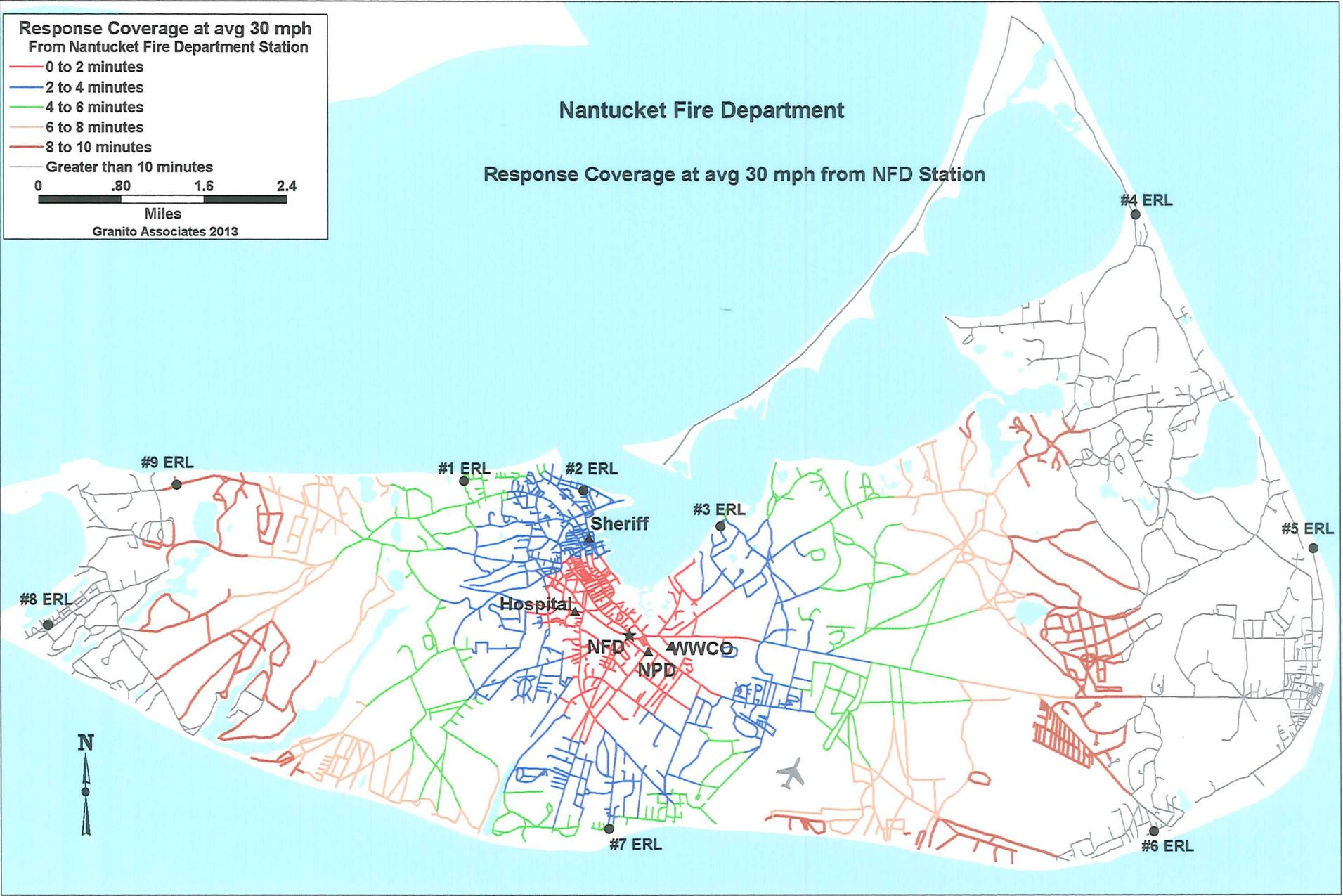
Nantucket Fire Department

Response Coverage at avg 30 mph from NFD Station

**Response Coverage at avg 30 mph
From Nantucket Fire Department Station**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

0 .80 1.6 2.4
Miles
Granito Associates 2013



**Response Coverage at avg 40 mph
From Nantucket Fire Department Station**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

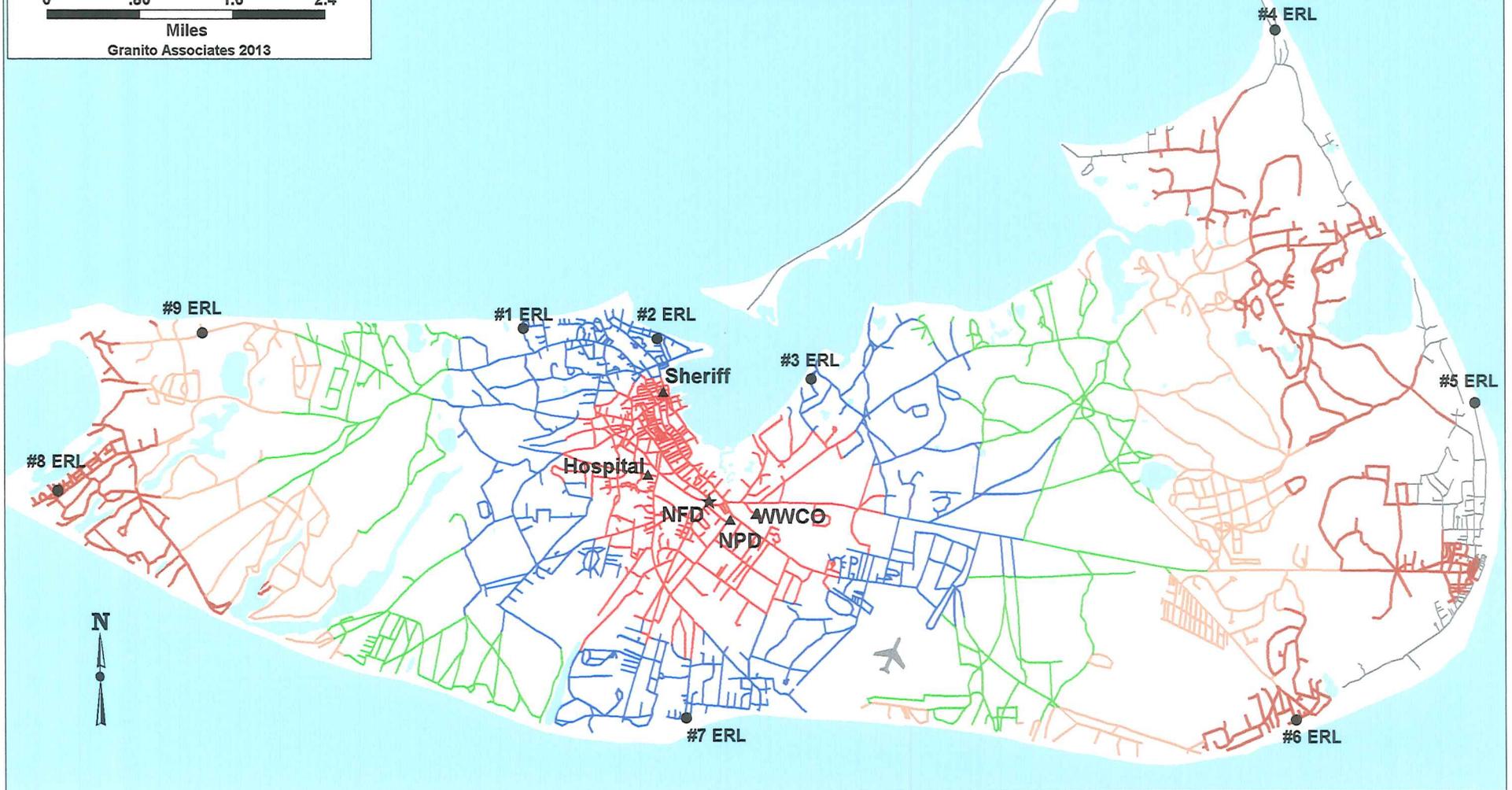
0 .80 1.6 2.4

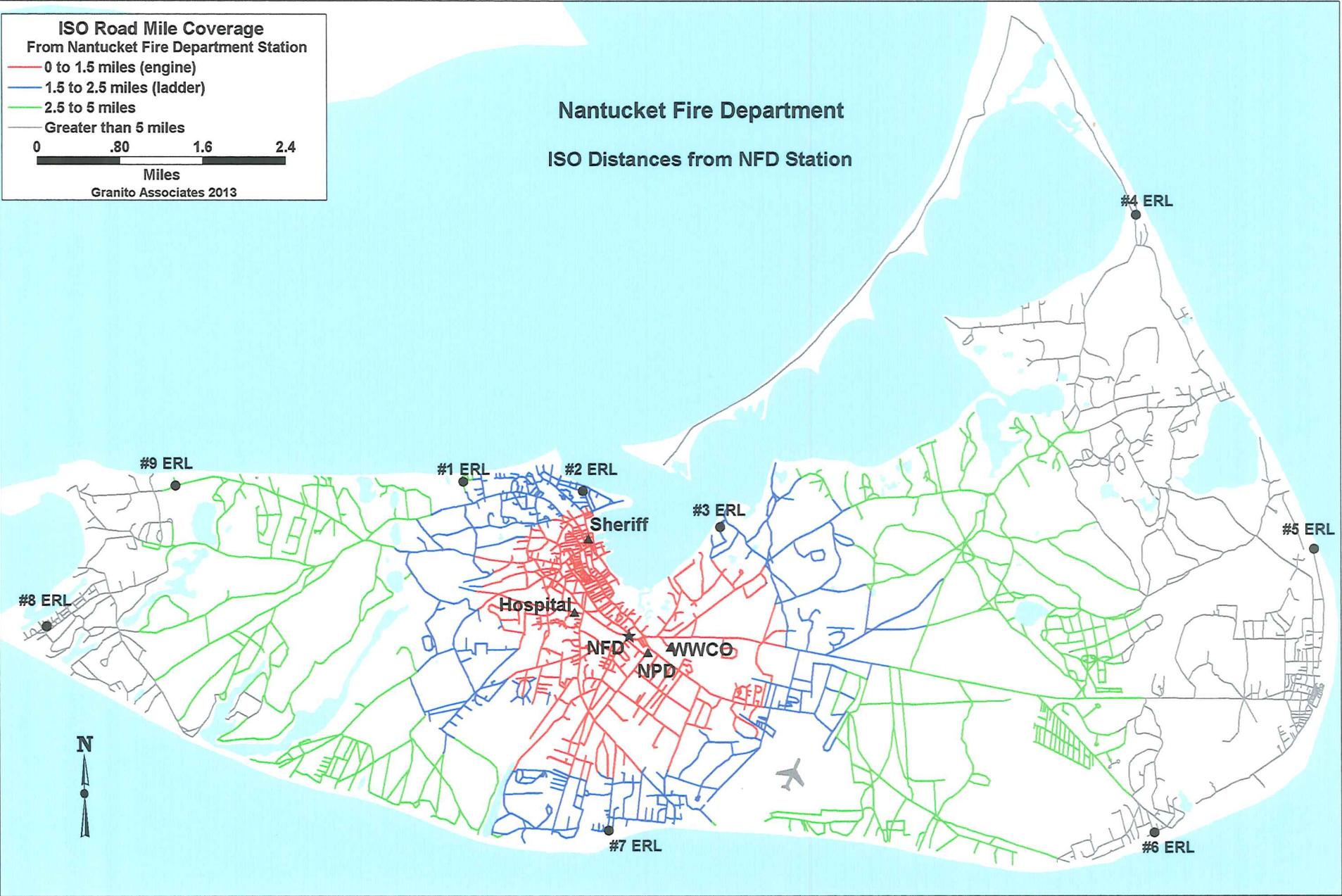
Miles

Granito Associates 2013

Nantucket Fire Department

Response Coverage at avg 40 mph from NFD Station





**Response Coverage at avg 25 mph
From the Hospital Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

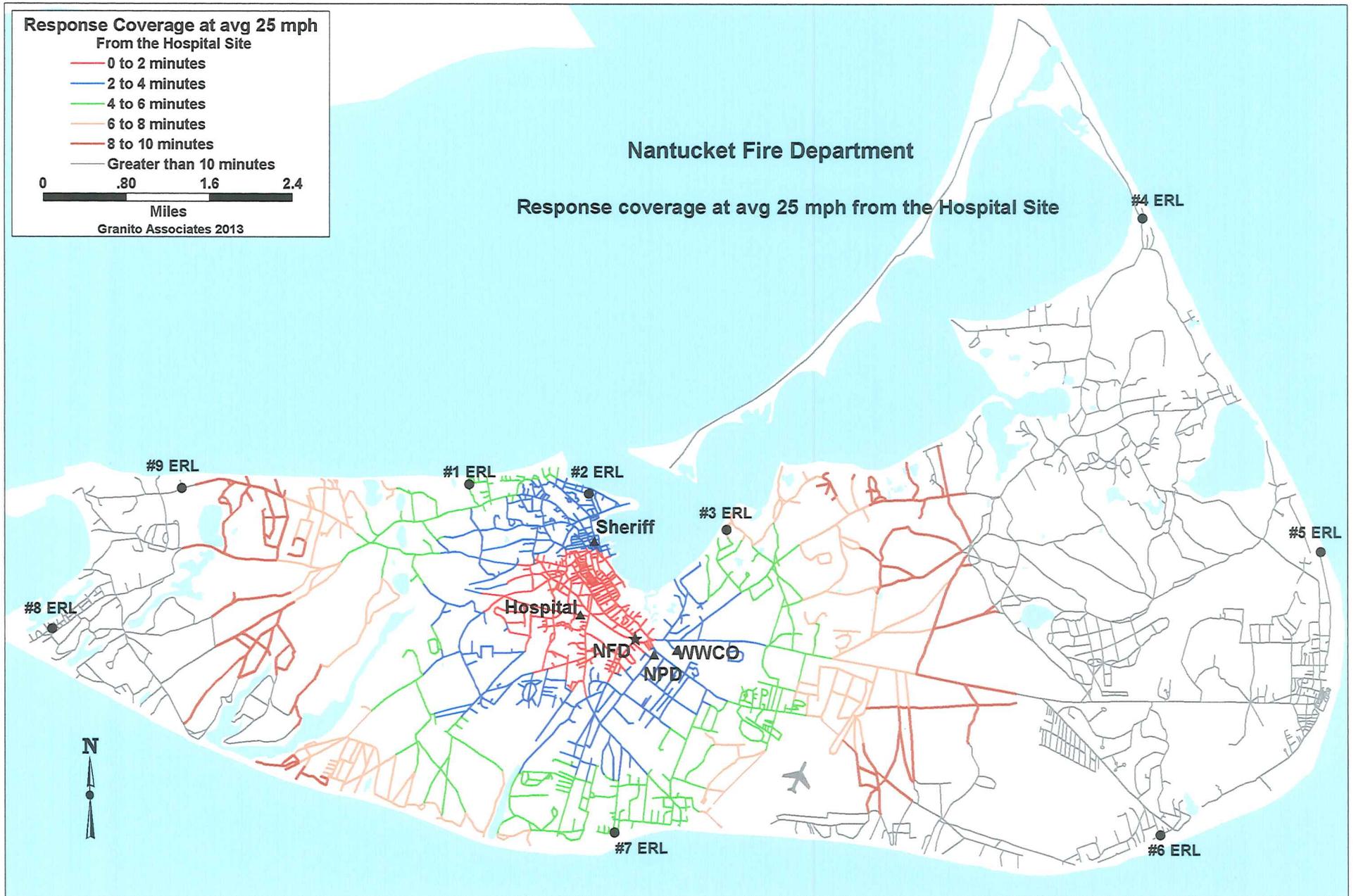
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response coverage at avg 25 mph from the Hospital Site



**Response Coverage at avg 30 mph
From the Hospital Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

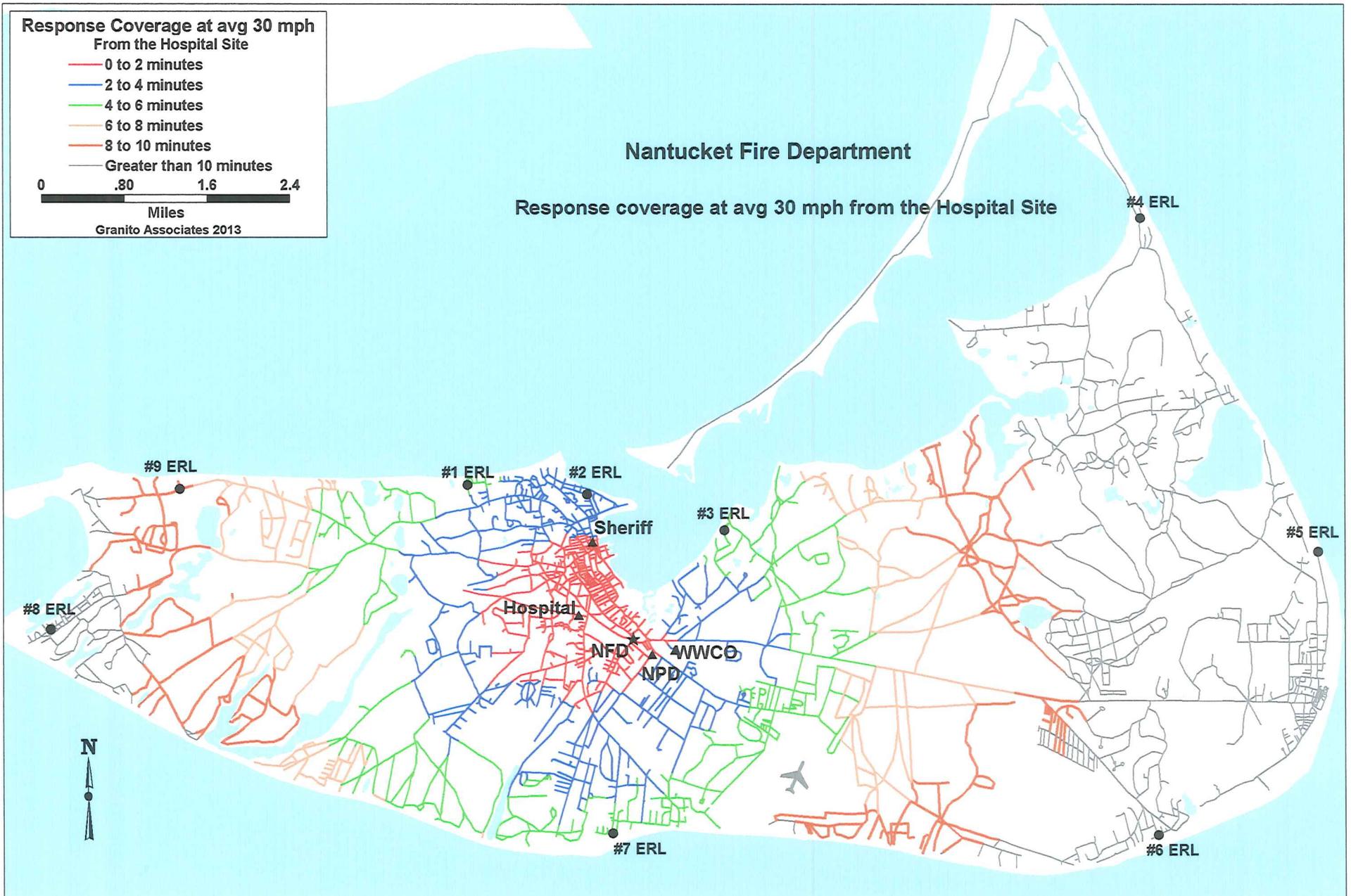
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response coverage at avg 30 mph from the Hospital Site



**Response Coverage at avg 40 mph
From the Hospital Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

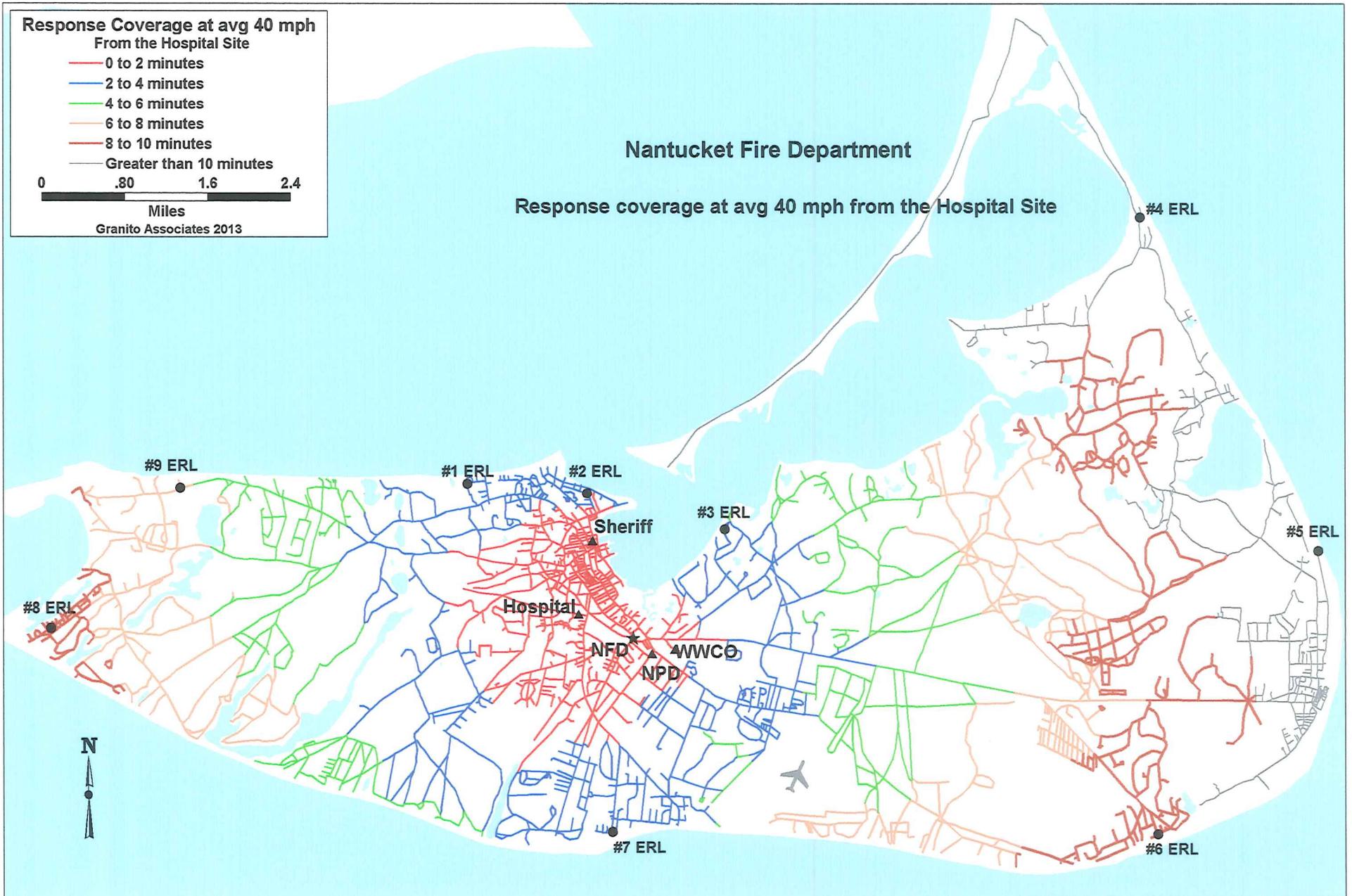
0 .80 1.6 2.4

Miles

Granito Associates 2013

Nantucket Fire Department

Response coverage at avg 40 mph from the Hospital Site



**ISO Road Mile Coverage
From the Hospital Site**

- 0 to 1.5 miles (engine)
- 1.5 to 2.5 miles (ladder)
- 2.5 to 5 miles
- Greater than 5 miles

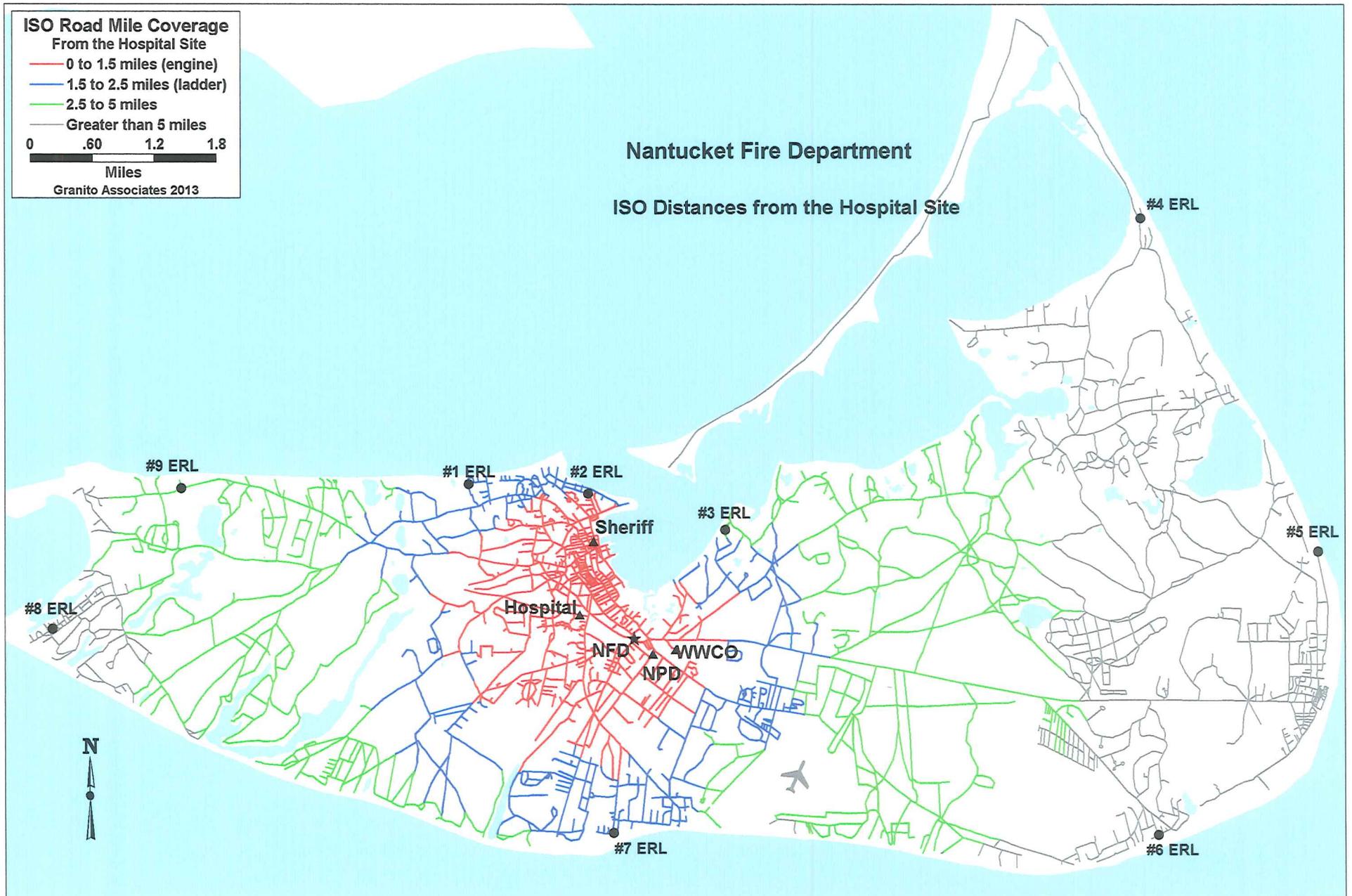
0 .60 1.2 1.8

Miles

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Nantucket Fire Department

ISO Distances from the Hospital Site



**Response Coverage at avg 25 mph
From the Nantucket Police Department Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

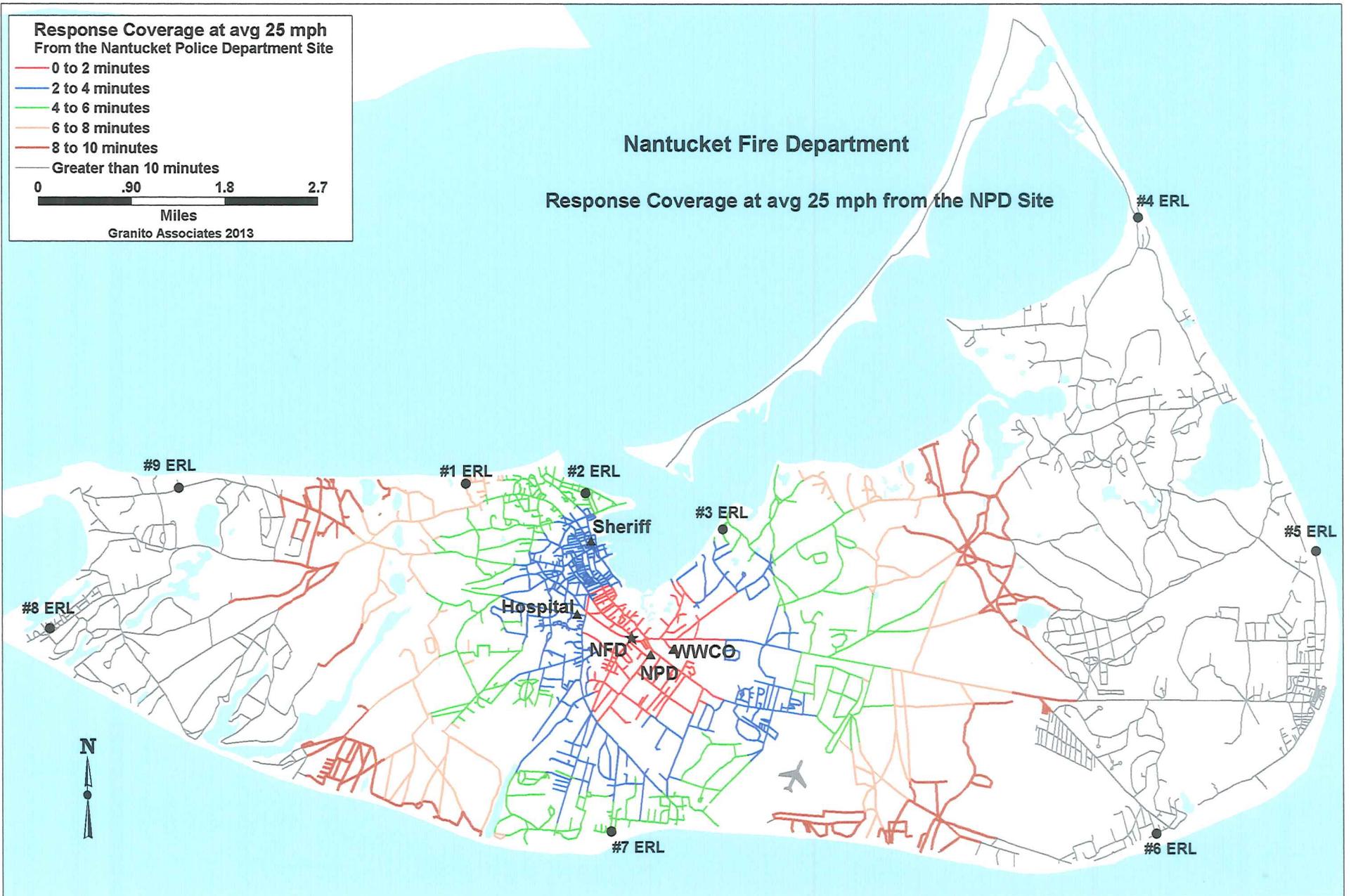
0 .90 1.8 2.7

Miles

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Nantucket Fire Department

Response Coverage at avg 25 mph from the NPD Site



**Response Coverage at avg 30 mph
From the Nantucket Police Department Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

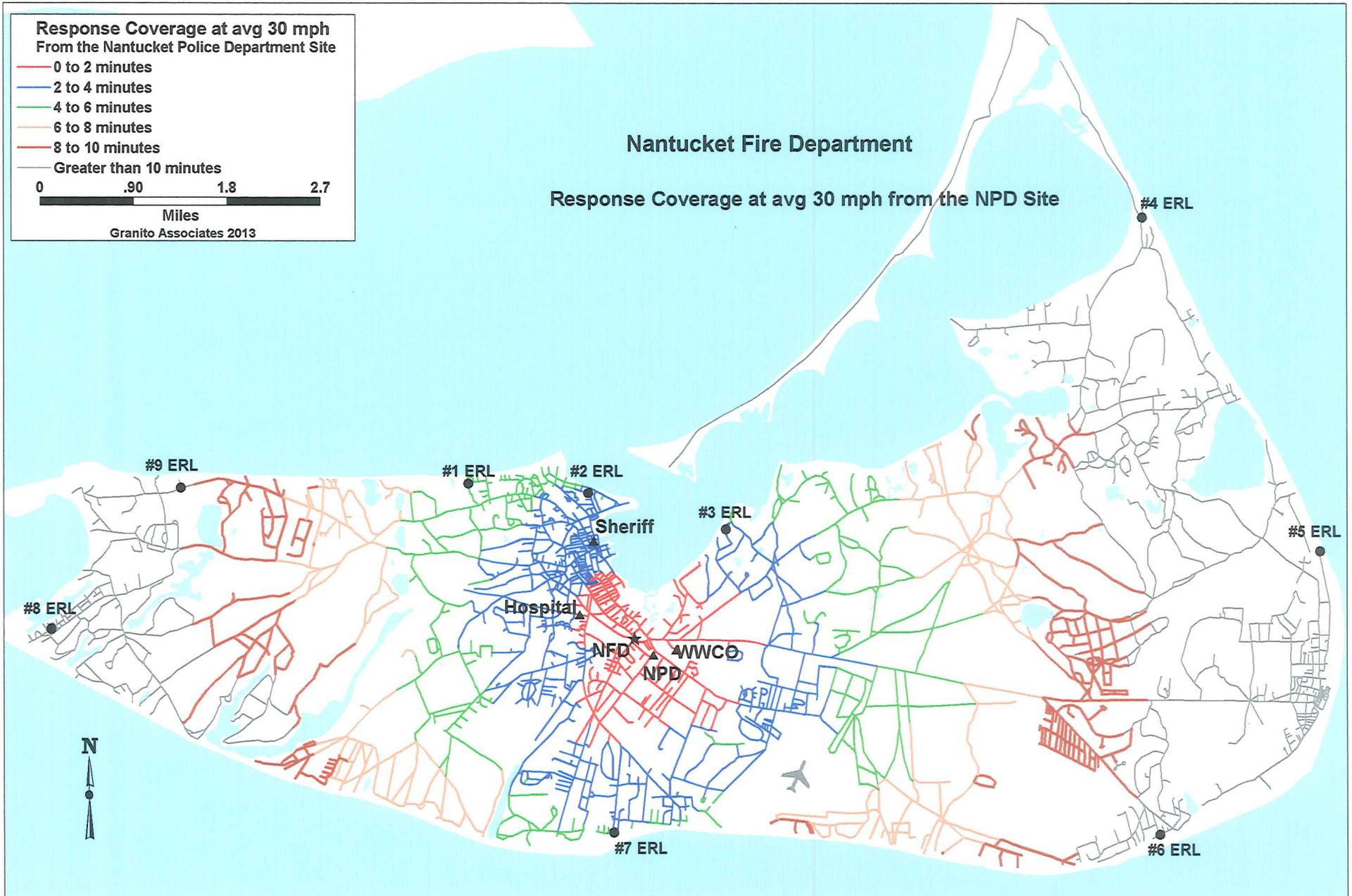
0 .90 1.8 2.7

Miles

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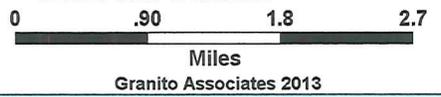
Nantucket Fire Department

Response Coverage at avg 30 mph from the NPD Site



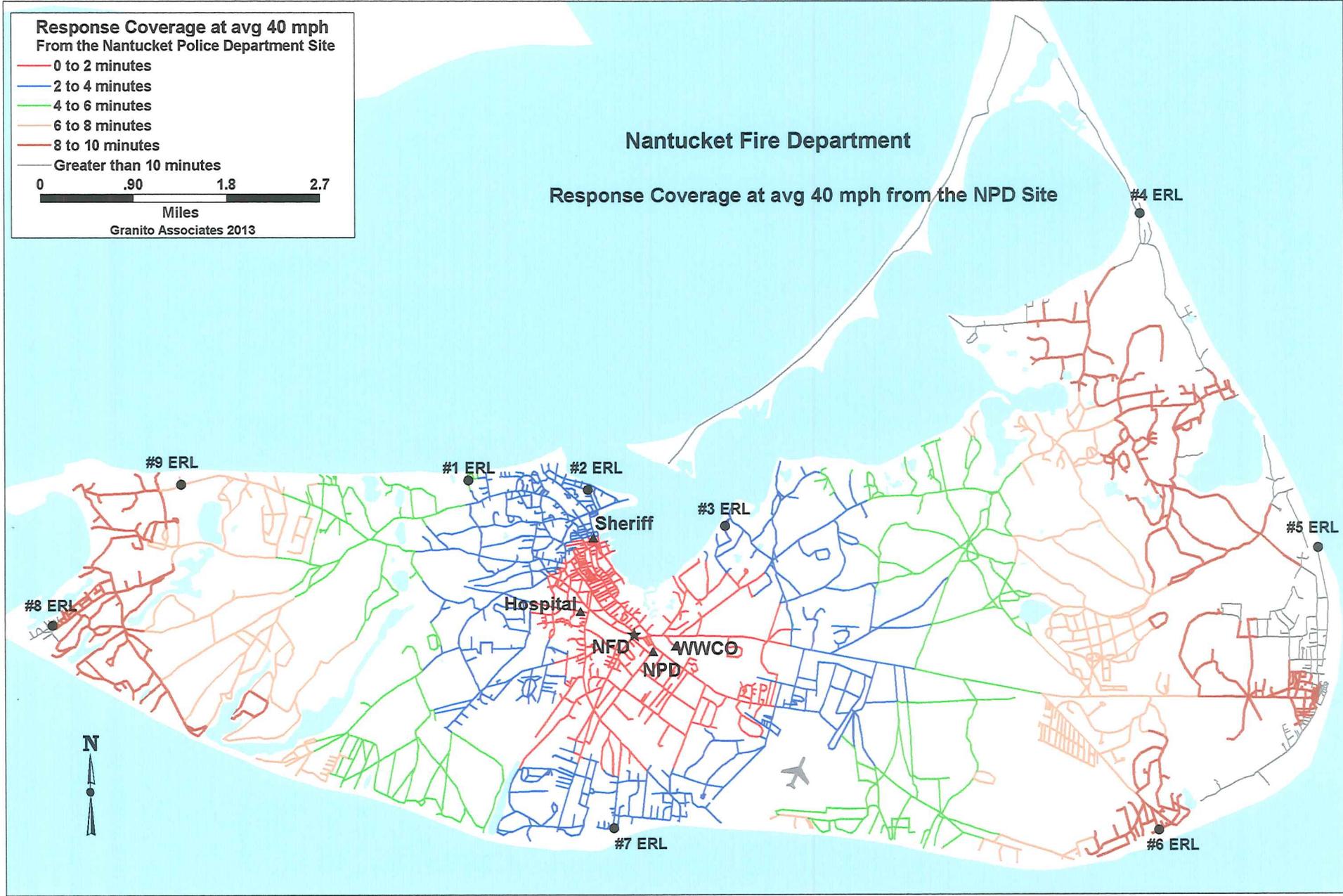
**Response Coverage at avg 40 mph
From the Nantucket Police Department Site**

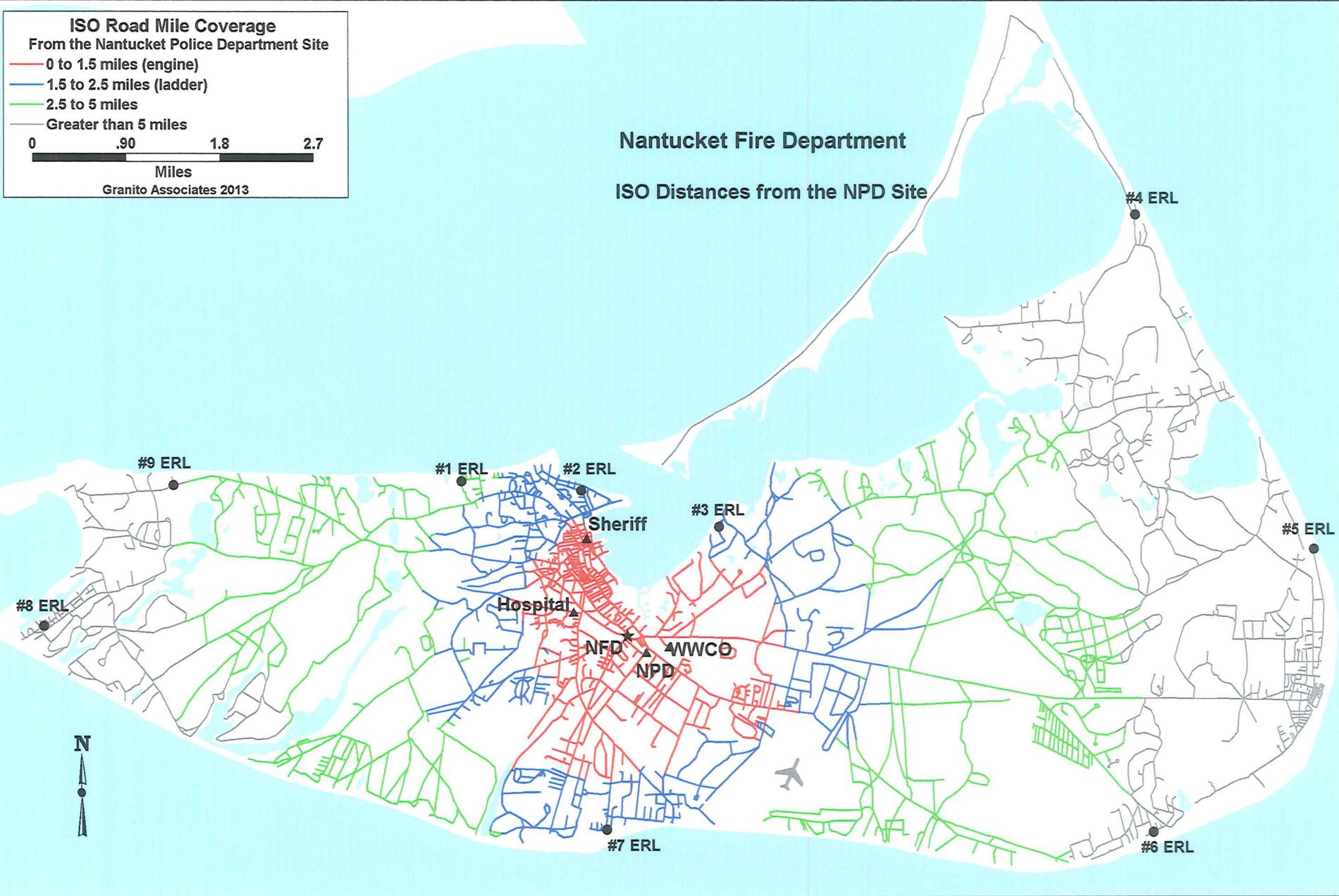
- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes



Nantucket Fire Department

Response Coverage at avg 40 mph from the NPD Site





**Response Coverage at avg 25 mph
From the Sheriff Department Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

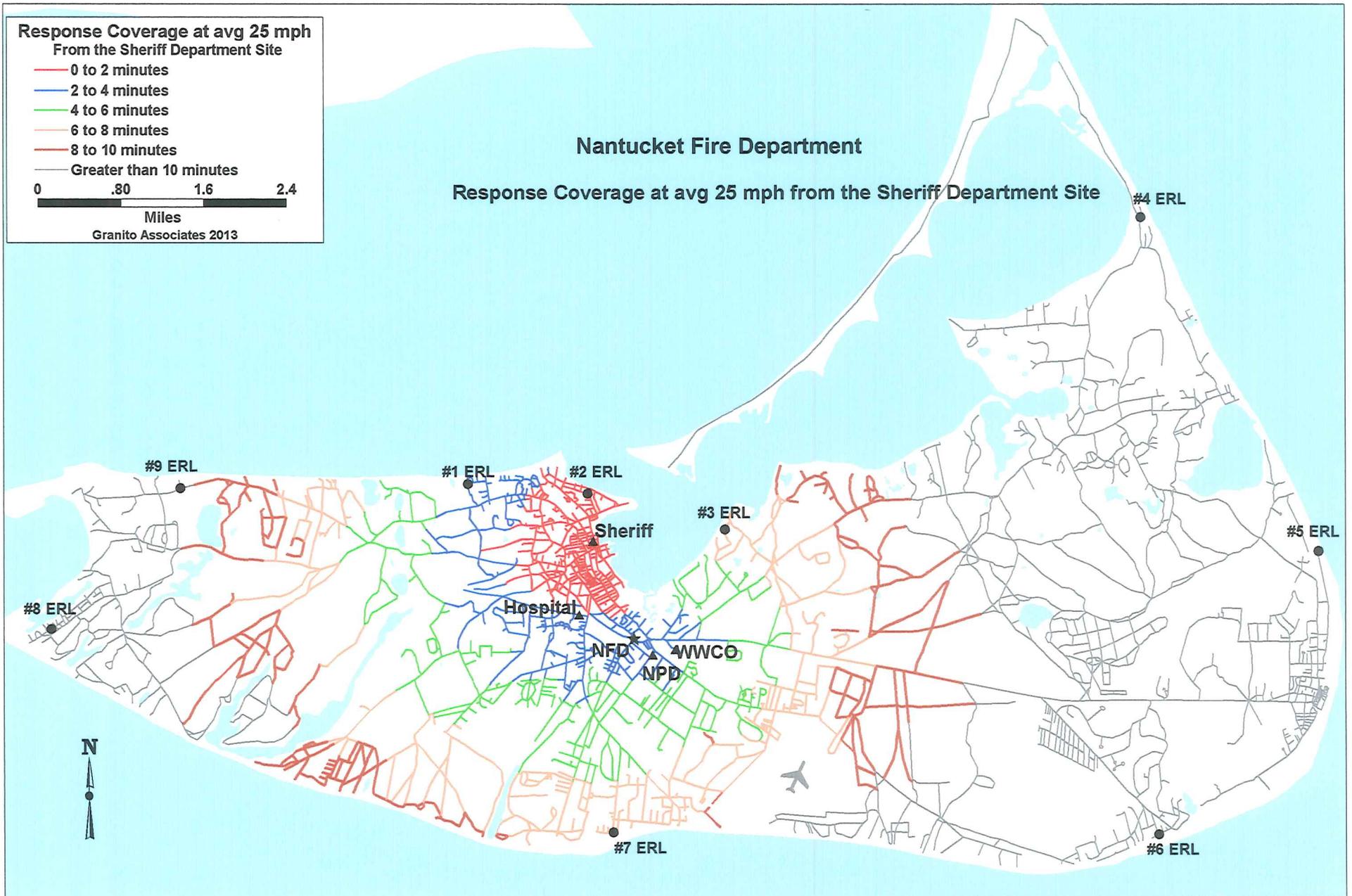
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response Coverage at avg 25 mph from the Sheriff Department Site



**Response Coverage at avg 30 mph
From the Sheriff Department Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

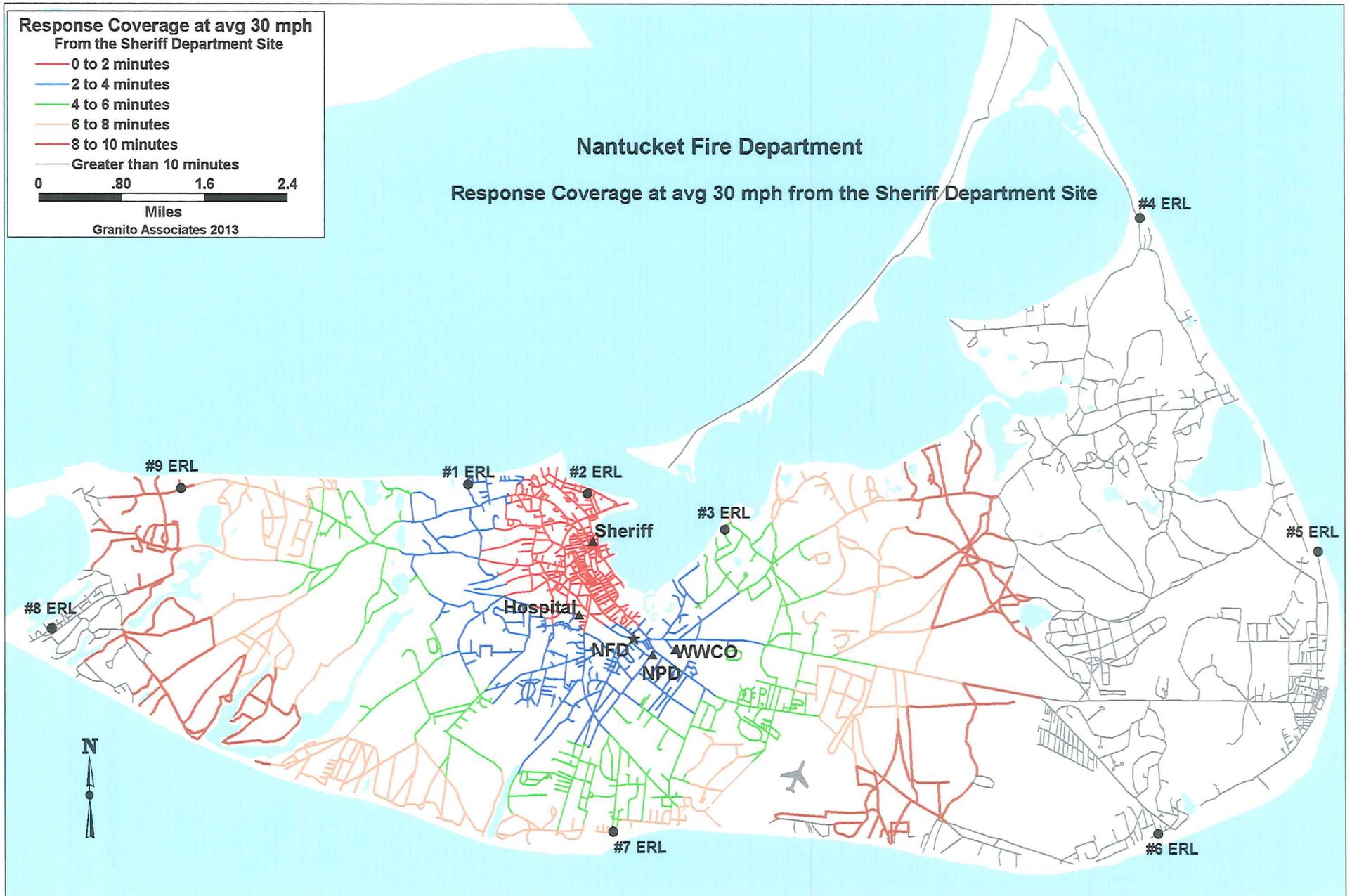
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response Coverage at avg 30 mph from the Sheriff Department Site



**Response Coverage at avg 40 mph
From the Sheriff Department Site**

- 0 to 2 minutes
- 2 to 4 minutes
- 4 to 6 minutes
- 6 to 8 minutes
- 8 to 10 minutes
- Greater than 10 minutes

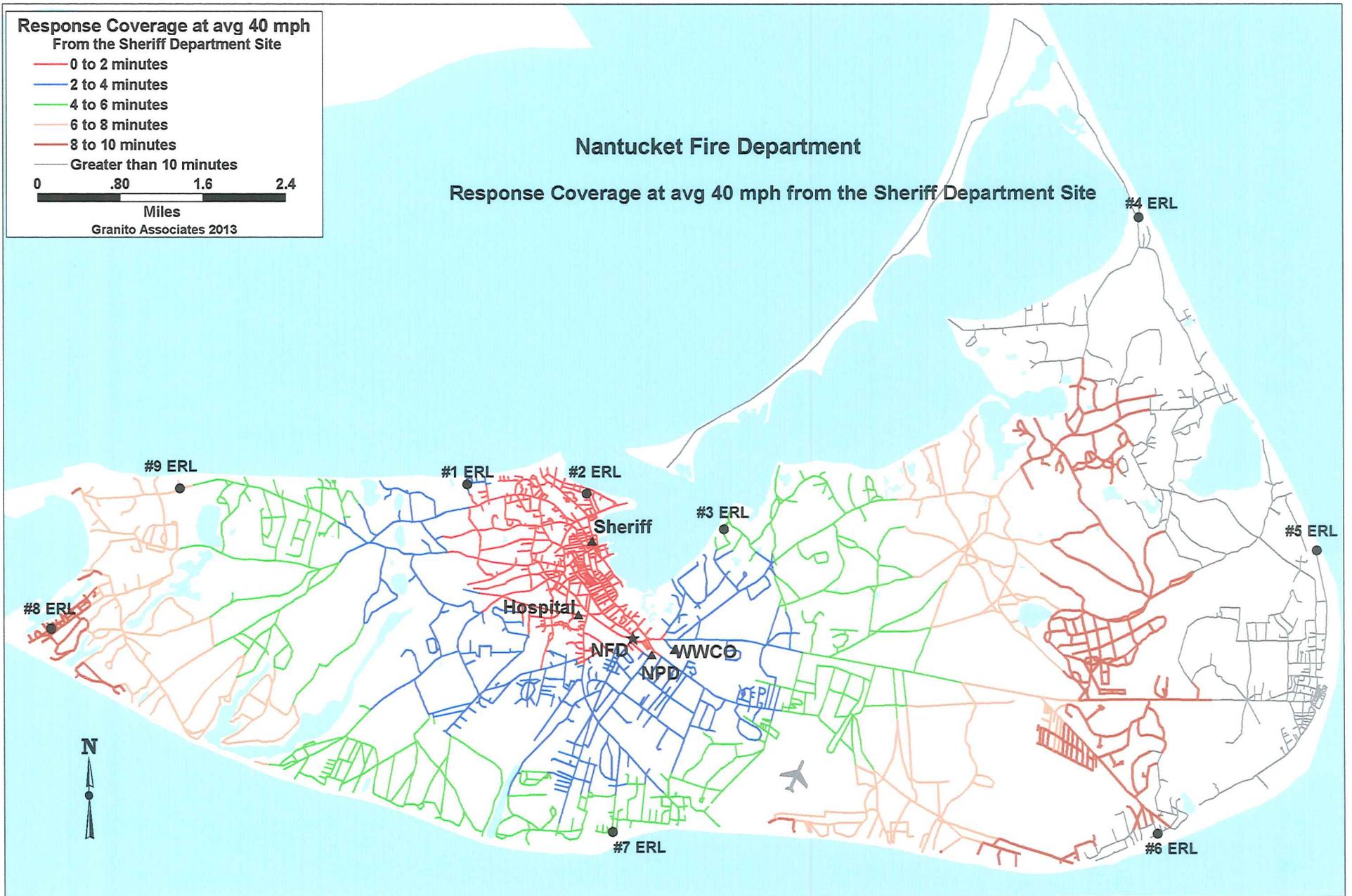
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

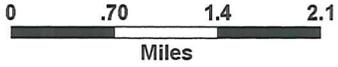
Response Coverage at avg 40 mph from the Sheriff Department Site



ISO Road Mile Coverage

From the Sheriff Department Site

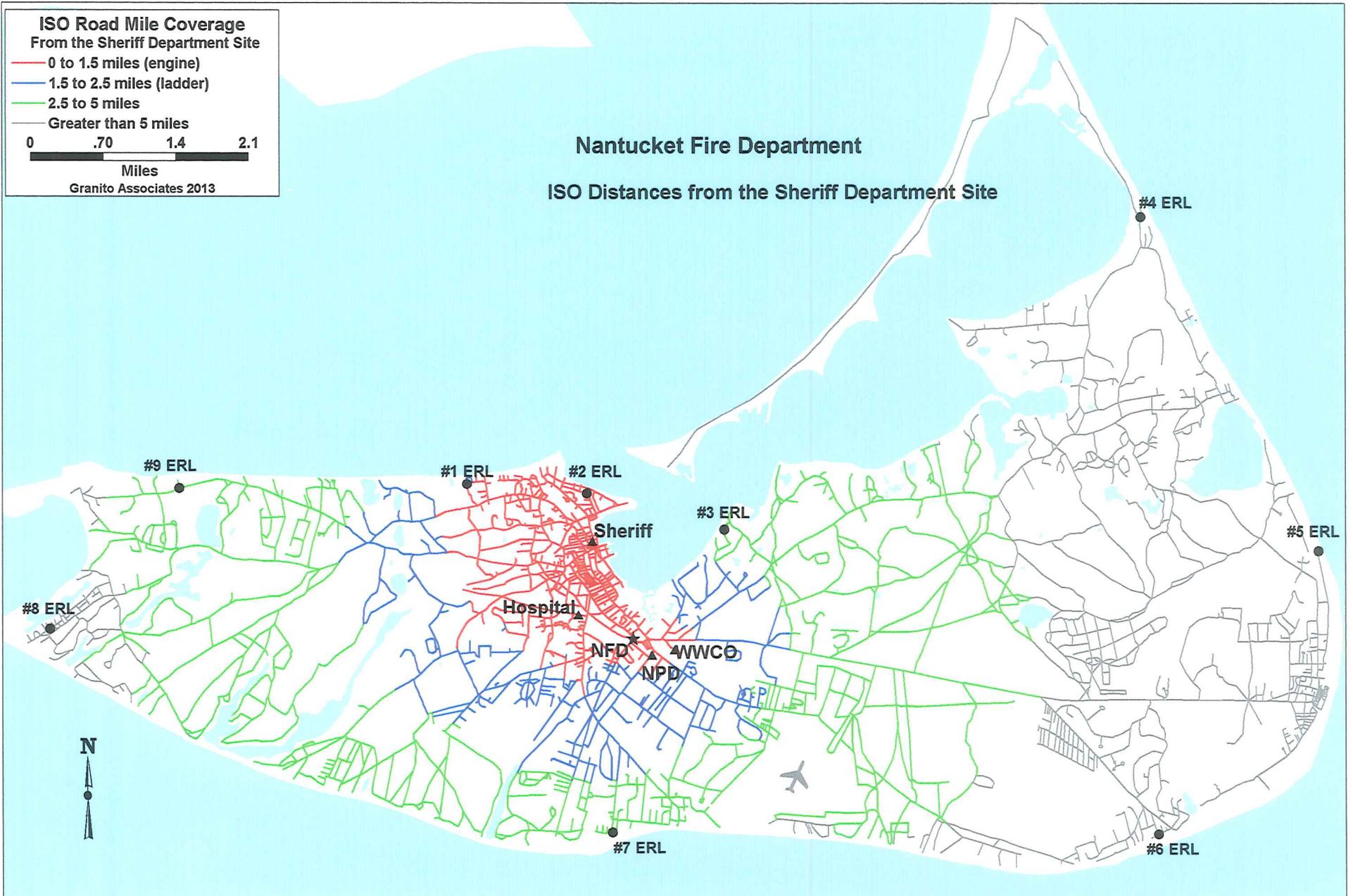
- 0 to 1.5 miles (engine)
- 1.5 to 2.5 miles (ladder)
- 2.5 to 5 miles
- Greater than 5 miles



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Nantucket Fire Department

ISO Distances from the Sheriff Department Site



Response Coverage at avg 25 mph

From the Water Works Site

0 to 2 minutes

2 to 4 minutes

4 to 6 minutes

6 to 8 minutes

8 to 10 minutes

Greater than 10 minutes

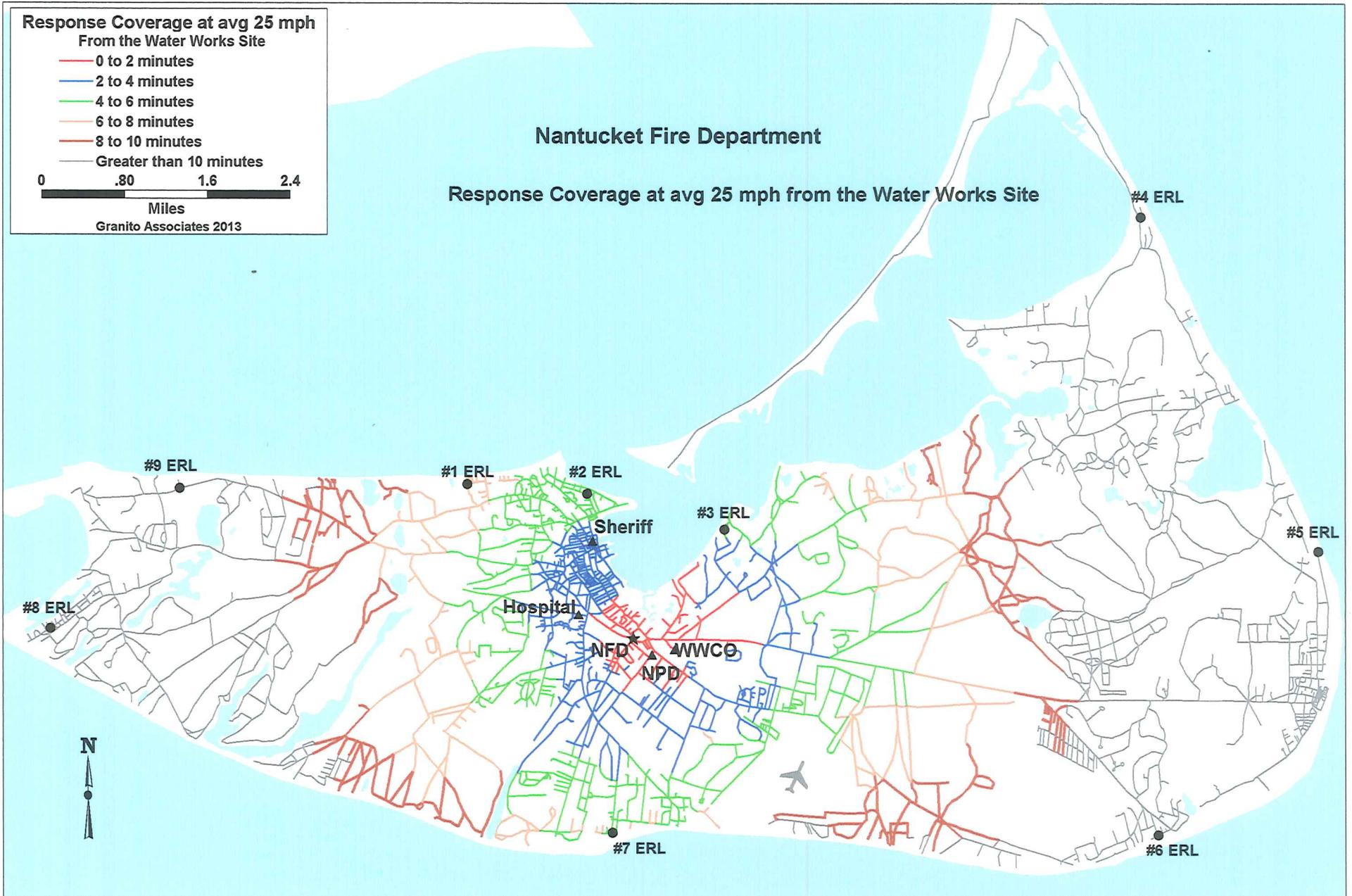
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response Coverage at avg 25 mph from the Water Works Site



Response Coverage at avg 30 mph

From the Water Works Site

0 to 2 minutes

2 to 4 minutes

4 to 6 minutes

6 to 8 minutes

8 to 10 minutes

Greater than 10 minutes

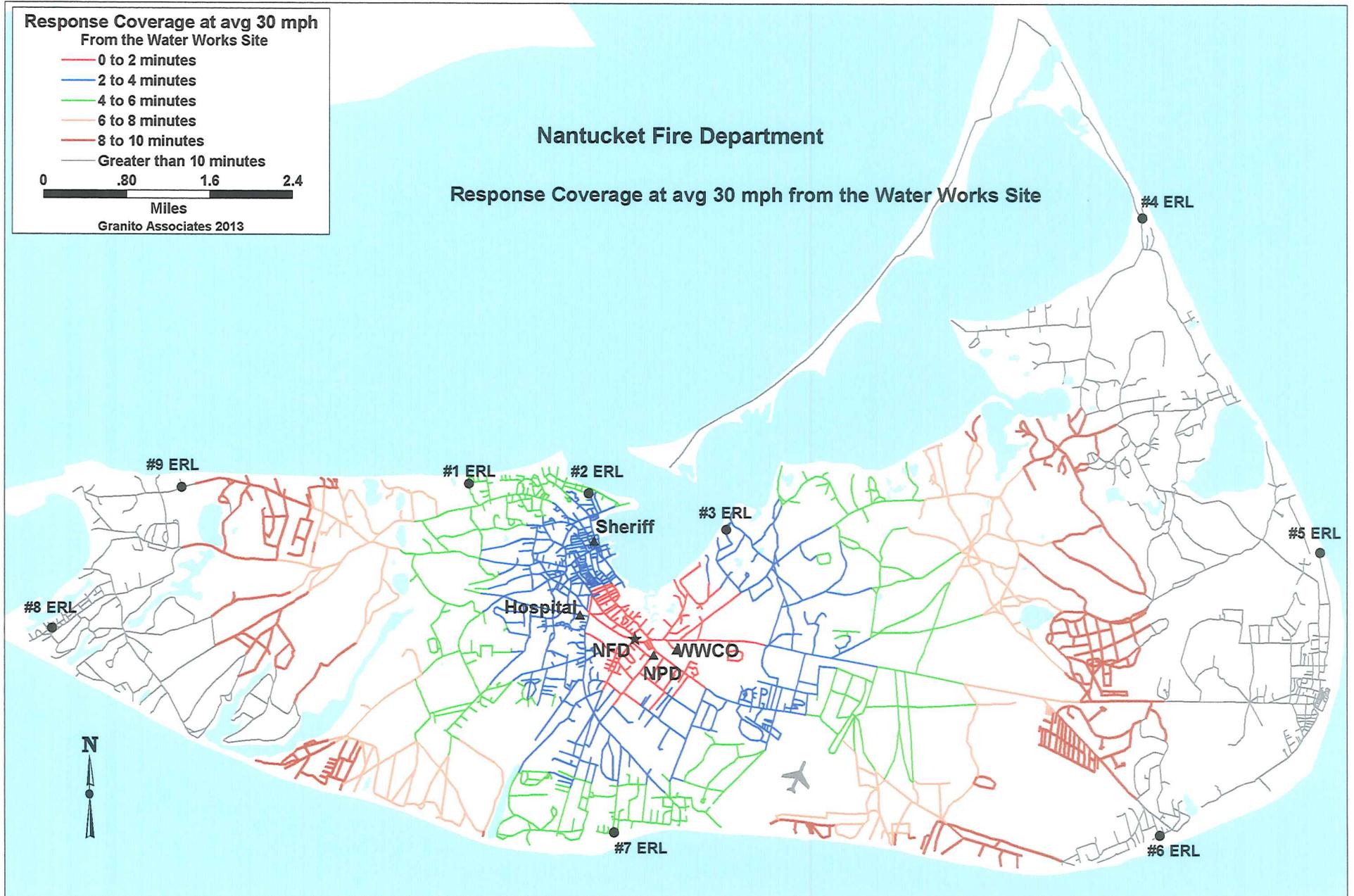
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response Coverage at avg 30 mph from the Water Works Site



**Response Coverage at avg 40 mph
From the Water Works Site**

0 to 2 minutes

2 to 4 minutes

4 to 6 minutes

6 to 8 minutes

8 to 10 minutes

Greater than 10 minutes

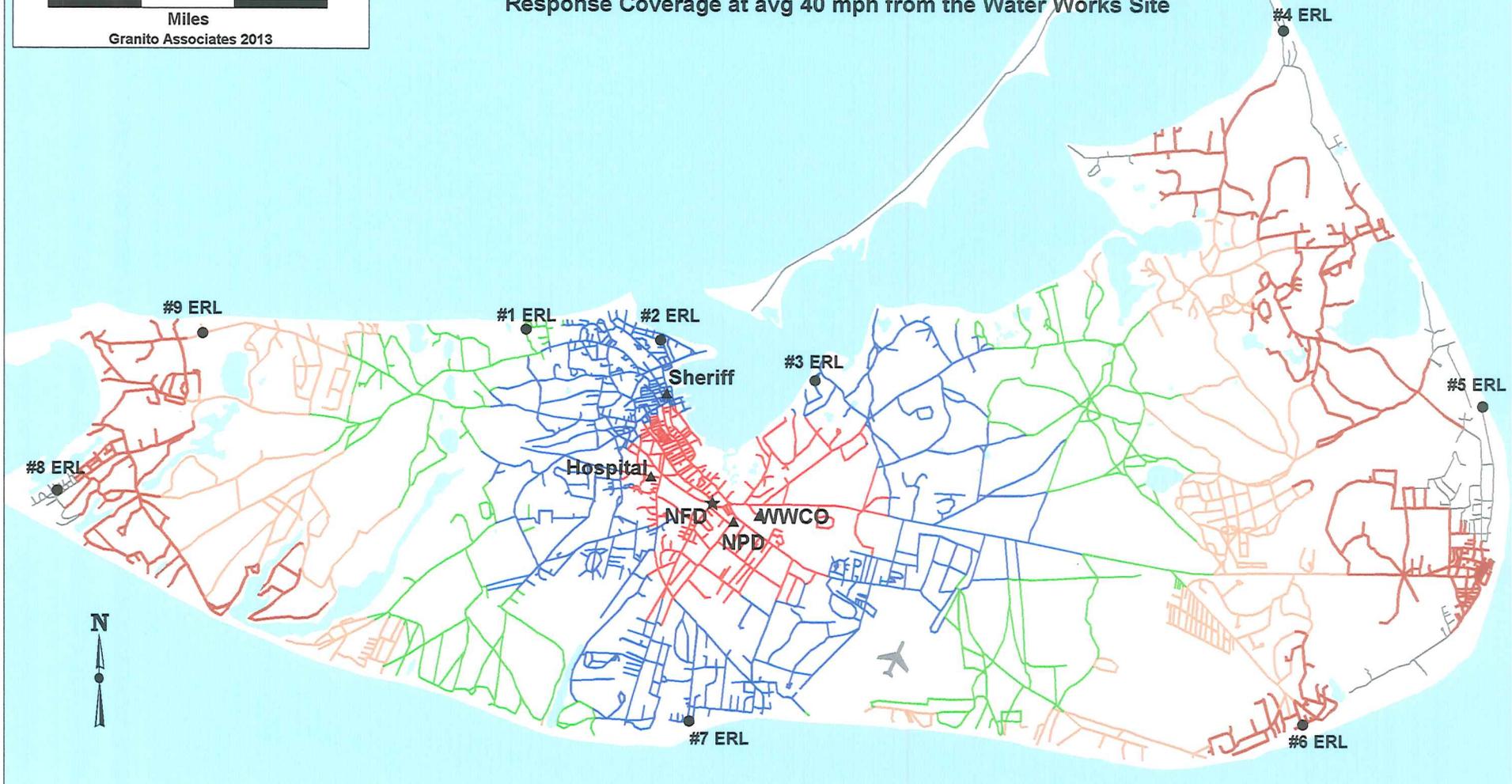
0 .80 1.6 2.4

Miles

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Nantucket Fire Department

Response Coverage at avg 40 mph from the Water Works Site



ISO Road Mile Coverage

From the Water Works Site

— 0 to 1.5 miles (engine)

— 1.5 to 2.5 miles (ladder)

— 2.5 to 5 miles

— Greater than 5 miles

0 .60 1.2 1.8

Miles

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Nantucket Fire Department

ISO Distances from the Water Works Site

