

Shelter Island Modeling Assessment

by Tom Cambareri
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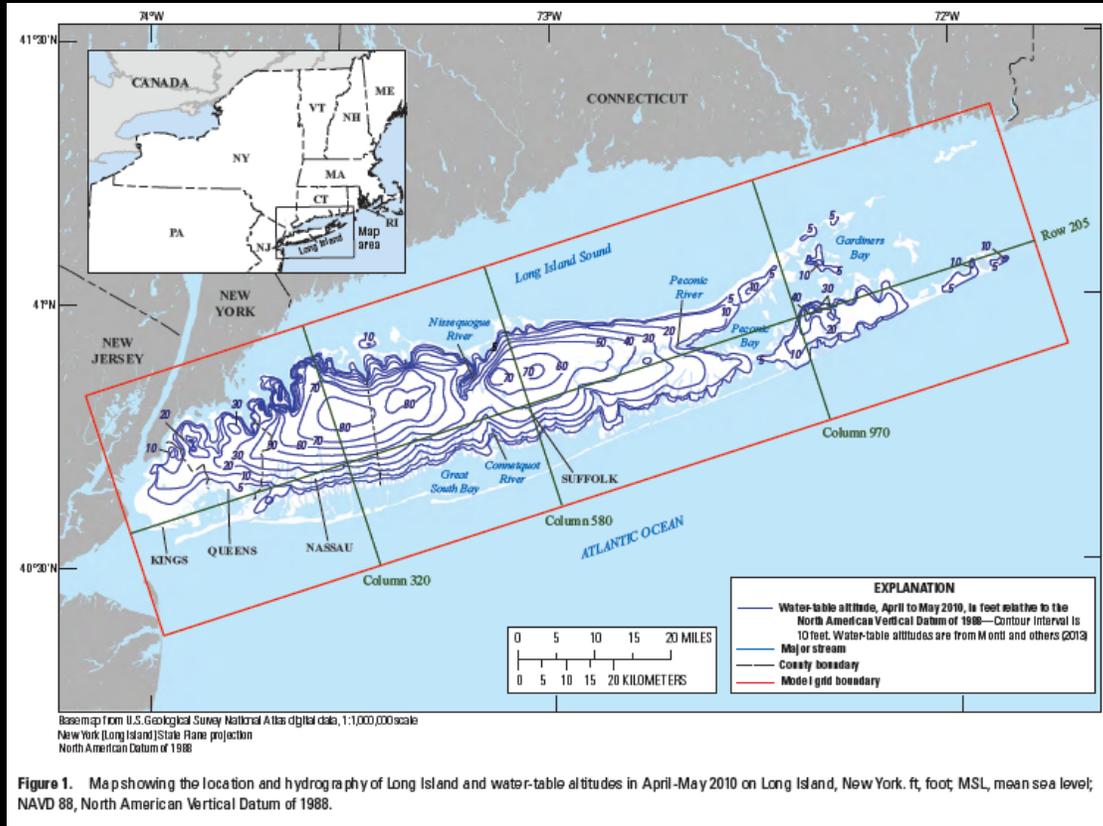
Background and Objective

- Proposed Shelter Island Wastewater Treatment Plan identifies a municipal wastewater collection area and proposed wastewater discharge at 16 Manwaring Rd with a 8,000 GPD Design Capacity treatment plant and an average flow for 4,000 GPD.
- There are several private water supply wells at 14 and 18 Manwaring Road.
- There are several downgradient private wells serving the Sylvester Manor property
- Evaluate the potential interactions of the nearby private wells and downgradient Sylvester Manor wells with the proposed discharge.

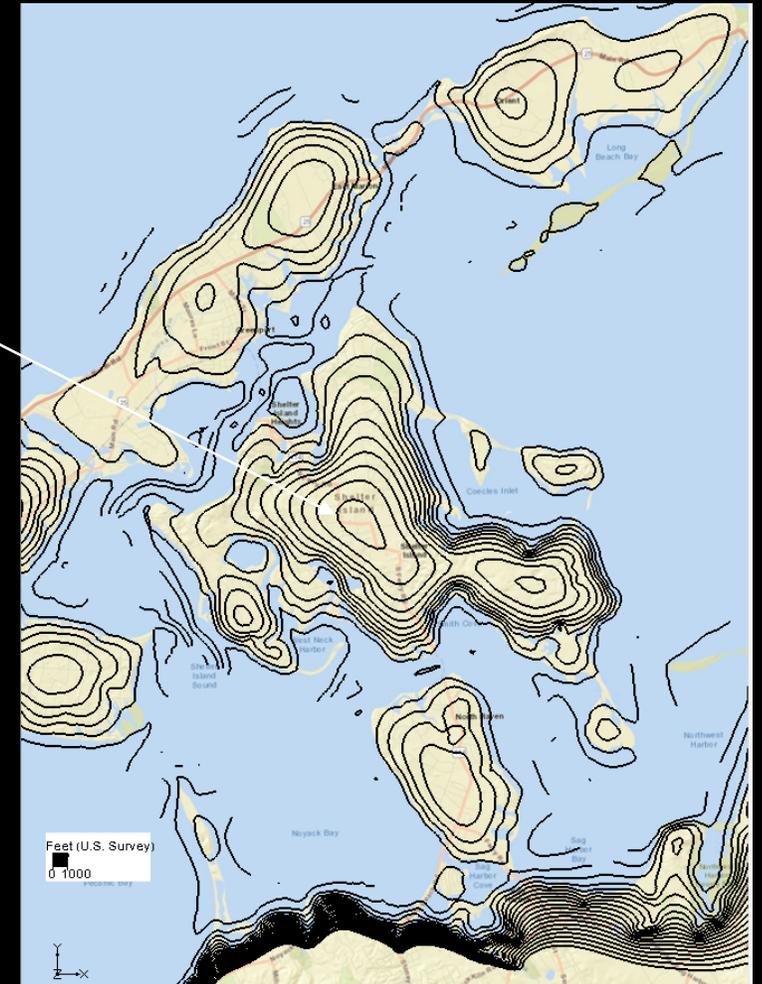
Methodology

- Use the 2021 USGS Groundwater Model to evaluate the wastewater discharge and private well interactions.
- The 500 by 500-foot grid spacing in the 2021 USGS model is too coarse to identify the relative proximity of the wells and discharges.
- Build and calibrate a “Shelter Island North Local Model” from the USGS Model with 50 by 50 ft grid spacing.
- Locate the private wells and discharge areas and simulate the withdrawals and wastewater discharge.
- Use particle tracking to identify the groundwater capture areas to the wells and the travel paths of treated effluent in the aquifer.
- Use the regional USGS Model to evaluate the septic system effluent groundwater travel paths from the municipal structures proposed for hook-up to the collection system.

Regional to Shelter Island North Local Model



Watertable contours at ½ foot intervals on shelter Island from the USGS Groundwater Model. The top contour is 6 feet above “mean sea Level”

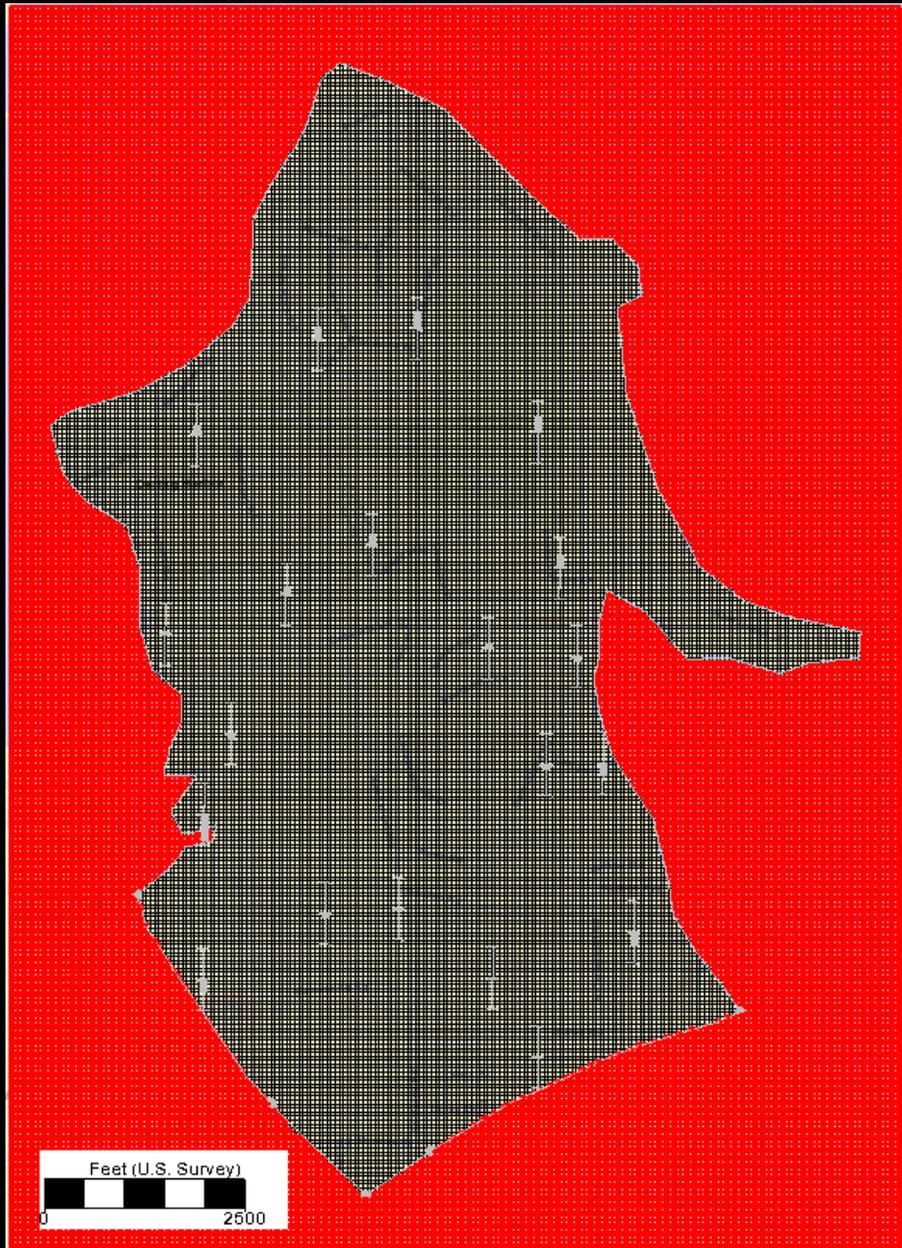


Walter, D.A., Masterson, J.P., Finkelstein, J.S., Monti, J., Jr., Misut, P.E., and Fienen, M.N., 2020, Simulation of groundwater flow in the regional aquifer system on Long Island, New York, for pumping and recharge conditions in 2005–15: U.S. Geological Survey Scientific Investigations Report 2020–5091, 75 p., <https://doi.org/10.31133/sir20205091>.

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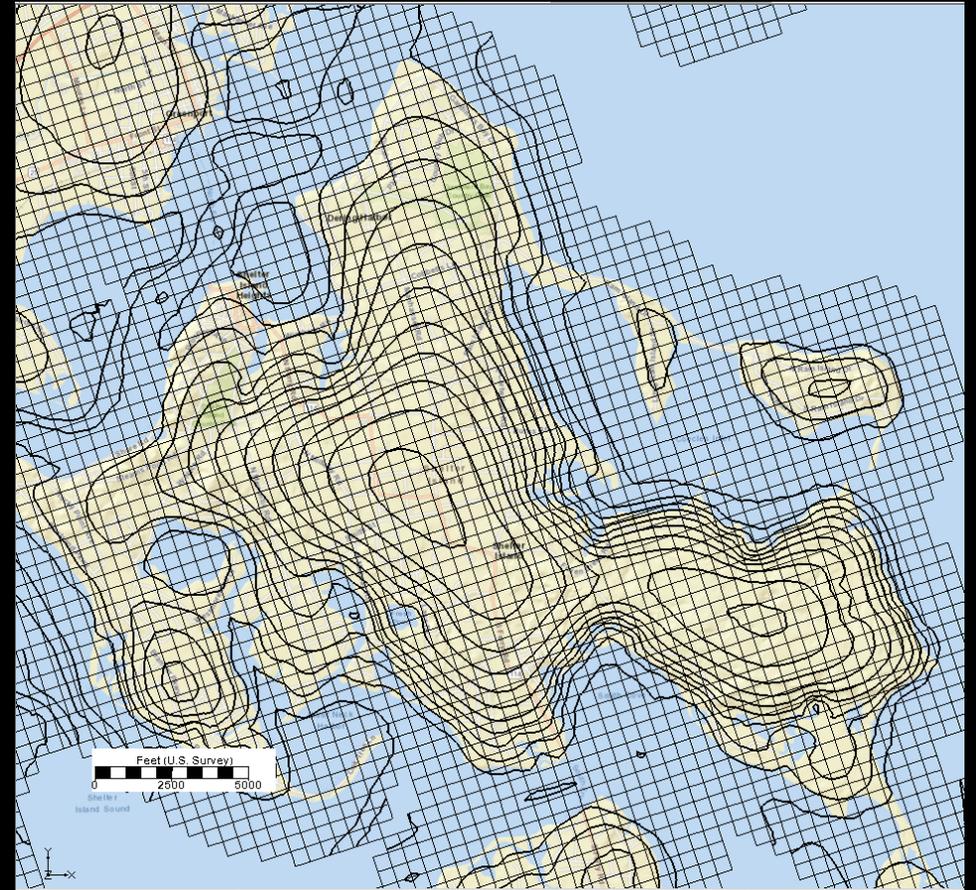
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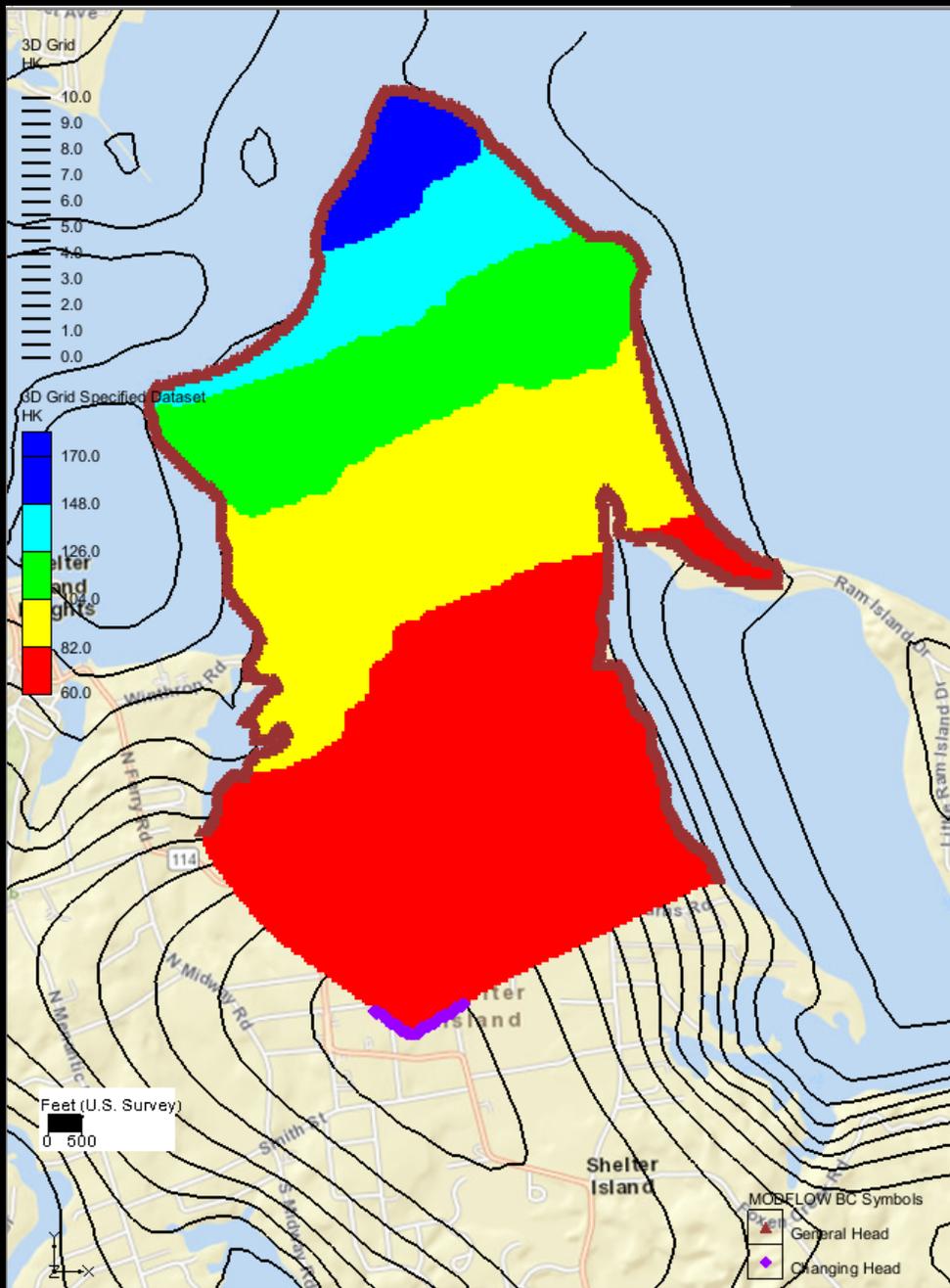
Local Shelter Island North Model is 312 cells wide by 522 cells long of 50 feet square with 5 layers with 20 ft thickness.

There are 147,910 Active Cells



USGS Grid with 500 foot Spacing

Shelter Island Local Model North



- Built Conceptual Model Based on USGS Long Island Model
- The Upper Aquifer in the USGS Model is in 1 Layer approximately 100 ft thick.
- The Local Model divides the Upper Aquifer into 5 layers
- Input Hydraulic Conductivity (HK) array from USGS
- HK – ranges from 65 ft/d to 150 ft (shown on map)
- Recharge factor of 19.9 inches per year
- General Head Boundary at 1.5 ft Elevation along the shore with
- Vertical Conductance of Estuary Bed of 0.1 ft/d Boundary
- Specified Head Boundary of ~ 6 ft in the upgradient area with No Flow boundary perpendicular to Water Table Contours

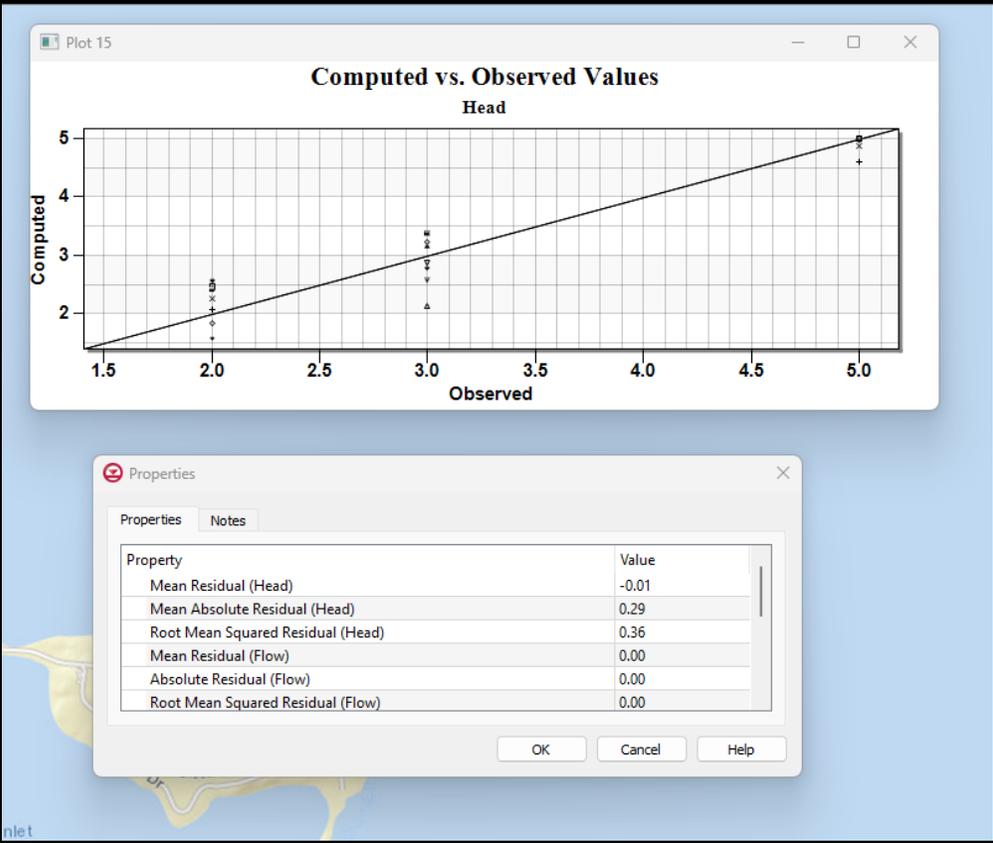
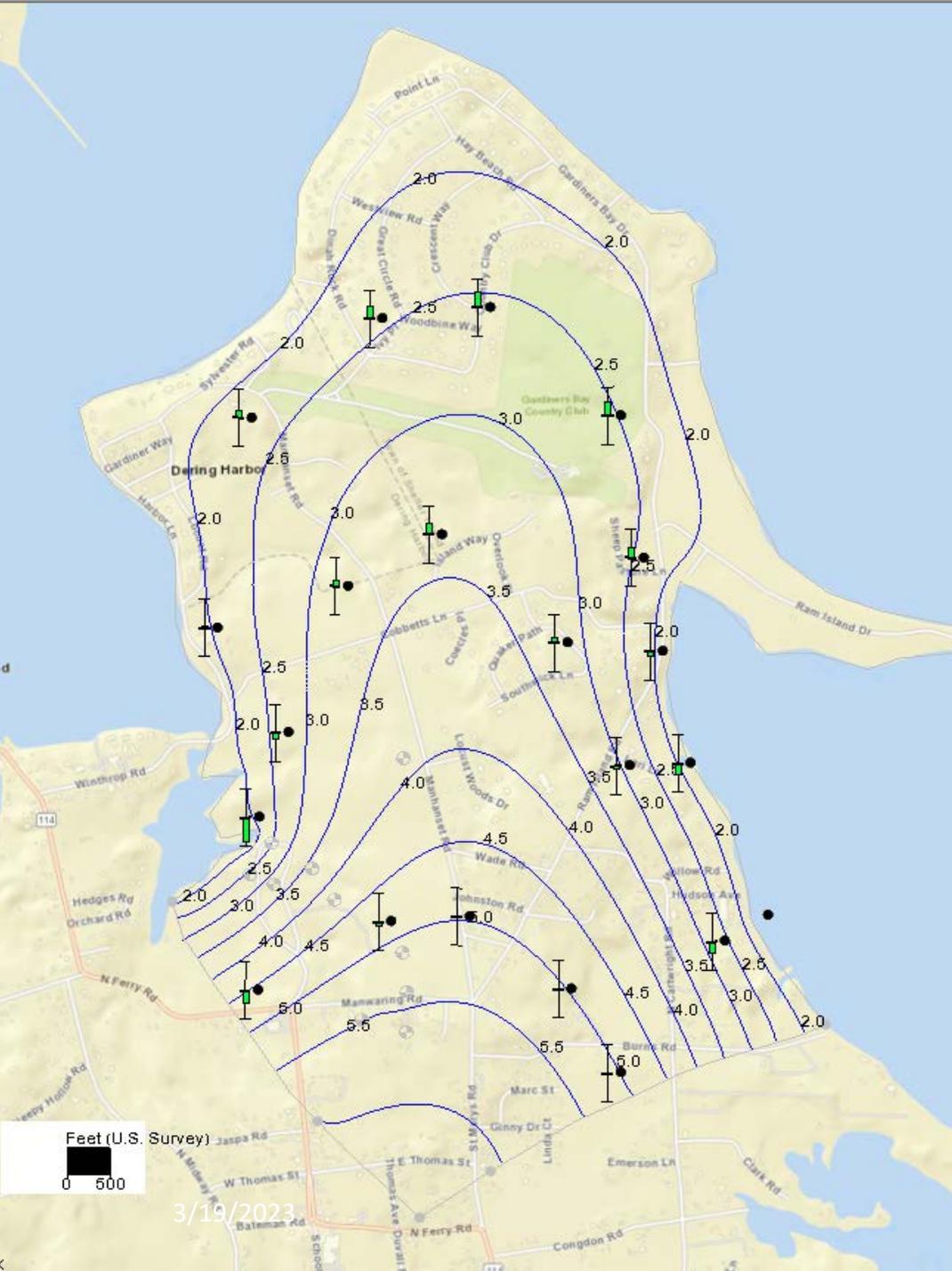
Calibration

Used USGS Contours to calibrate the Local Model

Water Budget .0005 percent error (insignificant)

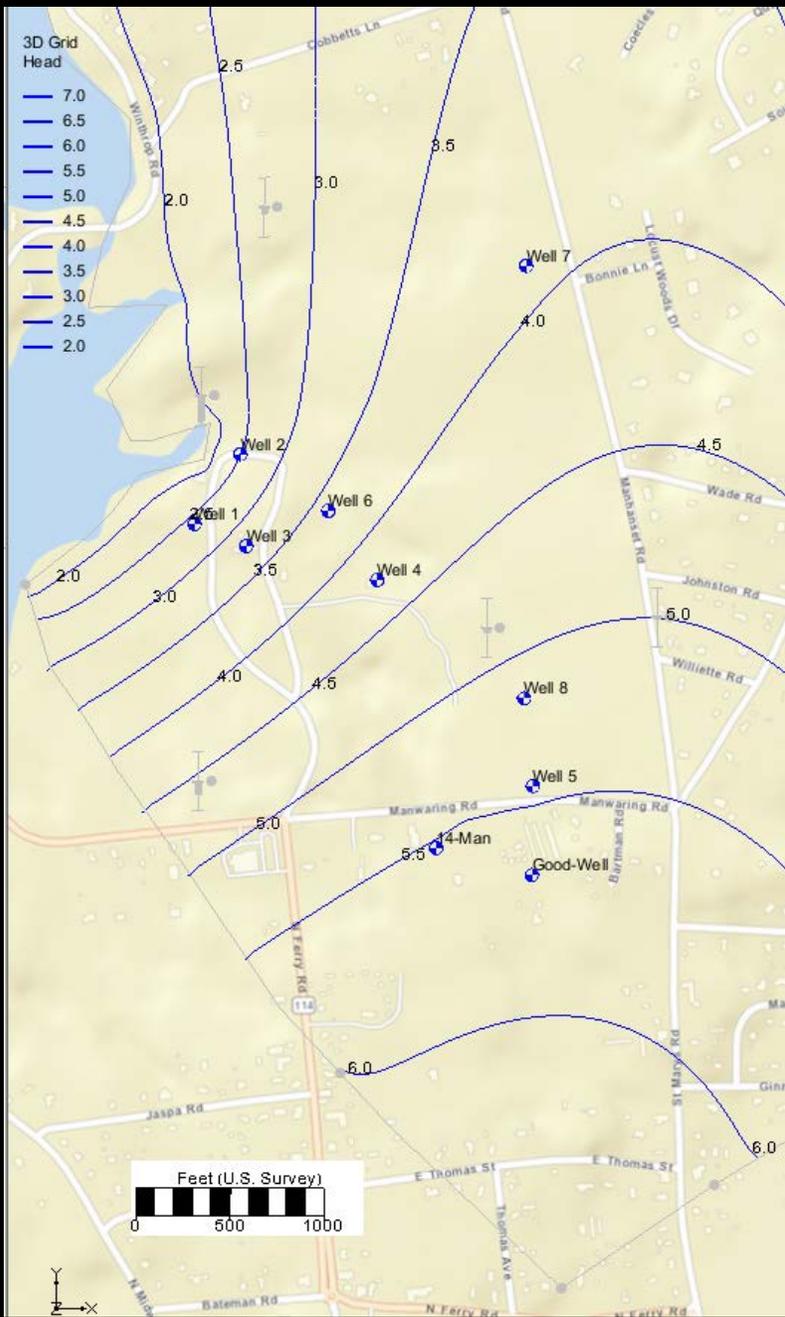
Residual Head of -0.01 ft

Mean Absolute Residual Head of 0.29 ft



Sylvester and Adjacent Well Pumping Rates for Steady State and Transient Conditions

	Steady-State				Transient 3-Month Summer	
	2017 to 2021 Ave Ann GPD	Ave Ann GPD	Modeled GPD	Modeled ft3/d	GPD	ft3/d
Well 1	64,320	176	177	24	300	40
Well 2	240	1	-	0	0	0
Well 3	29,400	81	81	11	176	24
Well 4	49,600	136	136	18	300	40
Well 5	787,940	2,159	2,159	289	16,942	2,265
Well 6	43,220	118	118	16	300	40
Well 7	107,680	295	295	39	2,695	360
Well 8	97,900	268	269	36	1,064	142
14 Manw.	Specified	150	150	20	300	40
18 Manw.	Specified	2,000	2,000	267	2,000	267

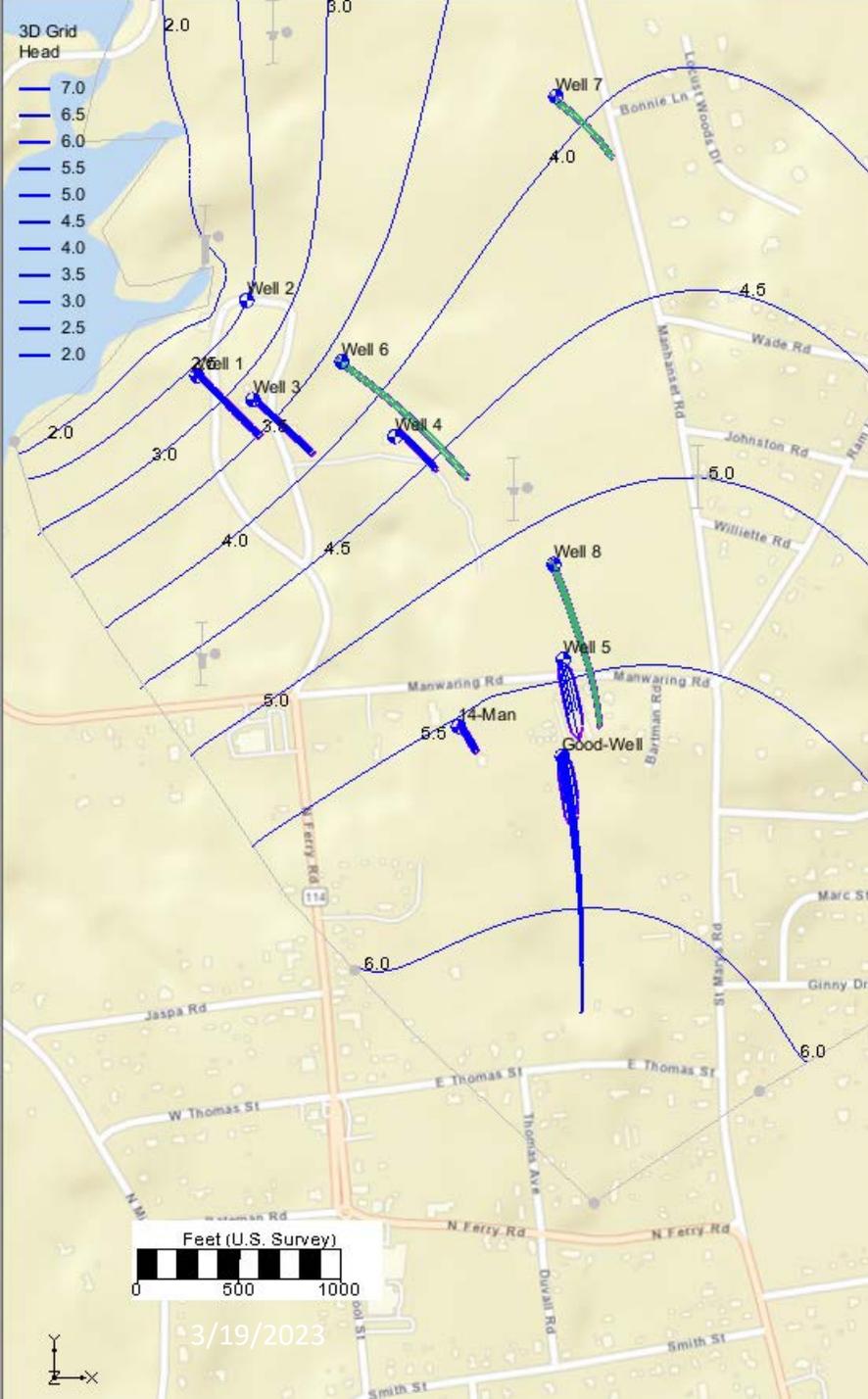


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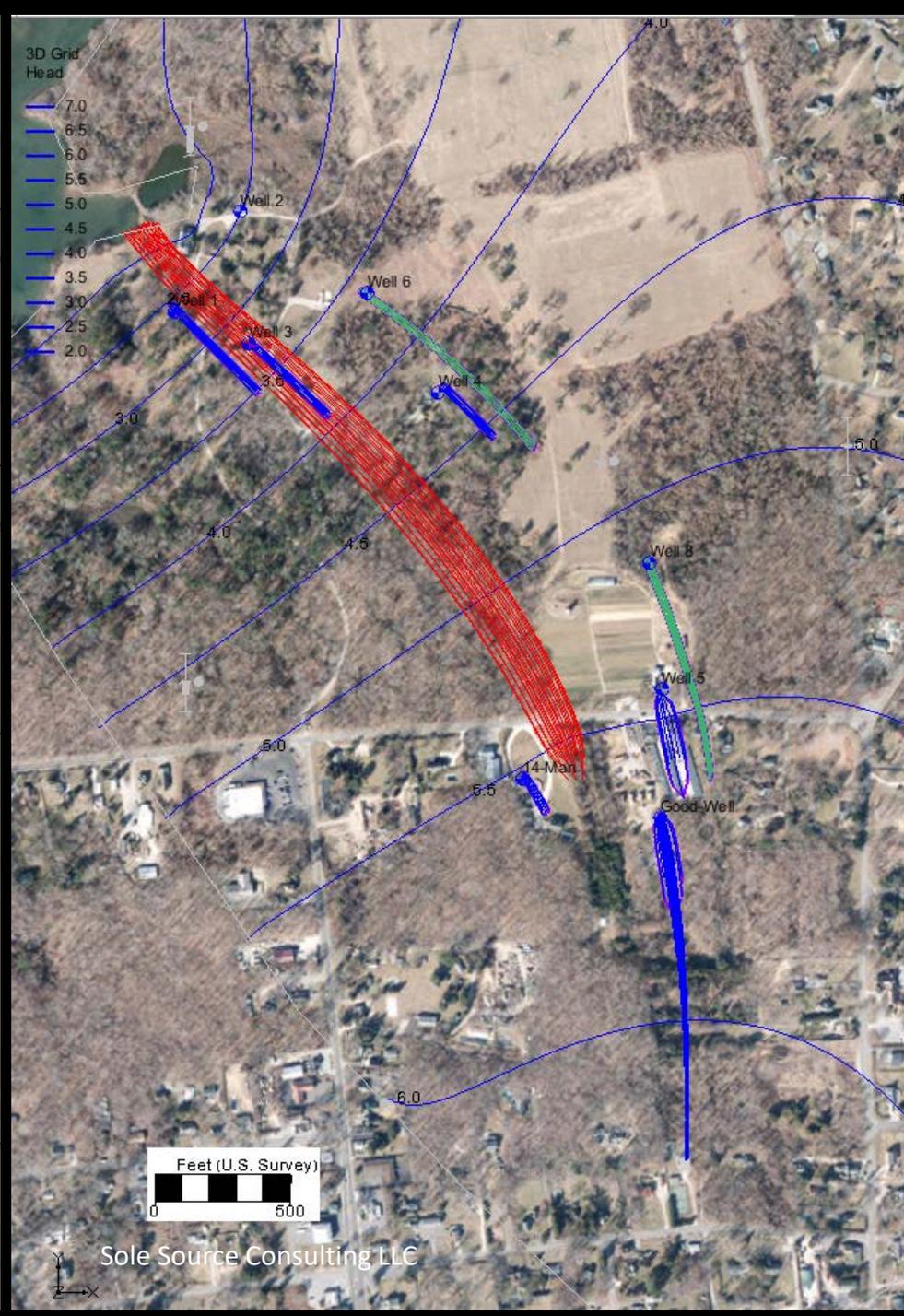
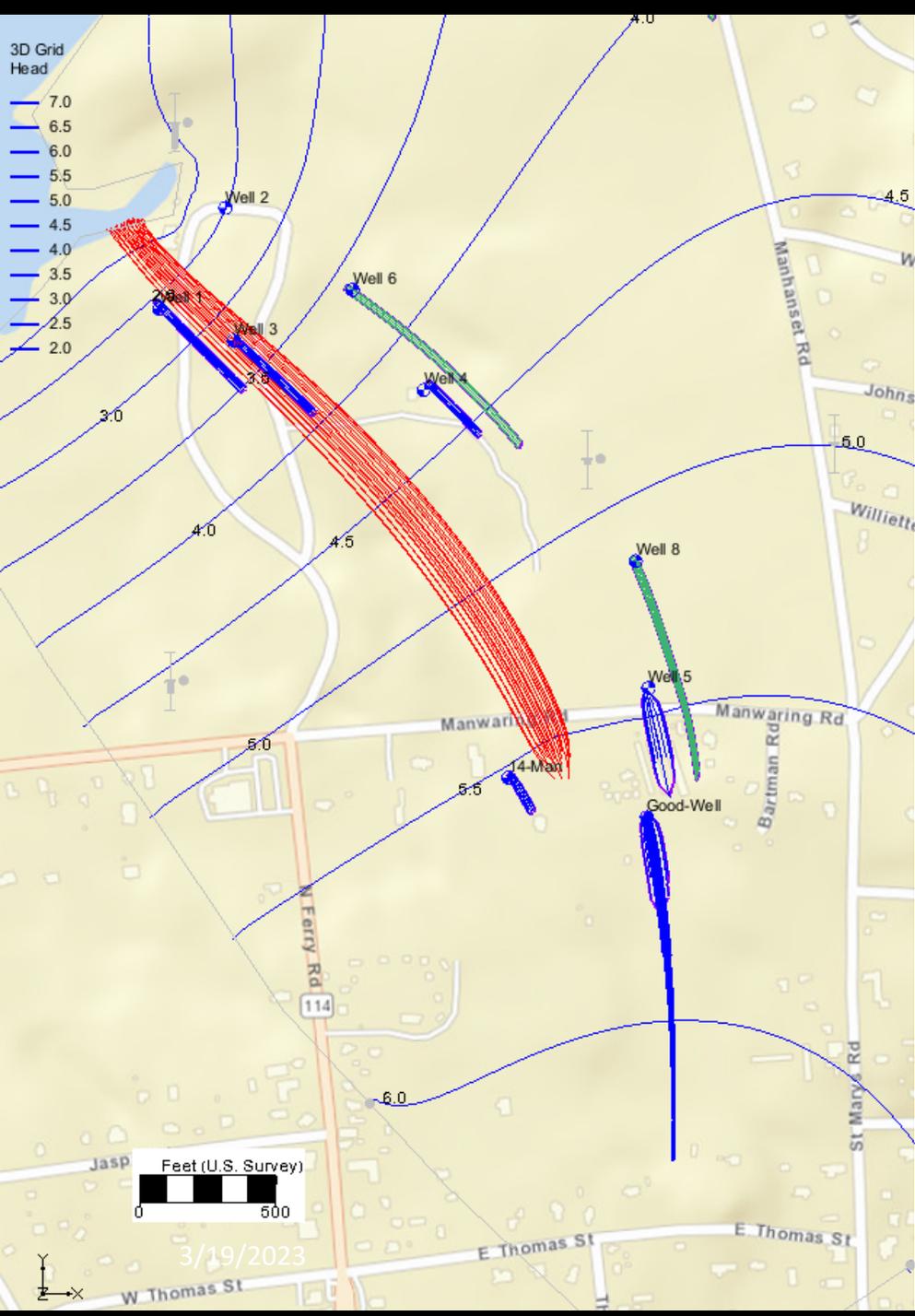
The Location of the Sylvester Manor and private wells nearby the proposed discharge



Steady-State Conditions

The particle paths to the wells indicate the recharge areas to the wells.

The Green particle paths are to wells that are screened deeper into the aquifer.

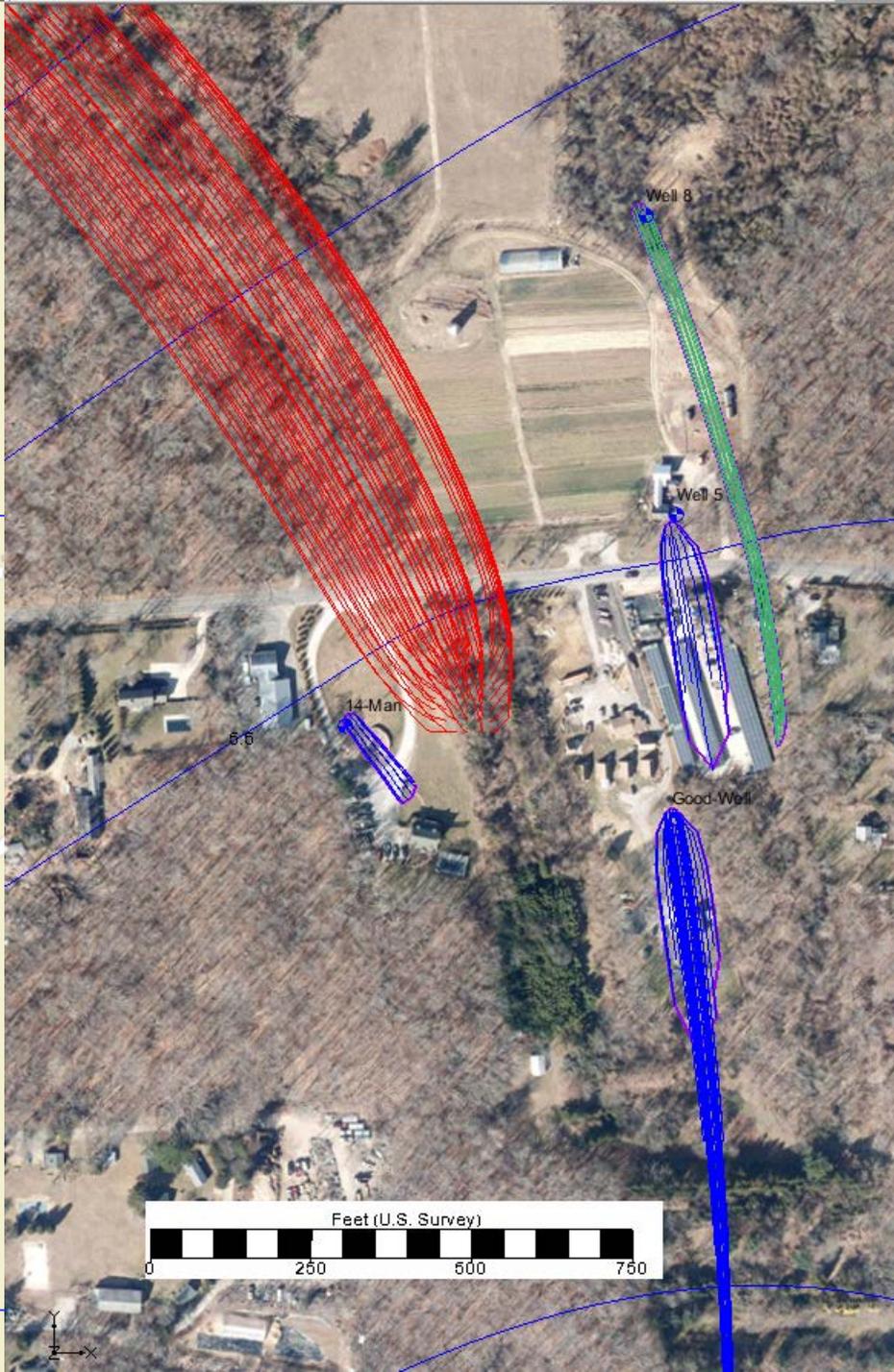
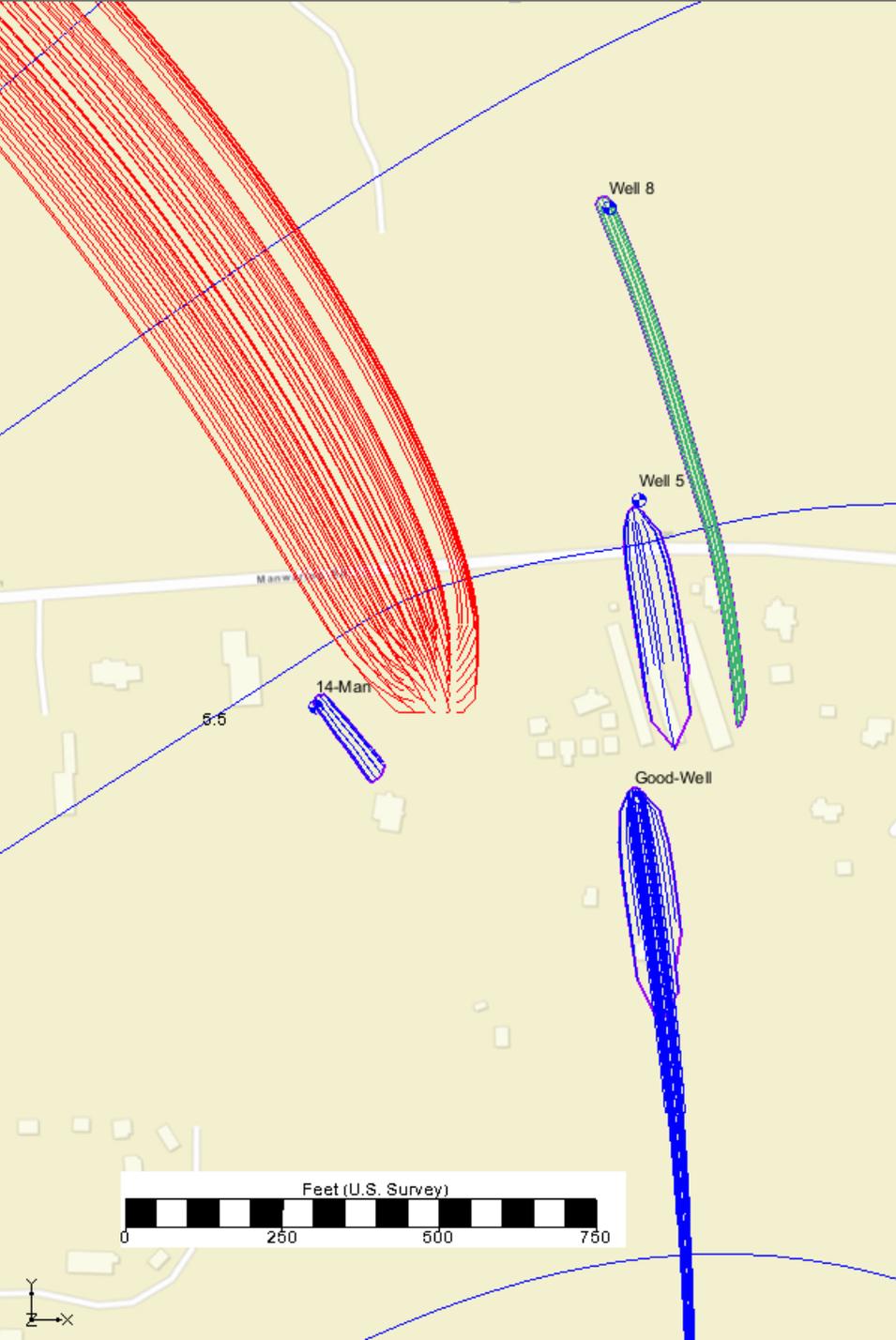


Particle Paths from the Proposed Wastewater Discharge at 4,000 GPD to Gardiners Creek.

The Time of Travel is approximately 21 to 24 years.

Particle Paths to wells and from discharge overlap but do not intersect.

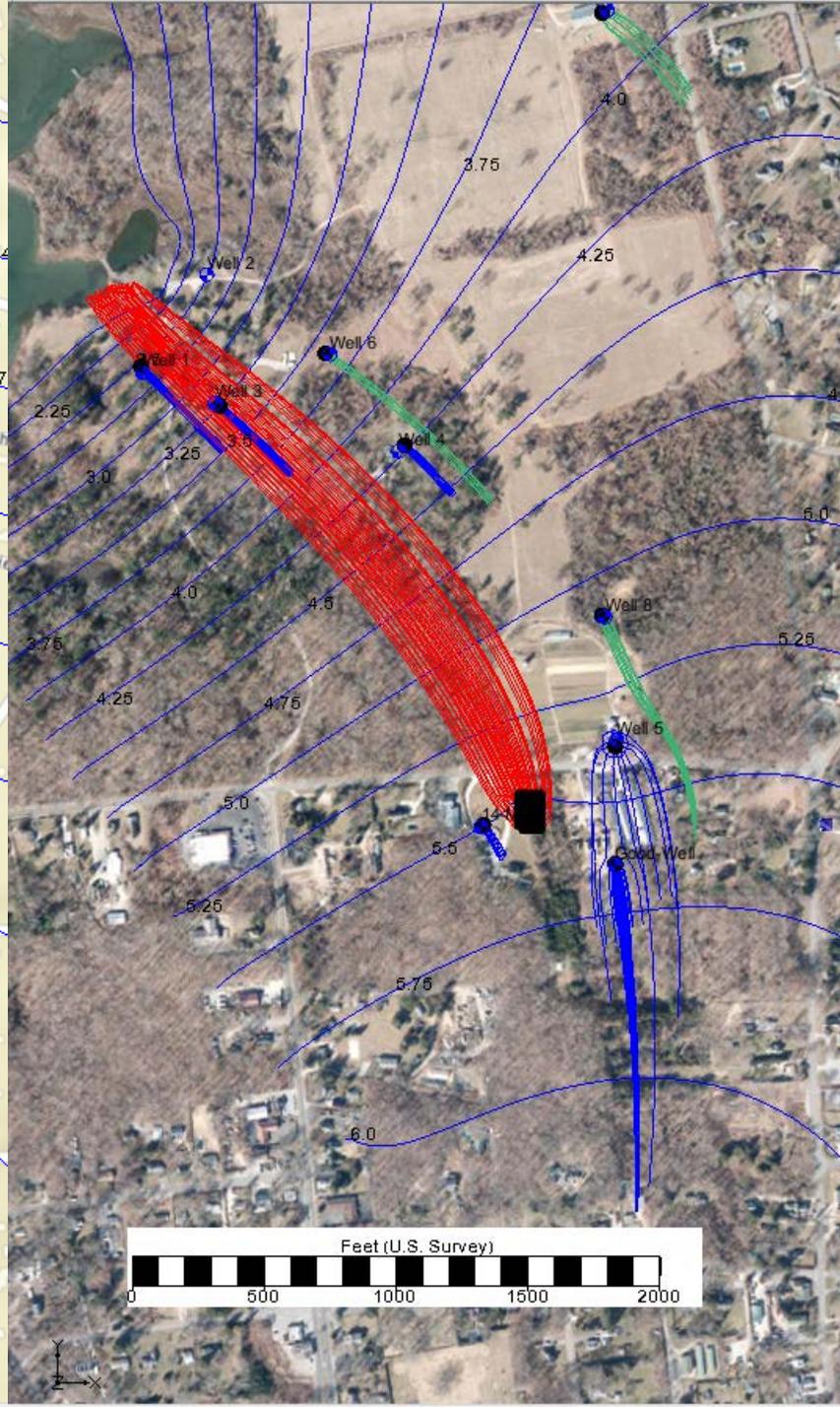
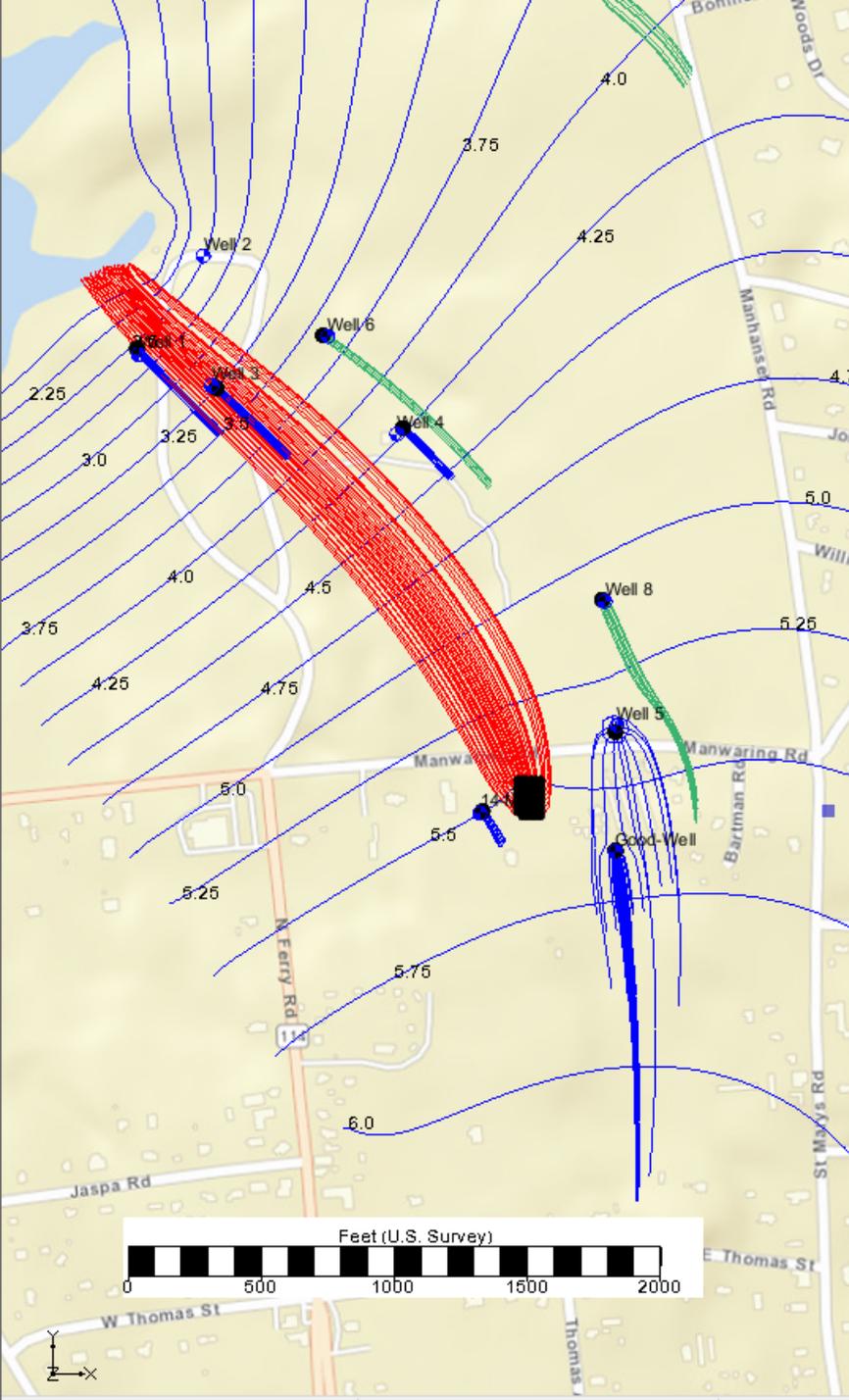
Slide 11



Particle Paths from the Proposed Wastewater Discharge at 8,000 GPD to Gardiners Creek.

The Time of Travel is approximately 21 to 24 years.

Particle Paths to wells and from discharge do not intersect.



Transient Conditions

Pumping for 3 Summer months without Recharge

Pumping Rates are at the Annual Average Volume over 3 months instead of 12 months for the Irrigation Wells as shown on the previous chart.

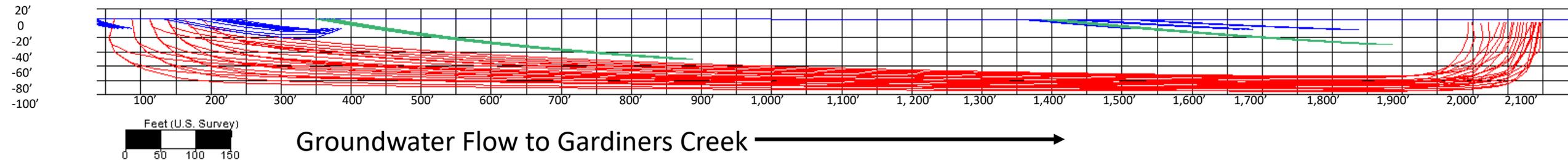
The Pumping Rate for Domestic Wells is at 300 GPD

Particles to wells do not intersect the 8,000 GPD Discharge.

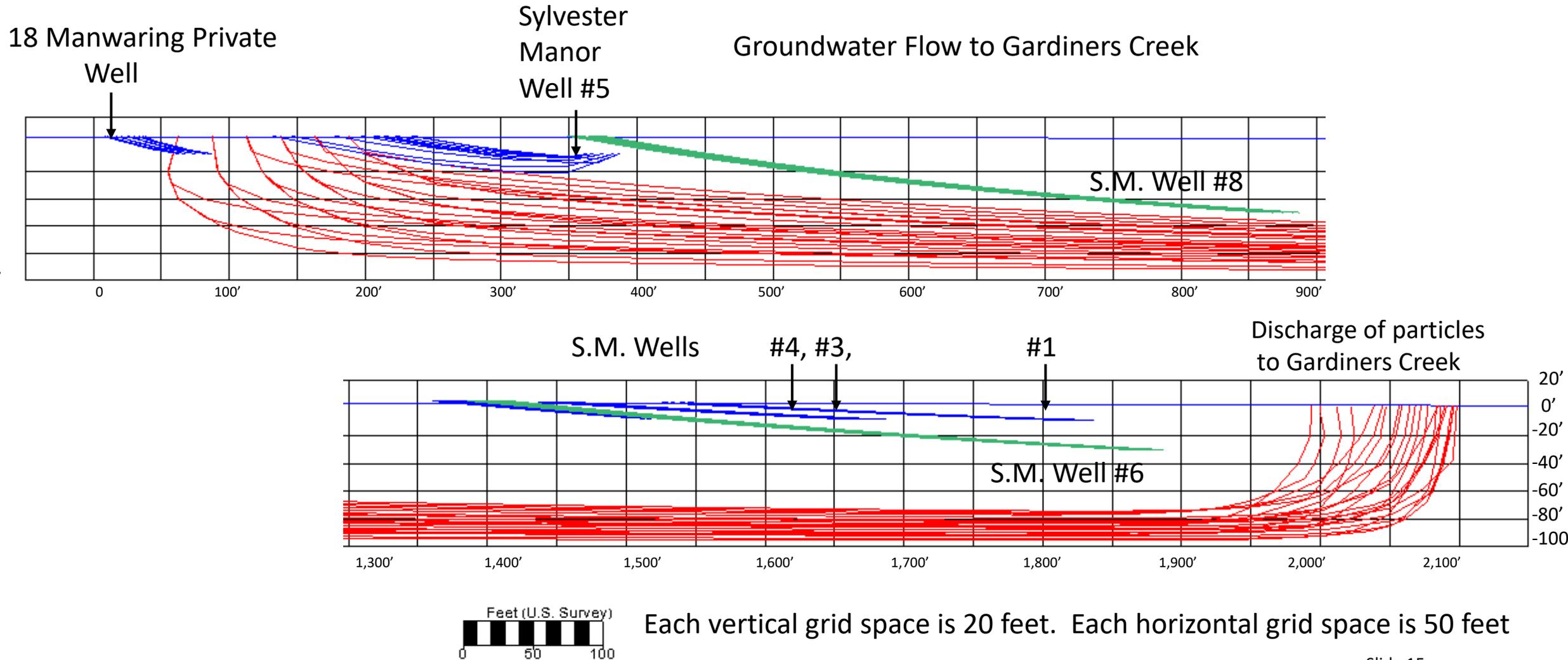
Cross Section of groundwater flow showing particle paths to Wells (Blue and Green) and particle paths from the Proposed Discharge at 8,000 GPD to Gardiners Creek (Red). The discharge particles are shown to migrate deeper in the aquifer than the well screens in the shallow and middle part of the aquifer.

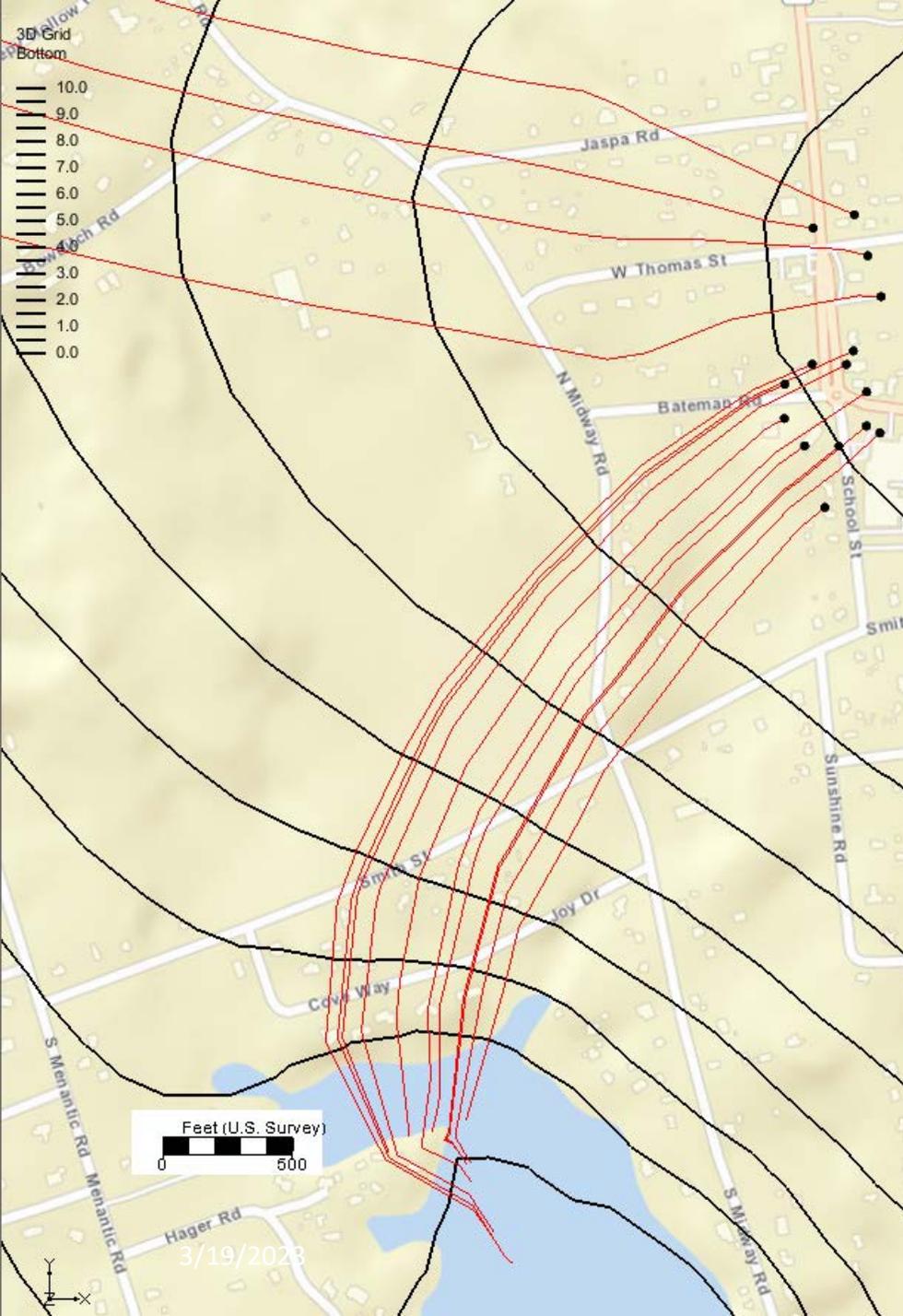
All paths are projected onto this Section. The Well and Wastewater paths do not intersect as shown on the map view (slides 12 & 13)

Groundwater Flow to Gardiners Creek



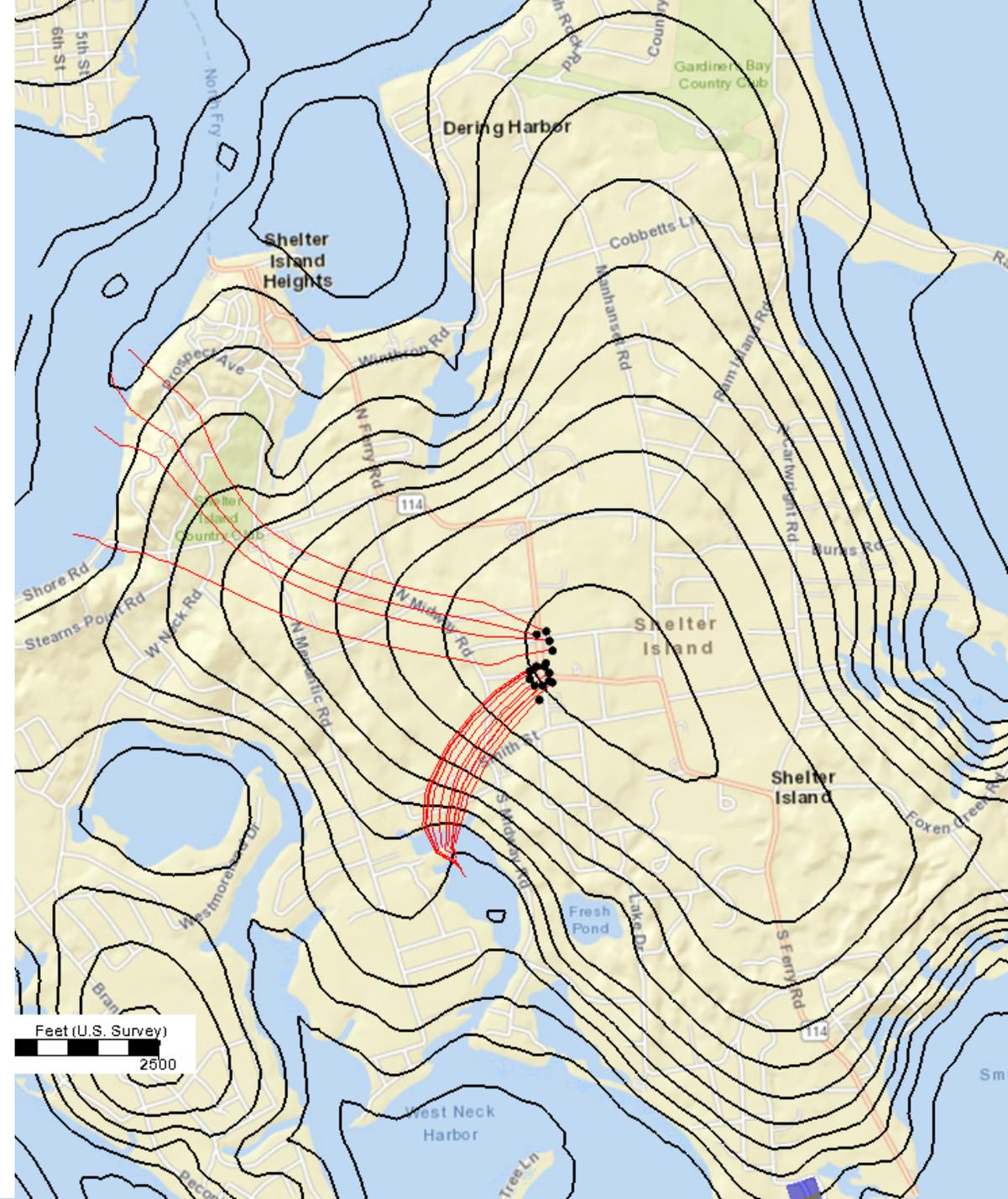
Enlargements of the south and north ends of cross section from slide 14





Evaluation of
Particle
Paths from
Proposed
Service Area

Using the
USGS Model



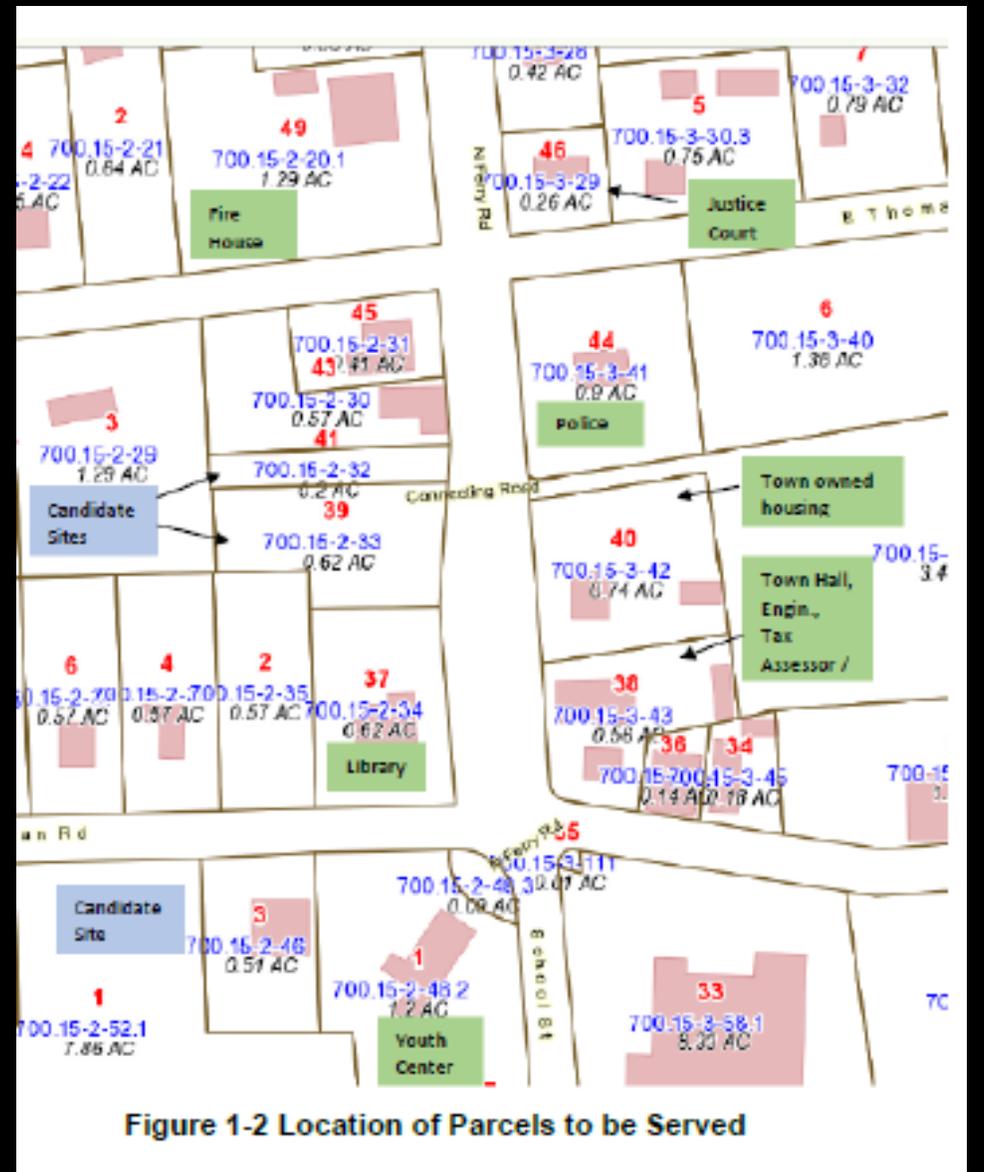
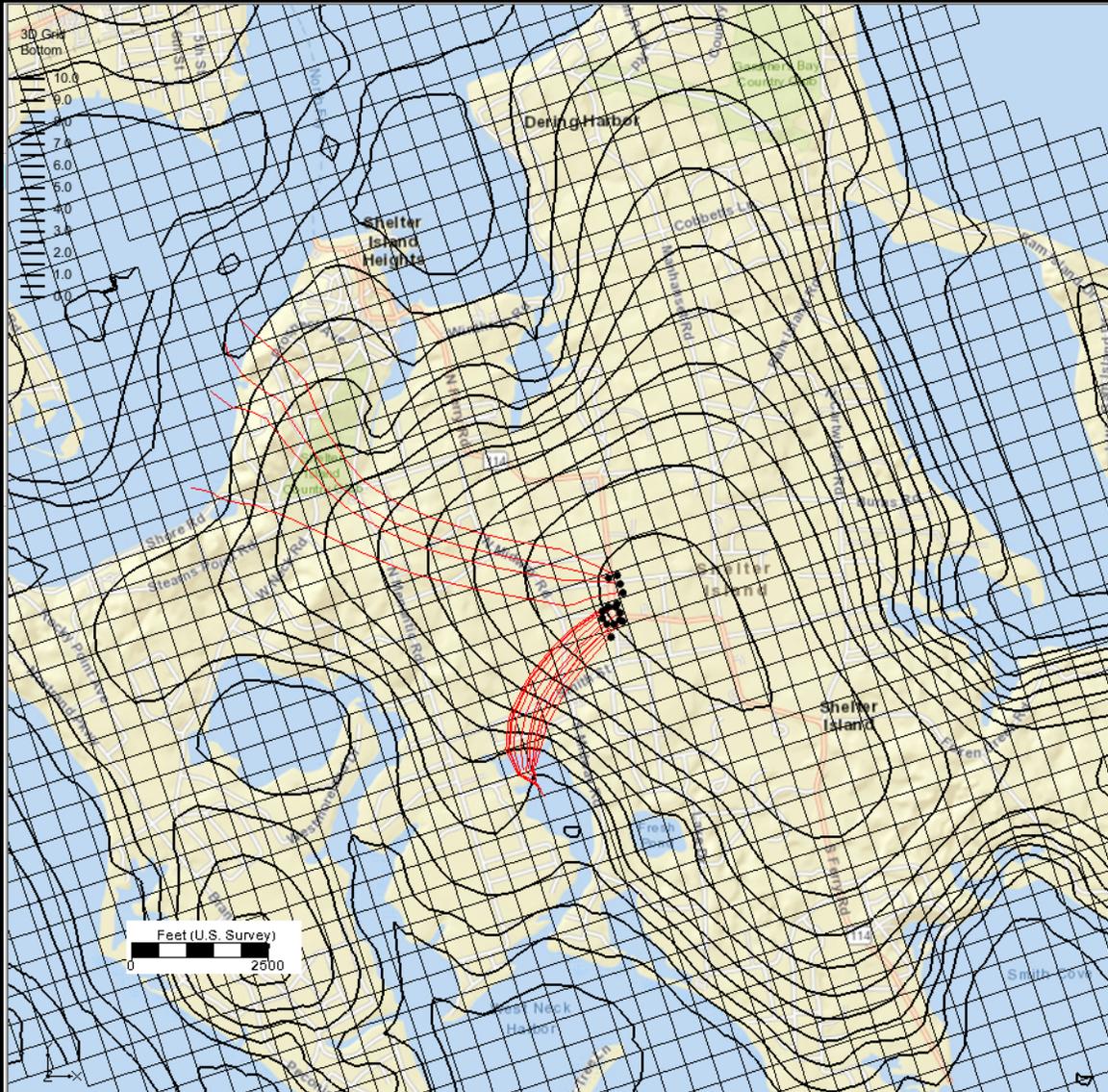


Figure 1-2 Location of Parcels to be Served

Particle Paths from the Existing Project Buildings to Discharge Locations
 Time of Travel is 33 years to Menantic Ck and over 100 years to Shelter Island Sound

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