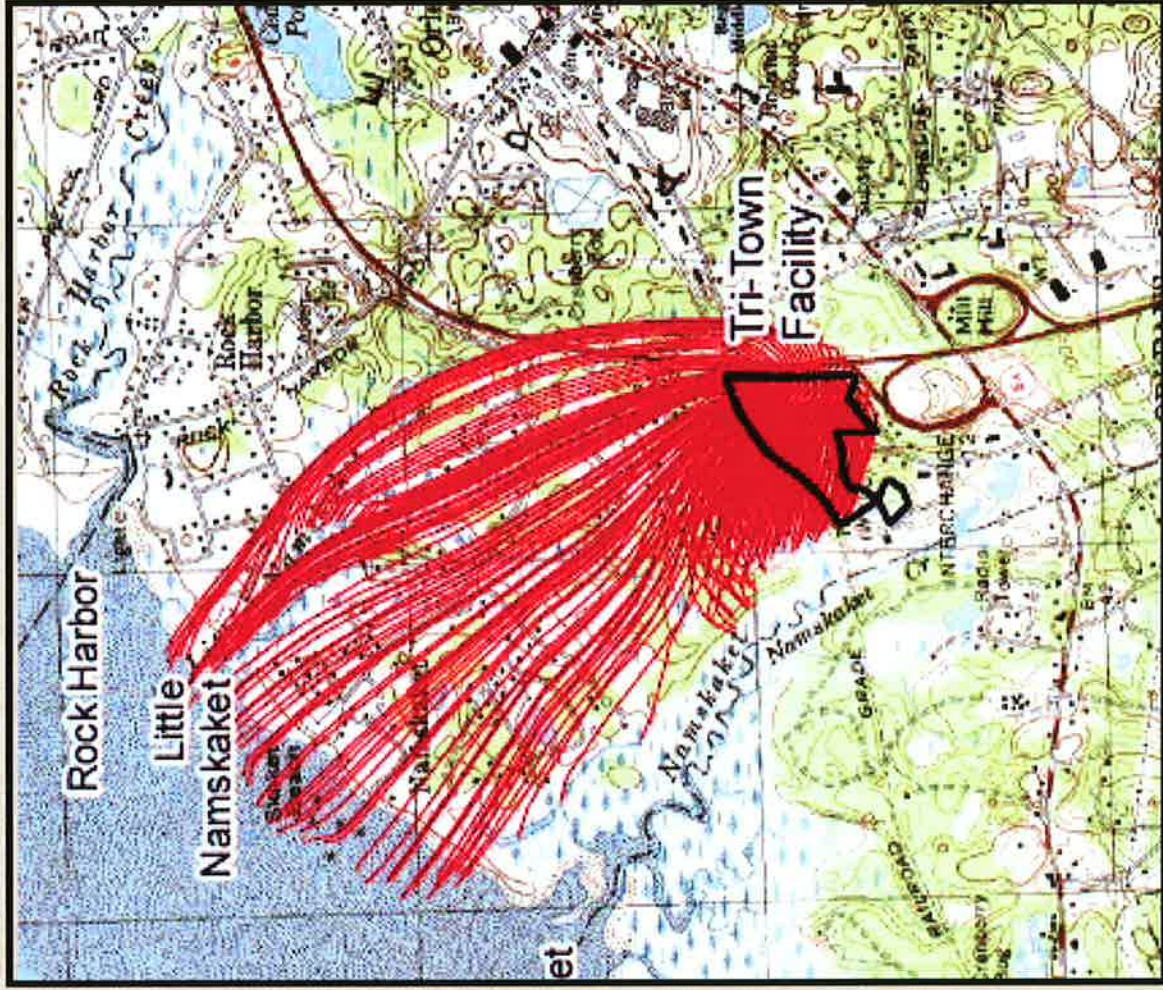


Wright-Pierce estimate of the wastewater plume flow by a "tracking model" (2010). Shows pathways of effluent flow from the Tri-Town Site.

From Orleans CWMP, 2010. Prepared by Jesse Schwalbaum, Hydrologist and consultant to Wright-Pierce.

Appendix E.



*Scenario 5 - 1.035 MGD Average
2.07 MGD Max - Month*

for the Namskaket Technical Panel
P. R. Ammann

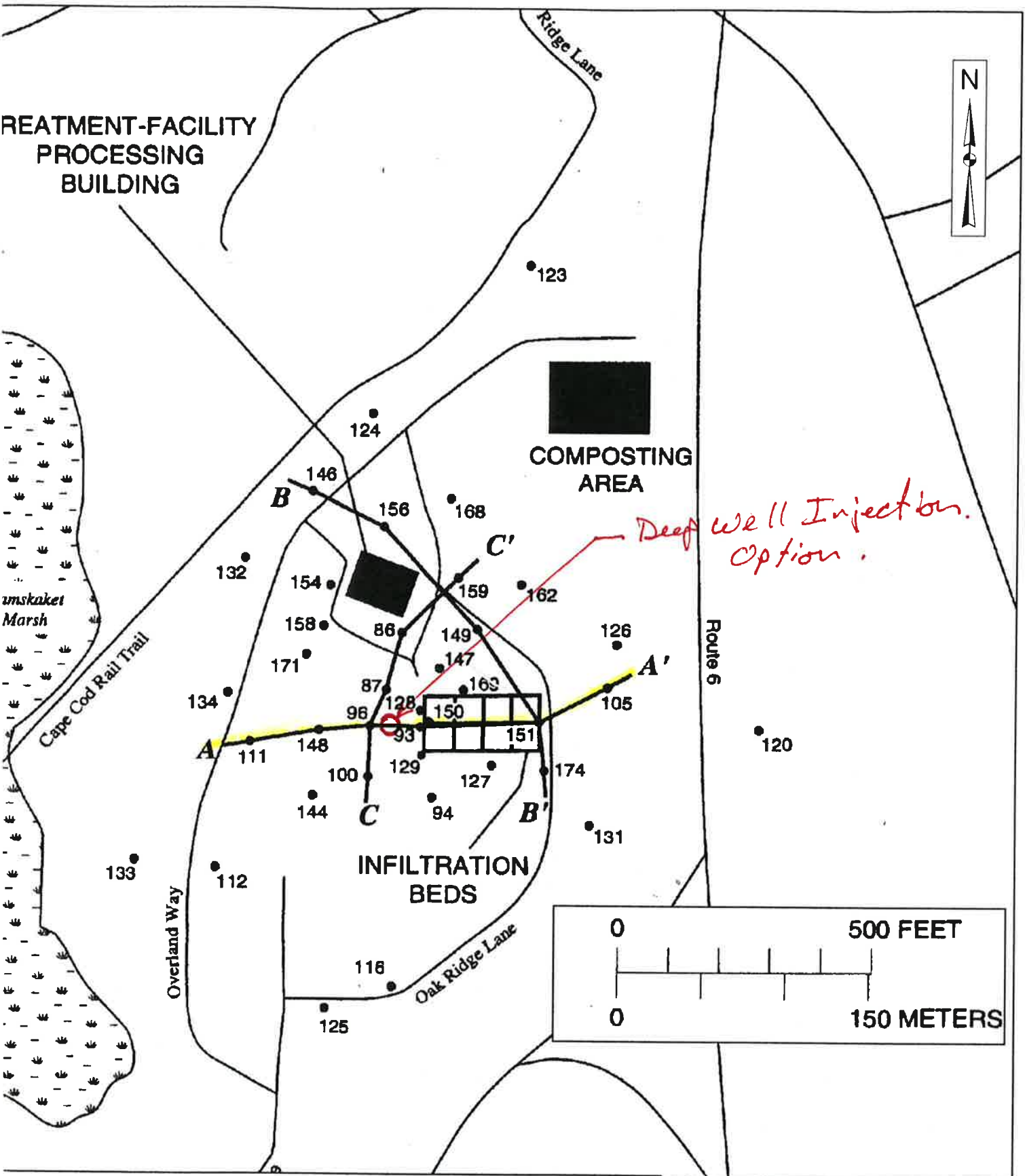
these three scenarios are 0.74, 0.504 and 0.37 mgd. The particle tracks for each of these scenarios is illustrated in Figures 14 through 16. In each scenario, the largest number of particles are discharged to Namskaket Creek. Discharges also occurred to Little Namskaket Creek. The particle trace analysis also indicates that a significant percent of the effluent-impacted groundwater will flow beneath the coastal wetlands and estuaries and emerges in Cape Cod Bay. No effluent-impacted water was predicted to flow to Rock Harbor. A summary of the ultimate fate of the wastewater discharge for each of the scenarios is presented in Table 5.

**TABLE 5
MODEL-PREDICTED FATE OF WASTEWATER DISCHARGES**

Scenario #	Application Volume mgd	Percentage of Total Discharge by Watershed			
		Namskaket %	Little Namskaket %	Cape Cod Bay %	Rock Harbor %
2	0.740	65	10	25	0
3	0.504	68	8	24	0
4	0.370	71	3	26	0
1	0.030	100	0	0	0

There is a significant difference in groundwater travel times associated with the discharges or ultimate fate of nitrogen-enriched groundwaters. Travel times to the upper portion of Namskaket Creek, particularly to the wetlands located approximately one thousand feet to the west of the Tri-Town site, will be on the order of months or years. Groundwater travel times to the remainder of the Namskaket Creek system and Little Namskaket Creek would be on the order of decades. Groundwater travel times to Cape Cod Bay are greater than 50 years and can be as long as 300 years. This is because these groundwater flow paths go deep into the aquifer. Because the model does not account for saltwater, it is not possible to accurately predict these flows. However, because the flows are deep within the aquifer, the discharges will not occur at the Cape Cod Bay beaches. Those near-shore discharges are derived from much more shallow groundwater and water quality at the beaches is impacted by stormwater discharges.

In addition to the first four scenarios summarized in Table 5, an additional simulation (Scenario 5) was conducted to determine the potential impacts associated with a theoretical planning horizon (year 2030) maximum wastewater discharge. Scenario 5 considers an annual average



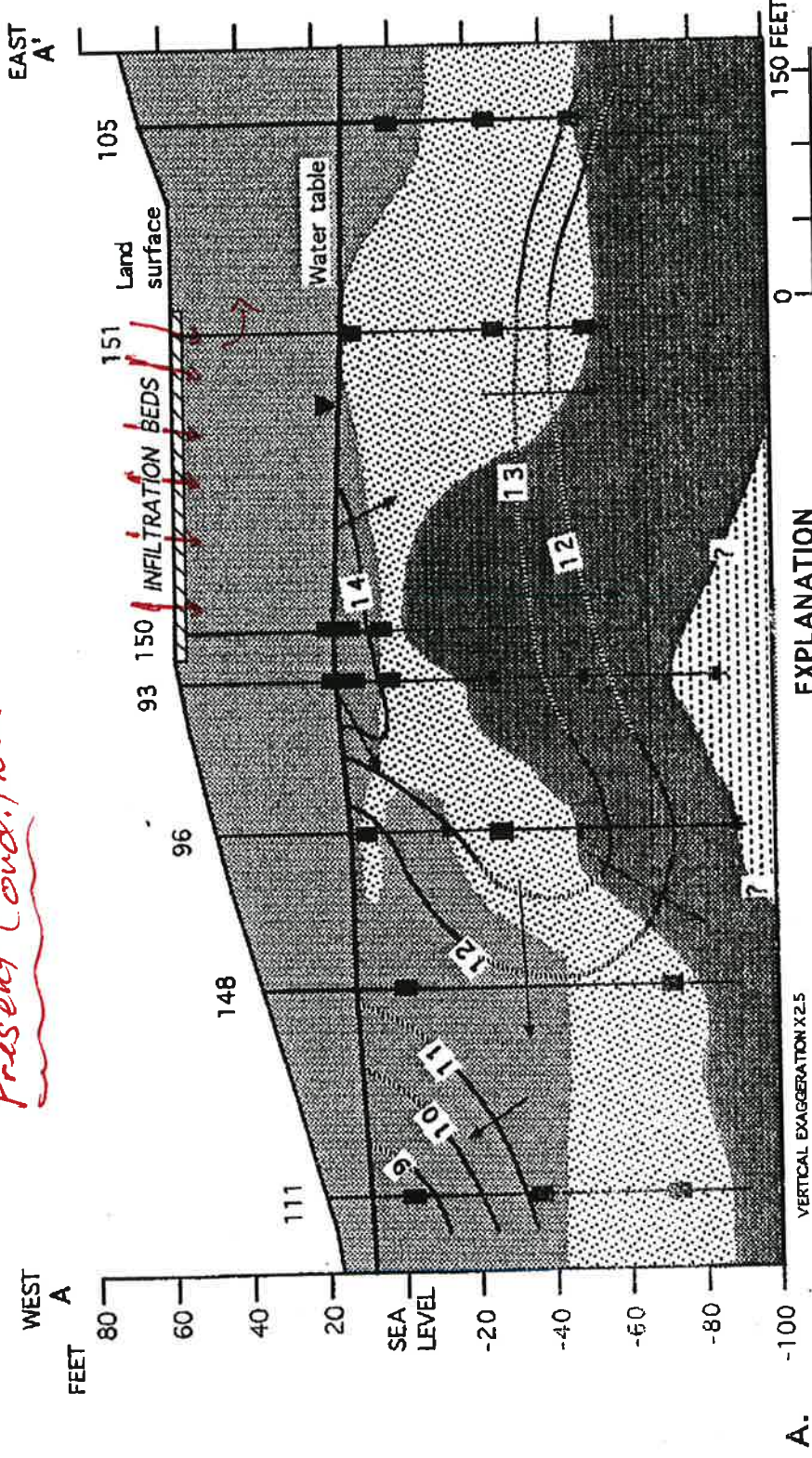
Legend
A-A' LINE OF HYDROGEOLOGIC SECTION--

● 118 **WELL CLUSTER SITE--** Site of one or more observation wells completed at different depths.

Orleans CWMP
 Site Investigations
 Site 241
 Base Map with Lines of
 Geologic Cross Section

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WRIGHT-PIERCE  Engineering a Better Environment		4

Present Condition



EXPLANATION

- 1 2 — POTENTIOMETRIC CONTOUR—Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval, 1 foot. Datum is sea level
- 1 2 — LITHOLOGIC UNITS—Boundaries between lithologic units queried where uncertain
- 1 2 — UPPER FINE-GRAINED UNIT—Fine to very fine or fine to medium sand, with silt
- 1 2 — INTERMEDIATE COARSE-GRAINED UNIT—Medium to very coarse sand, with gravel
- 1 2 — LOWER FINE-GRAINED UNIT—Fine to very fine or medium to fine sand, with silt
- 1 2 — LOWER COARSE-GRAINED UNIT—Medium to coarse sand

- 1 2 — WELL CLUSTER SITE IDENTIFIER AND SCREENED INTERVAL OF OBSERVATION WELL— Site of one or more observation wells completed at different depths. Length of screened interval is variable
- 1 2 — GENERAL DIRECTION OF GROUND-WATER FLOW

interval of well

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 Site 241
 Geologic Cross Section
 A-A'

PROJ NO 10645E DATE April 2008 FIGURE 5
WRIGHT-PIERCE
 Engineering a Better Environment

