

**Appendix R-4**  
**SONIR Computer Model Results, Alternative 2**

# SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton

Alternative 2a; Existing Zoning PRD; I/A; 75% seas; 10% turf; 30% LR

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	591.00	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Landscaping	88.65	acres
4	Fraction of Land in above	0.150	fraction
5	Evapotranspiration from above	23.00	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscape	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	23.90	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	1.18	acres
12	Fraction of above	0.002	fraction
13	Evapotranspiration from above	6.36	inches
14	Runoff from above	1.05	inches
15	Acreage of Water/Ponds/Wetlands	25.84	acres
16	Fraction of Site in above	0.044	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural/Natural Reveg	431.00	acres
20	Fraction of above	0.729	fraction
21	Evapotranspiration from above	23.00	inches
22	Runoff from above	0.35	inches
23	Acreage of Impervious/Paved/Bldgs	41.53	acres
24	Fraction of Land in above	0.070	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Wetlands/Rain Gardens	2.80	acres
24	Fraction of Land in above	0.005	fraction
25	Evapotrans. from above	30.00	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	88.65	acres
28	Fraction of Land Irrigated	0.150	fraction
29	Irrigation Rate	16.00	inches
30	Number of Dwellings	89	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	0	gal/day
33	Wastewater Design Flow (total)	26,550	gal/day
34	Adjusted WW Design Flow (total)	19,913	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	2.90	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Land (Residential)	88.65	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (Greens/Tees/Fairways)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
10	Outdoor Cat Population	0.74	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	1.40	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Adjusted Pet Waste (days/year occupied)	50%	percent
16	Area of Land Irrigated	88.65	acres
17	Irrigation Rate	16.00	inches
18	Irrigation Nitrogen Leaching Rate	30%	percent
19	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
20	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
21	Atmos. N Leaching Rate (Turf 30%; Golf 20%)	30%	percent
22	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
23	Nitrogen in Water Supply	2.00	mg/l
24	Nitrogen in Sanitary Flow -1	19.00	mg/l
25	Nitrogen in Sanitary Flow -2	10.00	mg/l

C	Comments
1)	Please refer to user manual for data input instructions; updated per LINAP.
	Developed Area 157.42 27%
	Natural/Unvegetated/Revegetated Area 433.58 73%
	Total Acreage Check 591.00 100%



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**Alternative 2a; Existing Zoning PRD; I/A; 75% seas; 10% turf; 30% LR**

**SITE RECHARGE COMPUTATIONS**

<b>A Landscaping</b>			<b>Value</b>	<b>Units</b>	<b>B Unfertilized Landscape</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.150	fraction	1	A = Fraction of Land in Cover Type	0.000	fraction	
2	P = Precipitation Rate		49.90	inches	2	P = Precipitation Rate	49.90	inches	
3	E = Evapotranspiration Rate		23.00	inches	3	E = Evapotranspiration Rate	23.90	inches	
4	Q = Runoff Rate		0.50	inches	4	Q = Runoff Rate	0.50	inches	
5	R(a) = P - (E + Q)		26.40	inches	5	R(b) = P - (E + Q)	25.50	inches	
6	R(A) = R(a) x A		3.96	inches	6	R(B) = R(b) x A	0.00	inches	

<b>C Unvegetated/Dirt Roads</b>			<b>Value</b>	<b>Units</b>	<b>D Water/Ponds</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.002	fraction	1	A = Fraction of Site in Water	0.044	fraction	
2	P = Precipitation Rate		49.90	inches	2	P = Precipitation Rate	49.90	inches	
3	E = Evapotranspiration Rate		6.36	inches	3	E = Evaporation Rate	30.00	inches	
4	Q = Runoff Rate		1.05	inches	4	Q = Runoff Rate	0.00	inches	
5	R(c) = P - (E + Q)		42.49	inches	5	M = Makeup Water	0.00	inches	
6	R(C) = R(c) x A		0.08	inches	6	R(d) = {P - (E+Q)} - M	19.90	inches	
					7	R(D) = R(d) x A	0.87	inches	

<b>E Natural/Natural Revegetation</b>			<b>Value</b>	<b>Units</b>	<b>F Impervious/Paved/Roads</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.729	fraction	1	A = Fraction of Land in Cover Type	0.070	fraction	
2	P = Precipitation Rate		49.90	inches	2	P = Precipitation Rate	49.90	inches	
3	E = Evapotranspiration Rate		23.00	inches	3	E = Evapotranspiration Rate	4.99	inches	
4	Q = Runoff Rate		0.35	inches	4	Q = Runoff Rate	0.00	inches	
5	R(e) = P - (E + Q)		26.55	inches	5	R(f) = P - (E + Q)	44.91	inches	
6	R(E) = R(e) x A		19.36	inches	6	R(F) = R(f) x A	3.16	inches	

<b>F Rain Gardens/Wetlands</b>			<b>Value</b>	<b>Units</b>	<b>H Irrigation Recharge</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.005	fraction	1	A = Fraction of Land Irrigated	0.150	fraction	
2	P = Precipitation Rate		49.90	inches	2	I = Irrigation Rate	16.00	inches	
3	E = Evapotranspiration Rate		30.00	inches	3	E = Evapotranspiration Rate	20.54	inches	
4	Q = Runoff Rate		0.00	inches	4	Q = Runoff Rate	0.50	inches	
5	R(g) = P - (E + Q)		19.90	inches	5	R(h) = I - (E + Q)	-5.04	inches	
6	R(G) = R(g) x A		0.09	inches	6	R(H) = R(H) x A	-0.76	inches	

<b>I Wastewater Recharge</b>			<b>Value</b>	<b>Units</b>	<b>J Runoff Recharge</b>			<b>Value</b>	<b>Units</b>
1	WDF = Wastewater Design Flow		19,913	gal/day	1	Q(A) = Runoff from Rough/Landscaped	0.075	inches	
2	WDF = Wastewater Design Flow		971,740	cu ft/yr	2	Q(B) = Runoff from Tees/Fairways	0.000	inches	
3	A = Area of Site		25,743,960	sq ft	3	Q(C) = Runoff from Unvegetated	0.002	inches	
4	R(j) = WDF/A		0.04	feet	4	Q(E) = Runoff from Natural	0.255	inches	
5	R(I) = Wastewater Recharge		0.45	inches	5	Q(H) = Runoff from Rain Gardens	0.000	inches	
					6	Q(I) = Runoff from Irrigation	0.08	inches	
					7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.41	inches	

<b>Total Site Recharge</b>		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
<b>R(T) =</b>	<b>27.63</b>	<b>inches</b>



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**Alternative 2a; Existing Zoning PRD; I/A; 75% seas; 10% turf; 30% LR**

**SITE NITROGEN BUDGET**

<b>A Sanitary Nitrogen-Residential</b>				<b>B Cat Waste Nitrogen</b>		
		<b>Value</b>	<b>Units</b>		<b>Value</b>	<b>Units</b>
1	Number of Dwellings	0	units	1	Number of Cats per Dwelling	0.74 cats/dwelling
2	Persons per Dwelling	2.90	capita	2	Number of Cats (Cats/dwelling x dwellings)	65 cats
3	P = Population	0.00	capita	3	Cat Waste Nitrogen Load	3.22 lbs/cat/year
4	N = Nitrogen per person	10	lbs	4	N(p) = AR x cats x Adjustment (if applicable)	210.88 lbs/year
6	N = (total; pre loss/removal)	0	lbs	5	LR = Leaching Rate	25% percent
7	LR = Leaching Rate	84%	percent	6	N(P) = N(p) x LR	52.72 lbs
8	N(S) = P x N x LR	0.00	lbs	7	N = (loss/removed)	158.16 lbs
9	N = loss/removed	0.00	lbs			
<b>C Sanitary Nitrogen (Wastewater Design Flow)</b>				<b>B' Dog Waste Nitrogen</b>		
					<b>Value</b>	<b>Units</b>
1	CF = Commercial/STP Flow	19,913	gal/day	1	Number of Dogs per Dwelling	1.40 dogs/dwelling
2	CF = Commercial/STP Flow	27,509,617	liters/yr	2	Number of Dogs (Dogs/dwelling x dwellings)	124 dogs
3	N = Nitrogen (1)	19.00	mg/l	3	Dog Waste Nitrogen Load	4.29 lbs/dog/year
4	N = Nitrogen (1)	1152.52	lbs	4	N(p) = AR x dogs x Adjustment (if applicable)	531.53 lbs/year
5	N =Nitrogen (2)	19.00	mg/l	5	LR = Leaching Rate	25% percent
6	N = Nitrogen (2)	1152.52	lbs	6	N(P) = N(p) x LR	132.88 lbs
7	LR = Leaching Rate	100%	percent	7	N = (loss/removed)	398.65 lbs
8	N(S) = CF x N x LR	522,682,715	milligrams			
9	N(S) = Sanitary Nitrogen	1152.52	lbs	<b>D Water Supply Nitrogen (other than wastewater, if applicable)</b>		
10	N = loss/removed	0.00	lbs	1	WDF = Wastewater Design Flow	0 gal/day
				2	WDF = Wastewater Design Flow	0 liters/yr
				3	N = Nitrogen in Water Supply	2.00 mg/l
				4	N(WW) = WDF x N	0 milligrams
				5	N(WW) = Wastewater Nitrogen	0.00 lbs
<b>E Fertilized Landscaping</b>				<b>F Unfertilized Landscape</b>		
1	A = Area of Land Fertilized 1	3,861,594	sq ft	1	A = Area of Land Fertilized 2	0 sq ft
2	AR = Application Rate	2.04	lbs/1000 sf	2	AR = Application Rate	0.00 lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7877.65	lbs	3	N(T) = Nitrogen (total applied)	0.00 lbs
4	LR = Leaching Rate	30%	percent	4	LR = Leaching Rate	30% percent
5	N(F1) = A x AR x LR	2363.30	lbs	5	N(F2) = A x AR x LR	0.00 lbs
6	N = loss/removed	5514.36	lbs	6	N = loss/removed	0.00 lbs
<b>G Atmospheric Nitrogen (existing condition)</b>				<b>H Irrigation Nitrogen</b>		
1	Application Load	0.041	lbs/1000 sf	1	R = Irrigation Recharge (inches)	-0.76 inches
2	Area of Natural/Wetlands/1000 sf	20,022	1000 sf	2	R = Irrigation Rate (feet)	-0.06 feet
3	Leaching Rate	25%	percent	3	A = Area of Land Irrigated	60,984 sq ft
4	Atmos. N Load-1 (natural/wetlands)	205.22	lbs/year	4	R(I) = R(irr) x A	0 cu ft
5	Area of turf/golf/1000 sf	3,862	1000 sf	5	R(I) = Site Precipitation (liters)	0 liters
6	Leaching Rate	30%	percent	6	N = Nitrogen in Water Supply	16.00 mg/l
7	Atmos. N Load-2 (turf)	47.50	lbs/year	7	N(T) = Nitrogen (total applied)	0.00 lbs
8	Area of Impervious/Agricult/1000 sf	1,860	1000 sf	8	LR = Leaching Rate	30% percent
9	Leaching Rate	40%	percent	9	N(irr) = R(I) x N x LR	0 milligrams
10	Atmos. N Load-3 (ag; imperv; other)	30.51	lbs/year	10	N(irr) = Irrigation Nitrogen	0.00 lbs
11	N(at) = N Load 1 + 2 +3	283.23	lbs	11	N = loss/removed	0.00 lbs
12	N = loss/removed	772.27	lbs			

<b>Total Site Nitrogen</b>	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	<b>3,984.65</b> lbs



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton  
Alternative 2a; Existing Zoning PRD; I/A; 75% seas; 10% turf; 30% LR

**FINAL COMPUTATIONS**

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	3,984.65	lbs
2	N = Total Nitrogen (milligrams)	1,809,029,613	milligrams
3	R(T) = Total Recharge (inches)	27.63	inches
4	R(T) = Total Recharge (feet)	2.30	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,278,758	cu ft
7	R = Site Recharge Volume	1,678,774,436	liters
9	NR = N/R	1.08	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	<b>1.08</b>
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<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	27.63	inches/yr
2	R = Site Recharge Volume	59,278,758	cu ft/yr
3	R = Site Recharge Volume	443,435,937	gal/yr
4	R = Site Recharge Volume	443.44	MG/yr

<i>Conversions used in SONIR</i>	
Acres x 43,560 =	Square Feet
Cubic Feet x 7.48052 =	Gallons
Cubic Feet x 28.32 =	Liters
Days x 365 =	Years
Feet x 12 =	Inches
Gallons x 0.1337 =	Cubic Feet
Gallons x 3.785 =	Liters
Grams / 1,000 =	Milligrams
Grams x 0.002205 =	Pounds
Milligrams / 1,000 =	Grams

**Total Nitrogen**

Site Nitrogen (No Mitigation)	3,984.65
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	3,984.65

**Total Anthropogenic Nitrogen**

Site Nitrogen (No Mitigation)	3,701.41
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	3,701.41



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**NAME OF PROJECT**

**The Hills at Southampton**  
**Alternative 2a; Existing Zoning PRD; I/A; 30% LR**

**DATA INPUT FIELD**

<b>A</b>	<b>Site Recharge Parameters</b>	<b>Value</b>	<b>Units</b>
1	Area of Site	591.00	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Landscaping	88.65	acres
4	Fraction of Land in above	0.150	fraction
5	Evapotranspiration from above	23.00	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscape	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	23.90	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	1.18	acres
12	Fraction of above	0.002	fraction
13	Evapotranspiration from above	6.36	inches
14	Runoff from above	1.05	inches
15	Acreage of Water/Ponds/Wetlands	25.84	acres
16	Fraction of Site in above	0.044	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural/Natural Reveg	431.00	acres
20	Fraction of above	0.729	fraction
21	Evapotranspiration from above	23.00	inches
22	Runoff from above	0.35	inches
23	Acreage of Impervious/Paved/Bldgs	41.53	acres
24	Fraction of Land in above	0.070	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Wetlands/Rain Gardens	2.80	acres
24	Fraction of Land in above	0.005	fraction
25	Evapotrans. from above	30.00	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	88.65	acres
28	Fraction of Land Irrigated	0.150	fraction
29	Irrigation Rate	16.00	inches
30	Number of Dwellings	118	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	0	gal/day
33	Wastewater Design Flow (total)	35,400	gal/day
34	Adjusted WW Design Flow (total)	35,400	gal/day

<b>B</b>	<b>Nitrogen Budget Parameters</b>	<b>Value</b>	<b>Units</b>
1	Persons per Dwelling	2.90	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Land (Residential)	88.65	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (Greens/Tees/Fairways)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
10	Outdoor Cat Population	0.74	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	1.40	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Adjusted Pet Waste (days/year occupied)	50%	percent
16	Area of Land Irrigated	88.65	acres
17	Irrigation Rate	16.00	inches
18	Irrigation Nitrogen Leaching Rate	30%	percent
19	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
20	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
21	Atmos. N Leaching Rate (Turf 30%; Golf 20%)	30%	percent
22	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
23	Nitrogen in Water Supply	2.00	mg/l
24	Nitrogen in Sanitary Flow -1	19.00	mg/l
25	Nitrogen in Sanitary Flow -2	10.00	mg/l

<b>C</b>	<b>Comments</b>
1)	Please refer to user manual for data input instructions; updated per LINAP.
	Developed Area 157.42 27%
	Natural/Unvegetated/Revegetated Area 433.58 73%
	Total Acreage Check 591.00 100%



# SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 2a; Existing Zoning PRD; I/A; 30% LR

## SITE RECHARGE COMPUTATIONS

<b>A Landscaping</b>			<b>Value</b>	<b>Units</b>	<b>B Unfertilized Landscape</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.150	fraction	1	A = Fraction of Land in Cover Type	0.000	fraction	
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3	E = Evapotranspiration Rate		23.00	inches	3	E = Evapotranspiration Rate	23.90	inches	
4	Q = Runoff Rate		0.50	inches	4	Q = Runoff Rate	0.50	inches	
5	R(a) = P - (E + Q)		26.40	inches	5	R(b) = P - (E + Q)	25.50	inches	
6	R(A) = R(a) x A		3.96	inches	6	R(B) = R(b) x A	0.00	inches	

<b>C Unvegetated/Dirt Roads</b>			<b>Value</b>	<b>Units</b>	<b>D Water/Ponds</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.002	fraction	1	A = Fraction of Site in Water	0.044	fraction	
2	P = Precipitation Rate		49.90	inches	2	P = Precipitation Rate	49.90	inches	
3	E = Evapotranspiration Rate		6.36	inches	3	E = Evaporation Rate	30.00	inches	
4	Q = Runoff Rate		1.05	inches	4	Q = Runoff Rate	0.00	inches	
5	R(c) = P - (E + Q)		42.49	inches	5	M = Makeup Water	0.00	inches	
6	R(C) = R(c) x A		0.08	inches	6	R(d) = {P - (E+Q)} - M	19.90	inches	
					7	R(D) = R(d) x A	0.87	inches	

<b>E Natural/Natural Revegetation</b>			<b>Value</b>	<b>Units</b>	<b>F Impervious/Paved/Roads</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.729	fraction	1	A = Fraction of Land in Cover Type	0.070	fraction	
2	P = Precipitation Rate		49.90	inches	2	P = Precipitation Rate	49.90	inches	
3	E = Evapotranspiration Rate		23.00	inches	3	E = Evapotranspiration Rate	4.99	inches	
4	Q = Runoff Rate		0.35	inches	4	Q = Runoff Rate	0.00	inches	
5	R(e) = P - (E + Q)		26.55	inches	5	R(f) = P - (E + Q)	44.91	inches	
6	R(E) = R(e) x A		19.36	inches	6	R(F) = R(f) x A	3.16	inches	

<b>F Rain Gardens/Wetlands</b>			<b>Value</b>	<b>Units</b>	<b>H Irrigation Recharge</b>			<b>Value</b>	<b>Units</b>
1	A = Fraction of Land in Cover Type		0.005	fraction	1	A = Fraction of Land Irrigated	0.150	fraction	
2	P = Precipitation Rate		49.90	inches	2	I = Irrigation Rate	16.00	inches	
3	E = Evapotranspiration Rate		30.00	inches	3	E = Evapotranspiration Rate	20.54	inches	
4	Q = Runoff Rate		0.00	inches	4	Q = Runoff Rate	0.50	inches	
5	R(g) = P - (E + Q)		19.90	inches	5	R(h) = I - (E + Q)	-5.04	inches	
6	R(G) = R(g) x A		0.09	inches	6	R(H) = R(H) x A	-0.76	inches	

<b>I Wastewater Recharge</b>			<b>Value</b>	<b>Units</b>	<b>J Runoff Recharge</b>			<b>Value</b>	<b>Units</b>
1	WDF = Wastewater Design Flow		35,400	gal/day	1	Q(A) = Runoff from Rough/Landscaped	0.075	inches	
2	WDF = Wastewater Design Flow		1,727,538	cu ft/yr	2	Q(B) = Runoff from Tees/Fairways	0.000	inches	
3	A = Area of Site		25,743,960	sq ft	3	Q(C) = Runoff from Unvegetated	0.002	inches	
4	R(j) = WDF/A		0.07	feet	4	Q(E) = Runoff from Natural	0.255	inches	
5	R(I) = Wastewater Recharge		0.81	inches	5	Q(H) = Runoff from Rain Gardens	0.000	inches	
					6	Q(I) = Runoff from Irrigation	0.08	inches	
					7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.41	inches	

<b>Total Site Recharge</b>		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	<b>27.98</b>	<b>inches</b>



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**Alternative 2a; Existing Zoning PRD; I/A; 30% LR**

**SITE NITROGEN BUDGET**

<b>A</b>	<b>Sanitary Nitrogen-Residential</b>	<b>Value</b>	<b>Units</b>
1	Number of Dwellings	0	units
2	Persons per Dwelling	2.90	capita
3	P = Population	0.00	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	0	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	0.00	lbs
9	N = loss/removed	0.00	lbs

<b>C</b>	<b>Sanitary Nitrogen (Wastewater Design Flow)</b>		
1	CF = Commercial/STP Flow	35,400	gal/day
2	CF = Commercial/STP Flow	48,905,985	liters/yr
3	N = Nitrogen (1)	19.00	mg/l
4	N = Nitrogen (1)	2048.92	lbs
5	N = Nitrogen (2)	19.00	mg/l
6	N = Nitrogen (2)	2048.92	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	929,213,715	milligrams
9	N(S) = Sanitary Nitrogen	2048.92	lbs
10	N = loss/removed	0.00	lbs

<b>E</b>	<b>Fertilized Landscaping</b>		
1	A = Area of Land Fertilized 1	3,861,594	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7877.65	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	2363.30	lbs
6	N = loss/removed	5514.36	lbs

<b>G</b>	<b>Atmospheric Nitrogen (existing condition)</b>		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,022	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	205.22	lbs/year
5	Area of turf/golf/1000 sf	3,862	1000 sf
6	Leaching Rate	30%	percent
7	Atmos. N Load-2 (turf)	47.50	lbs/year
8	Area of Impervious/Agriculture/1000 sf	1,860	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	30.51	lbs/year
11	N(at) = N Load 1 + 2 + 3	283.23	lbs
12	N = loss/removed	772.27	lbs

<b>B</b>	<b>Cat Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Cats per Dwelling	0.74	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	87	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	281.17	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	70.29	lbs
7	N = (loss/removed)	210.88	lbs

<b>B'</b>	<b>Dog Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	165	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	708.71	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	177.18	lbs
7	N = (loss/removed)	531.53	lbs

<b>D</b>	<b>Water Supply Nitrogen (other than wastewater, if applicable)</b>		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	2.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

<b>F</b>	<b>Unfertilized Landscape</b>		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	30%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

<b>H</b>	<b>Irrigation Nitrogen</b>		
1	R = Irrigation Recharge (inches)	-0.76	inches
2	R = Irrigation Rate (feet)	-0.06	feet
3	A = Area of Land Irrigated	60,984	sq ft
4	R(I) = R(irr) x A	0	cu ft
5	R(I) = Site Precipitation (liters)	0	liters
6	N = Nitrogen in Water Supply	16.00	mg/l
7	N(T) = Nitrogen (total applied)	0.00	lbs
8	LR = Leaching Rate	30%	percent
9	N(irr) = R(I) x N x LR	0	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.00	lbs

<b>Total Site Nitrogen</b>	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	<b>4,942.91</b> lbs





# SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**NAME OF PROJECT**

The Hills at Southampton  
Alternative 2a; Existing Zoning PRD; I/A; 30% LR

**FINAL COMPUTATIONS**

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	4,942.91	lbs
2	N = Total Nitrogen (milligrams)	2,244,083,401	milligrams
3	R(T) = Total Recharge (inches)	27.98	inches
4	R(T) = Total Recharge (feet)	2.33	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	60,034,556	cu ft
7	R = Site Recharge Volume	1,700,178,628	liters
9	NR = N/R	1.32	mg/l

CONCENTRATION OF  
NITROGEN IN RECHARGE

**1.32**

<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	27.98	inches/yr
2	R = Site Recharge Volume	60,034,556	cu ft/yr
3	R = Site Recharge Volume	449,089,697	gal/yr
4	R = Site Recharge Volume	449.09	MG/yr

<i>Conversions used in SONIR</i>	
Acres x 43,560 =	Square Feet
Cubic Feet x 7.48052 =	Gallons
Cubic Feet x 28.32 =	Liters
Days x 365 =	Years
Feet x 12 =	Inches
Gallons x 0.1337 =	Cubic Feet
Gallons x 3.785 =	Liters
Grams / 1,000 =	Milligrams
Grams x 0.002205 =	Pounds
Milligrams / 1,000 =	Grams

**Total Nitrogen**

Site Nitrogen (No Mitigation)	4,942.91
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	4,942.91

**Total Anthropogenic Nitrogen**

Site Nitrogen (No Mitigation)	4,659.68
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	4,659.68



# SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton

Alternative 2a; Existing Zoning PRD; no STP; 75% seas; 30% LR

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	591.00	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Landscaping	88.65	acres
4	Fraction of Land in above	0.150	fraction
5	Evapotranspiration from above	23.00	inches
6	Runoff from above	0.50	inches
7	Acreage of Unfertilized Landscape	0.00	acres
8	Fraction of above	0.000	fraction
9	Evapotranspiration from above	23.90	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	1.18	acres
12	Fraction of above	0.002	fraction
13	Evapotranspiration from above	6.36	inches
14	Runoff from above	1.05	inches
15	Acreage of Water/Ponds/Wetlands	25.84	acres
16	Fraction of Site in above	0.044	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural/Natural Reveg	431.00	acres
20	Fraction of above	0.729	fraction
21	Evapotranspiration from above	23.00	inches
22	Runoff from above	0.35	inches
23	Acreage of Impervious/Paved/Bldgs	41.53	acres
24	Fraction of Land in above	0.070	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Wetlands/Rain Gardens	2.80	acres
24	Fraction of Land in above	0.005	fraction
25	Evapotrans. from above	30.00	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	88.65	acres
28	Fraction of Land Irrigated	0.150	fraction
29	Irrigation Rate	16.00	inches
30	No. of Dwellings (-25% seasonal adj)	89	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	0	gal/day
33	Wastewater Design Flow (total)	26,550	gal/day
34	Adjusted WW Design Flow (total)	19,913	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	2.90	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	84%	percent
3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
4	Fertilized Land (Residential)	88.65	acres
5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
7	Fertilized Land (Greens/Tees/Fairways)	0.00	acres
8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent
10	Outdoor Cat Population	0.74	pets/dwelling
11	Cat Waste Nitrogen Load	3.22	lbs/pet/year
12	Outdoor Dog Population	1.40	pets/dwelling
13	Dog Waste Nitrogen Load	4.29	lbs/pet/year
14	Pet Waste Nitrogen Leaching Rate	25%	percent
15	Adjusted Pet Waste (days/year occupied)	50%	percent
16	Area of Land Irrigated	88.65	acres
17	Irrigation Rate	16.00	inches
18	Irrigation Nitrogen Leaching Rate	30%	percent
19	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft
20	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent
21	Atmos. N Leaching Rate (Turf 30%; Golf 20%)	30%	percent
22	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
23	Nitrogen in Water Supply	2.00	mg/l
24	Nitrogen in Sanitary Flow -1	50.00	mg/l
25	Nitrogen in Sanitary Flow -2	10.00	mg/l

C	Comments
1)	Please refer to user manual for data input instructions; updated per LINAP.
	Developed Area 157.42 27%
	Natural/Unvegetated/Revegetated Area 433.58 73%
	Total Acreage Check 591.00 100%



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 2a; Existing Zoning PRD; no STP; 75% seas; 30% LR

**SITE RECHARGE COMPUTATIONS**

<i>A</i>	<i>Landscaping</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.150	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	26.40	inches
6	R(A) = R(a) x A	3.96	inches

<i>B</i>	<i>Unfertilized Landscape</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	25.50	inches
6	R(B) = R(b) x A	0.00	inches

<i>C</i>	<i>Unvegetated/Dirt Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.002	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	6.36	inches
4	Q = Runoff Rate	1.05	inches
5	R(c) = P - (E + Q)	42.49	inches
6	R(C) = R(c) x A	0.08	inches

<i>D</i>	<i>Water/Ponds</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Site in Water	0.044	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.87	inches

<i>E</i>	<i>Natural/Natural Revegetation</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.729	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.35	inches
5	R(e) = P - (E + Q)	26.55	inches
6	R(E) = R(e) x A	19.36	inches

<i>F</i>	<i>Impervious/Paved/Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.070	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	3.16	inches

<i>F</i>	<i>Rain Gardens/Wetlands</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.005	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	19.90	inches
6	R(G) = R(g) x A	0.09	inches

<i>H</i>	<i>Irrigation Recharge</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land Irrigated	0.150	fraction
2	I = Irrigation Rate	16.00	inches
3	E = Evapotranspiration Rate	20.54	inches
4	Q = Runoff Rate	0.50	inches
5	R(h) = I - (E + Q)	-5.04	inches
6	R(H) = R(H) x A	-0.76	inches

<i>I</i>	<i>Wastewater Recharge</i>	<i>Value</i>	<i>Units</i>
1	WDF = Wastewater Design Flow	19,913	gal/day
2	WDF = Wastewater Design Flow	971,740	cu ft/yr
3	A = Area of Site	25,743,960	sq ft
4	R(j) = WDF/A	0.04	feet
5	R(I) = Wastewater Recharge	0.45	inches

<i>J</i>	<i>Runoff Recharge</i>	<i>Value</i>	<i>Units</i>
1	Q(A) = Runoff from Rough/Landscaped	0.075	inches
2	Q(B) = Runoff from Tees/Fairways	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.002	inches
4	Q(E) = Runoff from Natural	0.255	inches
5	Q(H) = Runoff from Rain Gardens	0.000	inches
6	Q(I) = Runoff from Irrigation	0.08	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.41	inches

<b>Total Site Recharge</b>		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	<b>27.63</b>	<b>inches</b>



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**Alternative 2a; Existing Zoning PRD; no STP; 75% seas; 30% LR**

**SITE NITROGEN BUDGET**

<b>A</b>	<b>Sanitary Nitrogen-Residential</b>	<b>Value</b>	<b>Units</b>
1	Number of Dwellings	89	units
2	Persons per Dwelling	2.90	capita
3	P = Population	256.65	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	2566.5	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	2155.86	lbs
9	N = loss/removed	410.64	lbs

<b>C</b>	<b>Sanitary Nitrogen (Wastewater Design Flow)</b>		
1	CF = Commercial/STP Flow	0	gal/day
2	CF = Commercial/STP Flow	0	liters/yr
3	N = Nitrogen (1)	50.00	mg/l
4	N = Nitrogen (1)	0.00	lbs
5	N =Nitrogen (2)	50.00	mg/l
6	N = Nitrogen (2)	0.00	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = CF x N x LR	0	milligrams
9	N(S) = Sanitary Nitrogen	0.00	lbs
10	N = loss/removed	0.00	lbs

<b>E</b>	<b>Fertilized Landscaping</b>		
1	A = Area of Land Fertilized 1	3,861,594	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7877.65	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	2363.30	lbs
6	N = loss/removed	5514.36	lbs

<b>G</b>	<b>Atmospheric Nitrogen (existing condition)</b>		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,022	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	205.22	lbs/year
5	Area of turf/golf/1000 sf	3,862	1000 sf
6	Leaching Rate	30%	percent
7	Atmos. N Load-2 (turf)	47.50	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,860	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	30.51	lbs/year
11	N(at) = N Load 1 + 2 +3	283.23	lbs
12	N = loss/removed	772.27	lbs

<b>B</b>	<b>Cat Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Cats per Dwelling	0.74	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	65	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	210.88	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	52.72	lbs
7	N = (loss/removed)	158.16	lbs

<b>B'</b>	<b>Dog Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	124	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	531.53	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	132.88	lbs
7	N = (loss/removed)	398.65	lbs

<b>D</b>	<b>Water Supply Nitrogen (other than wastewater, if applicable)</b>		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	2.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

<b>F</b>	<b>Unfertilized Landscape</b>		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	30%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

<b>H</b>	<b>Irrigation Nitrogen</b>		
1	R = Irrigation Recharge (inches)	-0.76	inches
2	R = Irrigation Rate (feet)	-0.06	feet
3	A = Area of Land Irrigated	60,984	sq ft
4	R(I) = R(irr) x A	0	cu ft
5	R(I) = Site Precipitation (liters)	0	liters
6	N = Nitrogen in Water Supply	16.00	mg/l
7	N(T) = Nitrogen (total applied)	0.00	lbs
8	LR = Leaching Rate	30%	percent
9	N(irr) = R(I) x N x LR	0	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.00	lbs

<b>Total Site Nitrogen</b>	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	<b>4,987.99</b> lbs



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton  
 Alternative 2a; Existing Zoning PRD; no STP; 75% seas; 30% LR

**FINAL COMPUTATIONS**

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	4,987.99	lbs
2	N = Total Nitrogen (milligrams)	2,264,548,068	milligrams
3	R(T) = Total Recharge (inches)	27.63	inches
4	R(T) = Total Recharge (feet)	2.30	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,278,758	cu ft
7	R = Site Recharge Volume	1,678,774,436	liters
9	NR = N/R	1.35	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	<b>1.35</b>
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<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	27.63	inches/yr
2	R = Site Recharge Volume	59,278,758	cu ft/yr
3	R = Site Recharge Volume	443,435,937	gal/yr
4	R = Site Recharge Volume	443.44	MG/yr

<i>Conversions used in SONIR</i>	
Acres x 43,560 =	Square Feet
Cubic Feet x 7.48052 =	Gallons
Cubic Feet x 28.32 =	Liters
Days x 365 =	Years
Feet x 12 =	Inches
Gallons x 0.1337 =	Cubic Feet
Gallons x 3.785 =	Liters
Grams / 1,000 =	Milligrams
Grams x 0.002205 =	Pounds
Milligrams / 1,000 =	Grams

**Total Nitrogen**

Site Nitrogen (No Mitigation)	4,987.99
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	4,987.99

**Total Anthropogenic Nitrogen**

Site Nitrogen (No Mitigation)	4,704.76
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	4,704.76



# SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton  
Alternative 2a; Existing Zoning PRD; no STP; 30% LR

DATA INPUT FIELD

A Site Recharge Parameters			B Nitrogen Budget Parameters												
	Value	Units		Value	Units										
1	Area of Site	591.00	acres	1	Persons per Dwelling	2.90	persons								
2	Precipitation Rate	49.90	inches	2	Nitrogen per Person per Year	10.0	lbs								
3	Acreage of Landscaping	88.65	acres	3	a. Sanitary Nitrogen Leaching Rate	84%	percent								
4	Fraction of Land in above	0.150	fraction	3	b. Treated Sanitary Nitrogen Leaching Rate	90%	percent								
5	Evapotranspiration from above	23.00	inches	4	Fertilized Land (Residential)	88.65	acres								
6	Runoff from above	0.50	inches	5	Fertilizer Application Rate (for above)	2.04	lbs/1000 sq ft								
7	Acreage of Unfertilized Landscape	0.00	acres	6	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent								
8	Fraction of above	0.000	fraction	7	Fertilized Land (Greens/Tees/Fairways)	0.00	acres								
9	Evapotranspiration from above	23.90	inches	8	Fertilizer Application Rate (for above)	0.00	lbs/1000 sq ft								
10	Runoff from above	0.50	inches	9	Fertilizer Nitrogen Leaching Rate (for above)	30%	percent								
11	Acreage of Unvegetated/Dirt Roads	1.18	acres	10	Outdoor Cat Population	0.74	pets/dwelling								
12	Fraction of above	0.002	fraction	11	Cat Waste Nitrogen Load	3.22	lbs/pet/year								
13	Evapotranspiration from above	6.36	inches	12	Outdoor Dog Population	1.40	pets/dwelling								
14	Runoff from above	1.05	inches	13	Dog Waste Nitrogen Load	4.29	lbs/pet/year								
15	Acreage of Water/Ponds/Wetlands	25.84	acres	14	Pet Waste Nitrogen Leaching Rate	25%	percent								
16	Fraction of Site in above	0.044	fraction	15	Adjusted Pet Waste (days/year occupied)	50%	percent								
17	Evaporation from above	30.00	inches	16	Area of Land Irrigated	88.65	acres								
18	Makeup Water (if applicable)	0.00	inches	17	Irrigation Rate	16.00	inches								
19	Acreage of Natural/Natural Reveg	431.00	acres	18	Irrigation Nitrogen Leaching Rate	30%	percent								
20	Fraction of above	0.729	fraction	19	Atmospheric Nitrogen Application/Load	0.04	lbs/1000 sq ft								
21	Evapotranspiration from above	23.00	inches	20	Atmos. N Leaching Rate (Natural/Wetlands)	25%	percent								
22	Runoff from above	0.35	inches	21	Atmos. N Leaching Rate (Turf 30%; Golf 20%)	30%	percent								
23	Acreage of Impervious/Paved/Bldgs	41.53	acres	22	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent								
24	Fraction of Land in above	0.070	fraction	23	Nitrogen in Water Supply	2.00	mg/l								
25	Evapotrans. from above	4.99	inches	24	Nitrogen in Sanitary Flow -1	50.00	mg/l								
26	Runoff from Impervious	0.00	inches	25	Nitrogen in Sanitary Flow -2	10.00	mg/l								
23	Acreage of Wetlands/Rain Gardens	2.80	acres												
24	Fraction of Land in above	0.005	fraction												
25	Evapotrans. from above	30.00	inches												
26	Runoff from above	0.00	inches												
27	Acreage of Land Irrigated	88.65	acres												
28	Fraction of Land Irrigated	0.150	fraction												
29	Irrigation Rate	16.00	inches												
30	Number of Dwellings	118	units												
31	Water Use per Dwelling	300	gal/day												
32	Wastewater Design Flow (units)	0	gal/day												
33	Wastewater Design Flow (total)	35,400	gal/day												
34	Adjusted WW Design Flow (total)	35,400	gal/day												
			<b>C Comments</b>												
			1) Please refer to user manual for data input instructions; updated per LINAP.												
			<table border="0"> <tr> <td>Developed Area</td> <td>157.42</td> <td>27%</td> </tr> <tr> <td>Natural/Unvegetated/Revegetated Area</td> <td>433.58</td> <td>73%</td> </tr> <tr> <td>Total Acreage Check</td> <td>591.00</td> <td>100%</td> </tr> </table>				Developed Area	157.42	27%	Natural/Unvegetated/Revegetated Area	433.58	73%	Total Acreage Check	591.00	100%
Developed Area	157.42	27%													
Natural/Unvegetated/Revegetated Area	433.58	73%													
Total Acreage Check	591.00	100%													



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Alternative 2a; Existing Zoning PRD; no STP; 30% LR

**SITE RECHARGE COMPUTATIONS**

<i>A</i>	<i>Landscaping</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.150	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.50	inches
5	R(a) = P - (E + Q)	26.40	inches
6	R(A) = R(a) x A	3.96	inches

<i>B</i>	<i>Unfertilized Landscape</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.50	inches
5	R(b) = P - (E + Q)	25.50	inches
6	R(B) = R(b) x A	0.00	inches

<i>C</i>	<i>Unvegetated/Dirt Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.002	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	6.36	inches
4	Q = Runoff Rate	1.05	inches
5	R(c) = P - (E + Q)	42.49	inches
6	R(C) = R(c) x A	0.08	inches

<i>D</i>	<i>Water/Ponds</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Site in Water	0.044	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = { P - (E+Q) } - M	19.90	inches
7	R(D) = R(d) x A	0.87	inches

<i>E</i>	<i>Natural/Natural Revegetation</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.729	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.35	inches
5	R(e) = P - (E + Q)	26.55	inches
6	R(E) = R(e) x A	19.36	inches

<i>F</i>	<i>Impervious/Paved/Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.070	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	3.16	inches

<i>F</i>	<i>Rain Gardens/Wetlands</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.005	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	19.90	inches
6	R(G) = R(g) x A	0.09	inches

<i>H</i>	<i>Irrigation Recharge</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land Irrigated	0.150	fraction
2	I = Irrigation Rate	16.00	inches
3	E = Evapotranspiration Rate	20.54	inches
4	Q = Runoff Rate	0.50	inches
5	R(h) = I - (E + Q)	-5.04	inches
6	R(H) = R(H) x A	-0.76	inches

<i>I</i>	<i>Wastewater Recharge</i>	<i>Value</i>	<i>Units</i>
1	WDF = Wastewater Design Flow	35,400	gal/day
2	WDF = Wastewater Design Flow	1,727,538	cu ft/yr
3	A = Area of Site	25,743,960	sq ft
4	R(j) = WDF/A	0.07	feet
5	R(I) = Wastewater Recharge	0.81	inches

<i>J</i>	<i>Runoff Recharge</i>	<i>Value</i>	<i>Units</i>
1	Q(A) = Runoff from Rough/Landscaped	0.075	inches
2	Q(B) = Runoff from Tees/Fairways	0.000	inches
3	Q(C) = Runoff from Unvegetated	0.002	inches
4	Q(E) = Runoff from Natural	0.255	inches
5	Q(H) = Runoff from Rain Gardens	0.000	inches
6	Q(I) = Runoff from Irrigation	0.08	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.41	inches

<b>Total Site Recharge</b>		
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)	
R(T) =	<b>27.98</b>	<b>inches</b>



**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

**Alternative 2a; Existing Zoning PRD; no STP; 30% LR**

**SITE NITROGEN BUDGET**

<b>A</b>	<b>Sanitary Nitrogen-Residential</b>	<b>Value</b>	<b>Units</b>
1	Number of Dwellings	118	units
2	Persons per Dwelling	2.90	capita
3	P = Population	342.20	capita
4	N = Nitrogen per person	10	lbs
6	N = (total; pre loss/removal)	3422	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = P x N x LR	2874.48	lbs
9	N = loss/removed	547.52	lbs

<b>C</b>	<b>Sanitary Nitrogen (Wastewater Design Flow)</b>		
1	CF = Commercial/STP Flow	0	gal/day
2	CF = Commercial/STP Flow	0	liters/yr
3	N = Nitrogen (1)	50.00	mg/l
4	N = Nitrogen (1)	0.00	lbs
5	N =Nitrogen (2)	50.00	mg/l
6	N = Nitrogen (2)	0.00	lbs
7	LR = Leaching Rate	84%	percent
8	N(S) = CF x N x LR	0	milligrams
9	N(S) = Sanitary Nitrogen	0.00	lbs
10	N = loss/removed	0.00	lbs

<b>E</b>	<b>Fertilized Landscaping</b>		
1	A = Area of Land Fertilized 1	3,861,594	sq ft
2	AR = Application Rate	2.04	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7877.65	lbs
4	LR = Leaching Rate	30%	percent
5	N(F1) = A x AR x LR	2363.30	lbs
6	N = loss/removed	5514.36	lbs

<b>G</b>	<b>Atmospheric Nitrogen (existing condition)</b>		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,022	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	205.22	lbs/year
5	Area of turf/golf/1000 sf	3,862	1000 sf
6	Leaching Rate	30%	percent
7	Atmos. N Load-2 (turf)	47.50	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,860	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	30.51	lbs/year
11	N(at) = N Load 1 + 2 +3	283.23	lbs
12	N = loss/removed	772.27	lbs

<b>B</b>	<b>Cat Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Cats per Dwelling	0.74	cats/dwelling
2	Number of Cats (Cats/dwelling x dwellings)	87	cats
3	Cat Waste Nitrogen Load	3.22	lbs/cat/year
4	N(p) = AR x cats x Adjustment (if applicable)	281.17	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	70.29	lbs
7	N = (loss/removed)	210.88	lbs

<b>B'</b>	<b>Dog Waste Nitrogen</b>	<b>Value</b>	<b>Units</b>
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	165	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	708.71	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	177.18	lbs
7	N = (loss/removed)	531.53	lbs

<b>D</b>	<b>Water Supply Nitrogen (other than wastewater, if applicable)</b>		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	2.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

<b>F</b>	<b>Unfertilized Landscape</b>		
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00	lbs
4	LR = Leaching Rate	30%	percent
5	N(F2) = A x AR x LR	0.00	lbs
6	N = loss/removed	0.00	lbs

<b>H</b>	<b>Irrigation Nitrogen</b>		
1	R = Irrigation Recharge (inches)	-0.76	inches
2	R = Irrigation Rate (feet)	-0.06	feet
3	A = Area of Land Irrigated	60,984	sq ft
4	R(I) = R(irr) x A	0	cu ft
5	R(I) = Site Precipitation (liters)	0	liters
6	N = Nitrogen in Water Supply	16.00	mg/l
7	N(T) = Nitrogen (total applied)	0.00	lbs
8	LR = Leaching Rate	30%	percent
9	N(irr) = R(I) x N x LR	0	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.00	lbs

<b>Total Site Nitrogen</b>	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	<b>5,768.48</b> lbs





**SIMULATION OF NITROGEN IN RECHARGE (SONIR)**

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton  
Alternative 2a; Existing Zoning PRD; no STP; 30% LR

**FINAL COMPUTATIONS**

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	5,768.48	lbs
2	N = Total Nitrogen (milligrams)	2,618,889,347	milligrams
3	R(T) = Total Recharge (inches)	27.98	inches
4	R(T) = Total Recharge (feet)	2.33	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	60,034,556	cu ft
7	R = Site Recharge Volume	1,700,178,628	liters
9	NR = N/R	1.54	mg/l

CONCENTRATION OF  
NITROGEN IN RECHARGE

**1.54**

<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	27.98	inches/yr
2	R = Site Recharge Volume	60,034,556	cu ft/yr
3	R = Site Recharge Volume	449,089,697	gal/yr
4	R = Site Recharge Volume	449.09	MG/yr

<i>Conversions used in SONIR</i>	
Acres x 43,560 =	Square Feet
Cubic Feet x 7.48052 =	Gallons
Cubic Feet x 28.32 =	Liters
Days x 365 =	Years
Feet x 12 =	Inches
Gallons x 0.1337 =	Cubic Feet
Gallons x 3.785 =	Liters
Grams / 1,000 =	Milligrams
Grams x 0.002205 =	Pounds
Milligrams / 1,000 =	Grams

**Total Nitrogen**

Site Nitrogen (No Mitigation)	5,768.48
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	5,768.48
<b><u>Total Anthropogenic Nitrogen</u></b>	
Site Nitrogen (No Mitigation)	5,485.25
Mitigation Nitrogen	<u>0.00</u>
Adjusted Total Site Nitrogen	5,485.25

