

Appendix R-2
SONIR Computer Model Results, Updated Master Plan

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

**The Hills at Southampton
PDD 117 resort homes plus golf; STP; 10% Turf LR; 60d**

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units	B	Nitrogen Budget Parameters	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 Rough/Res/Golf Landsc.	46.81	acres	3	a. Sanitary Nitrogen Leaching Rate	84%	percent
4	Fraction of Land in above	0.079	fraction	3	b. Treated Sanitary Nitrogen Leaching Rate	100%	percent
5	Evapotranspiration from above	23.00	inches	4	Fertilized Land (Golf Rough/Res/Golf Landsc.)	46.81	acres
6	Runoff from above	0.50	inches	5	Fertilizer Application Rate (for above)	1.00	lbs/1000 sq ft
7	Acreage of Greens/Tees/Fairways	41.24	acres	6	Fertilizer Nitrogen Leaching Rate (for above)	10%	percent
8	Fraction of above	0.070	fraction	7	Fertilized Land (Greens/Tees/Fairways)	41.24	acres
9	Evapotranspiration from above	23.90	inches	8	Fertilizer Application Rate (for above)	2.50	lbs/1000 sq ft
10	Runoff from above	0.50	inches	9	Fertilizer Nitrogen Leaching Rate (for above)	10%	percent
11	Acreage of Unvegetated/Dirt Roads	2.30	acres	10	Outdoor Cat Population	0.74	pets/dwelling
12	Fraction of above	0.004	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	7.26	acres	14	Pet Waste Nitrogen Leaching Rate	25%	percent
16	Fraction of Site in above	0.012	fraction	15	Adjusted Pet Waste (days/year occupied)	16%	percent
17	Evaporation from above	30.00	inches	16	Area of Land Irrigated	88.71	acres
18	Makeup Water (if applicable)	0.00	inches	17	Irrigation Rate	21.40	inches
19	Acreage of Natural/Natural Reveg.	468.19	acres	18	Irrigation Nitrogen Leaching Rate	10%	percent
20	Fraction of above	0.792	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%)	20%	percent
23	Acreage of Impervious/Paved/Bldgs	23.80	acres	22	Atmos. N. Leaching Rate (Ag; Imperv; Other)	40%	percent
24	Fraction of Land in above	0.040	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 Other (Rain Gardens)	1.40	acres				
24	Fraction of Land in above	0.002	fraction				
25	Evapotrans. from above	23.90	inches				
26	Runoff from above	0.00	inches				
27	Acreage of Land Irrigated	88.71	acres				
28	Fraction of Land Irrigated	0.150	fraction				
29	Irrigation Rate	21.40	inches				
30	Number of Dwellings	117	units				
31	Water Use per Dwelling	300	gal/day				
32	Wastewater Design Flow (units)	0	gal/day				
33	Wastewater Design Flow (total)	41,514	gal/day				
34	Adjusted WW Design Flow (total)	6,824	gal/day				
				C	Comments		
					1) Please refer to user manual for data input instructions; updated per LINAP.		
					2) Runoff for turfing areas increased/adjusted to 2.1% of ppt.		
					3) Irrigation includes April-Oct.; based on 51,456,148 gpy; irrigation equals ET.		
					4) Greens area equals 2.62 acres and does not include rain gardens.		
					5) Bunkers and rain gardens are not fertilized or irrigated.		
					6) Evapotranspiration from Unvegetated is 30% of ET for vegetated surfaces.		
					7) Evapotranspiration from Rain Gardens is similar to other landscaping.		
					8) Rain Garden runoff is adjusted to be similar to natural areas.		
					9) Fertilizer nitrogen leaching rate is 10%; all landscaping maintained by GC		
					10) Irrigation adjusted to increase runoff to 2.1% of ppt, and add leaching.		
					11) Area of land irrigated includes all turf/landscaping, plus golf rough.		
					12) Wastewater flow adjusted for maximum of 183 days/year; ensured by C&R.		
					13) Rain Gardens adjusted for 70% Nitrogen removal efficiency (see Sheet 4).		
					Developed Area	119.11	20%
					Natural/Unvegetated/Revegetated Area	471.89	80%
					Total Acreage Check	591.00	100%



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

PDD 117 resort homes plus golf; STP; 10% Turf LR; 60d

SITE RECHARGE COMPUTATIONS

A	Golf Rough/Res/Golf Landsc.	Value	Units
1	A = Fraction of Land in Cover Type	0.079	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	2.09	inches

B	Greens/Tees/Fairways	Value	Units
1	A = Fraction of Land in Cover Type	0.070	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	1.78	inches

C	Unvegetated/Dirt Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.004	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	0.17	inches

D	Water/Ponds/Wetlands	Value	Units
1	A = Fraction of Site in Water	0.012	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	0.24	inches

E	Natural/Natural Revegetation	Value	Units
1	A = Fraction of Land in Cover Type	0.792	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	21.03	inches

F	Impervious/Paved/Roads	Value	Units
1	A = Fraction of Land in Cover Type	0.040	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	1.81	inches

F	Rain Gardens	Value	Units
1	A = Fraction of Land in Cover Type	0.002	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	26.00	inches
6	R(G) = R(g) x A	0.06	inches

H	Irrigation Recharge	Value	Units
1	A = Fraction of Land Irrigated	0.150	fraction
2	I = Irrigation Rate	21.40	inches
3	E = Evapotranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	0.00	inches
6	R(H) = R(h) x A	0.00	inches

I	Wastewater Recharge	Value	Units
1	WDF = Wastewater Design Flow	6,824	gal/day
2	WDF = Wastewater Design Flow	333,025	cu ft/yr
3	A = Area of Site	25,743,960	sq ft
4	R(j) = WDF/A	0.01	feet
5	R(I) = Wastewater Recharge	0.16	inches

J	Runoff Recharge	Value	Units
1	Q(A) = Runoff from Rough/Landscaped	0.040	inches
2	Q(B) = Runoff from Tees/Fairways	0.035	inches
3	Q(C) = Runoff from Unvegetated	0.004	inches
4	Q(E) = Runoff from Natural	0.277	inches
5	Q(H) = Runoff from Rain Gardens	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.36	inches

Total Site Recharge		
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) =	27.70	inches



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PDD 117 resort homes plus golf; STP; 10% Turf LR; 60d

SITE NITROGEN BUDGET

A	Sanitary Nitrogen-Residential	Value	Units
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

C	Sanitary Nitrogen (Wastewater Design Flow)		
1	CF = Commercial/STP Flow	6,824	gal/day
2	CF = Commercial/STP Flow	9,427,829	liters/yr
3	N = Nitrogen (1)	10.00	mg/l
4	N = Nitrogen (1)	207.88	lbs
5	N = Nitrogen (2)	10.00	mg/l
6	N = Nitrogen (2)	207.88	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	94,278,294	milligrams
9	N(S) = Sanitary Nitrogen	207.88	lbs
10	N = loss/removed	0.00	lbs

E	Fertilized Land (Golf Rough/Res/Golf Landscaped)		
1	A = Area of Land Fertilized 1	2,039,044	sq ft
2	AR = Application Rate	1.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	2039.04	lbs
4	LR = Leaching Rate	10%	percent
5	N(F1) = A x AR x LR	203.90	lbs
6	N = loss/removed	1835.14	lbs

G	Atmospheric Nitrogen (existing condition)		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,772	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	212.91	lbs/year
5	Area of turf/golf/1000 sf	3,835	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	31.45	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,137	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	18.65	lbs/year
11	N(at) = N Load 1 + 2 + 3	263.00	lbs
12	N = loss/removed	792.50	lbs

B	Cat Waste Nitrogen	Value	Units
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)	45.83	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	11.46	lbs
7	N = (loss/removed)	34.37	lbs

B'	Dog Waste Nitrogen	Value	Units
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	164	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	115.51	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	28.88	lbs
7	N = (loss/removed)	86.63	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

F	Fertilized Land (Greens/Tees/Fairways)		
1	A = Area of Land Fertilized 2	1,796,414	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	4491.04	lbs
4	LR = Leaching Rate	10%	percent
5	N(F2) = A x AR x LR	449.10	lbs
6	N = loss/removed	4041.93	lbs

H	Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	0.00	inches
2	R = Irrigation Rate (feet)	0.0001	feet
3	A = Area of Land Irrigated	932,376	sq ft
4	R(I) = R(irr) x A	51	cu ft
5	R(I) = Site Irrigation (liters)	1,453	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	0.01	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	291	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.01	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	1,164.23	lbs



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

**The Hills at Southampton
PDD 117 resort homes plus golf; STP; 10% Turf LR; 60d**

FINAL COMPUTATIONS

A	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	1,164.23	lbs
2	N = Total Nitrogen (milligrams)	528,561,493	milligrams
3	R(T) = Total Recharge (inches)	27.70	inches
4	R(T) = Total Recharge (feet)	2.31	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,414,921	cu ft
7	R = Site Recharge Volume	1,682,630,563	liters
9	NR = N/R	0.31	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
Pre-Mitigation	0.31

A	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	870.25	lbs
2	N = Total Nitrogen (milligrams)	395,092,473	milligrams
3	R(T) = Total Recharge (inches)	27.70	inches
4	R(T) = Total Recharge (feet)	2.31	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,414,921	cu ft
7	R = Site Recharge Volume	1,682,630,563	liters
9	NR = N/R	0.23	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
With Mitigation (not including well pumping)	0.23

B	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	0.00	inches/yr
2	R = Site Recharge Volume	59,414,921	cu ft/yr
3	R = Site Recharge Volume	444,454,505	gal/yr
4	R = Site Recharge Volume	444.45	MG/yr

MITIGATION COMPUTATIONS

M1	<i>Reuse of Irrigation Water</i>	<i>Value</i>	<i>Units</i>
1	IW = Reused Irrigation Water	54,795	gal/day
2	IW = Reused Irrigation Water	75,700,000	liters/yr
3	N = Nitrogen in Aquifer	10.00	mg/l
4	AF = Additional Factor (n/a)	100%	percent
5	N(IW) = IW x N x AF	757,000,000	milligrams
6	N(IW) = Irrigation N Reduction	1669.19	lbs

<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	

M2	<i>Lined Greens</i>	<i>Value</i>	<i>Units</i>
1	A = Area of Land Fertilized 2	114,127	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
4	N(LG) = A x AR x LR	285.32	lbs
5	N(LG) = Potential Lined Greens N Reduction	285.32	lbs
6	N(LGeff) = Effective Lined Greens N Reduction	199.72	lbs (70% eff)

Mitigation Summary

M1 Reuse of Irrigation Water	1,669.19
M2 Lined Greens	199.72
M3 Rain Gardens	6.07
Total	1,874.97
Total Nitrogen	
Site Nitrogen (No Mitigation)	1,164.23
Mitigation Nitrogen	<u>1,874.97</u>
Adjusted Total Site Nitrogen	-710.74
Total Anthropogenic Nitrogen	
Site Nitrogen (No Mitigation)	901.23
Mitigation Nitrogen	<u>1,874.97</u>
Adjusted Total Site Nitrogen	-973.75

M3	<i>Rain Gardens</i>	<i>Value</i>	<i>Units</i>
1	RG = RG Recharge (inches)	0.36	inches
2	RG = RG Recharge (feet)	0.03	feet
3	A = Area of Golf Runoff (SF)	1,796,414	SF
4	RG = RG Recharge Volume (CF)	53,187	CF
5	RG = RG Recharge (Gallons/year)	397,864	gal/yr
6	RG = RG Recharge (Liters/year)	1,505,916	liters/yr
8	N = Nitrogen in Runoff (mg/l)	2.61	mg/l
9	N = Nitrogen Load (milligrams)	3,930,442	milligrams
10	N(IW) = IW x N x AF	8.67	lbs
12	N(RG) = Potential Rain Garden N Reduction	8.67	lbs
13	N(RGeff) = Effective Rain Garden N Reduction	6.07	lbs (70% eff)

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton
PDD 117 resort homes plus golf; STP; 10% Turf LR; 183d

DATA INPUT FIELD

<i>A</i>	<i>Site Recharge Parameters</i>	<i>Value</i>	<i>Units</i>
1	Area of Site	591.00	acres
2	Precipitation Rate	49.90	inches
3	Acreage of Rough/Res/Golf Landsc.	46.81	acres
4	Fraction of Land in above	0.079	fraction
5	Evapotranspiration from above	23.00	inches
6	Runoff from above	0.50	inches
7	Acreage of Greens/Tees/Fairways	41.24	acres
8	Fraction of above	0.070	fraction
9	Evapotranspiration from above	23.90	inches
10	Runoff from above	0.50	inches
11	Acreage of Unvegetated/Dirt Roads	2.30	acres
12	Fraction of above	0.004	fraction
13	Evapotranspiration from above	6.36	inches
14	Runoff from above	1.05	inches
15	Acreage of Water/Ponds/Wetlands	7.26	acres
16	Fraction of Site in above	0.012	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural/Natural Reveg.	468.19	acres
20	Fraction of above	0.792	fraction
21	Evapotranspiration from above	23.00	inches
22	Runoff from above	0.35	inches
23	Acreage of Impervious/Paved/Bldgs	23.80	acres
24	Fraction of Land in above	0.040	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreage of Other (Rain Gardens)	1.40	acres
24	Fraction of Land in above	0.002	fraction
25	Evapotrans. from above	23.90	inches
26	Runoff from above	0.00	inches
27	Acreage of Land Irrigated	88.71	acres
28	Fraction of Land Irrigated	0.150	fraction
29	Irrigation Rate	21.40	inches
30	Number of Dwellings	117	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	0	gal/day
33	Wastewater Design Flow (total)	41,514	gal/day
34	Adjusted WW Design Flow (total)	20,814	gal/day

<i>B</i>	<i>Nitrogen Budget Parameters</i>	<i>Value</i>	<i>Units</i>
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 (Golf Rough/Res/Golf Landsc.)	46.81	acres
5	Fertilizer Application Rate (for above)	1.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	10%	percent
7	Fertilized Land (Greens/Tees/Fairways)	41.24	acres
8	Fertilizer Application Rate (for above)	2.50	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	10%	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	88.71	acres
17	Irrigation Rate	21.40	inches
18	Irrigation Nitrogen Leaching Rate	10%	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%)	20%	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

<i>C</i>	<i>Comments</i>
1)	Please refer to user manual for data input instructions; updated per LINAP.
2)	Runoff for turfing areas increased/adjusted to 2.1% of ppt.
3)	Irrigation includes April-Oct.; based on 51,456,148 gpy; irrigation equals ET.
4)	Greens area equals 2.62 acres and does not include rain gardens.
5)	Bunkers and rain gardens are not fertilized or irrigated.
6)	Evapotranspiration from Unvegetated is 30% of ET for vegetated surfaces.
7)	Evapotranspiration from Rain Gardens is similar to other landscaping.
8)	Rain Garden runoff is adjusted to be similar to natural areas.
9)	Fertilizer nitrogen leaching rate is 10%; all landscaping maintained by GC
10)	Irrigation adjusted to increase runoff to 2.1% of ppt, and add leaching.
11)	Area of land irrigated includes all turf/landscaping, plus golf rough.
12)	Wastewater flow adjusted for maximum of 183 days/year; ensured by C&R.
13)	Rain Gardens adjusted for 70% Nitrogen removal efficiency (see Sheet 4).
	Developed Area 119.11 20%
	Natural/Unvegetated/Revegetated Area 471.89 80%
	Total Acreage Check 591.00 100%



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

PDD 117 resort homes plus golf; STP; 10% Turf LR; 183d

SITE RECHARGE COMPUTATIONS

A Golf Rough/Res/Golf Landsc.			Value	Units	B Greens/Tees/Fairways			Value	Units
1	A = Fraction of Land in Cover Type		0.079	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	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		2.09	inches	6	R(B) = R(b) x A	1.78	inches	

C Unvegetated/Dirt Roads			Value	Units	D Water/Ponds/Wetlands			Value	Units
1	A = Fraction of Land in Cover Type		0.004	fraction	1	A = Fraction of Site in Water	0.012	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		0.17	inches	6	R(d) = { P - (E+Q) } - M	19.90	inches	
					7	R(D) = R(d) x A	0.24	inches	

E Natural/Natural Revegetation			Value	Units	F Impervious/Paved/Roads			Value	Units
1	A = Fraction of Land in Cover Type		0.792	fraction	1	A = Fraction of Land in Cover Type	0.040	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		21.03	inches	6	R(F) = R(f) x A	1.81	inches	

F Rain Gardens			Value	Units	H Irrigation Recharge			Value	Units
1	A = Fraction of Land in Cover Type		0.002	fraction	1	A = Fraction of Land Irrigated	0.150	fraction	
2	P = Precipitation Rate		49.90	inches	2	I = Irrigation Rate	21.40	inches	
3	E = Evapotranspiration Rate		23.90	inches	3	E = Evapotranspiration Rate	21.40	inches	
4	Q = Runoff Rate		0.00	inches	4	Q = Runoff Rate	0.00	inches	
5	R(g) = P - (E + Q)		26.00	inches	5	R(h) = I - (E + Q)	0.00	inches	
6	R(G) = R(g) x A		0.06	inches	6	R(H) = R(H) x A	0.00	inches	

I Wastewater Recharge			Value	Units	J Runoff Recharge			Value	Units
1	WDF = Wastewater Design Flow		20,814	gal/day	1	Q(A) = Runoff from Rough/Landscaped	0.040	inches	
2	WDF = Wastewater Design Flow		1,015,727	cu ft/yr	2	Q(B) = Runoff from Tees/Fairways	0.035	inches	
3	A = Area of Site		25,743,960	sq ft	3	Q(C) = Runoff from Unvegetated	0.004	inches	
4	R(j) = WDF/A		0.04	feet	4	Q(E) = Runoff from Natural	0.277	inches	
5	R(I) = Wastewater Recharge		0.47	inches	5	Q(H) = Runoff from Rain Gardens	0.000	inches	
					6	Q(I) = Runoff from Irrigation	0.00	inches	
					7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.36	inches	

Total Site Recharge		
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) =	28.01	inches



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

PDD 117 resort homes plus golf; STP; 10% Turf LR; 183d

SITE NITROGEN BUDGET

A	Sanitary Nitrogen-Residential	Value	Units
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

C	Sanitary Nitrogen (Wastewater Design Flow)		
1	CF = Commercial/STP Flow	20,814	gal/day
2	CF = Commercial/STP Flow	28,754,880	liters/yr
3	N = Nitrogen (1)	10.00	mg/l
4	N = Nitrogen (1)	634.05	lbs
5	N = Nitrogen (2)	10.00	mg/l
6	N = Nitrogen (2)	634.05	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	287,548,797	milligrams
9	N(S) = Sanitary Nitrogen	634.05	lbs
10	N = loss/removed	0.00	lbs

E	Fertilized Land (Golf Rough/Res/Golf Landscaped)		
1	A = Area of Land Fertilized 1	2,039,044	sq ft
2	AR = Application Rate	1.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	2039.04	lbs
4	LR = Leaching Rate	10%	percent
5	N(F1) = A x AR x LR	203.90	lbs
6	N = loss/removed	1835.14	lbs

G	Atmospheric Nitrogen (existing condition)		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,772	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	212.91	lbs/year
5	Area of turf/golf/1000 sf	3,835	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	31.45	lbs/year
8	Area of Impervious/Agricult/1000 sf	1,137	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	18.65	lbs/year
11	N(at) = N Load 1 + 2 +3	263.00	lbs
12	N = loss/removed	792.50	lbs

B	Cat Waste Nitrogen	Value	Units
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)	139.78	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	34.94	lbs
7	N = (loss/removed)	104.83	lbs

B'	Dog Waste Nitrogen	Value	Units
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	164	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	352.31	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	88.08	lbs
7	N = (loss/removed)	264.24	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

F	Fertilized Land (Greens/Tees/Fairways)		
1	A = Area of Land Fertilized 2	1,796,414	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	4491.04	lbs
4	LR = Leaching Rate	10%	percent
5	N(F2) = A x AR x LR	449.10	lbs
6	N = loss/removed	4041.93	lbs

H	Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	0.00	inches
2	R = Irrigation Rate (feet)	0.0001	feet
3	A = Area of Land Irrigated	932,376	sq ft
4	R(I) = R(irr) x A	51	cu ft
5	R(I) = Site Irrigation (liters)	1,453	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	0.01	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	291	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.01	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	1,673.08	lbs



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

**The Hills at Southampton
PDD 117 resort homes plus golf; STP; 10% Turf LR; 183d**

FINAL COMPUTATIONS

A	<i>Nitrogen in Recharge</i>	Value	Units
1	N = Total Nitrogen (lbs)	1,673.08	lbs
2	N = Total Nitrogen (milligrams)	759,578,755	milligrams
3	R(T) = Total Recharge (inches)	28.01	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	60,097,623	cu ft
7	R = Site Recharge Volume	1,701,964,680	liters
9	NR = N/R	0.45	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
Pre-Mitigation	0.45

A	<i>Nitrogen in Recharge</i>	Value	Units
1	N = Total Nitrogen (lbs)	1,379.10	lbs
2	N = Total Nitrogen (milligrams)	626,109,736	milligrams
3	R(T) = Total Recharge (inches)	28.01	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	60,097,623	cu ft
7	R = Site Recharge Volume	1,701,964,680	liters
9	NR = N/R	0.37	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
With Mitigation (not including well pumping)	0.37

B	<i>Site Recharge Summary</i>	Value	Units
1	R(T) = Total Site Recharge	28.01	inches/yr
2	R = Site Recharge Volume	60,097,623	cu ft/yr
3	R = Site Recharge Volume	449,561,470	gal/yr
4	R = Site Recharge Volume	449.56	MG/yr

MITIGATION COMPUTATIONS

M1	<i>Reuse of Irrigation Water</i>	Value	Units
1	IW = Reused Irrigation Water	54,795	gal/day
2	IW = Reused Irrigation Water	75,700,000	liters/yr
3	N = Nitrogen in Aquifer	10.00	mg/l
4	AF = Additional Factor (n/a)	100%	percent
5	N(IW) = IW x N x AF	757,000,000	milligrams
6	N(IW) = Irrigation N Reduction	1669.19	lbs

<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	

M2	<i>Lined Greens</i>	Value	Units
1	A = Area of Land Fertilized 2	114,127	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
4	N(LG) = A x AR x LR	285.32	lbs
5	N(LG) = Potential Lined Greens N Reduction	285.32	lbs
6	N(LGeff) = Effective Lined Greens N Reduction	199.72	lbs (70% eff)

Mitigation Summary

M1 Reuse of Irrigation Water	1,669.19
M2 Lined Greens	199.72
M3 Rain Gardens	6.07
Total	1,874.97
Total Nitrogen	
Site Nitrogen (No Mitigation)	1,673.08
Mitigation Nitrogen	<u>1,874.97</u>
Adjusted Total Site Nitrogen	-201.89
Total Anthropogenic Nitrogen	
Site Nitrogen (No Mitigation)	1,410.08
Mitigation Nitrogen	<u>1,874.97</u>
Adjusted Total Site Nitrogen	-464.90

M3	<i>Rain Gardens</i>	Value	Units
1	RG = RG Recharge (inches)	0.36	inches
2	RG = RG Recharge (feet)	0.03	feet
3	A = Area of Golf Runoff (SF)	1,796,414	SF
4	RG = RG Recharge Volume (CF)	53,187	CF
5	RG = RG Recharge (Gallons/year)	397,864	gal/yr
6	RG = RG Recharge (Liters/year)	1,505,916	liters/yr
8	N = Nitrogen in Runoff (mg/l)	2.61	mg/l
9	N = Nitrogen Load (milligrams)	3,930,442	milligrams
10	N(IW) = IW x N x AF	8.67	lbs
12	N(RG) = Potential Rain Garden N Reduction	8.67	lbs
13	N(RGeff) = Effective Rain Garden N Reduction	6.07	lbs (70% eff)

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton

PDD 117 resort homes plus golf; STP; 20% Turf LR; 60d

DATA INPUT FIELD

A	Site Recharge Parameters	Value	Units
1	Area of Site	591.00	acres
2	Precipitation Rate	49.90	inches
3	Acreege of Rough/Res/Golf Landsc.	46.81	acres
4	Fraction of Land in above	0.079	fraction
5	Evapotranspiration from above	23.00	inches
6	Runoff from above	0.50	inches
7	Acreege of Greens/Tees/Fairways	41.24	acres
8	Fraction of above	0.070	fraction
9	Evapotranspiration from above	23.90	inches
10	Runoff from above	0.50	inches
11	Acreege of Unvegetated/Dirt Roads	2.30	acres
12	Fraction of above	0.004	fraction
13	Evapotranspiration from above	6.36	inches
14	Runoff from above	1.05	inches
15	Acreege of Water/Ponds/Wetlands	7.26	acres
16	Fraction of Site in above	0.012	fraction
17	Evaporation from above	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreege of Natural/Natural Reveg.	468.19	acres
20	Fraction of above	0.792	fraction
21	Evapotranspiration from above	23.00	inches
22	Runoff from above	0.35	inches
23	Acreege of Impervious/Paved/Bldgs	23.80	acres
24	Fraction of Land in above	0.040	fraction
25	Evapotrans. from above	4.99	inches
26	Runoff from Impervious	0.00	inches
23	Acreege of Other (Rain Gardens)	1.40	acres
24	Fraction of Land in above	0.002	fraction
25	Evapotrans. from above	23.90	inches
26	Runoff from above	0.00	inches
27	Acreege of Land Irrigated	88.71	acres
28	Fraction of Land Irrigated	0.150	fraction
29	Irrigation Rate	21.40	inches
30	Number of Dwellings	117	units
31	Water Use per Dwelling	300	gal/day
32	Wastewater Design Flow (units)	0	gal/day
33	Wastewater Design Flow (total)	41,514	gal/day
34	Adjusted WW Design Flow (total)	6,824	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 (Golf Rough/Res/Golf Landsc.)	46.81	acres
5	Fertilizer Application Rate (for above)	1.00	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate (for above)	20%	percent
7	Fertilized Land (Greens/Tees/Fairways)	41.24	acres
8	Fertilizer Application Rate (for above)	2.50	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate (for above)	20%	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)	16%	percent
16	Area of Land Irrigated	88.71	acres
17	Irrigation Rate	21.40	inches
18	Irrigation Nitrogen Leaching Rate	10%	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%)	20%	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.
2)	Runoff for turfed areas increased/adjusted to 2.1% of ppt.
3)	Irrigation includes April-Oct.; based on 51,456,148 gpy; irrigation equals ET.
4)	Greens area equals 2.62 acres and does not include rain gardens.
5)	Bunkers and rain gardens are not fertilized or irrigated.
6)	Evapotranspiration from Unvegetated is 30% of ET for vegetated surfaces.
7)	Evapotranspiration from Rain Gardens is similar to other landscaping.
8)	Rain Garden runoff is adjusted to be similar to natural areas.
9)	Fertilizer nitrogen leaching rate is 20%; all landscaping maintained by GC
10)	Irrigation adjusted to increase runoff to 2.1% of ppt, and add leaching.
11)	Area of land irrigated includes all turf/landscaping, plus golf rough.
12)	Wastewater flow adjusted for maximum of 183 days/year; ensured by C&R.
13)	Rain Gardens adjusted for 70% Nitrogen removal efficiency (see Sheet 4).
	Developed Area 119.11 20%
	Natural/Unvegetated/Revegetated Area 471.89 80%
	Total Acreage Check 591.00 100%



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

PDD 117 resort homes plus golf; STP; 20% Turf LR; 60d

SITE RECHARGE COMPUTATIONS

A	<i>Golf Rough/Res/Golf Landsc.</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.079	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	2.09	inches

B	<i>Greens/Tees/Fairways</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.070	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	1.78	inches

C	<i>Unvegetated/Dirt Roads</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.004	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	0.17	inches

D	<i>Water/Ponds/Wetlands</i>	Value	Units
1	A = Fraction of Site in Water	0.012	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	0.24	inches

E	<i>Natural/Natural Revegetation</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.792	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	21.03	inches

F	<i>Impervious/Paved/Roads</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.040	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	1.81	inches

F	<i>Rain Gardens</i>	Value	Units
1	A = Fraction of Land in Cover Type	0.002	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.00	inches
5	R(g) = P - (E + Q)	26.00	inches
6	R(G) = R(g) x A	0.06	inches

H	<i>Irrigation Recharge</i>	Value	Units
1	A = Fraction of Land Irrigated	0.150	fraction
2	I = Irrigation Rate	21.40	inches
3	E = Evapotranspiration Rate	21.40	inches
4	Q = Runoff Rate	0.00	inches
5	R(h) = I - (E + Q)	0.00	inches
6	R(H) = R(h) x A	0.00	inches

I	<i>Wastewater Recharge</i>	Value	Units
1	WDF = Wastewater Design Flow	6,824	gal/day
2	WDF = Wastewater Design Flow	333,025	cu ft/yr
3	A = Area of Site	25,743,960	sq ft
4	R(j) = WDF/A	0.01	feet
5	R(I) = Wastewater Recharge	0.16	inches

J	<i>Runoff Recharge</i>	Value	Units
1	Q(A) = Runoff from Rough/Landscaped	0.040	inches
2	Q(B) = Runoff from Tees/Fairways	0.035	inches
3	Q(C) = Runoff from Unvegetated	0.004	inches
4	Q(E) = Runoff from Natural	0.277	inches
5	Q(H) = Runoff from Rain Gardens	0.000	inches
6	Q(I) = Runoff from Irrigation	0.00	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.36	inches

Total Site Recharge	
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) =	27.70 inches



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

PDD 117 resort homes plus golf; STP; 20% Turf LR; 60d

SITE NITROGEN BUDGET

A	Sanitary Nitrogen-Residential	Value	Units
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

C	Sanitary Nitrogen (Wastewater Design Flow)		
1	CF = Commercial/STP Flow	6,824	gal/day
2	CF = Commercial/STP Flow	9,427,829	liters/yr
3	N = Nitrogen (1)	10.00	mg/l
4	N = Nitrogen (1)	207.88	lbs
5	N = Nitrogen (2)	10.00	mg/l
6	N = Nitrogen (2)	207.88	lbs
7	LR = Leaching Rate	100%	percent
8	N(S) = CF x N x LR	94,278,294	milligrams
9	N(S) = Sanitary Nitrogen	207.88	lbs
10	N = loss/removed	0.00	lbs

E	Fertilized Land (Golf Rough/Res/Golf Landscaped)		
1	A = Area of Land Fertilized 1	2,039,044	sq ft
2	AR = Application Rate	1.00	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	2039.04	lbs
4	LR = Leaching Rate	20%	percent
5	N(F1) = A x AR x LR	407.81	lbs
6	N = loss/removed	1631.23	lbs

G	Atmospheric Nitrogen (existing condition)		
1	Application Load	0.041	lbs/1000 sf
2	Area of Natural/Wetlands/1000 sf	20,772	1000 sf
3	Leaching Rate	25%	percent
4	Atmos. N Load-1 (natural/wetlands)	212.91	lbs/year
5	Area of turf/golf/1000 sf	3,835	1000 sf
6	Leaching Rate	20%	percent
7	Atmos. N Load-2 (golf/turf)	31.45	lbs/year
8	Area of Impervious/Agriculture/1000 sf	1,137	1000 sf
9	Leaching Rate	40%	percent
10	Atmos. N Load-3 (ag; imperv; other)	18.65	lbs/year
11	N(at) = N Load 1 + 2 + 3	263.00	lbs
12	N = loss/removed	792.50	lbs

B	Cat Waste Nitrogen	Value	Units
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)	45.83	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	11.46	lbs
7	N = (loss/removed)	34.37	lbs

B'	Dog Waste Nitrogen	Value	Units
1	Number of Dogs per Dwelling	1.40	dogs/dwelling
2	Number of Dogs (Dogs/dwelling x dwellings)	164	dogs
3	Dog Waste Nitrogen Load	4.29	lbs/dog/year
4	N(p) = AR x dogs x Adjustment (if applicable)	115.51	lbs/year
5	LR = Leaching Rate	25%	percent
6	N(P) = N(p) x LR	28.88	lbs
7	N = (loss/removed)	86.63	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)		
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	50.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

F	Fertilized Land (Greens/Tees/Fairways)		
1	A = Area of Land Fertilized 2	1,796,414	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
3	N(T) = Nitrogen (total applied)	4491.04	lbs
4	LR = Leaching Rate	20%	percent
5	N(F2) = A x AR x LR	898.21	lbs
6	N = loss/removed	3592.83	lbs

H	Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	0.00	inches
2	R = Irrigation Rate (feet)	0.0001	feet
3	A = Area of Land Irrigated	932,376	sq ft
4	R(I) = R(irr) x A	51	cu ft
5	R(I) = Site Irrigation (liters)	1,453	liters
6	N = Nitrogen in Water Supply	2.00	mg/l
7	N(T) = Nitrogen (total applied)	0.01	lbs
8	LR = Leaching Rate	10%	percent
9	N(irr) = R(I) x N x LR	291	milligrams
10	N(irr) = Irrigation Nitrogen	0.00	lbs
11	N = loss/removed	0.01	lbs

Total Site Nitrogen		
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)	
N=	1,817.24	lbs



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

The Hills at Southampton
PDD 117 resort homes plus golf; STP; 20% Turf LR; 60d

FINAL COMPUTATIONS

A	Nitrogen in Recharge	Value	Units
1	N = Total Nitrogen (lbs)	1,817.24	lbs
2	N = Total Nitrogen (milligrams)	825,027,107	milligrams
3	R(T) = Total Recharge (inches)	27.70	inches
4	R(T) = Total Recharge (feet)	2.31	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,414,921	cu ft
7	R = Site Recharge Volume	1,682,630,563	liters
9	NR = N/R	0.49	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
Pre-Mitigation	0.49

A	Nitrogen in Recharge	Value	Units
1	N = Total Nitrogen (lbs)	1,523.26	lbs
2	N = Total Nitrogen (milligrams)	691,558,087	milligrams
3	R(T) = Total Recharge (inches)	27.70	inches
4	R(T) = Total Recharge (feet)	2.31	feet
5	A = Area of Site	25,743,960	sq ft
6	R = R(T) x A	59,414,921	cu ft
7	R = Site Recharge Volume	1,682,630,563	liters
9	NR = N/R	0.41	mg/l

CONCENTRATION OF NITROGEN IN RECHARGE	
With Mitigation (not including well pumping)	0.41

B	Site Recharge Summary	Value	Units
1	R(T) = Total Site Recharge	0.00	inches/yr
2	R = Site Recharge Volume	59,414,921	cu ft/yr
3	R = Site Recharge Volume	444,454,505	gal/yr
4	R = Site Recharge Volume	444.45	MG/yr

MITIGATION COMPUTATIONS

M1	Reuse of Irrigation Water	Value	Units
1	IW = Reused Irrigation Water	54,795	gal/day
2	IW = Reused Irrigation Water	75,700,000	liters/yr
3	N = Nitrogen in Aquifer	10.00	mg/l
4	AF = Additional Factor (n/a)	100%	percent
5	N(IW) = IW x N x AF	757,000,000	milligrams
6	N(IW) = Irrigation N Reduction	1669.19	lbs

Conversions used in SONIR	
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	

M2	Lined Greens	Value	Units
1	A = Area of Land Fertilized 2	114,127	sq ft
2	AR = Application Rate	2.50	lbs/1000 sf
4	N(LG) = A x AR x LR	285.32	lbs
5	N(LG) = Potential Lined Greens N Reduction	285.32	lbs
6	N(LGeff) = Effective Lined Greens N Reduction	199.72	lbs (70% eff)

Mitigation Summary

M1 Reuse of Irrigation Water	1,669.19
M2 Lined Greens	199.72
M3 Rain Gardens	6.07
Total	1,874.97
Total Nitrogen	
Site Nitrogen (No Mitigation)	1,817.24
Mitigation Nitrogen	1,874.97
Adjusted Total Site Nitrogen	-57.73
Total Anthropogenic Nitrogen	
Site Nitrogen (No Mitigation)	1,554.24
Mitigation Nitrogen	1,874.97
Adjusted Total Site Nitrogen	-320.74

M3	Rain Gardens	Value	Units
1	RG = RG Recharge (inches)	0.36	inches
2	RG = RG Recharge (feet)	0.03	feet
3	A = Area of Golf Runoff (SF)	1,796,414	SF
4	RG = RG Recharge Volume (CF)	53,187	CF
5	RG = RG Recharge (Gallons/year)	397,864	gal/yr
6	RG = RG Recharge (Liters/year)	1,505,916	liters/yr
8	N = Nitrogen in Runoff (mg/l)	2.61	mg/l
9	N = Nitrogen Load (milligrams)	3,930,442	milligrams
10	N(IW) = IW x N x AF	8.67	lbs
12	N(RG) = Potential Rain Garden N Reduction	8.67	lbs
13	N(RGeff) = Effective Rain Garden N Reduction	6.07	lbs (70% eff)