

Appendix B-3
SONIR Model,
Proposed Conditions



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Deforest Williams Estates

DATA INPUT FIELD

Proposed Conditions

SHEET 1

<i>A</i>	<i>Site Recharge Parameters</i>	<i>Value</i>	<i>Units</i>
1	Area of Site	42.02	acres
2	Precipitation Rate	42.82	inches
3	Acreage of Lawn	11.39	acres
4	Fraction of Land in Lawn	0.271	fraction
5	Evapotranspiration from Lawn	24.20	inches
6	Runoff from Lawn	0.90	inches
7	Acreage of Impervious	4.62	acres
8	Fraction of Land Impervious	0.110	fraction
9	Evaporation from Impervious	4.28	inches
10	Runoff from Impervious	0.00	inches
11	Acreage of Unvegetated	1.05	acres
12	Fraction of Land Unvegetated	0.025	fraction
13	Evapotrans. from Unvegetated	24.20	inches
14	Runoff from Unvegetated	2.1	inches
15	Acreage of Water	0.00	acres
16	Fraction of Site in Water	0.000	fraction
17	Evaporation from Water	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural Area	26.34	acres
20	Fraction of Land Natural	0.627	fraction
21	Evapotrans. from Natural Area	24.20	inches
22	Runoff from Natural Area	0.30	inches
23	Acreage of Other Area	0.00	acres
24	Fraction of Land Other Area	0.000	fraction
25	Evapotrans. from Other Area	0.00	inches
26	Runoff from Other Area	0.00	inches
27	Acreage of Land Irrigated	12.89	acres
28	Fraction of Land Irrigated	0.307	fraction
29	Irrigation Rate	5.50	inches
30	Number of Dwellings	15	units
31	Water Use per Dwelling	0	gal/day
32	Wastewater Design Flow	0	gal/day
33	Commercial /STP Design Flow	0	gal/day

<i>B</i>	<i>Nitrogen Budget Parameters</i>	<i>Value</i>	<i>Units</i>
1	Persons per Dwelling	4.27	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	50%	percent
3	b. Sanitary Nitrogen Leaching Rate	0%	percent
4	Area of Land Fertilized 1	12.89	acres
5	Fertilizer Application Rate 1	2.30	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate 1	14%	percent
7	Area of Land Fertilized 2	0.00	acres
8	Fertilizer Application Rate 2	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate 2	0%	percent
10	Pet Waste Application Rate	3.19	lbs/pet
11	Pet Waste Nitrogen Leaching Rate	50%	percent
12	Area of Land Irrigated	12.89	acres
13	Irrigation Rate	5.50	inches
14	Irrigation Nitrogen Leaching Rate	15%	percent
15	Nitrogen in Precipitation	1.00	mg/l
16	Precipitation Nitrogen Leaching Rate	15%	percent
17	Nitrogen in Water Supply	1.00	mg/l
18	Nitrogen in Commercial/STP Flow	40.00	mg/l

<i>C</i>	<i>Comments</i>
1)	Please refer to user manual for data input instructions.
2)	Sanitary Nitrogen Leaching Rate 3.a.) is for residential wastewater and 3.b.) is for commercial or STP which varies from 50 percent for conventional systems to 10 percent for STP effluent discharge.
3)	Area of unvegetated = proposed recharge basin
4)	Proposed conditions will result in 15 residences and a total population of 65 people (4.27 persons/residence).

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

SITE RECHARGE COMPUTATIONS

Proposed Conditions

SHEET 2

A Lawn Area Recharge			Value	Units	B Impervious Area Recharge			Value	Units
1	A = Fraction of Land in Lawn		0.271	fraction	1	A = Fraction of Land in Impervious	0.110	fraction	
2	P = Precipitation Rate		42.82	inches	2	P = Precipitation Rate	42.82	inches	
3	E = Evapotranspiration Rate		24.20	inches	3	E = Evapotranspiration Rate	4.28	inches	
4	Q = Runoff Rate		0.90	inches	4	Q = Runoff Rate	0.00	inches	
5	$R(l) = P - (E + Q)$		17.72	inches	5	$R(i) = P - (E + Q)$	38.54	inches	
6	$R(L) = R(l) \times A$		4.80	inches	6	$R(I) = R(i) \times A$	4.24	inches	

C Unvegetated Area Recharge			D Water Area Loss					
1	A = Fraction of Land Unveg.		0.025	fraction	1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate		42.82	inches	2	P = Precipitation Rate	42.82	inches
3	E = Evapotranspiration Rate		2.10	inches	3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate		0.00	inches	4	Q = Runoff Rate	0.00	inches
5	$R(u) = P - (E + Q)$		40.72	inches	5	M = Makeup Water	0.00	inches
6	$R(U) = R(u) \times A$		1.02	inches	6	$R(w) = \{P - (E+Q)\} - M$	12.82	inches
					7	$R(W) = R(w) \times A$	0.00	inches

E Natural Area Recharge			F Other Area Recharge					
1	A = Fraction of Land in Natural		0.627	fraction	1	A = Fraction of Land in Other	0.000	fraction
2	P = Precipitation Rate		42.82	inches	2	P = Precipitation Rate	42.82	inches
3	E = Evapotranspiration Rate		24.20	inches	3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate		0.30	inches	4	Q = Runoff Rate	0.00	inches
5	$R(n) = P - (E + Q)$		18.32	inches	5	$R(o) = P - (E + Q)$	42.82	inches
6	$R(N) = R(n) \times A$		11.48	inches	6	$R(O) = R(o) \times A$	0.00	inches

G Irrigation Recharge			H Wastewater Recharge					
1	A = Fraction of Land Irrigated		0.307	fraction	1	WDF = Wastewater Design Flow	0	gal/day
2	I = Irrigation Rate		5.50	inches	2	WDF = Wastewater Design Flow	0	cu ft/yr
3	E = Evaptrnspiration Rate		3.11	inches	3	A = Area of Site	1,830,391	sq ft
4	Q = Runoff Rate		0.90	inches	4	$R(ww) = WDF/A$	0.00	feet
5	$R(irr) = I - (E + Q)$		1.49	inches	5	$R(WW) = Wastewater Recharge$	0.00	inches
6	$R(IRR) = R(irr) \times A$		0.46	inches				

Total Site Recharge		
$R(T) =$	$R(L) + R(I) + R(U) + R(W) + R(N) + R(O) + R(IRR) + R(WW)$	
$R(T) =$	22.00	inches

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

SITE NITROGEN BUDGET

Proposed Conditions

SHEET 3

A	Sanitary Nitrogen-Residential	Value	Units	B	Pet Waste Nitrogen	Value	Units
1	Number of Dwellings	15	units	1	AR = Application Rate	3.19	lbs/pet
2	Persons per Dwelling	4.27	capita	2	Human Population	64	capita
3	P = Population	64.00	capita	3	Pets = 17 percent of capita	11	pets
4	N = Nitrogen per person	10	lbs	4	N(p) = AR x pets	34.71	lbs
5	LR = Leaching Rate	50%	percent	5	LR = Leaching Rate	50%	percent
6	N(S) = P x N x LR	320.00	lbs	6	N(P) = N(p) x LR	17.35	lbs
7	N(S) = Sanitary Nitrogen	320.00	lbs	7	N(P) = Pet Waste Nitrogen	17.35	lbs

C	Sanitary Nitrogen (Commercial/STP)	Value	Units
1	CF = Commercial/STP Flow	0	gal/day
2	CF = Commercial/STP Flow	0	liters/yr
3	N = Nitrogen in Commercial	40.00	mg/l
4	LR = Leaching Rate	50%	percent
5	N(S) = CF x N x LR	0	milligrams
6	N(S) = Sanitary Nitrogen	0.00	lbs

D	Water Supply Nitrogen (other than wastewater, if applicable)	Value	Units
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	1.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E	Fertilizer Nitrogen 1	Value	Units
1	A = Area of Land Fertilized 1	561,488	sq ft
2	AR = Application Rate	2.30	lbs/1000 sf
3	LR = Leaching Rate	14%	percent
4	N(F1) = A x AR x LR	180.80	lbs
5	N(F1) = Fertilizer Nitrogen	180.80	lbs

F	Fertilizer Nitrogen 2	Value	Units
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	LR = Leaching Rate	0%	percent
4	N(F2) = A x AR x LR	0.00	lbs
5	N(F2) = Fertilizer Nitrogen	0.00	lbs

G	Precipitation Nitrogen	Value	Units
1	R(n) = Natural Recharge (feet)	1.80	feet
2	A = Area of Site (sq ft)	1,830,391	sq ft
3	R(N) = R(n) x A	3,285,841	cu ft
4	R(N) = Natural Recharge (liters)	93,055,021	liters
5	N = Nitrogen in Precipitation	1.00	mg/l
6	LR = Leaching Rate	15%	percent
7	N(ppt) = R(N) x N x LR	13,958,253	milligrams
8	N(ppt) = Precipitation Nitrogen	30.78	lbs

H	Irrigation Nitrogen	Value	Units
1	R = Irrigation Recharge (inches)	1.49	inches
2	R = Irrigation Rate (feet)	0.12	feet
3	A = Area of Land Irrigated	561,488	sq ft
4	R(I) = R(irr) x A	69,795	cu ft
5	R(I) = Site Precipitation (liters)	1,976,590	liters
6	N = Nitrogen in Water Supply	1.00	mg/l
7	LR = Leaching Rate	15%	percent
8	N(irr) = R(I) x N x LR	296,489	milligrams
9	N(irr) = Irrigation Nitrogen	0.65	lbs

Total Site Nitrogen	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	549.58 lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

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NAME OF PROJECT

Deforest Williams Estates

Proposed Conditions

FINAL COMPUTATIONS

SHEET 4

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	549.58	lbs
2	N = Total Nitrogen (milligrams)	249,511,371	milligrams
3	R(T) = Total Recharge (inches)	22.00	inches
4	R(T) = Total Recharge (feet)	1.83	feet
5	A = Area of Site	1,830,391	sq ft
6	R = R(T) x A	3,355,636	cu ft
7	R = Site Recharge Volume	95,031,612	liters
9	NR = N/R	2.63	mg/l

<p>FINAL CONCENTRATION OF NITROGEN IN RECHARGE</p> <div style="background-color: #cccccc; padding: 5px; width: fit-content; margin: 0 auto;"> <p>2.63</p> </div>

<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	22.00	inches/yr
2	R = Site Recharge Volume	3,355,636	cu ft/yr
3	R = Site Recharge Volume	25,101,902	gal/yr
4	R = Site Recharge Volume	25.10	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