APPENDIX E

DISSOLVED OXYGEN MODELING

2014
2009
1999

9.0 MGD Design Flow

18.0 MGD Design Flow

MEMORANDUM
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER DIVISION
Blue Ridge Regional Office

Subject: Dissolved Oxygen Modeling for Pepper's Ferry Regional Wastewater Treatment Authority – VPDES Permit VA0062685

To: Permit File

From: Bob Tate, Water Permit Writer

Date: March 5, 2014

Attachments: 2014 DO modeling documentation;
2009 DO modeling documentation;
1999 DO modeling documentation

This memo explains rationale for dissolved oxygen (DO) modeling used for reissuance of VPDES Permit VA0062685. DO modeling is essentially the same as modeling used for permit reissuance in 2009. Input data are identical to 2009 DO modeling except for channel cross section and effluent TKN. Observations of the New River at the discharge point on February 7, 2014, indicated that *rectangular* cross section is more appropriate than *irregular* cross section. Recent TKN application monitoring values (max 1.11 mg/L) are considerably lower than in 2009 (max 9.86 mg/L). This model uses 12 mg/L for a more conservative analysis that is also more consistent with the way ammonia is evaluated for reasonable potential analysis. GM00-2011 assumes a single effluent ammonia datum of 9.0 mg/L for reasonable potential analysis. Adding 3 mg/L for organic nitrogen results in a TKN value of 12 mg/L. (TKN = ammonia nitrogen + total organic nitrogen).

Other input data was obtained as described in the following two paragraphs.

Effluent BOD (30 mg/L) is the permitted monthly average limit. Stream BOD (2 mg/L) is determined by the models. Effluent DO (6.0 mg/L) is the permitted minimum limit. Steam DO (7.298 mg/L) is calculated by the models. Effluent temperature (23 ^{O}C) is the 90th percentile annual temperature. Stream temperature (23 ^{O}C) is the 90th percentile annual temperature (22.9 ^{O}C) rounded to the nearest degree. Drainage area (2,791 mi^2) is from flow frequency determinations. Stream segment length (1.83 mi) and elevations (1691.4 ft and 1682.4 ft) are from the USGS Radford North quadrangle topographic map. Steam width (475 ft) and channel characteristics are from observations at site visits February 7, 2014 and April 29, 2009 and from aerial photos on DEQ's GIS site. Stream depth and velocity are calculated by the models.

7Q10 stream flow (546 MGD) is from flow frequency determinations. 7Q10 flow conservatively accounts for stream withdrawals at Radford Army Ammunition Plant's #1 intake and at NRV Regional Water Authority's (formerly Blacksburg-Christiansburg-VPI Water Authority) intake, and discharge from the Christiansburg WWTP. (See flow frequency documentation for details.) DO is evaluated for 9.0 MGD and 18.0 MGD design flows. 9.0 MGD is the original and current design flow. Consequently antidegradation applies only to the 18.0 MGD model.

Output data predict that acceptable DO is maintained at 9.0 MGD and 18.0 MGD discharge flows. Minimum DO for 9.0 MGD discharge (7.277 mg/L) occurs immediately, 0 miles downstream of discharge. Minimum DO for 18.0 MGD discharge (7.256 mg/L) occurs 0.0-0.8 miles downstream of discharge. Class IV DO water quality criteria are 4.0 mg/L minimum and 5.0 mg/L daily average. Thus instream DO should protected by current BOD limits (30 mg/L monthly average, 45 mg/L maximum weekly average) in combination with the current DO limit (minimum 6.0 mg/L).

2014 and 2009 DO models are significantly different from the DO model used for permit reissuance in 1999. One difference is DEQ's Regional Model for Free Flowing Streams program was revised in 2001 (version 4.11). The two versions produce different results with identical data. Another difference is 2009 and 2014 models demonstrates DO in only one stream segment (the first segment in the 1999 model). Only one segment is needed because DO never decreases.

```
"Model Run For I:\rstate\Peppers Ferry Regional WTA\2014 reissuance\DO Model for 9.0
MGD.mod On 3/4/2014 1:59:05 PM"

"Model is for NEW RIVER."
"Model starts at the PFRWTA OUTFALL 001 discharge."

"Background Data"
"7Q10",  "cBOD5",  "TKN",     "DO",      "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
546,     2,        0,        7.298,    23

"Discharge/Tributary Input Data for Segment 1"
"Flow",  "cBOD5",  "TKN",     "DO",      "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
9,       30,       12,       ,6,       23

"Hydraulic Information for Segment 1"
"Length","Width",  "Depth",  "Velocity"
"(mi)",  "(ft)",   "(ft)",   "(ft/sec)"
1.83,    474.999,  2.939,    .615

"Initial Mix Values for Segment 1"
"Flow",  "DO",     "cBOD",   "nBOD",   "DOSat",  "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
555,     7.277,    6.135,    .632,     8.11,     23

"Rate Constants for Segment 1. - (All units Per Day)"
"k1",  "k1@T", "k2",   "k2@T", "kn",   "kn@T", "BD",   "BD@T"
.3,    .344,   2.951,  3.168,  .15,    .189,   0,      0

"Output for Segment 1"
"Segment starts at PFRWTA OUTFALL 001"
"Total", "Segm."
"Dist.", "Dist.",  "DO",     "cBOD",   "nBOD"
"(mi)",  "(mi)",   "(mg/l)", "(mg/l)", "(mg/l)"
0,       0,        7.277,    6.135,    .632
.1,      .1,       7.281,    6.114,    .631
.2,      .2,       7.285,    6.093,    .63
.3,      .3,       7.289,    6.072,    .629
.4,      .4,       7.293,    6.051,    .628
.5,      .5,       7.297,    6.03,     .627
.6,      .6,       7.299,    6.009,    .626
.7,      .7,       7.299,    5.988,    .625
.8,      .8,       7.299,    5.968,    .624
.9,      .9,       7.299,    5.948,    .623
1,       1,        7.299,    5.928,    .622
1.1,     1.1,      7.299,    5.908,    .621
1.2,     1.2,      7.299,    5.888,    .62
1.3,     1.3,      7.299,    5.868,    .619
1.4,     1.4,      7.299,    5.848,    .618
1.5,     1.5,      7.299,    5.828,    .617
1.6,     1.6,      7.299,    5.808,    .616
1.7,     1.7,      7.299,    5.788,    .615
1.8,     1.8,      7.299,    5.768,    .614
1.83,    1.83,     7.299,    5.762,    .614


"END OF FILE"
```

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to NEW RIVER.

File Information

File Name:	I:\rstate\Peppers Ferry Regional WTA\2014 reissuance\DO Model for 9.0 M
Date Modified:	March 04, 2014

Water Quality Standards Information

Stream Name:	NEW RIVER
River Basin:	New River Basin
Section:	2a
Class:	IV - Mountainous Zones Waters
Special Standards:	PWS, v

Background Flow Information

Gauge Used:	calculated flow at discharge point
Gauge Drainage Area:	2791 Sq.Mi.
Gauge 7Q10 Flow:	546 MGD
Headwater Drainage Area:	0 Sq.Mi.
Headwater 7Q10 Flow:	546 MGD (Net; includes Withdrawals/Discharges)
Withdrawal/Discharges:	0 MGD
Incremental Flow in Segments:	0.1956288 MGD/Sq.Mi.

Background Water Quality

Background Temperature:	23 Degrees C
Background cBOD5:	2 mg/l
Background TKN:	0 mg/l
Background D.O.:	7.297739 mg/l

Model Segmentation

Number of Segments:	1
Model Start Elevation:	1691.4 ft above MSL
Model End Elevation:	1682.4 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to NEW RIVER.

Segment Information for Segment 1

Definition Information

Segment Definition:	A discharge enters.
Discharge Name:	PFRWTA OUTFALL 001
VPDES Permit No.:	

Discharger Flow Information

Flow:	9 MGD
cBOD5:	30 mg/l
TKN:	12 mg/l
D.O.:	6 mg/l
Temperature:	23 Degrees C

Geographic Information

Segment Length:	1.83 miles
Upstream Drainage Area:	0 Sq.Mi.
Downstream Drainage Area:	0 Sq.Mi.
Upstream Elevation:	1691.4 Ft.
Downstream Elevation:	1682.4 Ft.

Hydraulic Information

Segment Width:	474.999 Ft.
Segment Depth:	2.939 Ft.
Segment Velocity:	0.615 Ft./Sec.
Segment Flow:	555 MGD
Incremental Flow:	0 MGD (Applied at end of segment.)

Channel Information

Cross Section:	Rectangular
Character:	Mostly Straight
Pool and Riffle:	Yes
Percent Pools:	75
Percent Riffles:	25
Pool Depth:	3.5 Ft.
Riffle Depth:	1 Ft.
Bottom Type:	Large Rock
Sludge:	None
Plants:	None
Algae:	Only On Edges

```
"Model Run For I:\rstate\Peppers Ferry Regional WTA\2014 reissuance\DO Model for
18.0 MGD.mod On 3/4/2014 2:15:41 PM"

"Model is for NEW RIVER."
"Model starts at the PFRWTA OUTFALL 001 discharge."

"Background Data"
"7Q10",  "cBOD5",  "TKN",     "DO",      "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
546,     2,        0,        7.298,     23

"Discharge/Tributary Input Data for Segment 1"
"Flow",  "cBOD5",  "TKN",     "DO",      "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
18,      30,       12,       ,6,        23

"Hydraulic Information for Segment 1"
"Length","Width",  "Depth",  "Velocity"
"(mi)",  "(ft)",   "(ft)",   "(ft/sec)"
1.83,    475,      2.967,    .619

"Initial Mix Values for Segment 1"
"Flow",  "DO",     "cBOD",   "nBOD",   "DOSat",  "Temp"
"(mgd)", "(mg/l)", "(mg/l)", "(mg/l)", "(mg/l)", "deg C"
564,     7.256,    7.234,    1.244,    8.11,     23

"Rate Constants for Segment 1. - (All units Per Day)"
"k1",  "k1@T", "k2",   "k2@T", "kn",   "kn@T", "BD",   "BD@T"
.3,    .344,   2.951,  3.168,  .15,    .189,   0,      0

"Output for Segment 1"
"Segment starts at PFRWTA OUTFALL 001"
"Total", "Segm."
"Dist.", "Dist.",  "DO",     "cBOD",   "nBOD"
"(mi)",  "(mi)",   "(mg/l)", "(mg/l)", "(mg/l)"
0,       0,        7.256,    7.234,    1.244
.1,      .1,       7.256,    7.209,    1.242
.2,      .2,       7.256,    7.185,    1.24
.3,      .3,       7.256,    7.161,    1.238
.4,      .4,       7.256,    7.137,    1.236
.5,      .5,       7.256,    7.113,    1.234
.6,      .6,       7.256,    7.089,    1.232
.7,      .7,       7.256,    7.065,    1.23
.8,      .8,       7.256,    7.041,    1.228
.9,      .9,       7.257,    7.017,    1.226
1,       1,        7.258,    6.993,    1.224
1.1,     1.1,      7.259,    6.969,    1.222
1.2,     1.2,      7.26,     6.945,    1.22
1.3,     1.3,      7.261,    6.921,    1.218
1.4,     1.4,      7.262,    6.898,    1.216
1.5,     1.5,      7.263,    6.875,    1.214
1.6,     1.6,      7.264,    6.852,    1.212
1.7,     1.7,      7.265,    6.829,    1.21
1.8,     1.8,      7.266,    6.806,    1.208
1.83,    1.83,     7.266,    6.799,    1.207


"END OF FILE"
```

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to NEW RIVER.

File Information

File Name:	I:\rstate\Peppers Ferry Regional WTA\2014 reissuance\DO Model for 18.0 M
Date Modified:	March 04, 2014

Water Quality Standards Information

Stream Name:	NEW RIVER
River Basin:	New River Basin
Section:	2a
Class:	IV - Mountainous Zones Waters
Special Standards:	PWS, v

Background Flow Information

Gauge Used:	calculated flow at discharge point
Gauge Drainage Area:	2791 Sq.Mi.
Gauge 7Q10 Flow:	546 MGD
Headwater Drainage Area:	0 Sq.Mi.
Headwater 7Q10 Flow:	546 MGD (Net; includes Withdrawals/Discharges)
Withdrawal/Discharges:	0 MGD
Incremental Flow in Segments:	0.1956288 MGD/Sq.Mi.

Background Water Quality

Background Temperature:	23 Degrees C
Background cBOD5:	2 mg/l
Background TKN:	0 mg/l
Background D.O.:	7.297739 mg/l

Model Segmentation

Number of Segments:	1
Model Start Elevation:	1691.4 ft above MSL
Model End Elevation:	1682.4 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to NEW RIVER.

Segment Information for Segment 1

Definition Information

Segment Definition:	A discharge enters.
Discharge Name:	PFRWTA OUTFALL 001
VPDES Permit No.:	

Discharger Flow Information

Flow:	18 MGD
cBOD5:	30 mg/l
TKN:	12 mg/l
D.O.:	6 mg/l
Temperature:	23 Degrees C

Geographic Information

Segment Length:	1.83 miles
Upstream Drainage Area:	0 Sq.Mi.
Downstream Drainage Area:	0 Sq.Mi.
Upstream Elevation:	1691.4 Ft.
Downstream Elevation:	1682.4 Ft.

Hydraulic Information

Segment Width:	475 Ft.
Segment Depth:	2.967 Ft.
Segment Velocity:	0.619 Ft./Sec.
Segment Flow:	564 MGD
Incremental Flow:	0 MGD (Applied at end of segment.)

Channel Information

Cross Section:	Rectangular
Character:	Mostly Straight
Pool and Riffle:	Yes
Percent Pools:	75
Percent Riffles:	25
Pool Depth:	3.5 Ft.
Riffle Depth:	1 Ft.
Bottom Type:	Large Rock
Sludge:	None
Plants:	None
Algae:	Only On Edges

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
Blue Ridge Regional Office
3019 Peters Creek Road Roanoke, Virginia 24019

SUBJECT Dissolved Oxygen Model
Pepper s Ferry Regional Wastewater Treatment Authority – VA0062685

TO Permit File

FROM Bob Tate, BRRO RST

DATE July 2, 2009

This memo explains rationale for the dissolved oxygen (DO) model used for reissuance of VPDES permit VA0062685

This DO model is significantly different from the DO model used for permit reissuance in 1999 One difference is DEQ s Regional Model for Free Flowing Streams program was revised in 2001 (version 4 11) The two versions produce different results with identical data Another difference is this model demonstrates DO in only one stream segment (the first segment in the 1999 model) Only one segment is needed because DO increases throughout the segment

Input data were the identical to the 1999 DO model with these exceptions 7Q10 flow, cBOD, TKN 7Q10 flow (564 MGD) is lower than that used in 1999 (569 MGD) For cBOD, this model uses the entire permit limit (30 mg/L) instead of 5/6 of the permit limit (25 mg/L) used in 1999 For TKN, this model uses 9 86 mg/L instead of 20 mg/L 9 86 is the highest TKN value in 15 monitoring events conducted from November 2007 to February 2009

Background data were similar to the 1999 DO model Background cBOD were 2 0 (2009) and 5 0 (1999) Temperatures were 23 0 °C (2009) and 23 2 °C (1999) DO were 7 298 (2009) and 7 274 (1999) both calculated by the respective programs

Instead of having the program determine flow at the discharge point, 7Q10 stream flow from the flow frequency determination is used This provides more consistency between the DO model and flow frequency determinations 7Q10 flow conservatively accounts for stream withdrawals at Radford Army Ammunition Plant s #1 intake and at Blacksburg Christiansburg-VPI Water Authority s intake, and discharge from the Christiansburg WWTP (See flow frequency documentation for details)

DO was evaluated for 9 0 MGD and 18 0 MGD design flows 9 0 MGD is the original and current design flow Consequently antidegradation applies only to the 18 0 MGD model

Output data (attached) predict that acceptable DO is maintained at 9 0 MGD and 18 0 MGD discharge flows Minimum DO for 9 0 MGD discharge (7 277 mg/L) occurs 0 miles downstream of discharge Minimum DO for 18 0 MGD discharge (7 256 mg/L) occurs 0 0 0 2 miles downstream of discharge The appropriate (Class IV) DO water quality criteria are 4 0 mg/L minimum and 5 0 mg/L daily average

Attached 2009 DO model input and output data
1999 DO model documentation

Model Run For I \rstate\Peppers Ferry\VPDES permitting\9 MGD mod On 7/2/2009
9 51 25 AM

Model is for NEW RIVER
Model starts at the PEPPER'S FERRY OUTFALL 001 discharge

Background Data

7Q10", (mgd)	cBOD5 (mg/l)	TKN , (mg/l) ,	DO (mg/l)	Temp deg C
546	2	0,	7 298	23

Discharge/Tributary Input Data for Segment 1

Flow , (mgd)	cBOD5 (mg/l)	TKN', (mg/l)	DO (mg/l)	Temp deg C
9	30,	9 86	,6,	23

Hydraulic Information for Segment 1

Length (mi)	Width , (ft) ,	Depth (ft)	Velocity (ft/sec)
1 83,	475	2 924,	618

Initial Mix Values for Segment 1

Flow (mgd)	DO (mg/l)	cBOD , (mg/l) ,	nBOD (mg/l)	DOSat (mg/l)	Temp deg C
555	7 277	6 135	482	8 11,	23

Rate Constants for Segment 1 - (All units Per Day)

k1	k1@T ,	k2	k2@T	kn ,	kn@T	BD'	BD@T
3	344	2 951	3 168,	15	189	0	0

Output for Segment 1
Segment starts at PEPPER S FERRY OUTFALL 001

Total Dist (mi)	Segm Dist (mi) ,	DO (mg/l)	cBOD (mg/l)	nBOD (mg/l)
0	0	7 277	6 135,	482
1	1,	7 281	6 114,	481
2,	2	7 285,	6 093	48
3	3	7 289	6 072	479
4,	4	7 293	6 051	478
5	5	7 297	6 03	477
6	6,	7 299	6 01	476
7	7,	7 299	5 99,	475
8	8,	7 299	5 97,	474
9	9	7 299,	5 95	473
1,	1	7 299	5 93	472
1 1	1 1,	7 299	5 91	471
1 2	1 2	7 299	5 89	47
1 3	1 3	7 299	5 87	469
1 4	1 4	7 299	5 85,	468
1 5	1 5	7 299	5 83	467
1 6	1 6	7 299	5 81	466
1 7	1 7	7 299	5 79	465
1 8,	1 8	7 299,	5 77,	464
1 83	1 83,	7 299	5 764	464

END OF FILE

REGIONAL MODELING SYSTEM VERSION 4 0
Model Input File for the Discharge to NEW RIVER

File Information

File Name	I \rstate\Peppers Ferry\VPDES permitting\9 MGD mod
Date Modified	July 02 2009

Water Quality Standards Information

Stream Name	NEW RIVER
River Basin	New River Basin
Section	2a
Class	IV Mountainous Zones Waters
Special Standards	PWS v

Background Flow Information

Gauge Used	calculated flow at discharge point Pepper s Fery Outfall 001
Gauge Drainage Area	2791 Sq Mi
Gauge 7Q10 Flow	546 MGD
Headwater Drainage Area	0 Sq Mi
Headwater 7Q10 Flow	546 MGD (Net includes Withdrawals/Discharges)
Withdrawal/Discharges	0 MGD
Incremental Flow in Segments	0 1956288 MGD/Sq Mi

Background Water Quality

Background Temperature	23 Degrees C
Background cBOD5	2 mg/l
Background TKN	0 mg/l
Background D O	7 297739 mg/l

Model Segmentation

Number of Segments	1
Model Start Elevation	1691 4 ft above MSL
Model End Elevation	1682 4 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4 0
Model Input File for the Discharge to NEW RIVER

Segment Information for Segment 1

Definition Information	
Segment Definition	A discharge enters
Discharge Name	PEPPER S FERRY OUTFALL 001
VPDES Permit No	
Discharger Flow Information	
Flow	9 MGD
cBOD5	30 mg/l
TKN	9 86 mg/l
D O	6 mg/l
Temperature	23 Degrees C
Geographic Information	
Segment Length	1 83 miles
Upstream Drainage Area	0 Sq Mi
Downstream Drainage Area	0 Sq Mi
Upstream Elevation	1691 4 Ft
Downstream Elevation	1682 4 Ft
Hydraulic Information	
Segment Width	475 Ft
Segment Depth	2 924 Ft
Segment Velocity	0 618 Ft /Sec
Segment Flow	555 MGD
Incremental Flow	0 MGD (Applied at end of segment)
Channel Information	
Cross Section	Irregular
Character	Mostly Straight
Pool and Riffle	Yes
Percent Pools	75
Percent Riffles	25
Pool Depth	3 5 Ft
Riffle Depth	1 Ft
Bottom Type	Large Rock
Sludge	None
Plants	None
Algae	Only On Edges

Model Run For I \rstate\Peppers Ferry\VPDES permitting\18 MGD mod On 7/2/2009
9 49 01 AM

Model is for NEW RIVER
Model starts at the PEPPER S FERRY OUTFALL 001 discharge

Background Data

7Q10" (mgd)	cBOD5 (mg/l)	TKN (mg/l)	DO , (mg/l)	Temp deg C
546	2,	0	7 298,	23

Discharge/Tributary Input Data for Segment 1

Flow (mgd)	cBOD5 (mg/l)	TKN (mg/l) ,	DO (mg/l)	Temp deg C
18	30,	9 86	6	23

Hydraulic Information for Segment 1

Length (mi)	Width , (ft)	Depth , (ft)	"Velocity (ft/sec)
1 83	475 001,	2 952,	622

Initial Mix Values for Segment 1

Flow (mgd)	DO (mg/l)	cBOD (mg/l)	nBOD , (mg/l)	DOSat (mg/l)	Temp deg C
564	7 256	7 234	948	8 11	23

Rate Constants for Segment 1 - (All units Per Day)

k1	k1@T	k2 ,	k2@T ,	kn ,	kn@T	BD'	BD@T
3,	344,	2 951,	3 168,	15,	189,	0	0

Output for Segment 1
Segment starts at PEPPER S FERRY OUTFALL 001

Total Dist (mi)	Segm Dist (mi) ,	DO (mg/l) ,	cBOD (mg/l) ,	nBOD (mg/l)
0	0	7 256,	7 234,	948
1,	1,	7 256	7 21	946
2	2	7 256	7 186	944
3,	3	7 257,	7 162,	942
4,	4	7 258	7 138	94
5,	5	7 259	7 114	938
6	6	7 26	7 09	936
7	7	7 261,	7 066	934
8	8	7 262	7 042	932
9,	9	7 263	7 018,	93
1	1	7 264	6 994	928
1 1,	1 1,	7 265,	6 97	926
1 2	1 2	7 266	6 946	924
1 3	1 3	7 267	6 923	922
1 4	1 4	7 268	6 9	92
1 5	1 5	7 269	6 877,	918
1 6	1 6	7 27	6 854	916
1 7	1 7,	7 271,	6 831	914
1 8	1 8	7 272	6 808	912
1 83,	1 83,	7 272	6 801,	911

END OF FILE

REGIONAL MODELING SYSTEM VERSION 4 0
Model Input File for the Discharge to NEW RIVER

File Information

File Name	I \rstate\Peppers Ferry\VPDES permitting\18 MGD mod
Date Modified	July 02 2009

Water Quality Standards Information

Stream Name	NEW RIVER
River Basin	New River Basin
Section	2a
Class	IV Mountainous Zones Waters
Special Standards	PWS v

Background Flow Information

Gauge Used	calculated flow at discharge point Pepper s Fery Outfall 001
Gauge Drainage Area	2791 Sq Mi
Gauge 7Q10 Flow	546 MGD
Headwater Drainage Area	0 Sq Mi
Headwater 7Q10 Flow	546 MGD (Net includes Withdrawals/Discharges)
Withdrawal/Discharges	0 MGD
Incremental Flow in Segments	0 1956288 MGD/Sq Mi

Background Water Quality

Background Temperature	23 Degrees C
Background cBOD5	2 mg/l
Background TKN	0 mg/l
Background D O	7 297739 mg/l

Model Segmentation

Number of Segments	1
Model Start Elevation	1691 4 ft above MSL
Model End Elevation	1682 4 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4 0
Model Input File for the Discharge to NEW RIVER

Segment Information for Segment 1

Definition Information	
Segment Definition	A discharge enters
Discharge Name	PEPPER S FERRY OUTFALL 001
VPDES Permit No	
Discharger Flow Information	
Flow	18 MGD
cBOD5	30 mg/l
TKN	9 86 mg/l
D O	6 mg/l
Temperature	23 Degrees C
Geographic Information	
Segment Length	1 83 miles
Upstream Drainage Area	0 Sq Mi
Downstream Drainage Area	0 Sq Mi
Upstream Elevation	1691 4 Ft
Downstream Elevation	1682 4 Ft
Hydraulic Information	
Segment Width	475 001 Ft
Segment Depth	2 952 Ft
Segment Velocity	0 622 Ft /Sec
Segment Flow	564 MGD
Incremental Flow	0 MGD (Applied at end of segment)
Channel Information	
Cross Section	Irregular
Character	Mostly Straight
Pool and Riffle	Yes
Percent Pools	75
Percent Riffles	25
Pool Depth	3 5 Ft
Riffle Depth	1 Ft
Bottom Type	Large Rock
Sludge	None
Plants	None
Algae	Only On Edges

Pepper's Ferry Regional Wastewater Treatment Authority
Nutrient Monitoring Database

Regional Facility Effluent

Date	Flow	P	P/lbs	Ortho P	OP/lbs	TKN	TKN/lbs	NH3	NH3/lbs	NO2	NO2/lbs	NO3	No3/lbs
11/1/2007	3 63	2 55	35	1 47	20	9 86	135	0 050	0 6870	0 025	0 3435	16 9	232
1/6/2008	3 19		0		0		0	0 370	4 4674		0 0000		0
1/15/2008	4 21	2 34	37	1 79	29	4 03	64	0 050	0 7967	0 025	0 3984	16 2	258
4/9/2008	4 70	2 47	44	0 71	13	1 1	20	0 015	0 2668	0 025	0 4447	10 6	189
4/17/2008	3 99	3 92	59	2 50	38	2 0	30	0 015	0 2265	0 025	0 3776	20 0	302
5/15/2008	3 77	3 65	52	0 87	12	1 8	26	0 500	7 1347	0 025	0 3567	20 7	295
5/27/2008	3 16	5 20	62	1 21	14	1 7	20	0 040	0 4784	0 025	0 2990	16 8	201
6/20/2008	2 72	3 86	40	1 00	10	3 1	32	0 160	1 6472	0 025	0 2574	18 6	191
7/9/2008	3 76	3 89	55	2 18	31	0 42	6	0 070	0 9962	0 025	0 3558	15 1	215
7/15/2008	2 81	3 10	33	1 09	12	0 42	4	0 050	0 5318	0 025	0 2659	14 9	158
8/20/2008	3 04	4 33	50	3 42	39	1 5	17	0 090	1 0356	0 380	4 3724	20 8	239
9/3/2008	3 91	3 75	55	0 6	9	0 42	6	0 015	0 2220	0 025	0 3700	18 3	271
10/3/2008	3 6	6 35	87	4 55	62	2 6	35	0 015	0 2044	0 025	0 3407	20 0	273
11/12/2008	3 35	4 73	60	3 08	39	2 3	29	0 050	0 6340	0 025	0 3170	24 3	308
12/18/2008	4 58	2 32	40	1 53	27	1 5	26	0 040	0 6934	0 025	0 4334	15 3	265
1/21/2009	3 47					1 1	14	0 040	0 5254	0 025	0 3283	18 3	240
2/4/2009	3 84	2 44	35	1 68	24								
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0
			0		0		0		0 0000		0 0000		0

RECEIVED
APR 29 2009
DEQ – BRRO

EVALUATION OF CONVENTIONAL POLLUTANTS

Effluent limitations for TSS at both the 9 0 and 18 0 MGD design flows are in accordance with Federal Effluent Requirements TSS limits for the 9 0 MGD design flow are unchanged

Effluent limitations for pH reflect current Water Quality Standards at the 9 0 and 18 0 MGD design flows pH limits for the 9 0 MGD design flow are unchanged

The analysis of effluent limitations for D O and BOD_5 are based upon Regional Water Quality Model Version 3 2 Four segments were modeled as follows segment 1 from Peppers Ferry Outfall 001 to Radford Army Ammunition Plant (RAAP) outfall 029 segment 2 from RAAP outfall 029 to RAAP outfall 007/026 segment 3 from RAAP 007/026 to Lower Stroubles Creek WWTP outfall 001 and segment 4 from Lower Stroubles Creek WWTP outfall 001 to one mile downstream of RAAP outfall 028 The segments were modeled on the basis that RAAP outfalls 029 026 and 007 and Lower Stroubles Creek WWTP outfall 001 have the potential to discharge oxygen depleting compounds that could interact with discharges from Peppers Ferry WWTP As RAAP outfalls 007/026 are only 0 04 miles apart they were modeled as one outfall for the purposes of evaluating their impact on D O depletion

D O model assumptions for RAAP outfalls are as follows Flow estimates are based upon maximum 30 day values taken from RAAP s VPDES permit application submitted on January 29 1999 TKN estimates are from the 90th percentile values of TKN data collected by RAAP between 1994 and 1999 at each of the outfalls (copies attached) BOD5 values are based upon effluent limits contained in the current permit converted to cBOD5 at concentration ratio of 5 cBOD5 6 BOD5 and D O concentrations are based on a conservative worst case assumption of '0 mg/l '

Lower Stroubles Creek WWTP model inputs are taken from the current permit limits for BOD5 and D O contained in the current VPDES permit with an expiration date of June 6 2004 TKN concentrations were estimated as 20 mg/l A printout of all model inputs are attached

A copy of model outputs for the 9 0 MGD design flow are attached **The model predicts that secondary limits for BOD_5 in combination with a D O limit of 6 0 mg/l should be protective of numeric criteria for D O required by Water Quality Standards at the 9 0 MGD design flow**

A copy of model outputs for 18 0 MGD design flow are attached **The model predicts that secondary limits for BOD_5 in combination with a D O limit of 6 0 mg/l should be protective of numeric criteria for D O required by Water Quality Standards at the 18 0 MGD design flow and comply with antidegradation requirements** The model establishes a D O concentration baseline of 7 27 mg/l at the Peppers Ferry outfall When compared with existing conditions the D O concentration will ensure that there will not be a D O decrease of more than 0 2 mg/l in any portion of the modeled segments as compared to existing conditions

********** ********** **********

REGIONAL MODELING SYSTEM VERSION 3 2

****

MODEL SIMULATION FOR THE Peppers Ferry STP DISCHARGE

TO New River

COMMENT Existing Conditions -- Peppers Ferry

THE SIMULATION STARTS AT THE Peppers Ferry STP DISCHARGE

********** PROPOSED PERMIT LIMITS **********

FLOW = 9 MGD cBOD5 = 25 Mg/L TKN = 20 Mg/L D O = 6 Mg/L

**** THE MAXIMUM CHLORINE ALLOWABLE IN THE DISCHARGE IS 0 707 Mg/L ****

THE SECTION BEING MODELED IS BROKEN INTO 4 SEGMENTS
RESULTS WILL BE GIVEN AT 0 1 MILE INTERVALS

********** BACKGROUND CONDITIONS **********

THE 7Q10 STREAM FLOW AT THE DISCHARGE IS 569 06744 MGD
THE DISSOLVED OXYGEN OF THE STREAM IS 7 274 Mg/L
THE BACKGROUND cBODu OF THE STREAM IS 5 Mg/L
THE BACKGROUND nBOD OF THE STREAM IS 0 Mg/L

********** MODEL PARAMETERS **********

SEG	LEN Mi	VEL F/S	K2 1/D	K1 1/D	KN 1/D	BENTHIC Mg/L	ELEV Ft	TEMP °C	DO-SAT Mg/L
1	1 83	0 632	2 951	0 300	0 150	0 000	1686 90	23 20	8 082
2	0 22	0 612	2 455	0 300	0 150	0 000	1681 95	23 20	8 084
3	0 22	0 642	3 000	0 300	0 150	0 000	1680 95	23 20	8 084
4	6 13	0 556	1 429	0 300	0 150	0 000	1673 10	23 20	8 086

(The K Rates shown are at 20°C the model corrects them for temperature)

********** RESPONSE FOR SEGMENT 1 **********

TOTAL STREAMFLOW = 578 0674 MGD
(Including Discharge)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	0 000	7 254	5 895	1 146
0 100	0 100	7 258	5 875	1 144
0 200	0 200	7 261	5 856	1 142
0 300	0 300	7 265	5 836	1 140
0 400	0 400	7 268	5 817	1 138
0 500	0 500	7 272	5 797	1 135
0 600	0 600	7 274	5 778	1 133
0 700	0 700	7 274	5 758	1 131
0 800	0 800	7 274	5 739	1 129
0 900	0 900	7 274	5 720	1 127
1 000	1 000	7 274	5 701	1 125
1 100	1 100	7 274	5 681	1 123
1 200	1 200	7 274	5 662	1 121
1 300	1 300	7 274	5 643	1 119
1 400	1 400	7 274	5 624	1 117
1 500	1 500	7 274	5 606	1 115
1 600	1 600	7 274	5 587	1 112
1 700	1 700	7 274	5 568	1 110
1 800	1 800	7 274	5 549	1 108
1 830	1 830	7 274	5 544	1 108

FOR THE DISCHARGE AT THE END OF SEGMENT 1
DISCHARGER = RAAP -- 029
FLOW = 1 57 MGD cBOD5 = 50 Mg/L TKN = 7 Mg/L D O = 0 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 0 2447 MGD

********** RESPONSE FOR SEGMENT 2 **********

TOTAL STREAMFLOW = 579 8821 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	1 830	7 254	5 867	1 151
0 100	1 930	7 254	5 847	1 149
0 200	2 030	7 253	5 826	1 147
0 220	2 050	7 253	5 822	1 146

FOR THE DISCHARGE AT THE END OF SEGMENT 2
DISCHARGER = RAAP -- 007/026
FLOW = 7 36 MGD cBOD5 = 25 Mg/L TKN = 6 Mg/L D O = 0 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 0 0204 MGD

********** RESPONSE FOR SEGMENT 3 **********

TOTAL STREAMFLOW = 587 2625 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	2 050	7 162	6 533	1 295
0 100	2 150	7 167	6 511	1 292
0 200	2 250	7 171	6 490	1 290
0 220	2 270	7 172	6 485	1 289

FOR THE DISCHARGE AT THE END OF SEGMENT 3
DISCHARGER = Lower Stroubles Creek STP
FLOW = 9 MGD cBOD5 = 20 Mg/L TKN = 20 Mg/L D O = 6 6 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 4 5468 MGD

********** RESPONSE FOR SEGMENT 4 **********

TOTAL STREAMFLOW = 600 8093 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	2 270	7 164	7 126	2 363
0 100	2 370	7 148	7 099	2 358
0 200	2 470	7 132	7 072	2 353
0 300	2 570	7 116	7 045	2 348
0 400	2 670	7 101	7 018	2 343
0 500	2 770	7 086	6 991	2 338
0 600	2 870	7 071	6 964	2 333
0 700	2 970	7 057	6 938	2 328
0 800	3 070	7 043	6 911	2 323
0 900	3 170	7 030	6 885	2 319
1 000	3 270	7 017	6 858	2 314
1 100	3 370	7 004	6 832	2 309
1 200	3 470	6 991	6 806	2 304
1 300	3 570	6 979	6 780	2 299
1 400	3 670	6 968	6 754	2 294
1 500	3 770	6 956	6 728	2 289
1 600	3 870	6 945	6 703	2 284
1 700	3 970	6 934	6 677	2 280
1 800	4 070	6 923	6 652	2 275
1 900	4 170	6 913	6 626	2 270
2 000	4 270	6 903	6 601	2 265
2 100	4 370	6 893	6 576	2 260
2 200	4 470	6 884	6 551	2 256
2 300	4 570	6 874	6 526	2 251
2 400	4 670	6 865	6 501	2 246
2 500	4 770	6 857	6 476	2 241
2 600	4 870	6 848	6 451	2 237
2 700	4 970	6 840	6 427	2 232
2 800	5 070	6 832	6 402	2 227
2 900	5 170	6 824	6 378	2 223
3 000	5 270	6 816	6 353	2 218
3 100	5 370	6 809	6 329	2 213
3 200	5 470	6 802	6 305	2 209
3 300	5 570	6 795	6 281	2 204
3 400	5 670	6 788	6 257	2 199
3 500	5 770	6 782	6 233	2 195
3 600	5 870	6 776	6 209	2 190
3 700	5 970	6 770	6 186	2 185
3 800	6 070	6 764	6 162	2 181
3 900	6 170	6 758	6 139	2 176
4 000	6 270	6 753	6 115	2 172
4 100	6 370	6 748	6 092	2 167
4 200	6 470	6 743	6 069	2 162
4 300	6 570	6 738	6 046	2 158
4 400	6 670	6 733	6 023	2 153
4 500	6 770	6 728	5 999	2 149
4 600	6 870	6 724	5 977	2 144
4 700	6 970	6 720	5 954	2 140

4 800	7 0	6 716	5 ,31	2 135
4 900	7 170	6 712	5 909	2 131
5 000	7 270	6 708	5 886	2 126
5 100	7 370	6 705	5 864	2 122
5 200	7 470	6 701	5 841	2 117
5 300	7 570	6 698	5 819	2 113
5 400	7 670	6 695	5 797	2 108
5 500	7 770	6 692	5 775	2 104
5 600	7 870	6 689	5 753	2 100
5 700	7 970	6 687	5 731	2 095
5 800	8 070	6 684	5 709	2 091
5 900	8 170	6 682	5 687	2 086
6 000	8 270	6 680	5 665	2 082
6 100	8 370	6 677	5 644	2 078
6 130	8 400	6 677	5 637	2 076

****

GIONAL MODELING SYSTEM Ver 3 2 (OWRM - 9/90)
,-22-1999 09 25 02

ATA FILE = PEPPERAD MOD

********** ********** **********

REGIONAL MODELING SYSTEM VERSION 3 2

****

MODEL SIMULATION FOR THE Peppers Ferry STP DISCHARGE

TO New River

COMMENT Expansion \D O Analysis -- Peppers ferry

THE SIMULATION STARTS AT THE Peppers Ferry STP DISCHARGE

********** PROPOSED PERMIT LIMITS **********

FLOW = 18 MGD cBOD5 = 25 Mg/L TKN = 20 Mg/L D O = 6 Mg/L

**** THE MAXIMUM CHLORINE ALLOWABLE IN THE DISCHARGE IS 0 359 Mg/L ****

THE SECTION BEING MODELED IS BROKEN INTO 4 SEGMENTS
RESULTS WILL BE GIVEN AT 0 1 MILE INTERVALS

********** BACKGROUND CONDITIONS **********

THE 7Q10 STREAM FLOW AT THE DISCHARGE IS 569 06744 MGD
THE DISSOLVED OXYGEN OF THE STREAM IS 7 274 Mg/L
THE BACKGROUND cBODu OF THE STREAM IS 5 Mg/L
THE BACKGROUND nBOD OF THE STREAM IS 0 Mg/L

********** MODEL PARAMETERS **********

SEG	LEN Mi	VEL F/S	K2 1/D	K1 1/D	KN 1/D	BENTHIC Mg/L	ELEV Ft	TEMP °C	DO-SAT Mg/L
1	1 83	0 632	2 951	0 300	0 150	0 000	1686 90	23 20	8 082
2	0 22	0 612	2 455	0 300	0 150	0 000	1681 95	23 20	8 084
3	0 22	0 642	3 000	0 300	0 150	0 000	1680 95	23 20	8 084
4	6 13	0 556	1 429	0 300	0 150	0 000	1673 10	23 20	8 086

(The K Rates shown are at 20°C the model corrects them for temperature)

Attachment 3/ page 10 of 2

4 800	7 0	6 716	5 931	2 135
4 900	7 170	6 712	5 909	2 131
5 000	7 270	6 708	5 886	2 126
5 100	7 370	6 705	5 864	2 122
5 200	7 470	6 701	5 841	2 117
5 300	7 570	6 698	5 819	2 113
5 400	7 670	6 695	5 797	2 108
5 500	7 770	6 692	5 775	2 104
5 600	7 870	6 689	5 753	2 100
5 700	7 970	6 687	5 731	2 095
5 800	8 070	6 684	5 709	2 091
5 900	8 170	6 682	5 687	2 086
6 000	8 270	6 680	5 665	2 082
6 100	8 370	6 677	5 644	2 078
6 130	8 400	6 677	5 637	2 076

****

'EGIONAL MODELING SYSTEM Ver 3 2 (OWRM - 9/90)
)6-22-1999 09 25 02

)ATA FILE = PEPPERAD MOD

********** RESPONSE FOR SEGMENT 1 **********

Attachment 5/page 9 of 23

TOTAL STREAMFLOW = 587 0674 MGD
(Including Discharge)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	0 000	7 235	6 763	2 257
0 100	0 100	7 234	6 740	2 253
0 200	0 200	7 233	6 718	2 249
0 300	0 300	7 233	6 695	2 244
0 400	0 400	7 232	6 673	2 240
0 500	0 500	7 232	6 650	2 236
0 600	0 600	7 232	6 628	2 232
0 700	0 700	7 231	6 606	2 228
0 800	0 800	7 231	6 584	2 224
0 900	0 900	7 231	6 562	2 220
1 000	1 000	7 231	6 540	2 215
1 100	1 100	7 232	6 518	2 211
1 200	1 200	7 232	6 496	2 207
1 300	1 300	7 232	6 474	2 203
1 400	1 400	7 232	6 452	2 199
1 500	1 500	7 233	6 431	2 195
1 600	1 600	7 233	6 409	2 191
1 700	1 700	7 234	6 388	2 187
1 800	1 800	7 234	6 366	2 183
1 830	1 830	7 235	6 360	2 181

FOR THE DISCHARGE AT THE END OF SEGMENT 1
DISCHARGER = RAAP -- 029
FLOW = 1 57 MGD cBOD5 = 50 Mg/L TKN = 7 Mg/L D O = 0 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 0 2447 MGD

********** RESPONSE FOR SEGMENT 2 **********

Attachment 5 page 10 of 2

TOTAL STREAMFLOW = 588 8821 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	1 830	7 215	6 676	2 221
0 100	1 930	7 211	6 653	2 217
0 200	2 030	7 207	6 629	2 212
0 220	2 050	7 206	6 625	2 212

FOR THE DISCHARGE AT THE END OF SEGMENT 2
DISCHARGER = RAAP -- 007/026
FLOW = 7 36 MGD cBOD5 = 25 Mg/L TKN = 6 Mg/L D O = 0 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 0 0204 MGD

********** RESPONSE FOR SEGMENT 3 **********

Attachment 5 / page 11 of 23

TOTAL STREAMFLOW = 596 2625 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	2 050	7 117	7 314	2 345
0 100	2 150	7 118	7 290	2 340
0 200	2 250	7 120	7 266	2 336
0 220	2 270	7 120	7 261	2 335

FOR THE DISCHARGE AT THE END OF SEGMENT 3
DISCHARGER = Lower Stroubles Creek STP
FLOW = 9 MGD cBOD5 = 20 Mg/L TKN = 20 Mg/L D O = 6 6 Mg/L

FLOW FROM INCREMENTAL DRAINAGE AREA = 4 5468 MGD

********** RESPONSE FOR SEGMENT 4 **********

Attachment 5 / page 12 of 23

TOTAL STREAMFLOW = 609 8093 MGD
(Including Discharge Tributaries and Incremental D A Flow)

DISTANCE FROM HEAD OF SEGMENT (MI)	TOTAL DISTANCE FROM MODEL BEGINNING (MI)	DISSOLVED OXYGEN (Mg/L)	cBODu (Mg/L)	nBODu (Mg/L)
0 000	2 270	7 114	7 875	3 370
0 100	2 370	7 093	7 845	3 362
0 200	2 470	7 073	7 815	3 355
0 300	2 570	7 054	7 786	3 348
0 400	2 670	7 035	7 756	3 341
0 500	2 770	7 016	7 726	3 334
0 600	2 870	6 998	7 697	3 327
0 700	2 970	6 980	7 667	3 320
0 800	3 070	6 963	7 638	3 313
0 900	3 170	6 946	7 609	3 306
1 000	3 270	6 929	7 580	3 299
1 100	3 370	6 913	7 551	3 292
1 200	3 470	6 897	7 522	3 285
1 300	3 570	6 882	7 494	3 278
1 400	3 670	6 867	7 465	3 272
1 500	3 770	6 853	7 437	3 265
1 600	3 870	6 838	7 408	3 258
1 700	3 970	6 825	7 380	3 251
1 800	4 070	6 811	7 352	3 244
1 900	4 170	6 798	7 324	3 237
2 000	4 270	6 785	7 296	3 230
2 100	4 370	6 773	7 268	3 224
2 200	4 470	6 761	7 240	3 217
2 300	4 570	6 749	7 213	3 210
2 400	4 670	6 737	7 185	3 203
2 500	4 770	6 726	7 158	3 196
2 600	4 870	6 715	7 130	3 190
2 700	4 970	6 705	7 103	3 183
2 800	5 070	6 694	7 076	3 176
2 900	5 170	6 684	7 049	3 170
3 000	5 270	6 675	7 022	3 163
3 100	5 370	6 665	6 996	3 156
3 200	5 470	6 656	6 969	3 149
3 300	5 570	6 647	6 942	3 143
3 400	5 670	6 639	6 916	3 136
3 500	5 770	6 630	6 889	3 130
3 600	5 870	6 622	6 863	3 123
3 700	5 970	6 614	6 837	3 116
3 800	6 070	6 607	6 811	3 110
3 900	6 170	6 599	6 785	3 103
4 000	6 270	6 592	6 759	3 097
4 100	6 370	6 585	6 733	3 090
4 200	6 470	6 578	6 707	3 084
4 300	6 570	6 572	6 682	3 077
4 400	6 670	6 566	6 656	3 071
4 500	6 770	6 560	6 631	3 064
4 600	6 870	6 554	6 606	3 058
4 700	6 970	6 548	6 580	3 051

4 800	7 0	6 543	6 55	3 045
4 900	7 170	6 538	6 530	3 039
5 000	7 270	6 533	6 505	3 032
5 100	7 370	6 528	6 481	3 026
5 200	7 470	6 523	6 456	3 019
5 300	7 570	6 519	6 431	3 013
5 400	7 670	6 515	6 407	3 007
5 500	7 770	6 510	6 382	3 000
5 600	7 870	6 507	6 358	2 994
5 700	7 970	6 503	6 334	2 988
5 800	8 070	6 499	6 310	2 981
5 900	8 170	6 496	6 286	2 975
6 000	8 270	6 493	6 261	2 969
6 100	8 370	6 490	6 238	2 963
6 130	8 400	6 489	6 231	2 961

****

EGIONAL MODELING SYSTEM Ver 3 2 (OWRM - 9/90)
6-22-1999 09 25 57

ATA FILE = PEPPERAD MOD

****

REGIONAL MODELING SYSTEM VERSION 3 2

DATA FILE SUMMARY

****

THE NAME OF THE DATA FILE IS PEPPERAD MOD

THE STREAM NAME IS New River
THE RIVER BASIN IS New River
THE SECTION NUMBER IS 2
THE CLASSIFICATION IS IV

STANDARDS VIOLATED (Y/N) = N
STANDARDS APPROPRIATE (Y/N) = Y

DISCHARGE WITHIN 3 MILES (Y/N) = N

THE DISCHARGE BEING MODELED IS Peppers Ferry STP

PROPOSED LIMITS ARE
FLOW = 18 MGD
BOD5 = 25 MG/L
TKN = 20 MG/L
D O = 6 MG/L

THE NUMBER OF SEGMENTS TO BE MODELED = 4

7Q10 WILL BE CALCULATED BY DRAINAGE AREA COMPARISON
THE GAUGE NAME IS New River -- Radford Route 11 bridge
GAUGE DRAINAGE AREA = 2748 SQ MI
GAUGE 7Q10 = 560 3 MGD
DRAINAGE AREA AT DISCHARGE = 2791 SQ MI

STREAM A DRY DITCH AT DISCHARGE (Y/N) = N
ANTIDEGRADATION APPLIES (Y/N) = Y

ALLOCATION DESIGN TEMPERATURE = 23 2 °C

Attachment 5
Page 15 of 23

SEGMENT INFORMATION

####### SEGMENT # 1 #######

SEGMENT ENDS BECAUSE A DISCHARGE ENTERS AT END

SEGMENT LENGTH = 1 83 MI

SEGMENT WIDTH = 475 FT
SEGMENT DEPTH = 2 9 FT
SEGMENT VELOCITY = 65 FT/SEC

DRAINAGE AREA AT SEGMENT START = 2791 4 SQ MI
DRAINAGE AREA AT SEGMENT END = 2792 6 SQ MI

ELEVATION AT UPSTREAM END = 1691 4 FT
ELEVATION AT DOWNSTREAM END = 1682 4 FT

THE CROSS SECTION IS IRREGULAR
THE CHANNEL IS MOSTLY STRAIGHT

POOLS AND RIFFLES (Y/N) = Y
THE SEGMENT LENGTH IS 75 ~ POOLS
POOL DEPTH = 4 FT
THE SEGMENT LENGTH IS 25 ~ RIFFLES
RIFFLE DEPTH = 1 FT

THE BOTTOM TYPE = LARGE ROCK
SLUDGE DEPOSITS = NONE
AQUATIC PLANTS = NONE
ALGAE OBSERVED = VISIBLE ONLY ON EDGES
WATER COLORED GREEN (Y/N) = N

THE DISCHARGE AT THE SEGMENT END IS RAAP -- 029

ITS CONCENTRATIONS ARE
FLOW = 1 57 MGD
BOD5 = 50 MG/L
TKN = 7 MG/L
D O = 0 MG/L

Attachment 5
Page 16 of 2

SEGMENT INFORMATION

####### SEGMENT # 2 #######

SEGMENT ENDS BECAUSE A DISCHARGE ENTERS AT END

SEGMENT LENGTH = 22 MI

SEGMENT WIDTH = 500 FT
SEGMENT DEPTH = 3 FT
SEGMENT VELOCITY = 65 FT/SEC

DRAINAGE AREA AT SEGMENT START = 2792 6 SQ MI
DRAINAGE AREA AT SEGMENT END = 2792 7 SQ MI

ELEVATION AT UPSTREAM END = 1682 4 FT
ELEVATION AT DOWNSTREAM END = 1681 5 FT

THE CROSS SECTION IS IRREGULAR
THE CHANNEL IS MOSTLY STRAIGHT

POOLS AND RIFFLES (Y/N) = Y
THE SEGMENT LENGTH IS 75 ~ POOLS
POOL DEPTH = 4 FT
THE SEGMENT LENGTH IS 25 ~ RIFFLES
RIFFLE DEPTH = 1 FT

THE BOTTOM TYPE = LARGE ROCK
SLUDGE DEPOSITS = NONE
AQUATIC PLANTS = NONE
ALGAE OBSERVED = VISIBLE ONLY ON EDGES
WATER COLORED GREEN (Y/N) = N

THE DISCHARGE AT THE SEGMENT END IS RAAP -- 007/026

ITS CONCENTRATIONS ARE
FLOW = 7 36 MGD
BOD5 = 25 MG/L
TKN = 6 MG/L
D O = 0 MG/L

SEGMENT INFORMATION

####### SEGMENT # 3 #######

SEGMENT ENDS BECAUSE A DISCHARGE ENTERS AT END

SEGMENT LENGTH = 22 MI

SEGMENT WIDTH = 500 FT
SEGMENT DEPTH = 3 FT
SEGMENT VELOCITY = 65 FT/SEC

DRAINAGE AREA AT SEGMENT START = 2792 7 SQ MI
DRAINAGE AREA AT SEGMENT END = 2815 SQ MI

ELEVATION AT UPSTREAM END = 1681 5 FT
ELEVATION AT DOWNSTREAM END = 1680 4 FT

THE CROSS SECTION IS IRREGULAR
THE CHANNEL IS MOSTLY STRAIGHT

POOLS AND RIFFLES (Y/N) = Y
THE SEGMENT LENGTH IS 75 - POOLS
POOL DEPTH = 4 FT
THE SEGMENT LENGTH IS 25 - RIFFLES
RIFFLE DEPTH = 1 FT

THE BOTTOM TYPE = LARGE ROCK
SLUDGE DEPOSITS = NONE
AQUATIC PLANTS = NONE
ALGAE OBSERVED = VISIBLE ONLY ON EDGES
WATER COLORED GREEN (Y/N) = N

THE DISCHARGE AT THE SEGMENT END IS Lower Stroubles Creek STP

ITS CONCENTRATIONS ARE
FLOW = 9 MGD
BOD5 = 20 MG/L
TKN = 20 MG/L
D O = 6 6 MG/L

Attachment 5
page 18 of 2

SEGMENT INFORMATION

####### SEGMENT # 4 #######

SEGMENT ENDS BECAUSE THE MODEL ENDS

SEGMENT LENGTH = 6 13 MI

SEGMENT WIDTH = 525 FT
SEGMENT DEPTH = 3 25 FT
SEGMENT VELOCITY = 65 FT/SEC

DRAINAGE AREA AT SEGMENT START = 2815 SQ MI
DRAINAGE AREA AT SEGMENT END = 2872 SQ MI

ELEVATION AT UPSTREAM END = 1680 4 FT
ELEVATION AT DOWNSTREAM END = 1665 8 FT

THE CROSS SECTION IS IRREGULAR
THE CHANNEL IS MOSTLY STRAIGHT

POOLS AND RIFFLES (Y/N) = Y
THE SEGMENT LENGTH IS 75 - POOLS
POOL DEPTH = 4 FT
THE SEGMENT LENGTH IS 25 - RIFFLES
RIFFLE DEPTH = 1 FT

THE BOTTOM TYPE = LARGE ROCK
SLUDGE DEPOSITS = NONE
AQUATIC PLANTS = NONE
ALGAE OBSERVED = VISIBLE ONLY ON EDGES
WATER COLORED GREEN (Y/N) = N

****

REGIONAL MODELING SYSTEM Ver 3 2 (OWRM - 9/90)
06-04-1999 12 09 17

Attachment 5
page 19 of 2

TKN data from RFAAP

NPID	PLD	DTDMRDUE	DTDMRCVD	PRA	MQAV	MQMX	MCA	MCM	MEX
							TKN		
VA000024	007	10-Oct 94	11-Oct-94	068	14 99	14 99	1 1	1 1	0
VA000024	007	10-Nov 94	10-Nov-94	068	1 64	1 64	0 1	0 1	0
VA000024	007	10-Dec 94	12-Dec-94	068	2 706	2 706	0 2	0 2	0
VA000024	007	10-Jan 95	10-Jan-95	068	3 325	3 325	0 2	0 2	0
VA000024	007	10-Feb 95	10-Feb-95	068	5 235	5 235	0 3	0 3	0
VA000024	007	10-Mar 95	10-Mar-95	068	1 494	1 494	0 1	0 1	0
VA000024	007	10-Apr 95	10-Apr-95	068	49 13	49 13	3 2	3 2	0
VA000024	007	10-May 95	11-May-95	068	15 19	15 19	1	1	0
VA000024	007	10-Jun 95	12-Jun-95	068	28 13	28 13	2 1	2 1	0
VA000024	007	10-Jul 95	11-Jul-95	068	66 94	66 94	5 6	5 6	0
VA000024	007	10-Aug 95	11-Aug-95	068	15 29	15 29	1 7	1 7	0
VA000024	007	10-Sep 95	08-Sep-95	068	35 6	35 6	2 8	2 8	0
VA000024	007	10-Oct 95	10-Oct-95	068	20 46	20 46	2 2	2 2	0
VA000024	007	10-Nov 95	13-Nov-95	068	21 1	21 1	1 7	1 7	0
VA000024	007	10-Dec 95	11-Dec-95	068	26 73	26 73	1 7	1 7	0
VA000024	007	10-Jan 96	16-Jan-96	068	60 8	60 8	3 4	3 4	0
VA000024	007	10-Feb 96	12-Feb-96	068	21 74	21 74	1 1	1 1	0
VA000024	007	10-Mar 96	11-Mar 96	068	58 14	58 14	2 2	2 2	
VA000024	007	10-Apr 96	10-Apr-96	068	25 97	25 97	1	1	0
VA000024	007	10-May 96	10-May-96	068	164 4	164 4	6 7	6 7	0
VA000024	007	10-Jul 96	10-Jul-96	068	60 92	60 92	5	5	
VA000024	007	10-Aug 96	12-Aug-96	068	8 41	8 41	1	1	0
VA000024	007	10-Aug 96	26-Jul-96	068	13 04	13 04	1 1	1 1	0
VA000024	007	10-Sep 96	10-Sep-96	068	56 48	56 48	3 9	3 9	0
VA000024	007	10-Oct 96	10-Oct-96	068	12 42	12 42	1 7	1 7	0
VA000024	007	10-Nov 96	12-Nov-96	068	37 49	37 49	3 4	3 4	0
VA000024	007	10-Dec 96	10-Dec-96	068	28 74	28 74	2 2	2 2	0
VA000024	007	10-Jan 97	10-Jan-97	068	20 79	20 79	1 7	1 7	0
VA000024	007	10-Feb 97	10-Feb-97	068	10 34	10 34	1 1	1 1	0
VA000024	007	10-Mar 97	10-Mar-97	068	25 8	25 8	1 7	1 7	0
VA000024	007	10-Apr 97	10-Apr-97	068	16 31	16 31	1 1	1 1	0
VA000024	007	10-May 97	12-May-97	068	43 15	43 15	3 4	3 4	0
VA000024	007	10-Jun 97	10-Jun-97	068	30 73	30 73	2 8	2 8	0
VA000024	007	10-Jul 97	10-Jul-97	068	37 94	37 94	4 5	4 5	0
VA000024	007	10-Aug 97	11-Aug-97	068	34 97	34 97	3 9	3 9	0
VA000024	007	10-Sep 97	10-Sep-97	068	16 35	16 35	1 7	1 7	0
VA000024	007	10-Oct-97	10-Oct-97	068	25 16	25 16	1 7	1 7	0
VA000024	007	10-Nov 97	10-Nov-97	068	18 84	18 84	1 7	1 7	0
VA000024	007	10-Dec 97	11-Dec 97	068	26 59	26 59	1 7	1 7	0
VA000024	007	10-Jan 98	12-Jan-98	068	7 97	7 97	0 68	0 68	0
VA000024	007	10-Feb 98	10-Feb-98	068	5 15	5 15	0 37	0 37	
VA000024	007	10-Mar 98	10-Mar-98	068	27 13	27 13	1 8	1 8	
VA000024	007	10-Apr 98	10-Apr-98	068	1 46	1 46	0 11	0 11	
VA000024	007	10-May 98	11-May-98	068	7 83	7 83	0 51	0 51	
VA000024	007	10-Jun 98	10-Jun-98	068	1 09	1 09	0 1	0 1	
VA000024	007	10-Jul 98	08-Jul-98	068	8 51	8 51	0 86	0 86	

163
112
51

Attachment 5

page 20 of 2

							TKN	
VA000024	007	10-Aug 98	04-Aug-98	068	3 93	3 95	0 45	0 45
VA000024	007	10-Sep 98	10-Sep-98	068	1 71	1 71	0 1	0 1
VA000024	007	10-Oct 98	13-Oct-98	068	3 05	3 05	0 2	0 2
VA000024	007	10-Nov 98	10-Nov-98	068	2 94	2 94	0 2	0 2
VA000024	007	10-Dec 98	10-Dec-98	068	2 88	2 88	0 2	0 2
VA000024	007	10-Jan 99	11-Jan-99	068	14 02	14 02	1 06	1 06

Attachment 5
page 2 of

	outfall						TKN		
VA000024	026	10-Oct 94	11-Oct-94	068	0 556	0 556	0 7	0 7	0
VA000024	026	10-Nov 94	10-Nov-94	068	13 28	13 28	16 8	16 8	0
VA000024	026	10-Dec 94	12-Dec-94	068	17 58	17 58	31	31	0
VA000024	026	10-Jan 95	10-Jan-95	068	4 813	4 813	5 6	5 6	0
VA000024	026	10-Feb 95	10-Feb-95	068	0 601	0 601	0 4	0 4	0
VA000024	026	10-Mar 95	10-Mar-95	068	5 331	5 331	4 7	4 7	0
VA000024	026	10-Apr 95	10-Apr-95	068	10 21	10 21	5 5	5 5	0
VA000024	026	10-May 95	11-May-95	068	8 758	8 758	7 8	7 8	0
VA000024	026	10-Jun 95	12-Jun-95	068	6 946	6 946	9	9	0
VA000024	026	10-Jul 95	11-Jul-95	068	4 346	4 346	6 2	6 2	0
VA000024	026	10-Aug 95	11-Aug-95	068	11 04	11 04	21	21	0
VA000024	026	10-Sep 95	08-Sep-95	068	13 01	13 01	16	16	0
VA000024	026	10-Oct 95	10-Oct-95	068	2 682	2 682	3 4	3 4	0
VA000024	026	10-Nov 95	13-Nov-95	068	12 52	12 52	6 2	6 2	0
VA000024	026	10-Dec 95	11-Dec-95	068	1 445	1 445	1 7	1 7	0
VA000024	026	10-Jan 96	16-Jan-96	068	5 28	5 28	5 6	5 6	0
VA000024	026	10-Feb 96	12-Feb-96	068	1 65	1 65	1 4	1 4	0
VA000024	026	10-Mar 96	11-Mar-96	068	1 92	1 928	1 7	1 7	
VA000024	026	10-Apr 96	10-Apr-96	068	4 6	5 79	6 55	8 5	0
VA000024	026	10-Jun 96	10-Jun-96	068	7 13	7 134	14	14	0
VA000024	026	10-Jul 96	10-Jul-96	068	8 84	8 84	7 3	7 3	0
VA000024	026	10-Sep 96	10-Sep-96	068	5 16	5 16	2 8	2 8	0
VA000024	026	10-Oct 96	10-Oct-96	068	1 15	1 15	1 7	1 7	0
VA000024	026	10-Nov 96	12-Nov-96	068	4 95	4 95	6 2	6 2	0
VA000024	026	10-Dec 96	10-Dec-96	068	8 32	8 32	9	9	0
VA000024	026	10-Jan 97	10-Jan-97	068	5 36	5 36	6 7	6 7	0
VA000024	026	10-Feb 97	10-Feb-97	068	1 14	1 14	1	1	0
VA000024	026	10-Mar 97	10-Mar-97	068	8 14	8 14	5 6	5 6	0
VA000024	026	10-Apr 97	10-Apr-97	068	5 19	5 19	4 5	4 5	0
VA000024	026	10-May 97	12-May-97	068	13 51	13 51	17	17	0
VA000024	026	10-Jun 97	10-Jun-97	068	1 37	1 37	2 2	2 2	0
VA000024	026	10-Jul 97	10-Jul-97	068	7 14	7 14	9	9	0
VA000024	026	10-Aug 97	11-Aug-97	068	2 53	2 53	4 5	4 5	0
VA000024	026	10-Sep 97	10-Sep-97	068	5 18	5 18	6 2	6 2	0
VA000024	026	10-Oct 97	10-Oct-97	068	3 73	3 73	4 5	4 5	0
VA000024	026	10-Nov 97	10-Nov-97	068	8 64	8 64	19	19	0
VA000024	026	10-Dec 97	11-Dec-97	068	7 95	7 95	17	17	0
VA000024	026	10-Jan 98	12-Jan-98	068	10 27	10 27	15	15	0
VA000024	026	10-Feb 98	10-Feb-98	068	7 34	7 34	8 4	8 4	
VA000024	026	10-Mar 98	10-Mar-98	068	13 46	13 46	12 2	12 2	
VA000024	026	10-Apr 98	10-Apr-98	068	8 19	8 19	12	12	
VA000024	026	10-May 98	11-May-98	068	18 6	18 6	24	24	
VA000024	026	10-Jun 98	10-Jun-98	068	1 68	1 68	2	2	
VA000024	026	10-Jul 98	08-Jul-98	068	4 93	4 93	6 5	6 5	
VA000024	026	10-Aug 98	04-Aug-98	068	2 49	2 49	3 4	3 4	
VA000024	026	10-Sep 98	10-Sep-98	068	3 33	3 33	4 6	4 6	
VA000024	026	10-Oct 98	13-Oct 98	068	7 3	7 3	8 12	8 12	
VA000024	026	10-Nov 98	10-Nov-98	068	4 19	4 19	4 7	4 7	
VA000024	026	10-Dec 98	10-Dec-98	068	4 11	4 11	4 76	4 76	
VA000024	026	10-Jan 99	11-Jan-99	068	4 44	4 44	6 03	6 03	

Attachment 5
page 22 of

	outfall						TKN		
VA000024	029	10-Oct-94	11-Oct-94	068	3 065	3 065	1 2	1 2	0
VA000024	029	10-Nov 94	10-Nov-94	068	5 796	5 796	1 6	1 6	0
VA000024	029	10-Dec 94	12-Dec-94	068	1 724	1 724	0 6	0 6	0
VA000024	029	10-Jan 95	10-Jan-95	068	9 485	9 485	2 2	2 2	0
VA000024	029	10-Feb 95	10-Feb-95	068	4 996	4 996	1 5	1 5	0
VA000024	029	10-Mar-95	10-Mar-95	068	4 666	4 666	2 8	2 8	0
VA000024	029	10-Apr 95	10-Apr-95	068	5 069	5 069	3 1	3 1	0
VA000024	029	10-May 95	11-May-95	068	2 372	2 372	1	1	0
VA000024	029	10-Jun 95	12-Jun-95	068	12 23	12 23	5 2	5 2	0
VA000024	029	10-Jul 95	11-Jul-95	068	17 55	17 55	8 5	8 5	0
VA000024	029	10-Aug 95	11-Aug-95	068	3 513	3 513	2 2	2 2	0
VA000024	029	10-Sep-95	08-Sep-95	068	7 42	7 42	1 7	1 7	0
VA000024	029	10-Oct-95	10-Oct-95	068	8 151	8 151	6 7	6 7	0
VA000024	029	10 Nov-95	13-Nov-95	068	5 426	5 426	1	1	0
VA000024	029	10-Dec 95	11-Dec-95	068	19 65	19 65	3 9	3 9	0
VA000024	029	10-Jan 96	16-Jan-96	068	12 53	12 53	3 9	3 9	0
VA000024	029	10-Feb 96	12-Feb-96	068	10 76	10 76	2 2	2 2	0
VA000024	029	10 Mar-96	11-Mar-96	068	5 72	5 72	1 1	1 1	
VA000024	029	10-Apr 96	10-Apr-96	068	10 68	10 68	2 5	2 5	0
VA000024	029	10-May-96	10-May-96	068	19 64	19 64	3 9	3 9	0
VA000024	029	10-Jun 96	10-Jun-96	068	8 79	8 79	2 2	2 2	0
VA000024	029	10-Jul 96	10-Jul-96	068	9 1	9 1	2 2	2 2	0
VA000024	029	10-Aug 96	12-Aug-96	068	2 46	2 46	1 1	1 1	0
VA000024	029	10-Sep-96	10-Sep-96	068	12 22	12 22	3 4	3 4	0
VA000024	029	10-Oct 96	10-Oct-96	068	10 86	10 86	3 4	3 4	0
VA000024	029	10-Nov-96	12-Nov-96	068	12 16	12 16	4 5	4 5	0
VA000024	029	10-Dec 96	10-Dec-96	068	4 35	4 35	1	1	0
VA000024	029	10-Jan 97	10-Jan-97	068	6 03	6 03	1 7	1 7	0
VA000024	029	10-Feb 97	10-Feb-97	068	20 76	41 04	5 13	9 77	0
VA000024	029	10-Mar 97	10-Mar-97	068	47 68	47 68	12	12	0
VA000024	029	10-Apr 97	10-Apr-97	068	14 53	14 53	3 4	3 4	0
VA000024	029	10-May 97	12-May-97	068	38 94	38 94	7 3	7 3	0
VA000024	029	10-Jun-97	10-Jun-97	068	4 55	4 55	1	1	0
VA000024	029	10-Jul 97	10-Jul-97	068	21 72	21 72	3 9	3 9	0
VA000024	029	10-Aug-97	11-Aug-97	068	3 23	3 23	1 1	1 1	0
VA000024	029	10-Sep 97	10-Sep-97	068	21 46	21 46	6 8	6 8	0
VA000024	029	10-Oct 97	10-Oct-97	068	7 38	7 38	2 2	2 2	0
VA000024	029	10-Nov 97	10-Nov-97	068	10 16	10 16	2 2	2 2	0
VA000024	029	10-Dec 97	11-Dec-97	068	12 44	12 44	3 7	3 7	0
VA000024	029	10-Jan 98	12-Jan-98	068	6 06	6 06	1 6	1 6	0
VA000024	029	10-Feb 98	10-Feb-98	068	15 95	15 95	4 7	4 7	
VA000024	029	10-Mar 98	10-Mar-98	068	26 63	26 63	3 2	3 2	
VA000024	029	10-Apr 98	10-Apr-98	068	0 36	0 36	0 11	0 11	
VA000024	029	10-May 98	11-May-98	068	1 38	1 38	0 45	0 45	
VA000024	029	10-Jun 98	10-Jun-98	068	1 74	1 74	0 58	0 58	
VA000024	029	10-Jul 98	08-Jul-98	068	28 95	28 95	10	10	
VA000024	029	10-Aug 98	04-Aug-98	068	4 37	4 37	2 5	2 5	
VA000024	029	10-Sep 98	10-Sep-98	068	9 59	9 59	3 6	3 6	
VA000024	029	10-Oct 98	13-Oct-98	068	6 13	6 13	2 16	2 16	
VA000024	029	10-Nov 98	10-Nov-98	068	0 54	0 54	0 25	0 25	

	outfall						TKN		
VA000024	029	10-Dec 98	10-Dec-98	068	5 76	5 76	1 87	1 87	
VA000024	029	10-Jan-99	11 Jan-99	068	6 49	6 49	2 22	2 22	

Attachment 5

page 23 of