APPALACHIAN POWER COMPANY

Clinch River Plant
Russell County, Virginia

VPDES Permit Renewal Application

Virginia Department of Environmental Quality
VPDES Permit No. VA0001015

Prepared by:

American Electric Power Service Corporation
Environmental Services
1 Riverside Plaza
Columbus, Ohio 43215

Prepared for:

Appalachian Power Company
Clinch River Plant
3464 Power Plant Road
Cleveland, Virginia 24225

March 2015

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Public Notice Billing Information Form

PUBLIC NOTICE BILLING INFORMATION FORM

I hereby authorize the Department of Environmental Quality to have the cost of publishing a public notice billed to the Agent/Department shown below. The public notice will be published once a week for two consecutive weeks in accordance with 9 VAC 25-31-290. C. 2.

Agent/Department to be billed: Alan R. Wood, P.E.

Owner: c/o American Electric Power

Applicant's Address: 1 Riverside Plaza

Columbus, Ohio 43215

Agent's Telephone No: 614-716-1233

Authorizing Agent: ______________________
(signature)

Facility Name: Appalachian Power Company –
Clinch River Plant
Permit No. VA00001015

Please return to: Attn: Mark Trent
Virginia Department of Environmental Quality
Southwest Regional Office
355-A Deadmore Street
Abingdon, VA 24210
Phone: 276-676-4800
Fax: 276-676-4899

EPA General Form 1

Please print or type in the unshaded areas only. Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S		T/A	C
F	VAD980554596		D
1	2 — 13	14	15

LABEL ITEMS	
I. EPA I.D. NUMBER	VAD980554596
III. FACILITY NAME	Appalachian Power Co - Clinch River Plant
V. FACILITY MAILING ADDRESS	Attn: Alan R. Wood 1 Riverside Plaza Columbus, OH 43215
VI. FACILITY LOCATION	3464 Power Plant Road, Cleveland, VA 24225

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)	16	X 17	18	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)	19	X 20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X 22	23	X 24	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)	25	X 26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	28	X 29	30	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)	31	X 32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	34	X 35	36	H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	37	X 38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	40	X 41	42	J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)	43	X 44	45

III. NAME OF FACILITY

C	SKIP	
1		Clinch River Plant
15	16 – 29	30 — 69

IV. FACILITY CONTACT

C	A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2	Wood, Alan R.-Director, Water & Ecological Resource Svcs	(614) 716-1233
15	16 — 45	46 — 48, 49 — 51, 52- — 55

V. FACILTY MAILING ADDRESS

C	A. STREET OR P.O. BOX
3	1 Riverside Plaza
15	16 — 45

C	B. CITY OR TOWN	C. STATE	D. ZIP CODE
4	Columbus	OH	43215
15	16 — 40	41 — 42	47 — 51

VI. FACILITY LOCATION

C	A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER
5	3464 Power Plant Road
15	16 — 45

B. COUNTY NAME
Russell
46 — 70

C	C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6	Cleveland	VA	24225	
15	16 — 40	41 — 42	47 — 51	52 — -54

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

	A. FIRST		B. SECOND
C: 7 — 4911	(specify) Electric Services	C: 7	(specify) N/A
	C. THIRD		D. FOURTH
C: 7	(specify) N/A	C: 7	(specify) N/A

VIII. OPERATOR INFORMATION

A. NAME: 8 Appalachian Power Company

B. Is the name listed in Item VIII-A also the owner? ☑ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box: if "Other," specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

Answer: P (specify)

D. PHONE (area code & no.): A (614) 716-1233

E. STREET OR P.O. BOX: 1 Riverside Plaza

F. CITY OR TOWN: B Columbus

G. STATE: OH

H. ZIP CODE: 43215

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☑ NO

X. EXISTING ENVIRONMENTAL PERMITS

C	T	Permit	Number	Specify
9	N	A. NPDES (Discharges to Surface Water)	VA0001015	
9	P	D. PSD (Air Emissions from Proposed Sources)	N/A	
9	U	B. UIC (Underground Injection of Fluids)	N/A	
9		E. OTHER (specify)	10236	VA Air Pollution Control
9	R	C. RCRA (Hazardous Wastes)	VAD980554596	
9		E. OTHER (specify)	223, 607	VA Solid Waste Permits

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

Clinch River Plant is an electric generating station consisting of three (3) 235-megawatt coal-fired generating units. The units are equipped with mechanical draft cooling towers to cool the circulating water, electrostatic precipitators for particulate control, and a Selective Non-Catalytic Reduction (SNCR) system for NOx emissions control.

Beginning in 2015, Units 1 and 2 will be converted to fire natural gas. Unit 3 will be permanently retired on May 31, 2015.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
John M. McManus, VP Environmental Services	John M. McManus	3/10/15

COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 2C for Outfalls 003, 007, and 015

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
VAD980554596

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM **2C** NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	36	56	05	82	11	51	Clinch River
003	36	56	05	82	11	53	Clinch River

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Reclaim Pond Emergency Overflow	0.0 MGD	Sedimentation	1-U	
	Maximum Flow:	6.2 MGD	Discharge to surface waters	4-A	
003	Advanced Wastewater Treatment Plant	1.635 MGD	Grit removal	1-M	
	Sources:		Mixing	1-O	
	Sump 004:	1.467 MGD	Neutralization	2-K	
	Cooling Tower 5 Blowdown	1.173 MGD	Screening	1-T	
	Low-volume wastes	0.294 MGD	Skimming		
	Oil/Water separator	0.135 MGD	Coagulation	2-D	
	Miscellaneous seal and	0.159 MGD	Sedimentation	1-U	
	cooling waters		Multimedia filtration	1-Q	
	Sump 003:	3.409 MGD	Cascade aeration		
	Cooling Tower 4 Blowdown	0.578 MGD	Gravity oil separation	1-H	
	Primary wastewater treatment	2.831 MGD	Flocculation	1-G	
	plant (WWTP)		Chemical precipitation	2-C	
	Ash tank overflow	0.086 MGD	Discharge to surface waters	4-A	
	CCB landfill runoff	0.004			
	Boiler room sump:				
	Turbine room sump				
	Boiler makeup water				
	Water treatment plant				
	backwash				
	Boiler room drains, etc.				

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

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VAD980554596

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM 2C NPDES EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
003A	36	56	04	82	11	52	Clinch River
005	36	55	58	82	12	05	Clinch River

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
003 (con.)	WWTP flter backwash to ash tank	-0.02 MGD			
	Solids contact basin blowdown	-0.003 MGD			
	(AWWTP sludge)				
	Maximum Flow:	6.5 MGD			
	Maximum Rainfall	1.62 MGD	10-year, 24-hour storm		
003A	AWWTP Alternate Discharge Point	0.0 MGD	Treatment identical to 003; See Appendix A for		
	Maximum Flow:	6.5 MGD	additional information		
005	Sump 004 Overflow	0.0 MGD	Gravity oil separation	1-H	
	Sources:		Discharge to surface waters	4-A	
	Low-volume wastes				
	Oil/water separator				
	Miscellaneous seal and				
	cooling waters				
	Cooling Tower 5 Blowdown				
	Maximum Flow:	1.467 MGD			

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

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FORM 2C NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE 1. DEG.	2. MIN.	3. SEC.	C. LONGITUDE 1. DEG.	2. MIN.	3. SEC.	D. RECEIVING WATER (*name*)
007	36	55	45	82	12	03	Clinch River
008	36	55	54	82	12	06	Clinch River
014	36	55	18	82	12	05	Clinch River
015	36	56	21	82	11	26	Dumps Creek

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	3. TREATMENT a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
007	Coal storage yard and coal handling	0.0096 MGD	Sedimentation	1-U	
	area runoff		Skimming		
	Bulk urea unloading area		Discharge to surface waters	4-A	
	Misc. materials storage areas				
	Plant roads				
	Maximum Flow:	0.80 MGD	Impact: 10-year, 24-hour storm event		
008	Sewage treatment plant	0.002 MGD	See EPA Form 2A for additional information		
	Maximum flow:	0.012 MGD			
014	CCB Landfill retention pond overflow	0.0 MGD	Sedimentation	1-U	
	Sources:		Discharge to surface waters	4-A	
	Ash storage leachate drains				
	Stormwater runoff				
	Maximum Flow:	6.2 MGD	Impact: 10-year, 24-hour storm event		
015	Ash Pond 2 dike seepage	0.013 MGD	Discharge to surface waters	4-A	
	Maximum flow:	0.034 MGD			

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

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FORM **2C** NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
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I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
727	36	55	54	82	12	05	Clinch River

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
727	Materials handling and parking lot	0.0 MGD	Sedimentation	1-U	
	stormwater runoff		Discharge to surface waters	4-A	
	Sources:				
	Plant area stormwater runoff	0.4 MGD	Impact: 10-year, 24-hour storm		
	(not collected in Watson's Pond)				
	Watson's Pond discharge	0.561 MGD	Impact: 10-year, 24-hour storm		
	Parking lot and silo washdown	0.0002 MGD			
	Maximum Flow:	0.961 MGD	Impact: 10-year, 24-hour storm		

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☑ YES (*complete the following table*) ☐ NO (*go to Section III*)

1. OUTFALL NUMBER (*list*)	2. OPERATION(*s*) CONTRIBUTING FLOW (*list*)	3. FREQUENCY a. DAYS PER WEEK (*specify average*)	3. FREQUENCY b. MONTHS PER YEAR (*specify average*)	4. FLOW a. FLOW RATE (*in mgd*) 1. LONG TERM AVERAGE	4. FLOW a. FLOW RATE (*in mgd*) 2. MAXIMUM DAILY	4. FLOW B. TOTAL VOLUME (*specify with units*) 1. LONG TERM AVERAGE	4. FLOW B. TOTAL VOLUME (*specify with units*) 2. MAXIMUM DAILY	4. FLOW C. DURATION (*in days*)
001	Reclaim Pond Overflow	See Appendix A	See Appendix A					
005	Low-volume wastes and Cooling Tower 5 blowdown	See Appendix A						
007	Coal storage pile and surrounding area runoff	1	10	0.010 MGD	0.034 MGD			
014	CCB landfill collection pond overflow	See Appendix A						
727	Materials handling and parking area stormwater runoff	See Form 2F and 2F Notes						

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☑ YES (*complete Item III-B*) ☐ NO (*go to Section IV*)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (*or other measure of operation*)?

☐ YES (*complete Item III-C*) ☑ NO (*go to Section IV*)

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (*specify*)	2. AFFECTED OUTFALLS (*list outfall numbers*)
N/A			

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operations of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES (*complete the following table*) ☑ NO (*go to Item IV-B*)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS a. NO.	2. AFFECTED OUTFALLS b. SOURCE OF DISCHARGE	3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE a. REQUIRED	4. FINAL COMPLIANCE DATE b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (*or other environmental projects which may affect your discharges*) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

CONTINUED FROM PAGE 2

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)

VAD980554596

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
Strontium Uranium Vanadium Zirconium	These may be found in trace quantities in bottom ash or fly ash due to their presence in coal. No recent analytical data exist for this facility.		
Asbestos	Some older equipment contains asbestos. Proper precautions for containment and disposal are taken when this equipment is used or decommissioned.		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☑ YES (*list all such pollutants below*) ☐ NO (*go to Item VI-B*)

Detection of low levels of metals in the Plant discharges can be substantially attributed to these elements being present in coal. It is also possible that trace amounts present in the Clinch River intake water are concentrated to detectable levels during cycling of the cooling tower blowdown.

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☑ YES (*identify the test(s) and describe their purposes below*) ☐ NO (*go to Section VIII*)

Please refer to Appendix E for a summary of the toxicity testing performed at the Plant over the permit term.

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☑ YES (*list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below*) ☐ NO (*go to Section IX*)

A. NAME	B. ADDRESS	C. TELEPHONE (*area code & no.*)	D. POLLUTANTS ANALYZED (*list*)
Please see Note 5, Form 2C Notes			

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (*type or print*)	B. PHONE NO. (*area code & no.*)
John M. McManus, VP Environmental Services	(614) 716-1268
C. SIGNATURE: John M McManus	D. DATE SIGNED: 3/10/15

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
VAD980554596

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
003

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT: a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. (2) MASS	d. NO. OF ANALYSES	3. UNITS (*specify if blank*) a. CONCEN-TRATION	3. b. MASS	4. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. a. (2) MASS	4. b. NO. OF ANALYSES
a. Biochemical Oxygen Demand (*BOD*)	2.5	19.5					1	mg/L	kg/d	<2.0		1
b. Chemical Oxygen Demand (*COD*)	11.6	32.5					1	mg/L	kg/d	<10		1
c. Total Organic Carbon (*TOC*)	3.28	9.19					1	mg/L	kg/d	1.50		1
d. Total Suspended Solids (*TSS*)	17	145.9			4.1	25.4	20	mg/L	kg/d	<10		4
e. Ammonia (*as N*)	28	159.0			3.1	19.2	54	mg/L	kg/d	<0.01		1
f. Flow	VALUE 4.54 MGD		VALUE 2.40 MGD		VALUE 1.635 MGD		cont.			VALUE		
g. Temperature (*winter*)	VALUE 14.1		VALUE		VALUE		1	°C		VALUE 15.1		1
h. Temperature (*summer*)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM 7.0	MAXIMUM 8.7	MINIMUM	MAXIMUM			204	STANDARD UNITS				

PART B – Mark “X” in column 2-a for each pollutant you know or have reason to believe is present. Mark “X” in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK “X” a. BELIEVED PRESENT	2. b. BELIEVED ABSENT	3. EFFLUENT: a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. (2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. a. (2) MASS	5. b. NO. OF ANALYSES
a. Bromide (24959-67-9)	X		<1	<3					1	mg/L	kg/d	<0.08		1
b. Chlorine, Total Residual	X		0.030	0.18	0.020	0.12	<0.010	<0.062	204	mg/L	kg/d			1
c. Color	X		20						1	CU		10		1
d. Fecal Coliform	X		350		285				2	MPN/0.1L		1600		1
e. Fluoride (16984-48-8)	X		<0.2	<0.6					1	mg/L	kg/d	<0.1		1
f. Nitrate-Nitrite (*as N*)	X		2.31	6.47					1	mg/L	kg/d	1.09		1

 CONTINUE ON REVERSE

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)	X		0.9	2.5					1	mg/L	kg/d	0.6		1
h. Oil and Grease	X		<5	<46			<5	<31	5	mg/L	kg/d			
i. Phosphorus (as P), Total (7723-14-0)	X		0.08	0.22					1	mg/L	kg/d	<0.01		1
j. Radioactivity														
(1) Alpha, Total	X		<2.62						1	pCi/L		<1.80		1
(2) Beta, Total	X		2.25						1	pCi/L		<4.00		1
(3) Radium, Total	X		<0.421						1	pCi/L		<0.537		1
(4) Radium 226, Total	X		<0.124						1	pCi/L		<0.119		1
k. Sulfate (*as SO_4*) (14808-79-8)	X		214	712.9			107.8	667.2	4	mg/L	kg/d	16.9		1
l. Sulfide (*as S*)	X		<10	<29					1	mg/L	kg/d	<0.053		1
m. Sulfite (*as SO_3*) (14265-45-3)	X													
n. Surfactants	X		<0.016	<0.13					1	mg/L	kg/d	<0.016		1
o. Aluminum, Total (7429-90-5)	X		0.289	0.963			0.131	0.0812	4	mg/L	kg/d	0.03		1
p. Barium, Total (7440-39-3)	X		121	0.463			81.1	0.502	5	ug/L	kg/d	44.9		1
q. Boron, Total (7440-42-8)	X		0.207	0.580					1	mg/L	kg/d	<0.02		1
r. Cobalt, Total (7440-48-4)	X		0.131	0.0004					1	ug/L	kg/d	0.088		1
s. Iron, Total (7439-89-6)	X		0.762	2.54			0.337	2.08	8	mg/L	kg/d	0.068		1
t. Magnesium, Total (7439-95-4)	X		18.8	62.6			13.2	81.9	1	mg/L	kg/d	12.2		1
u. Molybdenum, Total (7439-98-7)	X		256	0.717					1	ug/L	kg/d	0.20		1
v. Manganese, Total (7439-96-5)	X		0.0146	0.075			0.0092	0.057	8	mg/L	kg/d	0.0088		1
w. Tin, Total (7440-31-5)	X		<5	<0.02					1	ug/L	kg/d	<5		1
x. Titanium, Total (7440-32-6)	X		<2	<0.006					1	ug/L	kg/d	<2		1

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EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
VAD980554596	003

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X	X		2.58	0.0206			1.39	0.009	8	ug/L	kg/d	<0.05		1
2M. Arsenic, Total (7440-38-2)	X	X		7.42	0.0520			3.61	0.022	8	ug/L	kg/d	0.26		1
3M. Beryllium, Total (7440-41-7)	X	X		0.05	0.0002			<0.02	0.000	4	ug/L	kg/d	<0.004		1
4M. Cadmium, Total (7440-43-9)	X	X		0.14	0.0011			0.07	0.000	7	ug/L	kg/d	<0.01		1
5M. Chromium, Total (7440-47-3)	X	X		15	0.050			5.4	0.033	14	ug/L	kg/d	0.1		1
6M. Copper, Total (7440-50-8)	X	X		37	0.24			11.7	0.072	59	ug/L	kg/d	0.63		1
7M. Lead, Total (7439-92-1)	X	X		0.493	0.0016			0.169	0.001	8	ug/L	kg/d	0.114		1
8M. Mercury, Total (7439-97-6)	X	X		0.4	0.003			0.1	0.001	8	ug/L	kg/d	<0.004		1
9M. Nickel, Total (7440-02-0)	X	X		4.75	0.0158			3.08	0.019	8	ug/L	kg/d	0.24		1
10M. Selenium, Total (7782-49-2)	X	X		25.7	0.180			16.5	0.102	8	ug/L	kg/d	<0.1		1
11M. Silver, Total (7440-22-4)	X	X		0.088	0.0001			0.020	0.000	6	ug/L	kg/d	<0.003		1
12M. Thallium, Total (7440-28-0)	X	X		0.10	0.0008			0.07	0.000	8	ug/L	kg/d	<0.02		1
13M. Zinc, Total (7440-66-6)	X	X		8	0.073			3.2	0.020	14	ug/L	kg/d	10.6		1
14M. Cyanide, Total (57-12-5)	X		X	<0.01	<0.08			<0.01	<0.07	5	mg/L	kg/d	<0.0025		1
15M. Phenols, Total	X		X	<0.010	<0.08					1	mg/L	kg/d	<0.023		1
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

Outfall 003

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X		X	<2.6	<0.021					1	ug/L	kg/d	<2.6		1
2V. Acrylonitrile (107-13-1)	X		X	<0.55	<0.005					1	ug/L	kg/d	<0.55		1
3V. Benzene (71-43-2)	X		X	<0.11	<0.001					1	ug/L	kg/d	<0.11		1
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				*DELISTED 02-4-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
5V. Bromoform (75-25-2)	X		X	<1.0	<0.008					1	ug/L	kg/d	<0.19		1
6V. Carbon Tetrachloride (56-23-5)	X		X	<0.14	<0.002					1	ug/L	kg/d	<0.14		1
7V. Chlorobenzene (108-90-7)	X		X	<0.14	<0.002					1	ug/L	kg/d	<0.14		1
8V. Chlorodi-bromomethane (124-48-1)	X		X	<0.14	<0.002					1	ug/L	kg/d	<0.14		1
9V. Chloroethane (75-00-3)	X		X	<0.21	<0.002					1	ug/L	kg/d	<0.21		1
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X		X	<0.25	<0.002					1	ug/L	kg/d	<0.25		1
11V. Chloroform (67-66-3)	X		X	<0.17	<0.002					1	ug/L	kg/d	<0.17		1
12V. Dichloro-bromomethane (75-27-4)	X		X	<0.13	<0.002					1	ug/L	kg/d	<0.13		1
13V. Dichloro-difluoromethane (75-71-8)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
14V. 1,1-Dichloro-ethane (75-34-3)	X		X	<0.12	<.001					1	ug/L	kg/d	<0.12		1
15V. 1,2-Dichloro-ethane (107-06-2)	X		X	<0.21	<0.002					1	ug/L	kg/d	<0.21		1
16V. 1,1-Dichloro-ethylene (75-35-4)	X		X	<0.30	<0.003					1	ug/L	kg/d	<0.30		1
17V. 1,2-Dichloro-propane (78-87-5)	X		X	<0.095	<0.001					1	ug/L	kg/d	<0.095		1
18V. 1,3-Dichloro-propylene (542-75-6)	X		X	<0.33	<0.003					1	ug/L	kg/d	<0.33		1
19V. Ethylbenzene (100-41-4)	X		X	<0.23	<0.002					1	ug/L	kg/d	<0.23		1
20V. Methyl Bromide (74-83-9)	X		X	<0.31	<0.003					1	ug/L	kg/d	<0.31		1
21V. Methyl Chloride (74-87-3)	X		X	<0.28	<0.003					1	ug/L	kg/d	<0.28		1

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Outfall 003

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X		X	<0.13	<0.002					1	ug/L	kg/d	<0.13		1
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X		X	<0.20	<0.002					1	ug/L	kg/d	<0.20		1
24V. Tetrachloro-ethylene (127-18-4)	X		X	<0.15	<0.002					1	ug/L	kg/d	<0.15		1
25V. Toluene (108-88-3)	X		X	<0.15	<0.002					1	ug/L	kg/d	<0.15		1
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X		X	<0.17	<0.002					1	ug/L	kg/d	<0.17		1
27V. 1,1,1-Trichloro-ethane (71-55-6)	X		X	<0.29	<0.003					1	ug/L	kg/d	<0.29		1
28V. 1,1,2-Trichloro-ethane (79-00-5)	X		X	<0.20	<0.002					1	ug/L	kg/d	<0.20		1
29V Trichloro-ethylene (79-01-6)	X		X	<0.14	<0.002					1	ug/L	kg/d	<0.14		1
30V. Trichloro-fluoromethane (75-69-4)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
31V. Vinyl Chloride (75-01-4)	X		X	<0.23	<0.002					1	ug/L	kg/d	<0.23		1
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X		X	<2.1	<0.017					1	ug/L	kg/d	<2.1		1
2A. 2,4-Dichloro-phenol (120-83-2)	X		X	<0.62	<0.005					1	ug/L	kg/d	<0.62		1
3A. 2,4-Dimethyl-phenol (105-67-9)	X		X	<1.6	<0.013					1	ug/L	kg/d	<1.6		1
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X		X	<14	<0.110					1	ug/L	kg/d	<14		1
5A. 2,4-Dinitro-phenol (51-28-5)	X		X	<23	<0.180					1	ug/L	kg/d	<23		1
6A. 2-Nitrophenol (88-75-5)	X		X	<1.0	<0.008					1	ug/L	kg/d	<1.0		1
7A. 4-Nitrophenol (100-02-7)	X		X	<7.4	<0.058					1	ug/L	kg/d	<7.4		1
8A. P-Chloro-M-Cresol (59-50-7)	X		X	<1.6	<0.013					1	ug/L	kg/d	<1.6		1
9A. Pentachloro-phenol (87-86-5)	X		X	<4.6	<0.036					1	ug/L	kg/d	<4.6		1
10A. Phenol (108-95-2)	X		X	<0.51	<0.004					1	ug/L	kg/d	<0.51		1
11A. 2,4,6-Trichloro-phenol (88-05-2)	X		X	<2.8	<0.022					1	ug/L	kg/d	<2.8		1

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

Outfall 003

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)	X		X	<0.27	<0.003					1	ug/L	kg/d	<0.27		1
2B. Acenaphtylene (208-96-8)	X		X	<0.20	<0.002					1	ug/L	kg/d	<0.20		1
3B. Anthracene (120-12-7)	X		X	<0.18	<0.002					1	ug/L	kg/d	<0.18		1
4B. Benzidine (92-87-5)	X		X	<44	<0.344					1	ug/L	kg/d	<44		1
5B. Benzo (*a*) Anthracene (56-55-3)	X		X	<0.34	<0.003					1	ug/L	kg/d	<0.34		1
6B. Benzo (*a*) Pyrene (50-32-8)	X		X	<0.26	<0.003					1	ug/L	kg/d	<0.26		1
7B. 3,4-Benzo-fluoranthene (205-99-2)	X		X	<0.45	<0.004					1	ug/L	kg/d	<0.45		1
8B. Benzo (*ghi*) Perylene (191-24-2)	X		X	<0.27	<0.003					1	ug/L	kg/d	<0.27		1
9B. Benzo (*k*) Fluoranthene (207-08-9)	X		X	<0.28	<0.003					1	ug/L	kg/d	<0.28		1
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)	X		X	<1.2	<0.010					1	ug/L	kg/d	<1.2		1
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)	X		X	<0.29	<0.003					1	ug/L	kg/d	<0.29		1
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)	X		X	<0.22	<0.002					1	ug/L	kg/d	<0.22		1
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)	X		X	23	<0.180					1	ug/L	kg/d	<4.1		1
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	X		X	<1.1	<0.009					1	ug/L	kg/d	<1.1		1
15B. Butyl Benzyl Phthalate (85-68-7)	X		X	<2.0	<0.016					1	ug/L	kg/d	<2.0		1
16B. 2-Chloro-naphthalene (91-58-7)	X		X	<0.28	<0.003					1	ug/L	kg/d	<0.28		1
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)	X		X	<0.74	<0.006					1	ug/L	kg/d	<0.74		1
18B. Chrysene (218-01-9)	X		X	<0.29	<0.003					1	ug/L	kg/d	<0.29		1
19B. Dibenzo (*a,h*) Anthracene (53-70-3)	X		X	<0.25	<0.002					1	ug/L	kg/d	<0.25		1
20B. 1,2-Dichloro-benzene (95-50-1)	X		X	<0.15	<0.002					1	ug/L	kg/d	<0.15		1
21B. 1,3-Di-chloro-benzene (541-73-1)	X		X	<0.11	<0.001					1	ug/L	kg/d	<0.11		1

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Note: Please see Note 6, Form 2C Notes regarding detection of Item 13B, bis(2-ethylhexyl)phthalate.

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. b. BELIEVED PRESENT	2. c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. a. (2) MASS	3. b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. b. (2) MASS	3. c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. c. (2) MASS	3. d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. a. (2) MASS	5. b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)	X		X	<0.21	<0.002					1	ug/L	kg/d	<0.21		1
23B. 3,3-Dichloro-benzidine (91-94-1)	X		X	<1.4	<0.011					1	ug/L	kg/d	<1.4		1
24B. Diethyl Phthalate (84-66-2)	X		X	<2.7	<0.022					1	ug/L	kg/d	<2.7		1
25B. Dimethyl Phthalate (131 -11-3)	X		X	<1.7	<0.014					1	ug/L	kg/d	<1.7		1
26B. Di-N-Butyl Phthalate (84-74-2)	X		X	<2.2	<0.018					1	ug/L	kg/d	<2.2		1
27B. 2,4-Dinitro-toluene (121-14-2)	X		X	<2.0	<0.016					1	ug/L	kg/d	<2.0		1
28B. 2,6-Dinitro-toluene (606-20-2)	X		X	<1.3	<0.011					1	ug/L	kg/d	<1.3		1
29B. Di-N-Octyl Phthalate (117-84-0)	X		X	<1.9	<0.015					1	ug/L	kg/d	<1.9		1
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)	X		X	<1.1	<0.010					1	ug/L	kg/d	<0.28		1
31B. Fluoranthene (206-44-0)	X		X	<0.20	<0.002					1	ug/L	kg/d	<0.20		1
32B. Fluorene (86-73-7)	X		X	<0.22	<0.002					1	ug/L	kg/d	<0.22		1
33B. Hexachloro-benzene (118-74-1)	X		X	<0.56	<0.005					1	ug/L	kg/d	<0.56		1
34B. Hexachloro-butadiene (87-68-3)	X		X	<0.87	<0.007					1	ug/L	kg/d	<0.87		1
35B. Hexachloro-cyclopentadiene (77-47-4)	X		X	<1.3	<0.011					1	ug/L	kg/d	<1.3		1
36B Hexachloro-ethane (67-72-1)	X		X	<1.3	<0.011					1	ug/L	kg/d	<1.3		1
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X		X	<0.40	<0.004					1	ug/L	kg/d	<0.40		1
38B. Isophorone (78-59-1)	X		X	<0.68	<0.006					1	ug/L	kg/d	<0.68		1
39B. Naphthalene (91-20-3)	X		X	<0.21	<0.002					1	ug/L	kg/d	<0.21		1
40B. Nitrobenzene (98-95-3)	X		X	<1.4	<0.011					1	ug/L	kg/d	<1.4		1
41B. N-Nitro-sodimethylamine (62-75-9)	X		X	<1.1	<0.009					1	ug/L	kg/d	<1.1		1
42B. N-Nitrosodi-N-Propylamine (621-64-7)	X		X	<0.46	<0.004					1	ug/L	kg/d	<0.46		1

 CONTINUE ON REVERSE

Outfall 003

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)	X		X	<1.1	<0.009					1	ug/L	kg/d	<1.1		1
44B. Phenanthrene (85-01-8)	X		X	<0.38	<0.003					1	ug/L	kg/d	<0.38		1
45B. Pyrene (129-00-0)	X		X	<0.21	<0.002					1	ug/L	kg/d	<0.21		1
46B. 1,2,4-Tri-chlorobenzene (120-82-1)	X		X	<0.79	<0.007					1	ug/L	kg/d	<0.79		1
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)	X		X	<0.033	<0.000					1	ug/L	kg/d	<0.033		1
2P. α-BHC (319-84-6)	X		X	<0.027	<0.000					1	ug/L	kg/d	<0.027		1
3P. β-BHC (319-85-7)	X		X	<0.040	<0.000					1	ug/L	kg/d	<0.040		1
4P. γ-BHC (58-89-9)	X		X	<0.032	<0.000					1	ug/L	kg/d	<0.032		1
5P. δ-BHC (319-86-8)	X		X	<0.017	<0.000					1	ug/L	kg/d	<0.017		1
6P. Chlordane (57-74-9)	X		X	<0.066	<0.001					1	ug/L	kg/d	<0.066		1
7P. 4,4'-DDT (50-29-3)	X		X	<0.030	<0.000					1	ug/L	kg/d	<0.030		1
8P. 4,4'-DDE (72-55-9)	X		X	<0.032	<0.000					1	ug/L	kg/d	<0.032		1
9P. 4,4'-DDD (72-54-8)	X		X	<0.027	<0.000					1	ug/L	kg/d	<0.027		1
10P. Dieldrin (60-57-1)	X		X	<0.033	<0.000					1	ug/L	kg/d	<0.033		1
11P. α-Enosulfan (115-29-7)	X		X	<0.038	<0.000					1	ug/L	kg/d	<0.038		1
12P. β-Endosulfan (115-29-7)	X		X	<0.039	<0.000					1	ug/L	kg/d	<0.039		1
13P. Endosulfan Sulfate (1031-07-8)	X		X	<0.023	<0.000					1	ug/L	kg/d	<0.023		1
14P. Endrin (72-20-8)	X		X	<0.039	<0.000					1	ug/L	kg/d	<0.039		1
15P. Endrin Aldehyde (7421-93-4)	X		X	<0.036	<0.000					1	ug/L	kg/d	<0.036		1
16P. Heptachlor (76-44-8)	X		X	<0.040	<0.000					1	ug/L	kg/d	<0.040		1

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EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
VAD980554596	003

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. MARK "X" b. BELIEVED PRESENT	2. MARK "X" c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (*optional*) b. NO. OF ANALYSES
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)	X		X	<0.039	<0.000					1	ug/L	kg/d	<0.039		1
18P. PCB-1242 (53469-21-9)	X		X	<0.074	<0.001					1	ug/L	kg/d	<0.074		1
19P. PCB-1254 (11097-69-1)	X		X	<0.12	<0.001					1	ug/L	kg/d	<0.12		1
20P. PCB-1221 (11104-28-2)	X		X	<0.16	<0.002					1	ug/L	kg/d	<0.16		1
21P. PCB-1232 (11141-16-5)	X		X	<0.16	<0.002					1	ug/L	kg/d	<0.16		1
22P. PCB-1248 (12672-29-6)	X		X	<0.11	<0.001					1	ug/L	kg/d	<0.11		1
23P. PCB-1260 (11096-82-5)	X		X	<0.068	<0.001					1	ug/L	kg/d	<0.068		1
24P. PCB-1016 (12674-11-2)	X		X	<0.10	<0.001					1	ug/L	kg/d	<0.10		1
25P. Toxaphene (8001-35-2)	X		X	<0.74	<0.001					1	ug/L	kg/d	<0.74		1

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
VAD980554596

V. INTAKE AND EFFLUENT CHARACTERISTICS (*continued from page 3 of Form 2-C*)

OUTFALL NO.
007

PART A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (*BOD*)	<2.0	<1.0					1	mg/L	kg/d			
b. Chemical Oxygen Demand (*COD*)	<3	<2					1	mg/L	kg/d			
c. Total Organic Carbon (*TOC*)	1.54	0.76					1	mg/L	kg/d			
d. Total Suspended Solids (*TSS*)	61.4	30.2	31	15.3	10.1	5.0	82	mg/L	kg/d			
e. Ammonia (*as N*)	0.08	0.04					1	mg/L	kg/d			
f. Flow	VALUE 0.31		VALUE 0.034		VALUE 0.01		82	MGD		VALUE		
g. Temperature (*winter*)	VALUE 15.1		VALUE		VALUE		1	°C		VALUE		
h. Temperature (*summer*)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM 6.6	MAXIMUM 8.4	MINIMUM	MAXIMUM			82	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)		X	<0.08	<0.04					1	mg/L	kg/d			
b. Chlorine, Total Residual		X								mg/L	kg/d			
c. Color	X		10						1	CU				
d. Fecal Coliform		X	<1.8						1	MPN/0.1L				
e. Fluoride (16984-48-8)		X	0.16	0.079					1	mg/L	kg/d			
f. Nitrate-Nitrite (*as N*)		X	<0.02	<0.01					1	mg/L	kg/d			

Note: Please reference Note 4, Form 2C Notes regarding intake data.

Outfall 007

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)		X	<0.5	<0.3					1	mg/L	kg/d			
h. Oil and Grease	X		<5	<3			<5	<3	9	mg/L	kg/d			
i. Phosphorus (as P), Total (7723-14-0)		X	<0.01	<0.005					1	mg/L	kg/d			
j. Radioactivity														
(1) Alpha, Total	X		<1.76						1	pCi/L				
(2) Beta, Total	X		1.57						1	pCi/L				
(3) Radium, Total	X		<0.565						1	pCi/L				
(4) Radium 226, Total	X		<0.127						1	pCi/L				
k. Sulfate (*as SO_4*) (14808-79-8)	X		39.3	19.3					1	mg/L	kg/d			
l. Sulfide (*as S*)		X	<0.3	<0.2					1	mg/L	kg/d			
m. Sulfite (*as SO_3*) (14265-45-3)		X												
n. Surfactants		X	<0.016	<0.0079					1	mg/L	kg/d			
o. Aluminum, Total (7429-90-5)	X		0.0274	0.0135					1	mg/L	kg/d			
p. Barium, Total (7440-39-3)	X		71.6	0.0352					1	ug/L	kg/d			
q. Boron, Total (7440-42-8)	X		0.039	0.019					1	mg/L	kg/d			
r. Cobalt, Total (7440-48-4)	X		0.048	0.00002					1	ug/L	kg/d			
s. Iron, Total (7439-89-6)	X		0.034	0.017					1	mg/L	kg/d			
t. Magnesium, Total (7439-95-4)	X		5.42	2.67					1	mg/L	kg/d			
u. Molybdenum, Total (7439-98-7)	X		6.87	0.00338					1	ug/L	kg/d			
v. Manganese, Total (7439-96-5)	X		0.0055	0.0027					1	mg/L	kg/d			
w. Tin, Total (7440-31-5)	X		<5	<0.003					1	ug/L	kg/d			
x. Titanium, Total (7440-32-6)	X		<2	<0.001					1	ug/L	kg/d			

CONTINUE ON PAGE V-3

CONTINUED FROM PAGE 3 OF FORM 2-C

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
VAD980554596	007

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X	X		0.25	0.0001					1	ug/L	kg/d			
2M. Arsenic, Total (7440-38-2)	X	X		0.70	0.0003					1	ug/L	kg/d			
3M. Beryllium, Total (7440-41-7)	X	X		<0.004	<0.000					1	ug/L	kg/d			
4M. Cadmium, Total (7440-43-9)	X	X		<0.01	<0.000					1	ug/L	kg/d			
5M. Chromium, Total (7440-47-3)	X	X		0.2	0.0001					1	ug/L	kg/d			
6M. Copper, Total (7440-50-8)	X	X		0.97	0.0005					1	ug/L	kg/d			
7M. Lead, Total (7439-92-1)	X	X		0.058	0.0000					1	ug/L	kg/d			
8M. Mercury, Total (7439-97-6)	X	X		<0.004	<0.000					1	ug/L	kg/d			
9M. Nickel, Total (7440-02-0)	X	X		0.37	0.0002					1	ug/L	kg/d			
10M. Selenium, Total (7782-49-2)	X	X		1.3	0.0006					1	ug/L	kg/d			
11M. Silver, Total (7440-22-4)	X	X		<0.003	<0.000					1	ug/L	kg/d			
12M. Thallium, Total (7440-28-0)	X	X		0.034	0.0000					1	ug/L	kg/d			
13M. Zinc, Total (7440-66-6)	X	X		<1	<0.001					1	ug/L	kg/d			
14M. Cyanide, Total (57-12-5)	X		X	<0.010	<0.005					1	mg/L	kg/d			
15M. Phenols, Total	X		X	<0.0023	<0.002					1	mg/L	kg/d			
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUE ON REVERSE

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X		X	<2.6	<0.002					1	ug/L	kg/d			
2V. Acrylonitrile (107-13-1)	X		X	<0.55	<0.000					1	ug/L	kg/d			
3V. Benzene (71-43-2)	X		X	<0.11	<0.000					1	ug/L	kg/d			
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				*DELISTED 02-4-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
5V. Bromoform (75-25-2)	X		X	<0.19	<0.000					1	ug/L	kg/d			
6V. Carbon Tetrachloride (56-23-5)	X		X	<0.14	<0.000					1	ug/L	kg/d			
7V. Chlorobenzene (108-90-7)	X		X	<0.14	<0.000					1	ug/L	kg/d			
8V. Chlorodi-bromomethane (124-48-1)	X		X	<0.14	<0.000					1	ug/L	kg/d			
9V. Chloroethane (75-00-3)	X		X	<0.21	<0.000					1	ug/L	kg/d			
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X		X	<0.25	<0.000					1	ug/L	kg/d			
11V. Chloroform (67-66-3)	X		X	<0.17	<0.000					1	ug/L	kg/d			
12V. Dichloro-bromomethane (75-27-4)	X		X	<0.13	<0.000					1	ug/L	kg/d			
13V. Dichloro-difluoromethane (75-71-8)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
14V. 1,1-Dichloro-ethane (75-34-3)	X		X	<0.12	<0.000					1	ug/L	kg/d			
15V. 1,2-Dichloro-ethane (107-06-2)	X		X	<0.21	<0.000					1	ug/L	kg/d			
16V. 1,1-Dichloro-ethylene (75-35-4)	X		X	<0.30	<0.000					1	ug/L	kg/d			
17V. 1,2-Dichloro-propane (78-87-5)	X		X	<0.095	<0.000					1	ug/L	kg/d			
18V. 1,3-Dichloro-propylene (542-75-6)	X		X	<0.33	<0.000					1	ug/L	kg/d			
19V. Ethylbenzene (100-41-4)	X		X	<0.23	<0.000					1	ug/L	kg/d			
20V. Methyl Bromide (74-83-9)	X		X	<0.31	<0.000					1	ug/L	kg/d			
21V. Methyl Chloride (74-87-3)	X		X	<0.28	<0.000					1	ug/L	kg/d			

 CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X		X	<0.13	<0.000					1	ug/L	kg/d			
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X		X	<0.20	<0.000					1	ug/L	kg/d			
24V. Tetrachloro-ethylene (127-18-4)	X		X	<0.15	<0.000					1	ug/L	kg/d			
25V. Toluene (108-88-3)	X		X	<0.15	<0.000					1	ug/L	kg/d			
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X		X	<0.17	<0.000					1	ug/L	kg/d			
27V. 1,1,1-Trichloro-ethane (71-55-6)	X		X	<0.29	<0.000					1	ug/L	kg/d			
28V. 1,1,2-Trichloro-ethane (79-00-5)	X		X	<0.20	<0.000					1	ug/L	kg/d			
29V Trichloro-ethylene (79-01-6)	X		X	<0.14	<0.000					1	ug/L	kg/d			
30V. Trichloro-fluoromethane (75-69-4)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
31V. Vinyl Chloride (75-01-4)	X		X	<0.23	<0.000					1	ug/L	kg/d			
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X		X	<2.2	<0.002					1	ug/L	kg/d			
2A. 2,4-Dichloro-phenol (120-83-2)	X		X	<0.65	<0.000					1	ug/L	kg/d			
3A. 2,4-Dimethyl-phenol (105-67-9)	X		X	<1.6	<0.001					1	ug/L	kg/d			
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X		X	<15	<0.008					1	ug/L	kg/d			
5A. 2,4-Dinitro-phenol (51-28-5)	X		X	<24	<0.012					1	ug/L	kg/d			
6A. 2-Nitrophenol (88-75-5)	X		X	<1.1	<0.001					1	ug/L	kg/d			
7A. 4-Nitrophenol (100-02-7)	X		X	<7.7	<0.004					1	ug/L	kg/d			
8A. P-Chloro-M-Cresol (59-50-7)	X		X	<1.6	<0.001					1	ug/L	kg/d			
9A. Pentachloro-phenol (87-86-5)	X		X	<4.8	<0.003					1	ug/L	kg/d			
10A. Phenol (108-95-2)	X		X	<0.53	<0.000					1	ug/L	kg/d			
11A. 2,4,6-Trichloro-phenol (88-05-2)	X		X	<2.9	<1.5					1	ug/L	kg/d			

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)	X		X	<0.28	<0.000					1	ug/L	kg/d			
2B. Acenaphtylene (208-96-8)	X		X	<0.21	<0.000					1	ug/L	kg/d			
3B. Anthracene (120-12-7)	X		X	<0.18	<0.000					1	ug/L	kg/d			
4B. Benzidine (92-87-5)	X		X	<46	<0.023					1	ug/L	kg/d			
5B. Benzo (*a*) Anthracene (56-55-3)	X		X	<0.35	<0.000					1	ug/L	kg/d			
6B. Benzo (*a*) Pyrene (50-32-8)	X		X	<0.27	<0.000					1	ug/L	kg/d			
7B. 3,4-Benzo-fluoranthene (205-99-2)	X		X	<0.47	<0.000					1	ug/L	kg/d			
8B. Benzo (*ghi*) Perylene (191-24-2)	X		X	<0.28	<0.000					1	ug/L	kg/d			
9B. Benzo (*k*) Fluoranthene (207-08-9)	X		X	<0.29	<0.000					1	ug/L	kg/d			
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)	X		X	<1.3	<0.001					1	ug/L	kg/d			
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)	X		X	<0.30	<0.000					1	ug/L	kg/d			
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)	X		X	<0.23	<0.000					1	ug/L	kg/d			
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)	X		X	<4.2	<0.003					1	ug/L	kg/d			
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	X		X	<1.1	<0.001					1	ug/L	kg/d			
15B. Butyl Benzyl Phthalate (85-68-7)	X		X	<2.1	<0.002					1	ug/L	kg/d			
16B. 2-Chloro-naphthalene (91-58-7)	X		X	<0.30	<0.000					1	ug/L	kg/d			
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)	X		X	<0.77	<0.000					1	ug/L	kg/d			
18B. Chrysene (218-01-9)	X		X	<0.30	<0.000					1	ug/L	kg/d			
19B. Dibenzo (*a,h*) Anthracene (53-70-3)	X		X	<0.26	<0.000					1	ug/L	kg/d			
20B. 1,2-Dichloro-benzene (95-50-1)	X		X	<0.15	<0.000					1	ug/L	kg/d			
21B. 1,3-Di-chloro-benzene (541-73-1)	X		X	<0.11	<0.000					1	ug/L	kg/d			

 CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

Outfall 007

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	a. LONG TERM AVERAGE VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)	X		X	<0.21	<0.000					1	ug/L	kg/d			
23B. 3,3-Dichloro-benzidine (91-94-1)	X		X	<1.4	<0.001					1	ug/L	kg/d			
24B. Diethyl Phthalate (84-66-2)	X		X	<9.6	<0.005					1	ug/L	kg/d			
25B. Dimethyl Phthalate (131 -11-3)	X		X	<1.8	<0.001					1	ug/L	kg/d			
26B. Di-N-Butyl Phthalate (84-74-2)	X		X	<2.3	<0.002					1	ug/L	kg/d			
27B. 2,4-Dinitro-toluene (121-14-2)	X		X	<2.1	<0.002					1	ug/L	kg/d			
28B. 2,6-Dinitro-toluene (606-20-2)	X		X	<1.3	<0.001					1	ug/L	kg/d			
29B. Di-N-Octyl Phthalate (117-84-0)	X		X	<2.0	<0.001					1	ug/L	kg/d			
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)	X		X	<0.28	<0.000					1	ug/L	kg/d			
31B. Fluoranthene (206-44-0)	X		X	<0.20	<0.000					1	ug/L	kg/d			
32B. Fluorene (86-73-7)	X		X	<0.23	<0.000					1	ug/L	kg/d			
33B. Hexachloro-benzene (118-74-1)	X		X	<0.59	<0.000					1	ug/L	kg/d			
34B. Hexachloro-butadiene (87-68-3)	X		X	<0.90	<0.000					1	ug/L	kg/d			
35B. Hexachloro-cyclopentadiene (77-47-4)	X		X	<1.3	<0.001					1	ug/L	kg/d			
36B Hexachloro-ethane (67-72-1)	X		X	<1.3	<0.001					1	ug/L	kg/d			
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X		X	<0.42	<0.000					1	ug/L	kg/d			
38B. Isophorone (78-59-1)	X		X	<0.71	<0.000					1	ug/L	kg/d			
39B. Naphthalene (91-20-3)	X		X	<0.22	<0.000					1	ug/L	kg/d			
40B. Nitrobenzene (98-95-3)	X		X	<1.4	<0.001					1	ug/L	kg/d			
41B. N-Nitro-sodimethylamine (62-75-9)	X		X	<1.1	<0.001					1	ug/L	kg/d			
42B. N-Nitrosodi-N-Propylamine (621-64-7)	X		X	<0.48	<0.000					1	ug/L	kg/d			

CONTINUE ON REVERSE

Outfall 007

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. MARK "X" b. BELIEVED PRESENT	2. MARK "X" c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (*optional*) b. NO. OF ANALYSES
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)	X		X	<1.2	<0.001					1	ug/L	kg/d			
44B. Phenanthrene (85-01-8)	X		X	<0.40	<0.000					1	ug/L	kg/d			
45B. Pyrene (129-00-0)	X		X	<0.22	<0.000					1	ug/L	kg/d			
46B. 1,2,4-Tri-chlorobenzene (120-82-1)	X		X	<0.82	<0.000					1	ug/L	kg/d			
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α-BHC (319-84-6)			X												
3P. β-BHC (319-85-7)			X												
4P. γ-BHC (58-89-9)			X												
5P. δ-BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Enosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

 CONTINUE ON PAGE V-9

	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
	VAD980554596	007

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
VAD980554596

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.
015

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	2. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	2. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	2. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	2. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	2. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	3. UNITS (*specify if blank*) a. CONCEN-TRATION	3. UNITS b. MASS	4. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand (*BOD*)	2.2	0.021					1	mg/L	kg/d			
b. Chemical Oxygen Demand (*COD*)	<3	<0.03					1	mg/L	kg/d			
c. Total Organic Carbon (*TOC*)	1.51	0.014					1	mg/L	kg/d			
d. Total Suspended Solids (*TSS*)	179*	1.69			3.4	0.17	17	mg/L	kg/d			
e. Ammonia (*as N*)	1.60	0.015					1	mg/L	kg/d			
f. Flow	VALUE 0.034 MGD		VALUE		VALUE 0.013 MGD		17			VALUE		
g. Temperature (*winter*)	VALUE 15.3		VALUE		VALUE		1	°C		VALUE		
h. Temperature (*summer*)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM 10.9	MAXIMUM 12.1	MINIMUM	MAXIMUM			18	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X" a. BELIEVED PRESENT	2. MARK "X" b. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)		X	<0.4	<0.004					1	mg/L	kg/d			
b. Chlorine, Total Residual		X												
c. Color	X		5.0						1	CU				
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)		X	0.12	0.0011					1	mg/L	kg/d			
f. Nitrate-Nitrite (*as N*)		X	0.56	0.0053					1	mg/L	kg/d			

*Please see DMR Summary regarding maximum TSS reported at Outfall 015 and Note 4, Form 2C Notes regarding intake data.

ITEM V-B CONTINUED FROM FRONT

Outfall 015

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)		X	<0.1	<0.001					1	mg/L	kg/d			
h. Oil and Grease		X	<5	<0.05			<5	<0.26	18	mg/L	kg/d			
i. Phosphorus (as P), Total (7723-14-0)		X	<0.01	<0.0001					1	mg/L	kg/d			
j. Radioactivity														
(1) Alpha, Total	X		<3.00						1	pCi/L				
(2) Beta, Total	X		41.4						1	pCi/L				
(3) Radium, Total	X		<0.41						1	pCi/L				
(4) Radium 226, Total	X		<0.0832						1	pCi/L				
k. Sulfate (*as* SO_4) (14808-79-8)	X		188	1.78					1	mg/L	kg/d			
l. Sulfide (*as S*)		X	<1	<0.01					1	mg/L	kg/d			
m. Sulfite (*as* SO_3) (14265-45-3)		X												
n. Surfactants		X	<0.016	<0.0002					1	mg/L	kg/d			
o. Aluminum, Total (7429-90-5)	X		6.64	0.063					1	mg/L	kg/d			
p. Barium, Total (7440-39-3)	X		177	0.009			160	0.008	9	ug/L	kg/d			
q. Boron, Total (7440-42-8)	X		0.237	0.012			0.169	0.009	11	mg/L	kg/d			
r. Cobalt, Total (7440-48-4)	X		<0.02	<0.0000					1	ug/L	kg/d			
s. Iron, Total (7439-89-6)	X		<0.005	<0.0001					1	mg/L	kg/d			
t. Magnesium, Total (7439-95-4)	X		<0.01	<0.0001					1	mg/L	kg/d			
u. Molybdenum, Total (7439-98-7)	X		464	0.024			440	0.022	11	ug/L	kg/d			
v. Manganese, Total (7439-96-5)	X		<0.0001	<0.0000					1	mg/L	kg/d			
w. Tin, Total (7440-31-5)	X		<5	<0.0001					1	ug/L	kg/d			
x. Titanium, Total (7440-32-6)	X		<0.4	<0.0000					1	ug/L	kg/d			

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	EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
CONTINUED FROM PAGE 3 OF FORM 2-C	VAD980554596	015

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X	X		0.34	0.000			0.27	0.000	11	ug/L	kg/d			
2M. Arsenic, Total (7440-38-2)	X	X		5.75	0.000			4.46	0.000	11	ug/L	kg/d			
3M. Beryllium, Total (7440-41-7)	X	X		0.017	0.000			<0.1	0.000	11	ug/L	kg/d			
4M. Cadmium, Total (7440-43-9)	X	X		0.28	0.000			0.20	0.000	11	ug/L	kg/d			
5M. Chromium, Total (7440-47-3)	X	X		<0.2	0.000			<0.2	0.000	11	ug/L	kg/d			
6M. Copper, Total (7440-50-8)	X	X		0.80	0.000			0.39	0.000	10	ug/L	kg/d			
7M. Lead, Total (7439-92-1)	X	X		0.665	0.000			0.197	0.000	11	ug/L	kg/d			
8M. Mercury, Total (7439-97-6)	X	X		<0.2	0.000			<0.2	0.000	11	ug/L	kg/d			
9M. Nickel, Total (7440-02-0)	X	X		7.84	0.000			7.80	0.000	2	ug/L	kg/d			
10M. Selenium, Total (7782-49-2)	X	X		164	0.0016			145	0.007	1	ug/L	kg/d			
11M. Silver, Total (7440-22-4)	X	X		<0.003	0.000					1	ug/L	kg/d			
12M. Thallium, Total (7440-28-0)	X	X		<0.05	<0.000			<0.05	0.000	11	ug/L	kg/d			
13M. Zinc, Total (7440-66-6)	X	X		<1	<0.000					1	ug/L	kg/d			
14M. Cyanide, Total (57-12-5)	X		X	<0.010	<0.000					1	mg/L	kg/d			
15M. Phenols, Total	X		X	<0.010	<0.000					1	mg/L	kg/d			
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUE ON REVERSE

Outfall 015

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X		X	<2.6	<0.000					1	ug/L	kg/d			
2V. Acrylonitrile (107-13-1)	X		X	<0.55	<0.000					1	ug/L	kg/d			
3V. Benzene (71-43-2)	X		X	<0.11	<0.000					1	ug/L	kg/d			
4V. Bis (*Chloro-methyl*) Ether (542-88-1)				*DELISTED 02-4-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
5V. Bromoform (75-25-2)	X		X	<0.19	<0.000					1	ug/L	kg/d			
6V. Carbon Tetrachloride (56-23-5)	X		X	<0.14	<0.000					1	ug/L	kg/d			
7V. Chlorobenzene (108-90-7)	X		X	<0.14	<0.000					1	ug/L	kg/d			
8V. Chlorodi-bromomethane (124-48-1)	X		X	<0.14	<0.000					1	ug/L	kg/d			
9V. Chloroethane (75-00-3)	X		X	<0.21	<0.000					1	ug/L	kg/d			
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X		X	<0.25	<0.000					1	ug/L	kg/d			
11V. Chloroform (67-66-3)	X		X	<0.17	<0.000					1	ug/L	kg/d			
12V. Dichloro-bromomethane (75-27-4)	X		X	<0.13	<0.000					1	ug/L	kg/d			
13V. Dichloro-difluoromethane (75-71-8)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
14V. 1,1-Dichloro-ethane (75-34-3)	X		X	<0.12	<0.000					1	ug/L	kg/d			
15V. 1,2-Dichloro-ethane (107-06-2)	X		X	<0.21	<0.000					1	ug/L	kg/d			
16V. 1,1-Dichloro-ethylene (75-35-4)	X		X	<0.30	<0.000					1	ug/L	kg/d			
17V. 1,2-Dichloro-propane (78-87-5)	X		X	<0.095	<0.000					1	ug/L	kg/d			
18V. 1,3-Dichloro-propylene (542-75-6)	X		X	<0.33	<0.000					1	ug/L	kg/d			
19V. Ethylbenzene (100-41-4)	X		X	<0.23	<0.000					1	ug/L	kg/d			
20V. Methyl Bromide (74-83-9)	X		X	<0.31	<0.000					1	ug/L	kg/d			
21V. Methyl Chloride (74-87-3)	X		X	<0.28	<0.000					1	ug/L	kg/d			

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CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X		X	<0.13	<0.000					1	ug/L	kg/d			
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X		X	<0.20	<0.000					1	ug/L	kg/d			
24V. Tetrachloro-ethylene (127-18-4)	X		X	<0.15	<0.000					1	ug/L	kg/d			
25V. Toluene (108-88-3)	X		X	<1.0	<0.000					1	ug/L	kg/d			
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X		X	<0.17	<0.000					1	ug/L	kg/d			
27V. 1,1,1-Trichloro-ethane (71-55-6)	X		X	<0.29	<0.000					1	ug/L	kg/d			
28V. 1,1,2-Trichloro-ethane (79-00-5)	X		X	<0.20	<0.000					1	ug/L	kg/d			
29V Trichloro-ethylene (79-01-6)	X		X	<0.14	<0.000					1	ug/L	kg/d			
30V. Trichloro-fluoromethane (75-69-4)				*DELISTED 01-8-1981* ANALYSIS NOT REQUIRED FOR THIS PARAMETER											
31V. Vinyl Chloride (75-01-4)	X		X	<0.23	<0.000					1	ug/L	kg/d			
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X		X	<2.2	<0.000					1	ug/L	kg/d			
2A. 2,4-Dichloro-phenol (120-83-2)	X		X	<0.65	<0.000					1	ug/L	kg/d			
3A. 2,4-Dimethyl-phenol (105-67-9)	X		X	<1.6	<0.000					1	ug/L	kg/d			
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X		X	<15	<0.000					1	ug/L	kg/d			
5A. 2,4-Dinitro-phenol (51-28-5)	X		X	<24	<0.000					1	ug/L	kg/d			
6A. 2-Nitrophenol (88-75-5)	X		X	<1.1	<0.000					1	ug/L	kg/d			
7A. 4-Nitrophenol (100-02-7)	X		X	<7.7	<0.000					1	ug/L	kg/d			
8A. P-Chloro-M-Cresol (59-50-7)	X		X	<1.6	<0.000					1	ug/L	kg/d			
9A. Pentachloro-phenol (87-86-5)	X		X	<4.8	<0.000					1	ug/L	kg/d			
10A. Phenol (108-95-2)	X		X	<0.53	<0.000					1	ug/L	kg/d			
11A. 2,4,6-Trichloro-phenol (88-05-2)	X		X	<2.9	<0.000					1	ug/L	kg/d			

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)	X		X	<0.28	<0.000					1	ug/L	kg/d			
2B. Acenaphtylene (208-96-8)	X		X	<0.21	<0.000					1	ug/L	kg/d			
3B. Anthracene (120-12-7)	X		X	<0.18	<0.000					1	ug/L	kg/d			
4B. Benzidine (92-87-5)	X		X	<46	<0.000					1	ug/L	kg/d			
5B. Benzo (*a*) Anthracene (56-55-3)	X		X	<0.35	<0.000					1	ug/L	kg/d			
6B. Benzo (*a*) Pyrene (50-32-8)	X		X	<0.27	<0.000					1	ug/L	kg/d			
7B. 3,4-Benzo-fluoranthene (205-99-2)	X		X	<0.47	<0.000					1	ug/L	kg/d			
8B. Benzo (*ghi*) Perylene (191-24-2)	X		X	<0.28	<0.000					1	ug/L	kg/d			
9B. Benzo (*k*) Fluoranthene (207-08-9)	X		X	<0.29	<0.000					1	ug/L	kg/d			
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)	X		X	<1.3	<0.000					1	ug/L	kg/d			
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)	X		X	<0.30	<0.000					1	ug/L	kg/d			
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)	X		X	<0.23	<0.000					1	ug/L	kg/d			
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)	X		X	<4.2	<0.000					1	ug/L	kg/d			
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	X		X	<1.1	<0.000					1	ug/L	kg/d			
15B. Butyl Benzyl Phthalate (85-68-7)	X		X	<2.1	<0.000					1	ug/L	kg/d			
16B. 2-Chloro-naphthalene (91-58-7)	X		X	<0.30	<0.000					1	ug/L	kg/d			
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)	X		X	<0.77	<0.000					1	ug/L	kg/d			
18B. Chrysene (218-01-9)	X		X	<0.30	<0.000					1	ug/L	kg/d			
19B. Dibenzo (*a,h*) Anthracene (53-70-3)	X		X	<0.26	<0.000					1	ug/L	kg/d			
20B. 1,2-Dichloro-benzene (95-50-1)	X		X	<0.15	<0.000					1	ug/L	kg/d			
21B. 1,3-Di-chloro-benzene (541-73-1)	X		X	<0.11	<0.000					1	ug/L	kg/d			

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CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)	X		X	<0.21	<0.000					1	ug/L	kg/d			
23B. 3,3-Dichloro-benzidine (91-94-1)	X		X	<1.4	<0.000					1	ug/L	kg/d			
24B. Diethyl Phthalate (84-66-2)	X		X	<2.9	<0.000					1	ug/L	kg/d			
25B. Dimethyl Phthalate (131 -11-3)	X		X	<1.8	<0.000					1	ug/L	kg/d			
26B. Di-N-Butyl Phthalate (84-74-2)	X		X	<2.3	<0.000					1	ug/L	kg/d			
27B. 2,4-Dinitro-toluene (121-14-2)	X		X	<2.1	<0.000					1	ug/L	kg/d			
28B. 2,6-Dinitro-toluene (606-20-2)	X		X	<1.3	<0.000					1	ug/L	kg/d			
29B. Di-N-Octyl Phthalate (117-84-0)	X		X	<2.0	<0.000					1	ug/L	kg/d			
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)	X		X	<0.28	<0.000					1	ug/L	kg/d			
31B. Fluoranthene (206-44-0)	X		X	<0.20	<0.000					1	ug/L	kg/d			
32B. Fluorene (86-73-7)	X		X	<0.23	<0.000					1	ug/L	kg/d			
33B. Hexachloro-benzene (118-74-1)	X		X	<0.59	<0.000					1	ug/L	kg/d			
34B. Hexachloro-butadiene (87-68-3)	X		X	<0.90	<0.000					1	ug/L	kg/d			
35B. Hexachloro-cyclopentadiene (77-47-4)	X		X	<1.3	<0.000					1	ug/L	kg/d			
36B Hexachloro-ethane (67-72-1)	X		X	<1.3	<0.000					1	ug/L	kg/d			
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X		X	<0.42	<0.000					1	ug/L	kg/d			
38B. Isophorone (78-59-1)	X		X	<0.71	<0.000					1	ug/L	kg/d			
39B. Naphthalene (91-20-3)	X		X	<0.22	<0.000					1	ug/L	kg/d			
40B. Nitrobenzene (98-95-3)	X		X	<1.4	<0.000					1	ug/L	kg/d			
41B. N-Nitro-sodimethylamine (62-75-9)	X		X	<1.1	<0.000					1	ug/L	kg/d			
42B. N-Nitrosodi-N-Propylamine (621-64-7)	X		X	<0.48	<0.000					1	ug/L	kg/d			

CONTINUE ON REVERSE

Outfall 015

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)	X		X	<1.2	<0.000					1	ug/L	kg/d			
44B. Phenanthrene (85-01-8)	X		X	<0.40	<0.000					1	ug/L	kg/d			
45B. Pyrene (129-00-0)	X		X	<0.22	<0.000					1	ug/L	kg/d			
46B. 1,2,4-Tri-chlorobenzene (120-82-1)	X		X	<0.82	<0.000					1	ug/L	kg/d			
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α-BHC (319-84-6)			X												
3P. β-BHC (319-85-7)			X												
4P. γ-BHC (58-89-9)			X												
5P. δ-BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Enosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

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EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
VAD980554596	015

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X" a. TESTING REQUIRED	2. MARK "X" b. BELIEVED PRESENT	2. MARK "X" c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE (*optional*) b. NO. OF ANALYSES
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

Form 2C Notes

Note 1: Discussion of Flow Figures from Item II-A (Flow Diagram) and Item II-B (Description, Treatment, Sources, etc.)

The flow figures designated as normal flows listed on the water balance diagram and included on Form 2C (Item II-B Column 2b) represent the volume of water necessary to operate the Plant under normal conditions at full capacity. The Company feels that listing flow rates based on any other method of calculation would be misleading and not in keeping with the intentions of this section. The most important factors governing operation of the Plant's generating units are consumer demand and the availability of other generating units across the electrical grid. A large number of variables directly impact these two factors, making it difficult to accurately predict the units' operating schedules and, subsequently, the flow scheme for any one plant based on historical records. Because of this, the values listed on the water balance diagram and Form 2C represent the flow rates that would be expected when all units are operating at full capacity. The use of flow data determined by any other method could restrict the Company's ability to operate the Plant at full capacity, thereby de-rating the capacity of the Plant. These figures do not represent maximum design flow rates in that such factors as redundancy and extraordinary operations were not used in their calculation.

Note 2: Item II-B – Screen Backwash and Intake House Sump Flows

In addition to the various flows listed and described in Item II-B, intake screen backwash and intake house sump flows are returned to the Clinch River. Screen backwash is simply the return of water and other materials such as detritus that are a natural part of the river. The intake sump collects untreated river water that leaks from the river makeup pumps, strainers, and screen wash pumps. Neither the screen backwash nor the sump discharge contains any water or material other than that present in untreated intake water.

The intake sump discharge was removed from previous VPDES permits by VDEQ in recognition of the above. The Company does not believe that screen backwash should be regulated in the permit as it is not a discharge or addition of pollutants to navigable waters as contemplated by the Clean Water Act and is not an outfall.

Note 3: Discussion of Part V-C Substances with No Data Reported

Pollutants listed in Part V-C for which no analyses were performed are substances that are not limited in the effluent guidelines for the Steam Electric Point Source category. Any occurrence of one of these materials in the Plant discharges would be the result of its presence in the intake river water, or of incidental presence in Plant processes not considered important in effluent guidelines development. Some pollutants not subject to the guidelines were analyzed and the results reported.

Note 4: Part V Intake Data for Outfalls 007 and 015

No intake data are included on Form 2C, Part V for Outfalls 007 and 015. The intake water data listed for Outfall 003 do not apply to Outfalls 007 and 015, as the water sources for these outfalls are precipitation and groundwater seepage, respectively.

Note 5: Item VIII – Contractor Analysis Information

Various VELAP-accredited laboratories performed the analyses reported on Form 2C, as well as the routine compliance analyses required during the permit term.

1. Appalachian Power Company
   Clinch River Plant Laboratory
   3464 Power Plant Road
   Cleveland, VA 24225
   276-889-7322

   Parameters Analyzed: Temperature, Flow, pH, Total Residual Chlorine

2. Environmental Monitoring, Inc.
   P.O. Box 1190
   Norton, Virginia 24273
   276-679-6544

   VELAP ID: 460038

   Parameters Analyzed: Oil & Grease, Ammonia (as N), Total Suspended Solids, Total Copper, Fecal coliform

3. TestAmerica Laboratories, Inc.
   301 Alpha Drive
   PIDC Park
   Pittsburgh, PA 15238
   (412)963-7058

   VELAP ID: 460189, 460175, 460152, 460230 (TestAmerica Pittsburgh, TestAmerica Canton, TestAmerica Nashville, and TestAmerica St. Louis, respectively)

   Parameters Analyzed: BOD-5, Color, Radioactivity, Surfactants, Cyanide, Phenols, Volatile Compounds (1V-31V), Acid Compounds (1A-11A), Base/Neutral Compounds (1B-46B) Pesticides (1P-25P)

4. John E. Dolan Environmental Laboratory
   4001 Bixby Road
   Groveport, Ohio 43215
   614-836-4210

   VELAP ID: 460225

   Parameters Analyzed: COD, TOC, TSS, Ammonia, Bromide, Fluoride, Nitrate-Nitrite, TON, Total Phosphorus, Oil & Grease, Sulfate, Sulfide, Part V-B Metals

<u>Note 6: Outfall 003 Part V, Item 13B – Bis (*2-ethylhexyl*) phthalate</u>

Bis (*2-ethylhexyl*) phthalate was detected above method detection limits in the Outfall 003 effluent sample. However, the Company does not believe this pollutant originates at the Plant. Bis-phthalate is a manufactured organic compound used as a plasticizer in the production of polyvinyl chloride and other polymers. Detection of this compound in the Outfall 003 effluent is believed to be the result of sample contamination.

EPA Form 2F for Outfalls 501, 502, 503, 701, 731, 736, 737, 738, 739, 740, 801, 802, and 803

Please print or type in the unshaded areas only.

EPA ID Number (*copy from Item 1 of Form 1*)
VAD980554596

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

FORM **2F** NPDES

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number (*list*)	B. Latitude			C. Longitude			D. Receiving Water (*name*)
001	36	56	05	82	11	51	Clinch River
003	36	56	05	82	11	53	Clinch River
007	36	56	45	82	12	03	Clinch River
014	36	55	18	82	12	05	Clinch River
501	36	56	15	82	11	36	Dumps Creek
502	36	56	29	82	11	24	Dumps Creek
503	36	56	9	82	11	54	Clinch River
701	36	55	54	82	11	46	Clinch River
727	36	55	54	82	12	05	Clinch River
731	36	55	48	82	12	04	Clinch River

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B: You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall; paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied; each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

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Please print or type in the unshaded areas only.

EPA ID Number (*copy from Item 1 of Form 1*)
VAD980554596

Form Approved. OMB No. 2040-0086
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FORM **2F** NPDES

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number (*list*)	B. Latitude			C. Longitude			D. Receiving Water (*name*)
736	36	55	30	82	12	01	Clinch River
737	36	55	22	82	12	00	Clinch River
738	36	55	20	82	12	10	Clinch River
739	36	55	24	82	12	25	Clinch River
740	36	55	33	82	12	25	Clinch River
801	36	55	22	82	11	44	Possum Hollow
802	36	55	7	82	11	9	Possum Hollow
803	36	55	9	82	10	45	Unnamed isolated stream

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B: You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall; paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied; each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

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Continued from the Front

IV. Narrative Description of Pollutant Sources

A. For each outfall, provide an estimate of the area (include units) of imperious surfaces (including paved areas and building roofs) drained to the outfall, and an estimate of the total surface area drained by the outfall.

Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*	Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*
	Please see Note 2, Form 2F Notes and Figures 3-6.				

B. Provide a narrative description of significant materials that are currently or in the past three years have been treated, stored or disposed in a manner to allow exposure to storm water; method of treatment, storage, or disposal; past and present materials management practices employed to minimize contact by these materials with storm water runoff; materials loading and access areas, and the location, manner, and frequency in which pesticides, herbicides, soil conditioners, and fertilizers are applied.

Please see Notes 2 and 3, Form 2F Notes and Figures 3-6.

C. For each outfall, provide the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of the treatment the storm water receives, including the schedule and type of maintenance for control and treatment measures and the ultimate disposal of any solid or fluid wastes other than by discharge.

Outfall Number	Treatment	List Codes from Table 2F-1
	Please see Note 2, Form 2F Notes.	

V. Nonstormwater Discharges

A. I certify under penalty of law hat the outfall(s) covered by this application have been tested or evaluated for the presence of nonstormwater discharges, and that all nonstormwater discharged from these outfall(s) are identified in either an accompanying Form 2C or From 2E application for the outfall.

Name and Official Title *(type or print)*	Signature	Date Signed
John M. McManus VP Environmental Services	[signature]	3/10/15

B. Provide a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.

Please see Note 4, Form 2F Notes.

VI. Significant Leaks or Spills

Provide existing information regarding the history of significant leaks or spills of toxic or hazardous pollutants at the facility in the last three years, including the approximate date and location of the spill or leak, and the type and amount of material released.

Please see Note 5, Form 2F Notes.

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Continued from Page 2

EPA ID Number *(copy from Item 1 of Form 1)*
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VII. Discharge Information

A, B, C, & D: See instructions before proceeding. Complete one set of tables for each outfall. Annotate the outfall number in the space provided.
Table VII-A, VII-B, VII-C are included on separate sheets numbers VII-1 and VII-2. Please see Note 1, Form 2F Notes.

E. Potential discharges not covered by analysis – is any toxic pollutant listed in table 2F-2, 2F-3, or 2F-4, a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ Yes *(list all such pollutants below)* ☑ No *(go to Section IX)*

The Company does not specifically use any of the substances identified in Table 2F-2 in the generation of electricity. However, some of the metals on the list may be present in coal combution by-products due to their presence in coal.

VIII. Biological Toxicity Testing Data

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☑ Yes *(list all such pollutants below)* ☐ No *(go to Section IX)*

Please see Appendix E for a summary of whole effluent toxicity testing performed at Outfalls 003, 007, and 727 over the current permit term.

IX. Contract Analysis Information

Were any of the analyses reported in Item VII performed by a contract laboratory or consulting firm?

☑ Yes *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ No *(go to Section X)*

A. Name	B. Address	C. Area Code & Phone No.	D. Pollutants Analyzed
John E. Dolan Laboratory	4001 Bixby Road Groveport, OH 43215	(614)836-4210	Oil & Grease COD TSS TKN Nitrate/Nitrite Total Phosphorus Metals
TestAmerica Laboratories, Inc.	TestAmerica Pittsburgh 301 Alpha Drive RIDC Park Pittsburgh, PA 15238	(412)963-7058	BOD-5

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title *(Type Or Print)*	B. Area Code and Phone No.
John M. McManus, VP Environmental Services	(614) 716-1268
C. Signature	D. Date Signed
John M McManus	3/10/15

	EPA ID Number *(copy from Item I of Form 1)* VAD980554596	Form Approved. OMB No. 2040-0086 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil & Grease	<1 mg/L	N/A			1	Outfall 501 – Estimated from
Biological Oxygen Demand (BOD_5)	<2 mg/L				1	Outfall 502; See Note 6, Form 2F Notes
Chemical Oxygen Demand (COD)	<10 mg/L				1	Stormwater runoff (Winter, rainfall)
Total Suspended Solids (TSS)	<0.4 mg/L				1	
Total Kjeldahl Nitrogen (TKN)	<0.5 mg/L				1	
Nitrate/Nitrite	<0.02 mg/L				1	
Total Phosphorus	0.08 mg/L				1	
pH	Minimum 8.06	Maximum 8.06	Minimum	Maximum	1	

Part B – List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Antimony	0.12 μg/L				1	
Arsenic	5.62 μg/L				1	
Barium	36 μg/L				1	
Beryllium	0.015 μg/L				1	
Cadmium	<0.05 μg/L				1	
Chromium	0.3 μg/L				1	
Cobalt	0.115 μg/L				1	
Copper	0.79 μg/L				1	
Lead	14 μg/L				1	
Mercury	<0.004 μg/L				1	
Molybdenum	0.58 μg/L				1	
Nickel	2.74 μg/L				1	
Selenium	<0.5 μg/L				1	
Silver	0.040 μg/L				1	
Thallium	0.028 μg/L				1	
Tin	<5 μg/L				1	
Titanium	<2 μg/L				1	
Zinc	3.2 μg/L				1	
Aluminum	0.0225 mg/L				1	
Boron	0.086 mg/L				1	
Iron	0.017 mg/L				1	
Magnesium	43.4 mg/L				1	
Manganese	0.0174 mg/L				1	

 Continue on Reverse

Continued from the Front

Part C - List each pollutant shown in Table 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.						
Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
N/A						Outfall 501 - Estimated from Outfall
						502; See Note 6, Form 2F Notes.
						(Winter, rainfall)

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event *(in minutes)*	3. Total rainfall during storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event *(gallons/minute or specify units)*	6. Total flow from rain event *(gallons or specify units)*
02/01/15	~210 min	0.15 in	~216 hours	N/A - estimated data from Outfall 502	N/A - estimated data from Outfall 502

7. Provide a description of the method of flow measurement or estimate.

N/A - estimated data from Outfall 502

	EPA ID Number *(copy from Item I of Form 1)* VAD980554596	Form Approved. OMB No. 2040-0086 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil & Grease	<1 mg/L	N/A			1	Outfall 502 – Stormwater runoff (Winter, rainfall)
Biological Oxygen Demand (BOD_5)	<2 mg/L				1	
Chemical Oxygen Demand (COD)	<10 mg/L				1	
Total Suspended Solids (TSS)	<0.4 mg/L				1	
Total Kjeldahl Nitrogen (TKN)	<0.5 mg/L				1	
Nitrate/Nitrite	<0.02 mg/L				1	
Total Phosphorus	0.08 mg/L				1	
pH	Minimum 8.06	Maximum 8.06	Minimum	Maximum	1	

Part B – List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Antimony	0.12 µg/L				1	
Arsenic	5.62 µg/L				1	
Barium	36 µg/L				1	
Beryllium	0.015 µg/L				1	
Cadmium	<0.05 µg/L				1	
Chromium	0.3 µg/L				1	
Cobalt	0.115 µg/L				1	
Copper	0.79 µg/L				1	
Lead	14 µg/L				1	
Mercury	<0.004 µg/L				1	
Molybdenum	0.58 µg/L				1	
Nickel	2.74 µg/L				1	
Selenium	<0.5 µg/L				1	
Silver	0.040 µg/L				1	
Thallium	0.028 µg/L				1	
Tin	<5 µg/L				1	
Titanium	<2 µg/L				1	
Zinc	3.2 µg/L				1	
Aluminum	0.0225 mg/L				1	
Boron	0.086 mg/L				1	
Iron	0.017 mg/L				1	
Magnesium	43.4 mg/L				1	
Manganese	0.0174 mg/L				1	

Continued from the Front

Part C – List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
N/A						Outfall 502

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration Of Storm Event *(in minutes)*	3. Total rainfall During storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event *(gallons/minute or specify units)*	6. Total flow from rain event *(gallons or specify units)*
02/01/15	~210 min	0.15 in	~216 hours	~1 gpm	~200 gallons

7. Provide a description of the method of flow measurement or estimate.

Sample bottle and stop watch

	EPA ID Number *(copy from Item I of Form 1)* VAD980554596	Form Approved. OMB No. 2040-0086 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil & Grease	<1 mg/L	N/A			1	Outfall 727 – Controlled Discharge from
Biological Oxygen Demand (BOD_5)	<2.4 mg/L				1	Stormwater Basin
Chemical Oxygen Demand (COD)	<10 mg/L				1	
Total Suspended Solids (TSS)	52 mg/L				1	
Total Kjeldahl Nitrogen (TKN)	<0.5 mg/L				1	
Nitrate/Nitrite	<0.02 mg/L				1	
Total Phosphorus	<0.01 mg/L				1	
pH	Minimum 6.33	Maximum 9.45	Minimum	Maximum	6	

Part B – List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Antimony	0.69 µg/L				1	
Arsenic	4.88 µg/L				1	
Barium	35.7 µg/L				1	
Beryllium	0.081 µg/L				1	
Cadmium	<0.05 µg/L				1	
Chromium	2.6 µg/L				1	
Cobalt	0.482 µg/L				1	
Copper	3.91 µg/L				1	
Lead	1.68 µg/L				1	
Mercury	<0.01 µg/L				1	
Molybdenum	7.49 µg/L				1	
Nickel	1.49 µg/L				1	
Selenium	3.8 µg/L				1	
Silver	<0.003 µg/L				1	
Thallium	0.045 µg/L				1	
Tin	<5 µg/L				1	
Titanium	20.4 µg/L				1	
Zinc	49.9 µg/L				1	
Aluminum	0.638 mg/L				1	
Boron	0.056mg/L				1	
Iron	0.382 mg/L				1	
Magnesium	2.88 mg/L				1	
Manganese	0.0169 mg/L				1	

 Continue on Reverse

Continued from the Front

Part C – List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant And CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
N/A						Outfall 727

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration Of Storm Event *(in minutes)*	3. Total rainfall During storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event *(gallons/minute or specify units)*	6. Total flow from rain event *(gallons or specify units)*
11/17/14	~620 min	0.49 in	>72 hrs	N/A (controlled release from pond)	N/A (controlled release from pond)

7. Provide a description of the method of flow measurement or estimate.

N/A (controlled release from pond)

Form 2F Notes

Note 1: Form 2F Part VII Discharge Data

Due to limited staff presence and infrequent qualifying storm events, Plant staff were unable to collect samples in accordance with the requirements of Form 2F, Part VII for Outfalls 701, 731, 736, 737, 738, 740, 801, 802, and 803 prior to submittal of this application. The required monitoring will be performed during the soonest qualifying storm event during which the appropriate Plant staff are onsite and reported via an addendum.

Note 2: Further Description of Outfalls Containing Stormwater Runoff

Outfall 001 – Reclaim Pond Discharge

Bottom ash, fly ash, pyrites, and wastewater treatment plant sludge are routinely sluiced to Ash Pond 1A/1B for settling and disposal. After a period of settling, the Pond 1A/1B supernatant is decanted to the Reclaim Pond. The Reclaim Pond also receives water collected in the active landfill leachate ponds as well as seepage from the Pond 1A/1B dike system. Under normal operating conditions, wastewater from the Reclaim Pond is pumped back to the Plant in a closed loop system and re-used for transportation of the wastes listed above back to Pond 1A/1B. Typically there is no direct discharge from the Reclaim Pond. However, precipitation that lands directly on the landfill ponds, the Reclaim Pond, and the immediate drainage areas surrounding these ponds could be discharged via Outfall 001 in the event of a Reclaim Pond overflow.

There are no significant materials stored within the drainage area for the reclaim pond. The drainage area immediately surrounding and including the pond is approximately 1 acre in size. None of the drainage area is impervious.

Outfall 003

Stormwater runoff from a variety of Plant areas is discharged via Outfall 003. These drainage areas include:

- Roof drains from Units 1, 2, and 3
- Transformer deck
- Runoff collected from the landfill that is comingled with leachate and pumped to the WWTP
- Precipitation that lands directly on the cooling towers, reclaim pond, and ash ponds
- Northeast portion of the Plant yard from the main entrance to the cooling towers, including the precipitator area and area around the ash silo.

These areas total approximately 6.5 acres. Runoff from a fraction of that area is treated in the AWWTP before discharge. Specifically, runoff from the Plant roof drains, transformer deck, precipitator area, and the area directly underneath the ash silo undergoes treatment (described in Appendix A) with other plant wastewaters in the AWWTP. These drainage areas from the Plant that directly enter the AWWTP total approximately 0.5 acres, all of which is impervious. Additionally, much of the precipitation that lands directly on the Reclaim Pond and Ash Pond1A/1B is reused and/or evaporates, but some is likely treated and discharged through the AWWTP.

While this discharge is identified as containing stormwater runoff from the areas identified above, the Company believes that it is not necessary or appropriate for any stormwater monitoring requirements to be applied to this treatment system for the following reasons. The typical storm water flows discharged through Outfall 003 make up only a small portion of the overall contribution to the discharge. The stormwater that does enter the system undergoes the same treatment as the wastewater discharged through the system. Finally, the Company believes that it is impractical to determine when or how to sample the final discharge at a time when it could provide data representative of a storm event. Due to the dynamic nature of this treatment system based on any given day's wastewater flows, and the mixing effect the treatment system would have on the storm water, it would be virtually impossible to determine at what point in time the discharge from this system would provide representative data of a given storm event.

Outfall 007

Stormwater runoff discharged via Outfall 007 includes drainage from the following areas:

- Coal storage pile and surrounding area
- Main office building
- 138-kV switchyard
- A small area near the tractor shed
- Truck coal scale
- Warehouse "D"
- Used oil storage area
- Circulating water house 1&2
- A portion of the coal haul road

In addition to the drainage areas above, stormwater landing directly on the ponds and the drainage areas immediately surrounding the ponds enters this treatment system prior to discharge. The total drainage area is approximately 25.5 acres. Runoff from all of these areas drains to a common sump located within the coal pile, from which it is pumped to the first of two retention ponds. The stormwater runoff is stored for a period of time sufficient to allow for settling of suspended solids. The supernatant is transferred to the second retention pond for additional settling prior to discharge.

While the stormwater runoff typically requires a relatively short time to facilitate solids settling, the Company may, at some point in the future, choose to use a commercially available polymer for water treatment to facilitate the settling of solids.

Materials stored within the Outfall 007 drainage area include coal, diesel fuel, rail cars, heavy equipment, and the dust suppressant CoalTrol-60. Approximately 2.6 acres of the drainage area are impervious.

Outfall 014

Stormwater runoff and leachate from the Plant's coal combustion by-product (CCB) landfill are collected and comingled in two (2) retention basins prior to transfer to the Plant's primary WWTP and eventual discharge via Outfall 003. The basins are designed to contain a volume of runoff that would be expected from the 25-year, 24-hour storm event. If a storm event were to exceed the design capacity of the basins, or the Plant capacity to pump accumulated water to the WWTP, the excess water can be discharged to the Clinch River via a 24-inch concrete pipe. There are no significant materials storage areas within the Outfall 014 drainage area. The drainage area is estimated to be 8.3 acres. The retention basins are lined with a 60-mil PVC liner, therefore the full area could be considered impervious.

Outfall 701

Stormwater runoff from an area adjacent to Cooling Tower 1 and a materials storage area enters a vegetated swale running parallel to Cooling Tower 1 and is discharged to the Clinch River. Almost the entire drainage area is vegetated with grass which aids in stormwater flow attenuation. Pallets, piping, cable, and other miscellaneous Plant maintenance materials may be stored in this drainage area. The area is approximately 3.1 acres in size and none is considered impervious.

Outfall 727

Stormwater runoff from the following areas drains to Outfall 727:

- Plant main entrance area
- The area surrounding the stacks, ash silo, and precipitators
- Paved employee and visitor parking lot
- Warehouse "C" and the urea bulk storage and unloading area
- The area near the aboveground salt storage tank
- The Plant warehouse and a shipping and receiving area

Stormwater runoff from Warehouse “C” and the urea bulk storage and unloading area flows to a low point storm drain and is discharged directly to Outfall 727. Stormwater runoff from the remainder of these areas is collected in a retention basin known as Watson’s Pond for settling of entrained solids. The supernatant passes through a baffle near the southern end of the pond. The pond is manually discharged on an as-needed basis by operation of a knife gate valve after the basin contents have been inspected by Plant personnel. As the frequency of discharges is primarily dependent on the frequency and magnitude of storm events, this discharge is best characterized as intermittent. The discharge flows to a catch basin located on the drainage line leading to Outfall 727. A separate stormwater drainage area leading directly to Outfall 727 includes the Plant area to the south and east of the main Plant buildings.

The normal controlled discharge is similar to Outfall 007, and the flow from the basin is regulated during routine discharge at a rate of 0.48 MGD.

Materials stored and handled within the Outfall 727 drainage area include the following:

- Scrap metal, including a scrap metal dumpster and scrap metal hopper
- The 257,000-gallon bulk urea storage tank, equipped with secondary containment
- Wooden pallets, cable, miscellaneous piping and metal materials for construction projects
- Bins for the temporary storage of pyrites, reject coal, and fly ash prior to disposal
- The dry fly ash handling system is located adjacent to this drainage area. Trucks used to transport fly ash to the landfill travel through the Outfall 727 drainage area on a routine basis.
- The coal conveyor transporting coal from the coal storage pile to the Plant passes through a portion of the drainage area. The aboveground salt brine storage tank is located in this drainage area immediately south of the Plant office building.
- Various materials shipped to or from the Plant may be temporarily stored within the shipping/receiving area. These could include bulk chemicals, used oils, fuel oils, diesel fuel and gasoline. Various waste materials can also be stored within this drainage area prior to disposal. These could include drums of waste mineral oil, oil-filled electrical equipment that have been removed from service, and drums of cleanup debris.

<u>Outfall 731</u>

A small drainage area near the tractor shed adjacent to the coal pile is collected in a catch basin that enters a storm drain leading to the Clinch River. This 1-acre drainage area includes a section of rail lines used to transport coal to the Plant coal storage pile. The Plant’s ash handling contractor maintains a small trailer within the drainage area for personnel use. An oil drum storage shed equipped with concrete secondary containment is located within the drainage area. The total impervious area draining to Outfall 731 is approximately 0.1 acres.

Outfalls 736-740

These five outfalls were created during the expansion of the Plant’s active CCB landfill beginning in 1993, with the purpose of conveying non-contact stormwater away from the landfill to the Clinch River. There are no materials stored in the stormwater drainage areas surrounding the Plant’s active CCB landfill.

The approximate size of each drainage area at the CCB landfill is listed below. No significant impervious areas exist within any of the drainage areas. A topographic map showing the location of each outfall and its respective drainage area is included as Figure 3.

- Outfall 736 – 14.8 acres
- Outfall 737 – 6.2 acres
- Outfall 738 – 8.2 acres
- Outfall 739 – 8.2 acres
- Outfall 740 – 94.1 acres

Outfalls 501 and 502 – Ash Pond 2 Post-Closure Stormwater Management

The closure of Ash Pond 2 resulted in two stormwater outfalls that drain stormwater runoff and non-contact infiltration from the engineered cap system to Dumps Creek. Final grading is such that stormwater runoff from 6.4 acres constituting the west portion of the cap drains to Outfall 501. An additional 15.5 acres of offsite tributary area also drain to Outfall 501 for a total drainage area of 21.9 acres. The eastern 10.7 acres of the cap drain to Outfall 502, along with approximately 11.3 acres of offsite tributary drainage for a total drainage area of 22 acres. A geocomposite drainage net (GDN) installed 24 inches below final grade over the entire capped area collects non-contact infiltration and conveys it to each outfall for the respective drainage area. The conveyance capacity of the GDN prevents saturation of the cap.

Outfalls 501 and 502 became functional after the closure of Ash Pond 2 was complete and the drainage areas achieved final stabilization in the form of perennial vegetation. They have discharged stormwater under the VPDES General Permit registration VAR052112. No materials are stored within the Outfall 501 or 502 drainage areas, and neither drainage area contains significant impervious surface area. Appendix I contains a request to incorporate Outfalls 501 and 502 into the reissued permit.

Outfall 503 – Ash Pond 1A/1B Stormwater Management

A stormwater diversion system is being constructed around the active ash settling ponds (Ash Pond 1A/1B) under a directive from Virginia DCR. Construction began in 2014 and is ongoing as of the date of this application. The diversion system consists of a berm and channel that intercept stormwater runoff from offsite tributary areas and convey it around the facility to a discharge point on the Clinch River. This discharge is identified as Outfall 503. Discharges currently consist of construction stormwater runoff under VPDES general permit registration VAR10E-293. Following project completion and site stabilization, all discharges will be non-contact stormwater.

The Outfall 503 drainage area is approximately 53.6 acres. A legacy ash disposal site occupies approximately 8 acres of the drainage area, and the remainder is offsite wooded terrain. The ash fill site has protective cover and well-established vegetation that is regularly mowed and visually inspected. The Plant does not store any materials within the Outfall 503 drainage area. The diversion system consists partially of a concrete collection channel and energy dissipator basin totaling approximately 1 acre of impervious surface area. It is proposed that when Ash Pond 1A/1B is closed, surface runoff and non-contact infiltration from the cap will also discharge via Outfall 503. Appendix I contains a request to incorporate Outfall 503 into the reissued permit.

Outfalls 801, 802, and 803 – Possum Hollow Landfill Stormwater Management

Three stormwater management ponds were constructed as part of the Possum Hollow Landfill. Details of each pond and associated outfall are discussed below:

- Outfall 801 is the discharge point from the pond identified as the Haul Road Pond. It collects stormwater runoff primarily from the asphalt haul road via a roadside ditch. Approximately 25.12 acres drain to the Haul Road Pond, which was sized to handle the water quality volume specified by the VSMP regulations. The outlet of the pond is considered Outfall 801 and discharges to Possum Hollow, a tributary of the Clinch River.

- Outfall 802 is the discharge point for the stormwater pond identified as the North Pond. It collects runoff from a portion of the asphalt haul road via a roadside ditch, as well as runoff from vegetated areas around the landfill (North landfill buttress). Groundwater interceptor drains also drain into the North Pond. The tributary area is approximately 50.6 acres and the pond was sized to handle the water quality volume specified by the VSMP regulations. Outfall 802 also discharges to Possum Hollow.

- Outfall 803 is the discharge point from the pond known as the South Pond. It collects stormwater runoff from vegetated areas around the landfill (South landfill buttress). Groundwater interceptor drains also drain into the South Pond. Approximately 15.8 acres drain to the South Pond, which was sized to handle the water quality volume specified by the VSMP regulations. Outfall 803 discharges to an unnamed tributary which has no surface connection to waters of the United States.

At the time of the last VPDES permit renewal (December 2009) Outfalls 801, 802, and 803 were not yet constructed. A complete EPA Form 2F was submitted in July 2012 for each outfall following construction and final stabilization of all tributary areas. As of the date of this application, no coal combustion by-products have been disposed in the Possum Hollow Landfill.

Note 3: Herbicide Use

Portions of the Plant property undergo scheduled herbicide treatment on an annual basis. The primary herbicides used are Accord® and Pendulum®, or a similar product. Each is mixed in accordance with manufacturers' recommendations. The stormwater drainage areas affected by herbicide application are Outfalls 001, 003, 007, and 727. Areas surrounding the AWWTP and Cooling Towers 2, 3, and 4 are also included within the scheduled spraying program. Stormwater runoff from these areas is in the form of sheet flow.

Note 4: Non-Stormwater Discharges

The outfalls identified on EPA Form 2F have all been visually inspected or identified based on knowledge of Plant operations to be free of non-stormwater discharges. The drainage points directly observed include Outfalls 501, 502, 727, 731, 736-740, and 801-803. Observations took place in accordance with the monthly visual inspection requirement in the Plant's Stormwater Pollution Prevention Plan.

Note 5: Significant Leaks or Spills

There is no history of significant leaks or spills of toxic or hazardous substances occurring in the past 3 years in the drainage areas of the outfalls identified on Form 2F. However, a list of all oil and other spills that have occurred at Clinch River Plant in the past three years is included below:

January 25, 2013 – Unanticipated bypass of approximately 10,000 gallons of circulating cooling water from a flume overflow at the AWWTP due to a faulty high level alarm.

May 23, 2013 – Release of approximately 1,000 gallons of non-contact stormwater from the Possum Hollow Landfill Leachate Collection Sump due to malfunction of an automated control valve.

April 25, 2014 – Equipment failure resulted in fuel oil reaching Sump 004, which was then transferred to the AWWTP. A sheen was observed on the Clinch River and subsequently controlled with floating booms and absorbent materials. Due to partial containment of the spill at its source and within the AWWTP, the full spill volume is unknown.

Note 6: Representative Data for Stormwater Outfalls

The Company believes the following outfalls qualify as representative discharges for the reasons described below.

Outfalls 736-740

As described in Note 1, Outfalls 736-740 collect non-contact stormwater runoff from the active CCB landfill and convey it to the Clinch River. Each outfall is similar with regard to industrial activity, materials stored, land use characteristics, and stormwater management practices within the drainage area. As such, the Company and DEQ have historically agreed that Outfalls 736-740 are similar to the extent that stormwater characterized at any one outfall is representative of that discharged from all five. Storm event sampling for the purpose of this application will be performed at any one of Outfalls 736-740 and the water quality data obtained will be reported for each outfall.

Outfalls 501 and 502

As described in Note 1, Outfalls 501 and 502 discharge surface runoff and non-contact infiltration from the cap of Ash Pond 2 following pond closure. Each outfall drains a portion of the capped pond, as well as runoff from tributary areas up-gradient of the pond. The cap system is uniform in design and construction over the entire pond surface, and the off-site drainage areas are alike in terms of slope, soil type, ground cover, etc. As such, the Company believes that these outfalls qualify as representative discharges. Storm event sampling was performed at Outfall 502 and the water quality data obtained is being reported for both outfalls.

Outfalls 801-803

As described in Note 1, Outfalls 801, 802 and 803 each drain a portion of the Possum Hollow Landfill. Under normal operations, stormwater discharges from each of these three outfalls can be reasonably expected to be similar due to industrial activity, materials storage, land use characteristics, and stormwater management practices within each drainage area. To date, no waste has been placed in the Possum Hollow Landfill. Storm event sampling for the purpose of this application will be performed at any one of Outfalls 801-803 and the water quality data obtained will be reported for each outfall.

EPA Form 2A for Outfall 008

FACILITY NAME AND PERMIT NUMBER:
Clinch River Plant - VPDES Permit No. VA0001015

Form Approved 1/14/99
OMB Number 2040-0086

FORM **2A** NPDES

NPDES FORM 2A APPLICATION OVERVIEW

APPLICATION OVERVIEW

Form 2A has been developed in a modular format and consists of a "Basic Application Information" packet and a "Supplemental Application Information" packet. The Basic Application Information packet is divided into two parts. All applicants must complete Parts A and C. Applicants with a design flow greater than or equal to 0.1 mgd must also complete Part B. Some applicants must also complete the Supplemental Application Information packet. The following items explain which parts of Form 2A you must complete.

BASIC APPLICATION INFORMATION:

A. **Basic Application Information for all Applicants.** All applicants must complete questions A.1 through A.8. A treatment works that discharges effluent to surface waters of the United States must also answer questions A.9 through A.12.

B. **Additional Application Information for Applicants with a Design Flow ≥ 0.1 mgd.** All treatment works that have design flows greater than or equal to 0.1 million gallons per day must complete questions B.1 through B.6.

C. **Certification.** All applicants must complete Part C (Certification).

SUPPLEMENTAL APPLICATION INFORMATION:

D. **Expanded Effluent Testing Data.** A treatment works that discharges effluent to surface waters of the United States and meets one or more of the following criteria must complete Part D (Expanded Effluent Testing Data):

1. Has a design flow rate greater than or equal to 1 mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to provide the information.

E. **Toxicity Testing Data.** A treatment works that meets one or more of the following criteria must complete Part E (Toxicity Testing Data):

1. Has a design flow rate greater than or equal to 1 mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to submit results of toxicity testing.

F. **Industrial User Discharges and RCRA/CERCLA Wastes.** A treatment works that accepts process wastewater from any significant industrial users (SIUs) or receives RCRA or CERCLA wastes must complete Part F (Industrial User Discharges and RCRA/CERCLA Wastes). SIUs are defined as:

1. All industrial users subject to Categorical Pretreatment Standards under 40 Code of Federal Regulations (CFR) 403.6 and 40 CFR Chapter I, Subchapter N (see instructions); and
2. Any other industrial user that:
   a. Discharges an average of 25,000 gallons per day or more of process wastewater to the treatment works (with certain exclusions); or
   b. Contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the treatment plant; or
   c. Is designated as an SIU by the control authority.

G. **Combined Sewer Systems.** A treatment works that has a combined sewer system must complete Part G (Combined Sewer Systems).

ALL APPLICANTS MUST COMPLETE PART C (CERTIFICATION)

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BASIC APPLICATION INFORMATION

PART A. BASIC APPLICATION INFORMATION FOR ALL APPLICANTS:

All treatment works must complete questions A.1 through A.8 of this Basic Application Information packet.

A.1. Facility Information.

Facility name: Appalachian Power Company - Clinch River Plant

Mailing Address: 1 Riverside Plaza
Columbus, OH 43215

Contact person: Alan R. Wood, P.E.

Title: Director, Water & Ecological Resource Services

Telephone number: (614) 716-1233

Facility Address (not P.O. Box): 3464 Power Plant Road
Cleveland, VA 24225

A.2. Applicant Information. If the applicant is different from the above, provide the following:

Applicant name: Same as above

Mailing Address: ______

Contact person: ______

Title: ______

Telephone number: ______

Is the applicant the owner or operator (or both) of the treatment works?

✓ owner   ✓ operator

Indicate whether correspondence regarding this permit should be directed to the facility or the applicant.

___ facility   ✓ applicant

A.3. Existing Environmental Permits. Provide the permit number of any existing environmental permits that have been issued to the treatment works (include state-issued permits).

NPDES: VA0001015
UIC: N/A
RCRA: VAD980554596
PSD: N/A
Other: VA Air Pollution Control Permit 10236
Other: VA Solid Waste Permits 223 and 607

A.4. Collection System Information. Provide information on municipalities and areas served by the facility. Provide the name and population of each entity and, if known, provide information on the type of collection system (combined vs. separate) and its ownership (municipal, private, etc.).

Name	Population Served	Type of Collection System	Ownership
Clinch River Plant	Approximately 125	Separate	Private

Total population served ______

A.5. Indian Country.

a. Is the treatment works located in Indian Country?

___ Yes ✓ No

b. Does the treatment works discharge to a receiving water that is either in Indian Country or that is upstream from (and eventually flows through) Indian Country?

___ Yes ✓ No

A.6. Flow. Indicate the design flow rate of the treatment plant (i.e., the wastewater flow rate that the plant was built to handle). Also provide the average daily flow rate and maximum daily flow rate for each of the last three years. Each year's data must be based on a 12-month time period with the 12th month of "this year" occurring no more than three months prior to this application submittal.

a. Design flow rate 0.012 mgd

	Two Years Ago (2012)	Last Year (2013)	This Year (2014)	
b. Annual average daily flow rate	0.0037 MGD	0.0012 MGD	0.0016 MGD	mgd
c. Maximum daily flow rate	0.036 MGD	0.0055 MGD	0.006 MGD	mgd

A.7. Collection System. Indicate the type(s) of collection system(s) used by the treatment plant. Check all that apply. Also estimate the percent contribution (by miles) of each.

✓ Separate sanitary sewer 100 %

___ Combined storm and sanitary sewer ___ %

A.8. Discharges and Other Disposal Methods.

a. Does the treatment works discharge effluent to waters of the U.S.? ✓ Yes ___ No

If yes, list how many of each of the following types of discharge points the treatment works uses:

i. Discharges of treated effluent 1

ii. Discharges of untreated or partially treated effluent 0

iii. Combined sewer overflow points 0

iv. Constructed emergency overflows (prior to the headworks) 0

v. Other ___ 0

b. Does the treatment works discharge effluent to basins, ponds, or other surface impoundments that do not have outlets for discharge to waters of the U.S.? ___ Yes ✓ No

If yes, provide the following for each surface impoundment:

Location: N/A

Annual average daily volume discharged to surface impoundment(s) ___ mgd

Is discharge ___ continuous or ___ intermittent?

c. Does the treatment works land-apply treated wastewater? ___ Yes ✓ No

If yes, provide the following for each land application site:

Location: ___

Number of acres: ___

Annual average daily volume applied to site: ___ Mgd

Is land application ___ continuous or ___ intermittent?

d. Does the treatment works discharge or transport treated or untreated wastewater to another treatment works? ___ Yes ✓ No

If yes, describe the mean(s) by which the wastewater from the treatment works is discharged or transported to the other treatment works (e.g., tank truck, pipe).

____

If transport is by a party other than the applicant, provide:

Transporter name: ____________

Mailing Address: ____________

Contact person: ____________

Title: ____________

Telephone number: ____________

For each treatment works that receives this discharge, provide the following:

Name: ____________

Mailing Address: ____________

Contact person: ____________

Title: ____________

Telephone number: ____________

If known, provide the NPDES permit number of the treatment works that receives this discharge. ____________

Provide the average daily flow rate from the treatment works into the receiving facility. ____________ mgd

e. Does the treatment works discharge or dispose of its wastewater in a manner not included in A.8.a through A.8.d above (e.g., underground percolation, well injection)? ____ Yes ✓ No

If yes, provide the following for each disposal method:

Description of method (including location and size of site(s) if applicable):

____

Annual daily volume disposed of by this method: ____________

Is disposal through this method ____ continuous or ____ intermittent?

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WASTEWATER DISCHARGES:

If you answered "yes" to question A.8.a, complete questions A.9 through A.12 **once for each outfall** (including bypass points) through which effluent is discharged. Do not include information on combined sewer overflows in this section. **If you answered "no" to question A.8.a**, go to Part B, "Additional Application Information for Applicants with a Design Flow Greater than or Equal to 0.1 mgd."

A.9. Description of Outfall.

a. Outfall number: 008

b. Location:
Cleveland (City or town, if applicable) — 24225 (Zip Code)
Russell (County) — Virginia (State)
36° 55' 54" (Latitude) — -82° 12' 06" (Longitude)

c. Distance from shore (if applicable): N/A ft.

d. Depth below surface (if applicable): N/A ft.

e. Average daily flow rate: 0.0021 (9/10-12/14) mgd

f. Does this outfall have either an intermittent or a periodic discharge? ___ Yes ✓ No (go to A.9.g.)

If yes, provide the following information:

Number of times per year discharge occurs: N/A

Average duration of each discharge: N/A

Average flow per discharge: N/A mgd

Months in which discharge occurs: N/A

g. Is outfall equipped with a diffuser? ___ Yes ✓ No

A.10. Description of Receiving Waters.

a. Name of receiving water: Clinch River

b. Name of watershed (if known): Upper Clinch River

United States Soil Conservation Service 14-digit watershed code (if known): N/A

c. Name of State Management/River Basin (if known): Tennessee and Big Sandy Rivers

United States Geological Survey 8-digit hydrologic cataloging unit code (if known): 06010205

d. Critical low flow of receiving stream (if applicable):
acute 48.0 cfs chronic 55.7 cfs

e. Total hardness of receiving stream at critical low flow (if applicable): ________ mg/l of $CaCO_3$

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A.11. Description of Treatment.

a. What levels of treatment are provided? Check all that apply.

✓ Primary ✓ Secondary

✓ Advanced ____ Other. Describe: ____________

b. Indicate the following removal rates (as applicable):

Design BOD_5 removal or Design $CBOD_5$ removal 96 %

Design SS removal 94 %

Design P removal 20 %

Design N removal 20 %

Other ____________ ____________ %

c. What type of disinfection is used for the effluent from this outfall? If disinfection varies by season, please describe.

Ultraviolet radiation

If disinfection is by chlorination, is dechlorination used for this outfall? ____ Yes ____ No

d. Does the treatment plant have post aeration? ✓ Yes ____ No

A.12. Effluent Testing Information. All Applicants that discharge to waters of the US must provide effluent testing data for the following parameters. Provide the indicated effluent testing required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. At a minimum, effluent testing data must be based on at least three samples and must be no more than four and one-half years apart.

Outfall number: 008

PARAMETER	MAXIMUM DAILY VALUE		AVERAGE DAILY VALUE		
	Value	Units	Value	Units	Number of Samples
pH (Minimum)	6.1	s.u.			
pH (Maximum)	8.4	s.u.			
Flow Rate	0.036	MGD	0.0021	MGD	936
Temperature (Winter)	30	°C	17.8	°C	432
Temperature (Summer)	34	°C	24.9	°C	432

* For pH please report a minimum and a maximum daily value

POLLUTANT		MAXIMUM DAILY DISCHARGE		AVERAGE DAILY DISCHARGE			ANALYTICAL METHOD	ML / MDL
		Conc.	Units	Conc.	Units	Number of Samples		
CONVENTIONAL AND NONCONVENTIONAL COMPOUNDS.								
BIOCHEMICAL OXYGEN DEMAND (Report one)	BOD-5	10.5	mg/L	<2	mg/L	52		2.00 mg/L
	CBOD-5							
FECAL COLIFORM		BDL	MPN/0.1 L			1	SM 9221 C E	1.80 MPN/0.1L
TOTAL SUSPENDED SOLIDS (TSS)		21	mg/L	4.9	mg/L	52	SM 4500-H+B	1.00 mg/L

END OF PART A.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

FACILITY NAME AND PERMIT NUMBER:

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BASIC APPLICATION INFORMATION

PART C. CERTIFICATION

All applicants must complete the Certification Section. Refer to instructions to determine who is an officer for the purposes of this certification. All applicants must complete all applicable sections of Form 2A, as explained in the Application Overview. Indicate below which parts of Form 2A you have completed and are submitting. By signing this certification statement, applicants confirm that they have reviewed Form 2A and have completed all sections that apply to the facility for which this application is submitted.

Indicate which parts of Form 2A you have completed and are submitting:

✓ Basic Application Information packet

Supplemental Application Information packet:

_____ Part D (Expanded Effluent Testing Data)

_____ Part E (Toxicity Testing: Biomonitoring Data)

_____ Part F (Industrial User Discharges and RCRA/CERCLA Wastes)

_____ Part G (Combined Sewer Systems)

ALL APPLICANTS MUST COMPLETE THE FOLLOWING CERTIFICATION.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and official title: John M. McManus, VP Environmental Services

Signature: John M McManus

Telephone number: (614) 716-1268

Date signed: 3/10/15

Upon request of the permitting authority, you must submit any other information necessary to assess wastewater treatment practices at the treatment works or identify appropriate permitting requirements.

SEND COMPLETED FORMS TO:

Form 2A Notes

Note 1: Outfall 008 – Sewage Treatment Plant

The domestic sewage treatment plant serving Clinch River Plant uses a modified activated sludge treatment process, which includes extended aeration and a tertiary filter system. The treatment facility has a design capacity of 12,000 gallons per day, and consists of:

- One (1) 6,100-gallon surge tank
- One (1) 3,100-gallon sludge holding chamber
- One (1) 12,000-gallon aeration chamber
- One (1) 5,200-gallon clarifier
- One (1) 320-gallon dosing chamber
- Tertiary filter system

Wastewater is processed by six (6) treatment stages as it passes through the sewage treatment plant. The stages include:

1. Pretreatment (grinding and screening)
2. Aeration
3. Clarification
4. Filtration
5. Ultraviolet radiation
6. Post-aeration

Wastewater flows from the sanitary facilities in the Plant to the inlet surge chamber, where larger solids are shredded and screened through the bar screen. From the surge chamber, the wastewater is pumped at a controlled rate to the aeration chamber, which is designed for a 24-hour retention time. In this chamber the incoming sewage is mixed with activated sludge containing bacteria and other microorganisms.

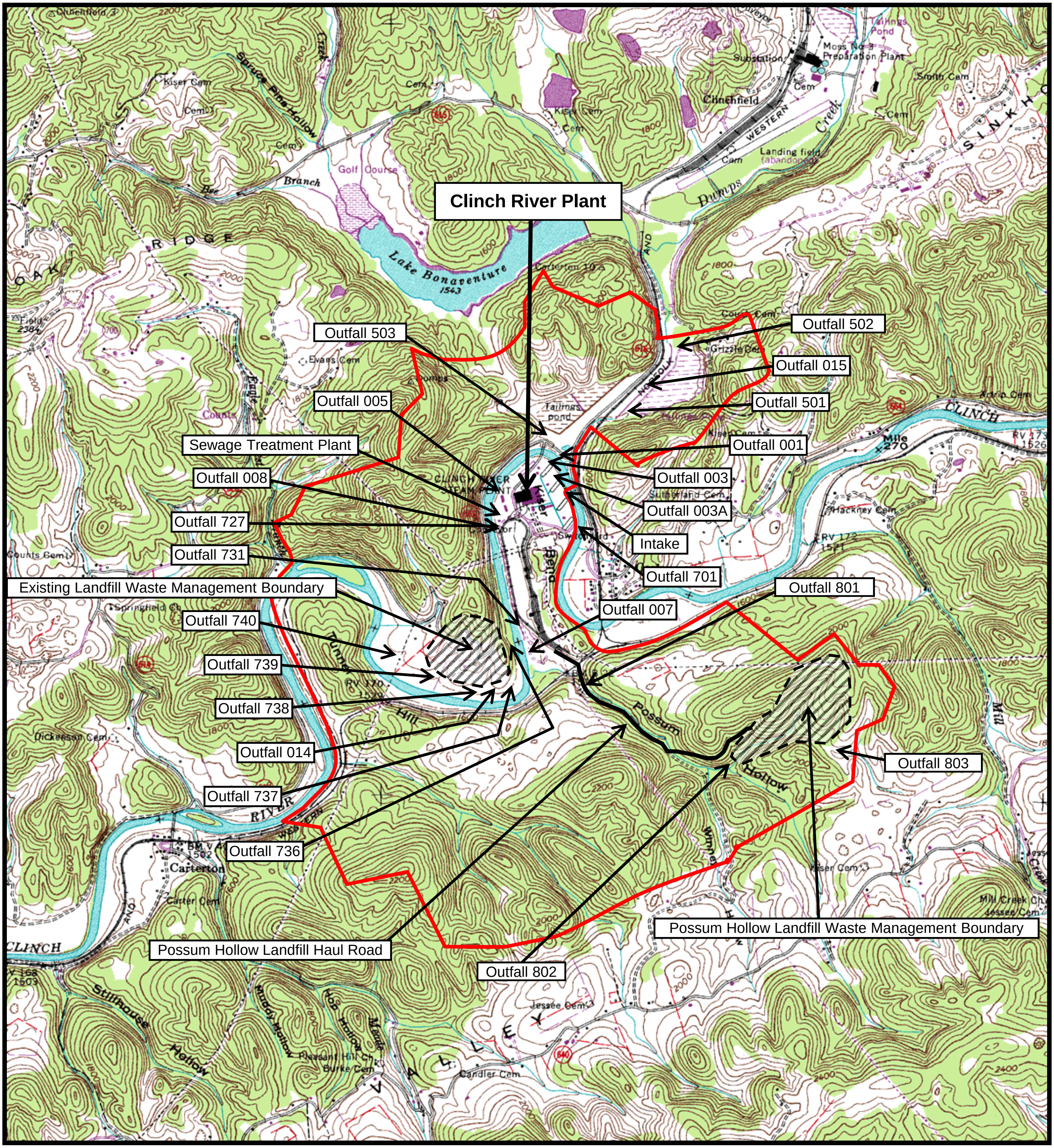
Wastewater flows by gravity from the aeration chamber into the clarifier where solids are skimmed and the activated sludge settles to the bottom. Both the floating solids and the settled sludge are re-circulated back to the aeration chamber. The clarified wastewater then passes into the tertiary treatment unit which consists of two (2) gravity filters that contain beds of sand and anthracite filter media. The filters are backwashed automatically and the backwash water is recirculated back to the inlet surge chamber.

After passing through the tertiary treatment system, the wastewater is disinfected using a bank of ultraviolet lamps that provide a minimum dosage of 50,000 microwatt-seconds per square centimeter. The disinfected wastewater then passes via gravity to a 6-inch diameter discharge pipe to the Clinch River at invert elevation 1503.0 feet.

Almost the full flow to the sewage treatment plant consists of sanitary wastewater generated at the Plant. However, a small amount of the total flow (maximum of approximately 100 gpd) is generated from operation of the Plant laboratory.

Figures

Figure 1



Plant Boundary (not actual survey, for general info only)

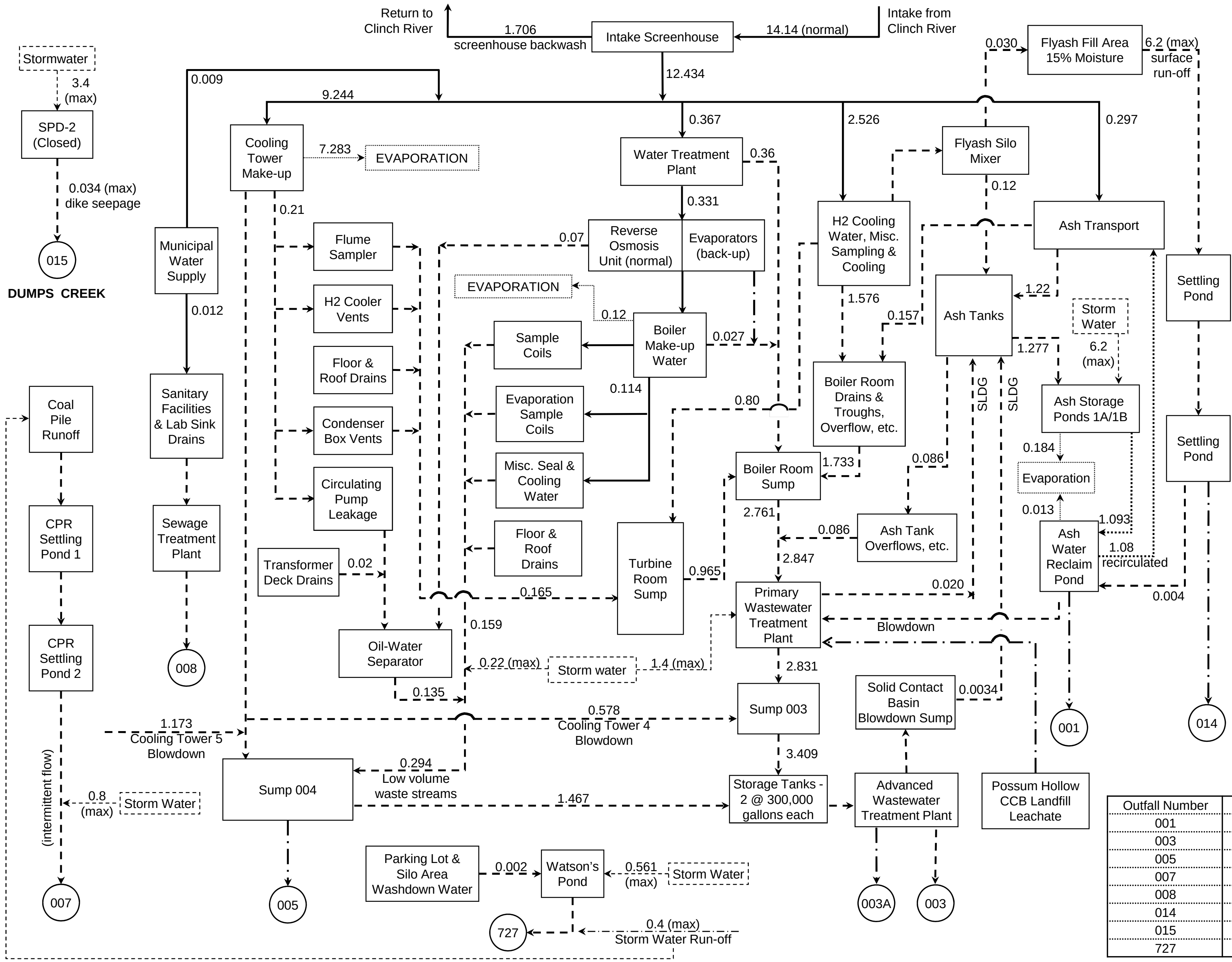
02.16.15

Appalachian Power Company
Clinch River Plant
VPDES Permit No. VA0001015
Outfall Location Map

Plant Latitude 36° 55' 58"
Plant Longitude 82° 11' 59"

AEP

Figure 2



Clinch River Plant

Water Balance Diagram
Units 1, 2 & 3

LEGEND

- Supply Water
- Waste Water
- Reclaim Water
- Storm Water
- Evaporation
- No flow associated with normal operating conditions (emergency overflow)
- ### Outfall Number

NOTES

Note 1: All flows represent average water usage with all units operating at full load.

Note 2: Maximum (max) flows include rainfall for a 10-year, 24-hour storm event.

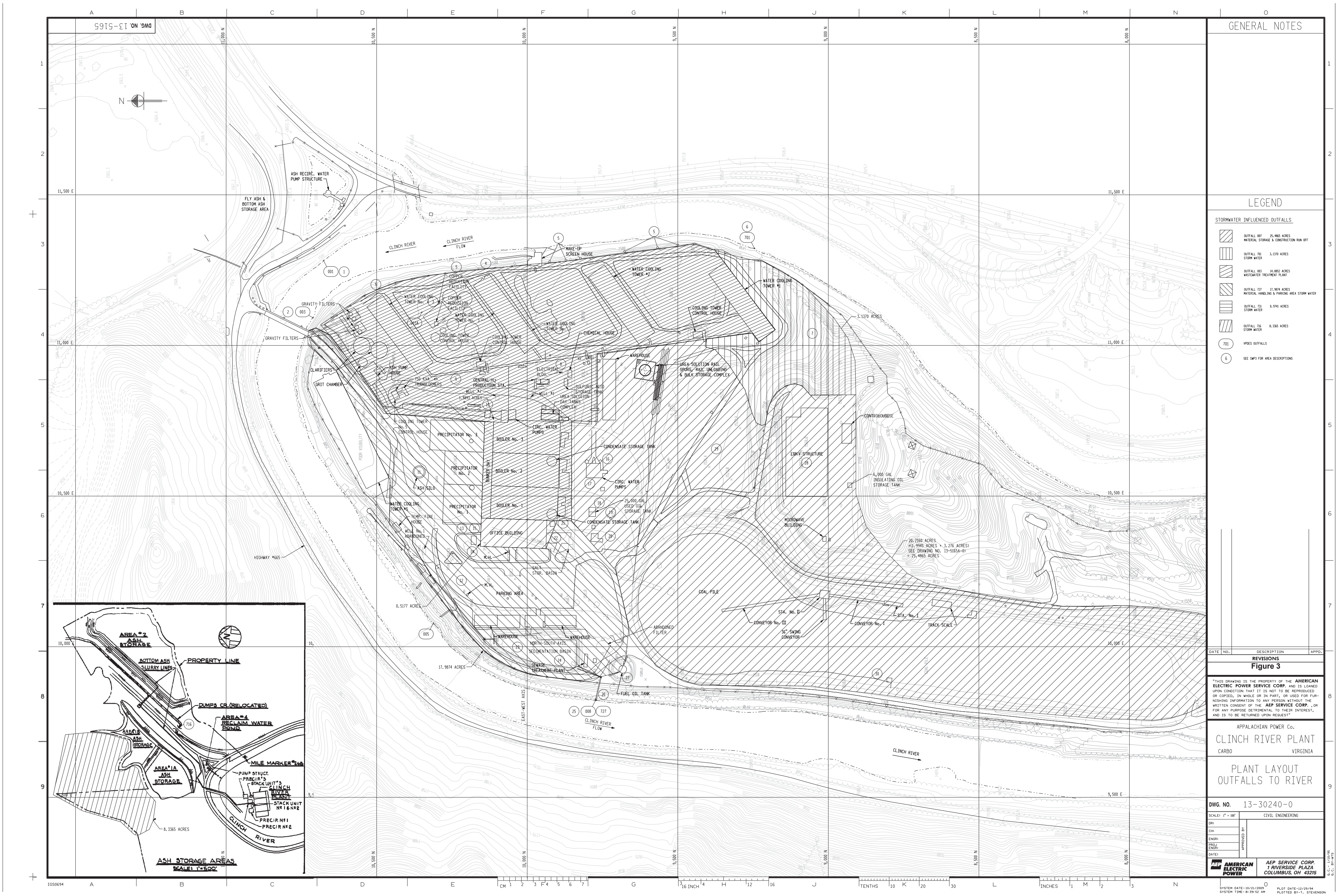
Note 3: Advanced Wastewater Treatment Plant maximum design capacity - 7.776 mgd (outfall 003).

All flows estimated based on design, unless indicated otherwise, and expressed in million gallons per day (MGD)

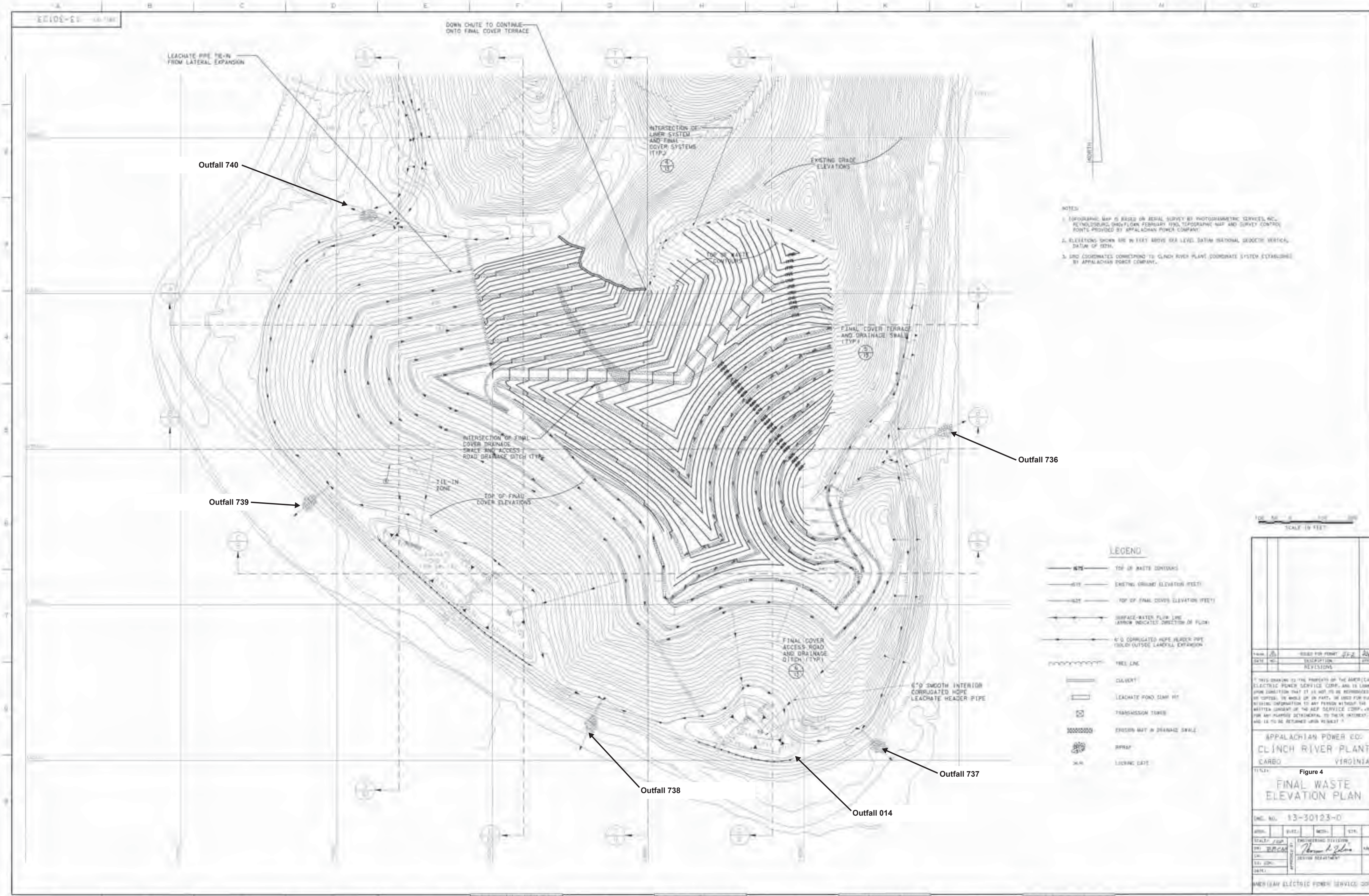
02.15.14

Water & Ecological Resource Services AEP

Outfall Number	Receiving Water	2014 Average Flow
001	Clinch River	0 (No Discharge)
003	Clinch River	1.53 MGD
005	Clinch River	0 (No Discharge)
007	Clinch River	0.0072 MGD
008	Clinch River	0.0016 MGD
014	Clinch River	0 (No Discharge)
015	Dumps Creek	0.0025 MGD
727	Clinch River	0 (No Discharge)



GENERAL NOTES
LEGEND
STORMWATER INFLUENCED OUTFALLS
OUTFALL 007 25.4865 ACRES
MATERIAL STORAGE & CONSTRUCTION RUN OFF
OUTFALL 701 3.1370 ACRES
STORM WATER
OUTFALL 003 14.8852 ACRES
WASTEWATER TREATMENT PLANT
OUTFALL 727 17.9874 ACRES
MATERIAL HANDLING & PARKING AREA STORM WATER
OUTFALL 731 0.9741 ACRES
STORM WATER
OUTFALL 716 8.3365 ACRES
STORM WATER
701 VPDES OUTFALLS
6 SEE SWP3 FOR AREA DESCRIPTIONS
DATE NO. DESCRIPTION APPD.
REVISIONS
Figure 3
"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP. ,OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST"
APPALACHIAN POWER Co.
CLINCH RIVER PLANT
CARBO VIRGINIA
PLANT LAYOUT
OUTFALLS TO RIVER
DWG. NO. 13-30240-0
SCALE: 1" = 100'
CIVIL ENGINEERING
DR:
CH:
ENGR:
PROJ ENGR:
DATE:
APPROVED BY
AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215
SYSTEM DATE-10/21/2009
SYSTEM TIME-8:39:52 AM
PLOT DATE-12/29/94
PLOTTED BY-T. STEVENSON
Q.C. - 1/10/95
Q.C. BY-WTS
DWG. NO. 13-5165
CLINCH RIVER
CLINCH RIVER FLOW
MAKE-UP SCREEN HOUSE
WATER COOLING TOWER #2
WATER COOLING TOWER #1
COOLING TOWER CONTROL HOUSE
3.1370 ACRES
CHEMICAL HOUSE
WAREHOUSE
UREA SOLUTION RAIL SPURS, RAIL UNLOADING & BULK STORAGE COMPLEX
GRAVITY FILTERS
CLARIFIERS
GRIT CHAMBER
ASH PUMP HOUSE
CENTRAL H2 PRODUCTION STK.
CIRC. WATER PUMPS
PRECIPITATOR No. 3
PRECIPITATOR No. 2
PRECIPITATOR No. 1
BOILER No. 3
BOILER No. 2
BOILER No. 1
CONDENSATE STORAGE TANK
138KV STRUCTURE
6,000 GAL INSULATING OIL STORAGE TANK
MICROWAVE BUILDING
20.2160 ACRES
(1.9945 ACRES + 3.276 ACRES)
SEE DRAWING NO. 13-5165A-01
+ 25.4865 ACRES
ASH SILO
WATER COOLING TOWER #3
OFFICE BUILDING
SALT STOR. BASIN
PARKING AREA
COAL PILE
CONVEYOR No. 3
CONVEYOR No. 1
TRACK SCALE
0.5177 ACRES
17.9874 ACRES
NORTH-SOUTH AXIS
SEDIMENTATION BASIN
SEWAGE TREATMENT PLANT
FUEL OIL TANK
EAST-WEST AXIS
HIGHWAY #665
FLY ASH & BOTTOM ASH STORAGE AREA
ASH RECIRC. WATER PUMP STRUCTURE
8.3365 ACRES
ASH STORAGE AREAS
SCALE: 1"=500'
AREA #2 ASH STORAGE
BOTTOM ASH SLURRY LINES
PROPERTY LINE
DUMPS CR. (RELOCATED)
AREA #4 RECLAIM WATER POND
AREA #1B ASH STORAGE
AREA #1A ASH STORAGE
MILE MARKER #268
CLINCH RIVER
CLINCH RIVER PLANT



Outfall 740
Outfall 736
Outfall 739
Outfall 738
Outfall 014
Outfall 737
DOWN CHUTE TO CONTINUE ONTO FINAL COVER TERRACE
LEACHATE PIPE TIE-IN FROM LATERAL EXPANSION
INTERSECTION OF LINER SYSTEM AND FINAL COVER SYSTEMS (TYP.)
EXISTING GRADE ELEVATIONS
TOP OF WASTE CONTOURS
FINAL COVER TERRACE AND DRAINAGE SWALE (TYP.)
INTERSECTION OF FINAL COVER DRAINAGE SWALE AND ACCESS ROAD DRAINAGE DITCH (TYP.)
TIE-IN ZONE
TOP OF FINAL COVER ELEVATIONS
FINAL COVER ACCESS ROAD AND DRAINAGE DITCH (TYP.)
6"Ø SMOOTH INTERIOR CORRUGATED HDPE LEACHATE HEADER PIPE
NORTH
NOTES:
SCALE IN FEET
LEGEND
TOP OF WASTE CONTOURS
EXISTING GROUND ELEVATION (FEET)
TOP OF FINAL COVER ELEVATION (FEET)
SURFACE-WATER FLOW LINE (ARROW INDICATES DIRECTION OF FLOW)
TREE LINE
CULVERT
LEACHATE POND SUMP PIT
TRANSMISSION TOWER
EROSION MAT IN DRAINAGE SWALE
RIPRAP
LOCKING GATE
REVISIONS
APPALACHIAN POWER CO.
CLINCH RIVER PLANT
CARBO VIRGINIA
Figure 4
FINAL WASTE ELEVATION PLAN
DWG. NO. 13-30123-0
ENGINEERING DIVISION
DESIGN DEPARTMENT
AMERICAN ELECTRIC POWER SERVICE CORP.

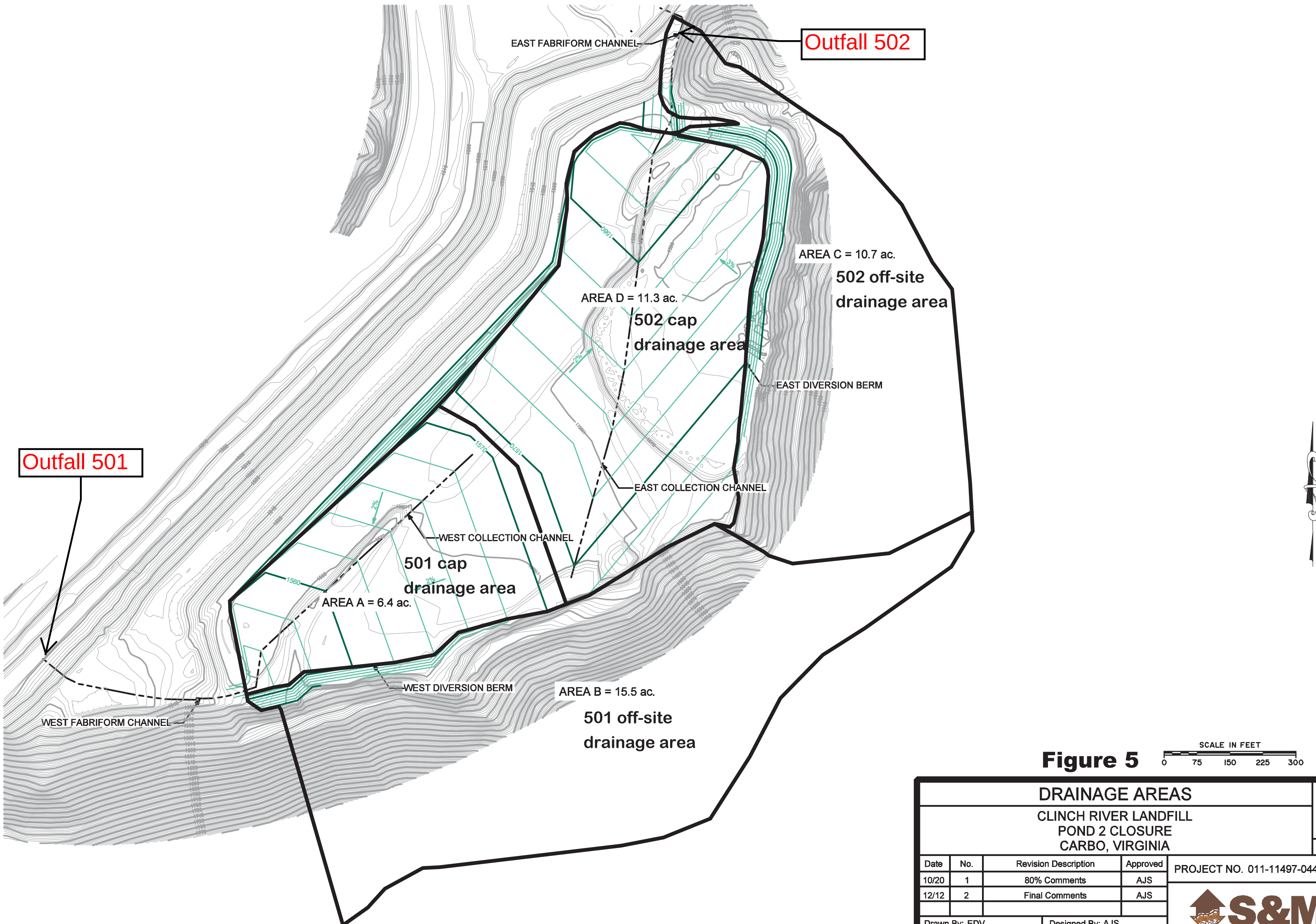


Figure 5

DRAINAGE AREAS

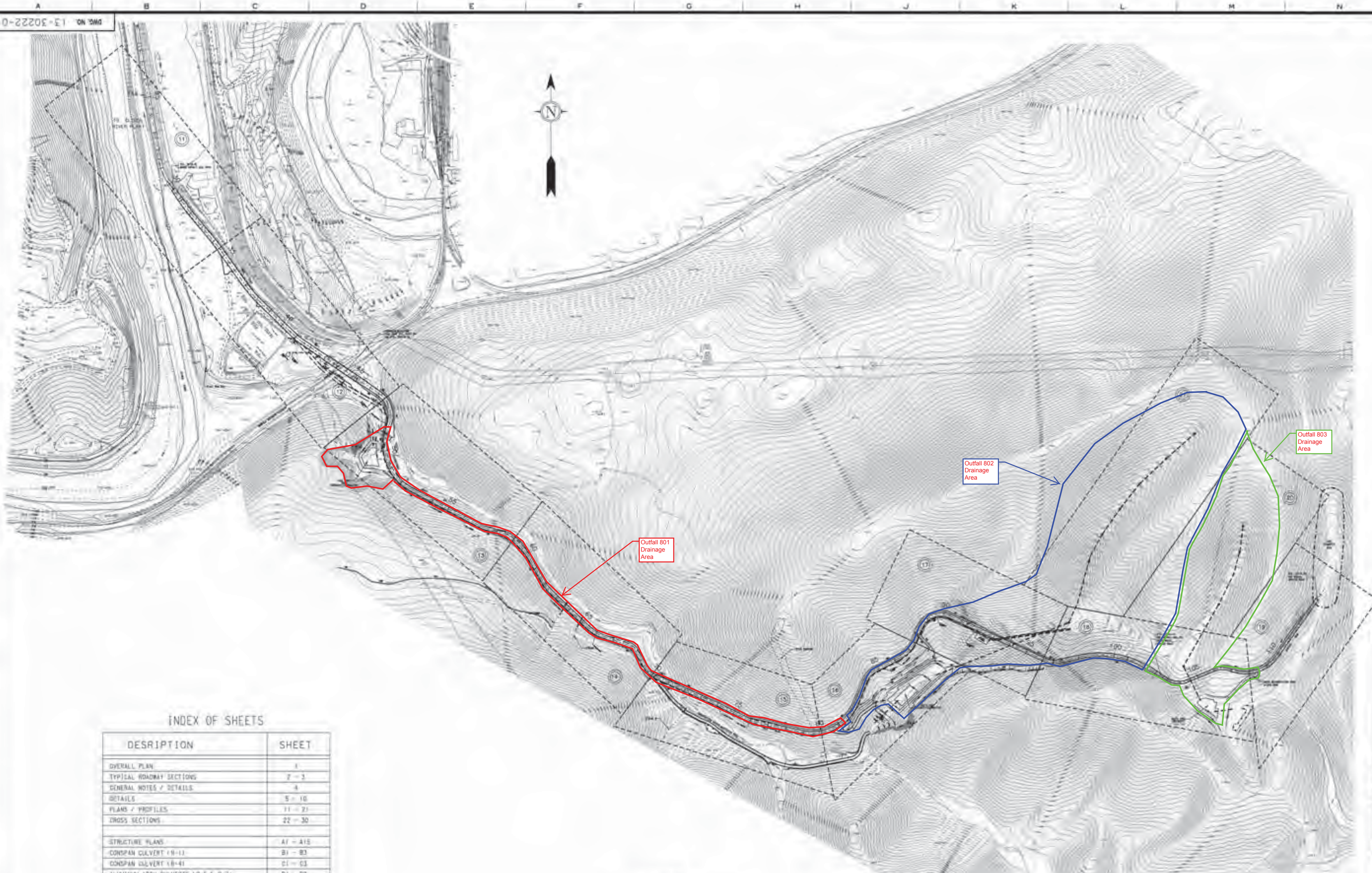
CLINCH RIVER LANDFILL
POND 2 CLOSURE
CARBO, VIRGINIA

Date	No.	Revision Description	Approved
10/20	1	80% Comments	AJS
12/12	2	Final Comments	AJS

PROJECT NO. 011-11497-044

Drawn By: EDV | Designed By: AJS
Approved By: MGR | Date: 9/12/08
Scale: 1" = 300'

S&ME
WWW.SMEINC.COM



INDEX OF SHEETS

DESRIPTION	SHEET
OVERALL PLAN	1
TYPICAL ROADWAY SECTIONS	2 - 3
GENERAL NOTES / DETAILS	4
DETAILS	5 - 10
PLANS / PROFILES	11 - 21
CROSS SECTIONS	22 - 30
STRUCTURE PLANS	A1 - A15
CONSPAN CULVERT (R-1)	B1 - B3
CONSPAN CULVERT (R-4)	C1 - C3
ALUMINUM ARCH CULVERTS (R-6 & R-7)	D1 - D2
RISER DETAILS	R1 - R2

LEGEND

PLAN / PROFILE SHEET NUMBER

MAP REFERENCES:

CLINCH RIVER PLANT SITE NEAR CARBO, RUSSELL COUNTY, VIRGINIA. PREPARED BY GeoOne, REYNOLDSBURG, OHIO FROM AERIAL PHOTOGRAPHY DATED 4-13-01. ORIGINAL SCALE 1 INCH EQUALS 100 FEET AND A CONTOUR INTERVAL OF 2 FEET.

CLINCH RIVER-PROPOSED FGD LANDFILL SITE NEAR CARBO, RUSSELL COUNTY, VIRGINIA. PREPARED BY AIR SURVEY, DULLES, VIRGINIA FROM AERIAL PHOTOGRAPHY DATED 3-04-06. ORIGINAL SCALE 1 INCH EQUALS 100 FEET AND A CONTOUR INTERVAL OF 2 FEET.

GRAPHIC SCALE 1"=200'

gai consultants

DRAWING NUMBER C060244-04-040-02-H-M001

	1	ISSUED FOR CONSTRUCTION ADDED SHEETS R1 AND R2	
	0	ISSUED FOR BIDDING	RKH
	B	ISSUED FOR ES/SWM PERMIT	
DATE	NO.	DESCRIPTION	APPD.

REVISIONS

APPALACHIAN POWER CO.

CLINCH RIVER PLANT

CARBO VIRGINIA

POSSUM HOLLOW HAUL ROAD

OVERALL PLAN

Figure 6: Outfall Drainage Areas

DWG. NO. 13-30222-01-1

CIVIL ENGINEERING DIVISION

AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA COLUMBUS, OH 43215

VPDES Permit Application Addendum

VPDES Permit Application Addendum

1. **Entity to whom the permit is to be issued**: Appalachian Power Company

Who will be legally responsible for the wastewater treatment facilities and compliance with the permit? This may or may not be the facility or property owner.

2. **Is this facility located within city or town boundaries?** Yes ☐ No ☒

3. **Provide the tax map parcel number for the land where the discharge is located.** 140A

4. **For the facility to be covered by this permit, how many acres will be disturbed during the next five years due to new construction activities?** Approximately 23 acres for closure of Pond 1A/1B and gas pipeline installation

5. **What is the design average effluent flow of this facility?** 7.74 MGD

For industrial facilities, provide the max. 30-day average production level, include units:

N/A

In addition to the design flow or production level, should the permit be written with limits for any other discharge flow tiers or production levels? Yes ☐ No ☒

If "Yes", please identify the other flow tiers (in MGD) or production levels:

Please consider the following questions for both the flow tiers and the production levels (if applicable): Do you plan to expand operations during the next five years? Is your facility's design flow considerably greater than your current flow?

6. **Nature of operations generating wastewater**:

Condenser cooling water, ash transport, leachate, other miscellaneous cooling and seal waters, various plant sumps, etc.

____ % of flow from domestic connections/sources

Number of private residences to be served by the treatment works: ____

100 % of flow from non-domestic connections/sources

7. **Mode of discharge**: ☒ Continuous ☒ Intermittent ☐ Seasonal

Describe frequency and duration of intermittent or seasonal discharges:

The coal pile runoff retention basins and Plant stormwater runoff basin are discharged manually on an as-needed basis.

8. **Identify the characteristics of the receiving stream at the point just above the facility's discharge point:**

X Permanent stream, never dry

____ Intermittent stream, usually flowing, sometimes dry

____ Ephemeral stream, wet-weather flow, often dry

____ Effluent-dependent stream, usually or always dry without effluent flow

____ Lake or pond at or below the discharge point

____ Other: ____

9. **Approval Date(s)**:

O & M Manual February 1997 **Sludge/Solids Management Plan** N/A

Have there been any changes in your operations or procedures since the above approval dates? Yes ☐ No ☒

Appendix A

Outfall Descriptions

Outfall 001 – Reclaim Pond Overflow

Bottom ash, fly ash, pyrites, and wastewater treatment plant sludge are routinely sluiced to Ash Pond 1A/1B for settling and disposal. Pond 1A/1B also periodically receives rinse water associated with non-chemical metal cleaning operations and air heater wash water. This differs from a spent chemical metal cleaning solvent. The concentrated spent cleaning solvent and dilution water generated during chemical metal cleaning operations are presently incinerated in an operating boiler. After a period of settling, the Pond 1A/1B supernatant is decanted to the Reclaim Pond and later pumped back to the Plant for reuse. The Reclaim Pond also receives water collected in the active CCB landfill leachate ponds and seepage from the Pond 1A/1B dike system. Under normal conditions wastewater in the Reclaim Pond is recycled in a closed system and the Reclaim Pond does not discharge.

Excess water (blowdown) from the Reclaim Pond is normally diverted to the primary wastewater treatment plant (WWTP) via a 4-inch connection from the reclaim water header to the ash tank overflow pipe. The blowdown is then treated in the WWTP, followed by additional treatment in the advanced wastewater treatment plant (AWWTP) prior to discharge to the Clinch River via Outfall 003/003A.

In the event that rainfall runoff into the reclaim pond exceeds the capacity of the system, the pond has an emergency overflow which is identified as Outfall 001. The overflow conveys water to the Clinch River via a 30-inch concrete pipe at invert elevation 1498.3 feet.

Outfall 003/003A – Advanced Wastewater Treatment Plant (AWWTP) Effluent

The AWWTP treats cooling tower blowdown, effluent from the primary WWTP, and other miscellaneous low-volume wastewaters. These flows are collected in two 300,000-gallon storage tanks and then treated in one of two separate but parallel treatment trains specifically designed for the removal of copper from the final effluent. The entire normal wastewater flow can be treated by one of the trains, thus allowing for system maintenance on one train without a system bypass. Each treatment train has a hydraulic capacity of 2,700 gpm or 3.9 MGD. The removal of copper and other metals is facilitated by addition of metals-reduction polymer(s). The remainder of the AWWTP is the same as conventional physical/chemical water treatment systems: rapid mix and reaction tanks, clarifiers, and gravity filters. The precipitate, or sludge, which settles in the clarifiers, is comingled with bottom ash transport water and disposed in the ash settling pond complex. Caustic is added to the process when needed to control pH In the past, metals (specifically copper) removal was achieved through an adsorption/co-precipitation process involving the addition of an iron salt. The adsorption/co-precipitation process remains a viable alternative to the polymer treatment method.

Each of the two identical AWWTP treatment trains includes the following equipment:

- (1) 300,000-gallon collection tank
- (1) pH adjustment tank
- (1) reaction tank
- (1) solids contact basin (clarifier)
- (2) gravity filter cells

Three half-capacity supply pumps transfer wastewater from the collection tanks to the head of the dual line treatment plant. Flow through each train is then by gravity to the pH adjustment tank, reaction tank, solids contact basin, gravity filter, and the clearwell. The clearwell is then discharged by gravity to the Clinch River via Outfall 003.

Metals reduction polymer(s) and caustic, when needed, are fed to the inlet of the pH adjustment tank along with recovered wash water, when available. Polymer is fed proportionally to flow rate, and caustic when pH adjustment is necessary to stay within the permitted limits of 6.0 – 9.0 S.U.

The conditioned wastewater flows from the pH adjustment tank to the reaction tank, where mixing occurs. The reaction tank feeds into the clarifier, at which point polymer is fed with the influent as a coagulant aid. Additional solids contact time, improved coagulation, and phase separation occurs in the clarifier. The clarifier sludge containing copper and other metals is separated and concentrated prior to transfer to the ash tanks. The clarified supernatant then flows by gravity to the gravity filter.

The gravity filter is a valve-less dual-media filter utilizing sand and anthracite. Filtration removes additional suspended solids that were not removed in the clarifier. The filtration step is an important part of the copper reduction treatment process to ensure compliance with the final effluent limit. After passing through the filter, flow is directed into the clearwell, from which almost all is discharged by gravity to the Clinch River via Outfall 003/003A. A small amount of water in the clearwell is used for filter backwash, filter surface wash, and other wash-down and chemical feed operations. Filter backwash is collected in the wash water recovery basin and returned to the front end of the treatment system.

Outfall 003A is simply an alternate discharge point for Outfall 003 during extremely high river conditions. If the river level is such that hydraulic head pressure prevents the effluent from gravity draining from the normal discharge line to Outfall 003, the treated wastewater will discharge via Outfall 003A. It is estimated that discharge from 003A will occur when the river level reaches an approximate elevation of 1506 feet.

Sources of wastewater entering the two 300,000-gallon storage tanks prior to treatment include various low-volume wastewater streams, cooling tower blowdown, and effluent from the primary WWTP. A more detailed discussion of the sources of this wastewater and the type of treatment it undergoes prior to final treatment in the AWWTP is outlined below.

Sump 003 – WWTP Discharge and Cooling Tower Blowdown

Wastewater Treatment Plant

The primary WWTP treatment equipment consists of:

- One (1) 30-foot diameter grit chamber
- Two (2) 50-foot diameter reinforced concrete thickener clarifiers
- Four (4) automatic valve-less gravity filters
- Two (2) acid injection systems for pH control
- One (1) carbon dioxide injection system for pH control (not currently in use; serves as backup to the acid injection system)
- Associated equipment such as pumps, electrical controls, recorder, and alarms.

Inputs to the WWTP include the following:

- Boiler room sumps from each of the three units, consisting of:
    - Overflow from clinker grinder sumps
    - Overflow from the ash hoppers
    - Boiler drains and blowdown
    - Ash pit sumps
    - Air pre-heater wash water
    - Boiler room floor drains and troughs
    - Treated water filter plant wastewater
- Overflow from the ash tanks
- Ash tank house sump
- Electrostatic precipitator (ESP) sumps
- Excess water from the reclaim pond
- Surface runoff and leachate from CCB Landfill (Permit No. 223)
- Turbine room sumps
- Intermittent discharges of general plant wastewaters that are compatible with the treatment system operations

These inputs either flow by gravity or are pumped to the grit chamber, where heavier particles settle to the bottom and are removed by grit pumps. Wastewater then flows through a mixing chamber in the grit chamber where it may undergo pH neutralization by sulfuric acid or carbon dioxide. Polymer(s) (anion and/or cation) may be added to aid in settlability. With the addition of the AWWTP downstream of the WWTP, pH neutralization in the mixing chamber has not been necessary. However, both pH adjustment systems remain in place in the event that neutralization is necessary.

After sedimentation, mixing, and neutralization occur in the grit chamber, wastewater flows through two Parshall flumes into the two thickener clarifiers. Both Parshall flumes are equipped with flow transmitters and recorders, as well as screens for the removal of floating ash cenospheres. The clarifiers have rotating surface skimmers for the removal of remaining floating solids, and sludge blowdown lines for removal of solids that settle to the bottom. Sludge removed from the grit chamber and clarifiers is comingled with ash transport water in the ash tanks, and then pumped to the ash settling pond complex for settling and disposal.

Clarified wastewater flows from the clarifiers into a cascade pit, where it is filtered through four automatic, valve-less gravity filters and recirculated to the bottom of the cascade. Solids collected in the filters are backwashed to a sump and transported with the other sludge to the ash settling pond complex for settling and disposal. An auxiliary acid injection system at the bottom of the cascade is available for further pH reduction if required.

Following gravity filtration, the treated wastewater flows across a rubble channel and enters Sump 003, from which it is pumped to either of the 300,000-gallon AWWTP collection tanks.

Cooling Tower Blowdown

A circulating water flow rate of 110,000 gpm is required for condensing steam in each of the three generating units at Clinch River Plant. In order to provide this large volume of cooling water continuously, the Plant maintains a closed-loop circulating water system. The system includes five mechanical-draft evaporative cooling towers which operate at a maximum five (5) cycles of concentration. The towers are identified as Cooling Towers 1 – 5. Cooling Towers 1-4 provide cooling water to Units 1 and 2 and Cooling Tower 5 provides cooling water to Unit 3. The circulating cooling water for each unit is pumped to the main turbine condensers, where it collects waste heat from steam at the end of the power generation cycle. The heated cooling water then flows to the cooling towers where waste heat is dissipated. After passing through the cooling towers and decreasing in temperature, the cooling water completes the closed loop by returning to the circulating water pumps via open concrete flumes.

The circulating water system for each unit is treated individually with a Nalco® (or equivalent) biocide containing chlorine and bromine for approximately 90 minutes per day. The treated cooling water is de-chlorinated with sodium bisulfate until levels of residual chlorine are not detectable. Plant personnel monitor the de-chlorination process to ensure that a sufficient amount of sodium bisulfate is added to the water. The biocide treatment is administered in such a way that the treated contents of the circulating water system can be entirely contained until the water can be de-chlorinated. In addition to the biocide treatment, the circulating water is treated with sulfuric acid for pH control and with an inorganic phosphate to prohibit corrosion and reduce the blowdown frequency. This corrosion inhibitor also reduces the amount of sulfuric acid needed for pH control.

Cooling tower blowdown/emergency overflows from Cooling Tower 4 are also directed to Sump 003. This alternate cooling tower blowdown point can be used on a routine basis for the blowdown of any one or combination of towers 1-4 during routine operations, in the event that Cooling Tower 5 is unavailable for service. Cooling Tower 5 blowdown typically goes to Sump 004 as described below.

Sump 004 – Cooling Tower Blowdown and Miscellaneous Low Volume Waste Streams

Cooling Tower Blowdown

Discharges from Cooling Tower 5, which can include cumulative blowdown from any of the five cooling towers and emergency overflow from Cooling Tower 5, enter Sump 004 and are pumped to the AWWTP storage tanks.

Miscellaneous Low Volume Waste Streams

Low volume waste streams associated with the following sources are combined in a concrete catch basin and routed to Sump 004 for transport to the AWWTP:

- Miscellaneous oil/water separator flows from various sources within the plant, including runoff from the transformer deck drains and circulating pump leakage.
- Reject water from the reverse osmosis water treatment system
- Various low-volume non-contact cooling water systems
- Runoff from floor and roof drains
- Overflows/leakage from the salt basin in the water softening treatment system

Outfall 005 – Sump 004 Overflow

Outfall 005 is the overflow point for Sump 004, and under normal conditions it does not flow. In the event that the sump pumps at Sump 004 were to fail, notwithstanding pump redundancy, flow would accumulate within the sump and back up to the catch basin leading to the former discharge point for the Plant’s low volume waste streams, identified as Outfall 005. A masonry plug was installed near the outlet end of this outfall in 1999 to prevent such backups from reaching the river through Outfall 005.

Outfall 007 – Coal Storage Area Runoff

Stormwater runoff from the coal storage area and surrounding plant areas, which contain miscellaneous material storage areas (used oil, structural steel, etc.) and plant roads, flows by gravity to the coal handling pumping chamber, which is equipped with a floating skimmer. From there it is pumped to the first in a series of two sedimentation ponds also equipped with floating skimmers, vertical slide gates, and manually operated shutoff valves. The No. 1 settling pond encompasses an area of 1.01 acres and has a holding capacity of approximately 483,335 gallons. The No. 2 settling pond is approximately one-third of that size. The partially clarified water is periodically transferred from the No. 1 settling pond to the No.2 settling pond for additional retention time and settling. The clarified water is then manually discharged on an intermittent basis to the Clinch River via a 12-inch polyethylene pipe at invert elevation 1505.0 feet.

Outfall 008 – Sewage Treatment Plant

Please refer to EPA Form 2A and Form 2A Notes.

Outfall 014 - Coal Combustion By-Product (CCB) Landfill

Stormwater runoff and leachate are collected from the Plant's active CCB landfill. The treatment system consists of a series of two (2) sedimentation basins underlain with a 60-mil thick PVC geomembrane liner. The surface areas of the ponds are approximately 1.8 acres and 4.5 acres. The wastewater from the No. 2 settling pond is transferred to the No. 1 settling pond, and then the partially treated wastewater is pumped to the Plant's Reclaim Pond for re-use within the Plant or treatment in the WWTP/AWWTP and discharge via Outfall 003. Previously the discharge from the ponds was piped directly to the primary WWTP; however, complications with the transfer piping led to the system being reconfigured such that the landfill ponds now discharge to the Reclaim Pond.

The sedimentation basins were designed to hold the volume of runoff associated with the 25-year 24-hour storm event. In the event that a storm exceeding the design capacity should occur, supernatant from the No. 1 settling pond can be manually discharged to the Clinch River via a 24-inch concrete pipe at invert elevation 1495.0 feet. The discharge pipe is kept locked under normal circumstances.

Outfall 015 – Ash Pond 2 Dike Seepage to Dumps Creek

Please refer to Appendix F.

Appendix B

VPDES Sewage Sludge Permit Application Form

VPDES SEWAGE SLUDGE PERMIT APPLICATION FORM

SCREENING INFORMATION

This application is divided into sections. Sections A pertain to all applicants. The applicability of Sections B, C and D depend on your facility's sewage sludge use or disposal practices. The information provided on this page will help you determine which sections to fill out.

1. All applicants must complete Section A (General Information).

2. Will this facility generate sewage sludge? _X_Yes __No

   Will this facility derive a material from sewage sludge? __Yes _X_No

   If you answered Yes to either, complete Section B (Generation Of Sewage Sludge Or Preparation Of A Material Derived From Sewage Sludge).

3. Will this facility apply sewage sludge to the land? __Yes _X_No

   Will sewage sludge from this facility be applied to the land? __Yes _X_No

   If you answered No to both questions above, skip Section C.

   If you answered Yes to either, answer the following three questions:

   a. Will the sewage sludge from this facility meet the ceiling concentrations, pollutant concentrations, Class A pathogen reduction requirements and one of the vector attraction reduction requirements 1-8, as identified in the instructions?
   __Yes __No

   b. Will sewage sludge from this facility be placed in a bag or other container for sale or give-away for application to the land? __Yes __No

   c. Will sewage sludge from this facility be sent to another facility for treatment or blending? __Yes __No

   If you answered No to all three, complete Section C (Land Application Of Bulk Sewage Sludge).

   If you answered Yes to a, b or c, skip Section C.

4. Do you own or operate a surface disposal site? __Yes _X_No

   If Yes, complete Section D (Surface Disposal).

SECTION A. GENERAL INFORMATION

All applicants must complete this section.

1. Facility Information.
   a. Facility name: Clinch River Plant
   b. Contact person: Alan R. Wood, P.E.
      Title: Director, Water & Ecological Resource Services
      Phone: (614)716-1233
   c. Mailing address:
      Street or P.O. Box: 1 Riverside Plaza
      City or Town: Columbus State: OH Zip: 43215
   d. Facility location:
      Street or Route #: 3464 Power Plant Road
      County: Russell
      City or Town: Cleveland State: VA Zip: 24225
   e. Is this facility a Class I sludge management facility? ___Yes _X_No
   f. Facility design flow rate: 0.012 mgd
   g. Total population served: approximately 125
   h. Indicate the type of facility:
      ___ Publicly owned treatment works (POTW)
      _X_ Privately owned treatment works
      ___ Federally owned treatment works
      ___ Blending or treatment operation
      ___ Surface disposal site
      ___ Other (describe):

2. Applicant Information. If the applicant is different from the above, provide the following:
   a. Applicant name: Same as above.
   b. Mailing address:
      Street or P.O. Box:
      City or Town: ____________ State: _______ Zip:
   c. Contact person:
      Title:
      Phone: ( )
   d. Is the applicant the owner or operator (or both) of this facility?
      _____owner _____ operator
   e. Should correspondence regarding this permit be directed to the facility or the applicant? (Check one)
      _____ facility _____ applicant

3. Permit Information.
   a. Facility's VPDES permit number (if applicable): VA0001015
   b. List on this form or an attachment, all other federal, state or local permits or construction approvals received or applied for that regulate this facility's sewage sludge management practices:

Permit Number:	Type of Permit:
N/A	

4. Indian Country. Does any generation, treatment, storage, application to land or disposal of sewage sludge from this facility occur in Indian Country? ___Yes _X_No If yes, describe:

5. Topographic Map. Provide a topographic map or maps (or other appropriate maps if a topographic map is unavailable) that shows the following information. Maps should include the area one mile beyond all property boundaries of the facility:
   a. Location of all sewage sludge management facilities, including locations where sewage sludge is generated, stored, treated, or disposed.
   b. Location of all wells, springs, and other surface water bodies listed in public records or otherwise known to the applicant within 1/4 mile of the property boundaries.

6. Line Drawing. Provide a line drawing and/or a narrative description that identifies all sewage sludge processes that will be employed during the term of the permit including all processes used for collecting, dewatering, storing, or treating sewage sludge, the destination(s) of all liquids and solids leaving each unit, and all methods used for pathogen reduction and vector attraction reduction.

7. Contractor Information. Are any operational or maintenance aspects of this facility related to sewage sludge generation, treatment, use or disposal the responsibility of a contractor? _X_Yes __No
   If yes, provide the following for each contractor (attach additional pages if necessary).
   Name: Blevins Septic Tank Service
   Mailing address:
   Street or P.O. Box: 1762 Middle Valley Road
   City or Town: Lebanon State: VA Zip: 24266
   Phone: (276) 794-9668
   Contractor's Federal, State or Local Permit Number(s) applicable to this facility's sewage sludge:
   Virginia Department of Health Permit No. 197-04

   If the contractor is responsible for the use and/or disposal of the sewage sludge, provide a description of the service to be provided to the applicant and the respective obligations of the applicant and the contractor(s).

8. Pollutant Concentrations. Using the table below or a separate attachment, provide sewage sludge monitoring data for the pollutants which limits in sewage sludge have been established in 9 VAC 25-31-10 et seq. for this facility's expected use or disposal practices. All data must be based on three or more samples taken at least one month apart and must be no more than four and one-half years old.

POLLUTANT	CONCENTRATION (mg/kg dry weight)	SAMPLE DATE	ANALYTICAL METHOD	DETECTION LEVEL FOR ANALYSIS
Arsenic	N/A			
Cadmium	N/A			
Chromium	N/A			
Copper	N/A			
Lead	N/A			
Mercury	N/A			
Molybdenum	N/A			
Nickel	N/A			
Selenium	N/A			
Zinc	N/A			

9. Certification. Read and submit the following certification statement with this application. Refer to the instructions to determine who is an officer for purposes of this certification. Indicate which parts of the application you have completed and are submitting:

   _X__Section A (General Information)
   _X__Section B (Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge)
   ____Section C (Land Application of Bulk Sewage Sludge)

____Section D (Surface Disposal)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and official title: John M. McManus, VP Environmental Services

Signature John M. McManus Date Signed 3/10/15

Telephone number (614)716-1268

Upon request of the department, you must submit any other information necessary to assess sewage sludge use or disposal practices at your facility or identify appropriate permitting requirements.

SECTION B. GENERATION OF SEWAGE SLUDGE OR PREPARATION OF A MATERIAL DERIVED FROM SEWAGE SLUDGE

Complete this section if your facility generates sewage sludge or derives a material from sewage sludge

1. Amount Generated On Site.
   Total dry metric tons per 365-day period generated at your facility: Removed as wet sludge; approx. 3250-6500 gal/yr ____ dry metric tons

2. Amount Received from Off Site. If your facility receives sewage sludge from another facility for treatment, use or disposal, provide the following information for each facility from which sewage sludge is received. If you receive sewage sludge from more than one facility, attach additional pages as necessary.
   a. Facility name: __N/A__
   b. Contact Person:
      Title:
      Phone ( )
   c. Mailing address:
      Street or P.O. Box:
      City or Town:_____________________ State:________ Zip:
   d. Facility Address:
      (not P.O. Box)
   e. Total dry metric tons per 365-day period received from this facility:_________________ dry metric tons
   f. Describe, on this form or on another sheet of paper, any treatment processes known to occur at the off-site facility, including blending activities and treatment to reduce pathogens or vector attraction characteristics:

3. Treatment Provided at Your Facility.
   a. Which class of pathogen reduction is achieved for the sewage sludge at your facility?
      ___Class A ___Class B _X_ Neither or unknown
   b. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce pathogens in sewage sludge: Treatment provided at this facility consists of flow equalization, tertiary filtration and ultraviolet disinfection.
   c. Which vector attraction reduction option is met for the sewage sludge at your facility?
      ___ Option 1 (Minimum 38 percent reduction in volatile solids)
      ___ Option 2 (Anaerobic process, with bench-scale demonstration)
      ___ Option 3 (Aerobic process, with bench-scale demonstration)
      ___ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)
      ___ Option 5 (Aerobic processes plus raised temperature)
      ___ Option 6 (Raise pH to 12 and retain at 11.5)
      ___ Option 7 (75 percent solids with no unstabilized solids)
      ___ Option 8 (90 percent solids with unstabilized solids)
      _X_ None or unknown
   d. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce vector attraction properties of sewage sludge: __N/A__
   e. Describe, on this form or another sheet of paper, any other sewage sludge treatment activities, including blending, not identified in a - d above: __N/A__

4. Preparation of Sewage Sludge Meeting Ceiling and Pollutant Concentrations, Class A Pathogen Requirements and One of Vector Attraction Reduction Options 1-8 (EQ Sludge).
   (**If sewage sludge from your facility does not meet all of these criteria, skip Question 4.**)
   a. Total dry metric tons per 365-day period of sewage sludge subject to this section that is applied to the land:
      _____________ dry metric tons
   b. Is sewage sludge subject to this section placed in bags or other containers for sale or give-away?
      __Yes __No

5. Sale or Give-Away in a Bag or Other Container for Application to the Land.
(**Complete this question if you place sewage sludge in a bag or other container for sale or give-away prior to land application. Skip this question if sewage sludge is covered in Question 4.**)
   a. Total dry metric tons per 365-day period of sewage sludge placed in a bag or other container at your facility for sale or give-away for application to the land:__________ dry metric tons
   b. Attach, with this application, a copy of all labels or notices that accompany the sewage sludge being sold or given away in a bag or other container for application to the land.

6. Shipment Off Site for Treatment or Blending.
(**Complete this question if sewage sludge from your facility is sent to another facility that provides treatment or blending. This question does not apply to sewage sludge sent directly to a land application or surface disposal site. Skip this question if the sewage sludge is covered in Questions 4 or 5. If you send sewage sludge to more than one facility, attach additional sheets as necessary.**)
   a. Receiving facility name: Town of St. Paul Sewage Treatment Plant
   b. Facility contact:
      Title: Plant Operator
      Phone: (276) 762-9575
   c. Mailing address:
      Street or P.O. Box: 16435 Bush Drive
      City or Town: St. Paul State: VA Zip: 24283
   d. Total dry metric tons per 365-day period of sewage sludge provided to receiving facility: ________ dry metric tons Removed as wet sludge; approximately 3250-6500 gallons/year
   e. List, on this form or an attachment, the receiving facility's VPDES permit number as well as the numbers of all other federal, state or local permits that regulate the receiving facility's sewage sludge use or disposal practices:

Permit Number:	Type of Permit:
VA0026221	VPDES Municipal Minor

   f. Does the receiving facility provide additional treatment to reduce pathogens in sewage sludge from your facility? ___Yes _X_No
      Which class of pathogen reduction is achieved for the sewage sludge at the receiving facility?
      ___Class A ___Class B _X_Neither or unknown
      Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce pathogens in sewage sludge:

   g. Does the receiving facility provide additional treatment to reduce vector attraction characteristics of the sewage sludge? ___Yes _X_No
      Which vector attraction reduction option is met for the sewage sludge at the receiving facility?
      ___ Option 1 (Minimum 38 percent reduction in volatile solids)
      ___ Option 2 (Anaerobic process, with bench-scale demonstration)
      ___ Option 3 (Aerobic process, with bench-scale demonstration)
      ___ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)
      ___ Option 5 (Aerobic processes plus raised temperature)
      ___ Option 6 (Raise pH to 12 and retain at 11.5)
      ___ Option 7 (75 percent solids with no unstabilized solids)
      ___ Option 8 (90 percent solids with unstabilized solids)
      _X_ None unknown
      Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce vector attraction properties of sewage sludge:

   h. Does the receiving facility provide any additional treatment or blending not identified in f or g above?
      ___Yes _X_No
      If yes, describe, on this form or another sheet of paper, the treatment processes not identified in f or g above:

   i. If you answered yes to f., g or h above, attach a copy of any information you provide to the receiving facility to comply with the "notice and necessary information" requirement of 9VAC 25-31-530.G.

j Does the receiving facility place sewage sludge from your facility in a bag or other container for sale or give-away for application to the land? ___Yes _X_No
If yes, provide a copy of all labels or notices that accompany the product being sold or given away.

k. Will the sewage sludge be transported to the receiving facility in a truck-mounted watertight tank normally used for such purposes? _X_ Yes ___ No. If no, provide description and specification on the vehicle used to transport the sewage sludge to the receiving facility.
Show the haul route(s) on a location map or briefly describe the haul route below and indicate the days of the week and the times of the day sewage sludge will be transported. See attached map. No regular transport schedule is used. The sludge is collected and transported as needed. Over the current permit term the collection frequency has been typically less than once per year.

7. Land Application of Bulk Sewage Sludge.
(**Complete Question 7.a if sewage sludge from your facility is applied to the land, unless the sewage sludge is covered in Questions 4, 5 or 6; complete Question 7.b, c & d only if you are responsible for land application of sewage sludge.**)

a. Total dry metric tons per 365-day period of sewage sludge applied to all land application sites: N/A dry metric tons

b. Do you identify all land application sites in Section C of this application? ___Yes ___No
If no, submit a copy of the Land Application Plan (LAP) with this application (LAP should be prepared in accordance with the instructions).

c. Are any land application sites located in States other than Virginia? ___Yes ___No
If yes, describe, on this form or on another sheet of paper, how you notify the permitting authority for the States where the land application sites are located. Provide a copy of the notification.

d. Attach a copy of any information you provide to the owner or lease holder of the land application sites to comply with the "notice and necessary" information requirement of 9 VAC 25-31-530 F and/or H (Examples may be obtained in Appendix IV).

8. Surface Disposal.
(**Complete Question 8 if sewage sludge from your facility is placed on a surface disposal site.**)

a. Total dry metric tons per 365-day period of sewage sludge from your facility placed on all surface disposal sites: ____N/A____ dry metric tons

b. Do you own or operate all surface disposal sites to which you send sewage sludge for disposal?
___Yes ___No
If no, answer questions c - g for each surface disposal site that you do not own or operate. If you send sewage sludge to more than one surface disposal site, attach additional pages as necessary.

c. Site name or number:

d. Contact person:
Title:
Phone: ( )
Contact is: ___Site Owner ___Site operator

e. Mailing address.
Street or P.O. Box:
City or Town:_____________________ State:________ Zip:

f. Total dry metric tons per 365-day period of sewage sludge from your facility placed on this surface disposal site: ______________ dry metric tons

g. List, on this form or an attachment, the surface disposal site VPDES permit number as well as the numbers of all other federal, state or local permits that regulate the sewage sludge use or disposal practices at the surface disposal site:

Permit Number:	Type of Permit:
______________	
______________	

9. Incineration.

(**Complete Question 9 if sewage sludge from your facility is fired in a sewage sludge incinerator.**)

a. Total dry metric tons per 365-day period of sewage sludge from your facility fired in a sewage sludge incinerator: ____N/A____ dry metric tons

b. Do you own or operate all sewage sludge incinerators in which sewage sludge from your facility is fired? ___Yes ___No

If no, answer questions c - g for each sewage sludge incinerator that you do not own or operate. If you send sewage sludge to more than one sewage sludge incinerator, attach additional pages as necessary.

c. Incinerator name or number:

d. Contact person:
Title:
Phone: ( )
Contact is: ___Incinerator Owner ___Incinerator Operator

e. Mailing address.
Street or P.O. Box:
City or Town:_____________________ State:________ Zip:

f. Total dry metric tons per 365-day period of sewage sludge from your facility fired in this sewage sludge incinerator: __________________ dry metric tons

g. List on this form or an attachment the numbers of all other federal, state or local permits that regulate the firing of sewage sludge at this incinerator:

Permit Number: Type of Permit:
____
____

10. Disposal in a Municipal Solid Waste Landfill.

(**Complete Question 10 if sewage sludge from your facility is placed on a municipal solid waste landfill. Provide the following information for each municipal solid waste landfill on which sewage sludge from your facility is placed. If sewage sludge is placed on more than one municipal solid waste landfill, attach additional pages as necessary.**)

a. Landfill name: __N/A

b. Contact person:
Title:
Phone: ( )
Contact is: ___Landfill Owner ___Landfill Operator

c. Mailing address.
Street or P.O. Box:
City or Town:_____________________ State:________ Zip:

d. Landfill location.
Street or Route #:
County:
City or Town: ___________________ State:________ Zip:

e. Total dry metric tons per 365-day period of sewage sludge placed in this municipal solid waste landfill: ____________________________ dry metric tons

f. List, on this form or an attachment, the numbers of all federal, state or local permits that regulate the operation of this municipal solid waste landfill:

Permit Number: Type of Permit:
____
____

g. Does sewage sludge meet applicable requirements in the Virginia Solid Waste Management Regulation, 9 VAC 20-80-10 et seq., concerning the quality of materials disposed in a municipal solid waste landfill? ___Yes ___No

h. Does the municipal solid waste landfill comply with all applicable criteria set forth in the Virginia Solid Waste Management Regulation, 9 VAC 20-80-10 et seq.? ___Yes ___No

i. Will the vehicle bed or other container used to transport sewage sludge to the municipal solid waste landfill be watertight and covered? ___ Yes ___ No

Show the haul route(s) on a location map or briefly describe the route below and indicate the days of the week and time of the day sewage sludge will be transported.

Appendix C

Summary of Discharge Monitoring Reports

The following tables summarize the effluent water quality data as reported on the Discharge Monitoring Reports (DMRs) over the current permit term. Results of whole effluent toxicity testing performed at the facility over the current permit term are included in Appendix E.

Outfall 003												
2010												
	Flow, avg (MGD)	Flow, max (MGD)	pH, min (S.U.)	pH, max (S.U.)	TRC, avg (µg/L)	TRC, max (µg/L)	Total Copper (µg/L)	Ammonia (mg/L)	TSS (mg/L)	O&G (mg/L)	Chromium (µg/L)	Zinc (µg/L)
September	2.2	4.4	7.7	8.4	<QL	<QL	<QL		N/A	<QL	<QL	0.008
October	1.7	2.9	7.9	8.3	<QL	<QL	<QL	19	<QL			
November	1.5	2.4	7.8	8.4	<QL	<QL	<QL	5.8				
December	1.5	2.9	8.3	8.7	<QL	<QL	<QL	28				
2011												
January	2.3	3.9	7.8	8.1	<QL	<QL	<QL	20	17	<QL	0.002	0.008
February	2.1	3.2	7.8	8.6	<QL	<QL	<QL	25				
March	2.4	3.6	7.9	8.2	<QL	<QL	17	6				
April	2.06	3	7.8	8.2	<QL	<QL	<10	3	5			
May	1.9	3.1	8.0	8.1	<QL	<QL	<10	0.174				
June	2	3.6	7.8	8.2	<QL	<QL	35	3				
July	2.23	3.47	7.7	7.9	16	20	14	1	<QL			
August	1.54	3.02	7.8	8.0	14	20	21.9	0.2				
September	2.15	3.41	7.7	8.0	10	20	11	24				
October	1.11	2.32	7.7	8.0	5	14	15	2	1.7			
November	1.34	2.85	7.5	7.9	20	20	17	0.1				
December	1.47	2.66	7.5	7.9	10	20	10.5	0.05				
2012												
January	2.18	3.35	7.9	8.1	1	10	9	<QL	<QL	<QL	<QL	<QL
February	1.74	3.55	7.9	8.1	10	20	16	0.3				
March	1.85	2.83	7.8	8.1	13	20	1.3	3.27				
April	1.65	2.66	7.7	8.1	13	20	8.8	0.61	3.4			
May	1.85	2.81	7.5	7.9	18	20	<QL	<QL				
June	1.58	3.17	7.9	8.0	20	30	8.5	0.24				
July	1.74	2.77	7.4	8.1	<QL	<QL	37	6.07	3.7			
August	1.74	4.54	7.7	8.2	<QL	<QL	11	0.6				
September	2.11	3.18	7.4	8.2	<QL	<QL	21	0.28				
October	1.39	2.41	8.0	8.3	<QL	<QL	10	0.12	2.6			
November	1.49	3.47	7.9	8.0	<QL	<QL	11	<QL				
December	1.19	2.72	7.7	8.3	<QL	<QL	5.1	<QL				
2013												
January	1.99	4.24	7.9	8.3	<QL	<QL	<QL	0.65	<QL	<QL	0.015	<QL
February	1.47	3.22	7.6	8.1	<QL	<QL	15.6	0.29				
March	0.97	2.07	7.3	8.1	<QL	<QL	2.9	0.55				
April	0.88	2.19	7.3	8.3	<QL	<QL	13.8	0.2	4.8			
May	1.48	2.48	7.3	8.0	<QL	<QL	4.7	0.33				
June	1.54	2.79	7.5	7.6	<QL	<QL	6.6	<QL				
July	1.46	2.78	7.4	8.1	<QL	<QL	3.8	<QL	4.4			
August	1.2	2.45	7.4	8.1	<QL	<QL	28	0.26				
September	1.4	3	7.4	8.2	<QL	<QL	24.8	<QL				
October	1.01	1.79	7.8	8.2	<QL	<QL	31	<QL	5.2			
November	1.4	2.4	7.5	8.2	<QL	<QL	19.2	1.67				
December	1.83	2.59	7.8	8.1	<QL	<QL	<QL	2.14				
2014												
January	1.68	3.44	7.7	8.1	<QL	<QL	18.4	0.97	13.2	<QL	0.003 (avg), 0.004 (max)	0.003 (avg), 0.004 (max)
February	2.02	3.06	7.6	8.1	<QL	<QL	16.8	2.28				
March	1.71	2.59	7.4	8.1	<QL	<QL	15.1	3.2				
April	1.52	2.64	7.5	8.0	<QL	<QL	16	0.54	2.2			
May	1.36	2.59	7.3	8.0	<QL	<QL	4.8	3.7				
June	1.36	2.47	7.2	8.0	<QL	<QL	3	<QL				
July	0.93	2.01	7.6	7.9	<QL	<QL	9.4	<QL	2.5			
August	0.89	2.2	7.5	8.0	<QL	<QL	5.7	0.2				
September	2.26	3.63	7.0	8.1	<QL	<QL	11.1	0.64				
October	1.87	3.16	7.8	8.2	<QL	<QL	13.4	<QL	5.4			
November	1.65	2.58	7.5	7.9	<QL	<QL	11.5	0.75				
December	1.13	2.64	7.7	8.5	<QL	<QL	10.3	1.02				

*Please see Appendix E for a summary of toxicity testing data.

Outfall 007						
2010						
	Flow, avg (MGD)	Flow, max (MGD)	pH, min (S.U.)	pH, max (S.U.)	TSS (mg/L)	Oil & Grease (mg/L)
September	0.01	0.17	8.4	8.4	<4.0	
October	0.004	0.13	8	8	23	
November	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
December	0.0086	0.13	7.9	8	9.2	<QL
2011						
January	0.0043	0.13	7.8	7.8	6.3	
February	0.0043	0.13	7.4	7.4	6.3	
March	0.013	0.13	7.8	8	31	
April	0.02	0.131	7.6	8	<QL	
May	0.017	0.131	7.6	7.9	<5.0	
June	0.004	0.131	8	8	<QL	<QL
July	0.014	0.131	7.8	8.4	8	
August	0.008	0.13	7.8	8.4	5.2	
September	0.008	0.13	7.8	8.3	<QL	
October	0.008	0.13	8.2	8.2	3.3	
November	0.017	0.13	7.6	8.2	9.3	
December	0.008	0.13	8	8.1	10.8	<QL
2012						
January	0.004	0.13	7.6	7.6	2.6	
February	0.004	0.13	8.3	8.3	6	
March	0.0344	0.13	7.9	8.3	13.4	
April	0.0144	0.13	7.9	8.3	8.8	
May	0.0081	0.13	7.8	8.3	15.8	
June	0.004	0.13	7.8	7.8	2.8	<QL
July	0.0067	0.13	7.7	7.9	14.9	
August	0.004	0.13	8	8	4.7	
September	0.004	0.13	7.8	7.8	18.7	
October	0.0067	0.13	7.5	8	10.5	
November	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
December	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	<QL
2013						
January	0.0067	0.133	6.8	7.7	18	
February	0.018	0.13	6.9	7.8	28.1	
March	0.004	0.13	7.6	7.6	7.5	
April	0.018	0.13	6.7	7.3	12.6	
May	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
June	0.0125	0.13	7.6	7.9	4.1	<QL
July	0.012	0.13	7.7	8	4.4	
August	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
September	0.0125	0.13	6.9	7.7	61.4	
October	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
November	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
December	0.014	0.31	6.8	7.5	11.6	<QL
2014						
January	0.0134	0.133	6.7	7.8	9	
February	0.0167	0.13	7.9	8	7.4	
March	0.0029	0.13	7.7	7.7	2.4	
April	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
May	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
June	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	ND
July	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	
August	0.004	0.13	7.6	7.6	7.8	
September	0.0042	0.13	8	8	2.2	
October	0.0081	0.13	6.6	7.4	7.6	
November	0.004	0.13	7.5	7.5	<QL	
December	0.004	0.13	8	8	1.5	<QL

*Please see Appendix E for a summary of toxicity testing data.

Outfall 008									
2010									
	Flow (MGD)		**pH (SU)**		**BOD-5**		**TSS**		***E. coli***
	Average	Maximum	Minimum	Maximum	Avg (mg/L)	Avg (kg/d)	Average (mg/L)	Average (kg/d)	Average (N/CML)
September	0.0033	0.006	7.5	7.7	2.4	0.02	<4.0	<0.04	<QL
October	0.0041	0.01	7.5	8.4	2.6	0.04	<4.0	<QL	2
November	0.0045	0.0075	6.9	8.0	<QL	<QL	<4.0	<QL	1
December	0.0048	0.0101	7.4	8.1	3.3	0.085	<QL	<QL	<QL
2011									
January	0.0031	0.0076	7.3	8.3	<QL	<QL	<4.0	<0.11	<QL
February	0.0018	0.0104	7.2	7.9	<QL	<QL	<QL	<QL	2
March	0.0011	0.0058	7.4	7.9	10	0.12	21	0.26	1
April	0.003	0.0118	7.0	8.1	<QL	<QL	5	0.06	<2
May	0.0018	0.0072	7.3	7.9	2.34	0.04	10	0.18	<QL
June	0.0011	0.0041	7.3	7.7	3.91	0.001	17.8	0.004	9
July	0.0008	0.004	7.2	7.8	5	0.0053	14	0.0148	6.2
August	0.0003	0.001	7.2	7.8	8.7	0.001	13	0.001	10.2
September	0.0004	0.0015	7.4	7.5	4	0.0081	4	0.0091	1.65
October	0.0003	0.0008	7.0	7.7	3.08	0.0056	18	0.0328	4.34
November	0.0024	0.006	7.0	7.8	9.8	0.18	18	0.33	11
December	0.0002	0.0006	6.9	8.0	10.5	0.0024	10.8	0.0025	5.2
2012									
January	0.0004	0.0011	7.0	8.0	9.71	0.0017	12	0.002	69
February	0.0013	0.0125	7.1	7.8	4.21	0.0233	8.8	0.0487	39
March	0.005	0.036	7.0	7.7	<QL	<QL	<QL	<QL	<QL
April	0.0083	0.0158	6.9	7.8	<QL	<QL	<QL	<QL	<QL
May	0.0061	0.0107	7.0	7.7	<QL	<QL	<QL	<QL	<QL
June	0.0059	0.0198	6.7	7.9	<QL	<QL	<QL	<QL	<QL
July	0.008	0.0129	6.8	8.1	<QL	<QL	<QL	<QL	1
August	0.0039	0.0149	7.3	8.4	<QL	<QL	5.3	0.0282	2
September	0.0012	0.0023	7.2	8.1	<QL	<QL	<QL	<QL	1
October	0.0012	0.0024	7.2	8.2	<QL	<QL	1.4	0.0117	1
November	0.0016	0.0053	7.1	7.9	<QL	<QL	<QL	<QL	1
December	0.001	0.0016	6.8	7.8	<QL	<QL	<QL	<QL	1
2013									
January	0.001	0.0022	6.4	7.8	<QL	<QL	<QL	<QL	1
February	0.0008	0.002	6.5	7.7	<QL	<QL	2.1	0.0074	1
March	0.0011	0.0024	6.5	8.1	4.9	0.0077	2.3	0.165	1
April	0.0014	0.0117	6.8	8.1	<QL	<QL	1.5	0.0023	1
May	0.0009	0.0017	6.7	7.7	<QL	<QL	<QL	<QL	1
June	0.001	0.002	6.7	7.8	<QL	<QL	1.1	0.0033	1
July	0.0009	0.0016	6.7	7.9	<QL	<QL	<QL	<QL	1
August	0.0005	0.001	6.9	7.9	2.11	0.0063	<QL	<QL	1
September	0.0007	0.0017	6.8	7.8	<QL	<QL	3.6	0.011	1
October	0.0018	0.0055	6.8	7.8	<QL	<QL	6.3	0.044	1
November	0.0018	0.0034	6.9	8.2	<QL	<QL	1.1	0.0072	1
December	0.0022	0.0041	6.8	7.8	<QL	<QL	<QL	<QL	1
2014									
January	0.0023	0.0044	6.8	7.9	<QL	<QL	10.5	0.089	1
February	0.0026	0.006	6.9	7.8	<QL	<QL	3.3	0.036	1
March	0.0023	0.0049	6.7	7.6	1.79	0.013	1	0.0068	1
April	0.002	0.004	6.8	7.5	<QL	<QL	<QL	<QL	1
May	0.0017	0.0023	6.5	7.4	<QL	<QL	<QL	<QL	1
June	0.0013	0.0039	6.8	7.3	<QL	<QL	1.4	0.0004	1
July	0.0013	0.0019	6.7	7.3	<QL	<QL	3.5	0.0081	4.87
August	0.0012	0.0019	6.9	7.7	<QL	<QL	<QL	<QL	1
September	0.0013	0.004	6.5	7.6	2.32	0.0077	<QL	<QL	1
October	0.0027	0.005	7.0	7.6	<QL	<QL	<QL	<QL	1
November	0.001	0.0034	6.4	8.0	<QL	<QL	1.8	0.023	1
December	0.00008	0.0017	6.1	8.2	<QL	<QL	1.7	0.008	1

Outfall 015				
2010				
	Flow (MGD)	pH (S.U.)	TSS (mg/L)	Oil & Grease (mg/L)
October - December	0.025	11.8	<QL	<QL
2011				
January - March	0.025	11.67	<QL	<QL
April - June	0.025	12.05	<QL	<QL
July - September	0.025	11.7	25.1	<QL
October - December	0.025	11.57	<QL	<QL
2012				
January - March	0.004	11.61	4.5	<QL
April - June	0.004	11.34	3.4	<QL
July - September	0.004	11.4	5	<QL
October - December	0.025	10.9	<QL	<QL
2013				
January - March	0.025	11.12	<QL	<QL
April - June	0.025	11.2	2.2	<QL
July - September	0.003	11.4	<QL	<QL
October - December	0.0025	11.62	5.6	<QL
2014				
January - March	0.0025	11.4	<QL	<QL
April - June	0.0025	11.4	1.3	<QL
July - September	0.0025	11.3	<QL	<QL
October - December	0.0025	11.46	179*	<QL

*Note: A resample of the fourth-quarter TSS yielded a result of <QL. It is believed that the initial result of 179 mg/L was the result of sample containmination or sampler error.

Outfall 727				
Monitoring Period	Flow (MGD)	pH (S.U.)	TSS (mg/L)	Oil & Grease (mg/L)
07/01/2010 - 06/30/2011	1.19	9.2	38	<QL
01/01/2011 - 12/31/2011	1.37	8.64	18.6	<QL
01/01/2012 - 12/31/2012	1.53	7.8	21.8	<QL
01/01/2013 - 12/31/2013	2.24	8.63	80.5	<QL
01/01/2014 - 12/31/2014	2.64	6.33 - 9.45	52	<QL

*Please see Appendix E for a summary of toxicity testing data.

Appendix D

Summary of Outfall 003 Semi-Annual Dissolved Metals Sampling (Attachment A)

In accordance with Part I.B.19 of the current permit, the Company conducted semi-annual monitoring of the effluent at Outfall 003 for the parameters included on Attachment A. The results of the Attachment A monitoring were reported to DEQ following each semi-annual monitoring period and are summarized in the following table. Please note that many of the parameters included on Attachment A had a required monitoring frequency of once per five (5) years. A portion of these analytical results are also reported on EPA Form 2C for Outfall 003.

DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY CRITERIA MONITORING

CASRN#	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL[(1)]	REPORTING RESULTS	SAMPLE TYPE[(2)]	SAMPLE FREQUENCY
METALS						
7440-36-0	Antimony, dissolved	(3)	10 ug/l	1.42 ug/L	Grab	1/ 6 Months
7440-38-2	Arsenic, dissolved	(3)	10 ug/l	0.50 ug/L	Grab	1/ 6 Months
7440-39-3	Barium, dissolved	(3)	1 mg/l	0.079 mg/L	Grab	1/ 5 Years
7440-43-9	Cadmium, dissolved	(3)	1 ug/l	<0.01 ug/L	Grab	1/ 6 Months
16065-83-1	Chromium III, dissolved [(6)]	(3)	10 ug/l	5.9 ug/L	Grab	1/ 6 Months
18540-29-9	Chromium VI, dissolved [(6)]	(3)	10 ug/l	5.3 ug/L	Grab	1/ 6 Months
7440-50-8	Copper, dissolved	(3)	10 ug/l	0.58 ug/L	Grab	1/ 6 Months
7439-89-6	Iron, dissolved	(3)	300 ug/l	9 ug/L	Grab	1/ 5 Years
7439-92-1	Lead, dissolved	(3)	10 ug/l	0.01 ug/L	Grab	1/ 6 Months
7439-96-5	Manganese, dissolved	(3)	100 ug/l	13.7 ug/L	Grab	1/ 5 Years
7439-97-6	Mercury, dissolved	(3)	1 ug/l	0.3 ng/L	Grab	1/ 6 Months
7440-02-0	Nickel, dissolved	(3)	10 ug/l	0.95 ug/L	Grab	1/ 6 Months
7782-49-2	Selenium, dissolved	(3)	10 ug/l	23.0 ug/L	Grab	1/ 6 Months
7440-22-4	Silver, dissolved	(3)	10 ug/l	<0.003 ug/L	Grab	1/ 6 Months
7440-28-0	Thallium, dissolved	(4)	(5)	0.070 ug/L	Grab	1/ 6 Months
7440-66-6	Zinc, dissolved	(3)	10 ug/l	3.8 ug/L	Grab	1/ 6 Months
PESTICIDES/PCB'S						
309-00-2	Aldrin	608	0.05	<0.033 ug/L	Grab	1/5 YR
57-74-9	Chlordane	608	0.2	<0.066 ug/L	Grab	1/5 YR
2921-88-2	Chlorpyrifos (synonym = Dursban)	622	(5)	<0.097 ug/L	Grab	1/5 YR
72-54-8	DDD	608	0.1	<0.025 ug/L	Grab	1/5 YR
72-55-9	DDE	608	0.1	<0.030 ug/L	Grab	1/5 YR
50-29-3	DDT	608	0.1	<0.028 ug/L	Grab	1/5 YR
8065-48-3	Demeton	(4)	(5)	<0.16 ug/L	Grab	1/5 YR
60-57-1	Dieldrin	608	0.1	<0.031 ug/L	Grab	1/5 YR
959-98-8	Alpha-Endosulfan	608	0.1	<0.035 ug/L	Grab	1/5 YR
33213-65-9	Beta-Endosulfan	608	0.1	<0.037 ug/L	Grab	1/5 YR

*Note: The analytical data for metals reported above were previously reported on July 1, 2014.

CASRN#	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL(1)	REPORTING RESULTS	SAMPLE TYPE(2)	SAMPLE FREQUENCY
1031-07-8	Endosulfan Sulfate	608	0.1	<0.022 ug/L	Grab	1/5 YR
72-20-8	Endrin	608	0.1	<0.036 ug/L	Grab	1/5 YR
7421-93-4	Endrin Aldehyde	(4)	(5)	<0.034 ug/L	Grab	1/5 YR
86-50-0	Guthion	622	(5)	<0.11 ug/L	Grab	1/5 YR
76-44-8	Heptachlor	608	0.05	<0.037 ug/L	Grab	1/5 YR
1024-57-3	Heptachlor Epoxide	(4)	(5)	<0.037 ug/L	Grab	1/5 YR
319-84-6	Hexachlorocyclohexane Alpha-BHC	608	(5)	<0.025 ug/L	Grab	1/5 YR
319-85-7	Hexachlorocyclohexane Beta-BHC	608	(5)	<0.038 ug/L	Grab	1/5 YR
58-89-9	Hexachlorocyclohexane Gamma-BHC or Lindane	608	(5)	<0.030 ug/L	Grab	1/5 YR
143-50-0	Kepone	(4)	(5)	<0.74 ug/L	Grab	1/5 YR
121-75-5	Malathion	(4)	(5)	<0.10 ug/L	Grab	1/5 YR
72-43-5	Methoxychlor	(4)	(5)	<0.034 ug/L	Grab	1/5 YR
2385-85-5	Mirex	(4)	(5)	<0.018 ug/L	Grab	1/5 YR
56-38-2	Parathion	(4)	(5)	<0.15 ug/L	Grab	1/5 YR
11096-82-5	PCB 1260	608	1.0	<0.068 ug/L	Grab	1/5 YR
11097-69-1	PCB 1254	608	1.0	<0.12 ug/L	Grab	1/5 YR
12672-29-6	PCB 1248	608	1.0	<0.11 ug/L	Grab	1/5 YR
53469-21-9	PCB 1242	608	1.0	<0.074 ug/L	Grab	1/5 YR
11141-16-5	PCB 1232	608	1.0	<0.16 ug/L	Grab	1/5 YR
11104-28-2	PCB 1221	608	1.0	<0.16 ug/L	Grab	1/5 YR
12674-11-2	PCB 1016	608	1.0	<0.10 ug/L	Grab	1/5 YR
1336-36-3	PCB Total	608	7.0	<0.16 ug/L	Grab	1/5 YR
8001-35-2	Toxaphene	608	5.0	<0.070 ug/L	Grab	1/5 YR
BASE NEUTRAL EXTRACTABLES						
83-32-9	Acenaphthene	625	10.0	<0.27 ug/L	Grab	1/5 YR
120-12-7	Anthracene	625	10.0	<0.18 ug/L	Grab	1/5 YR
92-87-5	Benzidine	(4)	(5)	<44 ug/L	Grab	1/5 YR
56-55-3	Benzo (a) anthracene	625	10.0	<0.34 ug/L	Grab	1/5 YR
207-08-9	Benzo (k) fluoranthene	625	10.0	<0.28 ug/L	Grab	1/5 YR
50-32-8	Benzo (a) pyrene	625	10.0	<0.26 ug/L	Grab	1/5 YR

CASRN#	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL(1)	REPORTING RESULTS	SAMPLE TYPE(2)	SAMPLE FREQUENCY
111-44-4	Bis 2-Chloroethyl Ether	(4)	(5)	<0.29 ug/L	Grab	1/5 YR
39638-32-9	Bis 2-Chloroisopropyl Ether	(4)	(5)	<0.22 ug/L	Grab	1/5 YR
85-68-7	Butyl benzyl phthalate	625	10.0	<2.0 ug/L	Grab	1/5 YR
91-58-7	2-Chloronaphthalene	(4)	(5)	<0.28 ug/L	Grab	1/5 YR
218-01-9	Chrysene	625	10.0	<0.29 ug/L	Grab	1/5 YR
53-70-3	Dibenz(a,h)anthracene	625	20.0	<0.25 ug/L	Grab	1/5 YR
84-74-2	Dibutyl phthalate (synonym = Di-n-Butyl Phthalate)	625	10.0	<2.2 ug/L	Grab	1/5 YR
95-50-1	1,2-Dichlorobenzene	624	10.0	<0.15 ug/L	Grab	1/5 YR
541-73-1	1,3-Dichlorobenzene	624	10.0	<0.11 ug/L	Grab	1/5 YR
106-46-7	1,4-Dichlorobenzene	624	10.0	<0.21 ug/L	Grab	1/5 YR
91-94-1	3,3-Dichlorobenzidine	(4)	(5)	<1.4 ug/L	Grab	1/5 YR
84-66-2	Diethyl phthalate	625	10.0	<2.7 ug/L	Grab	1/5 YR
117-81-7	Di-2-Ethylhexyl Phthalate	625	10.0	23 ug/L	Grab	1/5 YR
131-11-3	Dimethyl phthalate	(4)	(5)	<1.7 ug/L	Grab	1/5 YR
121-14-2	2,4-Dinitrotoluene	625	10.0	<2.0 ug/L	Grab	1/5 YR
122-66-7	1,2-Diphenylhydrazine	(4)	(5)	<1.1 ug/L	Grab	1/5 YR
206-44-0	Fluoranthene	625	10.0	<0.20 ug/L	Grab	1/5 YR
86-73-7	Fluorene	625	10.0	<0.22 ug/L	Grab	1/5 YR
118-74-1	Hexachlorobenzene	(4)	(5)	<0.56 ug/L	Grab	1/5 YR
87-68-3	Hexachlorobutadiene	(4)	(5)	<0.87 ug/L	Grab	1/5 YR
67-72-1	Hexachloroethane	(4)	(5)	<1.3 ug/L	Grab	1/5 YR
193-39-5	Indeno(1,2,3-cd)pyrene	625	20.0	<0.40 ug/L	Grab	1/5 YR
78-59-1	Isophorone	625	10.0	<0.68 ug/L	Grab	1/5 YR
98-95-3	Nitrobenzene	625	10.0	<1.4 ug/L	Grab	1/5 YR
62-75-9	N-Nitrosodimethylamine	(4)	(5)	<1.1 ug/L	Grab	1/5 YR
621-64-7	N-Nitrosodi-n-propylamine	(4)	(5)	<0.46 ug/L	Grab	1/5 YR
86-30-6	N-Nitrosodiphenylamine	(4)	(5)	<1.1 ug/L	Grab	1/5 YR
129-00-0	Pyrene	625	10.0	<0.21 ug/L	Grab	1/5 YR
120-82-1	1,2,4-Trichlorobenzene	625	10.0	<0.79 ug/L	Grab	1/5 YR

CASRN#	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL[1]	REPORTING RESULTS	SAMPLE TYPE[2]	SAMPLE FREQUENCY
VOLATILES						
107-02-8	Acrolein	(4)	(5)	<2.6 ug/L	Grab	1/5 YR
107-13-1	Acrylonitrile	(4)	(5)	<0.55 ug/L	Grab	1/5 YR
71-43-2	Benzene	624	10.0	<0.11 ug/L	Grab	1/5 YR
75-25-2	Bromoform	624	10.0	<1.0 ug/L	Grab	1/5 YR
56-23-5	Carbon Tetrachloride	624	10.0	<0.14 ug/L	Grab	1/5 YR
108-90-7	Chlorobenzene (synonym = monochlorobenzene)	624	50.0	<0.14 ug/L	Grab	1/5 YR
124-48-1	Chlorodibromomethane	624	10.0	<0.14 ug/L	Grab	1/5 YR
67-66-3	Chloroform	624	10.0	<0.17 ug/L	Grab	1/5 YR
75-09-2	Dichloromethane (synonym = methylene chloride)	624	20.0	<0.13 ug/L	Grab	1/5 YR
75-27-4	Dichlorobromomethane	624	10.0	<0.13 ug/L	Grab	1/5 YR
107-06-2	1,2-Dichloroethane	624	10.0	<0.21 ug/L	Grab	1/5 YR
75-35-4	1,1-Dichloroethylene	624	10.0	<0.30 ug/L	Grab	1/5 YR
156-60-5	1,2-trans-dichloroethylene	(4)	(5)	<0.17 ug/L	Grab	1/5 YR
78-87-5	1,2-Dichloropropane	(4)	(5)	<0.095 ug/L	Grab	1/5 YR
542-75-6	1,3-Dichloropropene	(4)	(5)	<0.33 ug/L	Grab	1/5 YR
100-41-4	Ethylbenzene	624	10.0	<0.23 ug/L	Grab	1/5 YR
74-83-9	Methyl Bromide	(4)	(5)	<0.31 ug/L	Grab	1/5 YR
79-34-5	1,1,2,2-Tetrachloroethane	(4)	(5)	<0.20 ug/L	Grab	1/5 YR
127-18-4	Tetrachloroethylene	624	10.0	<0.15 ug/L	Grab	1/5 YR
10-88-3	Toluene	624	10.0	<0.15 ug/L	Grab	1/5 YR
79-00-5	1,1,2-Trichloroethane	(4)	(5)	<0.20 ug/L	Grab	1/5 YR
79-01-6	Trichloroethylene	624	10.0	<0.14 ug/L	Grab	1/5 YR
75-01-4	Vinyl Chloride	624	10.0	<0.23 ug/L	Grab	1/5 YR
RADIONUCLIDES						
	Strontium 90 (pCi/L)	(4)	(5)	<0.353 ug/L	Grab	1/5 YR
	Tritium (pCi/L)	(4)	(5)	<410 pCi/L	Grab	1/5 YR
	Beta Particle & Photon Activity (mrem/yr)	(4)	(5)	<4.00 pCi/L (Beta particle only)	Grab	1/5 YR
	Gross Alpha Particle Activity (pCi/L)	(4)	(5)	<2.62 ug/L	Grab	1/5 YR

CASRN#	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL[1]	REPORTING RESULTS	SAMPLE TYPE[2]	SAMPLE FREQUENCY
ACID EXTRACTABLES [6]						
95-57-8	2-Chlorophenol	625	(5)	<2.1 ug/L	Grab	1/5 YR
120-83-2	2,4 Dichlorophenol	625	(5).	<0.62 ug/L	Grab	1/5 YR
105-67-9	2,4 Dimethylphenol	625	(5)	<1.6 ug/L	Grab	1/5 YR
51-28-5	2,4-Dinitrophenol	(4)	(5)	<23 ug/L	Grab	1/5 YR
534-52-1	2-Methyl-4,6-Dinitrophenol	(4)	(5)	<14 ug/L	Grab	1/5 YR
87-86-5	Pentachlorophenol	625	50.0	<4.6 ug/L	Grab	1/5 YR
108-95-2	Phenol	625	(5)	<0.51 ug/L	Grab	1/5 YR
88-06-2	2,4,6-Trichlorophenol	625	(5)	<2.8 ug/L	Grab	1/5 YR
MISCELLANEOUS						
16887-00-6	Chlorides	(4)	(5)	23.5 mg/L	Grab	1/ 6 Months
57-12-5	Cyanide, Total	(4)	50.0	<0.0025 mg/L	Grab	1/ 5 Yr
7783-06-4	Hydrogen Sulfide	(4)	(5)	<0.053 mg/L	Grab	1/5 YR
N/A	Sulfate (mg/L)	(4)	(5)	59.8 mg/L	Grab	1/5 YR
N/A	Total Dissolved Solids (mg/L)	(4)	(5)	422 mg/L	Grab	1/ 6 Months
Sample Date: 05/12/14 (TDS), 05/20/14 (metals), 11/19/14 (pesticides), 10/28/14 (all remaining parameters)						

John M. McManus, VP Environmental Services

Name of Principal Exec. Officer or Authorized Agent/Title

John M. McManus 3/10/15

Signature of Principal Officer or Authorized Agent/Date

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. Sec. 1001 and 33 U.S.C. Sec. 1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

FOOTNOTES:

(1) Quantification level (QL) is defined as the lowest concentration used for the calibration of a measurement system when the calibration is in accordance with the procedures published for the required method.

The quantification levels indicated for the metals are actually Specific Target Values developed for this permit. The Specific Target Value is the approximate value that may initiate a wasteload allocation analysis. Target values are not wasteload allocations or effluent limitations. The Specific Target Values are subject to change based on additional information such as hardness data, receiving stream flow, and design flows.

Units for the quantification level are micrograms/liter unless otherwise specified.

(2) Sample Type

Grab = An individual sample collected in less than 15 minutes. Substances specified with "grab" sample type shall only be collected as grabs. The permittee may analyze multiple grabs and report the average results provided that the individual grab results are also reported. .

(3) A specific analytical method is not specified; however a target value for each metal has been established. An appropriate method to meet the target value shall be selected from the following list of EPA methods (or any approved method presented in 40 CFR Part 136). If the test result is less than the method QL, a "<[QL]" shall be reported where the actual analytical test QL is substituted for [QL].

Metal	Analytical Method
Antimony	1638; 1639
Arsenic	206.5; 1632
Chromium[(8)]	1639
Chromium VI	218.6; 1639
Copper	1638; 1640
Lead	1637; 1638; 1640
Mercury	245.7; 1631
Nickel	1638;1639;1640
Selenium	1638; 1639
Silver	1638
Zinc	1638; 1639

(4) Any approved method presented in 40 CFR Part 136.

(5) The QL is at the discretion of the permittee. For any substances addressed in 40 CFR Part 136, the permittee shall use one of the approved methods in 40 CFR Part 136.

(6) Both Chromium III and Chromium VI may be measured by the total chromium analysis. If the result of the total chromium analysis is less than or equal to the lesser of the Chromium III or Chromium VI method QL, the results for both Chromium III and Chromium VI can be reported as "<[QL]", where the actual analytical test QL is substituted for [QL].

Appendix E

Whole Effluent Toxicity Testing Summary for Outfalls 003, 007, and 727

The following tables summarize the whole effluent toxicity testing performed at Outfalls 003, 007, and 727 in accordance with Part I.C.1 of the current permit. Per the permit conditions, the complete reports were individually submitted and are on file with DEQ.

Outfall 003 Effluent					Influent	
	Toxicity endpoint	**Permit Limits**	***P. promelas***	***C. dubia***	***P. promelas***	***C. dubia***
2010	48-hour LC50	100%	>100%	>100%	>100%	>100%
	NOEC Value - Survival	18%	100%	100%	<100%	100%
	NOEC Value - Growth/Reproduction	18%	50%	50%	<100%	100%
	TUc (NOEC)	5.8	2.0	2.0	>1.0	1.0
	IC25	Report Only	62.5%	69.9%		
2011	48-hour LC50	100%	>100%	>100%	>100%	>100%
	NOEC Value - Survival	18%	100%	100%	<100%	100%
	NOEC Value - Growth/Reproduction	18%	100%	100%	<100%	100%
	TUc (NOEC)	5.8	1.0	1.0	>1.0	1.0
	IC25	Report Only	>100%	>100%		
2012	48-hour LC50	100%	>100%	>100%	>100%	>100%
	NOEC Value - Survival	18%	100%	100%	100%	100%
	NOEC Value - Growth/Reproduction	18%	100%	100%	100%	100%
	TUc (NOEC)	5.8	1.0	1.0	1.0	1.0
	IC25	Report Only	>100%	>100%		
2013	48-hour LC50	100%	>100%	>100%	>100%	>100%
	NOEC Value - Survival	18%	100%	100%	100%	100%
	NOEC Value - Growth/Reproduction	18%	100%	100%	100%	100%
	TUc (NOEC)	5.8	1.0	1.0	1.0	1.0
	IC25	Report Only	>100%	>100%		
2014	48-hour LC50	100%	>100%	>100%	>100%	>100%
	NOEC Value - Survival	18%	100%	100%	100%	100%
	NOEC Value - Growth/Reproduction	18%	100%	50%	100%	100%
	TUc (NOEC)	5.8	1.0	2.0	1.0	1.0
	IC25	Report Only	>100%	25.2%		

Outfall 007 Effluent			
	Toxicity endpoint	***P. promelas***	***C. dubia***
2010	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2012	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2013	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2014	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%

Outfall 727 Effluent			
	Toxicity endpoint	***P. promelas***	***C. dubia***
Oct - Dec 2010	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0	0
Jan - March* 2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0.2	0.3
Jan - March* 2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	5%	0%
Apr - June 2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	35%	0%
July - Sept 2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	45%	0%
Oct - Dec 2011	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
Jan - March 2012	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
Apr - June 2012	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
July - Sept 2012**	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2013	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%
2014	48-hr LC50 Value (TUa)	>100% (<1.0 TUa)	>100% (<1.0 TUa)
	Percent Mortality in 100% Effluent	0%	0%

*Note: Split sample.
**Note: Testing frequency requirement reduced from 1/3 months to 1/year effective 8/21/2012.

Appendix F

Ash Pond 2 Closure – Dumps Creek Monitoring Summary

Ash Pond 2 Closure and Dumps Creek Monitoring

Clinch River Plant stopped using Ash Pond 2 as a settling pond in 1997, after which time there was no addition or removal of CCB material. In July 2012 a formal closure process began. The construction portion was completed in early 2014. Closure of Ash Pond 2 involved re-grading the existing surface contours, installation of a PVC geomembrane and geocomposite drainage net (GDN) over the limits of ash, and the placement of 24 inches of protective cover material planted with perennial vegetation for erosion control. As designed, this capping mechanism does not allow for the infiltration of stormwater into the disposed ash.

During the planning of the Ash Pond 2 closure, the Company and DEQ agreed that quarterly monitoring for a pre-determined selection of parameters would occur at the Outfall 015 seeps in lieu of installing groundwater monitoring wells and implementing a monitoring program. Additionally, selected locations upstream and downstream of the seeps would also be monitored for the same parameters as a means of observing potential impacts to ambient water quality. To date, ten (10) quarterly sampling events at these three locations have occurred. The data from these events are summarized and presented in the following tables. The Company did statistical analyses on the upstream and downstream data to identify statistically significant impacts of the dike seepage on the receiving stream. Measured levels of eighteen of the twenty monitored parameters showed no statistically significant difference between the upstream and downstream sample points. The differences in the upstream and downstream data for selenium and molybdenum exhibited statistical significance.

Under 9VAC25-260-500 Dumps Creek is designated a Class IV freshwater stream. No water quality criteria for molybdenum have been established. The maximum and average molybdenum concentrations measured downstream of the seepage points during quarterly monitoring were 8.33 µg/L and 3.63 µg/L, respectively The water quality criteria for selenium that are applicable to Dumps Creek are the following:

<table>
<tr><td>Parameter</td><td colspan="3">Use Designation</td></tr>
<tr><td rowspan="3">Selenium</td><td colspan="2">Aquatic Life - Freshwater</td><td rowspan="2">Human Health - All Other Surface Waters (non-PWS)</td></tr>
<tr><td>Acute</td><td>Chronic</td></tr>
<tr><td>20 µg/L</td><td>5.0 µg/L</td><td>4,200 µg/L</td></tr>
</table>

The maximum and average concentrations of selenium measured downstream of the seepage points during quarterly monitoring were 2.4 µg/L and 1.1 µg/L, respectively. These levels are consistently below the water quality criteria for both acute and chronic aquatic life protection. As such, the Company proposes to continue monitoring the locations and parameters described above on a semi-annual basis during the upcoming permit term.

	9/6/2012			11/14/2012			2/26/2013			6/4/2013		
	Upstream	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**
Antimony (µg/L)	0.15	0.24	0.14	0.07	0.24	0.08	0.09	0.25	0.08	0.07	0.34	0.08
Arsenic (µg/L)	0.82	4.35	0.82	0.53	4.29	0.58	0.22	4.03	0.27	0.38	4.20	0.36
Barium (µg/L)				87	165	90.7	57.1	164	59.7	87.1	173	85.8
Beryllium (µg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium (µg/L)	<0.01	0.25	<0.01	<0.01	0.23	<0.01	<0.05	0.16	<0.5	<0.01	0.12	<0.05
Chromium (µg/L)	<0.2	<0.03	<0.2	<0.03	<0.03	<0.03	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper (µg/L)	0.58	0.04	0.60	0.67	0.37	0.58	0.62	0.14	0.82	0.63	0.54	0.82
Lead (µg/L)	0.142	0.019	0.09	0.174	0.153	0.122	0.199	0.066	0.176	0.108	0.14	0.148
Mercury (µg/L)	<0.03	<0.09	<0.03	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.30	<0.3	<0.30
Molybdenum (µg/L)	1.50	424	5.29	0.77	454	5.16	0.31	419	2.09	0.56	417	2.68
Selenium (µg/L)	<0.5	138	1.2	<0.5	142	1.1	0.5	134	1	0.41	130	1
Thallium (µg/L)	<0.05	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.050	<0.050	<0.050
Uranium (µg/L)	0.929	<0.01	0.91	0.69	<0.01	0.683	0.381	<0.01	0.37	0.482	0.012	0.471
Vanadium (µg/L)	<0.5	47.7	<0.5	<2	42.4	<2	<2	46.7	<0.5	<2	46.6	<2
Boron (mg/L)	0.027	0.168	0.03	<0.02	0.113	0.02	<0.02	0.161	<0.02	0.043	0.178	0.041
Lithium (mg/L)	0.046	0.677	0.054	0.023	0.639	0.029	0.011	0.627	0.014	0.022	0.616	0.024
Strontium (mg/L)	0.582	6.77	0.611	0.507	6.72	0.538	0.349	6.65	0.391	0.476	6.55	0.504
Chloride (mg/L)	15.7	10	15.8	10	0.4	0.5	5.9	9.8	7.4	0.6	10.5	8.6
Total Dissolved Solids (mg/L)	497	551	495	350	518	361	226	494	229	326	506	323
Conductivity (µmho/cm)	797	1230	786	593	1230	607	384	1210	391	546	1200	541

	9/10/2013			11/19/2013			3/12/2014			5/29/2014		
	Upstream	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**
Antimony (µg/L)	0.1	0.25	0.12	0.01	0.25	0.1	0.06	0.29	0.05	0.09	0.027	0.08
Arsenic (µg/L)	0.52	4.27	0.65	0.43	4.48	0.52	0.20	4.24	0.21	0.42	4.66	0.47
Barium (µg/L)				94.8	157	95.7	51.2	158	50.8	69.9	152	70.5
Beryllium (µg/L)	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.02	<0.004	<0.02	<0.01	<0.004	<0.01
Cadmium (µg/L)	<0.010	0.06	<0.01	<0.01	<0.05	<0.01	<0.05	0.28	0.14	<0.05	<0.05	<0.01
Chromium (µg/L)	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	0.1	0.4
Copper (µg/L)				0.85	0.27	0.78	0.72	0.60	0.74	0.76	0.37	0.73
Lead (µg/L)	0.159	0.072	0.838	0.251	0.215	0.309	0.324	0.299	0.319	0.336	0.252	0.286
Mercury (µg/L)	<2	<2	<2	<0.3	<0.3	<0.3	<0.008	<0.008	<0.02	<0.004	<0.004	<0.004
Molybdenum (µg/L)	0.97	453	3.1	1.24	440	3.29	0.46	404	1.55	0.52	464	3
Selenium (µg/L)	<0.50	143	1	<0.5	143	0.8	0.5	146	0.8	<0.5	150	1
Thallium (µg/L)	<0.050	<0.050	<0.050	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	0.028
Uranium (µg/L)	0.71	<0.01	0.688	0.933	<0.01	0.932	0.311	0.011	0.288	0.452	0.017	0.448
Vanadium (µg/L)	<0.50	54.3	<0.50	<0.5	50	<0.5	<0.5	47.4	<0.5	<0.3	49.8	<2
Boron (mg/L)	<0.020	0.155	0.02	0.025	0.173	0.024	0.042	0.187	0.027	<0.02	0.163	<0.02
Lithium (mg/L)	0.033	0.618	0.036	0.032	0.596	0.035	0.01	0.672	0.012	0.016	0.64	0.015
Strontium (mg/L)	0.569	6.27	0.582	0.562	6.4	0.607	0.378	6.68	0.39	0.42	6.08	0.229
Chloride (mg/L)	9.4	11.5	9.4	11.3	11	11.8	5.5	11	5.6	6	10.2	6.7
Total Dissolved Solids (mg/L)	374	528	381	392	532	403	211	529	219	258	521	254
Conductivity (µmho/cm)	641	1220	639	667	1190	667	356	1160	362	425	1100	426

	8/6/2014			12/2/2014		
	Upstream	**Outfall 015**	**Downstream**	**Upstream**	**Outfall 015**	**Downstream**
Antimony (µg/L)	0.16	0.28	0.14	0.05	0.25	0.06
Arsenic (µg/L)	0.70	4.32	0.71	0.30	5.75	0.35
Barium (µg/L)	87.5	145	85.7	47.4	177	52.5
Beryllium (µg/L)	<0.01	<0.004	<0.004	<0.01	0.017	<0.004
Cadmium (µg/L)	<0.05	<0.01	<0.05	<0.01	<0.05	<0.01
Chromium (µg/L)	0.1	0.1	0.1	0.2	0.1	0.1
Copper (µg/L)	0.92	0.37	0.82	0.69	0.80	0.71
Lead (µg/L)	0.358	0.261	0.324	0.367	0.665	0.347
Mercury (µg/L)	<0.004	<0.004	<0.004	<0.002	<0.002	<0.002
Molybdenum (µg/L)	1.18	462	8.33	0.52	458	1.84
Selenium (µg/L)	<0.5	150	2.4	<0.5	150	0.7
Thallium (µg/L)	<0.02	<0.02	<0.02	<0.02	0.023	<0.02
Uranium (µg/L)	0.802	<0.01	0.748	0.483	0.174	0.485
Vanadium (µg/L)	<0.3	49.3	<0.3	<0.3	52.4	<2
Boron (mg/L)	0.117	0.237	0.095	<0.02	0.166	<0.02
Lithium (mg/L)	0.019	0.647	0.034	0.006	0.616	0.01
Strontium (mg/L)	0.551	6.08	0.627	0.313	6.3	0.354
Chloride (mg/L)	8.6	10.8	9.2	5.3	10.8	11.6
Total Dissolved Solids (mg/L)	343	512	347	219	513	222
Conductivity (µmho/cm)	542	1050	543	374	1090	392

Appendix G

Clean Water Act Section 311 Liability Exclusion Requests

Section 311 CWA Liability Exclusion Request

Exclusion 2

40 CFR 117.12 provides three exclusions to Section 311 liability as set forth in the Clean Water Act (CWA). As set out in Section 117.12(a)(2), a liability exclusion (commonly called Exclusion 2) is available for "…discharges resulting from circumstances identified, issued or modified under Section 402 of this Act, and subject to a condition in such permit." This Exclusion 2 is available where the substance and the amount of the substance, the origin and source of the substance, and the treatment which is to be provided for the discharge are identified as a part of the public record.

The Company requests Exclusion 2 for the following 311-designated hazardous substances, which are present at the Clinch River Plant:

- Sodium Nitrite
- Sulfuric Acid
- Urea / Ammonia

The following information supports this request.

Sodium Nitrite

Sodium nitrite is used in chemical solution as the product Nalco 8338, which is 10-20% sodium nitrite. It is fed at approximately 50 gallons/week (or 14 lbs/day sodium nitrite) to the total closed cooling water system as a rust inhibitor, which is normally operated as a common system to all three units independent of which unit(s) is(are) running.

Nalco 8338 is stored in two (2) 1,000-gallon bulk tanks in the basement of Unit 3. The tanks are connected with a common line, providing a total usable storage capacity of 1,700 gallons of product. Any leakage from this system would drain to the plant sumps, which would then direct it to the boiler room sump, which flows into the Advanced Wastewater Treatment Plant (AWWTP). A lesser amount of dry sodium nitrite is kept in 50-lb bags in storage for abnormal conditions.

Sulfuric Acid

Sulfuric acid is used at a typical rate of 6100 lbs/day for all three units to treat the circulating water. There are two 12,500-gallon tanks storage tanks located at the Chemical Building approximately 40 yards from the southeast corner of Unit 3. The sulfuric acid is fed by gravity through one-inch stainless steel lines to the Units 1 & 2 flume and the Unit 3 flume.

Urea / Ammonia

A 50% urea / 2% ammonia solution is used at a rate of approximately 34,445 lbs/day urea (3,744 gallons 50% urea) / 716 lbs/day ammonia total for NOx control in the flue gas of all three units at full load. The three (3) day storage tanks (35,000 gallons each) are located at the southeast corner of Unit 3 and the bulk storage tank (257,000 gallons) is located within a concrete secondary containment area approximately 100 yards southeast of Unit 3. The bulk storage tank feeds the day tanks and the day tanks are used to inject urea/ammonia into each respective unit.

Exclusion 3

40 CFR 117.12 provides three exclusions to Section 311 liability as set forth in the Clean Water Act (CWA). As set out in Section 117.12(a)(3), a liability exclusion (commonly called Exclusion 3) is available for "…continuous or anticipated intermittent discharges from a point source, identified in a permit or permit application under Section 402 of this Act, which are caused by events occurring within the scope of the relevant operating or treatment systems."

The Company requests Exclusion 3 for the following 311-designated hazardous substances for the Clinch River Plant:

- Sodium Nitrite
- Sulfuric Acid
- Urea / Ammonia

The following information supports this request.

Sodium Nitrite

Substance:		Sodium Nitrite as Nalco 8338®
Location:		Unit 3 basement
Reportable Quantity:		100 lbs.
Maximum Quantity Stored:		Approx. 1700 gallons
Maximum Usage Rate:		Approximately 50 gallons/week
Primary Containment:		HDPE tank
Prevention:		Sodium nitrite storage tanks are located in basement floor elevation on Unit 3
Containment:		Any spillage from these tanks would be collected in the plant sumps and go to the Advanced Wastewater Treatment Plant
Material Handling: (e.g. loading and unloading operations, and in-plant transfer)		Sodium nitrite is brought to the plant via tank trucks. The unloading of these trucks into storage tanks requires about one hour to complete and is inspected by plant lab personnel until the unloading is completed.
Clean-Up Method:		In the event of a leak in the storage tank, the sodium nitrite would be collected in the plant sumps and go to the WWTP
Nearest Supply & Type of Safety Equipment:		Plant personnel are required to wear hard hats and eye protection while working in this area. Other safety equipment available in the chemical inventory or on the plant site are: 1) Rubber gloves 2) Rubber apron 3) Rubber boots 4) Rubber suits 5) Full face shield 6) Full face respirator with appropriate cartridges 7) Bio-Pac 60 breather An eyewash station and safety showers are located in the immediate area.
Treatment:		Sodium nitrite would be collected in the WWTP/AWWTP
Ultimate Disposal:		Discharge to the Clinch River

Sulfuric Acid

Substance:		Sulfuric Acid
Location:		40 yards from SE corner of Unit 3
Reportable Quantity:		1,000 lbs.
Maximum Quantity Stored:		25,000 gallons (187,250 lbs.)
Maximum Usage Rate:		Approximately 500 gallons/day
Primary Containment:		Carbon steel tank
Prevention:		Sulfuric acid storage tanks are suspended on beams four feet above ground level. The storage area is inspected on a daily basis.
Containment:		Any spillage from these tanks would be collected in the containment area around the tanks and neutralized with lime.
Material Handling: (e.g., loading and unloading operations, and in-plant transfer)		Sulfuric acid is brought to the plant via tank trucks. The unloading of these trucks into storage tanks requires about one hour to complete, and is inspected by plant storeroom personnel until the loading is completed. In-plant transfer is done by pumping through with air 1-1/2 inch steel lines to stainless steel tanks, where it is diluted with water.
Clean-Up Method:		In the event of a leak in the storage tank, the sulfuric acid would be contained in the containment area around the two sulfuric acid tanks.
Nearest Supply & Type of Safety Equipment:		Plant personnel are required to wear hard hats and eye protection while working in this area. Other safety equipment available in the chemical inventory or on the plant site are: 1) Rubber gloves 2) Rubber apron 3) Rubber boots 4) Rubber suits 5) Full face shield 6) Full face respirator with appropriate cartridges 7) Bio-Pac 60 breather An eyewash station and safety showers are located in the immediate area.
Treatment:		Sulfuric acid collected in the containment area would be diluted or neutralized
Ultimate Disposal:		Acid collected in the containment area would be neutralized with lime, and disposed of in an approved manner

Urea / Ammonia

Substance:		50% Urea / 2% Ammonia
Location:		3-day tanks (35,000 gallons each) are located at the SE corner of Unit 3. The bulk storage tank (257,000 gallons) is located 100 yards SE of Unit 3.
Reportable Quantity:		100 lbs. (Ammonia; Urea is not a CWA reportable)
Maximum Quantity Stored:		362,000 gallons as 50% urea (estimated 3,330,400 lbs. urea, 66,608 lbs. ammonia)
Maximum Usage Rate:		Approximately 3,744 gal/day 50% urea
Primary Containment:		Day tanks are fiberglass, bulk storage tank is stainless steel
Prevention:		The 3-day tanks and bulk storage tank are provided with sized secondary contained to contain the volume of the largest tank plus generated water from a 25-year/24-hour storm event. The storage areas are inspected on a daily basis.
Containment:		Any spillage from the tanks would be collected in the containment areas around the tanks and either pumped back into a tank, or properly disposed.
Material Handling: (e.g., loading and unloading operations, and in-plant transfer)		Urea / ammonia is delivered to the plant via either two means: rail car or tank trucks. Truck and rail car unloading areas are provided with sized secondary containment and only one truck or railcar is unloaded at a time. The unloading is inspected by plant storeroom personnel until the loading is completed.
Clean-Up Method:		In the event of a leak in any of the tanks, the urea / ammonia would be contained in the provided containment areas.
Nearest Supply & Type of Safety Equipment:		Plant personnel are required to wear hard hats and eye protection while working in this area. Other safety equipment available in the chemical inventory or on the plant site are: 8) Rubber gloves 9) Rubber apron 10) Rubber boots 11) Rubber suits 12) Full face shield 13) Full face respirator with appropriate cartridges 14) Bio-Pac 60 breather An eyewash station and safety showers are located in the immediate area.
Treatment:		Urea / ammonia collected in the containment areas would be reused or properly disposed.
Ultimate Disposal:		Urea / ammonia collected in the containment areas would be reused or disposed of in an approved manner.

Appendix H

CWA § 316(b) Compliance Requirements

This section is being submitted as a stand-alone document accompanying this application. As described in the attached report, required under 40 CFR 122.21 and 125.95, the cooling water intake structure at Clinch River Plant represents Best Technology Available (BTA) for minimizing adverse environmental impacts due to impingement and entrainment per CWA §316(b).

Clean Water Act § 316(b) Compliance Submittal Requirements

Prepared for:
American Electric Power

Prepared by:
HDR Engineering, Inc.

February 27, 2015

Clinch River Plant
Carbo, VA

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Executive Summary

This report addresses requirements of the Clean Water Act's Section 316(b) existing facilities rule for American Electric Power's (AEP's) Clinch River Plant. For affected facilities[1], the rule defines national standards for the location, design, construction, and capacity of cooling water intake structures (CWIS) to be implemented under the National Pollutant Discharge Elimination System (NPDES). The existing facilities rule calls for the submission of several reports under 40 CFR 122.21(r) – Application for a permit renewal. This document represents those submittals for AEP's Clinch River Plant (i.e., those defined at 40 CFR 122.21(r)(2)-(6) and (8) for facilities with Actual Intake Flow (AIF) less than 125 MGD). This report examines the Clinch River Plant's Cooling Water Intake Structure (CWIS) relative to the rule's standards for Best Technology Available (BTA).

The Clinch River Plant is located near Carbo, Virginia on the Clinch River at River Mile 268. The facility and its cooling water system are intended for year-round, 24 hours/day operation, with the exception of down time due to outages. The facility has a single CWIS that serves its three generating units. The CWIS has two conventional traveling water screens. Three pumps, each rated at 6,500 gallons per minute (GPM), provide flow to the three units. Normal water needs can be met with two pumps while the third pump is held in reserve resulting in a design intake flow of 18.36 million gallons per day (MGD) (i.e., 12,750 GPM with 2 pump operation). Actual monthly intake flows from the period 2010-2013 ranged from 7.03 to 13.69 MGD (38 to 75% of design flow) where approximately 65% of the intake water is used for cooling purposes. The Clinch River Plant utilizes mechanical draft (5-cell counter-flow) cooling towers on a closed loop system. Water is recycled and reused in the steam turbine condensers.

There are several features of the design and operation of Clinch River Plant's CWIS and cooling water system that reduce losses of aquatic organisms due to impingement and entrainment. The combination of the technological and operational features used at Clinch River Plant should be considered BTA for both entrainment and impingement. In particular, several steps, as outlined below, have been undertaken to reduce water use at the facility.

Key Findings of No Adverse Environmental Impact:

- Clinch River uses a closed-cycle cooling system. The towers are presently operating at two-to-five cycles of concentration and provide a flow reduction of at least 97.0% compared to a once-through system. Since reductions in impingement and entrainment can be assumed to be commensurate with reductions in flow, use of closed-cycle cooling at Clinch River Plant is assumed to reduce potential impingement and

[1] Facilities affected by the rule are those that: 1) commenced construction on or before January 17, 2002; 2) withdraw at least two million gallons per day from waters of the United States; 3) use at least 25% of that water exclusively for cooling purposes; and 4) are regulated under the NPDES program.

entrainment by at least 97.0%. Use of closed-cycle cooling meets the impingement mortality reduction standard through Compliance Alternative 1 (§125.94(c)(1)).

- Unit 3 is scheduled for retirement in May 2015. After retirement, the CWIS design through-screen velocity at low water level is estimated to be 0.52 feet per second (fps or ft/sec). At normal pool elevation, the design through-screen velocity is estimated to be just 0.15 fps. A design through-screen velocity of less than 0.5 fps meets the impingement mortality reduction standard through Compliance Alternative 2 (§125.94(c)(2)).

- Current design withdrawal from the Clinch River by the river intake is 12,750 GPM (18.36 MGD). After retirement of Unit 3, this flow will be reduced to 6,500 GPM (9.36 MGD) or 49% reduction in design flow.

- The average Net Capacity Factors for the Clinch River Plant between 2007 and 2013 have ranged from 29.61 to 32.85 percent, indicating that the facility operates less than 1/3 of the time available.

- The Clinch River Plant uses a small percentage of the total Clinch River flows. Current design intake flows (i.e., 18.36 MGD) range from 2.0 to 12.9 percent of the average monthly flow of the Clinch River. Using actual intake flows, the Clinch River facility withdrew between 1.0 and 6.6 percent of the monthly average flow, with the lowest percentage withdrawn in April and peak in September. For this period, actual intake flows exceeded 5% of the monthly average flow in July and September only – when ichthyoplankton densities are expected to be low. Retirement of Unit 3 in May 2015 will reduce intake flows further such that the percentage of river flow withdrawn under design flow will exceed 5% only in September and October when potential for entrainment is negligible.

- State- and Federally-protected fish and mussel species are listed as occurring in the vicinity of the Clinch River plant. Protected mussel species are the subject of a re-introduction program in the relevant river reach. Low susceptibility to impingement and entrainment of listed species due to life history and occurrence considerations, combined with minimal intake area of influence and low through-screen velocities at Clinch River Plant result in negligible potential for impact or take.

For the reasons outlined above and consistent with the Section 316(b) existing facilities rule, AEP's Clinch River Plant utilizes BTA to reduce impingement and entrainment losses and minimize adverse environmental impact. Therefore, no additional control measures to reduce impingement and entrainment mortality are necessary.

1 Regulatory Background

Clean Water Act §316(b) was enacted under the 1972 Clean Water Act, which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program. Facilities with NPDES permits are subject to §316(b), which requires that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. Cooling water intakes can cause adverse environmental impacts by drawing early life-stage fish and shellfish into and through cooling water systems (entrainment) or trapping juvenile or adult fish against the screens at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) rule (final rule) for existing facilities was published in the Federal Register. The rule applies to existing facilities that withdraw more than 2 million gallons per day (MGD) from Waters of the United States, use at least 25 percent of that water exclusively for cooling purposes, and have or require an NPDES permit. The rule supersedes the Phase II rule, which regulated existing electrical generating facilities until it was remanded in 2007. (The final rule also replaces the remanded existing-facility portion of the previously promulgated Phase III rule) The final rule became effective on October 14, 2014.

Facilities subject to the final rule are required to develop and submit technical material, identified at §122.21(r)(2)-(13), that will be used by the NPDES Director (Director) to make a BTA determination for the facility. The actual intake flow (AIF) and design intake flow (DIF) at a facility determine what submittals will be required. As shown in Table 1-1, facilities with AIF rates of 125 MGD and less have fewer application submittal requirements and will generally be required to select from the impingement compliance options contained in the rule. For such facilities, the Director must still determine BTA for entrainment on a site-specific basis and the applicant may supply information relevant to the Director's decision. Facilities with AIF in excess of 125 MGD are required to address both impingement and entrainment and provide specific entrainment studies which may involve extensive field studies and analysis of alternatives to reduce entrainment (§122.21(r)(9)-(13)). Facilities equipped with closed-cycle recirculating systems are not automatically exempt from these requirements.

Table 1-1. Facility Flow Attributes and Permit Application Requirements

Facility Flow Attributes	Applicable Requirements
Existing facility w/ DIF> 2 MGD and AIF > 125 MGD	§122.21(r)(2)-(13) Includes impingement mortality standard and site-specific entrainment requirements with additional entrainment study and reporting requirements
Existing facility w/ DIF> 2 MGD and AIF < 125 MGD	§122.21(r)(2)-(6), (8) Includes impingement mortality standard and site-specific entrainment requirements; additional reports for entrainment at Director discretion
2 MGD or less DIF OR <25% of AIF used for cooling purposes	Director BPJ

The compliance schedule is dependent on the facility's NPDES permit renewal date. Facilities are to submit their §316(b) application material to their Director along with their next permit renewal, unless that permit renewal takes place prior to July 14, 2018, in which case an alternate schedule may be requested.

American Electric Power (AEP)'s Clinch River Plant is subject to the existing facility rule and based on its current configuration and operation is anticipated to be required to develop and submit each of the §122.21(r)(2)-(6) and (8) submittal requirements (Table 1-2) with its next permit renewal in accordance with the rule's technical and schedule requirements.

Table 1-2. Summary of §316(b) Rule for Existing Facilities Submittal Requirements for §122.21(r)(2)-(6) and (8)

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source Water Physical Data	Characterization of the source water body including intake area of influence
(3)	Cooling Water Intake Structure Data	Characterization of cooling water system; includes drawings and narrative; description of operation; water balance
(4)	Source Water Baseline Biological Characterization data	Characterization of biological community in the vicinity of the intake; life history summaries; susceptibility to impingement and entrainment; must include existing data; identification of missing data; threatened and endangered species and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival)
(5)	Cooling Water System Data	Narrative description of cooling water system and intake structure; proportion of design flow used; water reuse summary; proportion of source water body withdrawn (monthly); seasonal operation summary; existing impingement mortality and entrainment reduction measures; flow/MW efficiency
(6)	Chosen Method of Compliance with Impingement Mortality Standard	Provides facility's proposed approach to meet the impingement mortality requirement (chosen from seven available options); provides detailed study plan for monitoring compliance, if required by selected compliance option; addresses entrapment where required
(8)	Operational Status	Provides operational status for each unit; age and capacity utilizations for the past five years; upgrades within last 15 years; uprates and Nuclear Regulatory Committee relicensing status for nuclear facilities; decommissioning and replacement plans; current and future operation as it relates to actual and design intake flow

2 Source Water Physical Data [§122.21(r)(2)]

2.1 Description of Source Water Body [§122.21(r)(2)(i)]

The Clinch River Plant is located near Carbo, Virginia on the Clinch River at River Mile 268.0 (Figure 2-1). The Clinch River arises in southwest Virginia, flowing into Tennessee and joining with the Powell River before entering the Tennessee River. The Virginia waters of the Clinch River lie within the steep-sloped Ridge and Valley and Cumberland Plateau physiographic provinces of the central Appalachian Mountains. The average gradient of the upper, free-flowing portion of the river covering 188 miles from its source near Tazewell, Virginia, to Norris Reservoir in Tennessee is 9.3 ft/mi (Masnik 1974). The river is characterized by extensive pool-riffle development, including several islands and braided channel segments. The geology of the region is dominated by exposed limestone and dolomite formations, which produce a carbonate-rich system with pH in the range of 7.5-8.5 (Masnik 1974).

The upper Clinch River near the facility has a drainage area of approximately 533 sq. mi. (Krstolic et al. 2013). Land use is about two-thirds forestland, with most of the remainder utilized as grazing land. Urban, industrial, and mining uses combine for less than ten percent of land use (Van Hassel 2007). For the segment of the Clinch River that includes the plant intake and ten miles upstream, water quality was supportive of all uses except recreation, which was impaired by *E. coli* bacteria (VDEQ/VDCR 2014).

Water temperatures in the Clinch River at river mile 271.6, 3.6 miles upstream of the plant intake, ranged from means of 38.2 °F in January to 76.0 °F in July for the years 2010-2014 (see Table 2-1 below).

Table 2-1. Clinch River Water Temperature near the Clinch River Plant (°F)

Month	2010	2011	2012	2013	2014	Mean
January	38.0	36.7	42.3	42.6	31.6	38.2
February	39.5	42.7	44.7	42.6	32.7	40.4
March	45.8	49.5	54.9	44.2	51.1	49.1
April	59.3	57.3	57.8	55.4	58.1	57.6
May	65.2	62.1	67.7	63.0	66.4	64.9
June	74.0	73.9	72.9	72.1	75.2	73.6
July	78.3	77.6	76.3	73.8	73.9	76.0
August	75.3	76.5	73.6	71.2	73.2	74.0
September	70.7	68.5	67.8	68.2	69.0	68.8
October	57.9	57.1	56.5	61.0	--	58.1
November	47.9	49.2	43.5	53.6	--	48.6
December	37.1	45.5	43.7	51.1	--	44.4

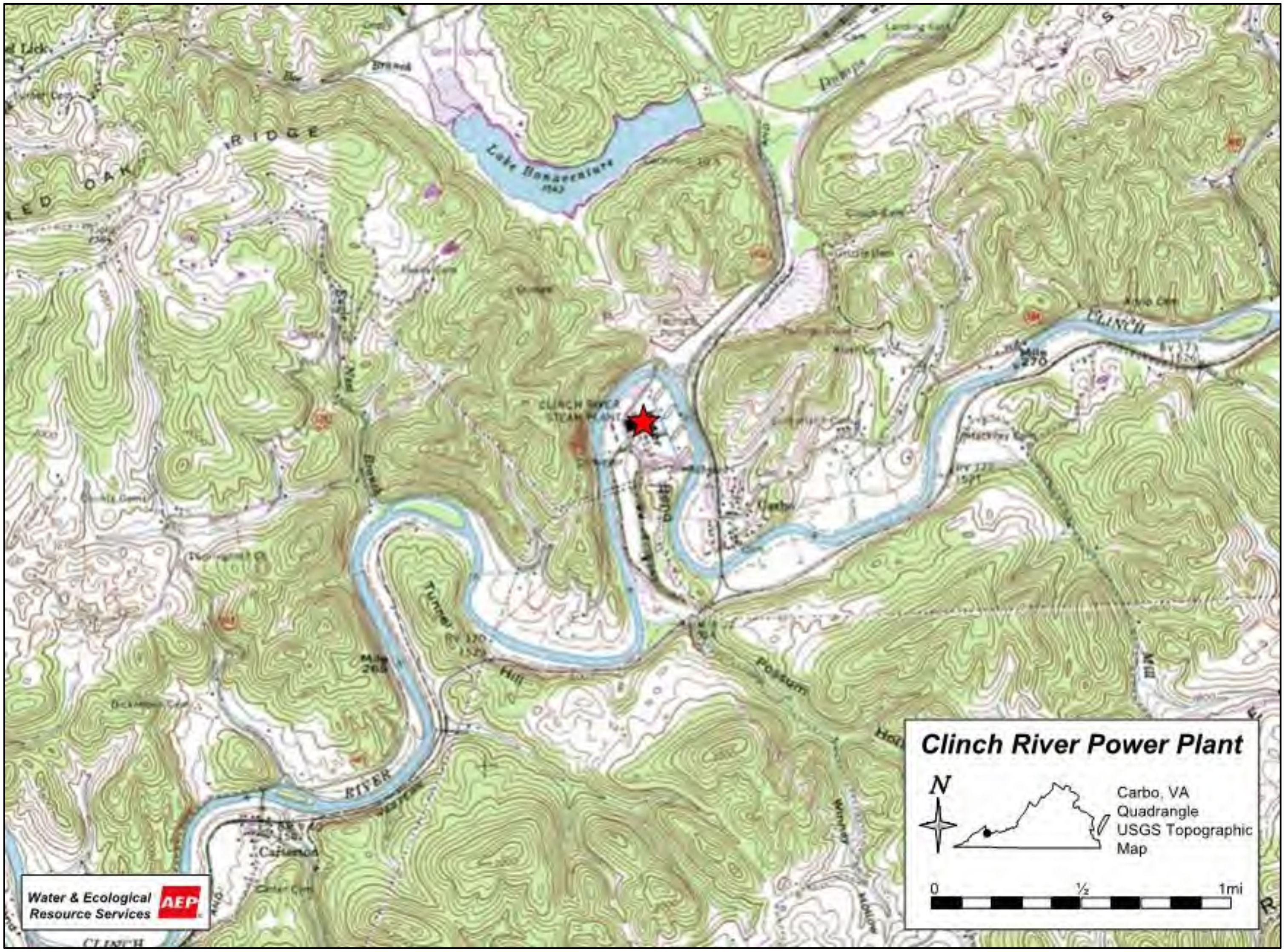


Figure 2-1. Locational Map of Clinch River Plant

2.2 Characterization of Source Water Body [§122.21(r)(2)(ii)]

2.2.1 Hydrology

River flow data were obtained from the U.S. Geological Survey (USGS) gage at Cleveland, Virginia, located 3.6 miles upstream of the plant. For the 84-year period of record, monthly mean flows were lowest in September, with a mean of 220 ft^3/sec (cfs), and highest in March, with a mean of 1,410 cfs. Table 2-2 presents Clinch River flows at the USGS Cleveland, VA station (River Mile 271.6).

Table 2-2. Clinch River Stream Flow (cfs) at River Mile 271.6

Month	Minimum Flow (cfs)	Maximum Flow (cfs)	Mean Flow (cfs)
January	92.1	2,817	1,120
February	206.4	3,360	1,330
March	309.4	4,572	1,410
April	228.4	3,414	1,050
May	194.9	2,254	790
June	79.7	2,353	495
July	78.2	1,292	342
August	63.2	1,640	323
September	55.3	1,003	220
October	53.8	1,389	255
November	64.0	2,011	414
December	80.7	3,043	789

2.2.2 Geomorphology

The Tennessee River drainage, including the Clinch River, is the largest tributary of the Ohio River basin, and contains the most diverse ichthyofauna in North America. In Virginia, the drainage is almost entirely in the Valley and Ridge Province, and is unique in the state for characteristic large shoals composed mainly of loose gravel (Jenkins and Burkhead 1994). Another feature contributing to the faunal diversity is the lack of a major impoundment in the Virginia portion of these rivers, which have retained their strong pool-riffle configuration.

In the plant vicinity, the Clinch River varies from approximately 75-120 feet in width, and <1-10 feet in depth. Substrate composition is dominated by the sand/gravel/rubble fractions. Measurements near the facility found percentages by volume of 32-46% rubble, 19-25% gravel, and 31-39% sand, with typically 0-5% boulder and silt (Van Hassel 2007).

2.2.3 Determination of Area of Influence

The "area of influence" (AOI) of a CWIS appears in three of the §122.21(r) sections of the §316(b) final rules for existing facilities:

- §122.21(r)(2) Source Water Physical Data requires information on "the methods used to conduct any physical studies to determine the intake's ***area of influence*** in the waterbody and the results of such studies."
- §122.21(r)(4) Source Water Baseline Biological Characterization Data says: "The study area should include, at a minimum, the ***area of influence*** of the cooling water intake structure."
- §122.21(r)(11) Benefits Valuation Study says: "The study would also include discussion of recent mitigation efforts already completed and how these have affected fish abundance and ecosystem viability in the intake structure's ***area of influence***."

Although the final rule does not provide a definition of AOI, the §316(b) Phase I rule for new facilities states that:

> *"The area of influence is the portion of water subject to the forces of the intake structure such that a particle within the area is likely to be pulled into the intake structure."*

While neither a formal definition of the AOI nor guidance for its estimation is provided within §316(b) final rule for existing facilities, it is commonly assumed that the AOI is that area of the source waterbody directly affected by the CWIS. Relative to impingeable organisms, generally juvenile and adult fish and shellfish, the concept is somewhat more concrete. It could be assumed that it is the point at which the organism is no longer capable of overcoming the forces of water withdrawal and impinges upon an intake screen (EPRI 2007). This would be highly dependent on the swimming capabilities of the species, its life stage, size, and general health condition; a point noted by EPRI in previous research on the relationship between intake approach velocity and the occurrence of impingement (EPRI 2000).

EPA considers 0.5 ft/s (fps) to be a *de minimis* value for the probability of impingement and this can be interpreted to mean that a fish can swim freely in a flow at this velocity and avoid impingement. As a compliance option for impingement in the 316(b) final rule for existing facilities, EPA indicates that there is no need for any type of impingement protection including impingement mortality studies if the maximum design or actual maximum through-screen velocity of the CWIS is 0.5 fps or less. Under these conditions, it is considered that the facility has met the performance standards for impingement mortality. Therefore, it can be interpreted that the 0.5 fps contour for velocities induced by the CWIS delineates the CWIS's AOI for impingement. This approach, in fact, was proposed to Ohio EPA (OEPA) by Dayton Power & Light (DPL) in their Proposal for Information Collection (PIC) for their Stuart Generating Station on the Ohio River. Their approach was accepted by OEPA and also recommended as a model for other facilities on the Ohio River (EPRI 2007).

Relative to entrainable organisms that have limited to no swimming capabilities and which are passively transported by water currents, a velocity threshold for entrainment, similar to the 0.5 fps velocity contour for impingement AOI, is not deemed a good approach because a passive particle in water may be drawn into the intake regardless of the magnitude of intake induced velocities. Therefore, our discussion on entrainment AOI will be focused on the volume of water withdrawn compared to the source water body and percent flow reduction achieved by the chosen compliance option compared to a once-through cooling system.

Methods

As stated above, the impingement AOI is the approximate area within the 0.5 fps velocity contour in the vicinity of CWIS and a simple desktop analysis is used for the following analysis.

Desktop calculations of the AOI of a cooling water intake are based on the principles of conservation of mass and continuity and require simplifying assumptions such as average water depth. A low water elevation and zero ambient velocity would provide a conservative estimate of AOI. Below are shown the calculation steps for estimating the AOI. By definition, Area of Influence (AOI) or Hydraulic Zone of Influence (HZI) is the location where the velocity induced by the intake is equal to a specified threshold velocity. In the case of impingement, and as discussed above, that threshold velocity is assumed to be 0.5 fps. The radius of AOI (R_{AOI}) for an arc angle of 180 degrees (i.e., a shoreline intake structure) can be estimated from a continuity equation:

$$Qi = \pi \times R_{AOI} \times d \times V \qquad \text{Eq. 1}$$

where, Q_i = Intake Flow
R_{AOI} = Radius of Area of Influence
d = Water depth at R_{AOI}
V = Threshold velocity (i.e., 0.5 fps for impingement AOI).

Rearranging terms in equation 1 gives:

$$R_{AOI} = Qi /(\pi \times d \times V) \qquad \text{Eq. 2}$$

As noted above the entrainment AOI will be evaluated based on comparison of the intake flow to the Clinch River flow.

Results

Using a low water depth at the intake of 4 ft (as a conservative assumption) and 12,750 GPM (18.36 MGD) rated capacity of the river water make-up pumps, the calculated radius of the AOI using the equation 2 above is 4.5 ft. After retirement of Unit 3, the rated capacity of the river water make-up pump will be 6,500 GPM. Using this reduced design flow, the calculated radius of the AOI post retirement of Unit 3 is 2.3 ft.

The monthly maximum percent of the Clinch River flow withdrawn by the Clinch River Plant CWIS is historically 6.6% and 12.9% for actual and design intake flows, respectively (See Table 5-1 in Section 5.1). After the retirement of Unit 3, design intake flows will be below 5% of the monthly average Clinch River flow for all months except September and October (See Table 5-1 in Section 5.1). Peak recruitment in the Clinch River occurs between March and July when withdrawals are projected to be less than 5% of the monthly average flow of the Clinch River, further reducing potential for impact as a result of entrainment at the CWIS. In the now remanded Phase II Rule, those facilities on freshwater rivers that withdrew less than 5% of the mean annual flow were not required to sample for or address entrainment, presumably because potential for adverse environmental impact as a result of entrainment at such facilities was considered inconsequential, i.e., *de minimis.*

In summary, the AOI at Clinch River Plant is considered insignificant for impingement due to the fact that the area over which the intake-induced velocity is greater than 0.5 fps, the threshold value for impingement, has a radius of just 4.5 ft. After Unit 3 is retired, the AOI would become smaller with a radius of 2.3 ft. Additionally, based on the magnitude of the intake flow relative to the river flow, the AOI for entrainment (i.e., the volume of river in which entrainment probability is high) would be less than 5% of the mean flow in the river, meeting a threshold value set in the Phase II Rule.

2.3 Locational Maps [§122.21(r)(iii)]

The locational map is provided in Figure 2-1 (under Section 2.1) which is the USGS topographic map showing the area near Clinch River Plant. Also, Figure 2-2 below presents an annotated aerial photo of the Plant and its environs.

Map source: Google earth

Figure 2-2. Aerial Photo of Clinch River Plant

3 Cooling Water Intake Structure Data [§122.21(r)(3)]

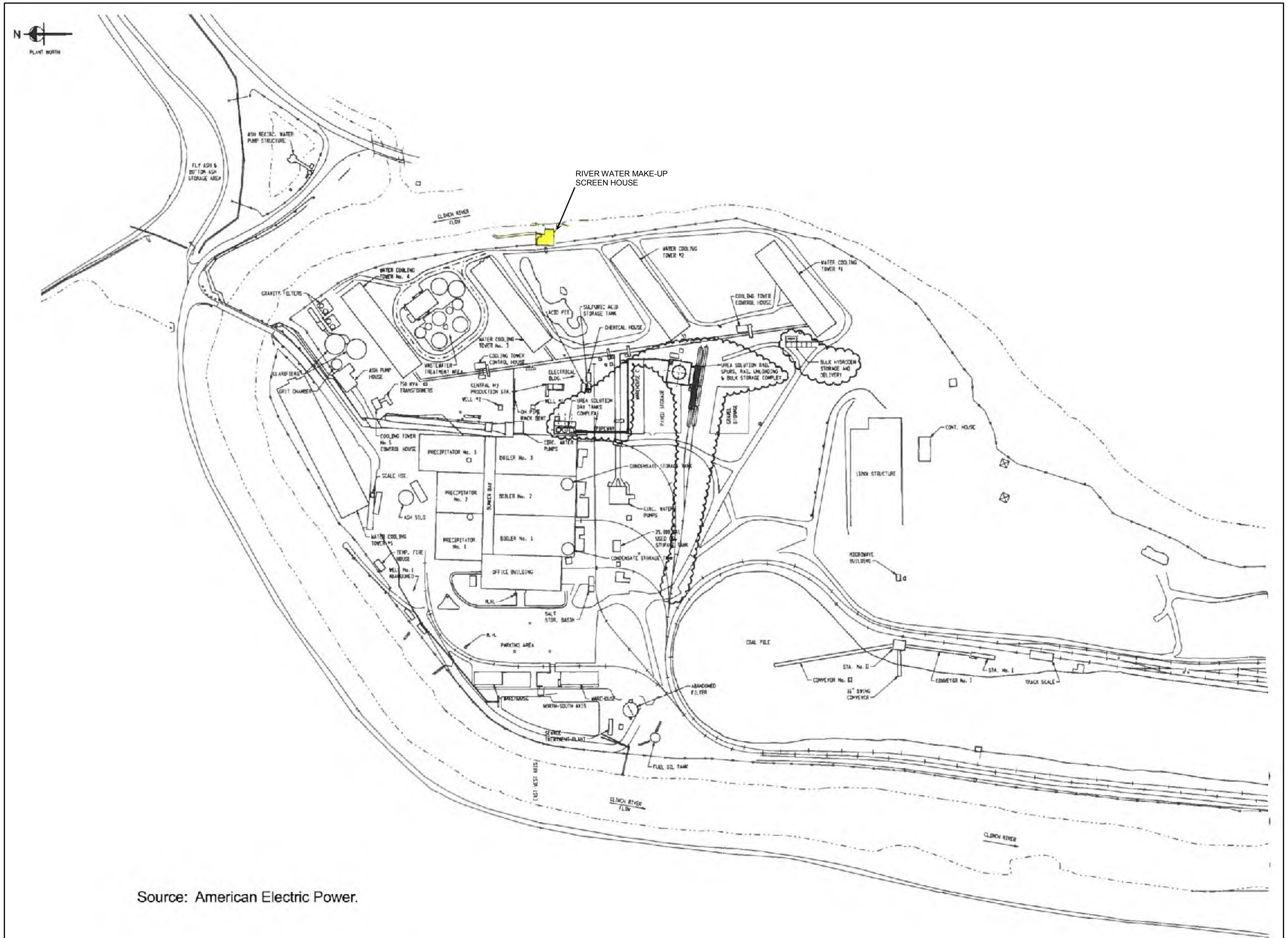
3.1 Description of CWIS Configuration [§122.21(r)(3)(i)]

The Clinch River Plant cooling system is a closed-cycle system; that is, the cooling water is recycled and reused in the steam turbine condensers. The plant currently has three generating units; however, Unit 3 will be permanently retired in May 2015. Approximately 65% of the intake water is used for cooling. The design flow for river water make-up from the Clinch River is currently 18.36 MGD (12,750 GPM) and will be reduced to 9.36 MGD (6,500 GPM) after the retirement of Unit 3 in May 2015. The Clinch River Plant has a single river CWIS to serve its three generating units, located at River Mile 268.0 (see Figures 2-1 and 3-1).

There is one river water intake structure for the entire Plant and two of the three river make-up pumps are required for normal operation with three Units. Each river water pump has a rated capacity of 6,500 GPM and the rated capacity for two pump operation is 12,750 GPM. When Unit 3 is permanently retired in May 2015, the expected river make-up flow should be accomplished with only one pump operation. The intake structure has two 7 ft-2 in. wide intake openings and contains two conventional traveling water screens (TWS) with each basket frame measuring 6 ft wide by 2 ft high and 3/8-inch square mesh openings (Figure 3-2). It is assumed that the screen mesh dimensions (where water flows through) for each basket are 71 in. wide by 21 in. high (i.e., 10.3 ft^2). US Filter has provided a percent open area (POA) of 67.9 for a screen with 3/8-in. square openings and #14 (0.080 in. diameter) mesh wire. The bottom of the screens are located at elevation 1,484 ft, compared to a low water level of 1,488 ft, and normal pool level of 1,498 ft.

The trash rakes are installed with a water level differential recorder in order to remove trash and debris from the water before it enters the traveling water screens and river water makeup pumps. The motor-operated trash rakes function to remove large debris from the front of the intake structure that is caught on the trash rack bars. The rakes are manually operated. If the water level differential across the trash rake becomes excessive, a signal is sent to the plant's control room. When the control operator receives this alarm signal, he must have the trash rack cleaned immediately to prevent possible loss of suction to the river makeup pumps.

Water for washing debris from the traveling screens is supplied by two screen wash pumps located in the intake house. Each pump is rated at 850 GPM at 225 ft. Total Dynamic Head (TDH) and is driven by a 75-hp, 1,750-rpm and 550-volt motor. Each pump takes suction via a 6-in line, derived from the south river makeup pump discharge header downstream of the 24-in self-cleaning strainer. The suction lines are equipped with shut-off valves. Each discharge line is equipped with a check valve and two shut-off valves. The rotating screens are each driven by a two-speed (2hp/1hp), 550-volt motor, and can be operated either manually from local switches in the intake house or automatically. Each screen is equipped with a dual-level recorder-controller which starts the screen wash pump motors when a predetermined water level differential exists across the screen.



Source: American Electric Power.

Figure 3-1. Clinch River Plant Plot Plan

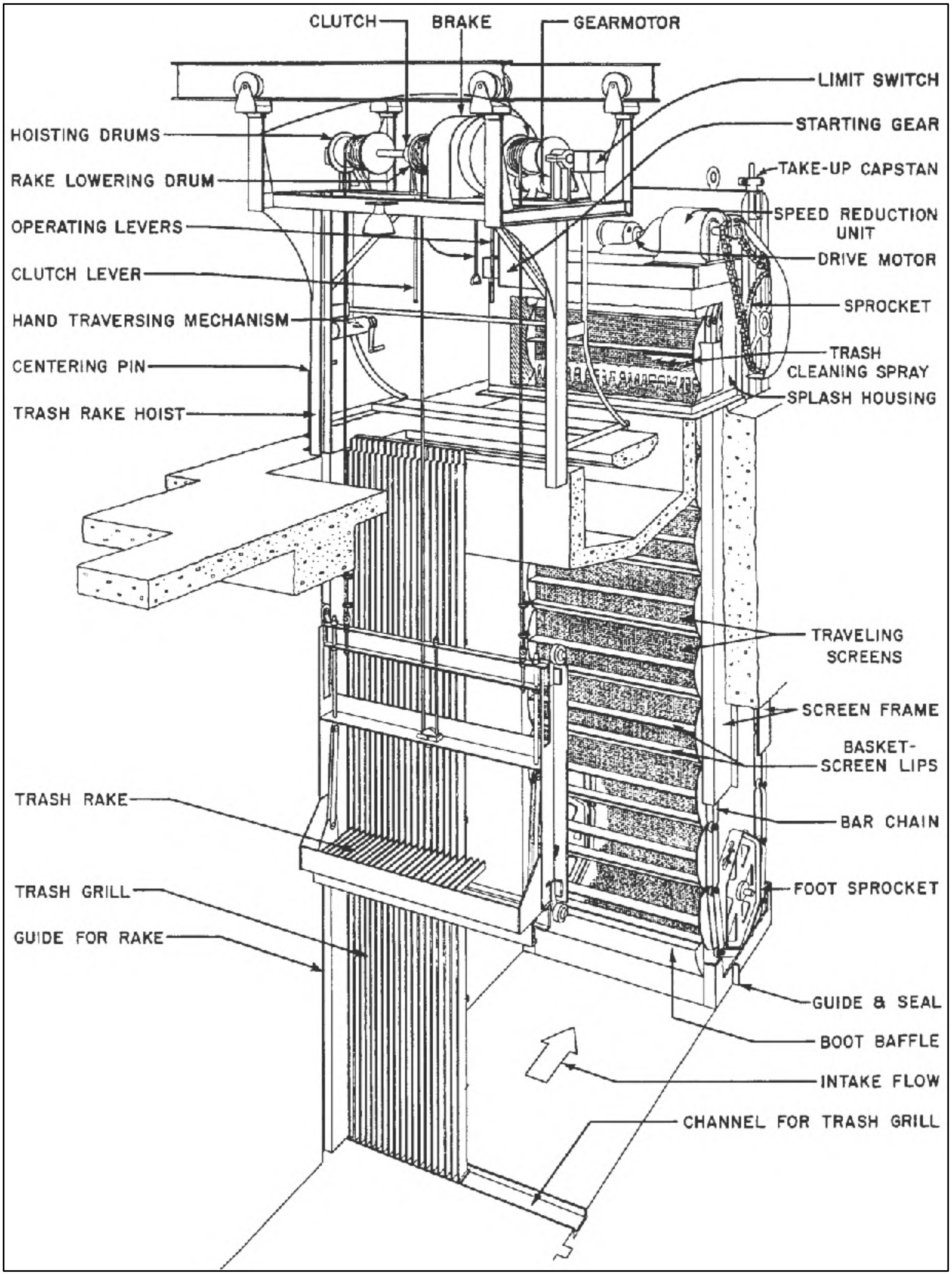


Figure 3-2. Traveling Screen and Trash Rake at Clinch River Plant

The screen-wash system is designed to operate: (1) automatically if the screen water level differential becomes excessive, (2) automatically for sufficient times for the screen to make approximately one revolution in each 24 hours regardless of screen water level differential, and (3) started manually by a push button in the intake house. When the screen wash pump and rotating screen motor control switches are set for automatic operation, the screen wash pump starts and establishes a water pressure. The existence of this pressure in turn starts the rotating screens via a pressure switch. The screen wash system will continue to operate as long as an excessive through-screen water level differential exists. If no screen wash level differential exists, the rotating screens and the screen-wash pump stop running. A running-time meter is provided for each screen wash pump motor. It records the number of hours of operation for each pump.

There are three river water makeup pumps, with each pump rated at 6,500 GPM at 50 ft TDH and driven by a 125 hp, 860 rpm, 550 volt motor. The pumps can be operated either remotely from control switches in the plant's main control room, or locally from switches in the intake house. Normally, two pumps are capable of providing the requirements of all three units, with the third pump in reserve. The three pumps discharge into a 36-inch water main to the plant, which in turn feeds two 24-in pipes.

Each outlet is equipped with a 24-inch motor-operated, self-cleaning strainer which operates automatically to clean itself when a high differential pressure exists across it. This involves 2-5% of the water being discharged backwards through an isolated vertical section of the strainer to wash the debris into a drain box. The backwashing water and refuse are discharged from the bottom of the strainer body to the trash trough. The strainers can also be operated manually. See Figure 3-3 for a schematic of the river makeup water and screen wash pumps.

3.2 Latitude and Longitude of CWIS [§122.21(r)(3)(ii)]

Intake coordinates are:

Latitude: 36° 56' 0.5" N
Longitude: 82° 11' 49.0" W

3.3 Description of CWIS Operation [§122.21(r)(3)(iii)]

The Clinch River Plant and its cooling water system are intended for year-round, 24 hours/day operation, with the exception of down time due to outages. Units 1, 2, and 3 can each generate 235 MW. Net capacity factors and annual net generation for the years 2007-2013 are shown in Table 3-1.

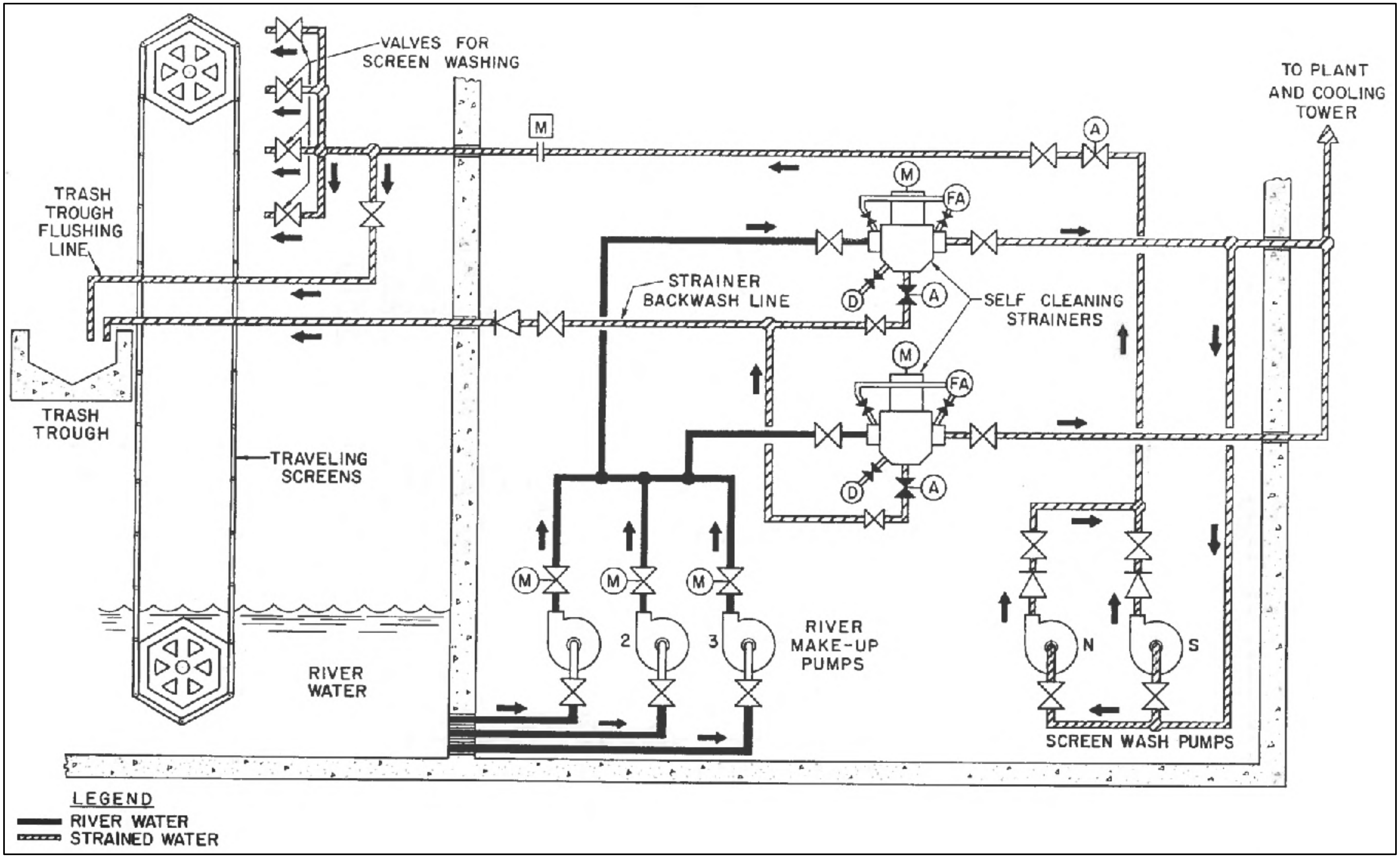


Figure 3-3. Schematic of River Makeup Water and Screen Wash Pumps at Clinch River Plant

Table 3-1. Clinch River Plant Net Capacity Factors (%) and Annual Net Generation (MWh)

Year	Net Capacity Factor (%)			Annual Net Generation (MWh)		
	Unit 1	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3
2013	18.54	12.58	12.51	381,602	258,996	257,475
2012	20.46	11.18	7.37	422,358	230,700	152,036
2011	14.52	24.14	24.50	298,971	496,891	504,316
2010	36.39	24.46	12.06	749,133	503,488	248,302
2009	21.34	11.25	42.02	439,257	231,518	865,034
2008	53.29	59.99	62.62	1,099,996	1,238,405	1,292,524
2007	64.21	63.68	68.87	1,321,779	1,310,952	1,417,742
7-Year Avg	**32.68**	**29.61**	**32.85**	**673,299**	**610,136**	**676,776**

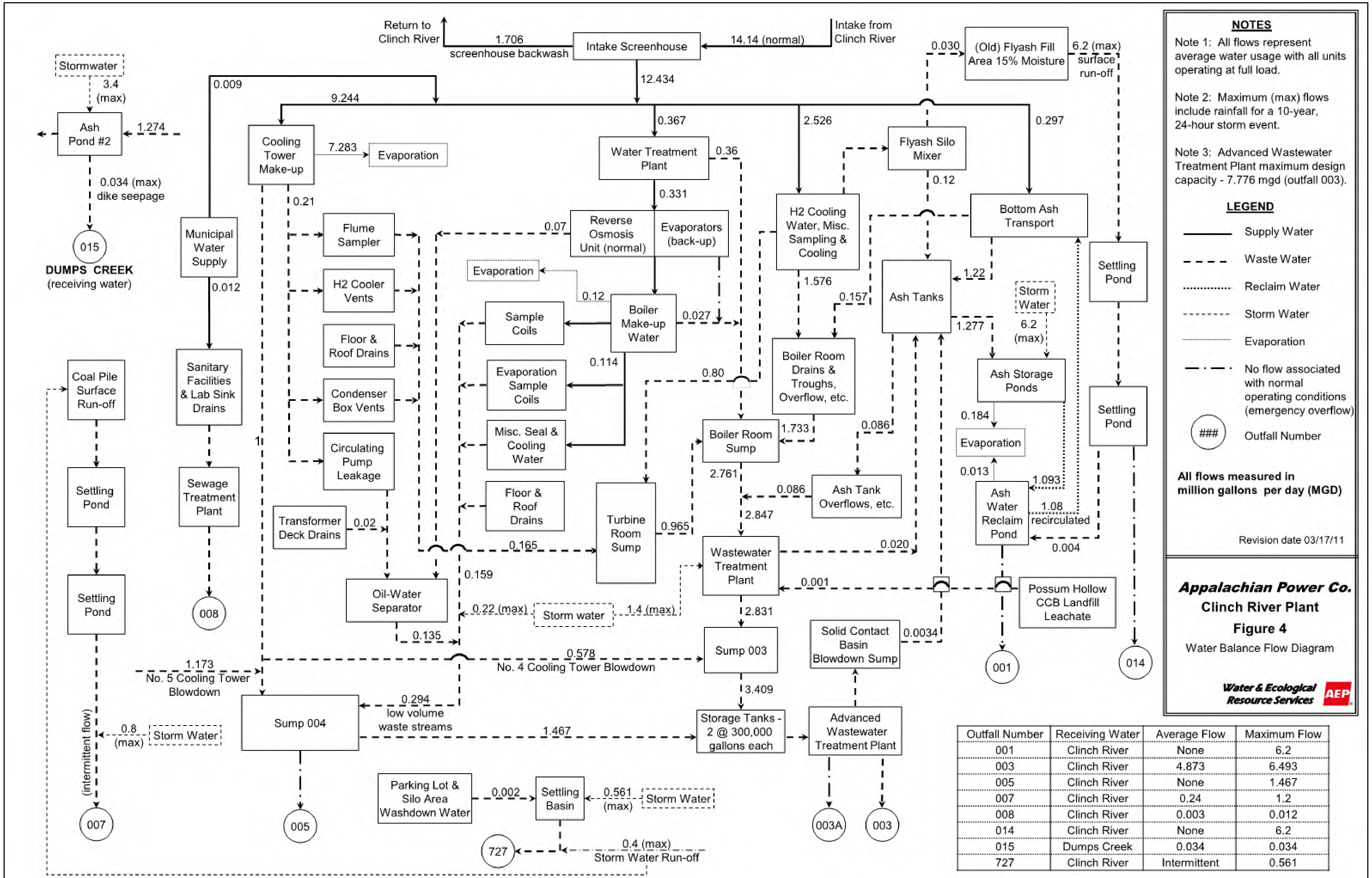
3.4 Description of Intake Flows [§122.21(r)(3)(iv)]

Figures 3-4 and 3-5 present water balance diagrams for the current operation and after the retirement of Unit 3 in May 2015 (DRAFT), respectively.

3.5 Engineering Drawings of CWIS [§122.21(r)(3)(v)]

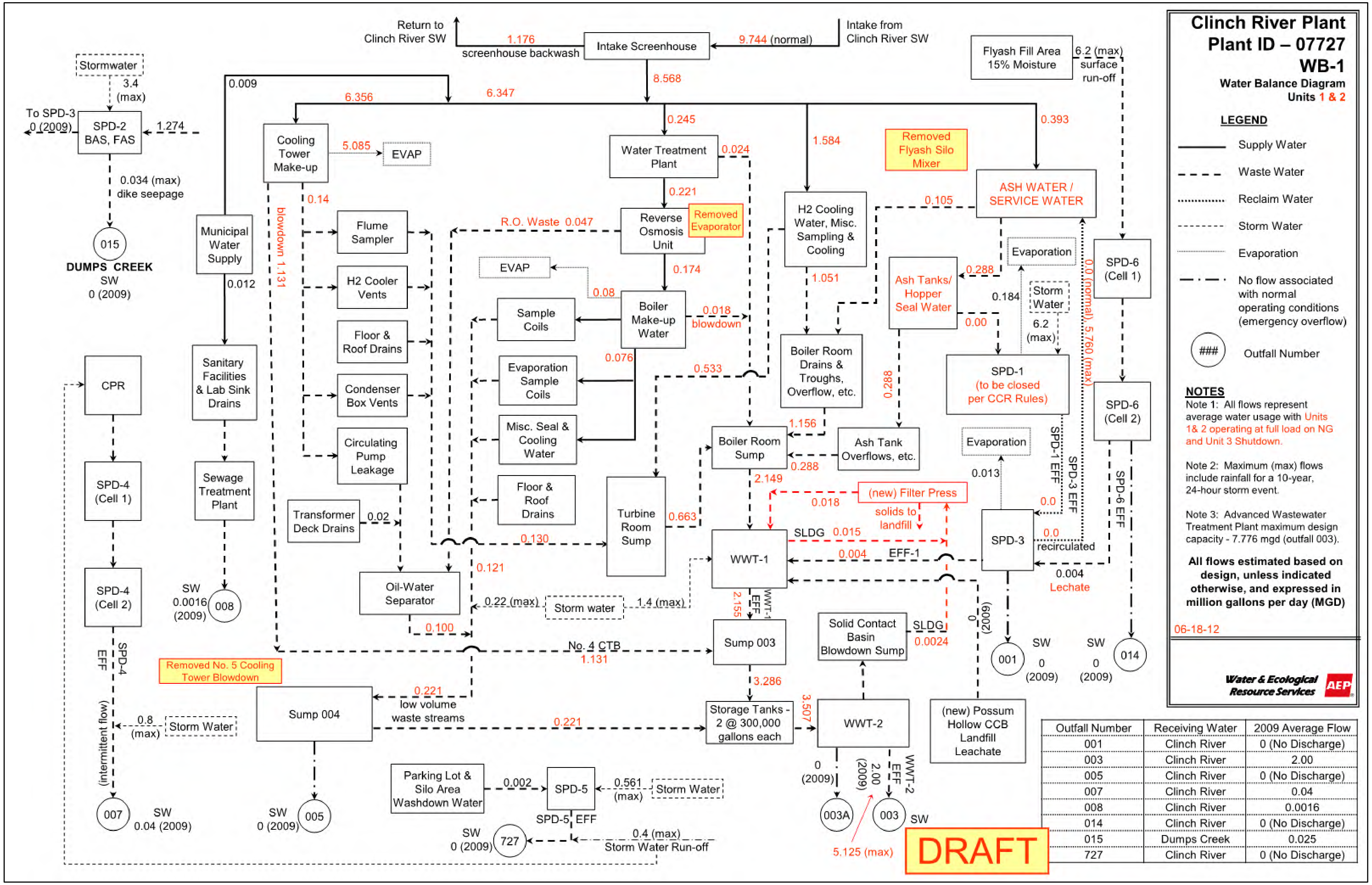
Following engineering drawings of river water make-up intake structures are provided in Appendix A:

- Drawing No.13-5024-15: Clinch River Plant Plot Plan
- Drawing No.12-5112-7: Screen House Arrangement, Make Up, Screen Wash and Drainage Piping (Unit 1 and 2)



Outfall Number	Receiving Water	Average Flow	Maximum Flow
001	Clinch River	None	6.2
003	Clinch River	4.873	6.493
005	Clinch River	None	1.467
007	Clinch River	0.24	1.2
008	Clinch River	0.003	0.012
014	Clinch River	None	6.2
015	Dumps Creek	0.034	0.034
727	Clinch River	Intermittent	0.561

Figure 3-4. Water Balance Diagram of Current Operation at Clinch River Plant



Outfall Number	Receiving Water	2009 Average Flow
001	Clinch River	0 (No Discharge)
003	Clinch River	2.00
005	Clinch River	0 (No Discharge)
007	Clinch River	0.04
008	Clinch River	0.0016
014	Clinch River	0 (No Discharge)
015	Dumps Creek	0.025
727	Clinch River	0 (No Discharge)

Figure 3-5. DRAFT Water Balance Diagram of Clinch River Plant Post Retirement of Unit 3 in May 2015

4 Source Water Baseline Biological Characterization Data [§122.21(r)(4)]

4.1 List of Unavailable Biological Data [§122.21(r)(4)(i)]

The data needed to prepare all elements of § 122.21(r)(4) were available.

4.2 List of Species and Relative Abundance in the vicinity of CWIS [§122.21(r)(4)(ii)]

There were data collected near the Clinch River Plant by AEP and the VADEQ. The sampling locations are shown in Figure 4-1. The AEP monitoring data were collected from three locations (Stations 4, 7, and 9) on the Clinch River near Clinch River Plant on the following dates:

- 19-20 July 1982;
- 19-20 July 1983;
- 28-29 August 1984;
- 30 July 1986;
- 22-23 July 1987;
- 12-13 July 1988;
- 24-25 July 1990; and
- 26-27 August 1991

Sampling was performed by AEP biologists. Sample Station 4 was located 2.5 river miles downstream of Cleveland, VA and 1.4 river miles upstream of the Clinch River Plant water intake (CRM 268.0) at CRM 269.4. Sample Station 7 was located downstream of Clinch River Plant wastewater discharges at CRM 267.2. Station 9 was located immediately downstream of the bridge at Carterton, VA, on Rt. 665 and approximately 3.3 miles downstream of Clinch River Plant at CRM 264.1 (AEP 1982-1991).

Data were collected by VADEQ on October 21 and 28, 2010. Sampling was conducted by state biologists at two locations: Sample ID 6BCLN250.67 record (28) was collected ~17 miles downstream of the Clinch River (Latitude: 36.89092; Longitude: -82.32846) and sample ID 6BCLN273.19 record (41) was collected ~5.5 miles upstream of the Clinch River Plant (Latitude: 36.95336; Longitude: -82.13814) (deq.virginia.gov).

AEP fish sampling was conducted in areas of the river channel containing both pool and riffle habitats and blocked off using 0.25-in mesh block nets. The length of enclosed areas was approximately 200 ft (range 170-210 ft). Channel width varied from 75-120 ft. Fish were sampled using a pulse DC electroshocker (300 v; 5-7 A) mounted on a 5-ft square raft. Using a three-man crew (2 netters, 1 operator), depletion sampling was performed by collecting all stunned fishes in three consecutive runs within the blocked-off area. Most fishes were then field identified and returned live to the river. Voucher specimens and specimens of uncertain identification were preserved in 10% formalin and returned to the laboratory (AEP 1982-1991).

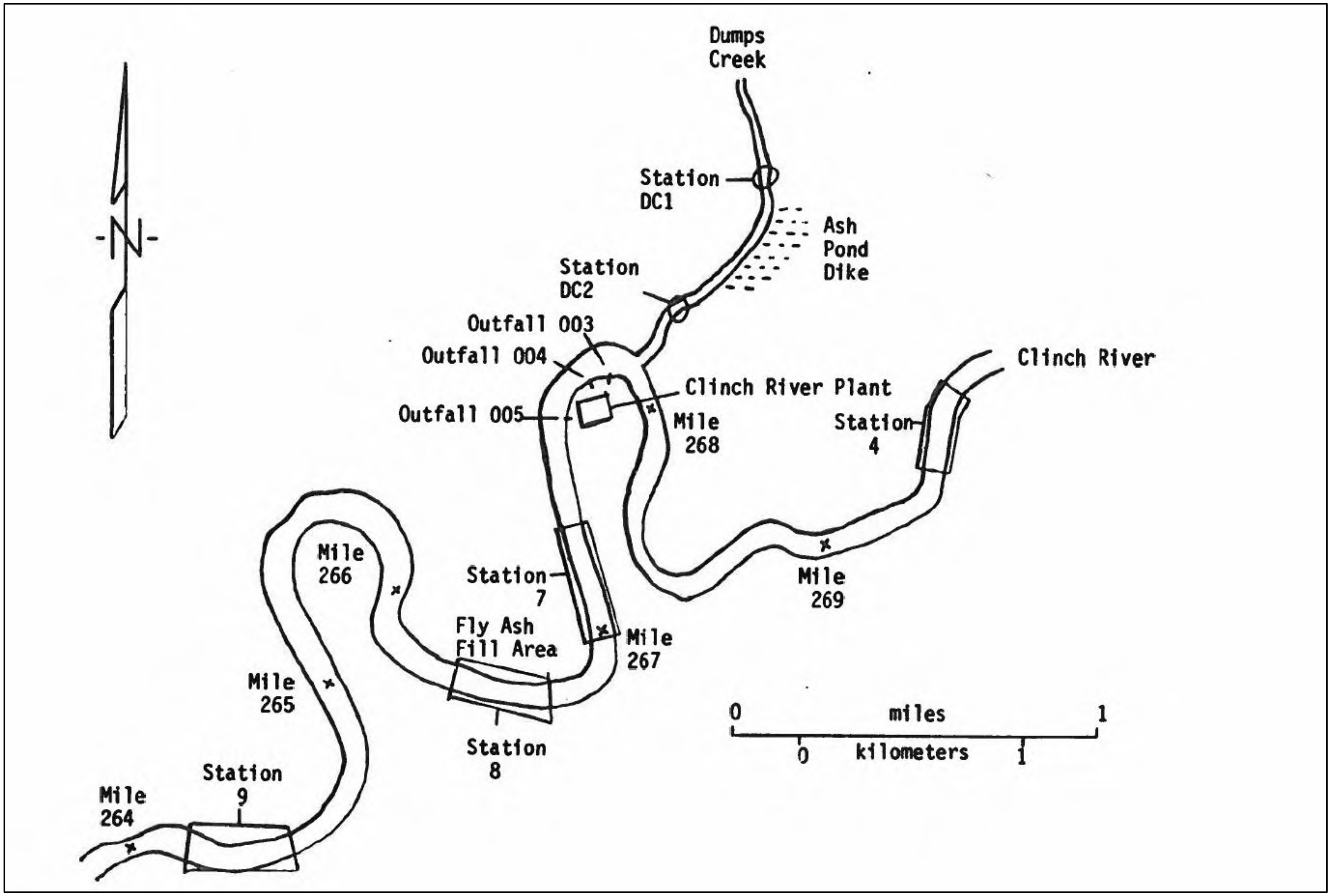


Figure 4-1. Biological Sampling Stations in the Clinch River near Clinch River Plant

VADEQ data were collected from an electrofishing boat. All habitat types present within the 2,000 foot survey areas were represented in the samples, both sites were fished for 7,500 seconds. Field teams consisted of a three-man crew (2 netters, 1 operator), all stunned fishes were collected (deq.virginia.gov). AEP's July and August samples would fall under summer catch data, while the VADEQ October samples are considered fall catch data. One would expect higher YOY counts during AEPs summer samples and less YOY during VADEQ fall samples; both of which are reflected in the data set (see Table 4-1).

Fish collected by electrofishing near Clinch River Plant by AEP from 1982 to 1991 and their relative abundance along with data collected by the state of Virginia Department of Environmental Quality (VADEQ) during sampling performed on October 21 and 28, 2010 are presented in Table 4-1.

Table 4-1. Relative Abundance of Fish in the Vicinity of the Clinch River Plant

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
Petromyzontidae	Ohio Lamprey	1.17%	0.11%
	Mountain Brook Lamprey	0.29%	0.00%
Lepistosteidae	Longnose Gar	0.10%	0.15%
Clupeidae	Gizzard Shad	0.10%	2.98%
Cyprinidae	Central Stoneroller	8.38%	16.07%
	Whitetail Shiner	1.56%	0.88%
	Spotfin Shiner	1.17%	2.69%
	Speckled Chub	0.00%	0.08%
	Streamline Chub	4.78%	1.35%
	Bigeye Chub	3.02%	2.46%
	Blotched Chub	0.00%	8.05%
	YOY Chubs (unidentified)	0.00%	0.20%
	Striped Shiner	1.36%	1.42%
	Warpaint Shiner	0.10%	0.60%
	River Chub	3.61%	1.08%
	Popeye Shiner	0.00%	0.95%
	Tennessee Shiner	11.99%	9.29%
	Highland Shiner	2.53%	0.00%
	Silver Shiner	3.02%	0.84%
	Sawfin Shiner	1.56%	0.70%
	Rosyface Shiner	0.00%	0.70%
	Telescope Shiner	1.07%	0.41%
	Mimic Shiner	3.41%	0.74%

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
	Steelcolor Shiner	0.00%	0.20%
	YOY Shiners (unidentified)	0.00%	10.21%
	Stargazing Minnow	0.00%	2.57%
	Bluntnose Minnow	1.36%	1.50%
	Creek Chub	0.00%	0.27%
	Rosyside Dace	0.00%	0.03%
	Western Blacknose Dace	0.39%	0.00%
Catastomidae	White Sucker	0.00%	0.03%
	Northern Hogsucker	4.09%	6.20%
	Smallmouth Redhorse**	1.46%	0.00%
	Silver Redhorse	0.00%	0.01%
	River Redhorse	0.00%	0.38%
	Shorthead Redhorse**	0.00%	1.77%
	Black Redhorse	4.68%	0.54%
	Golden Redhorse	0.97%	3.40%
	YOY Redhorse (unidentified)	0.00%	0.20%
Ictaluridae	Yellow Bullhead	0.10%	0.08%
	Channel Catfish	0.00%	0.04%
	Mountain Madtom	1.66%	0.01%
	Flathead Catfish	0.19%	0.03%
Cottidae	Clinch Sculpin	0.19%	0.00%
Centrarchidae	Rock Bass	3.61%	2.88%
	Redbreast Sunfish	0.97%	0.64%
	Bluegill	0.10%	0.79%
	Longear Sunfish	0.88%	2.68%
	Longear x Green Sunfish Hybrid	0.00%	0.01%
	Smallmouth Bass	1.46%	1.77%
	Spotted Bass	0.00%	0.24%
	Largemouth Bass	0.39%	0.16%
Percidae	Greenside Darter	6.53%	5.71%
	Bluebreast Darter	1.07%	0.16%
	Fantail Darter	0.00%	0.08%
	Ashy Darter	0.10%	0.00%
	Redline Darter	10.82%	2.52%

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
	Snubnose Darter	1.07%	0.01%
	Speckled Darter	2.05%	0.24%
	Tippecanoe Darter*	0.00%	0.05%
	Wounded Darter	0.10%	0.18%
	Banded Darter	2.44%	0.84%
	Tangerine Darter	1.27%	0.08%
	YOY Darters (unidentified)	0.00%	0.32%
	Blotchside Logperch	0.29%	0.00%
	Logperch	0.10%	0.46%
	Gilt Darter	2.24%	0.74%
	Dusky Darter	0.00%	0.15%
	Sauger	0.00%	0.01%
	Walleye	0.19%	0.00%

Data Source: deq.virginia.gov; AEP 1982-1991

Note: *Tippecanoe Darter (Ohio and Cumberland drainages) is also known as the Golden Darter in the Upper Tennessee River Drainage

** The Shorthead and Smallmouth Redhorse have been separated by drainages.

Table 4-2 below summarizes relative abundance by family of fish near the Clinch River Plant from VADEQ 2010 and AEP 1982-1991 Surveys.

Table 4-2. Relative Abundance by Family of Fish Near the Clinch River Plant

Family Name	VADEQ Survey 2010	AEP Surveys 1982-1991
Petromyzontidae	1.46%	0.11%
Lepistosteidae	0.10%	0.15%
Clupeidae	0.10%	2.98%
Cyprinidae	49.32%	63.31%
Catastomidae	11.21%	12.54%
Ictaluridae	1.95%	0.16%
Cottidae	0.19%	0.00%
Centrarchidae	7.41%	9.18%
Percidae	28.27%	11.57%

The ten most abundant fish species found within the Clinch River by each sampling study (the 2010 VADEQ and 1982-1991 AEP) are listed below in Table 4-3.

Table 4-3. Ten Most Abundant Fishes Collected during VADEQ 2010 & AEP 1982-1991 Electrofishing Surveys on the Clinch River

Rank	VADEQ 2010		AEP 1982-1991	
	Common Name	% Composition	Common Name	% Composition
1	Tennessee Shiner	11.99%	Central Stoneroller	16.07%
2	Redline Darter	10.82%	YOY Shiners (unidentified)	10.21%
3	Central Stoneroller	8.38%	Tennessee Shiner	9.29%
4	Greenside Darter	6.53%	Blotched Chub	8.05%
5	Streamline Chub	4.78%	Northern Hogsucker	6.20%
6	Black Redhorse	4.68%	Greenside Darter	5.71%
7	Northern Hogsucker	4.09%	Golden Redhorse	3.40%
8	River Chub	3.61%	Gizzard Shad	2.98%
9	Rock Bass	3.61%	Rock Bass	2.88%
10	Mimic Shiner	3.41%	Spotfin Shiner	2.69%
	Total	61.89%	Total	67.48%

These ten fish species accounted for 61.9% of the 2010 VADEQ sampling and 67.48% of the 1982-1991 AEP sampling. While there are differences in the dominate species over these two data sets, five of the most abundant species were observed within both sampling efforts. Of these species, the Tennessee shiner was the most abundant in VADEQ 2010, while the central stoneroller was the most abundant in the AEP 1982-1991 sampling efforts. In total 47 species were observed in the VADEQ 2010 sampling, while 62 species were observed in the AEP 1982-1991 sampling efforts. Because the AEP sampling was conducted over a 9-year period, it is not surprising that a greater number of species were observed in the samples.

4.3 Identification of Species and Life Stages Susceptible to I & E [§ 122.21(r)(4)(iii)]

The use of water from rivers for cooling power stations potentially impacts fishes in many ways, most directly through impingement and entrainment. In order to provide perspective on species likely to be susceptible to impingement and entrainment, monitoring data from AEP biologists along with VADEQ stream bioassessment data were reviewed. For reference, a two year sampling program was undertaken on the Ohio River (King et al. 2011). The 2005 and 2006 impingement abundance monitoring and standardized fish sampling studies near 15 Ohio River power plants were conducted as part of the Ohio River Ecological Research Program (ORERP) (King, et al., 2011). This study suggested impingement of fishes at intake structures was selective and did not represent the full species assemblages in the source waterbody. In particular, impingement data were compared to seasonal electrofishing and seining data to determine species composition and relative abundance. King et al. (2011) evaluated potential explanations for the presence, absence, or disproportionate occurrence of fishes between the two data sets. The impingement study demonstrated parallels in species composition among power plants over nearly 870 river miles of the Ohio River. The river surveys indicated that the abundance of some species varied significantly over the length of the river. However, Clupeids dominated the impingement collections at much higher levels than suggested by the populations encountered during the river surveys. Other forage species, especially Emerald Shiner and Channel Shiner, were under represented in the impingement collections.

While the Ohio River is a much larger river system than the Clinch River, the following study demonstrates how impingement and entrainment potentially affect various fish species and families at similar power plants. Several of the species and families mentioned are represented in both river systems and species behavior and habitat needs are alike in each river. It should be noted that while the overall conclusions about species composition subject to impingement are useful, much of the King, et al., 2011 data collected at cooling water intakes that use larger proportions of river flow and have substantially higher through-screen velocities than those present at the Clinch River Plant. For these reasons, the rates of impingement at the power plants on the Ohio River are likely to be higher than at the Clinch River Plant. In particular, as noted above, the rates of impingement are expected to be decreased at Clinch River Plant due to the low rate of monthly maximum actual intake flow (13.7 MGD) relative to the river discharge (221.0 MGD for the month of July when the maximum monthly withdrawal occurred based on 2010-2013 flow data; see Table 5-1 in Section 5.1 for more details) and low through-screen velocity of less than 0.5 fps on a normal pool level condition (see Section 5.2 for engineering calculations of through-screen velocities).

During the two-year river study on the Ohio River, 32 species collected were not impinged (King et al. 2011). On the other hand, 13 species were impinged that were not collected during the river surveys. The impingement study indicated that many species in the Ohio River are not particularly susceptible to impingement due to behavior, habitat preferences, or low population levels. This was evident for Carps and Minnows (Family Cyprinidae), Darters (Family Percidae), and Redhorse (*Moxostoma* spp.). The opposite was true for abundant, pelagic schooling Clupeids that were occasionally impinged at very high rates. Often higher Clupeid impingement rates were observed during periods of declining water temperatures. Channel Catfish (*Ictalurus punctatus*) were also impinged at much higher rates than would be predicted based on their abundance in the river collections (King et al. 2011). Similar species-specific differences between source water relative abundance and relative rates of impingement are expected to take place on other rivers with like species such as the Clinch River.

All species present within the Clinch River have the potential to be affected by impingement and entrainment, however the vast majority of fishes are unlikely to be affected based on multiple factors (see Table 4-4).

Table 4-4. Impingement and Entrainment Potential

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
LAMPREY				
Ohio Lamprey	*Ichthyomyzon bdellium*	Early life stages – Unlikely, spawn in riffles. Adults and Juveniles – Unlikely young burrow into sediment. Adults – low density, parasitic.	Unlikely	Unlikely
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	Early life stages - Unlikely, spawn in riffles. Adults and Juveniles - Unlikely young burrow into sediment. Adults – remain in smaller streams	Unlikely	Unlikely
GAR				
Longnose Gar	*Lepisosteus osseus*	Early life stages – Unlikely, newly hatched young adhere to submerged substrate. Adults and Juveniles – Unlikely due to feeding habits	Unlikely	Unlikely
SHAD				
Gizzard Shad	*Dorosoma cepedianum*	Early life stages– Likely, broadcast spawners Adults and Juveniles - Likely, congregate near outfall not far from intake, attracted to current	Yes	Unlikely
SALMON/TROUT				
Rainbow Trout	*Oncorhynchus mykiss*	Early life stages – Unlikely, no natural reproduction in the Clinch River - stocked Adults and Juveniles – Unlikely, prefer cooler waters - primarily found near tributaries	Unlikely	Unlikely
PIKE				
Muskellunge	Esox Masquinongy	Early life stages - Unlikely, shallow spawners Adults and Juveniles - Unlikely due to feeding habits	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
CARP / MINNOW				
*Unlikely based on previous data, spawning, and feeding habits				
Common Carp	*Cyprinus carpio*	Early life stages – Possible, broadcast spawners Adults and Juveniles – Unlikely, avoid current	Unlikely	Unlikely
Spotfin Shiner	*Cyprinella spiloptera*	Adults and Juveniles – known to school near currents, high density sp.	Potentially	Unlikely
Striped Shiner	*Luxilus chrysocephalus*	Adults and Juveniles – School near currents	Unlikely	Unlikely
Rosyside Dace	*Clinostomus funduloides*	Early life stages – Unlikely, spawn in riffles. Adults and Juveniles – Unlikely, attracted to deep pools and woody debris.	Unlikely	Unlikely
Speckled Chub	*Macrhybopsis aestivalis*	Adults and Juveniles – Prefers large flowing river channels with gravel and sand.	Unlikely	Unlikely
Bigeye Chub	*Hybopsis amblops*	*	Unlikely	Unlikely
Streamline Chub	*Erimystac dissimilis*	Adults and Juveniles – Often found in smaller streams - Prefer swift currents in 1~4 ft. of water.	Unlikely	Unlikely
Highland Shiner	*Notropis micropteryx*	Early life stages – eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel.	Unlikely	Unlikely
Western Blacknose Dace	*Rhinichthys obtusus*	Adults and Juveniles – Often found in smaller high gradient streams. Prefer riffles	Unlikely	Unlikely
Blotched Chub	*Erimystax insignis*	(*) Adults and Juveniles – Often found in smaller high gradient streams - Prefer riffles.	Unlikely	Unlikely
River Chub	*Nocomis micropogon*	Early life stages – Unlikely, males defend nest. Adults and Juveniles – Typically found in larger streams & medium size rivers, found in deep pools and swift currents.	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Popeye Shiner	*Notropis ariommus*	(*) Adults and Juveniles – sp. is seldom very common, highly localized	Unlikely	Unlikely
Silver Shiner	*Notropis photogenis*	Adults and Juveniles – School near currents	Unlikely	Unlikely
Rosyface Shiner	*Notropis rubellus*	Early life stages – eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel.	Unlikely	Unlikely
Warpaint Shiner	*Luxilus coccogenis*	Adults inhabit gravel riffles adjacent to pools in clear waters. Nest spawners	Unlikely	Unlikely
Whitetail Shiner	*Cyprinella galactura*	Adults and Juveniles – Inhabit rocky runs more often than pool and riffles.	Unlikely	Unlikely
Telescope Shiner	*Notropis telescopus*	Adults and Juveniles – Inhabit rocky runs and flowing pools, often near riffles.	Unlikely	Unlikely
Mimic Shiner	*Notropis volucellus*	Early life stages – Potentially, broadcast spawn. Typically found in larger to moderate size streams and rivers, high density sp.	Potentially	Unlikely
Steelcolor Shiner	*Cyprinella wipplei*	Early life stages– eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel. Often school near the top and middle of the water column.	Unlikely	Unlikely
Sawfin Shiner	*Notropis sp.*	Adults and Juveniles – Sometimes forms moderate-sized schools. Low density sp.	Unlikely	Unlikely
Stargazing Minnow	*Phenacobius uranops*	Young are often found near beds of water willow and margins of flowing pools. Adults typically found over very slightly silted gravel and small to medium rubbles.	Unlikely	Unlikely
Tennessee Shiner	*Notropis leuciodus*	Prefers pool and runs, usually clear rivers and streams with gravel substrates. Relatively large populations in areas.	Potentially	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Creek Chub	*Semotilus atromaculatus*	*	Unlikely	Unlikely
Central Stoneroller	*Campostoma anomalum*	*	Unlikely	Unlikely
Bluntnose Minnow	*Pimephales notatus*	*	Unlikely	Unlikely
SUCKER				
* These species have the potential to occur near the intake during larval and early life stages				
Shorthead Redhorse	*Moxostoma macrolepidotum*	*	Unlikely	Unlikely
Northern Hog Sucker	*Hypentelium nigricans*	*	Unlikely	Unlikely
Silver Redhorse	*Moxostoma anisurum*	*	Unlikely	Unlikely
River Redhorse	*Moxostoma carinatum*	*	Unlikely	Unlikely
Smallmouth Redhorse	*Moxostoma breviceps*	*	Unlikely	Unlikely
Black Redhorse	*Moxostoma duquesnei*	*	Unlikely	Unlikely
Golden Redhorse	*Moxostoma erythrurum*	*	Unlikely	Unlikely
White Sucker	*Catastomus commersonii*	*	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
CATFISH				
Channel Catfish	*Ictalurus punctatus*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding/ past surveys have yielded some impacts.	Unlikely	Unlikely
Flathead Catfish	*Pylodictis olivaris*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding	Unlikely	Unlikely
Yellow Bullhead	*Ameiurus natalis*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding	Unlikely	Unlikely
Mountain Madtom	*Noturus eleutherus*	Early life stages – Unlikely, spawn in riffles Adults – Potentially, prefer deep/ swift riffles Juveniles –unlikely, feed in riffles.	Unlikely	Unlikely
SUNFISH				
* Unlikely based on benthic nesting and feeding habits				
Rock Bass	*Ambloplites rupestris*	*	Unlikely	Unlikely
Bluegill	*Lepomis macrochirus*	*	Unlikely	Unlikely
Green Sunfish	*Lepomis cyanellus*	*	Unlikely	Unlikely
Longear Sunfish	*Lepomis megalotis*	*	Unlikely	Unlikely
Lepomis Hybrid	–	*	Unlikely	Unlikely
Redbreast Sunfish	Lepomis auritus	*	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
BLACK BASS				
* Unlikely based on benthic nesting and feeding habits				
Smallmouth Bass	*Micropterus dolomieu*	*	Unlikely	Unlikely
Largemouth Bass	*Micropterus salmoides*	*	Unlikely	Unlikely
Spotted Bass	*Micropterus punctulatus*	*	Unlikely	Unlikely
DARTER				
*Unlikely based on previous data, spawning, and feeding habits				
Greenside Darter	*Etheostoma blennioides*	*	Unlikely	Unlikely
Ashy Darter	*Etheostoma cinereum*	*	Unlikely	Unlikely
Speckled Darter	*Etheostoma stigmaeum*	*	Unlikely	Unlikely
Redline Darter	*Etheostoma rufilineatum*	*	Unlikely	Unlikely
Snubnose Darter	*Etheostoma simo*	*	Unlikely	Unlikely
Bluebreast Darter	*Etheostoma camurum*	*	Unlikely	Unlikely
Fantail Darter	*Etheostoma flabellare*	*	Unlikely	Unlikely
Blotchside Logperch	*Percina burtoni*	*; low density sp.	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Johnny Darter	*Etheostoma nigrum*	*	Unlikely	Unlikely
Tippecanoe Darter	*Etheostoma tippicanoe*	*	Unlikely	Unlikely
Wounded Darter	*Etheostoma vulneratum*	*	Unlikely	Unlikely
Banded Darter	*Etheostoma zonale*	*	Unlikely	Unlikely
Tangerine Darter	*Percina aurantiaca*	*	Unlikely	Unlikely
Gilt Darter	*Percina evides*	*	Unlikely	Unlikely
Dusky Darter	*Percina sciera*	*	Unlikely	Unlikely
Logperch	*Percina caprodes*	Adults and Juveniles – Potentially attracted to current. Typically higher populations than Blotchside when found in same habitat.	Unlikely	Unlikely
PERCH				
Walleye	*Sanders vitreus*	Early life stages – Deposit eggs over gravel or boulder-sized rocks in riffle areas Adults and Juveniles – Attracted warm water discharge during colder temperatures	Unlikely	Unlikely
Sauger	*Sander canadensis*	Adults and Juveniles – Attracted warm water discharge during colder temperatures	Unlikely	Unlikely

Note: **Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that will be less than 0.5 fps at normal water level after retirement of Unit 3 in May 2015.

Based on life history, feeding and spawning habits, species abundance, and on previously collected fisheries data, no specie are expected to be susceptible to impingement and four have the potential to be vulnerable to entrainment at the Clinch River Plant (see Table 4-5).

Table 4-5. Fish Species Expected to be Most Vulnerable to Entrainment at the Clinch River Plant

Common Name	Scientific Name
Gizzard Shad	*Dorosoma cepedianum*
Mimic Shiner	*Notropis volucellus*
Spotfin Shiner	*Cyprinella spiloptera*
Tennessee Shiner	*Notropis leuciodus*

Note: In the final Rule, EPA has made the argument that impingement is virtually eliminated when through screen velocities are at or below 0.5 ft/s (as will be the case at Clinch River when unit 3 is retired).

The primary factors behind the selection of these species are their known tendencies to gather in large schools, their attraction to warmer waters during the cold seasons, and the fact that they are predominately pelagic spawners with either demersal adhesive or semi-buoyant demersal eggs. The broadcast spawners in this group exert no parental investment, increasing the likelihood of entrainment during the juvenile state.

4.4 Identification and Evaluation of Primary Growth Period [§ 122.21(r)(4)(iv)]

The primary growth period for the majority of fishes directly follows the spring hatch. Growth rates are highest early and tend to decline throughout the summer along with total fish abundance. Fish are cold blooded, thus primary growth occurs when water temperatures are 50-degrees or above. The generally held view on seasonal variation in fish growth in North America is that growth is fastest in the spring and early summer, slows in the late summer and fall, and virtually stops in the winter (Gebhart et al. 1978). The majority of fishes will have their highest densities shortly after the hatch occurs when larvae are concentrated. Feeding competition is especially important during late spring through early summer when the bulk of fish are in their early life stages. During this time, they are more susceptible to starvation (May 1974). This is a critical stage in development, where larval fish have a short time period to initiate feeding before reaching a point of no return and, ultimately, starving (Ehrlich 1974; Miller et al. 1988).

4.4.1 Reproduction

Clinch River fishes almost always have external fertilization, which is principally controlled by water temperatures. Fish reproduction has the potential to produce high yields; however, mortality rates are also high. Additionally, most fish spawn only once a year regardless of prior success. Fecundity refers to the number of eggs a female produces and can vary widely depending on the risk level associated with various types of spawning methods and the amount of parental investment.

Reproduction activities for the four species with the highest risk of entrainment (Table 4-5) are as follows: Gizzard Shad *(Dorosoma cepedianum)* a member of the *Clupeidae* family reproduces from mid-March to later August, with the bulk of the population spawning in May and June when temperatures range from 15.6-22.8°C (Wallus et al. 1990). Gizzard Shad are extremely prolific spawners and therefore have very high larval densities (Storck et al. 1978). The remaining three species are all members of the *Cyprinidae* family. Spotfin Shiner (*Cyprinella spiloptera)* spawning occurs from mid-June to mid-August and mostly occurs in the morning (Jenkins and Burkhead 1993). Eggs are typically deposited in crevices formed by loose bark on submerged trees and stumps (Trautman 1981). Both male and female Mimic Shiners (*Notropis volucellus)* mature at 1 year of age. In Virginia, breeding occurs between May and early August and takes place over sand or gravel substrates in shallows and riffles (Jenkins and Burkhead 1993). Little is known about the life history of the Tennessee Shiner (*Notropis leuciodus).* Some fish don't mature until 2 years of age. Reproduction activities are known to occur during spring and early summer when temperatures are 17-25.6°C (Outten 1962). Spawning typically occurs over chub nests where 20-50 males gather in a school. However, spawning has also been known to occur over shallow gravel runs without nests (Jenkins and Burkhead 1993).

4.4.2 Larval Recruitment

Peak larval recruitment for most Clinch River fishes generally occurs between April and July. As a result, peak larval fish entrainment would be expected to be more prevalent during the same period. Young of year (YOY) for the majority of fishes are most abundant shortly after the spring and summer spawning period. It is unlikely that large numbers of eggs and larvae would become entrained at the Clinch River Plant given the predominately required spawning habitat (riffle / shallow water habitats) of the adults.

4.4.3 Period of Peak Abundance

Fish spawning is a direct function of water temperature, constraining most activity to the spring and early summer months with limited species spawning in the fall. This results in huge influxes of larval and juvenile fishes into the Clinch River system drainage each year when water temperatures begin to rise. Peak abundance for most juvenile fishes occurs between May and August depending on each species' unique spawning habits. Activities for the four species with the highest risk of entrainment are as follows.

Gizzard Shad of the Age-0 class are most abundant during late spring through early fall and dominate the diets of predators during this early life stage (Michaletz 1998). Gizzard Shad growth rates tend to be highest early after hatch, and decline throughout the summer (Welker 1994). Studies have shown that peak shad populations occurred between May 11 and June 22. The timing of peak density differs from year to year for every population and is likely correlated to variances in water temperature, with the highest densities corresponding to 17-22°C waters that had been stable or rising (Zweifel et al. 2009).

Mimic Shiner (*Notropis volucellus)* both male and females mature sexually at 1 year of age; 2 year old fish occur in relatively low numbers with 3 year old fish being extremely rare (Becker 1983). In-depth knowledge regarding the Mimic Shiner's life history is lacking. Peak density is directly correlated to the spawning time which is a function of temperature. Mimic Shiners are thought to spawn in early summer (Stauffer et al., 1995). Therefore, peak abundance is likely to occur between late-June and September.

Spotfin Shiner (*Cyprinella spiloptera)* are fractional spawners, a strategy that greatly increases reproductive potential. Breeding pairs have been known to spawn up to 12 times during a 1 to 7 day period from June 16 to August 10 in shallow pools. 169-945 eggs were observed to be released per spawning episode, totaling 7,474 eggs (Stone 1940, Gale and Gale 1977). Mature fish are 1-2 years of age with some being noted as living to the age of 5 (Jenkins and Burkhead 1993). They often become very abundant in areas with poor habitat for other species. Peak abundance is likely to occur in mid-to-late summer once eggs have hatched and YOY are plentiful with the optimum temperature range for maximum survival at 20.1 - 29.9°C (Kellogg and Gift 1983).

The life history of the Tennessee Shiner (*Notropis leuciodus)* is poorly understood and little is known about larval recruitment. In Virginia, this species is only found in the southwest corner of the state and often schools with other shiners such as the Rosyface and Telescope Shiners (Jenkins and Burkhead 1993). Reproduction activities are known to occur during spring and early summer; peak YOY numbers will likely occur during late summer into early fall.

4.5 Data Representative of Seasonal and Daily Activities of Organisms in the Vicinity of CWIS [§ 122.21(r)(4)(v)]

This information is summarized in Table 4-6 for the dominant species observed in the Clinch River in the vicinity of the Clinch River Plant.

Table 4-6. Seasonal and Daily Activities

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
LAMPREY			
Ohio Lamprey	*Ichthyomyzon bdellium*	Ohio lampreys spawn in late May or early June in shallow pits typically near the upper end of gravel riffles.	After hatching, the larval stage lampreys burrow into sediment where they feed on organic matter for several years. They then transform into parasitic adults in the spring. The following spring adults then typically migrate into smaller rivers where they spawn and then die shortly afterward.
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	Spawn in March and April in shallow pits typically near the upper end of gravel riffles. Typically move from larger river systems to smaller rivers and streams for spawning.	After hatching, the larval stage lampreys burrow into sediment where they feed on organic matter for three years. They then transform into non-parasitic adults in late summer or fall. Adults typically stay in smaller rivers and streams and do not feed. The following spring adults spawn and then die shortly afterward.
GAR			
Longnose Gar	*Lepisosteus osseus*	Spawning takes place in the late May or early June often in shallow riffles. The longnose gar migrates into smaller streams to spawn.	Although post larval longnose gar feed throughout the day, peak feeding activity was observed between 2:00 and 6:00 pm. Both adult and young of year longnose gar feed more actively at night than during the day.
SHAD			
Gizzard Shad	*Dorosoma cepedianum*	Seasonally variable diet dominated by zooplankton and organic detritus in early summer and consisting more exclusively of detritus throughout the rest of the growing season.	Inhabits slow moving or standing waters; it is relatively tolerant of turbidity, as long as its prey is plentiful. May become lethargic or moribund when water temperatures drop below 15°C.
TROUT/SALMON			
Rainbow Trout	*Oncorhynchus mykiss*	The majority of rainbow trout found in the Clinch River are stocked by the state of VA in smaller tributaries. Natural reproduction does not occur in the Clinch due to its warmer waters.	Rainbow trout find their way into the Clinch River via colder, smaller tributaries. Can be found in deeper shaded pools during warmer periods, as well as below riffles where they feed on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
CARP/ MINNOW			
Common Carp	*Cyprinus carpio*	Carp spawn in the spring to early summer, usually during the mornings of sunny days	Typically can be found feeding on or near the substrate.
Spotfin Shiner	*Cyprinella spiloptera*	Spotfin shiners spawn in crevices between rocks or in bark on submerged fallen trees. Spawning takes place throughout the warmer months of the year starting in late May or early June.	Feeds mainly in the late afternoon and early evening. Typically found near riffles with sand, gravel, mud, or rubble substrates.
Striped Shiner	*Luxilus chrysocephalus*	Consumes a wide variety of terrestrial and aquatic insects in the fall and a large quantity of filamentous algae during the winter. Spring spawn in large schools at top or bottom of riffles.	After spawning adults return to deeper pools where they spend most of their time. Once young hatch they spend most of their time near the edge of pools in shallow water. Both adults and juveniles prefer clean gravel and sand substrates.
Rosyside Dace	*Clinostomus funduloides*	Spawn in groups in late April through May. Utilize nests of other fishes /just above or below riffles in course sand or fine gravel.	Intolerant of turbidity and silt, attracted to deep pools, typically with abundant woody debris. Also primarily found in forested watersheds.
Speckled Chub	*Macrhybopsis aestivalis*	Spawn during the spring and summer, typically in smaller streams. There is limited literature on this species reproduction habits.	Found in shallow sandy areas where they feed on aquatic invertebrates.
Bigeye Chub	*Hybopsis amblops*	Spawn in late spring and early summer, little is known about how or where spawning takes place.	Highly intolerant of murky water and silt covered bottoms. Can be found in sandy substrates where they feed on aquatic invertebrates.
Streamline Chub	*Erimystac dissimilis*	Spawn in spring and early summer, little known about their reproductive biology.	Indicator of good water quality in medium to large rivers. Found in areas if swift current above or below a riffle. Often feed in 1-4 ft. of water on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Highland Shiner	*Notropis micropteryx*	Spawn during spring and early summer, thought to spawn in riffle habitat. Eggs sink and stick to the substrate.	Found typically in swift clear water with clean gravel or rubble, typically near riffles. Young eat mostly diatoms and algae, adults feed on aquatic invertebrates.
Western Blacknose Dace	*Rhinichthys obtusus*	Spawn during spring and early summer in shallow gravel riffles. Most spawn at 2 years of age.	Found in clear waters with clean substrates of sand, gravel, and cobble. Can typically be found in fast waters with undercut banks and cover. Feed on insect larvae and other invertebrates.
Blotched Chub	*Erimystax insignis*	Spawns in late spring to early summer, non-migrant.	Inhabits rocky riffles, runs, and pools. Most often found above and below riffles.
River Chub	*Nocomis micropogon*	River chubs spawn in April and May. The males select spawning sites with gravel substrate in riffles often adjacent to or just behind a large boulder. Males cover eggs with stones.	Benthic omnivore consuming a variety of invertebrates and plants. There is less food in the stomach of river chubs during the summer. This has been attributed to their tight schooling behavior during this period.
Popeye Shiner	*Notropis ariommus*	Spawn in spring and early summer, however little is known about their reproductive activities or requirements.	Require extremely clear waters, can be found in slow pools where they feed on aquatic invertebrates.
Silver Shiner	*Notropis photogenis*	Silver shiners spawn in June through July by scattering their eggs over gravel riffles.	Can typically be found in or at the tail end of deep swift riffles of cobble and boulders.
Rosyface Shiner	*Notropis rubellus*	Rosyface shiners spawn in May typically over the pebble mound nests of river and hornyhead chubs. Often large schools of rosyface shiners and other small minnows will congregate over a single chub nest. Eggs sink and stick to substrate.	Typically found in swift flowing water with a sand, gravel, or rock substrate. They are intolerant of streams with consistently turbid (murky) waters.
Warpaint Shiner	*Luxilus coccogenis*	Spawns in riffles and rapid areas early June to mid-July. Non-migrant.	Typically found in the upper to mid-levels of the water column over large boulders and gravel where they feed on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Whitetail Shiner	*Cyprinella galactura*	Spawns in late May to June at 24-28°C, sexually mature by age 2, males guard territories around the nest, eggs laid between sticks and logs. Non-migrant.	Found in benthic areas of moderate gradient rivers in both pools and riffle habitats. Prefer gravel and rocky substrates. Feed on aquatic invertebrates by sight.
Telescope Shiner	*Notropis telescopus*	Spawns during the spring and early summer, Non-migrant.	Typically found in runs or flowing pools near riffles with gravel or rocky bottoms.
Mimic Shiner	*Notropis volucellus*	Spawn in late spring and early summer, scatter eggs over sand or gravel substrate.	Found in areas with little to no current with some vegetation. Also commonly found in calm sandy areas, typically foraging on aquatic invertebrates.
Steelcolor Shiner	*Cyprinella wipplei*	Spawns in late spring and summer near submerged logs and vegetation, typically near a riffle, eggs are attached to submerged cover. Non-migrant.	Found in runs, pools, and backwaters of moderate gradient rivers and streams that are predominantly clear. Feeds on aquatic insects. Often school near the top and middle of the water column.
Sawfin Shiner	*Notropis sp.*	Spawn from mid-May to early July, sometimes form moderately sized schools. Non-migrant.	Found in benthic habitats, typically clear flowing pools and backwater. Feed on aquatic insects, beetles, and mayflies.
Stargazing Minnow	*Phenacobius uranops*	Spawns in May and June, sexually mature in 1 year.	Found in moderately gradient riffles, clear waters. Young found in clear shallows with sand, Adults typically found over very slightly silted gravel and small to medium rubbles. Adults feed in groups of 10-20 individuals.
Tennessee Shiner	*Notropis leuciodus*	Spawn in spring and summer 17-25°C over other *cyprinidae* nests, non-migrant.	Found in moderate gradient riffles, pools, and runs. Clear waters, with gravel and rubble substrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Creek Chub	*Semotilus atromaculatus*	Creek chubs migrate up smaller streams in early spring when water temperatures reach 55°F to spawn. The males select spawning sites in small streams in smooth water with gravel substrate just above or below a riffle.	During the day creek chubs feed on terrestrial insects, and at night they eat predominately aquatic invertebrates. Tend to feed equally on benthos and drift. Young fish feed during the day while larger individuals feed at night.
Central Stoneroller	*Campostoma anomalum*	In the fall, winter, and spring its diet consist mainly of nonmotile diatoms, but a lot of green algae is consumed in the summer.	Estimated home range of the fish in autumn was determined to be 35.2 + 14.1 m; no individual moved more than 135 m (Mundahl and Ingersoll 1989) The young frequent shoreline areas where the current is slower.
Bluntnose Minnow	*Pimephales notatus*	Bluntnose minnows spawn repeatedly starting in May and continue into August. Males select the spawning site, usually under logs, branches or rocks in shallow water. They will also use artificial spawning sites in old tiles or pipes, migration up smaller streams is not uncommon.	Can be found in shallow areas of clear water were they feed on algae, aquatic insects larvae, diatoms, small crustaceans, and other invertebrates.
SUCKER			
Smallmouth Buffalo	*Ictiobus bubalus*	Spawning takes place in the April and May when they congregate in areas of moderate flow in shallow water. Eggs are scattered over weeds and gravel bottoms and hatch in one to two weeks.	Smallmouth buffalo are found in large rivers in both the Lake Erie and Ohio River drainage systems. They are typically found in deep fast chutes below shallow riffles and prefer clearer waters than the bigmouth buffalo.
**Smallmouth Redhorse	*Moxostoma anisurum*	Spawn in April and May at night near the top and bottom ends of shallow riffles.	Can be found in shallow water and swift currents as well as areas with clean sand or gravel substrates. Feed on invertebrates. Intolerant of pollution and turbid water.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Northern Hog Sucker	*Hypentelium nigricans*	Hog suckers spawn in April or early May. Young are often found at the edge of pools over a sandy substrate. Like most suckers, they often migrate long distances' to spawn in smaller streams in spring.	Prefer the fast flowing riffles during most of the year but are found in pools during the colder months.
Silver Redhorse	*Moxostoma anisurum*	Spawn in April and May. Migrate into smaller streams and spawn at night at the top and bottom ends of shallow riffles.	Typically found in deep slow pools and is often found over a sand substrate.
River Redhorse	*Moxostoma carinatum*	Barriers effective at limiting upstream migration, however migration into smaller streams still occurs where redhorse spawn at night at the top and bottom ends of shallow riffles.	They are typically found in deep pools with moderate current over bedrock or gravel substrate.
**Shorthhead Redhorse	*Moxostoma macrolepidotum*	See Smallmouth Redhorse (Found in Lake Erie drainage)	See Smallmouth Redhorse (Found in Lake Erie drainage)
Black Redhorse	*Moxostoma duquesnei*	Barriers effective at limiting upstream migration, however migration into smaller streams still occurs where redhorse spawn at night at the top and bottom ends of shallow riffles.	Inhabit swift-flowing waters. Preferred substrates include gravel, bedrock, or sand. Young redhorses feed in schools near emergent aquatic vegetation close to the edge of pools. Adult black redhorses usually feed in schools just above or below a riffle moving slowly over the bottom.
Golden Redhorse	*Moxostoma erythrurum*	Make large migrations from larger rivers and reservoirs to smaller streams where they spawn at night in shallow riffles.	Spend much of the day and some of the nights in lager pools, feeding intensifies at daybreak and dusk. Feeds on benthic aquatic insects.
White Sucker	*Catastomus commersoni*	White suckers spawn from April to early May when they run upstream, usually starting at night. They seek areas with swift water and a gravel substrate to randomly spread their eggs. Migrations commence when water temperatures approach 10°C.	White suckers are very tolerant of pollution, turbidity (murky water), and low oxygen levels - can be found in many habitats.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
CATFISH			
Channel Catfish	*Ictalurus punctatus*	Move into shallows or tributaries to spawn. Begin spawning when water temperatures reach 70°F. They use natural cavities, undercut banks and as nests.	Prefer areas with deep water, clean gravel or boulder substrates, and low to moderate current. Tendency to move toward shallow waters at dusk where they feed.
Flathead Catfish	*Pylodictis olivaris*	They build nests in dark secluded shelters such as natural cavities, undercut banks, or near large, submerged objects.	Adults prefer deep pools with slow current and cover, such as submerged logs and brush piles.
Yellow Bullhead	*Ameiurus natalis*	They build nests in secluded shelters such as natural cavities, undercut banks, or near large, submerged objects. Young are guarded by the male several weeks.	Can be found in clear water with dense aquatic vegetation where they feed on other fish and aquatic insects.
Mountain Madtom	*Noturus eleutherus*	Spawn in early summer under large rocks within riffles, males guard eggs.	Found in deep swift riffles usually around cobbles and boulders where they feed on aquatic invertebrates.
SUNFISH			
Rock Bass	*Ambloplites rupestris*	Spring spawners - Male rock bass build nests over gravel substrate in a slight current often next to a large boulder.	Rock bass prefer clear streams and rivers with a rocky bottom. They often hide near large boulders, rock piles, or tree roots. Also look for them near steep drop offs at the edge of deep pools.
Bluegill	*Lepomis macrochirus*	Bluegill typically build nests in large groups, or colonies. They spawn multiple times between May and August. Peak spawning, in Ohio, usually occurs in June. Males select an area in one to four feet of water and sweep out a saucer shaped nest with their tails.	Most commonly found in clear waters with bank cover and aquatic vegetation.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Green Sunfish	*Lepomis cyanellus*	Green sunfish are communal spawners with males constructing nests in shallow water from mid-May to August. Green sunfish tend to spawn in shallower water, and dig deeper nests than bluegill.	Very tolerant of poor water quality and are often the only sunfish found in very muddy waters. They do have a strong preference to hide around structures such as rocks, logs, or brush piles.
Longear Sunfish	*Lepomis megalotis*	Longear sunfish spawn in groups but do not form large colonies like bluegill. Males select a spawning site in shallow water and build a nest on gravel substrate usually near cover. Longear sunfish spawn multiple times once the water temperature reaches the low 70's between mid-May and mid-August.	They favor slow to moderate flow in clear streams of moderate size with clean gravel substrate. They spend most of their time in pools near beds of aquatic vegetation, or other forms of cover such as roots, brush piles, and undercut banks.
Lepomis Hybrid	-	See Longear sunfish	See Longear Sunfish
Redbreast Sunfish	*Lepomis auritus*	Spawn in spring and summer, males guard the nest, and often guard hatchlings. Non-migrant.	Studies have found less than 200m life time movements during recapture studies. Found in deeper slower areas, rocky and sandy pools. Feed on aquatic invertebrates.
BLACK BASS			
Smallmouth Bass	*Micropterus dolomieu*	Smallmouth bass spawn in May and early June when water temperatures range from 55 to 65°F. Nests are built in gravel or hard bottom substrates in 2 to 20 feet of water.	Smallmouth bass thrive in streams with gravel or rock bottoms with a visible current. Found in benthic areas, adults seek deeper pools during the day.
Largemouth Bass	*Micropterus salmoides*	Largemouth bass usually spawn between mid-April and mid-June. Nests are constructed by the male in 1 to 6 feet of water.	Largemouth bass can adapt to many environments but prefer relatively clear non-flowing waters with some aquatic vegetation. They are found in nearly every lake, reservoir, and pond in Ohio.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Spotted Bass	*Micropterus punctulatus*	Spotted bass spawn between mid-April and mid-June. The males construct nests over rocky or gravely substrate near cover. They will spawn in deeper water than the other two species of black bass found in VA, sometimes at depths of up to 40 feet.	Preferred habitat is long deep pools of medium to large streams and rivers. They avoid both shallow, heavily vegetated, still, waters preferred by largemouth bass, and the swift flowing rocky waters preferred by smallmouth bass.
DARTER			
* Moves into shallow waters at night (Trautman,1981)			
Greenside Darter	*Etheostoma blennioides*	Adults spawn in deep, fast flowing riffles in April when water temperatures are between 55 and 65 °F. The eggs are attached to strands of filamentous algae and aquatic moss.	(*) occurs in varied habitats; often in medium to large streams and small to medium rivers with gravel and rubble riffle habitat. Avoids silt.
Ashy Darter	*Etheostoma cinereum*	Spawns from late January to early April, non-migratory.	Found in benthic areas above and below riffles, found in shallow waters, (0.05-2 meters) with litter current over clear gravel and rubble. Feed on aquatic invertebrates.
Speckled Darter	*Etheostoma stigmaeum*	Spawns in April and May. Eggs hatch in 9-10 days at 17-20^{o}C, eggs laid in gravel over riffles, Non-migrant.	Found in clear sandy and rocky pools with moderate gradients and fast water. Feed on aquatic invertebrates.
Redline Darter	*Etheostoma rufilineatum*	The river darter may move upstream to spawn in the spring (Trautman 1981, Shultz 1986).	Adults are usually only found in shallow areas at night, or when turbidity is high (Becker 1983).
Snubnose Darter	*Etheostoma simoterum*	Not much known on spawning habits, thought to spawn in early spring and summer. Non-migrant	Found in current-swept rocky pools and adjacent riffles.
Bluebreast Darter	*Etheostoma camurum*	Spawn in mid-May - late July. They bury their eggs in gravel in fast flowing riffles, spawning typically requires migration into smaller streams. Eggs hatch in 7-10 days at 19-23^{o}C	Typically found in clear or slightly turbid water with moderate gradient, moderately swift runs and riffles with substrates of coarse gravel, rubble, or boulders

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Fantail Darter	*Etheostoma flabellare*	Spawn on the underside of flat rocks in the spring, males guard eggs – hatch in 30-35 days at 17-20°C. Migrate downstream to deeper waters during winter months in some areas.	(*) Most abundant in medium to small streams in the range of 20 to 40 feet wide. Found in riffles with gravel substrates. Feed on immature aquatic insects.
Blotchside logperch	*Percina burtoni*	Spawns from April - June with water temps around 19°C. Non-migrant. Avoids turbid waters and silty substrates.	Found in moderately gradient systems within the riffle, run, and pool habitats, at or near the bottom. Eats primarily benthic invertebrates.
Johnny Darter	*Etheostoma nigrum*	Spawn on the underside of flat rocks in the spring – spawning often involves migration into smaller tributaries – considerable upstream and downstream movements may precede spawning	Inhabits streams and rivers of all sizes where it is found in pools and other slack water habitats on sand and gravel substrates.
Tippecanoe Darter	*Etheostoma tippicanoe*	Spawn in late spring and early summer when temperatures reach the upper to mid-20s , males guard eggs,	Found in shallow riffles and swift runs, typically in clear waters.
Wounded Darter	*Etheostoma vulneratum*	Spawn in spring and summer. Not much is known about the reproductive biology of this species has a very limited range across 4 states.	Habitats include fast rocky riffles of small to medium rivers.
Banded Darter	*Etheostoma zonale*	Banded darters spawn from mid-April to mid-May and sometimes as late as July, in swift riffles.	Banded darters can be found in streams of all sizes from small creeks to large rivers in rocky riffle habitats. Feeding activity peaks at midday.
Tangerine Darter	*Percina aurantiaca*	Spawns in May to June. Females breed between 2-4 years. of age. Live to be just over 4 years. Spawning likely occurs in sand and gravel riffles with moderate to swift currents.	Found in clear creeks and smaller river with moderate to steep gradients. Adults most often found in deeper, swift flowing runs and rapids near boulders. Juveniles more likely to be found in pools and slow runs with gravel substrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Gilt Darter	*Percina evides*	Spawn in May at 17-20°C in Virginia. Spawns only twice in its lifetime.	Found in clear rivers and streams with silt-free bottoms and permanently strong flow. Typically in moderate to fast deep riffles and pools over gravel, rubble, and small boulders.
Dusky Darter	*Percina sciera*	Spawns in late May to early July over loose gravel at depths of 30-90 cm - males and females mature in 1 yr. Make seasonal migrations between smaller tributaries in warm seasons and deeper downstream winter habitats in some past studies.	Found in benthic areas, fast runs and sometimes riffles. Mostly over course clean gravel at depths of 20 cm or more in spring and early summer.
Logperch	*Percina caprodes*	Spawn in mid-March to mid-May, a few hundred males gather in schools then females join a single male where they partially bury themselves in sand where the eggs are laid – hatch in 5-8 days. Move from deeper water to shallows to spawn.	Found in clean riffles and runs over substrates of mixed sand and gravel. Often associated with bottom debris. Young often found in dense beds of vegetation. Eats primarily benthic invertebrates. Typically inactive at night, stay on the bottom.
PERCH			
Walleye	*Sander vitreus*	Spawn throughout the month of April when water temperatures are between 40 and 55°F - Typically migrate to riffle areas to spawn, however many are stocked by the state of VA as fingerlings.	Usually associated with large rivers and lakes, where they congregate near the bottom during the day, and move into the shallows at night to feed.
Sauger	*Sander canadensis*	Growth rates and daily rations were highest between September and January and lowest between March through August. Spawn over 2 week period in the spring. Eggs hatch in 3-4 weeks at 5-15°C. Typically move little in the summer but movements of as far as 100 have been recorded in the Mississippi.	Found in sand and gravel runs, sandy and muddy pools and backwaters. Moves into shallow waters at night (Trautman 1981). Period activity increases in more turbid water.

Source: (Becker 1983); (Simon 1999); (Ohio DNR); (Stauffer et al., 1995); (Trautman 1957); (Robins et al., 1991); (Jenkins & Burkhead 1993); (explorer.natureserve.org)
Note: (**) The Shorthead and Smallmouth Redhorse have been separated by drainages.

4.6 Identification of Threatened, Endangered, and Other Protected Species Susceptible to I & E at CWIS [§ 122.21(r)(4)(vi)]

There are 13 fish species that are listed as threatened or endangered Federally or at the state level (Table 4-7). Summaries of Federally-listed species were available at the county level, but state-listed species were not, so Table 4-7 is overly inclusive. Nine (9) of these fish are unlikely to be found near the Clinch River Plant as there are no records of their observation in Russell County and/or the species are not found in that section of the Clinch River. Of the four remaining fish species in Table 4-7, one, the Sickle Darter, has the potential to be found in the area as there are records of it in this section of the Clinch River, however it seems to be rarely observed, while the Yellowfin Madtom, Steelcolor Shiner, and the Golden Darter have records of recent observance. In previous surveys conducted on the Clinch River near the facility the Golden Darter[1] and the Steelcolor Shiner have been collected, although in very low abundances. The Golden Darter is listed as a Federal Species of Concern (SOC) and is State Threatened and the Steelcolor Shiner is State Threatened. Both of these species have low potential for entrainment in early life stages. None of these species are likely to be impinged due to the low through-screen velocity associated with the facility. The Yellowfin Madtom, which is Federally and state threatened was recently found to have a “pretty good population” spanning 15 miles of river centered on Cleveland, VA (Shute, 2004).

The Clinch River has been described as having one of the most diverse mussel and fish faunas of any comparably-sized stream in North America (Neves 1991). Currently, of the 81 freshwater mussel species recognized in Virginia, 37 are listed as threatened or endangered, with 32 occurring in the Clinch, Powell, and Holston river watersheds of Virginia’s upper Tennessee River drainage. However, even with improvements in water quality since the Clean Water Act, mussel populations have continued to decline especially in the upper reaches of the Clinch River. There are 21 unionid species that are classified as threatened, endangered or protected at the state and Federal levels upstream and downstream of the Clinch River Plant (Table 4-8).

The Virginia Wildlife Action Plan (WAP) identifies 925 species of greatest conservation need, 60% of which are aquatic, 70% of which are invertebrates. These species are grouped into four tiers of relative conservation need: critical (I), very high (II), high (III), and moderate (IV) conservation need. These tiers allow for prioritization of threats facing species and of conservation actions addressing those threats. The action plan is a 10-year strategic plan that is required for continued funding through the State Wildlife Grant Program. There are 89 aquatic mollusk species on the current tiered list of Species of Greatest Conservation Need, 57 of which are unionid species. The 21 protected species listed on Table 4-8 are included in this tiered list.

Table 4-7. Federal and State Threatened and Endangered Fish Species and Species of Concern with the Potential to Occur within the vicinity of the Cooling Water Intake of the AEP Clinch River Plant

Common Name	Scientific Name	Status	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles***
Blackside Dace	*Chrosomus cumberlandensis*	FT, ST	Unlikely – prefers small upland tributaries. Only records in VA are a small tributary of the Powell River	Unlikely	Unlikely
Duskytail Darter	*Etheostoma percnurum*	FE, SE	Unlikely– only found in Copper Creek, a tributary of Clinch River. One specimen recorded in the Clinch River in 1980 at Speers Ferry	Unlikely	Unlikely
Emerald Shiner	*Notropis atherinoides*	ST	Unlikely*	Unlikely	Unlikely
Golden Darter**	*Etheostoma denoncourti*	SOC, ST	Likely	Unlikely	Unlikely
Paddlefish	*Polyodon spathula*	ST	Unlikely – closest record in the Clinch River near Dungannon in the ‘80’s	Unlikely	Unlikely
Sickle Darter	*Percina williamsi*	ST	Potential	Unlikely	Unlikely
Slender Chub	*Erimystax cahni*	FT, ST	Unlikely* - Not seen in the Clinch River since 1967	Unlikely	Unlikely
Spotfin Chub	*Erimonax monachus*	FT, ST	Unlikely* – Not seen in the Clinch River since 1893	Unlikely	Unlikely
Steelcolor Shiner	*Cyprinella whipplei*	ST	Likely – found in AEP surveys in “84, ’87, and 90	Unlikely	Unlikely

Common Name	Scientific Name	Status	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles***
Tennessee Dace	*Chrosomus tennesseenisis*	SE	Unlikely* -no records in Clinch	Unlikely	Unlikely
Variegate Darter	*Etheostoma variatum*	SE	Unlikely – very rare in Virgina, no records in the Clinch or its watershed	Unlikely	Unlikely
Western Sand Darter	*Ammocrypta clara*	ST	Unlikely*	Unlikely	Unlikely
Yellowfin Madtom	*Noturus flavipinnis*	FT, ST	Likely	Unlikely	Unlikely

Note:

FE=Federally Endangered, SOC=Federal Species of Concern, SE=State Endangered, ST=State Threatened, SSC=State Species of Concern.

*These species are recorded as being extirpated/possibly extirpated from the watershed. (NatureServe.org)
**This species designation was recently split from the Tippecanoe darter. The species are separated by drainages. See note on Table 4-1.
***Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that will be less than 0.5 fps at normal water level after shutdown of Unit 3 in May 2015.

Potential – Record of observation exist but very rare;
Likely – Presence recorded;
Unlikely – No records in that county or that section of the Clinch River, may be found in the watershed.

In 2002, the Virginia Department of Game and Inland Fisheries (VDGIF) developed a strategy to restore freshwater mussels at six reaches within the upper Tennessee River drainage. These reaches include four on the Clinch River, and one site each on the Powell and North Fork Holston rivers. This mussel restoration strategy includes four levels of introduction: augmentation, expansion, reintroduction and establishment. These levels have been defined by the National Strategy for the Conservation of Native Freshwater Mussels (NSCNFM) (NNMCC 1998) and the Upper Tennessee Mollusk Recovery Group (UTMRG). The UTMRG is comprised of representatives from the Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Polytechnic Institute and State University, U.S. Geological Survey, U.S. Fish and Wildlife Service, and The Nature Conservancy (VDGIF 2010). The main restoration technique, augmentation, was to release translocated adults or propagated juveniles into reaches where valid species records exist since at least 1980 (VDGIF 2005). The overall goal is to develop self-sustaining mussel populations with a goal of delisting. Almost 400,000 mussels of 11 species have been released as a result of these efforts.

Reach number 4 of the mussel augmentation includes approximately 12 river miles starting from Nash Ford to Carbo. American Electric Power's Clinch River Plant is located within this reach for mussel augmentation. Sixteen of the 21 species found near Clinch River Plant are being augmented to this stretch of river with some of the species being non-listed species (Table 4-8 summarizes the augmentation of listed species).

The majority of freshwater mussels use juvenile and adult fish as a means for population dispersal. Many mussel species have a wide variety of fish hosts they can use to infest with glochidia but there are a few that are limited to one or two hosts according to laboratory transformations of larvae into juvenile mussels. Many of these host-fish/mussel relationships are still unknown. However, in a natural situation, glochidia will attach to almost any fish including those that are not suitable hosts.

Regarding potential entrainment impacts to protected mussel species at the Clinch River Plant, it is important to note that early life stage fish are not typically host fish for glochidea and therefore the potential for entrainment of glochidea infested host fish is negligible. Similarly, potential impingement of glochidea infested host fish is also negligible primarily due to the low through screen velocities at the intake, particularly after retirement of Unit 3. Additionally, given that several other factors (i.e., use of closed cycle cooling, flow reduction, and use of a low fraction of the Clinch River flow) contribute to the cooling system of the Clinch River Plant being protective of fish, impacts to protected mussels species is not expected to occur (Table 4-8).

Table 4-8. Federal and State Threatened and Endangered Mussel Species and Species of Concern with the Potential to Occur within the vicinity of the Cooling Water Intake of the AEP Clinch River Plant

Common Name	Scientific Name	Status	WAP Tier	Host Fish	Species Augmented in Reach 4	Any Host Fish Susceptible to Impingement**
Appalachian Monkeyface	*Quadrula sparsa*	SE	I	Hosts unknown	Yes	Unlikely
Black Sandshell	*Ligumia recta*	ST	III	Central Stoneroller, Largemouth Bass, Bluegill, Sauger, Yellow Perch	Yes	Unlikely
Birdwing Pearlymussel	*Lemiox rimosus*	FE	I	Snubnose Darter and Greenside Darter	Yes	Unlikely
Crackling Pearlymussel	*Hemistena lata*	SE, FE	I	Banded Sculpin, Central Stoneroller, Whitetail Shiner, Fantail Darter, Streamline Chub	Yes	Unlikely
Cumberland Combshell	*Epioblasma brevidens*	SE, FE	I	Banded Sculpin, Black Sculpin, Fantail Darter, Greenside Darter, Spotted Darter, Redline Darter, Snubnose Darter, Roanoke Darter, Logperch	Yes	Unlikely
Cumberland Monkeyface	*Quadrula intermedia*	FE	I	Streamline Chub and Blotched Chub	Yes	Unlikely
Deertoe	*Truncilla truncata*	SE	IV	Freshwater Drum and Sauger	No	Unlikely
Dromedary Pearlymussel	*Dromus dromas*	SE, FE	I	Black Sculpin, Channel Darter, Fantail Darter, Greenside Darter, Gilt Darter, Tangerine Darter, Blotchside Darter, Roanoke Darter, Logperch	Yes	Unlikely
Fine-rayed Pigtoe	*Fusconaia cuneolus*	SE, FE	I	Bluntnose Minnow, Central Stoneroller, River Chub, Whitetail Shiner	Yes	Unlikely
Fragile Papershell	*Leptodea fragilis*	ST	IV	Freshwater Drum	No	Unlikely
Longsolid	*Fusconaia subrotunda*	SOC	III	Hosts unknown	Yes	Unlikely

Common Name	Scientific Name	Status	WAP Tier	Host Fish	Species Augmented in Reach 4	Any Host Fish Susceptible to Impingement**
Ohio Pigtoe	*Pleurobema cordatum*	SE	III	Creek Chub, Bluegill, Brook Stickleback, Guppy	No	Unlikely
Oyster Mussel	*Epioblasma capsaeformis*	FE	I	Greenside Darter, Bluebreast Darter, Fantail Darter, Redline Darter, Snubnose Darter, Wounded Darter, Dusky Darter, Black Sculpin, Mottled Sculpin, Banded Sculpin	Yes	Unlikely
Purple Bean	*Villosa perpurpurea*	SE, FE	I	Hosts unknown	Yes	Unlikely
Rayed Bean	*Villosa fabilis*	SOC	II	Greenside Darter, Mottled Sculpin, Largemouth Bass	No	Unlikely
Rough Rabbitsfoot	*Quadrula c. strigillata*	SE, FE	I	Whitetail Shiner, Bigeye Chub	Yes	Unlikely
Shiny Pigtoe	*Fusconaia cor*	SE, FE	I	Common Shiner, Whitetail Shiner, Redline Darter	Yes	Unlikely
Slabside Pearlymussel	*Lexingtonia dolabelloides*	ST	II	Shiners	Yes	Unlikely
Tennessee Clubshell	*Pleurobema oviforme*	SOC	III	Central Stoneroller, River Chub, Common Shiner, Whitetail Shiner, Tennessee Shiner, Telescope Shiner and Fantail Darter	Yes	Unlikely
Tennessee Heelsplitter	*Lasmigona holstonia*	ST	II	Banded Sculpin, Redline Darter, Snubnose Darter, Bluntnose Minnow, Central Stoneroller, Creek Chub	No	Unlikely
Tennessee Pigtoe	*Fusconaia barnesiana*	SSC	II	Hosts unknown	Yes	Unlikely

Note: **Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that will be less than 0.5 fps at normal water level after shutdown of Unit 3 in May 2015.

4.7 Documentation of Consultation with Services [§ 122.21(r)(4)(vii)]

There have been no formal consultations undertaken with the Services.

4.8 Methods and QA Procedures for Field Efforts [§ 122.21(r)(4)(viii)]

AEP is not relying upon any new data it collected to support the biological baseline characterization; therefore, there is no need to document methods and QA procedures for historical studies in this subsection.

4.9 Definition of Source Water Baseline Biological Characterization Data [§ 122.21(r)(4)(ix)]

AEP acknowledges that the final rule adds three additional subsections to the requirements of § 122.21(r)(4). While AEP has provided data to address § 122.21(r)(4)(i) – (viii) and (x) – (xii), there is no required submittal under this sub-section § 122.21(r)(4)(ix).

4.10 Identification of Protective Measures and Stabilization Activities [§ 122.21(r)(4)(x)]

AEP is not aware of any measures or stabilization activities that have been pursued in the Clinch River near the Clinch River Plant that might affect either the relevance of historical data on the river or attempt to restore any impingement or entrainment losses. On the other hand, the design of the cooling water system (i.e., use of closed cycle cooling) and the cooling water intake (i.e., through-screen velocity of less than 0.5 fps on normal pool level conditions) reduce the rates of impingement and entrainment.

4.11 List of Fragile Species [§ 122.21(r)(4)(xi)]

In the final 316(b) Rule, EPA identifies 14 species as fragile or having post-impingement survival rates of less than 30 percent, including:

- Alewife
- American Shad
- Atlantic Herring
- Bay Anchovy
- Blueback Herring
- Bluefish
- Butterfish
- Gizzard Shad
- Grey Snapper
- Hickory Shad

- Menhaden
- Rainbow Smelt
- Round Herring
- Silver Anchovy

Of these species only gizzard shad inhabits the Clinch River and is likely to be present near the intake.

Gizzard shad are represented in the Clinch River among the species most likely to be vulnerable to entrainment. Gizzard Shad spend most of their adult life in large schools where they filter feed on both phytoplankton and zooplankton. Gizzard Shad of all ages are extremely fragile, and handling them or keeping them in captivity for controlled laboratory testing is difficult even under the best of circumstances (Shoemaker 1942; Bodola 1965; Reutter and Herdendorf 1974). Conditions for Gizzard Shad populations are optimal in warm, fertile, shallow bodies of water with soft mud bottoms, high turbidity, and relatively few predators (Miller 1960; Zeller and Wyatt 1967). In fact, lacustrine habitats with these characteristics are the most likely to become overpopulated with Gizzard Shad. Factors contributing to this problem are the Gizzard Shad's high reproductive capacity, rapid growth rate, and efficient and direct use of plankton (Hubbs 1934; Miller 1960; Bodola 1965). While their life span is three to eleven years, few live beyond age three. In general, short life spans are correlated with rapid growth rates in the first year of life. In more northern parts of its range, Gizzard Shad typically live to ages 5 to 7 and may live to ages 10 or 11 (Miller 1960; Jester and Jensen 1972).

4.12 Information Submitted to Obtain Incidental Take Exemption or Authorization from Services [§ 122.21(r)(4)(xii)]

The Clinch River Plant has not sought or obtained an incidental take exemption or authorization for its cooling water intake structure from the U.S. Fish and Wildlife Service.

5 Cooling Water System Data [§122.21(r)(5)]

5.1 Description of Cooling Water System Operation [§122.21(r)(5)(i)]

The Clinch River Plant circulating water systems are closed-loop systems; that is, the cooling water is recycled and reused in the steam turbine condensers (see Figure 5-1 for Schematic of Units 1 and 2 Circulating Water System). The plant currently has three generating units; however, Unit 3 will be permanently retired in May 2015. The circulating water systems for Units 1 and 2 are identical for the purposes of this description. The normal requirement of circulating water for Units 1 and 2 is 220,000 GPM, and four cooling towers are used to cool the circulating water for reuse. Approximately 65% of the intake water is used for cooling (see Figure 3-4 under Section 3.4 for Water Balance Diagram of Current Operation at Clinch River Plant). Water withdrawal from the Clinch River expressed as a percent of the river's monthly average flow is shown in Table 5-1 for the current design intake flow of 18.36 MGD, actual average monthly intake flow for the period 2010-2013 and design intake flow of 9.36 MGD after the retirement of Unit 3.

Table 5-1. Clinch River Plant Withdrawal (Design and Actual) as a Percent of Monthly Average Clinch River Discharge

Month	Clinch River Flow (MGD)	Actual Intake Flow (MGD)	Design Flow (%)	Actual Intake Flow (%)	Design Flow After Retirement of Unit 3 (%)
January	723.9	8.79	2.5	1.2	1.3
February	859.6	10.29	2.1	1.2	1.1
March	911.3	9.67	2.0	1.1	1.0
April	678.6	7.03	2.7	1.0	1.4
May	510.6	8.55	3.6	1.7	1.8
June	319.9	9.93	5.7	3.2	2.9
July	221.0	13.69	8.4	6.2	4.2
August	208.8	8.85	8.8	4.2	4.5
September	142.2	9.34	12.9	6.6	6.6
October	164.8	7.88	11.1	4.8	5.7
November	267.6	8.64	6.9	3.2	3.5
December	509.9	7.44	3.6	1.5	1.8

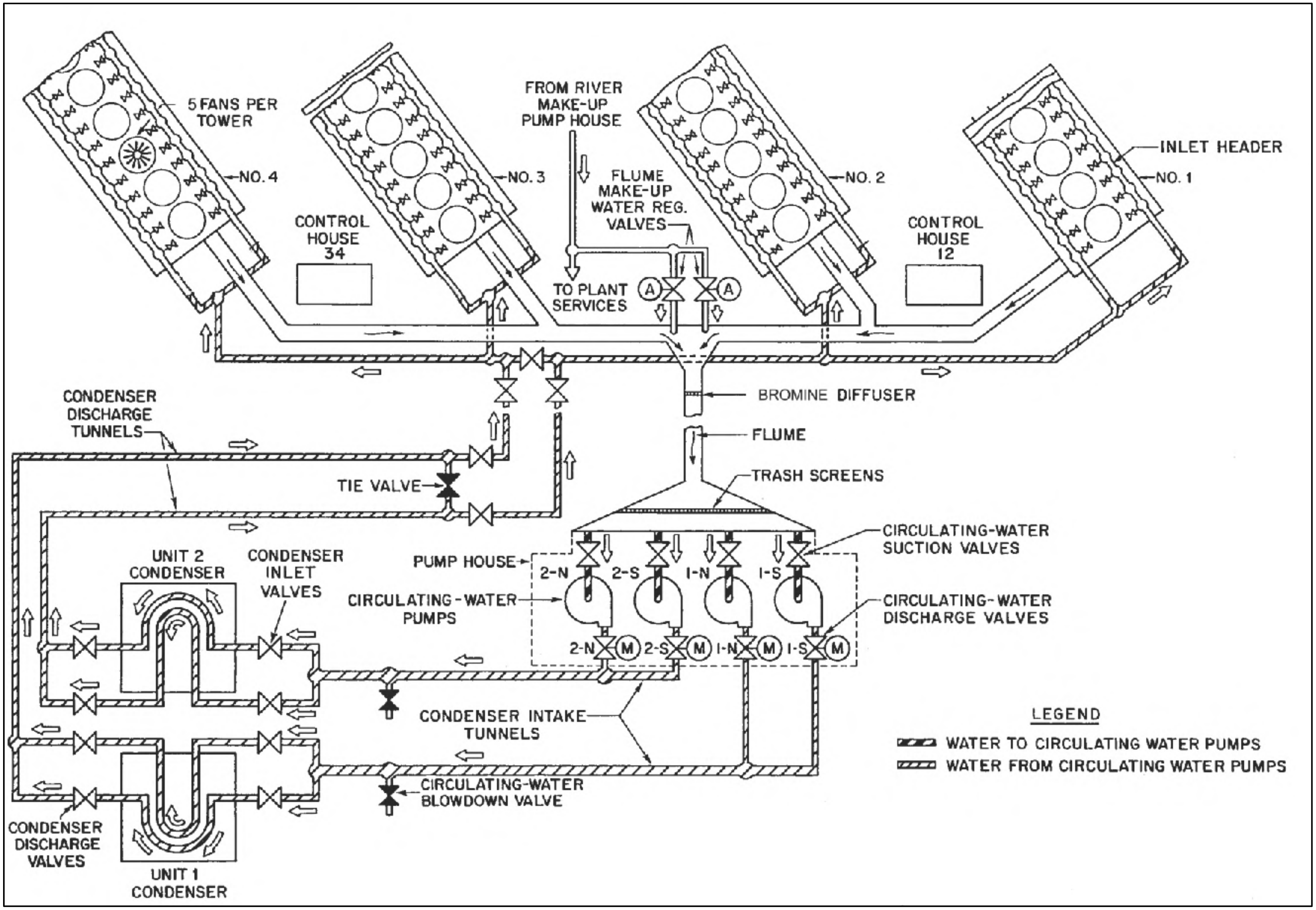


Figure 5-1. Units 1 and 2 Circulating Water System of Clinch River Plant

After passing through the conventional traveling screens (see Section 3.1 for more details), the circulating water flows to the suctions of the circulating water pumps. There are four such pumps, two pumps for each condenser. Each pump is rated at 55,000 GPM, 85 ft. TDH at 390 rpm, and is driven by a 1,500 hp, 4,000 volt motor. The circulating water pumps are controlled from the plant's main control room. Each pump is equipped with a hand-wheel operated suction valve and a motor-operated discharge valve.

The circulating water pumps discharge into two intake tunnels which supply circulating water to the condensers of Units 1 and 2. From the pump discharge, the water flows into a 72 in. concrete intake tunnel via 42 in. and 54 in. pipes. At the condenser, the 72 in. intake tunnel branches into two 54 in. inlet pipes so as to provide an independent supply of circulating water to each section of the condenser. The two 54 in. inlet pipes join the two condenser water-box inlet nozzles. Each inlet pipe is equipped with a hand-wheel-operated butterfly valve. The circulating water flows through the condenser tubes in the condenser and out via two 54 in. discharge nozzles and pipes. Each discharge pipe is equipped with a hand-wheel-operated butterfly valve. The water then flows into a 72 in. concrete discharge tunnel which leads to the cooling towers. The two 72 in. concrete discharge tunnels run parallel to each other under the basement floor. At the cooling towers, these tunnels sub-divide into 54 in. individual headers. Hand-operated valves are provided in the 72 in. concrete discharge tunnels so as to permit alternate flow from one tunnel to the other in emergencies. These valves will also be used when it becomes necessary to de-water either discharge tunnel.

On Tower 4 only, a 72 in. circulating water intake tunnel is equipped with an 8 in. blowdown valve. The amount of blowdown is determined in accordance with the pH control of the circulating water system. The blowdown is discharged to a sump that feeds into the plant's advanced wastewater treatment system.

Cooling Towers

Each of the four original 1958-vintage cooling towers for Units 1 and 2 measured 281 ft long, 67 ft wide and 61 ft high. Each of the mechanical draft towers consisted of ten cells with the heat transfer section designed as a cross-flow thermal configuration (e.g. water flows down while air is drawn in horizontally).

Between 1999 and 2002, the four 10-cell cross-flow cooling towers were replaced with four 5-cell counter-flow cooling towers while duplicating the original thermal design basis of each tower cooling 55,000 GPM from 97°F to 78°F at a wet bulb of 70°F. The dimensions of each of the four new five-cell counter-flow towers are 240 ft-8 in. long, 48 ft-8 in. wide and 45 ft high (Figure 5-2). As a result, the new towers fit within the original basins with empty space at the end and along one side.

The transfer of heat from the circulating water to the atmosphere is accomplished in the cooling tower by passing the warm circulating water through a stream of moving air. For maximum air-water contact, the warm water runs down thousands of modules which consist of corrugated polyvinyl chloride (PVC) sheets. This maximizes the water surface area for optimum cooling by the air stream. The air, rising counter flow to the water through the spacing between the sheets,

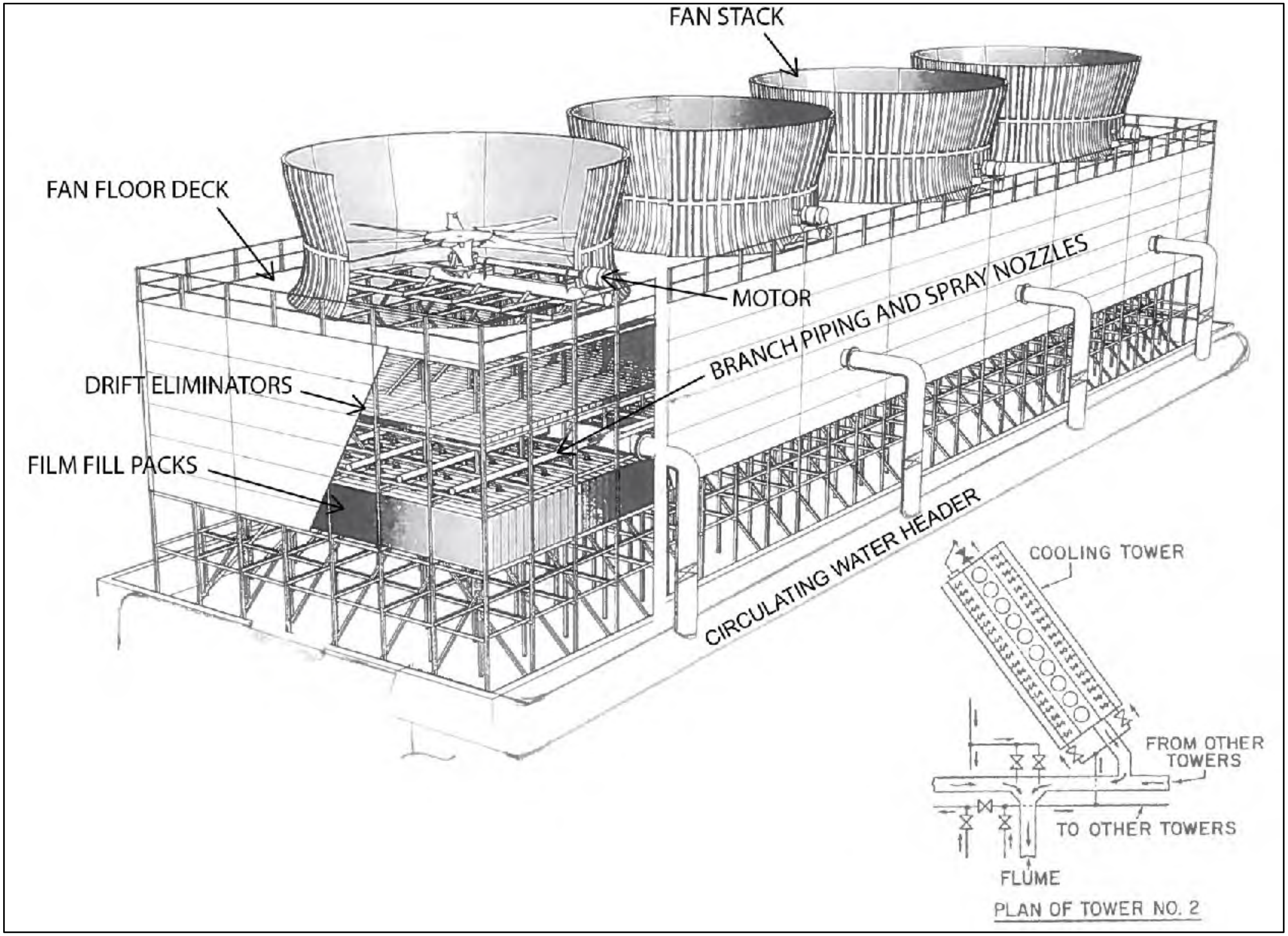


Figure 5-2. Schematic of Clinch River Plant Cooling Tower

is moved by 150 hp mechanical draft fans (28 ft diameter) discharging air through 14 ft tall fan stacks. The performance of cooling towers varies with wind velocity, humidity and outdoor temperature.

Evaporation accounts for the greatest part of the heat transfer. This effect makes it possible to cool the water below the atmospheric dry-bulb temperature. In evaporating one pound of water, approximately 1,000 Btu's are transferred from the water into the air. The water is also cooled by sensible heat transfer to the air.

The evaporation process results in a loss of water from the closed circulating water system. This loss is replaced by the river make-up system. When water is removed by the evaporation process, no dissolved solids are removed. As a result, the circulating water would contain more solids than can remain in solution, causing scaling and fouling of the system components (e.g., heat exchanger equipment - condensers, coolers). In order to prevent this scaling and fouling of the system, blowdown is required. The circulating water system for each Unit is currently run at two to five cycles of concentration before the blowdown. The plant chemist determines the required blowdown by test because the amount of solids in the river water is variable. This determination serves to minimize the amount of makeup water required. After the boilers are converted from coal to natural gas firing by late 2016, the circulating water system will run around five cycles of concentration before it is blown down.

The cooling tower has six main components: (1) the treated wood structure, (2) the 150 hp, 28 ft diameter mechanical draft fans with 14 ft tall fan stacks to direct the airflow, (3) the heat transfer section made up of corrugated PVC sheets commonly called the "fill", (4) the water distribution system, (5) the drift eliminator section and (6) the concrete basin which collects water for return to the condensers and auxiliaries.

The wood structure is laid out in the cold water basin with 4 in. by 4 in. columns laid out on a 6 ft transverse by 6 ft longitudinal grid. The horizontal girts are located 6 ft or 8 ft vertically from each other and composed of 2 in. by 4 in. or 2 in. by 6 in. wood members. The wood structure is composed of CCA (copper chromate acid) treated Dense No. 1 Douglas Fir members which are held together with 304 stainless hardware. The fan deck is composed of 1 in. thick treated plywood.

Each of the Marley induced draft fans are 28 ft diameter with 7 blades, and pull 1,097,174 cubic feet per minute (cfm) of air through each cell. The fiberglass fan stacks are 14 ft tall and slightly curved to provide velocity recovery of the air flow after passing through the fans. The fan stacks discharge exhaust vapor at a high elevation which minimizes the hazard of fogging.

The heat transfer section of the cooling tower consists of corrugated PVC sheets bonded together to form modules known as film fill packs. The thin PVC film fill sheets are bonded together with glue and have a before-formed-thickness of 0.020 in. and an after-formed-thickness of 0.017 in. The fill packs are 3 ft deep and there are two layers for a combined thickness of 6 ft. The fill packs are bottom-supported on the treated wood structure horizontal girts. Air seals are provided along the perimeter of each cell to prevent air from bypassing the film fill packs. The film fill packs are also cut so they fit close to the columns to prevent air from bypassing the fill packs.

At each tower, two 36 in. diameter steel pipe stubs exit the ground and combine into a 48 in. diameter fiberglass header pipe which runs on one side of the tower. A 24 in. diameter fiberglass riser supplies water to each cell and branches into eight 6 in. diameter PVC distribution pipes (or branch arms). There are 388 down spray nozzles (28 GPM/nozzle) in each cell which are laid out in a 3 ft by 2 ft pattern above the film fill to equally distribute the warm circulating water to all sections of the tower fill. The water flows through the nozzles and strikes the splash plates, producing “umbrella like” sprays over the fill modules below. The spray cascades down the corrugated module sheets as a thin film and falls into the cold water basin. Air-water contact is established as the ambient air rises upward through the fill.

Marley TU12 cellular PVC drift eliminator panels, 0.017 in. thick, are provided which have an efficiency of 0.005%. The 5-3/4 in. thick drift eliminator panels are supported off of the distribution piping. These panels are designed to reduce the amount of water entrained in the rising air that leaves the tower shell as drift by abruptly changing the direction of the airflow.

The cold-water, concrete, collecting basin has a capacity sufficient to provide a water storage reservoir and accommodate the falling water in the tower and the water in the riser pipes at the time of shutoff. The cold water is discharged from each tower collecting basin into flumes 5 ft wide by 6 ft deep, which in turn, widens into a 13 ft wide by 8 ft deep flume. Makeup water supply is automatically adjusted to maintain a normal water level of 2 in. to 7 in. above the top of the concrete pilasters supporting the outer walls of the tower. Normal basin water level is 1,512 ft. Maximum overflow level is 1,512 ft-8 in. with overflow commencing at 1,512 ft-3 in. Overflow is collected in a 4 ft by 19 in. box at the northeast end of the tower.

A cooling tower center-line trough, 2 ft wide by 8 in. deep, runs along the bottom length of each basin and is sloped downward in a northeast direction for drainage purposes. On Tower No. 4 only, this trough is discharged through a manual valve and motor operated valve to sump 003 and them pumped to the advanced waste water treatment plant for treatment.

The controls for each cooling tower are located in 2 cooling-tower control houses. Control House 12 controlling Towers 1 and 2 is located between these 2 towers. Control House 34 controlling Towers 3 and 4 is similarly located. The control panel for each cooling tower contains five 3-position fan switches and indicating lamps.

Freezing will not occur in the flooded portions of a tower, only in the relatively dry parts where fine drops of water splash out into the entering air stream. This can happen whenever the wet-bulb temperature is below freezing, regardless of the dry-bulb temperature. The ice will form on the structural framing, and on the outer filling. The ice starts to form near the bottom of the film fill and along the transverse structural framing, building inward and upward. The formation of ice restricts the flow of air and reduces the performance, causing a rise in the temperature of the water leaving the tower. Various operating procedures are used to minimize freezing, or to remove ice once it has formed. The ice may be melted by utilizing the heat in either the exhaust air or in the water that is being circulated over the tower. The method of doing this is air entering the lower level of film fill panels will cause ice to form along the lower perimeter of fill. Stopping the fans temporarily allows the water to fall vertically and melt ice that has formed along the perimeter. This will remove ice from the filling and part of the structure.

5.2 Design and Engineering Calculations [§122.21(r)(5)(ii)]

Engineering calculations for the through-screen velocity are provided below.

For the design and configuration of the Clinch River Plant CWIS (See Section 3.1 for more details), assuming a low water level of 4 ft (or two 2 ft tall baskets submerged) and 2 pump operation (12,750 GPM, or 18.36 MGD), the calculated through-screen velocity is:

v = (12,750 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (1 TWS/2 baskets) x (1/0.679 POA)

v = 1.02 ft/sec

When Unit 3 is permanently retired in May 2015, the river makeup water flow requirement will be reduced to 1 pump operation (6,500 GPM, or 9.36 MGD). The calculated through-screen velocity at low water level is:

v = (6,500 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (TWS/2 baskets) x (1/0.679 POA)

v = 0.52 ft/sec

Similarly, the following calculation shows the through-screen velocity using a normal pool level of 14 ft. For the design and configuration of the Clinch River Plant CWIS, with a normal pool level of 14 ft (or seven 2 ft tall baskets submerged) and 2 pump operation (12,750 GPM), the calculated through-screen velocity is:

v = (12,750 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (TWS/7 baskets) x (1/0.679 POA)

v = 0.29 ft/sec

When Unit 3 is permanently retired in May 2015, the river makeup water flow requirement will be reduced to 1 pump operation (6,500 GPM). The calculated through-screen velocity at a normal pool level of 14 ft is:

v = (6,500 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (TWS/7 baskets) x (1/0.679 POA)

v = 0.15 ft/sec

In addition, engineering calculations for evaporation, drift and blowdown rates are provided in Section 6.1.

5.3 Description of Existing I & E Reduction Measures [§122.21(r)(5)(iii)]

The primary reduction in both impingement and entrainment at the Clinch River Plant is achieved through the use of a closed-cycle cooling system. The cooling towers are described in detail in Section 5.1. The cooling towers are presently operating at two-to-five cycles of concentration (COC) and provide at least 97.0% flow reduction (using two COC) as compared to a once-through cooling system (see Section 6.1 for calculations of makeup water minimization).

The closed-cycle cooling system meets Compliance Alternative 1 (§125.94(c)(1)) for impingement mortality reduction in the final Rule. Assuming that the reduction in entrainment is commensurate with reduction in flow, then, the closed-cycle cooling system would reduce entrainment by at least 97.0% compared to a once-through system. Closed-cycle cooling alone should be sufficient to minimize adverse environmental impacts associated with CWIS operation. However, there are additional features at Clinch River Plant that further reduce impingement and entrainment.

Unit 3 is scheduled for retirement in May 2015. After retirement, the design through-screen velocity at low water level of 4 ft is estimated to be 0.52 feet per second (fps or ft/sec). At a normal pool level of 14 ft, the design through-screen velocity is estimated to be 0.15 fps after the retirement of Unit 3. A design through-screen velocity of less than 0.5 fps meets the impingement mortality reduction standard through Compliance Alternative 2 (§125.94(c)(2)) after the retirement of Unit 3.

In addition, Clinch River Plant uses a small percentage of the total Clinch River flows. Current design intake flows (i.e., 18.36 MGD) range from 2.0 to 12.9 percent of the monthly average of the Clinch River flows (using USGS data). See Table 5-1 in Section 5.1 for Clinch River Plant withdrawal (design and actual) as a percent of monthly average Clinch River discharge. Using 2010-2013 actual plant intake flows, the Clinch River facility withdrew between 1.0 and 6.6 percent of the monthly average of the Clinch River flows, with the lowest withdrawal in April and peak withdrawal in September. For this period, actual intake flows exceeded 5% of the monthly average flow in July and September – when ichthyoplankton densities are expected to be low. Retirement of Unit 3 in May 2015 will reduce intake flows further such that the percentage of river flow withdrawn under design flow will exceed 5% only in September and October when potential for entrainment is negligible.

6 Chosen Method(s) of Compliance with Impingement Mortality Standard [§122.21(r)(6)]

Clinch River Plant utilizes a closed-cycle cooling system and the flow reduction achieved relative to once-through cooling (OTC) is estimated to be 97.0% to 98.1% with current operation that has two-to-five COC. See Section 6.1 below for the calculation of makeup water minimization. A closed-cycle cooling system meets Compliance Alternative 1 for impingement mortality reduction in the final rule (§125.94(c)(1)). Assuming that the reduction in entrainment is commensurate with reduction in flow, then the closed-cycle cooling system also reduces entrainment by at least 97.0% (assuming that the tower is operated at only two COC) compared to a once-through system. Closed-cycle cooling alone should be sufficient to minimize adverse environmental impacts associated with CWIS operation and provides the strongest basis for the cooling system to be determined to be BTA for both impingement and entrainment.

6.1 Requirements of Makeup Water Minimization for Closed-cycle Recirculating System

A closed-cycle recirculating system withdraws significantly less water from its source water body than a once-through cooling system. The actual reduction in withdrawal quantities depends on how the recirculating cooling system is designed and operated. Table 6-1 presents the site-specific design and operation parameters of the closed-cycle cooling system at the Clinch River Plant.

Table 6-1. Site-Specific Design and Operation Parameters of Closed-Cycle Cooling System at Clinch River Plant

Design and Operational Parameters	Values
Condenser Cooling Water Flow and Condenser Temperature Rise (i.e., delta T)	Each of the four cooling towers for Units 1 and 2 is designed to cool 55,000 GPM of water from 97°F to 78°F (temperature range of 19°F) which would encompass the condensers and all the misc. exchangers.
Cycles of Concentration (COC) at which the cooling tower is typically operated	The circulation water system is currently operated at 2 to 5 Cycles of Concentration, and it will be changed to 5 cycles by late 2016 after conversion from coal to natural gas.
Drift Eliminator Efficiency (from the Cooling Tower Specification	0.005%
MW rating of generating units	The current MW rating of Units 1 to 2 is 235 MW each Unit and the unit capacity is expected to increase from 235 MW to 237 MW after the gas conversion.

The cooling towers installed at the Clinch River Plant are currently operating at two-to-five COC and providing a reduction in flow of at least 97.0% (using two COC) relative to a OTC. However, as a result of planned operational changes (which are conversions of Units 1 and 2 from coal to gas as described in Section 5.1) that will decrease makeup water flow, AEP Clinch River Plant plans to begin operating the cooling towers at five COC in late 2016. This will result in a flow reduction of 98.1% as compared to OTC. Makeup flow calculations are provided below.

Evaporation, drift and blowdown rates are calculated and summed as the makeup flow:

Makeup flow = **Evaporation** + **Drift** + **Blowdown**

where:

Evaporation, E = 0.0008 x Condenser temperature delta T(^{o}F) x Condenser cooling water flow rate (GPM)

Drift, D = Drift eliminator efficiency x Condenser cooling water flow (GPM)

Blowdown, B = [E-{(COC-1) x D}]/(COC-1)

Then, the makeup flow is compared with condenser cooling water flow (i.e., once-through flow) to determine the degree of flow reduction.

Using the cooling tower flow of 55,000 GPM, delta T of 19 °F, drift eliminator efficiency of 0.005% and 2 COC, the example calculations for evaporation, drift and blowdown rates are as follows:

E = 0.0008 x 19 ^{o}F x 55,000 GPM = 836 GPM

D = 0.00005 x 55,000 GPM = 3 GPM

B = [836 GPM – {(2-1) x 3 GPM}]/(2-1) = 833 GPM

Makeup Flow for 2 COC = 836 GPM + 3 GPM + 833 GPM = 1,672 GPM

Therefore, the calculated makeup water flows for two COC and five COC are 1,672 GPM and 1,045 GPM per cooling tower, respectively. As a result, the percent flow reductions compared to a once-through cooling system are 97.0% and 98.1% for two and five COC, respectively.

AEP believes that at five COC, the makeup water flow to the towers will have been minimized to the maximum extent possible within the constraints of practicality, scaling and other operational issues, and the need to comply with discharge concentration limits on cooling tower blowdown.

7 Operational Status [§122.21(r)(8)]

7.1 Description of Operating Status [§122.21(r)(8)(i)-(8)(v)]

The Clinch River Plant consists of three units. Units 1 and 2 both came into service in 1958, and each is currently rated at 235 MW capacity. Unit 3 came on-line in 1961, and is also rated at 235 MW. Cooling water at this plant is used only for power production. Utilization over the previous seven years is provided in Table 3-1. The only major change to the system in the last fifteen years has been replacement of all five cooling towers during the years 1999-2002. Planned changes over the next five years include:

- Retirement of Unit 3 in May 2015.
- Conversion of Unit 1 from coal to natural gas by December 2015, and similar conversion of Unit 2 by May 2016. This conversion will result in an increase in rated capacity of each unit from 235 to 237 MW, and decrease in heat rate from an average of 11,232 btu/kwh per unit (2011-2012 average) to an expected 10,051 btu/kwh per unit following the conversion.

8 References

American Electric Power (AEP), Biologists. 1982-1991. Clinch River Plant In-house Fish Monitoring. Clinch River Fish Collection Data.

Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.

Bodola, A. 1965. Life history of the gizzard shad, Dorosoma cepedianum (LeSueur), in western Lake Erie. U.S. Fish Wildlife and Service. Fish. Bull. 65:391-425.

Ehrlich, K. F. 1974. Chemical changes during growth and starvation of herring larvae. Pages 301-323 in J. H. S. Blaxter, editor. The early life history of fish. Springer-Verlag, New York.

Electric Power Research Institute (EPRI). 2000. Technical Evaluation of the Utility of Approach Velocity as an Indicator of Potential Adverse Environmental Impact under Clean Water Act Section 316(b). 1000731. EPRI, Palo Alto, CA.

EPRI. 2007. Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities. 1015322. EPRI, Palo Alto, CA

Gale, W. F. and C. A. Gale. 1977. Spawning habits of spotfin shiner (*Cyprinella spiloptera)* - a fractional, crevice spawner. Transactions of the American Fisheries Society 106:170-177.

Gebhart, Glen E., and Robert C. Summerfelt. Seasonal Growth of Fishes in Relation to Conditions Of Lake Stratification. “Oklahoma Cooperative Fishery Research Unit 58 (1978): 6-10. Oklahoma State University, Stillwater, Oklahoma.

Hubbs, C. L. 1934. Some experiences and suggestions on forage fish culture. Trans. Am. Fish. Soc. 63:53-63.

Jenkins, R. E., and N. M. Burkhead, 1993. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda. Maryland.

Jester, D. B., and B. L. Jensen. 1972. Life history and ecology of the gizzard shad, Dorosoma cepedianum (LeSueur) with reference to Elephant Butte Lake. New Mexico State Univ. Agric. Exp. Sta. Res. Rep. 218. 56 pp.

Kellogg, R.L. and J.J. Gift. 1983. Relationship Between Optimum Temperature for Growth and Preferred Temperatures for the Young of Four Fish Species. Trans. Am. Fish. Soc. 112:424-430.

King, R., Greg S., and J. Vondruska. "Selectivity of Impingement at Power Plants along the Ohio River." (2011)

Krstolic, J.L., G.C. Johnson, and B.J.K. Ostby. 2013. Water quality, sediment characteristics, aquatic habitat, geomorphology, and mussel population status of the Clinch River, Virginia and Tennessee, 2009-2011. U.S. Geological Survey Data Series 802. 14 pp. + app.

Masnik, M.T. 1974. Composition, longitudinal distribution, and zoogeography of the fish fauna of the upper Clinch system in Tennessee and Virginia. Ph.D. dissertation. Virginia Polytechnic Institute and State University, Blacksburg.

May, R. C. 1974. Larval mortality in marine fishes and the critical period concept. Pages 3-19 in J. H.S. Blaxter, editor. The early life history of fish. Springer-Verlag, New York.

Michaletz, P. H. 1998. Effects on sport fish growth of spatial and temporal variation in age-0 gizzard shad availability. North 542 hale et al. American Journal of Fisheries Management 18:616–624.

Miller, R. R. 1960. Systematics and biology of the gizzard shad (Dorosoma cepedianum) and related fishes. U.S. Fish Wildlife. Servo Fish. Bull. V. 60: 371-392.

Miller, T.J., Crowder, L.B., Rice, J.A., Marshall, E.A. 1988 Larval size and recruitment mechanisms in fishes: toward a conceptual framework. Canadian Journal of Fisheries and Aquatic Sciences 45:1657-1670.

NatureServe Explorer: An Online Encyclopedia of Life." NatureServe Explorer: An Online Encyclopedia of Life. N.p., 2014. Web. 7 Jan. 2015. <http://explorer.natureserve.org/>.

Neves, R. J. 1991. Mollusks. Pages 251 320. in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.Ohio.gov / Search. *Fish*. 19 Nov. 2014.

Outten, L. M. 1962. Some observations on the spawning coloration and behavior of *Notropis leuciodus.* Journal of the Elisha Mitchell Scientific Society 78:101-102.

Reutter, J.M. and C.E. Herdendorf. 1976. Thermal Discharge from a Nuclear Power Plant: Predicted Effects on Lake Erie Fish. Ohio J. Science 26:39-45

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea and W.B.

Shoemaker, H. H. 1942. The fishes of Wayne County, Indiana. Invest. Indiana Lakes Streams 2:267-296.

Shute, J.R. 2004. Fall 2004 Update. Conservation Fisheries, Inc. Newsletter #25, December 2004

Simon, T.P. 1999. Assessment of Balon’s reproductive guilds with application to Midwestern North American Freshwater Fishes, pp. 97-121. In: Simon, T.L. (ed.). Assessing the sustainability and biological integrity of water resources using fish communities. CRC Press. Boca Raton, Florida. 671 pp.

Stauffer, J. R., J. M. Boltz, and L. R. White. 1995. The Fishes of West Virginia. Philadelphia, PA: Academy of Natural Sciences of Philadelphia. Print.

Stone, U. B. 1940. Studies on biology of the satfin minnows *Notropis analostanus* and *Notropis spilopterus.* Doctoral dissertation. Cornell University, Ithaca New York.

Storck, T. W., D. W. Dufford, and K. T. Clement. 1978. The distribution of limnetic fish larvae in a floodcontrol reservoir in central Illinois. Transactions of the American Fisheries Society 107:419–424.

Trautman, M. B. 1957. The Fishes of Ohio, with Illustrated Keys. Columbus: Ohio State University Press, in Collaboration with the Ohio Division of Wildlife and the Ohio State Development Fund, 1957. Print.

Trautman, M.B. 1981. The Fishes of Ohio. 2nd Edition. Ohio State University Press, Columbus, Ohio. 683 pp.

Van Hassel, J.H. 2007. Case study: discrimination of factor affecting unionid mussel distribution in the Clinch River, Virginia, U.S.A. Pages 311-333 in J.L. Farris & J.H. Van Hassel, editors. Freshwater Bivalve Ecotoxicology. SETAC Press, Pensacola, FL.

VADEQ/VDCR (Virginia Department of Environmental Quality/Virginia Department of Conservation & Recreation). 2014. Virginia water quality assessment. Richmond. 1490 pp. + app.

VADEQ. 2014. Probabilistic Monitoring - Data Sources Fish EDAS Database. June 2014. Web accessed 7 Jan. 2015. <http://www.deq.virginia.gov/>.

Virginia Department of Game and Inland Fisheries. 2010. Virginia Freshwater Mussel Restoration Strategy: Upper Tennessee River Basin. Virginia Department of Game and Inland Fisheries, Bureau of Wildlife Resources, Wildlife Diversity Division, Nongame and Endangered Wildlife Program. Richmond, VA. 17 pp.

Wallus, R., B.L. Yeager, and T.P. Simon. 1990. Reproductive biology and early life history of fishes in the Ohio River drainage, Volume 1: Acipenseridae through Esocidae. Tennessee Valley Authority, Chattanooga, Tennessee. 273 pp.

Welker, M. T., C. L. Pierce and D. W. Wahl. 1994. Growth and survival of larval fishes: roles of competition and zooplankton abundance. Transactions of the American Fisheries Society 123:703–717.

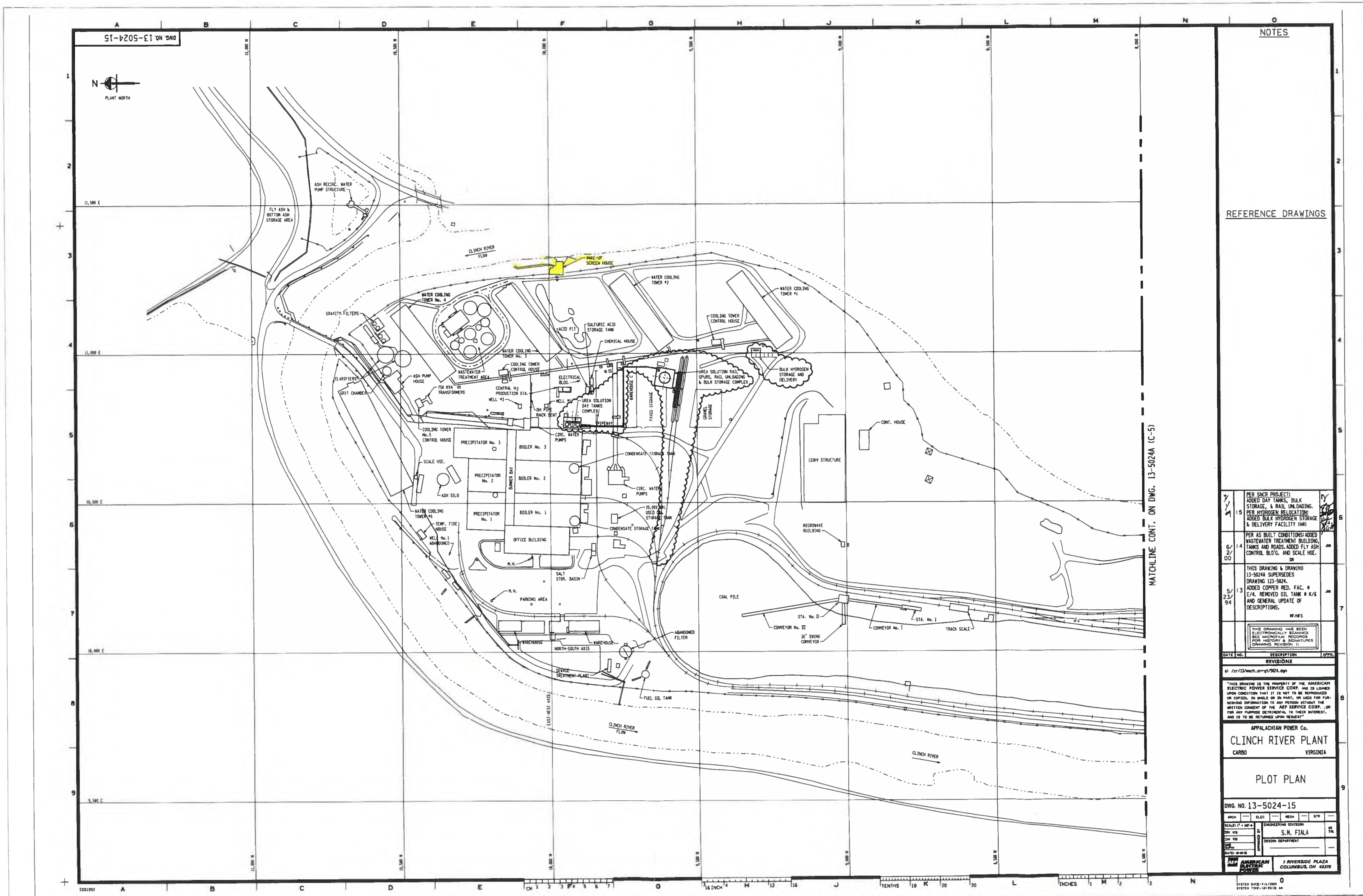
Zeller, H. D., and H. N. Wyatt. 1967. Selective shad removal in southern reservoirs. Pages 405-414 in C. E. Lane, Chairman. Reservoir Fish. Resour. Symp. Athens, GA. 5691pp.

Zweifel, R.D., R. S. Hale, D. B. Bunnell and M. T. Bremigan. 2009. Hatch Timing Variations among Reservoir Gizzard Shad Populations: Implications for Stocked Sander spp. Fingerlings. North American Journal of Fisheries Management 29(2): 488-494.

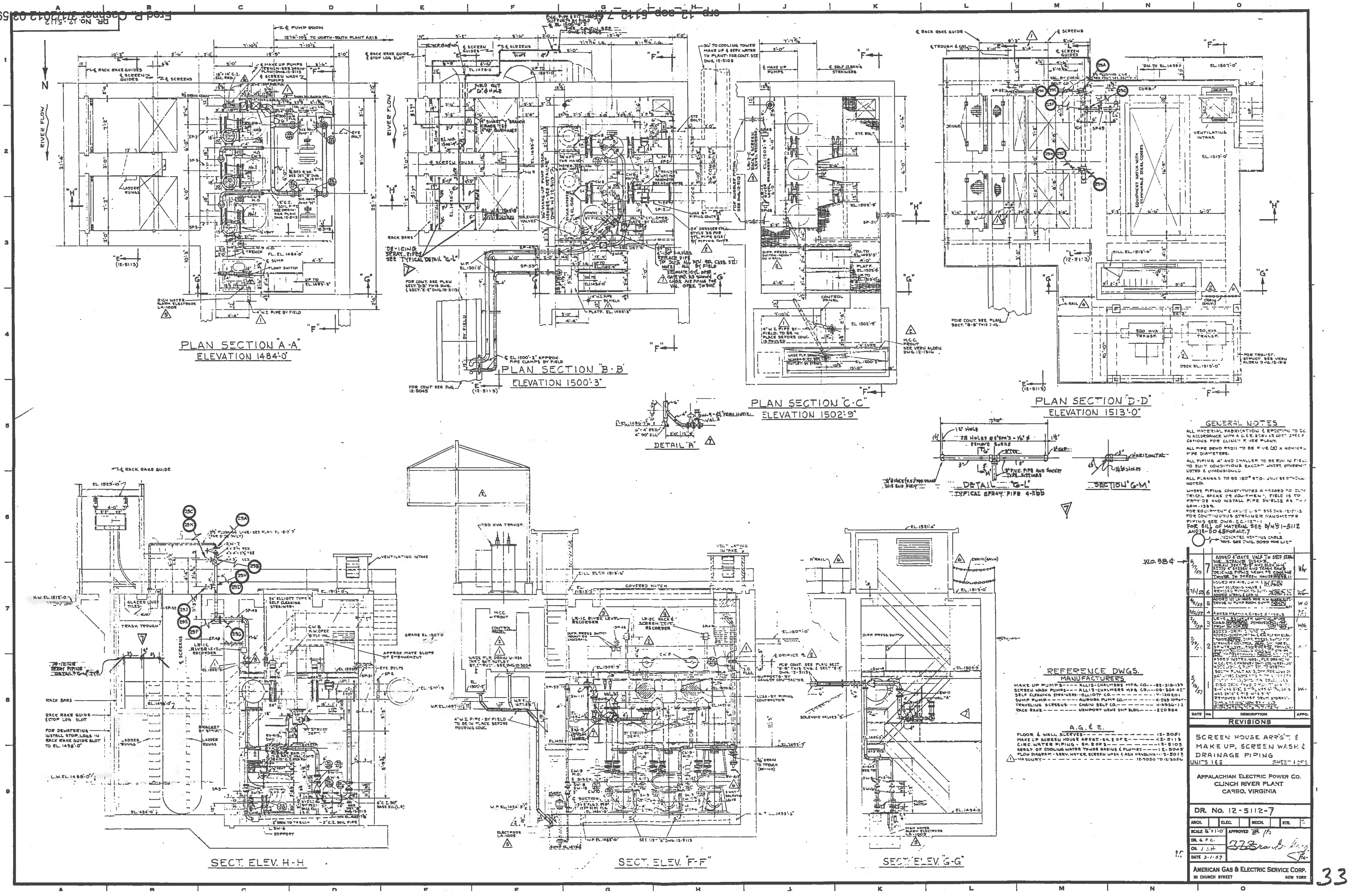
Appendix A

11” x 17” Engineering Drawings of River Water Make-Up Intake Structures:

- Drawing No.13-5024-15: Clinch River Plant Plot Plan
- Drawing No.12-5112-7: Screen House Arrangement, Make Up, Screen Wash and Drainage Piping (Unit 1 and 2)


DWG. NO. 13-5024-15
PLANT NORTH
ASH RECIRC. WATER PUMP STRUCTURE
FLY ASH & BOTTOM ASH STORAGE AREA
CLINCH RIVER FLOW
MAKE-UP SCREEN HOUSE
WATER COOLING TOWER #2
WATER COOLING TOWER #1
WATER COOLING TOWER No. 4
GRAVITY FILTERS
ACID PIT
SULFURIC ACID STORAGE TANK
CHEMICAL HOUSE
COOLING TOWER CONTROL HOUSE
BULK HYDROGEN STORAGE AND DELIVERY
UREA SOLUTION RAIL SPURS, RAIL UNLOADING & BULK STORAGE COMPLEX
WASTEWATER TREATMENT AREA
ELECTRICAL BLDG.
CLARIFIERS
GRIT CHAMBER
ASH PUMP HOUSE
750 KVA TRANSFORMERS
CENTRAL H2 PRODUCTION STA.
UREA SOLUTION DAY TANKS COMPLEX
PAVED STORAGE
GRAVEL STORAGE
CONT. HOUSE
138KV STRUCTURE
PRECIPITATOR No. 3
PRECIPITATOR No. 2
PRECIPITATOR No. 1
BOILER No. 3
BOILER No. 2
BOILER No. 1
BUNKER BAY
CIRC. WATER PUMPS
CONDENSATE STORAGE TANK
SCALE HSE.
ASH SILO
WATER COOLING TOWER #5
TEMP. FIRE HOUSE
OFFICE BUILDING
SALT STOR. BASIN
MICROWAVE BUILDING
COAL PILE
PARKING AREA
WAREHOUSE
NORTH-SOUTH AXIS
EAST-WEST AXIS
SEWAGE TREATMENT PLANT
FUEL OIL TANK
ABANDONED FILTER
CONVEYOR No. III
CONVEYOR No. I
36" SWING CONVEYOR
STA. No. II
STA. No. I
TRACK SCALE
CLINCH RIVER
MATCHLINE CONT. ON DWG. 13-5024A (C-5)
NOTES
REFERENCE DRAWINGS
PER SNCR PROJECT: ADDED DAY TANKS, BULK STORAGE, & RAIL UNLOADING. PER HYDROGEN RELOCATION: ADDED BULK HYDROGEN STORAGE & DELIVERY FACILITY (H4)
6/2/00 14 PER AS BUILT CONDITIONS: ADDED WASTEWATER TREATMENT BUILDING, TANKS AND ROADS. ADDED FLY ASH CONTROL BLD'G. AND SCALE HSE.
5/23/94 13 THIS DRAWING & DRAWING 13-5024A SUPERSEDES DRAWING 123-5024. ADDED COPPER RED. FAC. @ E/4. REMOVED OIL TANK @ K/6 AND GENERAL UPDATE OF DESCRIPTIONS.
THIS DRAWING HAS BEEN ELECTRONICALLY SCANNED SEE MICROFILM RECORDS FOR HISTORY & SIGNATURES DRAWING REVISION 11
DATE NO. DESCRIPTION APPD.
REVISIONS
"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP., OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST"
APPALACHIAN POWER Co.
CLINCH RIVER PLANT
CARBO VIRGINIA
PLOT PLAN
DWG. NO. 13-5024-15
ENGINEERING DIVISION
S.M. FIALA
DESIGN DEPARTMENT
AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

32


PLAN SECTION "A-A"
ELEVATION 1484'-0"
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ELEVATION 1500'-3"
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ELEVATION 1502'-9"
PLAN SECTION "D-D"
ELEVATION 1513'-0"
DETAIL "A"
DETAIL "G-L"
TYPICAL SPRAY PIPE
SECTION "G-M"
SECT. ELEV. H-H
SECT. ELEV. "F-F"
SECT. ELEV. "G-G"
RIVER FLOW
GENERAL NOTES
REFERENCE DWGS.
MANUFACTURERS
MAKE UP PUMPS---- ALLIS-CHALMERS MFG. CO.---82-318-139
SCREEN WASH PUMPS--- ALLIS-CHALMERS MFG. CO.---08-304 43
SELF CLEANING STRAINERS--ELLIOTT CO.----------Y-120201
SUMP PUMP---------AURORA PUMP CO.----------4-059
TRAVELING SCREENS --- CHAIN BELT CO.---------- H-6936-12
RACK RAKE---------- NEWPORT NEWS SHIP BLDG.----220984
A.G. & E.
FLOOR & WALL SLEEVES------------------- 12-5081
MAKE UP SCREEN HOUSE ARRGT.-SH. 2 OF 2--------12-5113
CIRC. WATER PIPING - SH. 2 OF 3----------------12-5109
ARRGT. OF COOLING WATER TOWER BASINS & FLUMES-----12-3045
FLOW DIAGRAM - SERV. WATER, SCREEN WASH & ASH HANDLING---2-5012
MASONRY------------------------12-3050 TO 12-3056
DATE
No.
DESCRIPTION
APPD.
REVISIONS
SCREEN HOUSE ARR'G'T. &
MAKE UP, SCREEN WASH &
DRAINAGE PIPING
UNITS 1 & 2
APPALACHIAN ELECTRIC POWER CO.
CLINCH RIVER PLANT
CARBO, VIRGINIA
DR. No. 12-5112-7
ARCH.
ELEC.
MECH.
STR.
SCALE 1/4" = 1'-0"
APPROVED
DR. & F.C.
CH. J.J.H.
DATE 3-1-57
AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET
NEW YORK
33

Appendix I

Permit Modification Requests

Permit Modification Request 1 – Additional Stormwater Outfalls

As discussed in Note 2, Form 2F Notes, stormwater Outfalls 501 and 502 resulted from the closure of Ash Pond 2. A complete Form 2F is included in this application for each Outfall 501 and Outfall 502. The Company requests the incorporation of these outfalls into the reissued permit. A third stormwater outfall designated as Outfall 503 will become functional in mid-2015 as part of the Ash Pond 1A/1B stormwater diversion project. A more detailed description of Outfall 503 and its drainage area is included in Note 2, Form 2F Notes. The Company also requests the incorporation of Outfall 503 to the reissued permit, with the condition that a complete Form 2F will be submitted to DEQ for the outfall within 1 year of its completion and drainage area stabilization. The Company suggests the following language be added to the reissued permit:

"**Sampling to Fulfill Form 2F Requirements** – The completed Part VII of Form 2F shall be submitted for Outfall 503 within one year of completion and commencement of discharge."

Discharges of stormwater from Outfalls 501, 502, and 503 are currently covered under General Permit registrations VAR052112 and VAR10E293. The Company proposes to terminate General Permit coverage following incorporation of these outfalls into the reissued permit.

Permit Modification Request 2 – Decreased STP Sampling Frequency (Outfall 008)

The Clinch River Plant Sewage Treatment Plant (STP) has a design flow of 0.012 MGD and historically served approximately 200 Company and contract employees on a given day. For a combination of reasons the Plant staff complement has decreased in recent years to 58 permanent staff and a varying number of contractors, to date. During 2014 the average discharge from Outfall 008 was less than 0.002 MGD. Clinch River Plant is currently required to provide a daily estimate of discharge flow rate and to collect grab samples at varying frequencies for four other parameters. Measurements of pH are taken six days per week; *E. coli* are measured weekly; BOD_5 and total suspended solids are measured once per month. As shown in the DMR Summary included in Appendix C, pH has been measured consistently within the permit limits of 6.0 – 9.0 over the current permit term. To better align with the above-described staff availability at the Plant and operation of the STP, the Company requests to decrease the pH monitoring requirement to four days/week.

Permit Modification Request 3 – Request to Discontinue Biological Monitoring

Whole effluent toxicity testing was conducted for Outfalls 003, 007, and 727 at varying intervals over the current permit term. The monitoring results are presented in Appendix E. As shown, limited toxicity was observed in testing the effluent of Outfalls 003 and 727. No toxic effects were observed during any of the tests of Outfall 007. Based on the results presented, the Company requests to discontinue biological monitoring for Outfalls 003, 007, and 727 during the upcoming permit term.

Permit Modification Request 4 – Clinch River Plant Fuel Conversion

The generating units at Clinch River Plant are not, in their current condition, equipped to comply with recently approved and anticipated air emissions regulations. Appalachian Power Company evaluated alternatives and determined that Units 1 and 2 will be converted to burn natural gas and Unit 3 will be permanently retired. The Virginia State Corporation Commission granted a Certificate of Public Convenience and Necessity for this proposal on December 20, 2013. The combined unit conversion and retirement plan best meets forecasted customer needs while taking into account economic and environmental considerations. The two converted units will have a nominal generating capacity of 242 megawatts each, for a Plant nameplate capacity of 484 megawatts.

The primary driver for the fuel conversion is the Mercury & Air Toxics Standards (MATS) rule. The resultant emissions reductions from combustion of natural gas instead of coal are projected to comply with applicable Air Toxic regulations without the addition of substantial pollution control equipment. Unit 3 will not be converted and will permanently retire on June 1, 2015. Virginia DEQ granted the Company a 1-year administrative extension for compliance with the MATS rule for Units 1 & 2 to April 16, 2016. After that date, coal will no longer be burned in either unit at Clinch River Plant. Unit 1 is scheduled to undergo the fuel conversion process beginning in September 2015, followed by Unit 2 in February 2016. The expected duration of each unit outage is 12-16 weeks. The scheduled outage start dates are dependent on a number of variables and are subject to change. There may be a transitory period from late 2015 to early 2016 during which Unit 1 will be operational on natural gas and Unit 2 and/or Unit 3 will continue to burn coal. Both unit fuel conversions are expected to be complete by mid-2016. The anticipated impacts of the fuel source conversion on Clinch River Plant water intake, use, and discharges are summarized below.

Plant Intake

Water withdrawals following the fuel conversion of Units 1 and 2 and the retirement of Unit 3 are expected to decrease by approximately one-third from existing rates. No new facilities are needed for water withdrawals. Clinch River Plant's current intake structure is not proposed to be modified. The intake flow reduction further substantiates the finding of Best Technology Available (BTA) for the cooling water intake structure, as described in Appendix H, under CWA §316(b).

Outfall 003

In the absence of coal combustion, Plant process waters will no longer come into contact with coal combustion byproducts (CCBs) other than seepage and leachate from previously disposed CCBs. Water flows related to CCB handling and the operation of Unit 3 will be eliminated, including:

- Fly ash and bottom ash sluice water
- Water used in the fly ash silo mixer
- Ash tank overflows
- Decanted water from the ash settling ponds (following pond closure)
- Cooling Tower 5 blowdown

Operation of the primary WWTP and the AWWTP will continue as described in Appendix A. No physical modifications to the wastewater treatment process are currently proposed, although chemical feed rates may be adjusted to account for changes in incoming wastewater quality. As shown on the draft water balance diagram, the upcoming closure of the ash settling pond complex dictates the need for an alternate solids removal mechanism. Various press systems and other options are currently being evaluated and will be installed once a design is selected. In the interim, solids will continue to be managed using Pond 1A/1B as a settling and disposal basin until its closure.

Outfall 007

Although Clinch River Plant will no longer use coal as a fuel source, the existing coal storage area, handling, and blending systems are proposed to remain in operation after the fuel conversion and Unit 3 retirement. The Company is in the process of forming agreements for external use of the facility. Coal is currently delivered to the Plant by rail via an unloading system near the southern end of the Plant, where it is managed in a 5.7-acre storage pile prior to use in the generating units. Under the tentative agreement, the Plant will continue to receive coal by rail and manage the storage pile, including handling and blending. From the storage area coal will be trucked to an external destination for use by an outside party. Appalachian Power Company will not be involved in the handling or disposal of resultant CCBs from the end-user of the coal. However, it is anticipated that the coal pile runoff ponds will remain operational during the upcoming permit term and the Company will retain responsibility for the effluent water quality discharged via Outfall 007. It is important to note that an agreement has not yet been finalized and the stated conditions are subject to change. If finalized, this agreement will be communicated to DEQ in a separate submittal.

Outfall 008

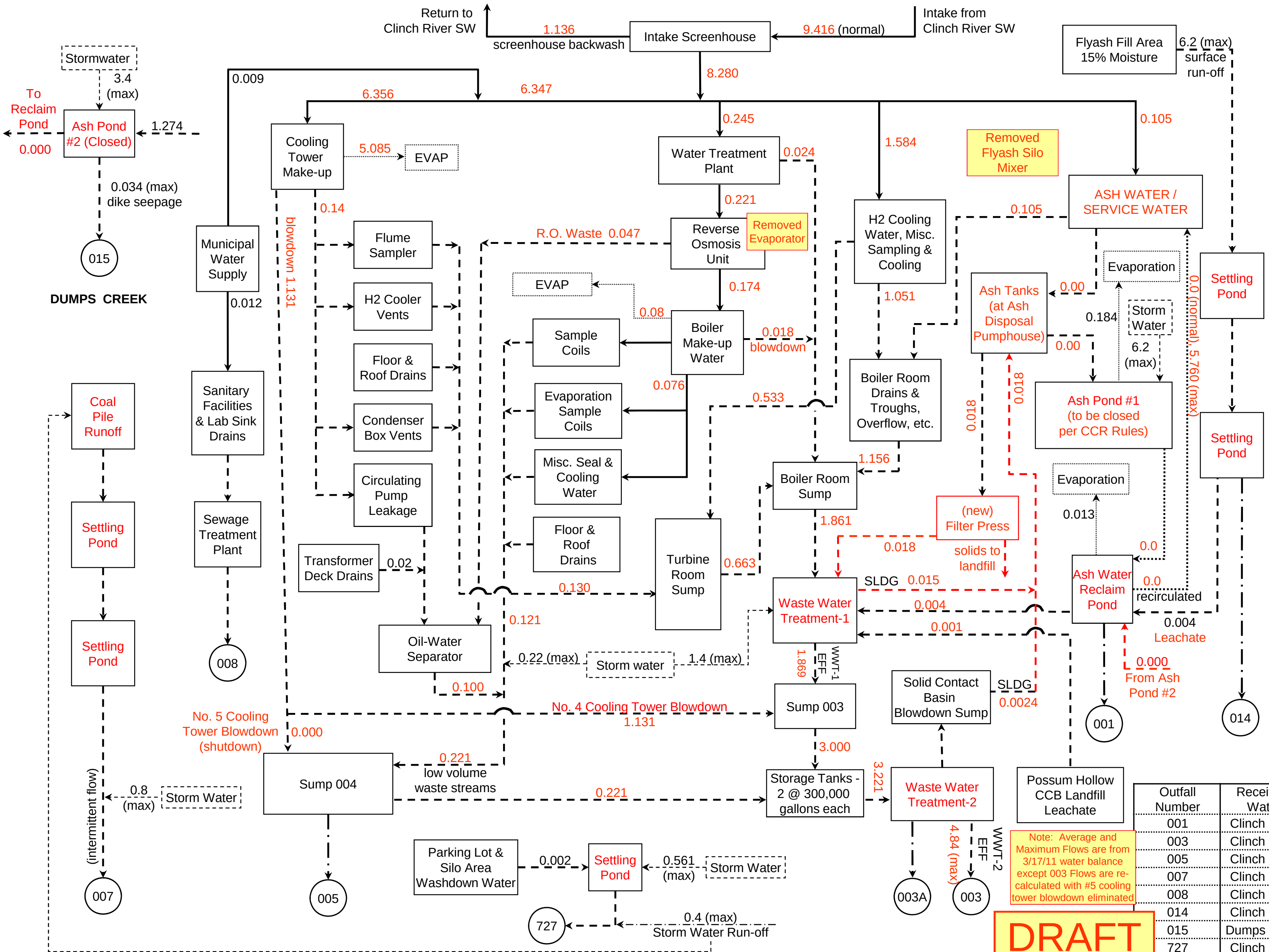
Clinch River Plant is expected to maintain a post-conversion staff complement of 40 permanent employees with a varying number of contractors on site at any given time. As indicated on the DMR summary, the Outfall 008 discharge is expected to remain significantly below the design basis of 0.012 MGD. No modifications to the treatment process are proposed, other than the requested reduction in pH monitoring.

Draft Water Balance Diagram

The following figure shows a draft post-conversion water balance diagram for the Plant that provides anticipated flow patterns and rates. In addition to the water balance changes described above, other various Plant process waters related to operation of the generating units are anticipated to decrease by approximately one-third due to the Unit 3 retirement. It is important to note that the included flow patterns and rates are estimations based on a variety of factors that are subject to change.

Clinch River Plant

Water Balance Diagram
Units 1 & 2



LEGEND

- Supply Water
- Waste Water
- Reclaim Water
- Storm Water
- Evaporation
- No flow associated with normal operating conditions (emergency overflow)
- ### Outfall Number

NOTES

Note 1: All flows represent average water usage with Units 1& 2 operating at full load on NG and Unit 3 Shutdown.

Note 2: Maximum (max) flows include rainfall for a 10-year, 24-hour storm event.

Note 3: Advanced Wastewater Treatment Plant maximum design capacity - 7.776 mgd (outfall 003).

All flows estimated based on design, unless indicated otherwise, and expressed in million gallons per day (MGD)

05-02-14

Water & Ecological Resource Services AEP

Outfall Number	Receiving Water	Average Flow	Maximum Flow
001	Clinch River	0.000	6.200
003	Clinch River	3.220	4.840
005	Clinch River	0.000	1.467
007	Clinch River	0.240	1.200
008	Clinch River	0.003	0.012
014	Clinch River	0.000	6.200
015	Dumps Creek	0.034	0.034
727	Clinch River	Intermittent	0.561

Clean Water Act § 316(b) Compliance Submittal Requirements

Prepared for:
American Electric Power

Prepared by:
HDR Engineering, Inc.

July 20, 2015

Clinch River Plant
Carbo, VA

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Executive Summary

This report addresses requirements of the Clean Water Act's Section 316(b) existing facilities rule for American Electric Power's (AEP's) Clinch River Plant. For affected facilities[1], the rule defines national standards for the location, design, construction, and capacity of cooling water intake structures (CWIS) to be implemented under the National Pollutant Discharge Elimination System (NPDES) permit program. The existing facilities rule calls for the submission of several reports under 40 CFR 122.21(r) – Application for a permit renewal. This document represents those submittals for AEP's Clinch River Plant (i.e., those defined at 40 CFR 122.21(r)(2)-(8) for facilities with Actual Intake Flow (AIF) less than 125 MGD). This report examines the Clinch River Plant's Cooling Water Intake Structure (CWIS) relative to the rule's standards for Best Technology Available (BTA).

The Clinch River Plant is located near Carbo, Virginia on the Clinch River at River Mile 268. The facility and its cooling water system are intended for year-round, 24 hours/day operation, with the exception of down time due to outages. The facility has a single CWIS that serves its two generating units. Historically, there were three generating units, but Unit 3 has been retired since May 2015. The CWIS has two conventional traveling water screens. Three pumps, each rated at 6,500 gallons per minute (GPM), provide flows to the two units. Normal water needs can be met with only one pump while the second and third pumps are held in standby mode, resulting in a design intake flow of 9.36 million gallons per day (MGD). Approximately 65% of the design intake flow is used for cooling purposes. The Clinch River Plant utilizes mechanical draft (5-cell counter-flow) cooling towers on a closed loop system. Water is recycled and reused in the steam turbine condensers.

There are several features of the design and operation of Clinch River Plant's CWIS and cooling water system that reduce losses of aquatic organisms due to impingement and entrainment. The combination of the technological and operational features used at Clinch River Plant should be considered BTA for both entrainment and impingement. In particular, several steps, as outlined below, have been undertaken to reduce water use at the facility.

Key Findings of No Adverse Environmental Impact:

- Clinch River uses a closed-cycle cooling system. The towers are presently operating at two-to-five cycles of concentration and provide a flow reduction of at least 97.0% compared to a once-through system. Since reductions in impingement and entrainment can be assumed to be commensurate with reductions in flow, use of closed-cycle cooling at Clinch River Plant is assumed to reduce potential impingement and

[1] Facilities affected by the rule are those that: 1) commenced construction on or before January 17, 2002; 2) withdraw at least two million gallons per day from waters of the United States; 3) use at least 25% of that water exclusively for cooling purposes; and 4) are regulated under the NPDES program.

entrainment by at least 97.0%. Use of closed-cycle cooling meets the impingement mortality reduction standard through Compliance Alternative 1 (§125.94(c)(1)).

- Current design withdrawal from the Clinch River by the river intake is 6,500 GPM (9.36 MGD) with a maximum design through-screen velocity of 0.5 fps.
- Clinch River Plant has a favorable orientation of the intake in terms of potential reduction in impingement and entrainment because of (1) perpendicular orientation of the intake to river currents such that passive organisms would tend to be carried past the intake and (2) intake location in the midsection of a long pool, which physically isolates it from the majority of fish and mussel species that tend to inhabit riffle/run habitat (in particular the T&E species).
- State- and Federally-protected fish and mussel species are listed as occurring in the vicinity of the Clinch River plant. Protected mussel species are the subject of a re-introduction program in the relevant river reach. Low susceptibility to impingement and entrainment of listed species due to life history and occurrence considerations, combined with minimal intake area of influence and low through-screen velocities at Clinch River Plant result in negligible potential for impact or take.

For the reasons outlined above and consistent with the Section 316(b) existing facilities rule, AEP's Clinch River Plant utilizes BTA to reduce impingement and entrainment losses and minimize adverse environmental impact. Therefore, no additional control measures to reduce impingement and entrainment mortality are expected to be necessary.

1 Regulatory Background

Clean Water Act §316(b) was enacted under the 1972 Clean Water Act, which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program. Facilities with NPDES permits are subject to §316(b), which requires that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. Cooling water intakes can cause adverse environmental impacts by drawing early life-stage fish and shellfish into and through cooling water systems (entrainment), or trapping juvenile or adult fish against the screens at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) rule (final rule) for existing facilities was published in the Federal Register. The rule applies to existing facilities that withdraw more than 2 million gallons per day (MGD) from Waters of the United States, use at least 25 percent of that water exclusively for cooling purposes, and have or require an NPDES permit. The rule supersedes the Phase II rule, which regulated existing electrical generating facilities until it was remanded in 2007. (The final rule also replaces the remanded existing-facility portion of the previously promulgated Phase III rule) The final rule became effective on October 14, 2014.

Facilities subject to the final rule are required to develop and submit technical material, identified at §122.21(r)(2)-(13), that will be used by the NPDES Director (Director) to make a BTA determination for the facility. The actual intake flow (AIF) and design intake flow (DIF) at a facility determine what submittals will be required. As shown in Table 1-1, facilities with AIF rates of 125 MGD and less have fewer application submittal requirements and will generally be required to select from the impingement compliance options contained in the rule. For such facilities, the Director must still determine BTA for entrainment on a site-specific basis and the applicant may supply information relevant to the Director's decision. Facilities with AIF in excess of 125 MGD are required to address both impingement and entrainment and provide specific entrainment studies which may involve extensive field studies and analysis of alternatives to reduce entrainment (§122.21(r)(9)-(13)). Facilities equipped with closed-cycle recirculating systems are not automatically exempt from these requirements.

Table 1-1. Facility Flow Attributes and Permit Application Requirements

Facility Flow Attributes	Applicable Requirements
Existing facility w/ DIF > 2 MGD and AIF > 125 MGD	§122.21(r)(2)-(13) Includes impingement mortality standard and site-specific entrainment requirements with additional entrainment study and reporting requirements
Existing facility w/ DIF > 2 MGD and AIF < 125 MGD	§122.21(r)(2)-(8) Includes impingement mortality standard and site-specific entrainment requirements; additional reports for entrainment at Director discretion
2 MGD or less DIF or < 25% of AIF used for cooling purposes	Director BPJ

The compliance schedule is dependent on the facility's NPDES permit renewal date. Facilities are to submit their §316(b) application material to their Director along with their next permit renewal, unless that permit renewal takes place prior to July 14, 2018, in which case an alternate schedule may be requested.

American Electric Power (AEP)'s Clinch River Plant is subject to the existing facility rule and based on its current configuration and operation is anticipated to be required to develop and submit each of the §122.21(r)(2)-(8) submittal requirements (Table 1-2) with its next permit renewal in accordance with the rule's technical and schedule requirements.

Table 1-2. Summary of §316(b) Rule for Existing Facilities Submittal Requirements for §122.21(r)(2)-(8)

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source Water Physical Data	Characterization of the source water body including intake area of influence
(3)	Cooling Water Intake Structure Data	Characterization of cooling water system; includes drawings and narrative; description of operation; water balance
(4)	Source Water Baseline Biological Characterization data	Characterization of biological community in the vicinity of the intake; life history summaries; susceptibility to impingement and entrainment; must include existing data; identification of missing data; threatened and endangered species and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival)
(5)	Cooling Water System Data	Narrative description of cooling water system and intake structure; proportion of design flow used; water reuse summary; proportion of source water body withdrawn (monthly); seasonal operation summary; existing impingement mortality and entrainment reduction measures; flow/MW efficiency
(6)	Chosen Method of Compliance with Impingement Mortality Standard	Provides facility's proposed approach to meet the impingement mortality requirement (chosen from seven available options); provides detailed study plan for monitoring compliance, if required by selected compliance option; addresses entrapment where required
(7)	Entrainment Performance Studies	Provides a summary of relevant entrainment mortality studies (latent mortality, technology efficacy); can be from the facility or elsewhere with justification; studies should not be more than 10 years old without justification; new studies are not required
(8)	Operational Status	Provides operational status for each unit; age and capacity utilizations for the past five years; upgrades within last 15 years; uprates and Nuclear Regulatory Committee relicensing status for nuclear facilities; decommissioning and replacement plans; current and future operation as it relates to actual and design intake flow

2 Source Water Physical Data [§122.21(r)(2)]

2.1 Description of Source Water Body [§122.21(r)(2)(i)]

The Clinch River Plant is located near Carbo, Virginia on the Clinch River at River Mile 268.0. The USGS Topographic elevation map showing the vicinity of the plant is provided in Figure 2-1. The Clinch River arises in southwest Virginia, flowing into Tennessee and joining with the Powell River before entering the Tennessee River. The Virginia waters of the Clinch River lie within the steep-sloped Ridge and Valley and Cumberland Plateau physiographic provinces of the central Appalachian Mountains. The average gradient of the upper, free-flowing portion of the river covering 188 miles from its source near Tazewell, Virginia, to Norris Reservoir in Tennessee is 9.3 ft/mi (Masnik 1974). The river is characterized by extensive pool-riffle development, including several islands and braided channel segments. The geology of the region is dominated by exposed limestone and dolomite formations, which produce a carbonate-rich system with pH in the range of 7.5-8.5 (Masnik 1974). There is no scaled drawing for salinity and the parameter is not believed to be relevant due to the plant being located on a freshwater river.

The upper Clinch River near the facility has a drainage area of approximately 533 sq. mi. (Krstolic et al. 2013). Land use is about two-thirds forestland, with most of the remainder utilized as grazing land. Urban, industrial, and mining uses combine for less than ten percent of land use (Van Hassel 2007). For the segment of the Clinch River that includes the plant intake and ten miles upstream, water quality was supportive of all uses except recreation, which was impaired by *E. coli* bacteria (VDEQ/VDCR 2014).

Water temperatures in the Clinch River at river mile 271.6, 3.6 miles upstream of the plant intake, ranged from means of 38.2°F in January to 76.0°F in July for the years 2010-2014 (see Table 2-1 below). There is no scaled drawing for water temperatures available. The data presented in Table 2-1 characterize the Clinch River thermal regime at the plant intake. This section of the Clinch River is characterized by well-defined pools and riffles, and is well mixed such that thermal stratification or zones are not typical.

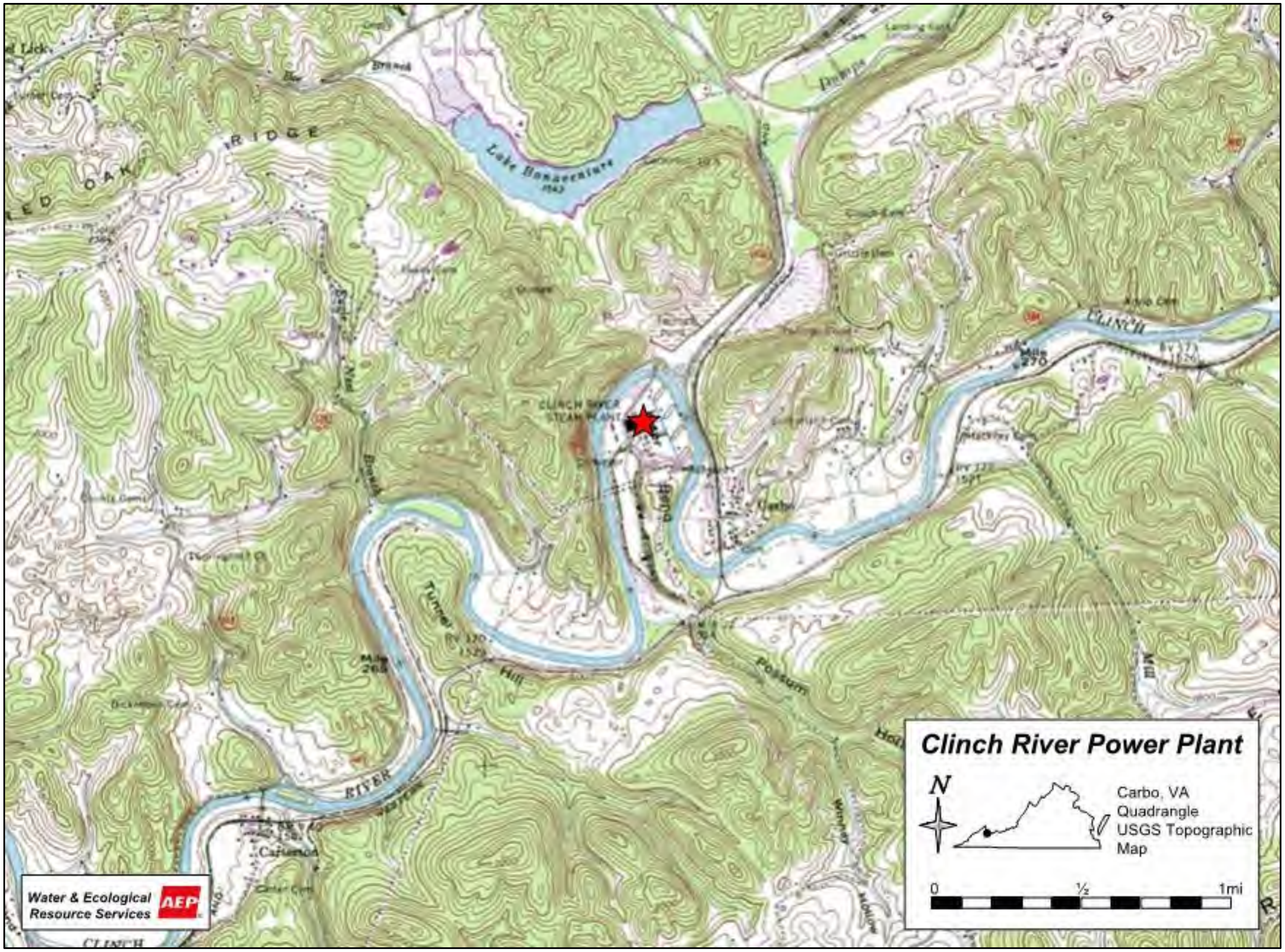


Figure 2-1. Locational Map of Clinch River Plant

Table 2-1. Clinch River Water Temperature near the Clinch River Plant (°F)

Month	2010	2011	2012	2013	2014	Mean
January	38.0	36.7	42.3	42.6	31.6	38.2
February	39.5	42.7	44.7	42.6	32.7	40.4
March	45.8	49.5	54.9	44.2	51.1	49.1
April	59.3	57.3	57.8	55.4	58.1	57.6
May	65.2	62.1	67.7	63.0	66.4	64.9
June	74.0	73.9	72.9	72.1	75.2	73.6
July	78.3	77.6	76.3	73.8	73.9	76.0
August	75.3	76.5	73.6	71.2	73.2	74.0
September	70.7	68.5	67.8	68.2	69.0	68.8
October	57.9	57.1	56.5	61.0	--	58.1
November	47.9	49.2	43.5	53.6	--	48.6
December	37.1	45.5	43.7	51.1	--	44.4

2.2 Characterization of Source Water Body [§122.21(r)(2)(ii)]

2.2.1 Hydrology

River flow data were obtained from the U.S. Geological Survey (USGS) gage at Cleveland, Virginia, located 3.6 miles upstream of the plant. For the data record from 1921 to 2015, monthly mean flows were lowest in September, with a mean of 220 ft^3/sec (cfs), and highest in March, with a mean of 1,407 cfs. Tables 2-2 and 2-3 present monthly minimum, maximum and average flows and summary statistics of Clinch River flows at the USGS Cleveland, VA station (River Mile 271.6), respectively. Drought conditions, defined as flows below a 7Q10 of 56 cfs, are rare outside of the September to October time frame and are typically of a short duration (e.g., < 10 days).

2.2.2 Geomorphology

The Tennessee River drainage, including the Clinch River, is the largest tributary of the Ohio River basin, and contains the most diverse ichthyofauna in North America. In Virginia, the drainage is almost entirely in the Valley and Ridge Province, and is unique in the state for characteristic large shoals composed mainly of loose gravel (Jenkins and Burkhead 1994). Another feature contributing to the faunal diversity is the lack of a major impoundment in the Virginia portion of these rivers, which have retained their strong pool-riffle configuration.

Table 2-2. Clinch River Stream Flow (cfs) at River Mile 271.6

Month	Monthly Mean Flow (cfs)	Monthly Maximum		Monthly Minimum	
		Flow (cfs)	Water Year* (WY)	Flow (cfs)	WY
Jan	1,116	2,817	1937	92	1940
Feb	1,330	3,360	1957	206	1941
Mar	1,407	4,572	1955	309	1988
Apr	1,052	3,414	1987	228	1942
May	790	2,254	1958	195	1941
Jun	495	2,353	2004	80	1930
Jul	342	1,292	2001	78	1930
Aug	323	1,640	1940	63	1988
Sep	220	1,003	1989	55	1930
Oct	264	1,389	1977	54	1931
Nov	417	2,011	1978	64	1940
Dec	793	3,043	1927	81	1940

Note: *The term "water year" in reports that deal with surface-water supply is defined as the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

Table 2-3. Summary Statistics of Clinch River flows at the USGS Cleveland, VA Station

Statistic	WY 2014		WY 1921 - 2015	
Annual mean (cfs)	631.9		708.5	
Highest annual mean (cfs)			1,128	WY 2004
Lowest annual mean (cfs)			287.4	WY 1988
Highest daily mean (cfs)	4,490	Dec 30, 2013	27,800	Apr 05, 1977
Lowest daily mean (cfs)	108.0	Nov 14, 2013	37.0	Sep 13, 1964
Annual 7-day minimum (cfs)*	113.1	Nov 11, 2013	39.6	Sep 13, 1964
Maximum peak flow (cfs)	5,750	Feb 03, 2014	34,500	Apr 05, 1977
Maximum peak stage (ft)	8.66	Feb 03, 2014	26.4	Apr 05, 1977
Annual runoff (cfsm)	1.19		1.33	
Annual runoff (inches)	16.1		18.1	
10 percent exceeds (cfs)	1,368		1,560	
50 percent exceeds (cfs)	407.0		383.0	
90 percent exceeds (cfs)	134.0		98.0	

Data Source: Water Data Report 2014 of USGS Gaging Station #03524000 Clinch River at Cleveland, VA
Note: *Annual 7-day minimum flow is the lowest mean discharge for 7 consecutive days during a water year. The date shown in the summary statistics table is the initial date of the 7-day period.

In the plant vicinity, the Clinch River varies from approximately 75-120 feet in width, and the Clinch River Plant's CWIS is located at the center of a deep pool approximately 900 feet long with depth of approximately 10 feet around the intake. No scaled drawing of water depth is available. Substrate composition is dominated by the sand/gravel/rubble fractions. Measurements near the facility found percentages by volume of 32-46% rubble, 19-25% gravel, and 31-39% sand, with typically 0-5% boulder and silt (Van Hassel 2007). The sediment movement in the river is dynamic, with scour and deposition changing with changing flow conditions. There has been no excessive deposition in the immediate vicinity of the plant intake structure.

2.2.3 Determination of Area of Influence

The "area of influence" (AOI) of a CWIS appears in three of the §122.21(r) sections of the §316(b) final rules for existing facilities:

- §122.21(r)(2) Source Water Physical Data requires information on "the methods used to conduct any physical studies to determine the intake's ***area of influence*** in the waterbody and the results of such studies."
- §122.21(r)(4) Source Water Baseline Biological Characterization Data says: "The study area should include, at a minimum, the ***area of influence*** of the cooling water intake structure."
- §122.21(r)(11) Benefits Valuation Study says: "The study would also include discussion of recent mitigation efforts already completed and how these have affected fish abundance and ecosystem viability in the intake structure's ***area of influence***."

Although the final rule does not provide a definition of AOI, the §316(b) Phase I rule for new facilities states that:

> *"The area of influence is the portion of water subject to the forces of the intake structure such that a particle within the area is likely to be pulled into the intake structure."*

While neither a formal definition of the AOI nor guidance for its estimation is provided within §316(b) final rule for existing facilities, it is commonly assumed that the AOI is that area of the source waterbody directly affected by the CWIS. Relative to impingeable organisms, generally juvenile and adult fish and shellfish, the concept is somewhat more concrete. It could be assumed that it is the point at which the organism is no longer capable of overcoming the forces of water withdrawal and impinges upon an intake screen (EPRI 2007). This would be highly dependent on the swimming capabilities of the species, its life stage, size, and general health condition; a point noted by EPRI in previous research on the relationship between intake approach velocity and the occurrence of impingement (EPRI 2000).

EPA considers 0.5 ft/s (fps) to be a *de minimis* value for the probability of impingement and this can be interpreted to mean that a fish can swim freely in a flow at this velocity and avoid impingement. As a compliance option for impingement in the 316(b) final rule for existing facilities, EPA indicates that there is no need for any type of impingement protection including impingement mortality studies if the maximum design or actual maximum through-screen velocity of the CWIS is 0.5 fps or less. Under these conditions, it is considered that the facility has met the performance standards for impingement mortality. Therefore, it can be interpreted that the 0.5 fps contour for velocities induced by the CWIS delineates the CWIS's AOI for impingement. This approach, in fact, was proposed to Ohio EPA (OEPA) by Dayton Power & Light (DPL) in their Proposal for Information Collection (PIC) for their Stuart Generating Station on the Ohio River. Their approach was accepted by OEPA and also recommended as a model for other facilities on the Ohio River (EPRI 2007).

Relative to entrainable organisms that have limited to no swimming capabilities and which are passively transported by water currents, a velocity threshold for entrainment, similar to the 0.5 fps velocity contour for impingement AOI, is not deemed a good approach because a passive particle in water may be drawn into the intake regardless of the magnitude of intake induced velocities. Therefore, our discussion on entrainment AOI will be focused on the volume of water withdrawn compared to the source water body and percent flow reduction achieved by the chosen compliance option compared to a once-through cooling system.

Methods

As stated above, the impingement AOI is the approximate area within the 0.5 fps velocity contour in the vicinity of CWIS and a simple desktop analysis is used for the following analysis.

Desktop calculations of the AOI of a cooling water intake are based on the principles of conservation of mass and continuity and require simplifying assumptions such as average water depth. A low water elevation and zero ambient velocity would provide a conservative estimate of AOI. Below are shown the calculation steps for estimating the AOI. By definition, Area of Influence (AOI) or Hydraulic Zone of Influence (HZI) is the location where the velocity induced by the intake is equal to a specified threshold velocity. In the case of impingement, and as discussed above, that threshold velocity is assumed to be 0.5 fps. The radius of AOI (R_{AOI}) for an arc angle of 180 degrees (i.e., a shoreline intake structure) can be estimated from a continuity equation:

$$Qi = \pi \times R_{AOI} \times d \times V \qquad \text{Eq. 1}$$

where, Q_i = Intake Flow
R_{AOI} = Radius of Area of Influence
d = Water depth at R_{AOI}
V = Threshold velocity (i.e., 0.5 fps for impingement AOI).

Rearranging terms in equation 1 gives:

$$R_{AOI} = Qi /(\pi \times d \times V) \qquad \text{Eq. 2}$$

As noted above the entrainment AOI will be evaluated based on comparison of the intake flow to the Clinch River flow.

Results

Using a low water depth at the intake of 4 ft (as a conservative assumption) and 6,500 GPM (9.36 MGD) rated capacity of the river water make-up pump, the calculated radius of the AOI using the equation 2 above is 2.3 ft.

The plant design intake withdrawal (9.36 MGD) during low-flow conditions in the March-July peak larval density period is estimated at 2.6-13.1% of the low river flows (95% exceedance flows) and 1.0-4.2% of mean monthly flows. Additionally, the water withdrawn is not totally consumed by the plant, i.e., approximately one third of the water withdrawn is returned to the river, resulting in less than 15% of the river being consumed during critical low flow events based on the lowest 95% exceedance flow in October (see Table 5-1 in Section 5.1). This withdrawal should not impact downstream aquatic life, recreation, water supply, and other water uses. Also, the perpendicular orientation of the intake structure to river current, and less than 0.5 fps through-screen velocities, reduces adverse impacts such that passive organisms will tend to be carried past the intake.

In summary, the AOI at Clinch River Plant is considered insignificant for impingement due to the fact that the area over which the intake-induced velocity is greater than 0.5 fps, the threshold value for impingement, has a radius of 2.3 ft. Additionally, based on the magnitude of the intake flow relative to the river flow, the AOI for entrainment (i.e., the volume of river in which entrainment probability is high) would be small.

2.3 Locational Maps [§122.21(r)(iii)]

The locational map is provided in Figure 2-1 (under Section 2.1) which is the USGS topographic map showing the area near Clinch River Plant. Also, Figure 2-2 below presents an annotated aerial photo of the Plant and its environs.

Map source: Google earth

Figure 2-2. Aerial Photo of Clinch River Plant

3 Cooling Water Intake Structure Data [§122.21(r)(3)]

3.1 Description of CWIS Configuration [§122.21(r)(3)(i)]

The Clinch River Plant cooling system is a closed-cycle system; that is, the cooling water is recycled and reused in the steam turbine condensers. The plant currently has two generating units (Units 1 and 2); Unit 3 was permanently retired in May 2015. Approximately 65% of the design intake water is used for cooling. The current design flow for make-up from the Clinch River is 9.36 MGD (6,500 GPM). The Clinch River Plant has a single river CWIS to serve its two generating units, located at River Mile 268.0 (see Figures 2-1 and 3-1).

The intake structure is located approximately flush with the shoreline and oriented perpendicular to the direction of Clinch River flow. One of the three river make-up pumps are required for normal operation with two Units and two pumps held in standby mode. Each river water pump has a rated capacity of 6,500 GPM. The intake structure has two 7 ft-2 in. wide intake openings and contains two conventional traveling water screens (TWS) with each basket frame measuring 6 ft wide by 2 ft high and 3/8-inch square mesh openings (Figure 3-2). It is assumed that the screen mesh dimensions (where water flows through) for each basket are 71 in. wide by 21 in. high (i.e., 10.3 ft^2). U.S. Filter has provided a percent open area (POA) of 67.9 for a screen with 3/8-in. square openings and #14 (0.080 in. diameter) mesh wire. The bottom of the screens are located at elevation 1,484 ft, compared to a low water level of 1,488 ft, and normal pool level of 1,498 ft.

The trash rakes are installed with a water level differential recorder in order to remove trash and debris from the water before it enters the traveling water screens and river water makeup pumps. The motor-operated trash rakes function to remove large debris from the front of the intake structure that is caught on the trash rack bars. The rakes are manually operated. If the water level differential across the trash rake becomes excessive, a signal is sent to the plant's control room. When the control operator receives this alarm signal, he must have the trash rack cleaned immediately to prevent possible loss of suction to the river makeup pumps. Surface ice buildup is not an issue at the intake; therefore, no treatment and operational measures are necessary.

Water for washing debris from the traveling screens is supplied by two screen wash pumps located in the intake house. Each pump is rated at 850 GPM at 225 ft. Total Dynamic Head (TDH) and is driven by a 75-hp, 1,750-rpm and 550-volt motor. Each pump takes suction via a 6-in line, derived from the south river makeup pump discharge header downstream of the 24-in self-cleaning strainer. The suction lines are equipped with shut-off valves. Each discharge line is equipped with a check valve and two shut-off valves. The rotating screens are each driven by a two-speed (2hp/1hp), 550-volt motor, and can be operated either manually from local switches in the intake house or automatically. Each screen is equipped with a dual-level recorder-controller which starts the screen wash pump motors when a predetermined water level differential exists across the screen.

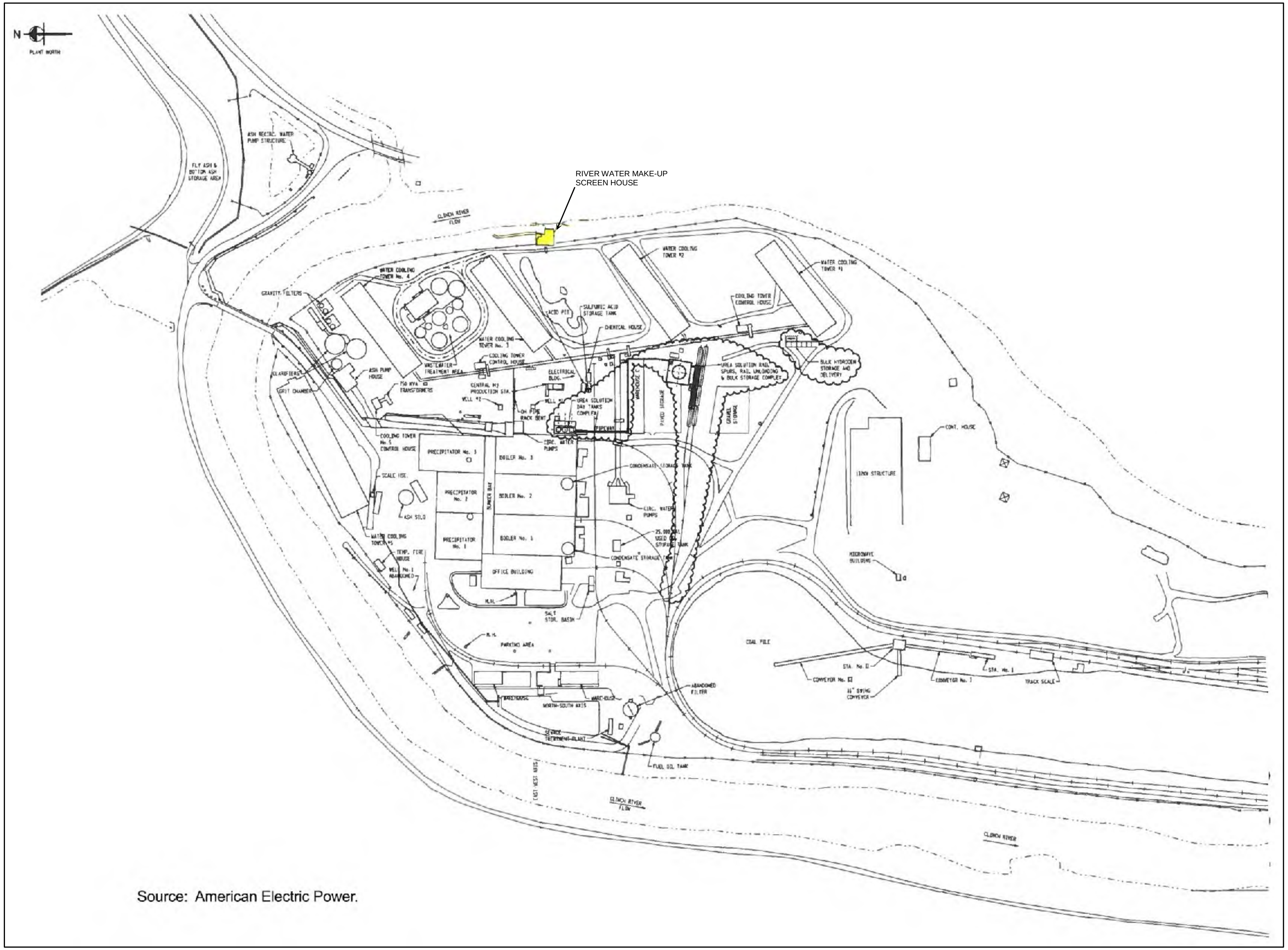


Figure 3-1. Clinch River Plant Plot Plan

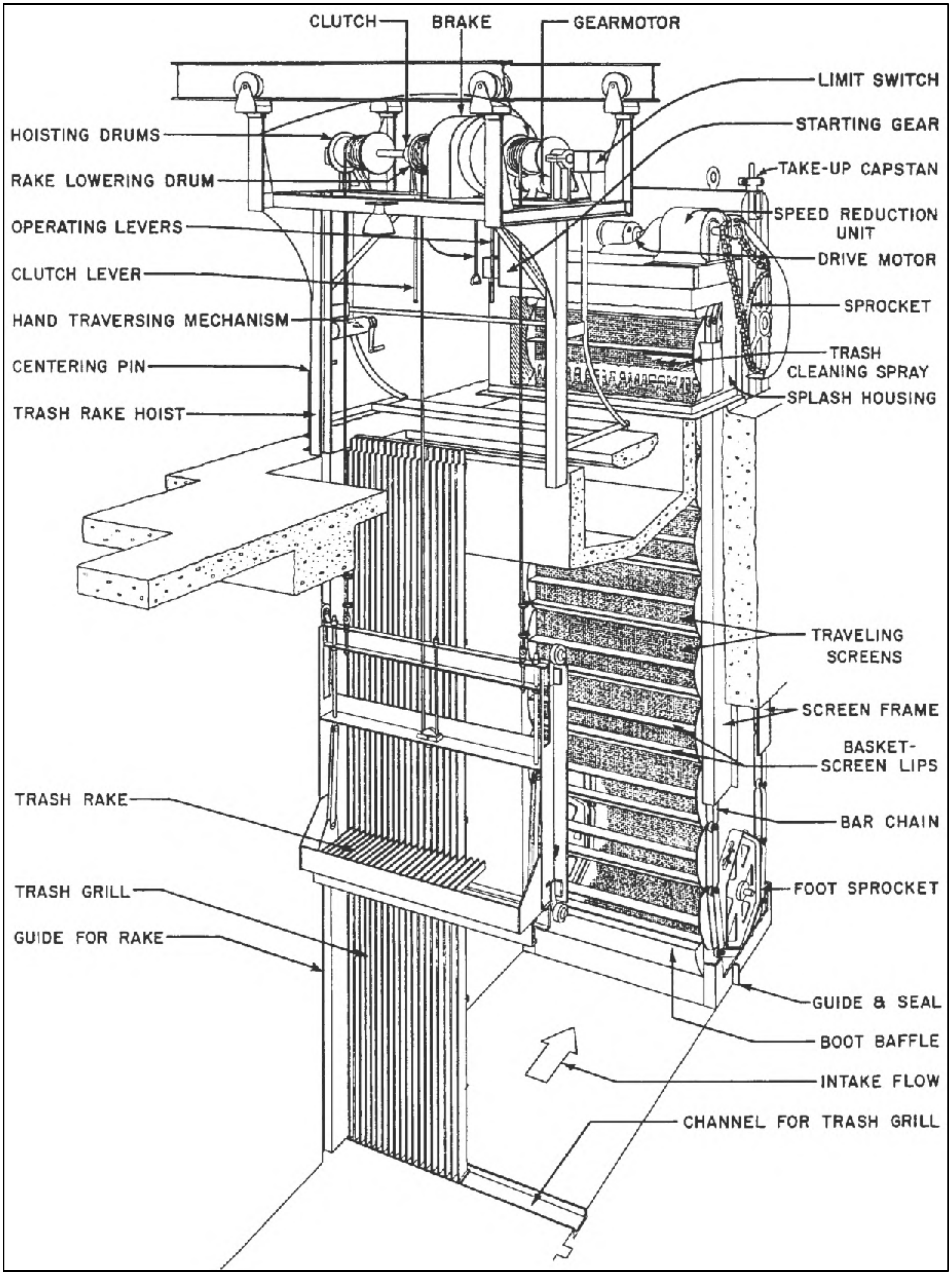


Figure 3-2. Traveling Screen and Trash Rake at Clinch River Plant

The screen-wash system is designed to operate: (1) automatically if the screen water level differential becomes excessive, (2) automatically for sufficient times for the screen to make approximately one revolution in each 24 hours regardless of screen water level differential, and (3) started manually by a push button in the intake house. When the screen wash pump and rotating screen motor control switches are set for automatic operation, the screen wash pump starts and establishes a water pressure. The existence of this pressure in turn starts the rotating screens via a pressure switch. The screen wash system will continue to operate as long as an excessive through-screen water level differential exists. If no screen wash level differential exists, the rotating screens and the screen-wash pump stop running. A running-time meter is provided for each screen wash pump motor. It records the number of hours of operation for each pump.

There are three river water makeup pumps, with each pump rated at 6,500 GPM at 50 ft TDH and driven by a 125 hp, 860 rpm, 550 volt motor. The pumps can be operated either remotely from control switches in the plant's main control room, or locally from switches in the intake house. Normally, two pumps are capable of providing the requirements of all three units, with the third pump in reserve. The three pumps discharge into a 36-inch water main to the plant, which in turn feeds two 24-in pipes.

Each outlet is equipped with a 24-inch motor-operated, self-cleaning strainer which operates automatically to clean itself when a high differential pressure exists across it. This involves 2-5% of the water being discharged backwards through an isolated vertical section of the strainer to wash the debris into a drain box. The backwashing water and refuse are discharged from the bottom of the strainer body to the trash trough. The strainers can also be operated manually. See Figure 3-3 for a schematic of the river makeup water and screen wash pumps.

3.2 Latitude and Longitude of CWIS [§122.21(r)(3)(ii)]

Intake coordinates are:

Latitude: 36° 56' 0.5" N
Longitude: 82° 11' 49.0" W

3.3 Description of CWIS Operation [§122.21(r)(3)(iii)]

The Clinch River Plant and its cooling water system are intended for year-round, 24 hours/day operation, with the exception of down time due to outages. Units 1 and 2 can each generate 235 MW. Net capacity factors and annual net generation prior to Unit 3 retirement for years from 2007 to 2013 are shown in Table 3-1.

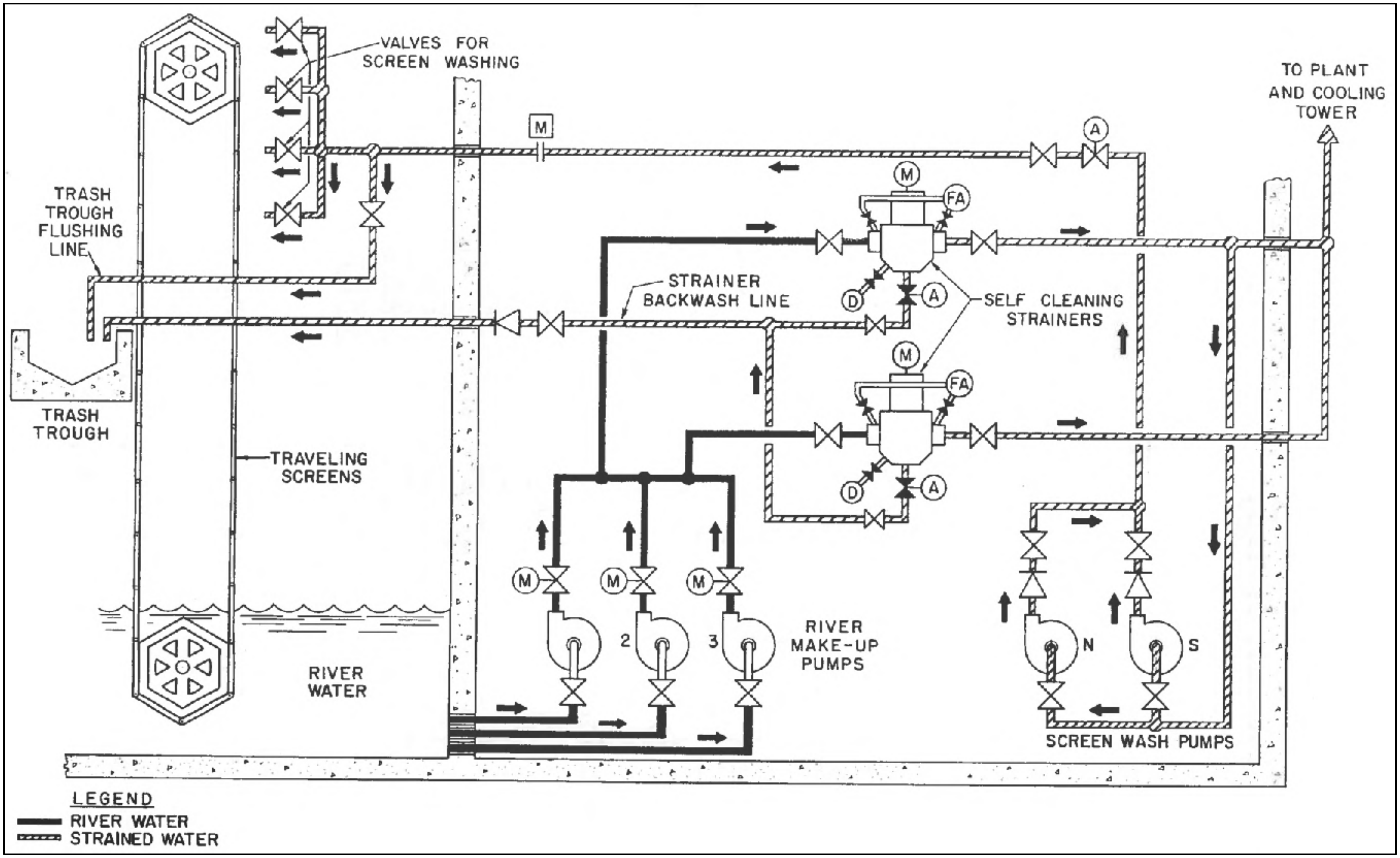


Figure 3-3. Schematic of River Makeup Water and Screen Wash Pumps at Clinch River Plant

Table 3-1. Clinch River Plant Net Capacity Factors (%) and Annual Net Generation (MWh)

Year	Net Capacity Factor (%)			Annual Net Generation (MWh)		
	Unit 1	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3
2013	18.54	12.58	12.51	381,602	258,996	257,475
2012	20.46	11.18	7.37	422,358	230,700	152,036
2011	14.52	24.14	24.50	298,971	496,891	504,316
2010	36.39	24.46	12.06	749,133	503,488	248,302
2009	21.34	11.25	42.02	439,257	231,518	865,034
2008	53.29	59.99	62.62	1,099,996	1,238,405	1,292,524
2007	64.21	63.68	68.87	1,321,779	1,310,952	1,417,742
7-Year Avg	**32.68**	**29.61**	**32.85**	**673,299**	**610,136**	**676,776**

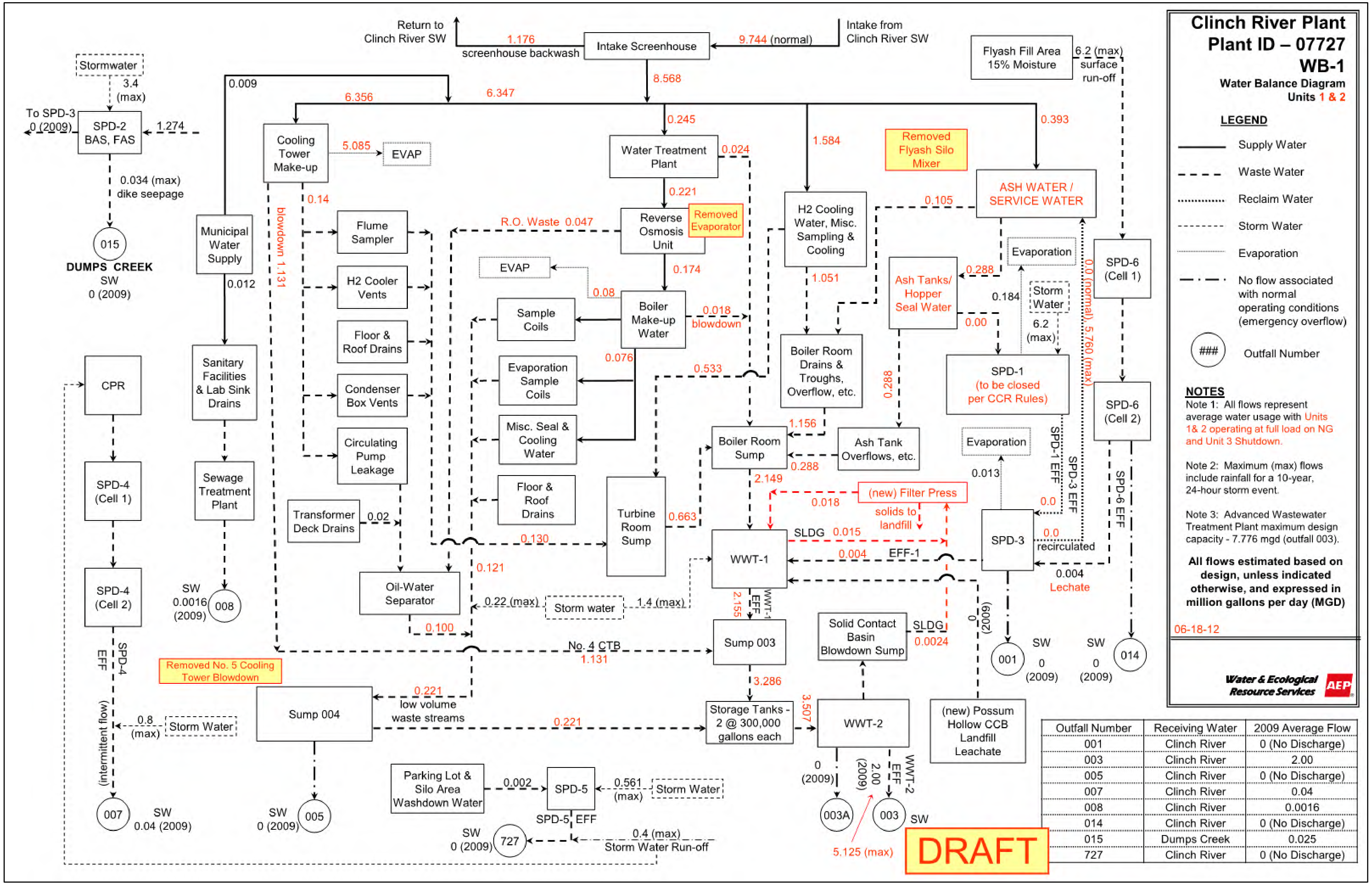
3.4 Description of Intake Flows [§122.21(r)(3)(iv)]

Figures 3-4 presents a water balance diagrams for the current operation (i.e., after the retirement of Unit 3).

3.5 Engineering Drawings of CWIS [§122.21(r)(3)(v)]

Following engineering drawings of river water make-up intake structures are provided in Appendix A:

- Drawing No.13-5024-15: Clinch River Plant Plot Plan
- Drawing No.12-5112-7: Screen House Arrangement, Make Up, Screen Wash and Drainage Piping (Unit 1 and 2)



Outfall Number	Receiving Water	2009 Average Flow
001	Clinch River	0 (No Discharge)
003	Clinch River	2.00
005	Clinch River	0 (No Discharge)
007	Clinch River	0.04
008	Clinch River	0.0016
014	Clinch River	0 (No Discharge)
015	Dumps Creek	0.025
727	Clinch River	0 (No Discharge)

Figure 3-4. DRAFT Water Balance Diagram of Clinch River Plant Post Retirement of Unit 3 in May 2015

4 Source Water Baseline Biological Characterization Data [§122.21(r)(4)]

4.1 List of Unavailable Biological Data [§122.21(r)(4)(i)]

The data needed to prepare all elements of § 122.21(r)(4) were available.

4.2 List of Species and Relative Abundance in the vicinity of CWIS [§122.21(r)(4)(ii)]

There were data collected near the Clinch River Plant by AEP and the VADEQ. The sampling locations are shown in Figure 4-1. The AEP monitoring data were collected from three locations (Stations 4, 7, and 9) on the Clinch River near Clinch River Plant on the following dates:

- 19-20 July 1982;
- 19-20 July 1983;
- 28-29 August 1984;
- 30 July 1986;
- 22-23 July 1987;
- 12-13 July 1988;
- 24-25 July 1990; and
- 26-27 August 1991

Sampling was performed by AEP biologists. Sample Station 4 was located 2.5 river miles downstream of Cleveland, VA and 1.4 river miles upstream of the Clinch River Plant water intake (CRM 268.0) at CRM 269.4. Sample Station 7 was located downstream of Clinch River Plant wastewater discharges at CRM 267.2. Station 9 was located immediately downstream of the bridge at Carterton, VA, on Rt. 665 and approximately 3.3 miles downstream of Clinch River Plant at CRM 264.1 (AEP 1982-1991). Although the AEP data are about 20 years old, the species collected and community dominants are very similar to the more recent VDEQ data; for this reason the AEP data provide valuable supplemental information.

Data were collected by VADEQ on October 21 and 28, 2010. Sampling was conducted by state biologists at two locations: Sample ID 6BCLN250.67 record (28) was collected ~17 miles downstream of the Clinch River (Latitude: 36.89092; Longitude: -82.32846) and sample ID 6BCLN273.19 record (41) was collected ~5.5 miles upstream of the Clinch River Plant (Latitude: 36.95336; Longitude: -82.13814) (deq.virginia.gov).

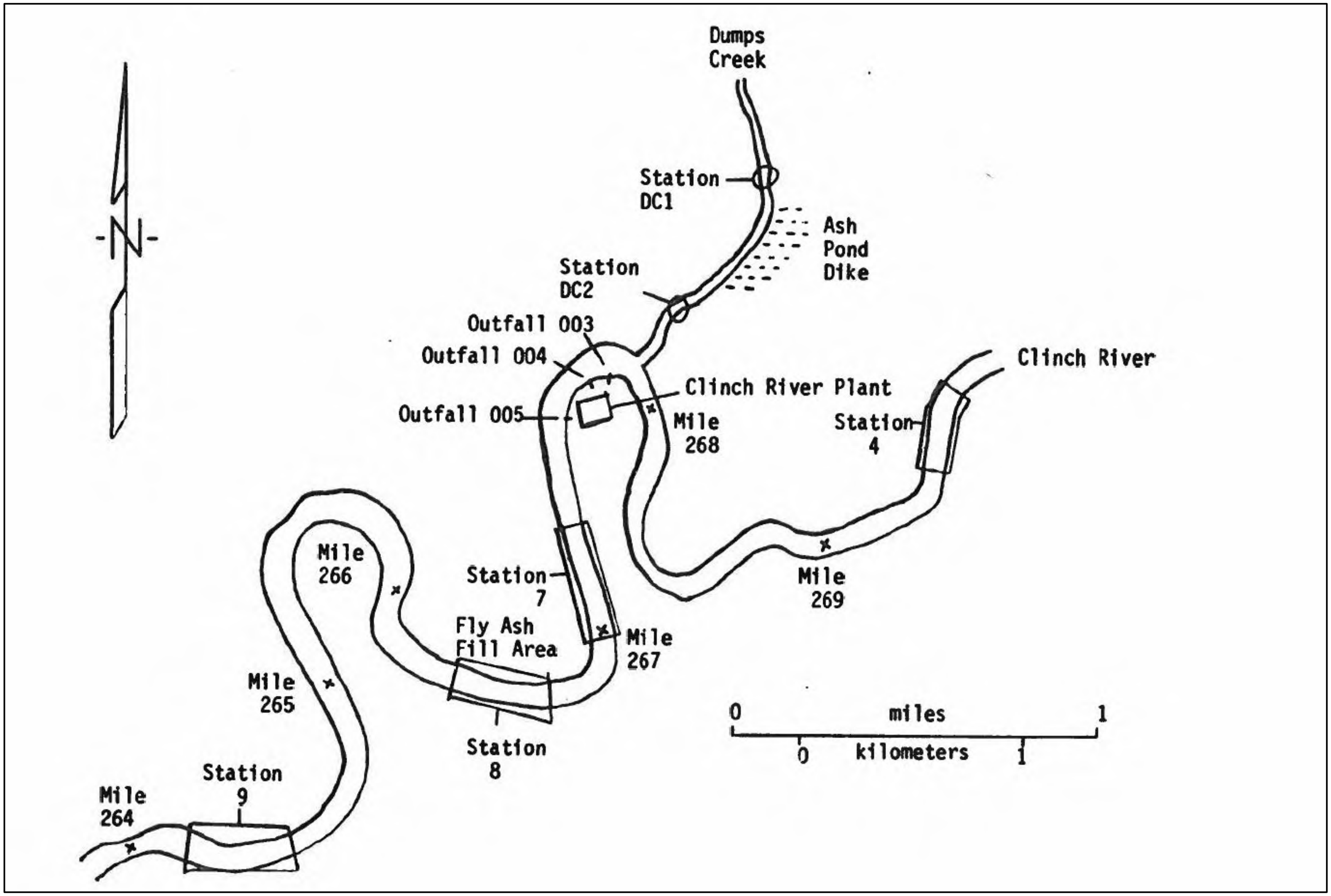


Figure 4-1. Biological Sampling Stations in the Clinch River near Clinch River Plant

AEP fish sampling was conducted in areas of the river channel containing both pool and riffle habitats and blocked off using 0.25-in mesh block nets. The length of enclosed areas was approximately 200 ft (range 170-210 ft). Channel width varied from 75-120 ft. Fish were sampled using a pulse DC electroshocker (300 v; 5-7 A) mounted on a 5-ft square raft. Using a three-man crew (2 netters, 1 operator), depletion sampling was performed by collecting all stunned fishes in three consecutive runs within the blocked-off area. Most fishes were then field identified and returned live to the river. Voucher specimens and specimens of uncertain identification were preserved in 10% formalin and returned to the laboratory (AEP 1982-1991).

VADEQ data were collected from an electrofishing boat. All habitat types present within the 2,000 foot survey areas were represented in the samples, both sites were fished for 7,500 seconds. Field teams consisted of a three-man crew (2 netters, 1 operator), all stunned fishes were collected (deq.virginia.gov). AEP's July and August samples would fall under summer catch data, while the VADEQ October samples are considered fall catch data. One would expect higher YOY counts during AEPs summer samples and less YOY during VADEQ fall samples; both of which are reflected in the data set (see Table 4-1).

Fish collected by electrofishing near Clinch River Plant by AEP from 1982 to 1991 and their relative abundance along with data collected by the state of Virginia Department of Environmental Quality (VADEQ) during sampling performed on October 21 and 28, 2010 are presented in Table 4-1.

Table 4-1. Relative Abundance of Fish in the Vicinity of the Clinch River Plant

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
Petromyzontidae	Ohio Lamprey	1.17%	0.11%
	Mountain Brook Lamprey	0.29%	0.00%
Lepistosteidae	Longnose Gar	0.10%	0.15%
Clupeidae	Gizzard Shad	0.10%	2.98%
Cyprinidae	Central Stoneroller	8.38%	16.07%
	Whitetail Shiner	1.56%	0.88%
	Spotfin Shiner	1.17%	2.69%
	Speckled Chub	0.00%	0.08%
	Streamline Chub	4.78%	1.35%
	Bigeye Chub	3.02%	2.46%
	Blotched Chub	0.00%	8.05%
	YOY Chubs (unidentified)	0.00%	0.20%
	Striped Shiner	1.36%	1.42%
	Warpaint Shiner	0.10%	0.60%
	River Chub	3.61%	1.08%
	Popeye Shiner	0.00%	0.95%

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
	Tennessee Shiner	11.99%	9.29%
	Highland Shiner	2.53%	0.00%
	Silver Shiner	3.02%	0.84%
	Sawfin Shiner	1.56%	0.70%
	Rosyface Shiner	0.00%	0.70%
	Telescope Shiner	1.07%	0.41%
	Mimic Shiner	3.41%	0.74%
	Steelcolor Shiner	0.00%	0.20%
	YOY Shiners (unidentified)	0.00%	10.21%
	Stargazing Minnow	0.00%	2.57%
	Bluntnose Minnow	1.36%	1.50%
	Creek Chub	0.00%	0.27%
	Rosyside Dace	0.00%	0.03%
	Western Blacknose Dace	0.39%	0.00%
Catastomidae	White Sucker	0.00%	0.03%
	Northern Hogsucker	4.09%	6.20%
	Smallmouth Redhorse**	1.46%	0.00%
	Silver Redhorse	0.00%	0.01%
	River Redhorse	0.00%	0.38%
	Shorthead Redhorse**	0.00%	1.77%
	Black Redhorse	4.68%	0.54%
	Golden Redhorse	0.97%	3.40%
	YOY Redhorse (unidentified)	0.00%	0.20%
Ictaluridae	Yellow Bullhead	0.10%	0.08%
	Channel Catfish	0.00%	0.04%
	Mountain Madtom	1.66%	0.01%
	Flathead Catfish	0.19%	0.03%
Cottidae	Clinch Sculpin	0.19%	0.00%
Centrarchidae	Rock Bass	3.61%	2.88%
	Redbreast Sunfish	0.97%	0.64%
	Bluegill	0.10%	0.79%
	Longear Sunfish	0.88%	2.68%
	Longear x Green Sunfish Hybrid	0.00%	0.01%
	Smallmouth Bass	1.46%	1.77%

Family Name	Species (Common Name)	VADEQ Survey 2010	AEP Surveys 1982-1991
	Spotted Bass	0.00%	0.24%
	Largemouth Bass	0.39%	0.16%
Percidae	Greenside Darter	6.53%	5.71%
	Bluebreast Darter	1.07%	0.16%
	Fantail Darter	0.00%	0.08%
	Ashy Darter	0.10%	0.00%
	Redline Darter	10.82%	2.52%
	Snubnose Darter	1.07%	0.01%
	Speckled Darter	2.05%	0.24%
	Tippecanoe Darter*	0.00%	0.05%
	Wounded Darter	0.10%	0.18%
	Banded Darter	2.44%	0.84%
	Tangerine Darter	1.27%	0.08%
	YOY Darters (unidentified)	0.00%	0.32%
	Blotchside Logperch	0.29%	0.00%
	Logperch	0.10%	0.46%
	Gilt Darter	2.24%	0.74%
	Dusky Darter	0.00%	0.15%
	Sauger	0.00%	0.01%
	Walleye	0.19%	0.00%

Data Source: deq.virginia.gov; AEP 1982-1991

Note: *Tippecanoe Darter (Ohio and Cumberland drainages) is also known as the Golden Darter in the Upper Tennessee River Drainage

** The Shorthead and Smallmouth Redhorse have been separated by drainages.

Table 4-2 below summarizes relative abundance by family of fish near the Clinch River Plant from VADEQ 2010 and AEP 1982-1991 Surveys.

Table 4-2. Relative Abundance by Family of Fish Near the Clinch River Plant

Family Name	VADEQ Survey 2010	AEP Surveys 1982-1991
Petromyzontidae	1.46%	0.11%
Lepistosteidae	0.10%	0.15%
Clupeidae	0.10%	2.98%
Cyprinidae	49.32%	63.31%
Catastomidae	11.21%	12.54%
Ictaluridae	1.95%	0.16%
Cottidae	0.19%	0.00%
Centrarchidae	7.41%	9.18%
Percidae	28.27%	11.57%

The ten most abundant fish species found within the Clinch River by each sampling study (the 2010 VADEQ and 1982-1991 AEP) are listed below in Table 4-3.

Table 4-3. Ten Most Abundant Fishes Collected during VADEQ 2010 & AEP 1982-1991 Electrofishing Surveys on the Clinch River

Rank	VADEQ 2010		AEP 1982-1991	
	Common Name	% Composition	Common Name	% Composition
1	Tennessee Shiner	11.99%	Central Stoneroller	16.07%
2	Redline Darter	10.82%	YOY Shiners (unidentified)	10.21%
3	Central Stoneroller	8.38%	Tennessee Shiner	9.29%
4	Greenside Darter	6.53%	Blotched Chub	8.05%
5	Streamline Chub	4.78%	Northern Hogsucker	6.20%
6	Black Redhorse	4.68%	Greenside Darter	5.71%
7	Northern Hogsucker	4.09%	Golden Redhorse	3.40%
8	River Chub	3.61%	Gizzard Shad	2.98%
9	Rock Bass	3.61%	Rock Bass	2.88%
10	Mimic Shiner	3.41%	Spotfin Shiner	2.69%
	Total	**61.89%**	**Total**	**67.48%**

These ten fish species accounted for 61.9% of the 2010 VADEQ sampling and 67.48% of the 1982-1991 AEP sampling. While there are differences in the dominate species over these two data sets, five of the most abundant species were observed within both sampling efforts. Of these species, the Tennessee shiner was the most abundant in VADEQ 2010, while the central stoneroller was the most abundant in the AEP 1982-1991 sampling efforts. In total 47 species were observed in the VADEQ 2010 sampling, while 62 species were observed in the AEP 1982-1991 sampling efforts. Because the AEP sampling was conducted over a 9-year period, it is not surprising that a greater number of species were observed in the samples.

4.3 Identification of Species and Life Stages Susceptible to I & E [§ 122.21(r)(4)(iii)]

The use of water from rivers for cooling power stations potentially impacts fishes in many ways, most directly through impingement and entrainment. In order to provide perspective on species likely to be susceptible to impingement and entrainment, monitoring data from AEP biologists along with VADEQ stream bioassessment data were reviewed. For reference, a two year sampling program was undertaken on the Ohio River (King et al. 2011). The 2005 and 2006 impingement abundance monitoring and standardized fish sampling studies near 15 Ohio River power plants were conducted as part of the Ohio River Ecological Research Program (ORERP) (King, et al., 2011). This study suggested impingement of fishes at intake structures was selective and did not represent the full species assemblages in the source waterbody. In particular, impingement data were compared to seasonal electrofishing and seining data to determine species composition and relative abundance. King et al. (2011) evaluated potential explanations for the presence, absence, or disproportionate occurrence of fishes between the two data sets. The impingement study demonstrated parallels in species composition among power plants over nearly 870 river miles of the Ohio River. The river surveys indicated that the abundance of some species varied significantly over the length of the river. However, Clupeids dominated the impingement collections at much higher levels than suggested by the populations encountered during the river surveys. Other forage species, especially Emerald Shiner and Channel Shiner, were under represented in the impingement collections.

While the Ohio River is a much larger river system than the Clinch River, the following study demonstrates how impingement and entrainment potentially affect various fish species and families at similar power plants. Several of the species and families mentioned are represented in both river systems and species behavior and habitat needs are alike in each river. It should be noted that while the overall conclusions about species composition subject to impingement are useful, much of the King, et al., 2011 data collected at cooling water intakes that use larger proportions of river flow and have substantially higher through-screen velocities than those present at the Clinch River Plant. For these reasons, the rates of impingement at the power plants on the Ohio River are likely to be higher than at the Clinch River Plant (see Appendix B for engineering calculations of through-screen velocities).

During the two-year river study on the Ohio River, 32 species collected were not impinged (King et al. 2011). On the other hand, 13 species were impinged that were not collected during the river surveys. The impingement study indicated that many species in the Ohio River are not particularly susceptible to impingement due to behavior, habitat preferences, or low population levels. This was evident for Carps and Minnows (Family Cyprinidae), Darters (Family Percidae), and Redhorse (*Moxostoma* spp.). The opposite was true for abundant, pelagic schooling Clupeids that were occasionally impinged at very high rates. Often higher Clupeid impingement rates were observed during periods of declining water temperatures. Channel Catfish (*Ictalurus* *punctatus*) were also impinged at much higher rates than would be predicted based on their abundance in the river collections (King et al. 2011*).* Similar species-specific differences between source water relative abundance and relative rates of impingement are expected to take place on other rivers with like species such as the Clinch River.

All species present within the Clinch River have the potential to be affected by impingement and entrainment, however the vast majority of fishes are unlikely to be affected based on multiple factors (see Table 4-4).

Based on life history, feeding and spawning habits, species abundance, and on previously collected fisheries data, no species are expected to be susceptible to impingement and four have the potential to be vulnerable to entrainment at the Clinch River Plant (see Table 4-5).

The primary factors behind the selection of these species are their known tendencies to gather in large schools and the fact that they are predominately pelagic spawners with either demersal adhesive or semi-buoyant demersal eggs. The broadcast spawners in this group exert no parental investment, increasing the likelihood of entrainment during early life stages.

Table 4-4. Impingement and Entrainment Potential

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
LAMPREY				
Ohio Lamprey	*Ichthyomyzon bdellium*	Early life stages – Unlikely, spawn in riffles. Adults and Juveniles – Unlikely young burrow into sediment. Adults – low density, parasitic.	Unlikely	Unlikely
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	Early life stages - Unlikely, spawn in riffles. Adults and Juveniles - Unlikely young burrow into sediment. Adults – remain in smaller streams	Unlikely	Unlikely
GAR				
Longnose Gar	*Lepisosteus osseus*	Early life stages – Unlikely, newly hatched young adhere to submerged substrate. Adults and Juveniles – Unlikely due to feeding habits	Unlikely	Unlikely
SHAD				
Gizzard Shad	*Dorosoma cepedianum*	Early life stages– Likely, broadcast spawners Adults and Juveniles - Likely, congregate near outfall not far from intake, attracted to current	Yes	Unlikely
SALMON/TROUT				
Rainbow Trout	*Oncorhynchus mykiss*	Early life stages – Unlikely, no natural reproduction in the Clinch River - stocked Adults and Juveniles – Unlikely, prefer cooler waters - primarily found near tributaries	Unlikely	Unlikely
PIKE				
Muskellunge	Esox Masquinongy	Early life stages - Unlikely, shallow spawners Adults and Juveniles - Unlikely due to feeding habits	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
CARP / MINNOW				
*Unlikely based on previous data, spawning, and feeding habits				
Common Carp	*Cyprinus carpio*	Early life stages – Possible, broadcast spawners Adults and Juveniles – Unlikely, avoid current	Unlikely	Unlikely
Spotfin Shiner	*Cyprinella spiloptera*	Adults and Juveniles – known to school near currents, high density sp.	Potentially	Unlikely
Striped Shiner	*Luxilus chrysocephalus*	Adults and Juveniles – School near currents	Unlikely	Unlikely
Rosyside Dace	*Clinostomus funduloides*	Early life stages – Unlikely, spawn in riffles. Adults and Juveniles – Unlikely, attracted to deep pools and woody debris.	Unlikely	Unlikely
Speckled Chub	*Macrhybopsis aestivalis*	Adults and Juveniles – Prefers large flowing river channels with gravel and sand.	Unlikely	Unlikely
Bigeye Chub	*Hybopsis amblops*	*	Unlikely	Unlikely
Streamline Chub	*Erimystac dissimilis*	Adults and Juveniles – Often found in smaller streams - Prefer swift currents in 1~4 ft of water.	Unlikely	Unlikely
Highland Shiner	*Notropis micropteryx*	Early life stages – eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel.	Unlikely	Unlikely
Western Blacknose Dace	*Rhinichthys obtusus*	Adults and Juveniles – Often found in smaller high gradient streams. Prefer riffles	Unlikely	Unlikely
Blotched Chub	*Erimystax insignis*	(*) Adults and Juveniles – Often found in smaller high gradient streams - Prefer riffles.	Unlikely	Unlikely
River Chub	*Nocomis micropogon*	Early life stages – Unlikely, males defend nest. Adults and Juveniles – Typically found in larger streams & medium size rivers, found in deep pools and swift currents.	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Popeye Shiner	*Notropis ariommus*	(*) Adults and Juveniles – sp. is seldom very common, highly localized	Unlikely	Unlikely
Silver Shiner	*Notropis photogenis*	Adults and Juveniles – School near currents	Unlikely	Unlikely
Rosyface Shiner	*Notropis rubellus*	Early life stages – eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel.	Unlikely	Unlikely
Warpaint Shiner	*Luxilus coccogenis*	Adults inhabit gravel riffles adjacent to pools in clear waters. Nest spawners	Unlikely	Unlikely
Whitetail Shiner	*Cyprinella galactura*	Adults and Juveniles – Inhabit rocky runs more often than pool and riffles.	Unlikely	Unlikely
Telescope Shiner	*Notropis telescopus*	Adults and Juveniles – Inhabit rocky runs and flowing pools, often near riffles.	Unlikely	Unlikely
Mimic Shiner	*Notropis volucellus*	Early life stages – Potentially, broadcast spawn. Typically found in larger to moderate size streams and rivers, high density sp.	Potentially	Unlikely
Steelcolor Shiner	*Cyprinella wipplei*	Early life stages– eggs sink and stick to substrate. Adults and Juveniles – found in swift currents over gravel. Often school near the top and middle of the water column.	Unlikely	Unlikely
Sawfin Shiner	*Notropis sp.*	Adults and Juveniles – Sometimes forms moderate-sized schools. Low density sp.	Unlikely	Unlikely
Stargazing Minnow	*Phenacobius uranops*	Young are often found near beds of water willow and margins of flowing pools. Adults typically found over very slightly silted gravel and small to medium rubbles.	Unlikely	Unlikely
Tennessee Shiner	*Notropis leuciodus*	Prefers pool and runs, usually clear rivers and streams with gravel substrates. Relatively large populations in areas.	Potentially	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Creek Chub	*Semotilus atromaculatus*	*	Unlikely	Unlikely
Central Stoneroller	*Campostoma anomalum*	*	Unlikely	Unlikely
Bluntnose Minnow	*Pimephales notatus*	*	Unlikely	Unlikely
SUCKER				
* These species have the potential to occur near the intake during larval and early life stages				
Shorthead Redhorse	*Moxostoma macrolepidotum*	*	Unlikely	Unlikely
Northern Hog Sucker	*Hypentelium nigricans*	*	Unlikely	Unlikely
Silver Redhorse	*Moxostoma anisurum*	*	Unlikely	Unlikely
River Redhorse	*Moxostoma carinatum*	*	Unlikely	Unlikely
Smallmouth Redhorse	*Moxostoma breviceps*	*	Unlikely	Unlikely
Black Redhorse	*Moxostoma duquesnei*	*	Unlikely	Unlikely
Golden Redhorse	*Moxostoma erythrurum*	*	Unlikely	Unlikely
White Sucker	*Catastomus commersonii*	*	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
CATFISH				
Channel Catfish	*Ictalurus punctatus*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding/ past surveys have yielded some impacts.	Unlikely	Unlikely
Flathead Catfish	*Pylodictis olivaris*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding	Unlikely	Unlikely
Yellow Bullhead	*Ameiurus natalis*	Early life stages – Unlikely, cavity nesters Adults – No Juveniles – Potentially for feeding	Unlikely	Unlikely
Mountain Madtom	*Noturus eleutherus*	Early life stages – Unlikely, spawn in riffles Adults – Potentially, prefer deep/ swift riffles Juveniles –unlikely, feed in riffles.	Unlikely	Unlikely
SCULPIN				
Clinch Sculpin	*Cottus sp.*	Early life stages – Unlikely, cavity nesters Adults - Potentially	Unlikely	Unlikely
SUNFISH				
* Unlikely based on benthic nesting and feeding habits				
Rock Bass	*Ambloplites rupestris*	*	Unlikely	Unlikely
Bluegill	*Lepomis macrochirus*	*	Unlikely	Unlikely
Green Sunfish	*Lepomis cyanellus*	*	Unlikely	Unlikely
Longear Sunfish	*Lepomis megalotis*	*	Unlikely	Unlikely
Lepomis Hybrid	–	*	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Redbreast Sunfish	Lepomis auritus	*	Unlikely	Unlikely
BLACK BASS				
* Unlikely based on benthic nesting and feeding habits				
Smallmouth Bass	*Micropterus dolomieu*	*	Unlikely	Unlikely
Largemouth Bass	*Micropterus salmoides*	*	Unlikely	Unlikely
Spotted Bass	*Micropterus punctulatus*	*	Unlikely	Unlikely
DARTER				
*Unlikely based on previous data, spawning, and feeding habits				
Greenside Darter	*Etheostoma blennioides*	*	Unlikely	Unlikely
Ashy Darter	*Etheostoma cinereum*	*	Unlikely	Unlikely
Speckled Darter	*Etheostoma stigmaeum*	*	Unlikely	Unlikely
Redline Darter	*Etheostoma rufilineatum*	*	Unlikely	Unlikely
Snubnose Darter	*Etheostoma simo*	*	Unlikely	Unlikely
Bluebreast Darter	*Etheostoma camurum*	*	Unlikely	Unlikely
Fantail Darter	*Etheostoma flabellare*	*	Unlikely	Unlikely
Blotchside Logperch	*Percina burtoni*	*; low density sp.	Unlikely	Unlikely

Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles**
Johnny Darter	*Etheostoma nigrum*	*	Unlikely	Unlikely
Tippecanoe Darter	*Etheostoma tippicanoe*	*	Unlikely	Unlikely
Wounded Darter	*Etheostoma vulneratum*	*	Unlikely	Unlikely
Banded Darter	*Etheostoma zonale*	*	Unlikely	Unlikely
Tangerine Darter	*Percina aurantiaca*	*	Unlikely	Unlikely
Gilt Darter	*Percina evides*	*	Unlikely	Unlikely
Dusky Darter	*Percina sciera*	*	Unlikely	Unlikely
Logperch	*Percina caprodes*	Adults and Juveniles – Potentially attracted to current. Typically higher populations than Blotchside when found in same habitat.	Unlikely	Unlikely
PERCH				
Walleye	*Sanders vitreus*	Early life stages – Deposit eggs over gravel or boulder-sized rocks in riffle areas Adults and Juveniles – Attracted warm water discharge during colder temperatures	Unlikely	Unlikely
Sauger	*Sander canadensis*	Adults and Juveniles – Attracted warm water discharge during colder temperatures	Unlikely	Unlikely

Note: **Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that are 0.5 fps or less.

Table 4-5. Fish Species Expected to be Most Vulnerable to Entrainment at the Clinch River Plant

Common Name	Scientific Name
Gizzard Shad	*Dorosoma cepedianum*
Mimic Shiner	*Notropis volucellus*
Spotfin Shiner	*Cyprinella spiloptera*
Tennessee Shiner	*Notropis leuciodus*

Note: In the final Rule, EPA has made the argument that impingement is virtually eliminated when through screen velocities are at or below 0.5 ft/s (as will be the case at Clinch River when unit 3 is retired).

4.4 Identification and Evaluation of Primary Growth Period [§ 122.21(r)(4)(iv)]

The primary growth period for the majority of fishes directly follows the spring hatch. Growth rates are highest early and tend to decline throughout the summer along with total fish abundance. Fish are cold blooded, thus primary growth occurs when water temperatures are 50-degrees or above. The generally held view on seasonal variation in fish growth in North America is that growth is fastest in the spring and early summer, slows in the late summer and fall, and virtually stops in the winter (Gebhart et al. 1978). The majority of fishes will have their highest densities shortly after the hatch occurs when larvae are concentrated. Feeding competition is especially important during late spring through early summer when the bulk of fish are in their early life stages. During this time, they are more susceptible to starvation (May 1974). This is a critical stage in development, where larval fish have a short time period to initiate feeding before reaching a point of no return and, ultimately, starving (Ehrlich 1974; Miller et al. 1988).

4.4.1 Reproduction

Clinch River fishes almost always have external fertilization, which is principally controlled by water temperatures. Fish reproduction has the potential to produce high yields; however, mortality rates are also high. Additionally, most fish spawn only once a year regardless of prior success. Fecundity refers to the number of eggs a female produces and can vary widely depending on the risk level associated with various types of spawning methods and the amount of parental investment.

Reproduction activities for the four species with the highest risk of entrainment (Table 4-5) are as follows: Gizzard Shad *(Dorosoma cepedianum)* a member of the *Clupeidae* family reproduces from mid-March to later August, with the bulk of the population spawning in May and June when temperatures range from 15.6-22.8°C (Wallus et al. 1990). Gizzard Shad are extremely prolific spawners and therefore have very high larval densities (Storck et al. 1978). The remaining three species are all members of the *Cyprinidae* family. Spotfin Shiner

(*Cyprinella spiloptera)* spawning occurs from mid-June to mid-August and mostly occurs in the morning (Jenkins and Burkhead 1993). Eggs are typically deposited in crevices formed by loose bark on submerged trees and stumps (Trautman 1981). Both male and female Mimic Shiners (*Notropis volucellus)* mature at 1 year of age. In Virginia, breeding occurs between May and early August and takes place over sand or gravel substrates in shallows and riffles (Jenkins and Burkhead 1993). Little is known about the life history of the Tennessee Shiner (*Notropis leuciodus).* Some fish don't mature until 2 years of age. Reproduction activities are known to occur during spring and early summer when temperatures are 17-25.6°C (Outten 1962). Spawning typically occurs over chub nests where 20-50 males gather in a school. However, spawning has also been known to occur over shallow gravel runs without nests (Jenkins and Burkhead 1993).

4.4.2 Larval Recruitment

Peak larval recruitment for most Clinch River fishes generally occurs between April and July. As a result, peak larval fish entrainment would be expected to be more prevalent during the same period. Young of year (YOY) for the majority of fishes are most abundant shortly after the spring and summer spawning period. It is unlikely that large numbers of eggs and larvae would become entrained at the Clinch River Plant given the predominately required spawning habitat (riffle / shallow water habitats) of the adults.

4.4.3 Period of Peak Abundance

Fish spawning is a direct function of water temperature, constraining most activity to the spring and early summer months with limited species spawning in the fall. This results in huge influxes of larval and juvenile fishes into the Clinch River system drainage each year when water temperatures begin to rise. Peak abundance for most juvenile fishes occurs between May and August depending on each species' unique spawning habits. Activities for the four species with the highest risk of entrainment are as follows.

Gizzard Shad of the Age-0 class are most abundant during late spring through early fall and dominate the diets of predators during this early life stage (Michaletz 1998). Gizzard Shad growth rates tend to be highest early after hatch, and decline throughout the summer (Welker 1994). Studies have shown that peak shad populations occurred between May 11 and June 22. The timing of peak density differs from year to year for every population and is likely correlated to variances in water temperature, with the highest densities corresponding to 17-22°C waters that had been stable or rising (Zweifel et al. 2009).

Mimic Shiner (*Notropis volucellus)* both male and females mature sexually at 1 year of age; 2 year old fish occur in relatively low numbers with 3 year old fish being extremely rare (Becker 1983). In-depth knowledge regarding the Mimic Shiner's life history is lacking. Peak density is directly correlated to the spawning time which is a function of temperature. Mimic Shiners are thought to spawn in early summer (Stauffer et al., 1995). Therefore, peak abundance is likely to occur between late-June and September.

Spotfin Shiner (*Cyprinella spiloptera)* are fractional spawners, a strategy that greatly increases reproductive potential. Breeding pairs have been known to spawn up to 12 times during a 1 to 7 day period from June 16 to August 10 in shallow pools. 169-945 eggs were observed to be released per spawning episode, totaling 7,474 eggs (Stone 1940, Gale and Gale 1977). Mature fish are 1-2 years of age with some being noted as living to the age of 5 (Jenkins and Burkhead 1993). They often become very abundant in areas with poor habitat for other species. Peak abundance is likely to occur in mid-to-late summer once eggs have hatched and YOY are plentiful with the optimum temperature range for maximum survival at 20.1 - 29.9°C (Kellogg and Gift 1983).

The life history of the Tennessee Shiner (*Notropis leuciodus)* is poorly understood and little is known about larval recruitment. In Virginia, this species is only found in the southwest corner of the state and often schools with other shiners such as the Rosyface and Telescope Shiners (Jenkins and Burkhead 1993). Reproduction activities are known to occur during spring and early summer; peak YOY numbers will likely occur during late summer into early fall.

4.5 Data Representative of Seasonal and Daily Activities of Organisms in the Vicinity of CWIS [§ 122.21(r)(4)(v)]

This information is summarized in Table 4-6 for the dominant species observed in the Clinch River in the vicinity of the Clinch River Plant.

Table 4-6. Seasonal and Daily Activities

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
LAMPREY			
Ohio Lamprey	*Ichthyomyzon bdellium*	Ohio lampreys spawn in late May or early June in shallow pits typically near the upper end of gravel riffles.	After hatching, the larval stage lampreys burrow into sediment where they feed on organic matter for several years. They then transform into parasitic adults in the spring. The following spring adults then typically migrate into smaller rivers where they spawn and then die shortly afterward.
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	Spawn in March and April in shallow pits typically near the upper end of gravel riffles. Typically move from larger river systems to smaller rivers and streams for spawning.	After hatching, the larval stage lampreys burrow into sediment where they feed on organic matter for three years. They then transform into non-parasitic adults in late summer or fall. Adults typically stay in smaller rivers and streams and do not feed. The following spring adults spawn and then die shortly afterward.
GAR			
Longnose Gar	*Lepisosteus osseus*	Spawning takes place in the late May or early June often in shallow riffles. The longnose gar migrates into smaller streams to spawn.	Although post larval longnose gar feed throughout the day, peak feeding activity was observed between 2:00 and 6:00 pm. Both adult and young of year longnose gar feed more actively at night than during the day.
SHAD			
Gizzard Shad	*Dorosoma cepedianum*	Seasonally variable diet dominated by zooplankton and organic detritus in early summer and consisting more exclusively of detritus throughout the rest of the growing season.	Inhabits slow moving or standing waters; it is relatively tolerant of turbidity, as long as its prey is plentiful. May become lethargic or moribund when water temperatures drop below 15°C.
TROUT/SALMON			
Rainbow Trout	*Oncorhynchus mykiss*	The majority of rainbow trout found in the Clinch River are stocked by the state of VA in smaller tributaries. Natural reproduction does not occur in the Clinch due to its warmer waters.	Rainbow trout find their way into the Clinch River via colder, smaller tributaries. Can be found in deeper shaded pools during warmer periods, as well as below riffles where they feed on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
CARP/ MINNOW			
Common Carp	*Cyprinus carpio*	Carp spawn in the spring to early summer, usually during the mornings of sunny days	Typically can be found feeding on or near the substrate.
Spotfin Shiner	*Cyprinella spiloptera*	Spotfin shiners spawn in crevices between rocks or in bark on submerged fallen trees. Spawning takes place throughout the warmer months of the year starting in late May or early June.	Feeds mainly in the late afternoon and early evening. Typically found near riffles with sand, gravel, mud, or rubble substrates.
Striped Shiner	*Luxilus chrysocephalus*	Consumes a wide variety of terrestrial and aquatic insects in the fall and a large quantity of filamentous algae during the winter. Spring spawn in large schools at top or bottom of riffles.	After spawning adults return to deeper pools where they spend most of their time. Once young hatch they spend most of their time near the edge of pools in shallow water. Both adults and juveniles prefer clean gravel and sand substrates.
Rosyside Dace	*Clinostomus funduloides*	Spawn in groups in late April through May. Utilize nests of other fishes /just above or below riffles in course sand or fine gravel.	Intolerant of turbidity and silt, attracted to deep pools, typically with abundant woody debris. Also primarily found in forested watersheds.
Speckled Chub	*Macrhybopsis aestivalis*	Spawn during the spring and summer, typically in smaller streams. There is limited literature on this species reproduction habits.	Found in shallow sandy areas where they feed on aquatic invertebrates.
Bigeye Chub	*Hybopsis amblops*	Spawn in late spring and early summer, little is known about how or where spawning takes place.	Highly intolerant of murky water and silt covered bottoms. Can be found in sandy substrates where they feed on aquatic invertebrates.
Streamline Chub	*Erimystac dissimilis*	Spawn in spring and early summer, little known about their reproductive biology.	Indicator of good water quality in medium to large rivers. Found in areas if swift current above or below a riffle. Often feed in 1-4 ft. of water on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Highland Shiner	*Notropis micropteryx*	Spawn during spring and early summer, thought to spawn in riffle habitat. Eggs sink and stick to the substrate.	Found typically in swift clear water with clean gravel or rubble, typically near riffles. Young eat mostly diatoms and algae, adults feed on aquatic invertebrates.
Western Blacknose Dace	*Rhinichthys obtusus*	Spawn during spring and early summer in shallow gravel riffles. Most spawn at 2 years of age.	Found in clear waters with clean substrates of sand, gravel, and cobble. Can typically be found in fast waters with undercut banks and cover. Feed on insect larvae and other invertebrates.
Blotched Chub	*Erimystax insignis*	Spawns in late spring to early summer, non-migrant.	Inhabits rocky riffles, runs, and pools. Most often found above and below riffles.
River Chub	*Nocomis micropogon*	River chubs spawn in April and May. The males select spawning sites with gravel substrate in riffles often adjacent to or just behind a large boulder. Males cover eggs with stones.	Benthic omnivore consuming a variety of invertebrates and plants. There is less food in the stomach of river chubs during the summer. This has been attributed to their tight schooling behavior during this period.
Popeye Shiner	*Notropis ariommus*	Spawn in spring and early summer, however little is known about their reproductive activities or requirements.	Require extremely clear waters, can be found in slow pools where they feed on aquatic invertebrates.
Silver Shiner	*Notropis photogenis*	Silver shiners spawn in June through July by scattering their eggs over gravel riffles.	Can typically be found in or at the tail end of deep swift riffles of cobble and boulders.
Rosyface Shiner	*Notropis rubellus*	Rosyface shiners spawn in May typically over the pebble mound nests of river and hornyhead chubs. Often large schools of rosyface shiners and other small minnows will congregate over a single chub nest. Eggs sink and stick to substrate.	Typically found in swift flowing water with a sand, gravel, or rock substrate. They are intolerant of streams with consistently turbid (murky) waters.
Warpaint Shiner	*Luxilus coccogenis*	Spawns in riffles and rapid areas early June to mid-July. Non-migrant.	Typically found in the upper to mid-levels of the water column over large boulders and gravel where they feed on aquatic invertebrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Whitetail Shiner	*Cyprinella galactura*	Spawns in late May to June at 24-28°C, sexually mature by age 2, males guard territories around the nest, eggs laid between sticks and logs. Non-migrant.	Found in benthic areas of moderate gradient rivers in both pools and riffle habitats. Prefer gravel and rocky substrates. Feed on aquatic invertebrates by sight.
Telescope Shiner	*Notropis telescopus*	Spawns during the spring and early summer, Non-migrant.	Typically found in runs or flowing pools near riffles with gravel or rocky bottoms.
Mimic Shiner	*Notropis volucellus*	Spawn in late spring and early summer, scatter eggs over sand or gravel substrate.	Found in areas with little to no current with some vegetation. Also commonly found in calm sandy areas, typically foraging on aquatic invertebrates.
Steelcolor Shiner	*Cyprinella wipplei*	Spawns in late spring and summer near submerged logs and vegetation, typically near a riffle, eggs are attached to submerged cover. Non-migrant.	Found in runs, pools, and backwaters of moderate gradient rivers and streams that are predominantly clear. Feeds on aquatic insects. Often school near the top and middle of the water column.
Sawfin Shiner	*Notropis sp.*	Spawn from mid-May to early July, sometimes form moderately sized schools. Non-migrant.	Found in benthic habitats, typically clear flowing pools and backwater. Feed on aquatic insects, beetles, and mayflies.
Stargazing Minnow	*Phenacobius uranops*	Spawns in May and June, sexually mature in 1 year.	Found in moderately gradient riffles, clear waters. Young found in clear shallows with sand, Adults typically found over very slightly silted gravel and small to medium rubbles. Adults feed in groups of 10-20 individuals.
Tennessee Shiner	*Notropis leuciodus*	Spawn in spring and summer 17-25°C over other *cyprinidae* nests, non-migrant.	Found in moderate gradient riffles, pools, and runs. Clear waters, with gravel and rubble substrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Creek Chub	*Semotilus atromaculatus*	Creek chubs migrate up smaller streams in early spring when water temperatures reach 55°F to spawn. The males select spawning sites in small streams in smooth water with gravel substrate just above or below a riffle.	During the day creek chubs feed on terrestrial insects, and at night they eat predominately aquatic invertebrates. Tend to feed equally on benthos and drift. Young fish feed during the day while larger individuals feed at night.
Central Stoneroller	*Campostoma anomalum*	In the fall, winter, and spring its diet consist mainly of nonmotile diatoms, but a lot of green algae is consumed in the summer.	Estimated home range of the fish in autumn was determined to be 35.2 + 14.1 m; no individual moved more than 135 m (Mundahl and Ingersoll 1989) The young frequent shoreline areas where the current is slower.
Bluntnose Minnow	*Pimephales notatus*	Bluntnose minnows spawn repeatedly starting in May and continue into August. Males select the spawning site, usually under logs, branches or rocks in shallow water. They will also use artificial spawning sites in old tiles or pipes, migration up smaller streams is not uncommon.	Can be found in shallow areas of clear water were they feed on algae, aquatic insects larvae, diatoms, small crustaceans, and other invertebrates.
SUCKER			
Smallmouth Redhorse**	*Moxostoma breviceps*	Spawn in April and May at night near the top and bottom ends of shallow riffles.	Can be found in shallow water and swift currents as well as areas with clean sand or gravel substrates. Feed on invertebrates. Intolerant of pollution and turbid water.
Northern Hog Sucker	*Hypentelium nigricans*	Hog suckers spawn in April or early May. Young are often found at the edge of pools over a sandy substrate. Like most suckers, they often migrate long distances' to spawn in smaller streams in spring.	Prefer the fast flowing riffles during most of the year but are found in pools during the colder months.
Silver Redhorse	*Moxostoma anisurum*	Spawn in April and May. Migrate into smaller streams and spawn at night at the top and bottom ends of shallow riffles.	Typically found in deep slow pools and is often found over a sand substrate.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
River Redhorse	*Moxostoma carinatum*	Barriers effective at limiting upstream migration, however migration into smaller streams still occurs where redhorse spawn at night at the top and bottom ends of shallow riffles.	They are typically found in deep pools with moderate current over bedrock or gravel substrate.
Shorthhead Redhorse**	*Moxostoma macrolepidotum*	See Smallmouth Redhorse (Found in Lake Erie drainage)	See Smallmouth Redhorse (Found in Lake Erie drainage)
Black Redhorse	*Moxostoma duquesnei*	Barriers effective at limiting upstream migration, however migration into smaller streams still occurs where redhorse spawn at night at the top and bottom ends of shallow riffles.	Inhabit swift-flowing waters. Preferred substrates include gravel, bedrock, or sand. Young redhorses feed in schools near emergent aquatic vegetation close to the edge of pools. Adult black redhorses usually feed in schools just above or below a riffle moving slowly over the bottom.
Golden Redhorse	*Moxostoma erythrurum*	Make large migrations from larger rivers and reservoirs to smaller streams where they spawn at night in shallow riffles.	Spend much of the day and some of the nights in lager pools, feeding intensifies at daybreak and dusk. Feeds on benthic aquatic insects.
White Sucker	*Catastomus commersoni*	White suckers spawn from April to early May when they run upstream, usually starting at night. They seek areas with swift water and a gravel substrate to randomly spread their eggs. Migrations commence when water temperatures approach 10°C.	White suckers are very tolerant of pollution, turbidity (murky water), and low oxygen levels - can be found in many habitats.
CATFISH			
Channel Catfish	*Ictalurus punctatus*	Move into shallows or tributaries to spawn. Begin spawning when water temperatures reach 70°F. They use natural cavities, undercut banks and as nests.	Prefer areas with deep water, clean gravel or boulder substrates, and low to moderate current. Tendency to move toward shallow waters at dusk where they feed.
Flathead Catfish	*Pylodictis olivaris*	They build nests in dark secluded shelters such as natural cavities, undercut banks, or near large, submerged objects.	Adults prefer deep pools with slow current and cover, such as submerged logs and brush piles.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Yellow Bullhead	*Ameiurus natalis*	They build nests in secluded shelters such as natural cavities, undercut banks, or near large, submerged objects. Young are guarded by the male several weeks.	Can be found in clear water with dense aquatic vegetation where they feed on other fish and aquatic insects.
Mountain Madtom	*Noturus eleutherus*	Spawn in early summer under large rocks within riffles, males guard eggs.	Found in deep swift riffles usually around cobbles and boulders where they feed on aquatic invertebrates.
SCULPIN			
Clinch Sculpin	*Cottus sp.*	Generally spawn once a year in winter, spring, or cool boreal summer. Nest sites are small cavities under rocks, logs, and divers other structures that are guarded by the male.	Found in cool swift water in Virginia. They inhabit spring runs, creeks, and streams that typically are clear year-round and cold to cool in summer. Sculpins lie on the bottom and ambush approaching prey.
SUNFISH			
Rock Bass	*Ambloplites rupestris*	Spring spawners - Male rock bass build nests over gravel substrate in a slight current often next to a large boulder.	Rock bass prefer clear streams and rivers with a rocky bottom. They often hide near large boulders, rock piles, or tree roots. Also look for them near steep drop offs at the edge of deep pools.
Bluegill	*Lepomis macrochirus*	Bluegill typically build nests in large groups, or colonies. They spawn multiple times between May and August. Peak spawning, in Ohio, usually occurs in June. Males select an area in one to four feet of water and sweep out a saucer shaped nest with their tails.	Most commonly found in clear waters with bank cover and aquatic vegetation.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Green Sunfish	*Lepomis cyanellus*	Green sunfish are communal spawners with males constructing nests in shallow water from mid-May to August. Green sunfish tend to spawn in shallower water, and dig deeper nests than bluegill.	Very tolerant of poor water quality and are often the only sunfish found in very muddy waters. They do have a strong preference to hide around structures such as rocks, logs, or brush piles.
Longear Sunfish	*Lepomis megalotis*	Longear sunfish spawn in groups but do not form large colonies like bluegill. Males select a spawning site in shallow water and build a nest on gravel substrate usually near cover. Longear sunfish spawn multiple times once the water temperature reaches the low 70's between mid-May and mid-August.	They favor slow to moderate flow in clear streams of moderate size with clean gravel substrate. They spend most of their time in pools near beds of aquatic vegetation, or other forms of cover such as roots, brush piles, and undercut banks.
Lepomis Hybrid	-	See Longear sunfish	See Longear Sunfish
Redbreast Sunfish	*Lepomis auritus*	Spawn in spring and summer, males guard the nest, and often guard hatchlings. Non-migrant.	Studies have found less than 200m life time movements during recapture studies. Found in deeper slower areas, rocky and sandy pools. Feed on aquatic invertebrates.
BLACK BASS			
Smallmouth Bass	*Micropterus dolomieu*	Smallmouth bass spawn in May and early June when water temperatures range from 55 to 65°F. Nests are built in gravel or hard bottom substrates in 2 to 20 feet of water.	Smallmouth bass thrive in streams with gravel or rock bottoms with a visible current. Found in benthic areas, adults seek deeper pools during the day.
Largemouth Bass	*Micropterus salmoides*	Largemouth bass usually spawn between mid-April and mid-June. Nests are constructed by the male in 1 to 6 feet of water.	Largemouth bass can adapt to many environments but prefer relatively clear non-flowing waters with some aquatic vegetation. They are found in nearly every lake, reservoir, and pond in Ohio.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Spotted Bass	*Micropterus punctulatus*	Spotted bass spawn between mid-April and mid-June. The males construct nests over rocky or gravely substrate near cover. They will spawn in deeper water than the other two species of black bass found in VA, sometimes at depths of up to 40 feet.	Preferred habitat is long deep pools of medium to large streams and rivers. They avoid both shallow, heavily vegetated, still, waters preferred by largemouth bass, and the swift flowing rocky waters preferred by smallmouth bass.
DARTER			
* Moves into shallow waters at night (Trautman,1981)			
Greenside Darter	*Etheostoma blennioides*	Adults spawn in deep, fast flowing riffles in April when water temperatures are between 55 and 65°F. The eggs are attached to strands of filamentous algae and aquatic moss.	(*) occurs in varied habitats; often in medium to large streams and small to medium rivers with gravel and rubble riffle habitat. Avoids silt.
Ashy Darter	*Etheostoma cinereum*	Spawns from late January to early April, non-migratory.	Found in benthic areas above and below riffles, found in shallow waters, (0.05-2 meters) with litter current over clear gravel and rubble. Feed on aquatic invertebrates.
Speckled Darter	*Etheostoma stigmaeum*	Spawns in April and May. Eggs hatch in 9-10 days at 17-20^{o}C, eggs laid in gravel over riffles, Non-migrant.	Found in clear sandy and rocky pools with moderate gradients and fast water. Feed on aquatic invertebrates.
Redline Darter	*Etheostoma rufilineatum*	The river darter may move upstream to spawn in the spring (Trautman 1981, Shultz 1986).	Adults are usually only found in shallow areas at night, or when turbidity is high (Becker 1983).
Snubnose Darter	*Etheostoma simoterum*	Not much known on spawning habits, thought to spawn in early spring and summer. Non-migrant	Found in current-swept rocky pools and adjacent riffles.
Bluebreast Darter	*Etheostoma camurum*	Spawn in mid-May - late July. They bury their eggs in gravel in fast flowing riffles, spawning typically requires migration into smaller streams. Eggs hatch in 7-10 days at 19-23^{o}C	Typically found in clear or slightly turbid water with moderate gradient, moderately swift runs and riffles with substrates of coarse gravel, rubble, or boulders

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Fantail Darter	*Etheostoma flabellare*	Spawn on the underside of flat rocks in the spring, males guard eggs – hatch in 30-35 days at 17-20^{o}C. Migrate downstream to deeper waters during winter months in some areas.	(*) Most abundant in medium to small streams in the range of 20 to 40 feet wide. Found in riffles with gravel substrates. Feed on immature aquatic insects.
Blotchside logperch	*Percina burtoni*	Spawns from April - June with water temps around 19^{o}C. Non-migrant. Avoids turbid waters and silty substrates.	Found in moderately gradient systems within the riffle, run, and pool habitats, at or near the bottom. Eats primarily benthic invertebrates.
Johnny Darter	*Etheostoma nigrum*	Spawn on the underside of flat rocks in the spring – spawning often involves migration into smaller tributaries – considerable upstream and downstream movements may precede spawning	Inhabits streams and rivers of all sizes where it is found in pools and other slack water habitats on sand and gravel substrates.
Tippecanoe Darter	*Etheostoma tippicanoe*	Spawn in late spring and early summer when temperatures reach the upper to mid-20s , males guard eggs,	Found in shallow riffles and swift runs, typically in clear waters.
Wounded Darter	*Etheostoma vulneratum*	Spawn in spring and summer. Not much is known about the reproductive biology of this species has a very limited range across 4 states.	Habitats include fast rocky riffles of small to medium rivers.
Banded Darter	*Etheostoma zonale*	Banded darters spawn from mid-April to mid-May and sometimes as late as July, in swift riffles.	Banded darters can be found in streams of all sizes from small creeks to large rivers in rocky riffle habitats. Feeding activity peaks at midday.
Tangerine Darter	*Percina aurantiaca*	Spawns in May to June. Females breed between 2-4 years. of age. Live to be just over 4 years. Spawning likely occurs in sand and gravel riffles with moderate to swift currents.	Found in clear creeks and smaller river with moderate to steep gradients. Adults most often found in deeper, swift flowing runs and rapids near boulders. Juveniles more likely to be found in pools and slow runs with gravel substrates.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Gilt Darter	*Percina evides*	Spawn in May at 17-20°C in Virginia. Spawns only twice in its lifetime.	Found in clear rivers and streams with silt-free bottoms and permanently strong flow. Typically in moderate to fast deep riffles and pools over gravel, rubble, and small boulders.
Dusky Darter	*Percina sciera*	Spawns in late May to early July over loose gravel at depths of 30-90 cm - males and females mature in 1 yr. Make seasonal migrations between smaller tributaries in warm seasons and deeper downstream winter habitats in some past studies.	Found in benthic areas, fast runs and sometimes riffles. Mostly over course clean gravel at depths of 20 cm or more in spring and early summer.
Logperch	*Percina caprodes*	Spawn in mid-March to mid-May, a few hundred males gather in schools then females join a single male where they partially bury themselves in sand where the eggs are laid – hatch in 5-8 days. Move from deeper water to shallows to spawn.	Found in clean riffles and runs over substrates of mixed sand and gravel. Often associated with bottom debris. Young often found in dense beds of vegetation. Eats primarily benthic invertebrates. Typically inactive at night, stay on the bottom.
PERCH			
Walleye	*Sander vitreus*	Spawn throughout the month of April when water temperatures are between 40 and 55°F - Typically migrate to riffle areas to spawn, however many are stocked by the state of VA as fingerlings.	Usually associated with large rivers and lakes, where they congregate near the bottom during the day, and move into the shallows at night to feed.

Common Name	Scientific Name	Seasonal Activities/ Spawning Migration	Daily Activities/ Migration/ Habitat
Sauger	*Sander canadensis*	Growth rates and daily rations were highest between September and January and lowest between March through August. Spawn over 2 week period in the spring. Eggs hatch in 3-4 weeks at 5-15°C. Typically move little in the summer but movements of as far as 100 have been recorded in the Mississippi.	Found in sand and gravel runs, sandy and muddy pools and backwaters. Moves into shallow waters at night (Trautman 1981). Period activity increases in more turbid water.

Source: (Becker 1983); (Simon 1999); (Ohio DNR); (Stauffer et al., 1995); (Trautman 1957); (Robins et al., 1991); (Jenkins & Burkhead 1993); (explorer.natureserve.org)
Note: (**) The Shorthead and Smallmouth Redhorse have been separated by drainages.

4.6 Identification of Threatened, Endangered, and Other Protected Species Susceptible to I & E at CWIS [§ 122.21(r)(4)(vi)]

There are 13 fish species that are listed as threatened or endangered Federally or at the state level (Table 4-7). Summaries of Federally-listed species were available at the county level, but state-listed species were not, so Table 4-7 is overly inclusive. Nine (9) of these fish are unlikely to be found near the Clinch River Plant as there are no records of their observation in Russell County and/or the species are not found in that section of the Clinch River. Of the four remaining fish species in Table 4-7, one, the Sickle Darter, has the potential to be found in the area as there are records of it in this section of the Clinch River, however it seems to be rarely observed, while the Yellowfin Madtom, Steelcolor Shiner, and the Golden Darter have records of recent observance. In previous surveys conducted on the Clinch River near the facility the Golden Darter[1] and the Steelcolor Shiner have been collected, although in very low abundances. The Golden Darter is listed as a Federal Species of Concern (SOC) and is State Threatened and the Steelcolor Shiner is State Threatened. Both of these species have low potential for entrainment in early life stages. None of these species are likely to be impinged or entrained due to the low through-screen velocity associated with the facility. The Yellowfin Madtom, which is Federally and state threatened was recently found to have a “pretty good population” spanning 15 miles of river centered on Cleveland, VA (Shute, 2004).

The Clinch River has been described as having one of the most diverse mussel and fish faunas of any comparably-sized stream in North America (Neves 1991). Currently, of the 81 freshwater mussel species recognized in Virginia, 37 are listed as threatened or endangered, with 32 occurring in the Clinch, Powell, and Holston river watersheds of Virginia’s upper Tennessee River drainage. However, even with improvements in water quality since the Clean Water Act, mussel populations have continued to decline especially in the upper reaches of the Clinch River. There are 21 unionid species that are classified as threatened, endangered or protected at the state and Federal levels upstream and downstream of the Clinch River Plant (Table 4-8).

The Virginia Wildlife Action Plan (WAP) identifies 925 species of greatest conservation need, 60% of which are aquatic, 70% of which are invertebrates. These species are grouped into four tiers of relative conservation need: critical (I), very high (II), high (III), and moderate (IV) conservation need. These tiers allow for prioritization of threats facing species and of conservation actions addressing those threats. The action plan is a 10-year strategic plan that is required for continued funding through the State Wildlife Grant Program. There are 89 aquatic mollusk species on the current tiered list of Species of Greatest Conservation Need, 57 of which are unionid species. The 21 protected species listed on Table 4-8 are included in this tiered list.

Table 4-7. Federal and State Threatened and Endangered Fish Species and Species of Concern with the Potential to Occur within the vicinity of Clinch River Plant CWIS

Common Name	Scientific Name	Status	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles***
Blackside Dace	*Chrosomus cumberlandensis*	FT, ST	Unlikely – prefers small upland tributaries. Only records in VA are a small tributary of the Powell River	Unlikely	Unlikely
Duskytail Darter	*Etheostoma percnurum*	FE, SE	Unlikely– only found in Copper Creek, a tributary of Clinch River. One specimen recorded in the Clinch River in 1980 at Speers Ferry	Unlikely	Unlikely
Emerald Shiner	*Notropis atherinoides*	ST	Unlikely*	Unlikely	Unlikely
Golden Darter**	*Etheostoma denoncourti*	SOC, ST	Likely	Unlikely	Unlikely
Paddlefish	*Polyodon spathula*	ST	Unlikely – closest record in the Clinch River near Dungannon in the ‘80’s	Unlikely	Unlikely
Sickle Darter	*Percina williamsi*	ST	Potential	Unlikely	Unlikely
Slender Chub	*Erimystax cahni*	FT, ST	Unlikely* - Not seen in the Clinch River since 1967	Unlikely	Unlikely
Spotfin Chub	*Erimonax monachus*	FT, ST	Unlikely* – Not seen in the Clinch River since 1893	Unlikely	Unlikely
Steelcolor Shiner	*Cyprinella whipplei*	ST	Likely – found in AEP surveys in “84, ’87, and 90	Unlikely	Unlikely

Common Name	Scientific Name	Status	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles***
Tennessee Dace	*Chrosomus tennesseenisis*	SE	Unlikely* – no records in Clinch	Unlikely	Unlikely
Variegate Darter	*Etheostoma variatum*	SE	Unlikely – very rare in Virginia, no records in the Clinch or its watershed	Unlikely	Unlikely
Western Sand Darter	*Ammocrypta clara*	ST	Unlikely*	Unlikely	Unlikely
Yellowfin Madtom	*Noturus flavipinnis*	FT, ST	Likely	Unlikely	Unlikely

Note:

FE=Federally Endangered, SOC=Federal Species of Concern, SE=State Endangered, ST=State Threatened, SSC=State Species of Concern.

*These species are recorded as being extirpated/possibly extirpated from the watershed. (NatureServe.org) / suitable habitat unlikely available for these species
**This species designation was recently split from the Tippecanoe darter. The species are separated by drainages. See note on Table 4-1.
***Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that will be less than 0.5 fps at normal water level after shutdown of Unit 3 in May 2015.

Potential – Record of observation exist but very rare;
Likely – Presence recorded;
Unlikely – No records in that county or that section of the Clinch River, may be found in the watershed.

In 2002, the Virginia Department of Game and Inland Fisheries (VDGIF) developed a strategy to restore freshwater mussels at six reaches within the upper Tennessee River drainage. These reaches include four on the Clinch River, and one site each on the Powell and North Fork Holston rivers. This mussel restoration strategy includes four levels of introduction: augmentation, expansion, reintroduction and establishment. These levels have been defined by the National Strategy for the Conservation of Native Freshwater Mussels (NSCNFM) (NNMCC 1998) and the Upper Tennessee Mollusk Recovery Group (UTMRG). The UTMRG is comprised of representatives from the Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Polytechnic Institute and State University, U.S. Geological Survey, U.S. Fish and Wildlife Service, and The Nature Conservancy (VDGIF 2010). The main restoration technique, augmentation, was to release translocated adults or propagated juveniles into reaches where valid species records exist since at least 1980 (VDGIF 2005). The overall goal is to develop self-sustaining mussel populations with a goal of delisting. Almost 400,000 mussels of 11 species have been released as a result of these efforts. DGIF's efforts have enhanced mussel presence in the plant vicinity, and these species have been included in the assessment of potential impingement/entrainment impacts.

Reach number 4 of the mussel augmentation includes approximately 12 river miles starting from Nash Ford to Carbo. American Electric Power's Clinch River Plant is located within this reach for mussel augmentation. Sixteen of the 21 species found near Clinch River Plant are being augmented to this stretch of river with some of the species being non-listed species (Table 4-8 summarizes the augmentation of listed species).

The majority of freshwater mussels use juvenile and adult fish as a means for population dispersal. Many mussel species have a wide variety of fish hosts they can use to infest with glochidia but there are a few that are limited to one or two hosts according to laboratory transformations of larvae into juvenile mussels. Many of these host-fish/mussel relationships are still unknown. However, in a natural situation, glochidia will attach to almost any fish including those that are not suitable hosts.

Regarding potential entrainment impacts to protected mussel species at the Clinch River Plant, it is important to note that early life stage fish are not typically host fish for glochidea and therefore the potential for entrainment of glochidea infested host fish is negligible. Similarly, potential impingement of glochidea infested host fish is also negligible primarily due to the low through screen velocities at the intake, particularly after retirement of Unit 3. Additionally, given that several other factors (i.e., use of closed cycle cooling, flow reduction, and use of a low fraction of the Clinch River flow) contribute to the cooling system of the Clinch River Plant being protective of fish, impacts to protected mussels species is not expected to occur (Table 4-8).

There are 3 federally-listed non-aquatic species found near Clinch River Plant (see Table 4-9). Bats generally forage on flying prey/insects and not fish or macroinvertebrates in the water body, thus they are unlikely to be affected by impingement or entrainment.

Table 4-8. Federal and State Threatened and Endangered Mussel Species and Species of Concern with the Potential to Occur within the vicinity of Clinch River Plant CWIS

Common Name	Scientific Name	Status	WAP Tier	Host Fish	Species Augmented in Reach 4	Any Host Fish Susceptible to Impingement**
Appalachian Monkeyface	*Quadrula sparsa*	SE	I	Hosts unknown	Yes	Unlikely
Black Sandshell	*Ligumia recta*	ST	III	Central Stoneroller, Largemouth Bass, Bluegill, Sauger, Yellow Perch	Yes	Unlikely
Birdwing Pearlymussel	*Lemiox rimosus*	FE	I	Snubnose Darter and Greenside Darter	Yes	Unlikely
Crackling Pearlymussel	*Hemistena lata*	SE, FE	I	Banded Sculpin, Central Stoneroller, Whitetail Shiner, Fantail Darter, Streamline Chub	Yes	Unlikely
Cumberland Combshell	*Epioblasma brevidens*	SE, FE	I	Banded Sculpin, Black Sculpin, Fantail Darter, Greenside Darter, Spotted Darter, Redline Darter, Snubnose Darter, Roanoke Darter, Logperch	Yes	Unlikely
Cumberland Monkeyface	*Quadrula intermedia*	FE	I	Streamline Chub and Blotched Chub	Yes	Unlikely
Deertoe	*Truncilla truncata*	SE	IV	Freshwater Drum and Sauger	No	Unlikely
Dromedary Pearlymussel	*Dromus dromas*	SE, FE	I	Black Sculpin, Channel Darter, Fantail Darter, Greenside Darter, Gilt Darter, Tangerine Darter, Blotchside Darter, Roanoke Darter, Logperch	Yes	Unlikely
Fine-rayed Pigtoe	*Fusconaia cuneolus*	SE, FE	I	Bluntnose Minnow, Central Stoneroller, River Chub, Whitetail Shiner	Yes	Unlikely
Fragile Papershell	*Leptodea fragilis*	ST	IV	Freshwater Drum	No	Unlikely
Longsolid	*Fusconaia subrotunda*	SOC	III	Hosts unknown	Yes	Unlikely

Common Name	Scientific Name	Status	WAP Tier	Host Fish	Species Augmented in Reach 4	Any Host Fish Susceptible to Impingement**
Ohio Pigtoe	*Pleurobema cordatum*	SE	III	Creek Chub, Bluegill, Brook Stickleback, Guppy	No	Unlikely
Oyster Mussel	*Epioblasma capsaeformis*	FE	I	Greenside Darter, Bluebreast Darter, Fantail Darter, Redline Darter, Snubnose Darter, Wounded Darter, Dusky Darter, Black Sculpin, Mottled Sculpin, Banded Sculpin	Yes	Unlikely
Purple Bean	*Villosa perpurpurea*	SE, FE	I	Hosts unknown	Yes	Unlikely
Rayed Bean	*Villosa fabilis*	SOC	II	Greenside Darter, Mottled Sculpin, Largemouth Bass	No	Unlikely
Rough Rabbitsfoot	*Quadrula c. strigillata*	SE, FE	I	Whitetail Shiner, Bigeye Chub	Yes	Unlikely
Shiny Pigtoe	*Fusconaia cor*	SE, FE	I	Common Shiner, Whitetail Shiner, Redline Darter	Yes	Unlikely
Slabside Pearlymussel	*Lexingtonia dolabelloides*	ST	II	Shiners	Yes	Unlikely
Tennessee Clubshell	*Pleurobema oviforme*	SOC	III	Central Stoneroller, River Chub, Common Shiner, Whitetail Shiner, Tennessee Shiner, Telescope Shiner and Fantail Darter	Yes	Unlikely
Tennessee Heelsplitter	*Lasmigona holstonia*	ST	II	Banded Sculpin, Redline Darter, Snubnose Darter, Bluntnose Minnow, Central Stoneroller, Creek Chub	No	Unlikely
Tennessee Pigtoe	*Fusconaia barnesiana*	SSC	II	Hosts unknown	Yes	Unlikely

Note: **Potential for Impingement of Juveniles and Adults assumed to be unlikely for all species due to small AOI and through-screen velocities that will be less than 0.5 fps at normal water level after shutdown of Unit 3 in May 2015.

Table 4-9. Remaining Federally-listed Species (non-fish and non-shellfish) with the Potential to Occur within the Vicinity of Clinch River Plant CWIS

Common Name	Scientific Name	Status	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment	Potential for Impingement
Indiana bat	*Myotis sodalis*	FE	Possible – within range	Unlikely	Unlikely
Gray Bat	*Myotis grisecens*	FE	Possible – within range	Unlikely	Unlikely
Northern Long-Eared Bat	*Myotis septentrionalis*	FT	Possible – within range	Unlikely	Unlikely
Note: FE=Federally Endangered, FT = Federally Threatened.					

4.7 Documentation of Consultation with Services [§ 122.21(r)(4)(vii)]

There have been neither public participation, nor coordination undertaken with U.S. Fish and Wildlife Services or Virginia Department of Game and Inland Fisheries.

4.8 Methods and QA Procedures for Field Efforts [§ 122.21(r)(4)(viii)]

AEP is not relying upon any new data it collected to support the biological baseline characterization; therefore, there is no need to document methods and QA procedures for historical studies in this subsection.

4.9 Definition of Source Water Baseline Biological Characterization Data [§ 122.21(r)(4)(ix)]

AEP acknowledges that the final rule adds three additional subsections to the requirements of § 122.21(r)(4). While AEP has provided data to address § 122.21(r)(4)(i) – (viii) and (x) – (xii), there is no required submittal under this sub-section § 122.21(r)(4)(ix).

4.10 Identification of Protective Measures and Stabilization Activities [§ 122.21(r)(4)(x)]

AEP is not aware of any measures or stabilization activities that have been pursued in the Clinch River near the Clinch River Plant that might affect either the relevance of historical data or attempt to restore any impingement or entrainment losses. On the other hand, the design of the cooling water system (i.e., use of closed cycle cooling) and the cooling water intake (i.e., through-screen velocity of less than 0.5 fps on normal pool level conditions) reduce the rates of impingement and entrainment.

4.11 List of Fragile Species [§ 122.21(r)(4)(xi)]

In the final 316(b) Rule, EPA identifies 14 species as fragile or having post-impingement survival rates of less than 30 percent, including:

- Alewife
- American Shad
- Atlantic Herring
- Bay Anchovy
- Blueback Herring
- Bluefish
- Butterfish
- Gizzard Shad
- Grey Snapper

- Hickory Shad
- Menhaden
- Rainbow Smelt
- Round Herring
- Silver Anchovy

Of these species only gizzard shad inhabits the Clinch River and is likely to be present near the intake.

Gizzard shad are represented in the Clinch River among the species most likely to be vulnerable to entrainment. Gizzard Shad spend most of their adult life in large schools where they filter feed on both phytoplankton and zooplankton. Gizzard Shad of all ages are extremely fragile, and handling them or keeping them in captivity for controlled laboratory testing is difficult even under the best of circumstances (Shoemaker 1942; Bodola 1965; Reutter and Herdendorf 1974). Conditions for Gizzard Shad populations are optimal in warm, fertile, shallow bodies of water with soft mud bottoms, high turbidity, and relatively few predators (Miller 1960; Zeller and Wyatt 1967). In fact, lacustrine habitats with these characteristics are the most likely to become overpopulated with Gizzard Shad. Factors contributing to this problem are the Gizzard Shad's high reproductive capacity, rapid growth rate, and efficient and direct use of plankton (Hubbs 1934; Miller 1960; Bodola 1965). While their life span is three to eleven years, few live beyond age three. In general, short life spans are correlated with rapid growth rates in the first year of life. In more northern parts of its range, Gizzard Shad typically live to ages 5 to 7 and may live to ages 10 or 11 (Miller 1960; Jester and Jensen 1972).

4.12 Information Submitted to Obtain Incidental Take Exemption or Authorization from Services [§ 122.21(r)(4)(xii)]

The Clinch River Plant has not sought or obtained an incidental take exemption or authorization for its cooling water intake structure from the U.S. Fish and Wildlife Service.

5 Cooling Water System Data [§122.21(r)(5)]

5.1 Description of Cooling Water System Operation [§122.21(r)(5)(i)]

The Clinch River Plant circulating water systems are closed-loop systems; that is, the cooling water is recycled and reused in the steam turbine condensers (see Figure 5-1 for Schematic of Units 1 and 2 Circulating Water System). The plant currently has two generating units; Unit 3 was permanently retired in May 2015. The circulating water systems for Units 1 and 2 are identical for the purposes of this description. The normal requirement of circulating water for Units 1 and 2 is 220,000 GPM, and four cooling towers are used to cool the circulating water for reuse. Approximately 65% of the design intake flow is used for cooling (see Figure 3-4 under Section 3.4 for Water Balance Diagram of Current Operation at Clinch River Plant). Clinch River Plant cooling water is not used in any manufacturing process either before or after it is used for cooling[2].

Monthly water withdrawals from the Clinch River expressed as a percent of the low flow[3] and mean flow conditions relative to actual average monthly intake flow prior to Unit 3 retirement for a period from 2010 to 2013 and current design intake flow of 9.36 MGD after the retirement of Unit 3 are shown in Table 5-1. The plant design intake withdrawal (9.36 MGD) during low-flow conditions in the March-July peak larval density period is estimated at 2.6-13.1% of the low river flows (95% exceedance flows) and 1.0-4.2% of mean monthly flows. Additionally, the water withdrawn is not totally consumed by the plant, i.e., approximately one third of the water withdrawn is returned to the river, resulting in less than 15% of the river being consumed during critical low flow events based on the lowest 95% exceedance flow in October (Table 5-1). The design maximum through-screen velocity is estimated to be 0.5 fps and 0.2 fps at the low water depth of 4 ft and normal pool level of 14 ft, respectively (see Appendix B for engineering calculations of through-screen velocities). Therefore, the withdrawal by Clinch River Plant should not impact downstream aquatic life, recreation, water supply, and other water uses.

Clinch River Plant is used for base-load generation and runs 24 hours a day, seven days a week; therefore, the cooling water intake structure is operating 24 hours a day to meet the facility's cooling demands. Seasonal variations of Clinch River Plant cooling water system operation also coincides with those of the intake structure operation. Based on the daily intake flow data from 2010 to 2013, minimum makeup water demand occurs in April due to lower demand, cooler temperatures and humidity, and scheduled maintenance shutdowns. Maximum water demand occurs in July when the demand for electricity is greatest and higher temperatures and high relative humidity result in a decline in cooling efficiency.

[2] It is also noted that the facility is fairly isolated, such that no nearby alternative water sources (e.g., reclaimed wastewater, grey water) are available. Groundwater and public water supply resources are also inadequate to provide an alternative cooling water source for this facility.

[3] Low flow conditions are expressed as 95% exceedance flows (i.e., 95% of flow values are above the value provided).

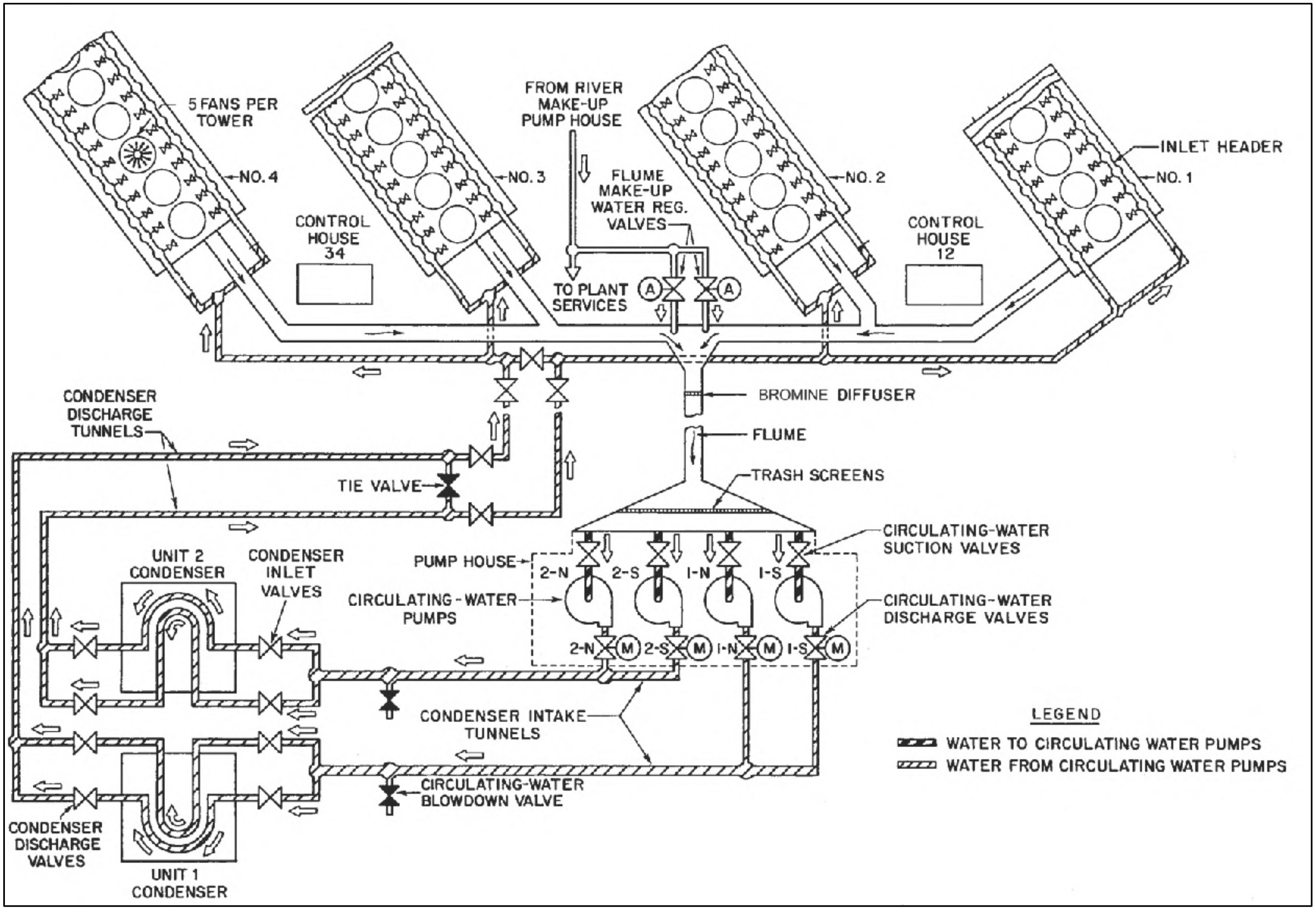


Figure 5-1. Units 1 and 2 Circulating Water System of Clinch River Plant

Table 5-1. Clinch River Plant Withdrawal (Design and Actual) as Percent of Clinch River Flows

Month	Low Flow Condition (95% Exceedance River Flow; MGD)	[1]Monthly Mean River Flow (MGD)	[2]Historical Actual Intake Flow (MGD) Prior to Retirement of Unit 3	Percent Withdrawal Relative To Low River Flow Condition		Percent Withdrawal Relative To Mean River Flow Condition	
				Historical Actual Intake Flow Prior to Retirement of Unit 3	Design Flow of 9.36 MGD Post Retirement of Unit 3	Historical Actual Intake Flow Prior to Retirement of Unit 3	Design Flow of 9.36 MGD Post Retirement of Unit 3
Jan	149.2	721.3	8.8	5.9%	6.3%	1.2%	1.3%
Feb	278.5	859.6	10.3	3.7%	3.4%	1.2%	1.1%
Mar	355.1	909.4	9.7	2.7%	2.6%	1.1%	1.0%
Apr	276.3	679.9	7.0	2.5%	3.4%	1.0%	1.4%
May	165.5	510.6	8.6	5.2%	5.7%	1.7%	1.8%
Jun	84.7	319.9	9.9	11.7%	11.1%	3.1%	2.9%
Jul	71.5	221.0	13.7	19.1%	13.1%	6.2%	4.2%
Aug	64.7	208.8	8.9	13.7%	14.5%	4.2%	4.5%
Sep	46.2	142.2	9.3	20.2%	20.3%	6.6%	6.6%
Oct	41.8	170.6	7.9	18.9%	22.4%	4.6%	5.5%
Nov	57.1	269.5	8.6	15.1%	16.4%	3.2%	3.5%
Dec	80.5	512.5	7.4	9.2%	11.6%	1.5%	1.8%

Note:
1. USGS flows at gaging station #03524000 (Clinch River at Cleveland, VA) from water years 1921 to 2015 were used.
2. Historical Actual Intake Flows prior to Retirement of Unit 3 are based on the CWIS operation in 2010-2013; Unit 3 was retired in May 2015.

After passing through the conventional traveling screens (see Section 3.1 for more details), the circulating water flows to the suctions of the circulating water pumps. There are four such pumps, two pumps for each condenser. Each pump is rated at 55,000 GPM, 85 ft. TDH at 390 rpm, and is driven by a 1,500 hp, 4,000 volt motor. The circulating water pumps are controlled from the plant's main control room. Each pump is equipped with a hand-wheel operated suction valve and a motor-operated discharge valve.

The circulating water pumps discharge into two intake tunnels which supply circulating water to the condensers of Units 1 and 2. From the pump discharge, the water flows into a 72 in. concrete intake tunnel via 42 in. and 54 in. pipes. At the condenser, the 72 in. intake tunnel branches into two 54 in. inlet pipes so as to provide an independent supply of circulating water to each section of the condenser. The two 54 in. inlet pipes join the two condenser water-box inlet nozzles. Each inlet pipe is equipped with a hand-wheel-operated butterfly valve. The circulating water flows through the condenser tubes in the condenser and out via two 54 in. discharge nozzles and pipes. Each discharge pipe is equipped with a hand-wheel-operated butterfly valve. The water then flows into a 72 in. concrete discharge tunnel which leads to the cooling towers. The two 72 in. concrete discharge tunnels run parallel to each other under the basement floor. At the cooling towers, these tunnels sub-divide into 54 in. individual headers. Hand-operated valves are provided in the 72 in. concrete discharge tunnels so as to permit alternate flow from one tunnel to the other in emergencies. These valves will also be used when it becomes necessary to de-water either discharge tunnel.

On Tower 4 only, a 72 in. circulating water intake tunnel is equipped with an 8 in. blowdown valve. The amount of blowdown is determined in accordance with the pH control of the circulating water system. The blowdown is discharged to a sump that feeds into the plant's advanced wastewater treatment system.

Cooling Towers

Each of the four original 1958-vintage cooling towers for Units 1 and 2 measured 281 ft long, 67 ft wide and 61 ft high. Each of the mechanical draft towers consisted of ten cells with the heat transfer section designed as a cross-flow thermal configuration (e.g. water flows down while air is drawn in horizontally).

Between 1999 and 2002, the four 10-cell cross-flow cooling towers were replaced with four 5-cell counter-flow cooling towers while duplicating the original thermal design basis of each tower cooling 55,000 GPM from 97°F to 78°F at a wet bulb of 70°F. The dimensions of each of the four new five-cell counter-flow towers are 240 ft-8 in. long, 48 ft-8 in. wide and 45 ft high (Figure 5-2). As a result, the new towers fit within the original basins with empty space at the end and along one side.

The transfer of heat from the circulating water to the atmosphere is accomplished in the cooling tower by passing the warm circulating water through a stream of moving air. For maximum air-water contact, the warm water runs down thousands of modules which consist of corrugated polyvinyl chloride (PVC) sheets. This maximizes the water surface area for optimum cooling by the air stream. The air, rising counter flow to the water through the spacing between the sheets, is moved by 150 hp mechanical draft fans (28 ft diameter) discharging air through 14 ft tall fan stacks. The performance of cooling towers varies with wind velocity, humidity and outdoor temperature.

Evaporation accounts for the greatest part of the heat transfer. This effect makes it possible to cool the water below the atmospheric dry-bulb temperature. In evaporating one pound of water, approximately 1,000 Btu's are transferred from the water into the air. The water is also cooled by sensible heat transfer to the air.

The evaporation process results in a loss of water from the closed circulating water system. This loss is replaced by the river make-up system. When water is removed by the evaporation process, no dissolved solids are removed. As a result, the circulating water would contain more solids than can remain in solution, causing scaling and fouling of the system components (e.g., heat exchanger equipment - condensers, coolers). In order to prevent this scaling and fouling of the system, blowdown is required. The circulating water system for each Unit is currently run at two to five cycles of concentration before the blowdown. The plant chemist determines the required blowdown by test because the amount of solids in the river water is variable. This determination serves to minimize the amount of makeup water required. After the boilers are converted from coal to natural gas firing by late 2016, the circulating water system will run around five cycles of concentration before it is blown down.

The cooling tower has six main components: (1) the treated wood structure, (2) the 150 hp, 28 ft diameter mechanical draft fans with 14 ft tall fan stacks to direct the airflow, (3) the heat transfer section made up of corrugated PVC sheets commonly called the "fill", (4) the water distribution system, (5) the drift eliminator section and (6) the concrete basin which collects water for return to the condensers and auxiliaries.

The wood structure is laid out in the cold water basin with 4 in. by 4 in. columns laid out on a 6 ft transverse by 6 ft longitudinal grid. The horizontal girts are located 6 ft or 8 ft vertically from each other and composed of 2 in. by 4 in. or 2 in. by 6 in. wood members. The wood structure is composed of CCA (copper chromate acid) treated Dense No. 1 Douglas Fir members which are held together with 304 stainless hardware. The fan deck is composed of 1 in. thick treated plywood.

Each of the Marley induced draft fans are 28 ft diameter with 7 blades, and pull 1,097,174 cubic feet per minute (cfm) of air through each cell. The fiberglass fan stacks are 14 ft tall and slightly curved to provide velocity recovery of the air flow after passing through the fans. The fan stacks discharge exhaust vapor at a high elevation which minimizes the hazard of fogging.

The heat transfer section of the cooling tower consists of corrugated PVC sheets bonded together to form modules known as film fill packs. The thin PVC film fill sheets are bonded together with glue and have a before-formed-thickness of 0.020 in. and an after-formed-thickness of 0.017 in. The fill packs are 3 ft deep and there are two layers for a combined thickness of 6 ft. The fill packs are bottom-supported on the treated wood structure horizontal girts. Air seals are provided along the perimeter of each cell to prevent air from bypassing the film fill packs. The film fill packs are also cut so they fit close to the columns to prevent air from

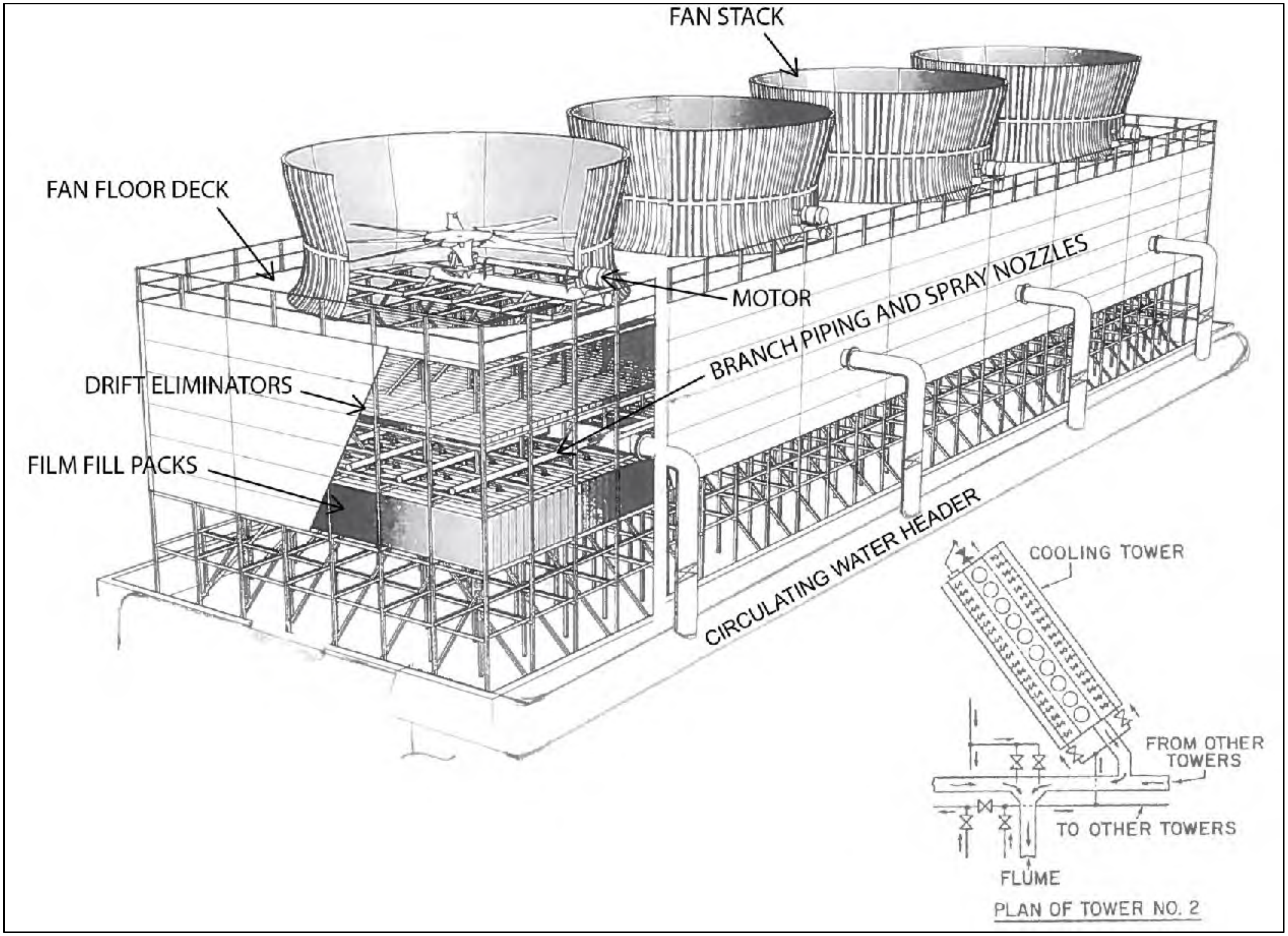


Figure 5-2. Schematic of Clinch River Plant Cooling Tower

bypassing the fill packs.

At each tower, two 36 in. diameter steel pipe stubs exit the ground and combine into a 48 in. diameter fiberglass header pipe which runs on one side of the tower. A 24 in. diameter fiberglass riser supplies water to each cell and branches into eight 6 in. diameter PVC distribution pipes (or branch arms). There are 388 down spray nozzles (28 GPM/nozzle) in each cell which are laid out in a 3 ft by 2 ft pattern above the film fill to equally distribute the warm circulating water to all sections of the tower fill. The water flows through the nozzles and strikes the splash plates, producing “umbrella like” sprays over the fill modules below. The spray cascades down the corrugated module sheets as a thin film and falls into the cold water basin. Air-water contact is established as the ambient air rises upward through the fill.

Marley TU12 cellular PVC drift eliminator panels, 0.017 in. thick, are provided which have an efficiency of 0.005%. The 5-3/4 in. thick drift eliminator panels are supported off of the distribution piping. These panels are designed to reduce the amount of water entrained in the rising air that leaves the tower shell as drift by abruptly changing the direction of the airflow.

The cold-water, concrete, collecting basin has a capacity sufficient to provide a water storage reservoir and accommodate the falling water in the tower and the water in the riser pipes at the time of shutoff. The cold water is discharged from each tower collecting basin into flumes 5 ft wide by 6 ft deep, which in turn, widens into a 13 ft wide by 8 ft deep flume. Makeup water supply is automatically adjusted to maintain a normal water level of 2 in. to 7 in. above the top of the concrete pilasters supporting the outer walls of the tower. Normal basin water level is 1,512 ft. Maximum overflow level is 1,512 ft-8 in. with overflow commencing at 1,512 ft-3 in. Overflow is collected in a 4 ft by 19 in. box at the northeast end of the tower.

A cooling tower center-line trough, 2 ft wide by 8 in. deep, runs along the bottom length of each basin and is sloped downward in a northeast direction for drainage purposes. On Tower No. 4 only, this trough is discharged through a manual valve and motor operated valve to sump 003 and them pumped to the advanced waste water treatment plant for treatment.

The controls for each cooling tower are located in 2 cooling-tower control houses. Control House 12 controlling Towers 1 and 2 is located between these 2 towers. Control House 34 controlling Towers 3 and 4 is similarly located. The control panel for each cooling tower contains five 3-position fan switches and indicating lamps.

Freezing will not occur in the flooded portions of a tower, only in the relatively dry parts where fine drops of water splash out into the entering air stream. This can happen whenever the wet-bulb temperature is below freezing, regardless of the dry-bulb temperature. The ice will form on the structural framing, and on the outer filling. The ice starts to form near the bottom of the film fill and along the transverse structural framing, building inward and upward. The formation of ice restricts the flow of air and reduces the performance, causing a rise in the temperature of the water leaving the tower. Various operating procedures are used to minimize freezing, or to remove ice once it has formed. The ice may be melted by utilizing the heat in either the exhaust air or in the water that is being circulated over the tower. The method of doing this is air entering the lower level of film fill panels will cause ice to form along the lower perimeter of fill. Stopping the fans temporarily allows the water to fall vertically and melt ice that has formed along the perimeter. This will remove ice from the filling and part of the structure.

5.2 Design and Engineering Calculations [§122.21(r)(5)(ii)]

The design and engineering calculations and supporting data that provide the basis of Section 5.1 were prepared and reviewed by AEP using a qualified professional. Engineering calculations of the through-screen velocity prepared by an AEP and reviewed by an HDR qualified professional are provided in Appendix B.

5.3 Description of Existing I & E Reduction Measures [§122.21(r)(5)(iii)]

The primary reduction in both impingement and entrainment at the Clinch River Plant is achieved through the use of a closed-cycle cooling system. The cooling towers are described in detail in Section 5.1. The cooling towers are presently operating at two-to-five cycles of concentration (COC) and provide at least 97.0% flow reduction (using two COC) as compared to a once-through cooling system (see Section 6.1 for calculations of makeup water minimization).

The closed-cycle cooling system meets Compliance Alternative 1 (§125.94(c)(1)) for impingement mortality reduction in the final Rule. Assuming that the reduction in entrainment is commensurate with reduction in flow, then, the closed-cycle cooling system would reduce entrainment by at least 97.0% compared to a once-through system. Closed-cycle cooling alone should be sufficient to minimize adverse environmental impacts associated with CWIS operation. However, there are additional features at Clinch River Plant that further reduce impingement and entrainment.

Since Unit 3 is now retired, the design through-screen velocity is estimated to be 0.5 fps and 0.2 fps at low water level of 4 ft and a normal pool level of 14 ft, respectively. A maximum design through-screen velocity of 0.5 fps meets the impingement mortality reduction standard through Compliance Alternative 2 (§125.94(c)(2)).

Water withdrawals for the cooling water system are further minimized by operating at higher cycles of concentration, which will increase to five in late 2016 with conversion from coal to natural gas.

In addition, Clinch River Plant has a favorable orientation of the intake in terms of potential reduction in impingement and entrainment because of (1) perpendicular orientation of intake to river current such that passive organisms would tend to be carried past the intake and (2) intake location in the midsection of a long pool, which physically isolates it from the majority of fish and mussel species that tend to inhabit riffle/run habitat (in particular the T&E species).

Furthermore, Clinch River Plant is a fairly isolated area, so that no nearby alternative water sources (e.g., reclaimed wastewater, grey water) are available. Groundwater and public water supply resources are inadequate to provide an alternative cooling water source for this facility.

6 Chosen Method(s) of Compliance with Impingement Mortality Standard [§122.21(r)(6)]

Clinch River Plant utilizes a closed-cycle cooling system and the flow reduction achieved relative to once-through cooling (OTC) is estimated to be 97.0% to 98.1% with current operation that has two-to-five COC. See Section 6.1 below for the calculation of makeup water minimization. A closed-cycle cooling system meets Compliance Alternative 1 for impingement mortality reduction in the final rule (§125.94(c)(1)). Assuming that the reduction in entrainment is commensurate with reduction in flow, then the closed-cycle cooling system also reduces entrainment by at least 97.0% (assuming that the tower is operated at only two COC) compared to a once-through system. Closed-cycle cooling alone should be sufficient to minimize adverse environmental impacts associated with CWIS operation and provides the strongest basis for the cooling system to be determined to be BTA for both impingement and entrainment. Additionally, the Clinch River CWIS is compliant with a separate, fully sufficient, approach to impingement BTA under §125.94(c)(2) as the maximum design intake through-screen velocity is 0.5 fps.

AEP neither has site-specific data to support *de minimis* rate of impingement (§125.94(c)(11)), nor requests BTA determination based on low capacity utilization (§125.94(c)(12)) because of its base-load generating units with high capacity utilization. In summary, AEP proposes that the existing intake structure and cooling water system are BTA under the final rule and that no additional measures are necessary or appropriate.

6.1 Requirements of Makeup Water Minimization for Closed-cycle Recirculating System

A closed-cycle recirculating system withdraws significantly less water from its source water body than a once-through cooling system. The actual reduction in withdrawal quantities depends on how the recirculating cooling system is designed and operated. Table 6-1 presents the site-specific design and operation parameters of the closed-cycle cooling system at the Clinch River Plant.

The cooling towers installed at the Clinch River Plant are currently operating at two-to-five COC and providing a reduction in flow of at least 97.0% (using two COC) relative to a OTC. However, as a result of planned operational changes (which are conversions of Units 1 and 2 from coal to gas as described in Section 5.1) that will decrease makeup water flow, AEP Clinch River Plant plans to begin operating the cooling towers at five COC in late 2016. This will result in a flow reduction of 98.1% as compared to OTC. Makeup flow calculations are provided below.

Table 6-1. Site-Specific Design and Operation Parameters of Closed-Cycle Cooling System at Clinch River Plant

Design and Operational Parameters	Values
Condenser Cooling Water Flow and Condenser Temperature Rise (i.e., delta T)	Each of the four cooling towers for Units 1 and 2 is designed to cool 55,000 GPM of water from 97°F to 78°F (temperature range of 19°F) which would encompass the condensers and all the misc. exchangers.
Cycles of Concentration (COC) at which the cooling tower is typically operated	The circulation water system is currently operated at 2 to 5 Cycles of Concentration, and it will be changed to 5 cycles by late 2016 after conversion from coal to natural gas.
Drift Eliminator Efficiency (from the Cooling Tower Specification	0.005%
MW rating of generating units	The current MW rating of Units 1 to 2 is 235 MW each Unit and the unit capacity is expected to increase from 235 MW to 237 MW after the gas conversion.

Evaporation, drift and blowdown rates are calculated and summed as the makeup flow:

Makeup flow = **Evaporation** + **Drift** + **Blowdown**

where:

Evaporation, E = 0.0008 x Condenser temperature delta T(°F) x Condenser cooling water flow rate (GPM)

Drift, D = Drift eliminator efficiency x Condenser cooling water flow (GPM)

Blowdown, B = [E-{(COC-1) x D}]/(COC-1)

Then, the makeup flow is compared with condenser cooling water flow (i.e., once-through flow) to determine the degree of flow reduction.

Using the cooling tower flow of 55,000 GPM, delta T of 19 °F, drift eliminator efficiency of 0.005% and 2 COC, the example calculations for evaporation, drift and blowdown rates are as follows:

E = 0.0008 x 19 °F x 55,000 GPM = 836 GPM

D = 0.00005 x 55,000 GPM = 3 GPM

B = [836 GPM – {(2-1) x 3 GPM}]/(2-1) = 833 GPM

Makeup Flow for 2 COC = 836 GPM + 3 GPM + 833 GPM = 1,672 GPM

Therefore, the calculated makeup water flows for two COC and five COC are 1,672 GPM and 1,045 GPM per cooling tower, respectively. As a result, the percent flow reductions compared to a once-through cooling system are 97.0% and 98.1% for two and five COC, respectively.

AEP believes that at five COC, the makeup water flow to the towers will have been minimized to the maximum extent possible within the constraints of practicality, scaling and other operational issues, and the need to comply with discharge concentration limits on cooling tower blowdown.

7 Entrainment Performance Studies [§122.21(r)(7)]

There have been neither site-specific entrainment performance studies conducted at Clinch River Plant, nor relevant studies from other facilities.

8 Operational Status [§122.21(r)(8)]

8.1 Description of Operating Status [§122.21(r)(8)(i)-(8)(v)]

The Clinch River Plant currently consists of two units. Units 1 and 2 both came into service in 1958, and each is currently rated at 235 MW capacity. Unit 3 rated at 235 MW came on-line in 1961 and is now retired. Cooling water at this plant is used only for power production. Utilization over the previous seven years is provided in Table 3-1 in Section 3.3. The major changes to the system in the last fifteen years have been the replacement of all five cooling towers during the years 1999-2002 and retirement of Unit 3. Planned changes over the next five years include:

- Conversion of Unit 1 from coal to natural gas by December 2015, and similar conversion of Unit 2 by May 2016. This conversion will result in an increase in rated capacity of each unit from 235 to 237 MW, and decrease in heat rate from an average of 11,232 btu/kwh per unit (2011-2012 average) to an expected 10,051 btu/kwh per unit following the conversion.

9 References

American Electric Power (AEP), Biologists. 1982-1991. Clinch River Plant In-house Fish Monitoring. Clinch River Fish Collection Data.

Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.

Bodola, A. 1965. Life history of the gizzard shad, Dorosoma cepedianum (LeSueur), in western Lake Erie. U.S. Fish Wildlife and Service. Fish. Bull. 65:391-425.

Ehrlich, K. F. 1974. Chemical changes during growth and starvation of herring larvae. Pages 301-323 in J. H. S. Blaxter, editor. The early life history of fish. Springer-Verlag, New York.

Electric Power Research Institute (EPRI). 2000. Technical Evaluation of the Utility of Approach Velocity as an Indicator of Potential Adverse Environmental Impact under Clean Water Act Section 316(b). 1000731. EPRI, Palo Alto, CA.

EPRI. 2007. Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities. 1015322. EPRI, Palo Alto, CA

Gale, W. F. and C. A. Gale. 1977. Spawning habits of spotfin shiner (*Cyprinella spiloptera)* - a fractional, crevice spawner. Transactions of the American Fisheries Society 106:170-177.

Gebhart, Glen E., and Robert C. Summerfelt. Seasonal Growth of Fishes in Relation to Conditions Of Lake Stratification. "Oklahoma Cooperative Fishery Research Unit 58 (1978): 6-10. Oklahoma State University, Stillwater, Oklahoma.

Hubbs, C. L. 1934. Some experiences and suggestions on forage fish culture. Trans. Am. Fish. Soc. 63:53-63.

Jenkins, R. E., and N. M. Burkhead, 1993. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda. Maryland.

Jester, D. B., and B. L. Jensen. 1972. Life history and ecology of the gizzard shad, Dorosoma cepedianum (LeSueur) with reference to Elephant Butte Lake. New Mexico State Univ. Agric. Exp. Sta. Res. Rep. 218. 56 pp.

Kellogg, R.L. and J.J. Gift. 1983. Relationship Between Optimum Temperature for Growth and Preferred Temperatures for the Young of Four Fish Species. Trans. Am. Fish. Soc. 112:424-430.

King, R. Greg S., and J. Vondruska. 2011. "Selectivity of Impingement at Power Plants along the Ohio River."

Krstolic, J.L., G.C. Johnson, and B.J.K. Ostby. 2013. Water quality, sediment characteristics, aquatic habitat, geomorphology, and mussel population status of the Clinch River, Virginia and Tennessee, 2009-2011. U.S. Geological Survey Data Series 802. 14 pp. + app.

Masnik, M.T. 1974. Composition, longitudinal distribution, and zoogeography of the fish fauna of the upper Clinch system in Tennessee and Virginia. Ph.D. dissertation. Virginia Polytechnic Institute and State University, Blacksburg.

May, R. C. 1974. Larval mortality in marine fishes and the critical period concept. Pages 3-19 in J. H.S. Blaxter, editor. The early life history of fish. Springer-Verlag, New York.

Michaletz, P. H. 1998. Effects on sport fish growth of spatial and temporal variation in age-0 gizzard shad availability. North 542 hale et al. American Journal of Fisheries Management 18:616–624.

Miller, R. R. 1960. Systematics and biology of the gizzard shad (Dorosoma cepedianum) and related fishes. U.S. Fish Wildlife. Servo Fish. Bull. V. 60: 371-392.

Miller, T.J., Crowder, L.B., Rice, J.A., Marshall, E.A. 1988 Larval size and recruitment mechanisms in fishes: toward a conceptual framework. Canadian Journal of Fisheries and Aquatic Sciences 45:1657-1670.

NatureServe Explorer: An Online Encyclopedia of Life." NatureServe Explorer: An Online Encyclopedia of Life. N.p., 2014. Web. 7 Jan. 2015. <http://explorer.natureserve.org/>.

Neves, R. J. 1991. Mollusks. Pages 251 320. in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.Ohio.gov / Search. *Fish*. 19 Nov. 2014.

Outten, L. M. 1962. Some observations on the spawning coloration and behavior of *Notropis leuciodus.* Journal of the Elisha Mitchell Scientific Society 78:101-102.

Reutter, J.M. and C.E. Herdendorf. 1976. Thermal Discharge from a Nuclear Power Plant: Predicted Effects on Lake Erie Fish. Ohio J. Science 26:39-45

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea and W.B.

Shoemaker, H. H. 1942. The fishes of Wayne County, Indiana. Invest. Indiana Lakes Streams 2:267-296.

Shute, J.R. 2004. Fall 2004 Update. Conservation Fisheries, Inc. Newsletter #25, December 2004

Simon, T.P. 1999. Assessment of Balon's reproductive guilds with application to Midwestern North American Freshwater Fishes, pp. 97-121. In: Simon, T.L. (ed.). Assessing the sustainability and biological integrity of water resources using fish communities. CRC Press. Boca Raton, Florida. 671 pp.

Stauffer, J. R., J. M. Boltz, and L. R. White. 1995. The Fishes of West Virginia. Philadelphia, PA: Academy of Natural Sciences of Philadelphia. Print.

Stone, U. B. 1940. Studies on biology of the satfin minnows *Notropis analostanus* and *Notropis spilopterus.* Doctoral dissertation. Cornell University, Ithaca New York.

Storck, T. W., D. W. Dufford, and K. T. Clement. 1978. The distribution of limnetic fish larvae in a floodcontrol reservoir in central Illinois. Transactions of the American Fisheries Society 107:419–424.

Trautman, M. B. 1957. The Fishes of Ohio, with Illustrated Keys. Columbus: Ohio State University Press, in Collaboration with the Ohio Division of Wildlife and the Ohio State Development Fund, 1957. Print.

Trautman, M.B. 1981. The Fishes of Ohio. 2nd Edition. Ohio State University Press, Columbus, Ohio. 683 pp.

Van Hassel, J.H. 2007. Case study: discrimination of factor affecting unionid mussel distribution in the Clinch River, Virginia, U.S.A. Pages 311-333 in J.L. Farris & J.H. Van Hassel, editors. Freshwater Bivalve Ecotoxicology. SETAC Press, Pensacola, FL.

VADEQ/VDCR (Virginia Department of Environmental Quality/Virginia Department of Conservation & Recreation). 2014. Virginia water quality assessment. Richmond. 1490 pp. + app.

VADEQ. 2014. Probabilistic Monitoring - Data Sources Fish EDAS Database. June 2014. Web accessed 7 Jan. 2015. <http://www.deq.virginia.gov/>.

Virginia Department of Game and Inland Fisheries. 2010. Virginia Freshwater Mussel Restoration Strategy: Upper Tennessee River Basin. Virginia Department of Game and Inland Fisheries, Bureau of Wildlife Resources, Wildlife Diversity Division, Nongame and Endangered Wildlife Program. Richmond, VA. 17 pp.

Wallus, R., B.L. Yeager, and T.P. Simon. 1990. Reproductive biology and early life history of fishes in the Ohio River drainage, Volume 1: Acipenseridae through Esocidae. Tennessee Valley Authority, Chattanooga, Tennessee. 273 pp.

Welker, M. T., C. L. Pierce and D. W. Wahl. 1994. Growth and survival of larval fishes: roles of competition and zooplankton abundance. Transactions of the American Fisheries Society 123:703–717.

Zeller, H. D., and H. N. Wyatt. 1967. Selective shad removal in southern reservoirs. Pages 405-414 in C. E. Lane, Chairman. Reservoir Fish. Resour. Symp. Athens, GA. 5691pp.

Zweifel, R.D., R. S. Hale, D. B. Bunnell and M. T. Bremigan. 2009. Hatch Timing Variations among Reservoir Gizzard Shad Populations: Implications for Stocked Sander spp. Fingerlings. North American Journal of Fisheries Management 29(2): 488-494.

Appendix A

11” x 17” Engineering Drawings of River Water Make-Up Intake Structures:

- Drawing No.13-5024-15: Clinch River Plant Plot Plan
- Drawing No.12-5112-7: Screen House Arrangement, Make Up, Screen Wash and Drainage Piping (Unit 1 and 2)

NOTES

REFERENCE DRAWINGS

DATE	NO.	DESCRIPTION	APPD.
7/ / 09	15	PER SNCR PROJECT: ADDED DAY TANKS, BULK STORAGE, & RAIL UNLOADING. PER HYDROGEN RELOCATION: ADDED BULK HYDROGEN STORAGE & DELIVERY FACILITY (H4)	
6/ 2/ 00	14	PER AS BUILT CONDITIONS: ADDED WASTEWATER TREATMENT BUILDING, TANKS AND ROADS. ADDED FLY ASH CONTROL BLD'G. AND SCALE HSE. DR	
5/ 23/ 94	13	THIS DRAWING & DRAWING 13-5024A SUPERSEDES DRAWING 123-5024. ADDED COPPER RED. FAC. @ E/4. REMOVED OIL TANK @ K/6 AND GENERAL UPDATE OF DESCRIPTIONS.	
		THIS DRAWING HAS BEEN ELECTRONICALLY SCANNED SEE MICROFILM RECORDS FOR HISTORY & SIGNATURES DRAWING REVISION 11	

REVISIONS

s: /cr/13/mech_arrgt/5024.dgn

APPALACHIAN POWER Co.

CLINCH RIVER PLANT

CARBO VIRGINIA

PLOT PLAN

DWG. NO. 13-5024-15

ENGINEERING DIVISION S.M. FIALA

DESIGN DEPARTMENT

AMERICAN ELECTRIC POWER — 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

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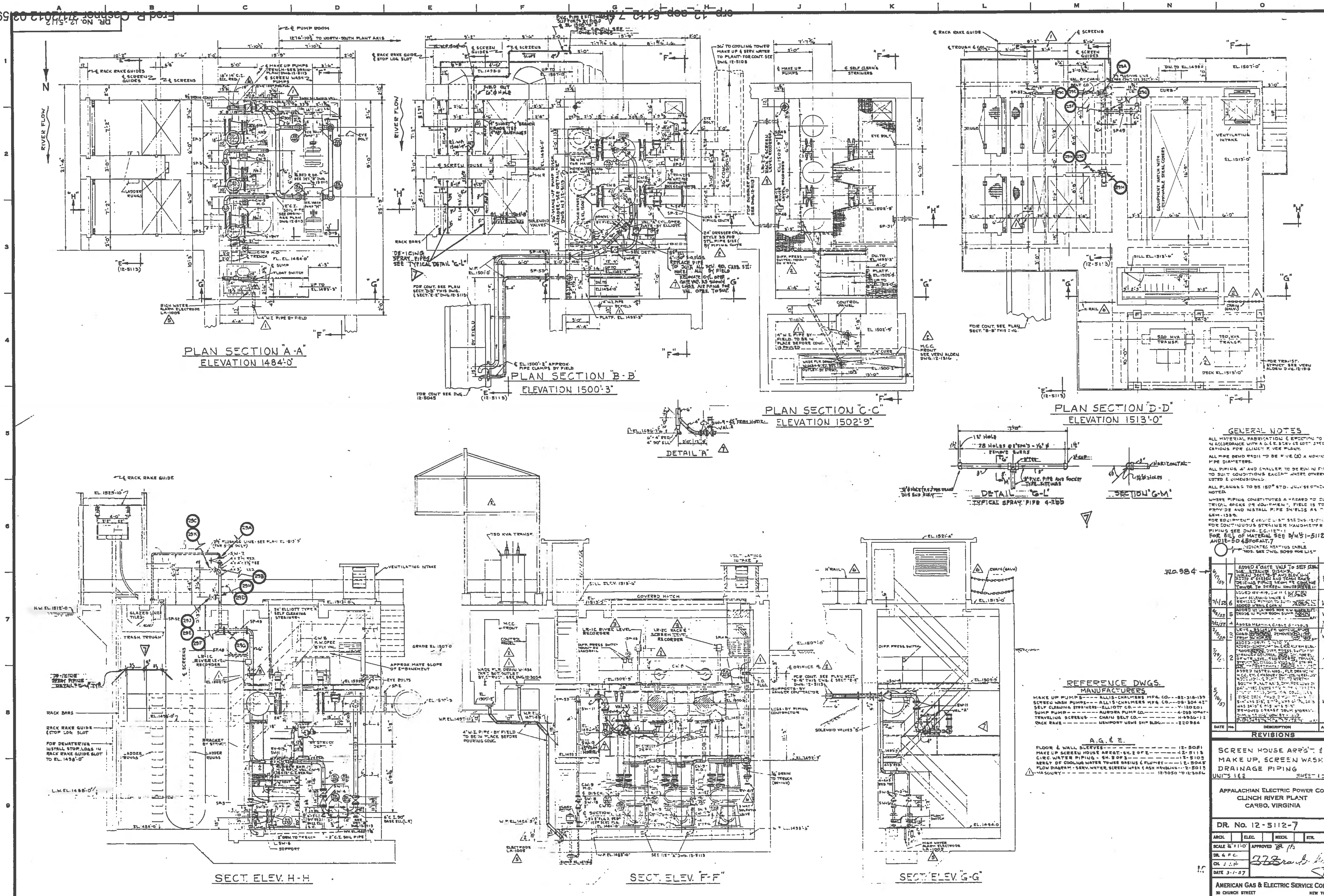

DR. No. 12-5112 Fred R. Gaschler 3/12/2012 02:59 PM
PLAN SECTION "A-A"
ELEVATION 1484'-0"
PLAN SECTION "B-B"
ELEVATION 1500'-3"
PLAN SECTION "C-C"
ELEVATION 1502'-9"
PLAN SECTION "D-D"
ELEVATION 1513'-0"
DETAIL "A"
DETAIL "G-L"
TYPICAL SPRAY PIPE 4-Rqd
SECTION "G-M"
SECT. ELEV. H-H
SECT. ELEV. "F-F"
SECT. ELEV. "G-G"
RIVER FLOW
GENERAL NOTES
ALL MATERIAL FABRICATION & ERECTION TO BE IN ACCORDANCE WITH A.G.&E. SERV. CO. CONT. SPECIFICATIONS FOR CLINCH RIVER PLANT.
ALL PIPE BEND RADII TO BE FIVE (5) x NOMINAL PIPE DIAMETERS.
ALL PIPING 4" AND SMALLER TO BE RUN IN FIELD TO SUIT CONDITIONS EXCEPT WHERE OTHERWISE NOTED & DIMENSIONED.
ALL FLANGES TO BE 150# STD. UNLESS OTHERWISE NOTED.
WHERE PIPING CONSTITUTES A HAZARD TO ELECTRICAL RACKS OR EQUIPMENT, FIELD IS TO PROVIDE AND INSTALL PIPE SHIELDS AS PER GEM-1359.
FOR EQUIPMENT & VALVE LIST SEE DWG. 12-5112
FOR CONTINUOUS STRAINER MANOMETER PIPING SEE DWG. E.C.-127-1
FOR BILL OF MATERIAL SEE B/M 51-5112 AND 12-5045 FOR ALT. 7
INDICATES HEATING CABLE NOS. SEE DWG. 5099 FOR LIST
W.O. 984
REFERENCE DWGS.
MANUFACTURERS
MAKE UP PUMPS---- ALLIS-CHALMERS MFG. CO.---82-318-139
SCREEN WASH PUMPS--- ALLIS-CHALMERS MFG. CO.---08-304 43
SELF CLEANING STRAINERS--ELLIOTT CO.---Y-120201
SUMP PUMP---AURORA PUMP CO.---4-059 10945
TRAVELING SCREENS--- CHAIN BELT CO.--- H-6936-12
RACK RAKE--- NEWPORT NEWS SHIP BLDG.---220984
A.G.&E.
FLOOR & WALL SLEEVES---12-5081
MAKE UP SCREEN HOUSE ARRGT.-SH. 2 OF 2---12-5113
CIRC. WATER PIPING - SH. 3 OF 3---12-5103
ARRGT. OF COOLING WATER TOWER BASINS & FLUMES---12-5045
FLOW DIAGRAM - SERV. WATER, SCREEN WASH & ASH HANDLING---2-5013
MASONRY---12-5050 TO 12-5056
6/17/59 7 ADDED 4" GATE VALS TO SELF CLEAN. STRAINER DISCHS. ... ADDED 4" SCREEN AND TRASH RAKE DEICING PIPING FROM CIRC. COOLING TOWER TO SCREEN HOUSE
7/1/58 6 ADDED RV-419, ... 3 WAY SOLENOID VALVE & REVISED PIPING TO SUIT. ADDED H'RAIL & CHAIN
4/2/58 5 ADDED LA-1005 FOR H.W. ALARM ELECTRODE IN PUMP ROOM SUMP
4 ADDED HEATING CABLE
2/5/58 3
7/29/57 2
5/16/57 1
DATE No. DESCRIPTION APPD.
REVISIONS
SCREEN HOUSE ARR'G'T. & MAKE UP, SCREEN WASH & DRAINAGE PIPING
UNITS 1 & 2 SHEET 1 OF 2
APPALACHIAN ELECTRIC POWER CO.
CLINCH RIVER PLANT
CARBO, VIRGINIA
DR. No. 12-5112-7
ARCH. ELEC. MECH. STR.
SCALE 1/4" = 1'-0"
APPROVED
DR. & F.C.
CH. J.J.H.
DATE 3-1-57
AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

33

Appendix B

Engineering Calculations of Through-Screen Velocity for Traveling Screen Design

Prepared By:	Date
Bob Cashner, PE American Electric Power Lead Engineer	August 12, 2014

Reviewed By:	Date
Radhika de Silva, PhD, PE HDR Engineering, Inc. Senior Project Manager	February 26, 2015

Approved By:	Date
John Burnett HDR Engineering, Inc. Senior Environmental Scientist	February 26, 2015

Calculation Purpose:

Calculate the through-slot velocity at the traveling screens under the design capacity of the screen.

System Description:

The intake structure has two 7 ft-2 in. wide intake openings and contains two conventional traveling water screens (TWS) with each basket frame measuring 6 ft wide by 2 ft high and 3/8-inch square mesh openings. It is assumed that the screen mesh dimensions (where water flows through) for each basket are 71 in. wide by 21 in. high (i.e., 10.3 ft^2). US Filter has provided a percent open area (POA) of 67.9 for a screen with 3/8-in. square openings and #14 (0.080 in. diameter) mesh wire. The bottom of the screens are located at elevation 1,484 ft, compared to a low water level of 1,488 ft, and normal pool level of 1,498 ft.

Calculation Methodology:

For the design and configuration of the Clinch River Plant CWIS, assuming a low water level of 4 ft (or two 2 ft tall baskets submerged) and 1 pump operation (6,500 GPM, or 9.36 MGD), the calculated through-screen velocity[4] at low water level is:

> v = (6,500 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (TWS/2 baskets) x (1/0.679 POA)
>
> v = 0.52 ft/sec

Similarly, the following calculation shows the through-screen velocity using a normal pool level of 14 ft. For the design and configuration of the Clinch River Plant CWIS, with a normal pool level of 14 ft (or seven 2 ft tall baskets submerged) and 1 pump operation (6,500 GPM), the calculated through-screen velocity[4] is:

> v = (6,500 gal/min) x (1 min/60 sec) x (0.1337 ft^3/gal) x (1/2 TWS) x (basket/10.3 ft^2) x (TWS/7 baskets) x (1/0.679 POA)
>
> v = 0.15 ft/sec

[4] Calculated values were rounded to tenths for use within the body of the Clinch River Plan Clean Water Act §316(b) Compliance Submittal Requirements report.

AMERICAN ELECTRIC POWER

American Electric Power
1 Riverside Plaza
Columbus, OH 43215-2373
AEP.com

February 23, 2016

Mr. Mark Trent
Water Permit Manager
Virginia Department of Environmental Quality
Southwest Regional Office
355-A Deadmore Street
Abingdon, Virginia 24210

Re: Appalachian Power Company
Clinch River Plant VPDES Permit Renewal Application Addendum
VPDES Permit No. VA0001015

Dear Mr. Trent,

In response to discussions held on February 3, 2016 between representatives of Virginia Department of Environmental Quality and Appalachian Power Company staff, please find enclosed an addendum to the VPDES permit renewal application for the above-referenced facility and permit, originally submitted on March 12, 2015. This addendum contains additional information on the proposed Ash Pond 1A/1B draining and closure process, interim and long-term wastewater treatment plant sludge management plans, and a stormwater outfall that will be constructed in 2016-2017. A revised EPA Form 2F, Form 2F Notes, Figure 1, and Appendix I are enclosed. These documents are intended to replace those submitted in the initial application.

If you have any questions or need additional information, please contact Lindsey Forhan of my staff at (614) 716-2275 or lgforhan@aep.com.

"I certify under penalty of law that I have read and understand this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Sincerely,

John M. McManus
Vice President, Environmental Services

Enclosures

Please print or type in the unshaded areas only.

EPA ID Number (*copy from Item 1 of Form 1*)
VAD980554596

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

FORM **2F** NPDES

EPA

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number (*list*)	B. Latitude			C. Longitude			D. Receiving Water (*name*)
001	36	56	05	82	11	51	Clinch River
003	36	56	05	82	11	53	Clinch River
007	36	56	45	82	12	03	Clinch River
014	36	55	18	82	12	05	Clinch River
501	36	56	15	82	11	36	Dumps Creek
502	36	56	29	82	11	24	Dumps Creek
503	36	56	9	82	11	54	Clinch River
504	36	56	16	82	11	36	Dumps Creek
701	36	55	54	82	11	46	Clinch River
727	36	55	54	82	12	05	Clinch River

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B: You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall; paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied; each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

 Continue on Page 2

Please print or type in the unshaded areas only.

EPA ID Number (*copy from Item 1 of Form 1*)
VAD980554596

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

FORM **2F** NPDES

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number (*list*)	B. Latitude			C. Longitude			D. Receiving Water (*name*)
731	36	55	48	82	12	04	Clinch River
736	36	55	30	82	12	01	Clinch River
737	36	55	22	82	12	00	Clinch River
738	36	55	20	82	12	10	Clinch River
739	36	55	24	82	12	25	Clinch River
740	36	55	33	82	12	25	Clinch River
801	36	55	22	82	11	44	Possum Hollow
802	36	55	7	82	11	9	Possum Hollow
803	36	55	9	82	10	45	Unnamed isolated stream
736	36	55	30	82	12	01	Clinch River

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B: You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall; paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied; each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

 Continue on Page 2

Continued from the Front

IV. Narrative Description of Pollutant Sources

A. For each outfall, provide an estimate of the area (include units) of impervious surfaces (including paved areas and building roofs) drained to the outfall, and an estimate of the total surface area drained by the outfall.

Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*	Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*
	Please see Note 2, Form 2F Notes and Figures 3-6.				

B. Provide a narrative description of significant materials that are currently or in the past three years have been treated, stored or disposed in a manner to allow exposure to storm water; method of treatment, storage, or disposal; past and present materials management practices employed to minimize contact by these materials with storm water runoff; materials loading and access areas, and the location, manner, and frequency in which pesticides, herbicides, soil conditioners, and fertilizers are applied.

Please see Notes 2 and 3, Form 2F Notes and Figures 3-6.

C. For each outfall, provide the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of the treatment the storm water receives, including the schedule and type of maintenance for control and treatment measures and the ultimate disposal of any solid or fluid wastes other than by discharge.

Outfall Number	Treatment	List Codes from Table 2F-1
	Please see Note 2, Form 2F Notes.	

V. Nonstormwater Discharges

A. I certify under penalty of law hat the outfall(s) covered by this application have been tested or evaluated for the presence of nonstormwater discharges, and that all nonstormwater discharged from these outfall(s) are identified in either an accompanying Form 2C or From 2E application for the outfall.

Name and Official Title (*type or print*)	Signature	Date Signed
John M. McManus VP Environmental Services	John M. McManus	2/23/16

B. Provide a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.

Please see Note 4, Form 2F Notes.

VI. Significant Leaks or Spills

Provide existing information regarding the history of significant leaks or spills of toxic or hazardous pollutants at the facility in the last three years, including the approximate date and location of the spill or leak, and the type and amount of material released.

Please see Note 5, Form 2F Notes.

 Continue on Page 3

Continued from Page 2

EPA ID Number (*copy from Item 1 of Form 1*)
VAD980554596

VII. Discharge Information

A, B, C, & D: See instructions before proceeding. Complete one set of tables for each outfall. Annotate the outfall number in the space provided.
Table VII-A, VII-B, VII-C are included on separate sheets numbers VII-1 and VII-2.

E. Potential discharges not covered by analysis – is any toxic pollutant listed in table 2F-2, 2F-3, or 2F-4, a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ Yes (*list all such pollutants below*) ☑ No (*go to Section IX*)

The Company does not specifically use any of the substances identified in Table 2F-2 in the generation of electricity. However, some of the metals on the list may be present in coal combustion by-products due to their presence in coal.

VIII. Biological Toxicity Testing Data

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☑ Yes (*list all such pollutants below*) ☐ No (*go to Section IX*)

Please see Appendix E for a summary of whole effluent toxicity testing performed at Outfalls 003, 007, and 727 over the current permit term.

IX. Contract Analysis Information

Were any of the analyses reported in Item VII performed by a contract laboratory or consulting firm?

☑ Yes (*list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below*) ☐ No (*go to Section X*)

A. Name	B. Address	C. Area Code & Phone No.	D. Pollutants Analyzed
John E. Dolan Laboratory	4001 Bixby Road Groveport, OH 43215	(614)836-4210	Oil & Grease COD TSS TKN Nitrate/Nitrite Total Phosphorus Metals
TestAmerica Laboratories, Inc.	TestAmerica Pittsburgh 301 Alpha Drive RIDC Park Pittsburgh, PA 15238	(412)963-7058	BOD-5

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title (*Type Or Print*)	B. Area Code and Phone No.
John M. McManus, VP Environmental Services	(614) 716-1268
C. Signature: John M. McManus	D. Date Signed: 2/23/16

Form 2F Notes *(Revised 2-23-16)*

Note 1: Form 2F Part VII Discharge Data

Due to limited staff presence and infrequent qualifying storm events, Plant staff were unable to collect samples in accordance with the requirements of Form 2F, Part VII for Outfalls 701, 731, 736, 737, 738, 740, 801, 802, and 803 prior to submittal of this application. The required monitoring will be performed during the soonest qualifying storm event during which the appropriate Plant staff are onsite and reported via an addendum.

Note 2: Further Description of Outfalls Containing Stormwater Runoff

Outfall 001 – Reclaim Pond Discharge

Bottom ash, fly ash, pyrites, and wastewater treatment plant sludge are routinely sluiced to Ash Pond 1A/1B for settling and disposal. After a period of settling, the Pond 1A/1B supernatant is decanted to the Reclaim Pond. The Reclaim Pond also receives water collected in the active landfill leachate ponds as well as seepage from the Pond 1A/1B dike system. Under normal operating conditions, wastewater from the Reclaim Pond is pumped back to the Plant in a closed loop system and re-used for transportation of the wastes listed above back to Pond 1A/1B. Typically there is no direct discharge from the Reclaim Pond. However, precipitation that lands directly on the landfill ponds, the Reclaim Pond, and the immediate drainage areas surrounding these ponds could be discharged via Outfall 001 in the event of a Reclaim Pond overflow.

There are no significant materials stored within the drainage area for the reclaim pond. The drainage area immediately surrounding and including the pond is approximately 1 acre in size. None of the drainage area is impervious.

Outfall 003

Stormwater runoff from a variety of Plant areas is discharged via Outfall 003. These drainage areas include:

- Roof drains from Units 1, 2, and 3
- Transformer deck
- Runoff collected from the landfill that is comingled with leachate and pumped to the WWTP
- Precipitation that lands directly on the cooling towers, reclaim pond, and ash ponds
- Northeast portion of the Plant yard from the main entrance to the cooling towers, including the precipitator area and area around the ash silo.

These areas total approximately 6.5 acres. Runoff from a fraction of that area is treated in the AWWTP before discharge. Specifically, runoff from the Plant roof drains, transformer deck, precipitator area, and the area directly underneath the ash silo undergoes treatment (described in Appendix A) with other plant wastewaters in the AWWTP. These drainage areas from the Plant that directly enter the AWWTP total approximately 0.5 acres, all of which is impervious. Additionally, much of the precipitation that lands directly on the Reclaim Pond and Ash Pond1A/1B is reused and/or evaporates, but some is likely treated and discharged through the AWWTP.

While this discharge is identified as containing stormwater runoff from the areas identified above, the Company believes that it is not necessary or appropriate for any stormwater monitoring requirements to be applied to this treatment system for the following reasons. The typical storm water flows discharged through Outfall 003 make up only a small portion of the overall contribution to the discharge. The stormwater that does enter the system undergoes the same treatment as the wastewater discharged through the system. Finally, the Company believes that it is impractical to determine when or how to sample the final discharge at a time when it could provide data representative of a storm event. Due to the dynamic nature of this treatment system based on any given day's wastewater flows, and the mixing effect the treatment system would have on the storm water, it would be virtually impossible to determine at what point in time the discharge from this system would provide representative data of a given storm event.

Outfall 007

Stormwater runoff discharged via Outfall 007 includes drainage from the following areas:

- Coal storage pile and surrounding area
- Main office building
- 138-kV switchyard
- A small area near the tractor shed
- Truck coal scale
- Warehouse "D"
- Used oil storage area
- Circulating water house 1&2
- A portion of the coal haul road

In addition to the drainage areas above, stormwater landing directly on the ponds and the drainage areas immediately surrounding the ponds enters this treatment system prior to discharge. The total drainage area is approximately 25.5 acres. Runoff from all of these areas drains to a common sump located within the coal pile, from which it is pumped to the first of two retention ponds. The stormwater runoff is stored for a period of time sufficient to allow for settling of suspended solids. The supernatant is transferred to the second retention pond for additional settling prior to discharge.

While the stormwater runoff typically requires a relatively short time to facilitate solids settling, the Company may, at some point in the future, choose to use a commercially available polymer for water treatment to facilitate the settling of solids.

Materials stored within the Outfall 007 drainage area include coal, diesel fuel, rail cars, heavy equipment, and the dust suppressant CoalTrol-60. Approximately 2.6 acres of the drainage area are impervious.

Outfall 014

Stormwater runoff and leachate from the Plant's coal combustion by-product (CCB) landfill are collected and comingled in two (2) retention basins prior to transfer to the Plant's primary WWTP and eventual discharge via Outfall 003. The basins are designed to contain a volume of runoff that would be expected from the 25-year, 24-hour storm event. If a storm event were to exceed the design capacity of the basins, or the Plant capacity to pump accumulated water to the WWTP, the excess water can be discharged to the Clinch River via a 24-inch concrete pipe. There are no significant materials storage areas within the Outfall 014 drainage area. The drainage area is estimated to be 8.3 acres. The retention basins are lined with a 60-mil PVC liner, therefore the full area could be considered impervious.

Outfall 701

Stormwater runoff from an area adjacent to Cooling Tower 1 and a materials storage area enters a vegetated swale running parallel to Cooling Tower 1 and is discharged to the Clinch River. Almost the entire drainage area is vegetated with grass which aids in stormwater flow attenuation. Pallets, piping, cable, and other miscellaneous Plant maintenance materials may be stored in this drainage area. The area is approximately 3.1 acres in size and none is considered impervious.

Outfall 727

Stormwater runoff from the following areas drains to Outfall 727:

- Plant main entrance area
- The area surrounding the stacks, ash silo, and precipitators
- Paved employee and visitor parking lot
- Warehouse "C" and the urea bulk storage and unloading area
- The area near the aboveground salt storage tank
- The Plant warehouse and a shipping and receiving area

Stormwater runoff from Warehouse "C" and the urea bulk storage and unloading area flows to a low point storm drain and is discharged directly to Outfall 727. Stormwater runoff from the remainder of these areas is collected in a retention basin known as Watson's Pond for settling of entrained solids. The supernatant passes through a baffle near the southern end of the pond. The pond is manually discharged on an as-needed basis by operation of a knife gate valve after the basin contents have been inspected by Plant personnel. As the frequency of discharges is primarily dependent on the frequency and magnitude of storm events, this discharge is best characterized as intermittent. The discharge flows to a catch basin located on the drainage line leading to Outfall 727. A separate stormwater drainage area leading directly to Outfall 727 includes the Plant area to the south and east of the main Plant buildings.

The normal controlled discharge is similar to Outfall 007, and the flow from the basin is regulated during routine discharge at a rate of 0.48 MGD.

Materials stored and handled within the Outfall 727 drainage area include the following:

- Scrap metal, including a scrap metal dumpster and scrap metal hopper
- The 257,000-gallon bulk urea storage tank, equipped with secondary containment
- Wooden pallets, cable, miscellaneous piping and metal materials for construction projects
- Bins for the temporary storage of pyrites, reject coal, and fly ash prior to disposal
- The dry fly ash handling system is located adjacent to this drainage area. Trucks used to transport fly ash to the landfill travel through the Outfall 727 drainage area on a routine basis.
- The coal conveyor transporting coal from the coal storage pile to the Plant passes through a portion of the drainage area. The aboveground salt brine storage tank is located in this drainage area immediately south of the Plant office building.
- Various materials shipped to or from the Plant may be temporarily stored within the shipping/receiving area. These could include bulk chemicals, used oils, fuel oils, diesel fuel and gasoline. Various waste materials can also be stored within this drainage area prior to disposal. These could include drums of waste mineral oil, oil-filled electrical equipment that have been removed from service, and drums of cleanup debris.

<u>Outfall 731</u>

A small drainage area near the tractor shed adjacent to the coal pile is collected in a catch basin that enters a storm drain leading to the Clinch River. This 1-acre drainage area includes a section of rail lines used to transport coal to the Plant coal storage pile. The Plant's ash handling contractor maintains a small trailer within the drainage area for personnel use. An oil drum storage shed equipped with concrete secondary containment is located within the drainage area. The total impervious area draining to Outfall 731 is approximately 0.1 acres.

Outfalls 736-740

These five outfalls were created during the expansion of the Plant's active CCB landfill beginning in 1993, with the purpose of conveying non-contact stormwater away from the landfill to the Clinch River. There are no materials stored in the stormwater drainage areas surrounding the Plant's active CCB landfill.

The approximate size of each drainage area at the CCB landfill is listed below. No significant impervious areas exist within any of the drainage areas. A topographic map showing the location of each outfall and its respective drainage area is included as Figure 3.

- Outfall 736 – 14.8 acres
- Outfall 737 – 6.2 acres
- Outfall 738 – 8.2 acres
- Outfall 739 – 8.2 acres
- Outfall 740 – 94.1 acres

Outfalls 501 and 502 – Ash Pond 2 Post-Closure Stormwater Management

The closure of Ash Pond 2 resulted in two stormwater outfalls that drain stormwater runoff and non-contact infiltration from the engineered cap system to Dumps Creek. Final grading is such that stormwater runoff from 6.4 acres constituting the west portion of the cap drains to Outfall 501. An additional 15.5 acres of offsite tributary area also drain to Outfall 501 for a total drainage area of 21.9 acres. The eastern 10.7 acres of the cap drain to Outfall 502, along with approximately 11.3 acres of offsite tributary drainage for a total drainage area of 22 acres. A geocomposite drainage net (GDN) installed 24 inches below final grade over the entire capped area collects non-contact infiltration and conveys it to each outfall for the respective drainage area. The conveyance capacity of the GDN prevents saturation of the cap.

Outfalls 501 and 502 became functional after the closure of Ash Pond 2 was complete and the drainage areas achieved final stabilization in the form of perennial vegetation. They have discharged stormwater under the VPDES General Permit registration VAR052112. No materials are stored within the Outfall 501 or 502 drainage areas, and neither drainage area contains significant impervious surface area. Appendix I contains a request to incorporate Outfalls 501 and 502 into the reissued permit.

Outfalls 503 and 504 – Ash Pond 1A/1B Stormwater Management

A stormwater diversion system is being constructed around the active ash settling ponds (Ash Pond 1A/1B) under a directive from Virginia DCR. Construction began in 2014 and is ongoing as of the date of this application. The diversion system consists of a berm and channel that intercept stormwater runoff from offsite tributary areas and convey it around the facility to a discharge point on the Clinch River. This discharge is identified as Outfall 503. Discharges currently consist of construction stormwater runoff under VPDES general permit registration VAR10E-293. Following project completion and site stabilization, all discharges will be non-contact stormwater.

The Outfall 503 drainage area is currently approximately 63.6 acres. A legacy ash disposal site occupies approximately 8 acres of the drainage area, and the remainder is offsite wooded terrain. The ash fill site has protective cover and well-established vegetation that is regularly mowed and visually inspected. Following closure of Ash Pond 1A/1B, Outfall 503 will also drain surface runoff and non-contact infiltration from a 15.8-acre portion of the pond cap. The outfall was designed to account for the full future drainage area. The Plant does not store any materials within the Outfall 503 drainage area. The diversion system consists partially of a concrete collection channel and energy dissipator basin totaling approximately 1 acre of impervious surface area.

A second stormwater outfall, identified as Outfall 504, will result from the closure of Ash Pond 1A/1B. It is expected to be complete in mid-2018. Outfall 504 will drain surface runoff and non-contact infiltration from an 8.7-acre portion of the pond cap and 65.2 acres of offsite wooded terrain. The Plant will not store any materials within the Outfall 504 drainage area. The collection channel draining to Outfall 504 will be a combination of VDOT Class 1 riprap, gabion baskets, and VDOT Class 2 grouted riprap totaling approximately 1 acre of impervious surface area.

Appendix I contains a request to incorporate Outfalls 503 and 504 into the reissued permit.

Outfalls 801, 802, and 803 – Possum Hollow Landfill Stormwater Management

Three stormwater management ponds were constructed as part of the Possum Hollow Landfill. Details of each pond and associated outfall are discussed below:

- Outfall 801 is the discharge point from the pond identified as the Haul Road Pond. It collects stormwater runoff primarily from the asphalt haul road via a roadside ditch. Approximately 25.12 acres drain to the Haul Road Pond, which was sized to handle the water quality volume specified by the VSMP regulations. The outlet of the pond is considered Outfall 801 and discharges to Possum Hollow, a tributary of the Clinch River.

- Outfall 802 is the discharge point for the stormwater pond identified as the North Pond. It collects runoff from a portion of the asphalt haul road via a roadside ditch, as well as runoff from vegetated areas around the landfill (North landfill buttress). Groundwater interceptor drains also drain into the North Pond. The tributary area is approximately 50.6 acres and the pond was sized to handle the water quality volume specified by the VSMP regulations. Outfall 802 also discharges to Possum Hollow.

- Outfall 803 is the discharge point from the pond known as the South Pond. It collects stormwater runoff from vegetated areas around the landfill (South landfill buttress). Groundwater interceptor drains also drain into the South Pond. Approximately 15.8 acres drain to the South Pond, which was sized to handle the water quality volume specified by the VSMP regulations. Outfall 803 discharges to an unnamed tributary which has no surface connection to waters of the United States.

At the time of the last VPDES permit renewal (December 2009) Outfalls 801, 802, and 803 were not yet constructed. A complete EPA Form 2F was submitted in July 2012 for each outfall following construction and final stabilization of all tributary areas. As of the date of this application, no coal combustion by-products have been disposed in the Possum Hollow Landfill.

Note 3: Herbicide Use

Portions of the Plant property undergo scheduled herbicide treatment on an annual basis. The primary herbicides used are Accord® and Pendulum®, or a similar product. Each is mixed in accordance with manufacturers' recommendations. The stormwater drainage areas affected by herbicide application are Outfalls 001, 003, 007, and 727. Areas surrounding the AWWTP and Cooling Towers 2, 3, and 4 are also included within the scheduled spraying program. Stormwater runoff from these areas is in the form of sheet flow.

Note 4: Non-Stormwater Discharges

The outfalls identified on EPA Form 2F have all been visually inspected or identified based on knowledge of Plant operations to be free of non-stormwater discharges. The drainage points directly observed include Outfalls 501, 502, 727, 731, 736-740, and 801-803. Observations took place in accordance with the monthly visual inspection requirement in the Plant's Stormwater Pollution Prevention Plan.

Note 5: Significant Leaks or Spills

There is no history of significant leaks or spills of toxic or hazardous substances occurring in the past 3 years in the drainage areas of the outfalls identified on Form 2F. However, a list of all oil and other spills that have occurred at Clinch River Plant in the past three years is included below:

January 25, 2013 – Unanticipated bypass of approximately 10,000 gallons of circulating cooling water from a flume overflow at the AWWTP due to a faulty high level alarm.

May 23, 2013 – Release of approximately 1,000 gallons of non-contact stormwater from the Possum Hollow Landfill Leachate Collection Sump due to malfunction of an automated control valve.

April 25, 2014 – Equipment failure resulted in fuel oil reaching Sump 004, which was then transferred to the AWWTP. A sheen was observed on the Clinch River and subsequently controlled with floating booms and absorbent materials. Due to partial containment of the spill at its source and within the AWWTP, the full spill volume is unknown.

Note 6: Representative Data for Stormwater Outfalls

The Company believes the following outfalls qualify as representative discharges for the reasons described below.

Outfalls 736-740

As described in Note 1, Outfalls 736-740 collect non-contact stormwater runoff from the active CCB landfill and convey it to the Clinch River. Each outfall is similar with regard to industrial activity, materials stored, land use characteristics, and stormwater management practices within the drainage area. As such, the Company and DEQ have historically agreed that Outfalls 736-740 are similar to the extent that stormwater characterized at any one outfall is representative of that discharged from all five. Storm event sampling for the purpose of this application will be performed at any one of Outfalls 736-740 and the water quality data obtained will be reported for each outfall.

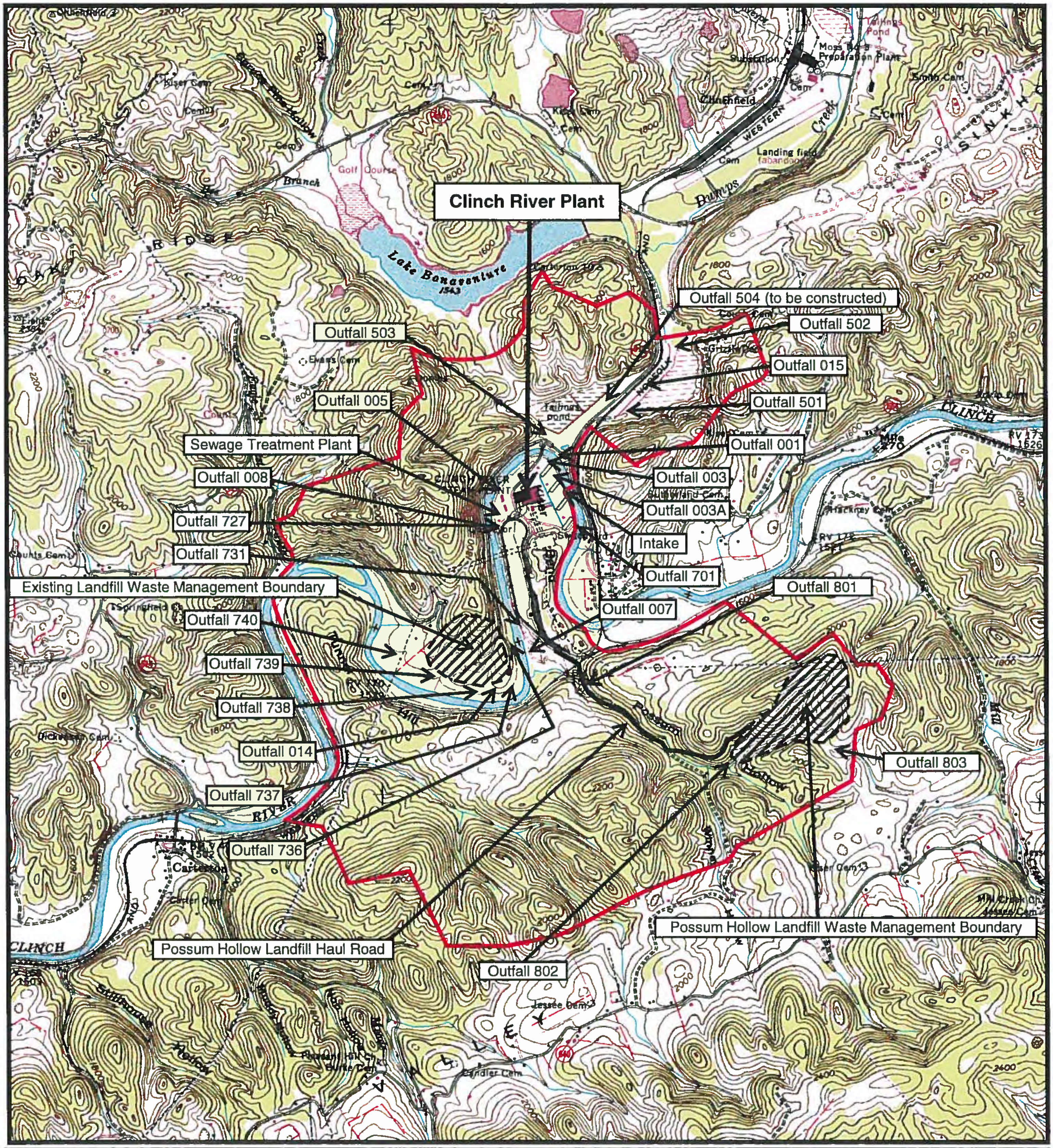
Outfalls 501 and 502

As described in Note 1, Outfalls 501 and 502 discharge surface runoff and non-contact infiltration from the cap of Ash Pond 2 following pond closure. Each outfall drains a portion of the capped pond, as well as runoff from tributary areas up-gradient of the pond. The cap system is uniform in design and construction over the entire pond surface, and the off-site drainage areas are alike in terms of slope, soil type, ground cover, etc. As such, the Company believes that these outfalls qualify as representative discharges. Storm event sampling was performed at Outfall 502 and the water quality data obtained is being reported for both outfalls.

Outfalls 801-803

As described in Note 1, Outfalls 801, 802 and 803 each drain a portion of the Possum Hollow Landfill. Under normal operations, stormwater discharges from each of these three outfalls can be reasonably expected to be similar due to industrial activity, materials storage, land use characteristics, and stormwater management practices within each drainage area. To date, no waste has been placed in the Possum Hollow Landfill. Storm event sampling for the purpose of this application will be performed at any one of Outfalls 801-803 and the water quality data obtained will be reported for each outfall.

Figure 1



N

Carbo, VA Quadrangle
USGS Topographic Map

Plant Boundary (not actual survey, for general info only)

0 ½ 1mi

02.16.15

Appalachian Power Company
Clinch River Plant
VPDES Permit No. VA0001015
Outfall Location Map

Plant Latitude 36° 55' 58"
Plant Longitude 82° 11' 59"

AEP

Appendix I *(Revised 2-23-16)*

Permit Modification Requests

Permit Modification Request 1 – Additional Stormwater Outfalls

As discussed in Note 2, Form 2F Notes, stormwater Outfalls 501 and 502 resulted from the closure of Ash Pond 2. A complete Form 2F is included in this application for each Outfall 501 and Outfall 502. The Company requests the incorporation of these outfalls into the reissued permit. A third stormwater outfall designated as Outfall 503 will become functional in mid-~~2015~~ 2016 as part of the Ash Pond 1A/1B stormwater diversion project. A more detailed description of Outfall 503 and its drainage area is included in Note 2, Form 2F Notes. The Company also requests the incorporation of Outfall 503 into the reissued permit, with the condition that a complete Form 2F will be submitted to DEQ for the outfall within 1 year of its completion and drainage area stabilization.

Discharges of stormwater from Outfalls 501, 502, and 503 are currently covered under General Permit registrations VAR052112 and VAR10E293. The Company proposes to terminate General Permit coverage following incorporation of these outfalls into the reissued permit.

A plan for closure of Ash Pond 1A/1B was submitted to Virginia DEQ as part of a Solid Waste Part B Permit Application on January 8, 2016. The design will result in a stormwater outfall, to be identified as Outfall 504, at the eastern side of the facility. Similar to Outfalls 501, 502, and 503, it will collect surface runoff and non-contact infiltration from the pond cap and some amount of tributary off-site terrain. It will be sized to safely convey the 0.9 PMF storm event in accordance with Virginia DCR Dam Safety regulations. It will convey stormwater to Dumps Creek via the existing pipe bridge tunnel under State Route 616. The tunnel will be retrofitted with appropriately sized stormwater piping. Closure of Pond 1A/1B and completion of Outfall 504 are scheduled to take place by April 2018.

The Company requests the incorporation of Outfall 504 to the reissued permit, with the condition that a complete Form 2F will be submitted to DEQ for the outfall within 1 year of its completion and drainage area stabilization. The Company suggests the following language be added to the reissued permit:

"**Sampling to Fulfill Form 2F Requirements** – A completed EPA Form 2F shall be submitted for Outfalls 503 and 504 within one year of completion and commencement of discharge."

Permit Modification Request 2 – Decreased STP Sampling Frequency (Outfall 008)

The Clinch River Plant Sewage Treatment Plant (STP) has a design flow of 0.012 MGD and historically served approximately 200 Company and contract employees on a given day. For a combination of reasons the Plant staff complement has decreased in recent years to 58 permanent staff and a varying number of contractors, to date. During 2014 the average discharge from Outfall 008 was less than 0.002 MGD. Clinch River Plant is currently required to provide a daily estimate of discharge flow rate and to collect grab samples at varying frequencies for four other parameters. Measurements of pH are taken six days per week; *E. coli* are measured weekly; BOD_5 and total suspended solids are measured once per month. As shown in the DMR Summary included in Appendix C, pH has been measured consistently within the permit limits of 6.0 – 9.0 over the current permit term. To better align with the above-described staff availability at the Plant and operation of the STP, the Company requests to decrease the pH monitoring requirement to four days/week.

Permit Modification Request 3 – Request to Discontinue Biological Monitoring

Whole effluent toxicity testing was conducted for Outfalls 003, 007, and 727 at varying intervals over the current permit term. The monitoring results are presented in Appendix E. As shown, limited toxicity was observed in testing the effluent of Outfalls 003 and 727. No toxic effects were observed during any of the tests of Outfall 007. Based on the results presented, the Company requests to discontinue biological monitoring for Outfalls 003, 007, and 727 during the upcoming permit term.

Permit Modification Request 4 – Clinch River Plant Fuel Conversion

The generating units at Clinch River Plant are not, in their current condition, equipped to comply with recently approved and anticipated air emissions regulations. Appalachian Power Company evaluated alternatives and determined that Units 1 and 2 will be converted to burn natural gas and Unit 3 will be permanently retired. The Virginia State Corporation Commission granted a Certificate of Public Convenience and Necessity for this proposal on December 20, 2013. The combined unit conversion and retirement plan best meets forecasted customer needs while taking into account economic and environmental considerations. The two converted units will have a nominal generating capacity of 242 megawatts each, for a Plant nameplate capacity of 484 megawatts.

The primary driver for the fuel conversion is the Mercury & Air Toxics Standards (MATS) rule. The resultant emissions reductions from combustion of natural gas instead of coal are projected to comply with applicable Air Toxic regulations without the addition of substantial pollution control equipment. Unit 3 will not be converted and will permanently retire on June 1, 2015. Virginia DEQ granted the Company a 1-year administrative extension for compliance with the MATS rule for Units 1 & 2 to April 16, 2016. After that date, coal will no longer be burned in either unit at Clinch River Plant. Unit 1 is scheduled to undergo the fuel conversion process beginning in September 2015, followed by Unit 2 in February 2016. The expected duration of each unit outage is 12-16 weeks. The scheduled outage start dates are dependent on a number of variables and are subject to change. There may be a transitory period from late 2015 to early 2016 during which Unit 1 will be operational on natural gas and Unit 2 and/or Unit 3 will continue to burn coal. Both unit fuel conversions are expected to be complete by mid-2016. The anticipated impacts of the fuel source conversion on Clinch River Plant water intake, use, and discharges are summarized below.

Plant Intake

Water withdrawals following the fuel conversion of Units 1 and 2 and the retirement of Unit 3 are expected to decrease by approximately one-third from existing rates. No new facilities are needed for water withdrawals. Clinch River Plant's current intake structure is not proposed to be modified. The intake flow reduction further substantiates the finding of Best Technology Available (BTA) for the cooling water intake structure, as described in Appendix H, under CWA §316(b).

Outfall 003

In the absence of coal combustion, Plant process waters will no longer come into contact with coal combustion byproducts (CCBs) other than seepage and leachate from previously disposed CCBs. Water flows related to CCB handling and the operation of Unit 3 will be eliminated, including:

- Fly ash and bottom ash sluice water
- Water used in the fly ash silo mixer
- Ash tank overflows
- Decanted water from the ash settling ponds (following pond closure)
- Cooling Tower 5 blowdown

Operation of the primary WWTP and the AWWTP will continue as described in Appendix A. No physical modifications to the wastewater treatment process are currently proposed, although chemical feed rates may be adjusted to account for changes in incoming wastewater quality. As shown on the draft water balance diagram, the upcoming closure of the ash settling pond complex dictates the need for an alternate solids removal mechanism. Various press systems and other options are currently being evaluated and will be installed once a design is selected. In the interim, solids will continue to be managed using Pond 1A/1B as a settling and disposal basin until its closure.

Outfall 007

Although Clinch River Plant will no longer use coal as a fuel source, the existing coal storage area, handling, and blending systems are proposed to remain in operation after the fuel conversion and Unit 3 retirement. The Company is in the process of forming agreements for external use of the facility. Coal is currently delivered to the Plant by rail via an unloading system near the southern end of the Plant, where it is managed in a 5.7-acre storage pile prior to use in the generating units. Under the tentative agreement, the Plant will continue to receive coal by rail and manage the storage pile, including handling and blending. From the storage area coal will be trucked to an external destination for use by an outside party. Appalachian Power Company will not be involved in the handling or disposal of resultant CCBs from the end-user of the coal. However, it is anticipated that the coal pile runoff ponds will remain operational during the upcoming permit term and the Company will retain responsibility for the effluent water quality discharged via Outfall 007. It is important to note that an agreement has not yet been finalized and the stated conditions are subject to change. If finalized, this agreement will be communicated to DEQ in a separate submittal.

Outfall 008

Clinch River Plant is expected to maintain a post-conversion staff complement of 40 permanent employees with a varying number of contractors on site at any given time. As indicated on the DMR summary, the Outfall 008 discharge is expected to remain significantly below the design basis of 0.012 MGD. No modifications to the treatment process are proposed, other than the requested reduction in pH monitoring.

Draft Water Balance Diagram

The following figure shows a draft post-conversion water balance diagram for the Plant that provides anticipated flow patterns and rates. In addition to the water balance changes described above, other various Plant process waters related to operation of the generating units are anticipated to decrease by approximately one-third due to the Unit 3 retirement. It is important to note that the included flow patterns and rates are estimations based on a variety of factors that are subject to change.

Permit Modification Request 5 – Ash Pond 1A/1B Closure

The Company will close Ash Pond 1A/1B (Pond 1) by April 18, 2018 to comply with the federal coal combustion residuals rule (40 CFR 257). Pond 1 must be drained of free water in order to facilitate closure construction activities. The draining process is scheduled to begin in March 2016 to allow construction to begin in June 2016. Cell 1B of the pond has a discharge structure that drains via a 36" concrete pipe to the Plant's reclaim pond. The significant portion of the effluent from the reclaim pond was historically recirculated through the Plant for ash transport, while excess reclaim pond effluent was routed to the wastewater treatment plant system (WWTP/AWWTP) for treatment and discharge. The Plant ceased burning coal in October 2015 and no longer generates ash. Therefore, once the Pond 1 draining process initiates, the effluent from the reclaim pond will be solely pumped to the WWTP/AWWTP for treatment and discharge.

As of the date of this submittal, the Pond 1 level is being maintained at the elevation of the discharge structure, approximately 1554.0'. A bathymetric survey was performed by D.R. Price Engineering & Land Surveying, Inc. in November 2014. The survey resulted in the approximate storage volume described below.

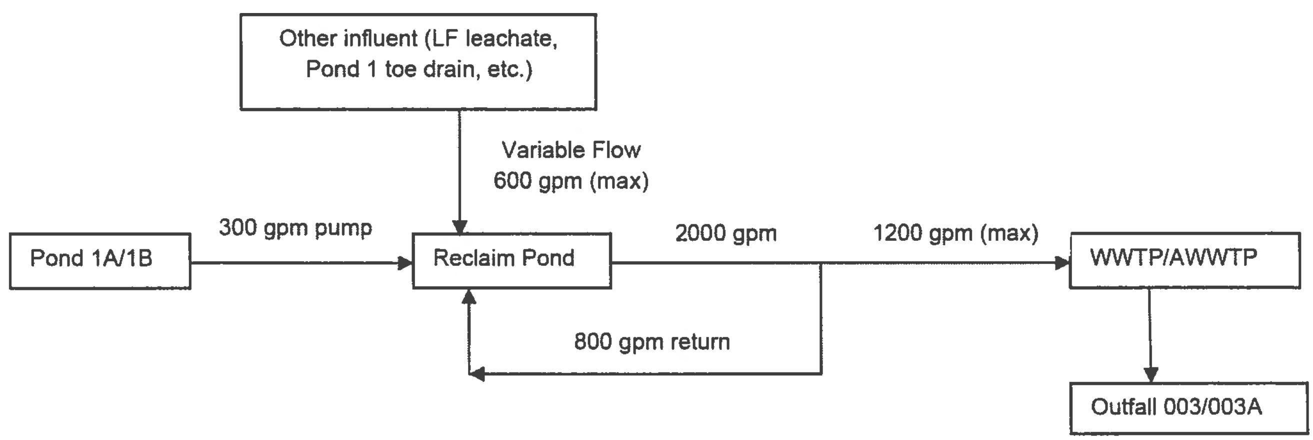
Elevation Increment	Storage (Acre-Feet)	Cubic Feet	Gallons
Below 1541.0'	0.00330	143.6	1,074.4
1541.0-1542.0	0.00038	16.6	124.4
1542.0-1543.0	0.02426	1,056.8	7,905.4
1543.0-1544.0	0.08989	3,915.8	29,292.1
1544.0-1545.0	0.19701	8,581.8	64,196.6
1545.0-1546.0	0.41853	18,231.1	136,378.3
1546.0-1547.0	0.62269	27,124.4	202,904.9
1547.0-1548.0	0.79054	34,436.1	257,600.0
1548.0-1549.0	0.97959	42,670.8	319,199.5
1549.0-1550.0	1.28777	56,095.1	419,620.1
1550.0-1551.0	1.64090	71,477.8	534,691.0
1551.0-1552.0	1.99622	86,955.2	650,469.9
1552.0-1553.0	2.37489	103,450.2	773,860.9
1553.0-1554.0	2.79991	121,963.9	912,353.1
TOTAL	**13.22588**	**576,119.3**	**4,309,372.6**

Based on the November 2014 survey, total volume in Pond 1 at elevation 1554.0' is calculated to be approximately 4.31 MG. The current storage volume may be slightly less based on some amount of filling by ash transported between November 2014 and October 2015.

Pond 1 will be drained to the extent possible using the existing discharge structure, after which a temporary pump system will be used to drain the remaining free water to the reclaim pond. The temporary pump(s) are proposed to operate at 300 gpm to ensure that inflow to the reclaim pond does not exceed outflow. Other influent flows to the reclaim pond include various toe drains, landfill leachate and stormwater. These combined sources are estimated to contribute a maximum of 600 gpm to the reclaim pond.

Three (3) 2,000-gpm pumps transport reclaim pond effluent either back to the ash transport system for reuse or to the WWTP/AWWTP for treatment and discharge. The ash transport system will be decommissioned once the Pond 1 draining process initiates, so all reclaim pond effluent will be pumped to the WWTP/AWWTP. During Pond 1 draining only one (1) of the 2,000-gpm pumps will run at a given time. The reclaim pond is proposed to be discharged to the WWTP/AWWTP at a rate of 1,200 gpm. An 800-gpm return line will return excess flow to the reclaim pond to match pump rates. The 1,200 gpm discharge will be directed to the WWTP/AWWTP via the existing 18" HDPE reclaim line, which feeds the ash tanks via a 10" line. The controlled overflow from the ash tanks is directed to the grit tank, which feeds the primary WWTP. Effluent from the primary WWTP is directed to the AWWTP. A flow diagram of this arrangement is as follows:

Initial Pond 1A/1B Draining (March – June 2016)



The Company expects to drain Pond 1 at a rate of 300 gpm for approximately 10 hours per day. This amounts to a drawdown volume of 180,000 gallons per day. Excluding input from precipitation events, this process would require approximately 24 working days to drain the full volume of the pond.

The WWTP/AWWTP system has a maximum design flow capacity of approximately 8 MGD, while the expected design flow rate will be approximately 5 MGD with both Unit 1 and Unit 2 in service. Over the current permit term, the discharge flow rate from Outfall 003 has averaged approximately 1.64 MGD. Units 1 and 2 are currently undergoing a fuel source conversion, and at the time the Company anticipates draining Pond 1, it is anticipated that one or both converted generating units may still be out of service. During these outages the WWTP/AWWTP experiences reduced inflow. Therefore, the additional 0.18 MGD input to the WWTP/AWWTP from Pond 1 draining will not increase the Outfall 003 flow rate beyond normally observed levels, as well as not increase the Outfall 003 flow rate beyond the maximum design flow capacity.

The composition of the effluent to Outfall 003 during initial Pond 1 draining is expected to be similar to recent effluent quality, as solids removal will not be significantly different and all wastewater will be processed through the AWWTP treatment steps.

Pond 1A/1B Closure Stormwater Management

The Company will continue to manage stormwater at the site in the manner described above during conditions of exposed ash. Two basins are proposed that have been sized to contain runoff from the 25-year, 24-hour storm event. One 300-gpm pump will be installed in each basin to convey water to the reclaim pond on an as-needed basis. Reclaim pond effluent will continue to be treated in the WWTP/AWWTP and discharged via Outfall 003.

WWTP/AWWTP Sludge Management During and After Pond 1A/1B Closure

The Plant's wastewater treatment system is currently operated such that wastewater treatment solids are sluiced to Ash Pond 1A/1B for settling. However, during and after the pond closure, the sludge requires an alternate solids removal method that will no longer be provided by the pond. The Company evaluated alternatives and selected a screw filter press system for long-term management of WWTP/AWWTP solids. The Company is moving forward with design and procurement of that system. It is expected to be installed and operational in late 2016. The pond closure is scheduled to start in mid-2016, therefore an interim sludge handling and solids removal method is also required. The following are descriptions of both the interim and long-term solutions.

Interim Sludge Management Plan

During the period after Pond 1 no longer accepts wastewater but before the screw press is installed and operational, the Company intends to use a vendor-supplied system consisting of vacuum filter boxes with 250 micron filter liners to capture and dewater wastewater treatment solids (sludge). This method of wastewater treatment solids management is expected to take place from approximately March 2016 – November 2016.

The wastewater treatment solids will be conditioned with a polymer flocculant for increased removal of solids. The proposed polymer is Formula 7560 manufactured by the Garratt-Callahan Company. The product SDS is attached. The Company anticipates using the product at a rate of 200-250 ppm. Based on a calculated maximum daily flow rate of WWTP/AWWTP sludge to the filter boxes of 4,286 gallons, polymer usage at 250 ppm would result in 8.93 lbs of undiluted polymer used per day. This amounts to total usage of 1,777 lbs of the Formula 7560 polymer over the expected course of the interim sludge management plan.

Following polymer injection, the sludge will be pumped through the vacuum filter boxes with liners to capture the wastewater treatment solids. Once filled to capacity, each vacuum filter box will undergo a period of drying and will then be hauled offsite for proper disposal. The Company expects to have four (4) 25-cubic yard vacuum filter boxes onsite at any given time. Two boxes will be actively filling and two will be draining/drying. A vacuum pump will be attached to these boxes to accelerate the removal of water. The filtrate will be collected and recirculated back into the AWWTP for treatment and discharge via Outfall 003. Piping to support this interim system will be 6" HDPE and will be fully located within bermed Plant property. No changes in effluent quality at Outfall 003 are anticipated as a result of this arrangement.

Long-Term Sludge Management Plan

The screw filter press system is currently being engineered and is scheduled to be operational by late 2016 to dewater wastewater treatment solids. In this scenario, one of the existing primary WWTP clarifier-thickeners is being evaluated to be repurposed as a feed sludge storage vessel for the screw press system. Wastewater treatment solids stored in the clarifier-thickener will be pumped through a polymer reaction tank where it will be mixed with a polymer flocculant to condition the wastewater treatment solids for dewatering. The operation of the screw press may necessitate changing the formulation and dosage of the polymer, or the Garratt-Callahan Formula 7560 polymer may continue to be used. However, the Company will not know whether a polymer change is needed until the screw press is installed and commissioned. It is probable that Garratt-Callahan Formula 7560 will continue to be used in the screw press system at the same dosage as described in the interim system, but the Company reserves the right to switch to a similar polymer to support operation of the system

Once the wastewater treatment solids are conditioned, the flow will be pumped to the screw press for solids dewatering. The screw press is being designed to be situated above a waste dumpster for collection of caked solids. Solids will be hauled offsite for proper solid waste disposal, and the filtrate will be returned to the AWWTP for treatment and discharged via Outfall 003. No significant changes in effluent quality at Outfall 003 are anticipated. This flow pattern was described on the draft plant water balance diagram dated 05-02-14 provided in the initial renewal application (Appendix I) submitted in March 2015.

Garratt CALLAHAN

SAFETY DATA SHEET

SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME:	FORMULA 7560
PRODUCT USE:	FLOCCULANT
RESTRICTIONS ON USE:	Refer to label, available technical information, and other appropriate sections of this SDS.
UN NUMBER:	NOT REGULATED
PROPER SHIPPING NAME:	NOT REGULATED
MANUFACTURER'S NAME:	Garratt-Callahan Company
ADDRESS:	50 Ingold Road, Burlingame, CA 94010-2206
EMERGENCY PHONE:	**North America: CHEMTREC: 1-800-424-9300** **Outside North America: +1-703-527-3887**
BUSINESS PHONE:	Product Information: 650-697-5811
SDS NUMBER:	SD7560
DATE OF REVISION:	11/25/2015

SECTION 2 - HAZARDS IDENTIFICATION

SIGNAL WORD: None

HAZARD STATEMENT: None

PRECAUTIONARY STATEMENTS: (PREVENTION)
P101: If medical advice is needed, have product container or label at hand.
P102: Keep out of reach of children.
P103: Read label before use.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash all exposed skin/hair thoroughly after handling.
Wear protective gloves/protective clothing/eye protection/face protection.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

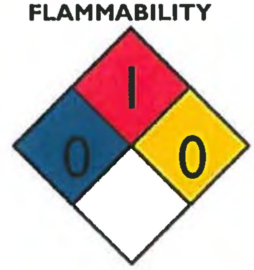
HEALTH HAZARD (BLUE)	0
FLAMMABILITY HAZARD (RED)	1
PHYSICAL HAZARD (YELLOW)	0

Hazard Scale
0=Minimal
1=Slight
2=Moderate
3=Serious
4=Severe
*=Chronic hazard

NFPA RATING

FLAMMABILITY

HEALTH



INSTABILITY

OTHER

SECTION 3 - COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients	CAS#	EC#	ICSC#	WT %
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	64742-47-8	265-149-8	1379	20-30
POLY(OXY-1, 2-ETHANEDIYL), A-TRIDECYL-W-HYDROXY-, BRANCHED	69011-36-5	500-241-6	N/A	<3

SECTION 4 - FIRST AID MEASURES

Call a POISON CENTER or doctor/physician if you feel unwell. Take a copy of this SDS to the health professional with the individual.

Refer to Section 11 for symptoms, effects, and likely routes of exposure for this product.

TARGET ORGANS:
ACUTE: Irritation to eyes and skin.
CHRONIC: Irritation to eyes and skin.

SKIN EXPOSURE: IF ON SKIN: Wash with soap and water. Minimum rinsing time is for 15 minutes. Take off contaminated clothing and wash before reuse. If skin irritation occurs: Get medical advice/attention.

EYE EXPOSURE: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing. Use sufficient force to open the eyelids. Have the exposed individual "roll" their eyes. Minimum rinsing time is for 15 minutes. If eye irritation persists: Get medical advice/attention.

INHALATION: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.

INGESTION: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Never induce vomiting or give diluents (milk or water) by mouth to someone who is unconscious, having convulsions, or unable to swallow. Call a POISON CENTER or doctor/physician if you feel unwell.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None reported.

NOTES TO PHYSICIAN: Treat symptoms as demonstrated by signs and distress in the patient.

SECTION 5 - FIRE FIGHTING MEASURES

SUITABLE (AND UNSUITABLE) EXTINGUISHING MATERIALS:	Water, water spray, foam, carbon dioxide (CO2), dry powder. Use media appropriate for surrounding fire.
SPECIFIC HAZARDS ARISING FROM THE CHEMICAL:	Aqueous solutions or powders that become wet render surface extremely slippery. Harmful decomposition products may include: Ammonia, carbon oxides (COx), nirtogen oxides (NOx). Hydrogen cyanide (hydrocyanic acid) may be produced in the event of combustion in an oxygen deficient atmostphere.
SPECIAL PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS:	Firefighters should wear fully protective clothing (chemical impermeable, fully encapsulated suit) and positive pressure self-contained breathing apparatus. Do not release run off from fire control methods to sewer or waterways.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT, ENVIRONMENTAL PRECAUTIONS AND EMERGENCY PROCEDURES.
WARNING: Any container expansion or rounding indicates pressure build-up. Use extreme caution. When opening, release pressure slowly through opening. Do not touch or walk through spilled material. Spills produce extremely slippery surfaces.

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by appropriately trained personnel using pre-planned procedures. Proper protective equipment should be used, refer to Section 8 - exposure controls. P391: Collect spillage.

Small Spill: Collect material and place in an appropriate waste disposal container.

Large Spill: Restrict access to the area. Provide adequate protective equipment and ventilation. Stop leak if without risk. Remove chemicals which can react with the spilled material. Prevent entry into surface waters, sewers, basements or confined areas, dike if needed. Ensure that exposure to product is not at a concentration exceeding regulatory limits. Decontaminate the area thoroughly. Decontaminate all response equipment with soapy water before returning to service. Place all spill residue in a suitable container and seal.

SECTION 7 - HANDLING AND STORAGE

PRECAUTIONS FOR SAFE HANDLING: Keep out of reach of children. All employees who handle this material should be trained to handle it safely. Open containers slowly on a stable surface. As with all chemicals, avoid getting this product ON YOU or IN YOU. Avoid direct or prolonged contact with skin or eyes. Do not ingest. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing vapors, dusts or mists generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately. Use only as directed. Refer to Section 8 for exposure controls. When preparing the working solution ensure there is adequate ventilation. When using this product do not smoke.

CONDITIONS FOR SAFE STORAGE: Containers of this product must be properly labeled. Storage areas of this product should be clearly identified, well-illuminated, clear of obstruction and accessible only to trained and authorized personnel. Store containers in a clean, cool, well ventilated, dry location, away from direct sunlight, away from incompatible materials at temperatures between 0°C - 30°C. Keep container tightly closed when not in use. Store locked up. Do not ingest. Do not breathe vapor mist. Wash hands after handling. Refer to Section 10 for incompatibilities. Keep away from heat and sources of ignition. Freezing will affect the physical condition and may damage the material. Incompatible with oxidizing agents.

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Eyewash/safety shower station is recommended to be available near where this product is used/stored.

EXPOSURE LIMITS/GUIDELINES:

CHEMICAL NAME	CAS#	EXPOSURE LIMITS IN AIR: ACGIH TLV TWA	ACGIH TLV STEL	OSHA PEL TWA	OTHER
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT*	64742-47-8	NE	NE	NE	N/A
POLY(OXY-1, 2-ETHANEDIYL), A-TRIDECYL-W-HYDROXY-, BRANCHED	69011-36-5	NE	NE	NE	N/A

* Multiple authorities have established exposure limits for "Petroleum distillates (Naptha) (Rubber Solvent)". These limits include: Fed OSHA PEL: 500 ppm and 2000 mg/m³; Cal/OSHA PEL TWA: 1600 ppm; Cal/OSHA [Oil (mineral) mist, particulate] PEL: 5 mg/m³; NIOSH REL TWA: 350mg/m³(C) and 15.6 ppm [15-min]; and ACGIH values which must be individually derived based upon the methodology presented in the ACGIH TLV Handbook, Appendix H.

NE = Not Established

INGESTION: Do not eat, drink, smoke, or apply cosmetics when handling this product. Wash all exposed skin/hair thoroughly after handling.

RESPIRATORY PROTECTION: Avoid breathing dust/fume/gas/mist/vapours/spray. Use only outdoors or in a well ventilated area. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. Air-purifying respirators with dust/mist/fume/spray filters are recommended if operations may produce dusts, mists or sprays from this product with concentrations at or above levels posted above.

EYE PROTECTION: Wash all exposed skin/hair thoroughly after handling. Wear chemical safety goggles or safety glasses with side shields. A face shield may also be necessary for splash protection.

SKIN PROTECTION: Wash all exposed skin/hair thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Use chemically-resistant gloves and skin protection, when handling this product. Use body protection appropriate for task (e.g., lab coat, overalls).

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE and COLOR:	Milky viscous liquid	VAPOR PRESSURE, mm Hg @ 20°C :	2.3 kPa @ 20°C
ODOR :	Aliphatic	VAPOR DENSITY (Air=1):	0.804 g/litre @ 20°C
ODOR THRESHOLD:	Not established	RELATIVE DENSITY@20°C (water=1):	1.0-1.1
pH:	4.0 - 6.0 @ 5 g/L	SOLUBILITY IN WATER:	Completely micible
MELTING/FREEZING POINT:	<5°C	PARTITION COEFFICIENT(n-octanol/water):	Not applicable
BOILING POINT:	>100°C	AUTOIGNITION TEMPERATURE:	Not applicable
FLASHPOINT:	Does not flash	DECOMPOSITION TEMPERATURE:	>150°C
EVAPORATION RATE (n-BuAc=1):	Not established	VISCOSITY:	>20.5 mm²/s @ 40°C
FLAMMABILITY (SOLID/GAS):	Not applicable	VOLATILE ORGANIC COMPOUNDS (%):	Not established
FLAMMABLE LIMITS (in air by volume, %):	Not established		

SECTION 10 - STABILITY AND REACTIVITY

REACTIVITY: Product is not reactive under standard ambient temperature and pressure.

STABILITY: Stable under ambient conditions.

POSSIBILITY OF HAZARDOUS REACTIONS: Oxidizing agents may cause exothermic reactions.

CONDITIONS TO AVOID: Protect from frost, heat and sunlight.

INCOMPATIBLE MATERIALS: Oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce: hydrogen chloride gas, nitrogen oxides (NOx), carbon oxides (COx), ammonia, hydrogen cyanide (hydrocyanic acid).

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICOLOGICAL EFFECTS: No data available for this product.

LIKELY ROUTES OF EXPOSURE: Skin/eye contact and inhalation.

RELATED SYMPTOMS: None reported.

DELAYED/IMMEDIATE/CHRONIC EFFECTS FROM SHORT AND LONG TERM EXPOSURES: May cause serious eye irritation with susceptible persons.

NUMERICAL MEASURES OF TOXICITY: Oral: LD50, Rat > 5000 mg/kg
Dermal: LD50, Rat > 5000 mg/kg
Inhalation: The product is not expected to be toxic by inhalation.

CARCINOGENICITY: None of the components of this product are listed by the NTP, IARC, or regulated by OSHA as carcinogens.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.
ECOTOXICITY:
Fish: LC50/Danio rerio/96 hrs = 10 - 100 mg/L
Invertebrates: EC50/Daphnia/48 hrs = 10 - 100 mg/L
Algae: Algal inhibition tests are not appropriate. The flocculation characteristics of the product interefere directly in the test medium preventing homogenous distribution which invalidates the test.
PERSISTENCE AND DEGRADABILITY: At natural pHs (>6) the polymer degrades due to hydrolysis to more than 70% in 28 days. The hydrolysis products are not harmful to aquatic organisms. Readily biodegradable.
BIOLOGICAL ACCUMULATION POTENTIAL: Does not bioaccumulate.
MOBILITY IN SOIL: No data available for this product.
OTHER ADVERSE EFFECTS (i.e., hazardous to the ozone layer): No data available for this product.

BIOLOGICAL EXPOSURE INDICES: Currently, Biological Exposure Indices (BEIs) have not been determined for this product.

SECTION 13 - DISPOSAL CONSIDERATIONS

DISPOSAL: Thoroughly drain/empty containers and offer for recycling. Refer to Section 8 for exposure controls - personal protection. P501: Dispose of contents/container in accordance with local/regional/national/international regulations.

SECTION 14 - TRANSPORTATION INFORMATION

PROPER SHIPPING NAME

DOT: NOT REGULATED
IMDG/IMO: NOT REGULATED
IATA/ICAO: NOT REGULATED

ENVIRONMENTAL HAZARDS (i.e., MARINE POLLUTANT): None known.
TRANSPORT IN BULK (according to annex II marpol 73/78 and the IBC code): Not applicable.
SPECIAL PRECAUTIONS FOR USER: None known.

SECTION 15 - REGULATORY INFORMATION

United States and International Regulations

United States Regulations: U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting as listed below, requirements of Sections 302, 304, and 313 of Title of the Superfund Amendments and Reauthorization Act:

CHEMICAL NAME	
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	SARA 302 (40 CFR 355, Appendix A) - NO SARA 304 (40 CFR Table 302.4) - NO SARA 313 (40 CFR 372.65) - NO
POLY(OXY-1, 2-ETHANEDIYL), A-TRIDECYL-W-HYDROXY-, BRANCHED	SARA 302 (40 CFR 355, Appendix A) - NO SARA 304 (40 CFR Table 302.4) - NO SARA 313 (40 CFR 372.65) - NO

U.S. Regulations
U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the components of this product. The default Federal SDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.
U.S. CERCLA REPORTABLE QUANTITY (RQ): None.
U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.
SARA Title 311/312, Hazard Category: Acute Health: NO; Chronic: YES; Fire: NO; Reactive: NO; Sudden Release of Pressure: NO

California Safe Drinking Water and Toxic Enforcement Act (proposition 65): WARNING! This product contains a chemical known to the State of California to cause cancer, birth defects or other reproductive harm, Acrylamide.

International Regulations

CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this product are on the DSL or NDSL Inventories or are exempt from listing.

CANADIAN WHMIS CLASSIFICATION: None. A component of this product, Distillates (Petroleum), Hydrotreated Light (CAS # 64742-47-8) has a WHMIS classification of: B3.

SECTION 16 - OTHER INFORMATION

PREPARED BY: **GARRATT CALLAHAN**

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