LETTER OF TRANSMITTAL

DATE:	PROJECT NUMBER:
11/9/2015	N/A
REFERENCE:	NPDES Amendment Application Shell Chemical Appalachia LLC

681 Andersen Drive, Suite 400
Foster Plaza 6
Pittsburgh, PA 15220
Phone 412-503-4594 Fax: 412.503-4701
www.urscorp.com
e-mail address: jerry.joseph@urs.com

TO: Mr. Ronald Schwartz
Assistant Regional Director
PA Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222
(412) 442-4000

RECEIVED
NOV 09 2015
By

WE ARE SENDING:

☒ *Herewith* ☐ *Under Separate Cover*

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications ☐ Copy of Letter

☒ Other Permit Application

☒ For Approval ☐ For Your Use ☐ As Requested ☐ For Comment ☐ For Correction ☐ Resubmit

Copies	Date	Description
3 (1 Original and 2 copies)	November 9, 2015	NPDES Amendment Application – Shell Chemical Appalachia LLC

SENT VIA:

☒ *Our Messenger* ☐ *FedEx/Airborne* ☐ *Certified Mail* ☐ *As Noted Below*
☐ *Your Messenger* ☐ *United Parcel* ☐ *First Class Mail* ☐ *Regular Mail*

NOTES:

Copy to:

Sincerely,
AECOM

Jerry Joseph

SHELL CHEMICAL APPALACHIA LLC
PROPOSED PETROCHEMICALS COMPLEX
POTTER AND CENTER TOWNSHIPS
BEAVER COUNTY, PENNSYLVANIA

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION FOR PERMIT AMENDMENT

NOVEMBER 2015

Prepared for:
Shell Chemical Appalachia LLC

Prepared by:

AECOM

November 6, 2015

Shell Chemical Appalachia LLC

Shell Oil Company
One Shell Plaza
910 Louisiana St.
Houston, TX 77002
United States of America
Internet:www.shell.us

Mr. Ronald Schwartz
Assistant Regional Director
PA Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Subject: **Amendment Application**
NPDES Permit Number PA0002208
Shell Chemical Appalachia LLC, Beaver County, Pennsylvania

Dear Mr. Schwartz:

As we have discussed, enclosed is an application to amend the subject permit.

Enclosed for your review are one original and two copies of the application which includes:

- General Information Form (GIF) (8000-PM-IT0001)
- Application Fee check for $5,000.00 made payable to the "**Commonwealth of Pennsylvania**"
- Acts 14/67/68/127 Notifications and Receipts
- Evidence of newspaper publication for 4 consecutive weeks
- PADEP NPDES Application Forms:
  - Forms 3800-PM-BPNPSM0027b/3800-PM-BPNPSM0008b
  - Module 1 – Stormwater
  - Module 5 – Cooling Water Intake Structures
  - Chemical Additives Notification Forms
  - PENNTOXSD Summary and Results for Chemical Additives
- Wastewater and Stormwater Description and Diagrams
- Post Construction Stormwater Management Plan
- Erosion and Sedimentation Control Plan
- Source Water Physical and Biological Baseline Characterization Study

Please call if we can provide any additional information or answer any questions about this application.

Sincerely,

H. James Sewell
Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Rd., Shell Trailer #3
Monaca, PA 15061

Enclosures: Application

Shell Chemical Appalachia LLC is a trading style used
by a network of companies
of the Shell Group

SHELL CHEMICAL APPALACHIA LLC

SPECIAL POWER OF ATTORNEY

Shell Chemical Appalachia LLC, a Delaware limited liability company (the "Company"), with offices at 910 Louisiana Street, Houston, Texas 77002, hereby appoints and authorizes Jim Sewell, who is managing environmental permitting and other regulatory affairs on behalf of the Company's efforts to construct a petrochemical facility in Beaver County, PA, as its true and lawful Attorney-in-Fact, in the name and on behalf of the Company in connection with Health, Safety, Security and Environment (HSS&E) related activities to:

1. Interface with government agencies;
2. Make binding representations to government agencies;
3. Sign permits, licenses and applications;
4. Sign discharge monitoring reports, routine compliance reports, routine compliance reports, fines, penalties, and other required HSS&E reports; and/or
5. Sign site access agreements not to exceed $10,000,000.00,

with full power and authority to do and perform every act and deed necessary and proper in the exercise of the forgoing powers as fully as the Company could do by any duly authorized officer, hereby ratifying and confirming all that the said Attorney-in-Fact shall lawfully do or cause to be done by virtue thereof.

This Special Power of Attorney is effective as of June 3, 2015, and shall continue in full force and effect until specifically revoked in writing. The authorities granted by this Special Power of Attorney may not be sub-delegated.

IN WITNESS WHEREOF, the Company has caused this Special Power of Attorney to be signed by its President, sealed with its company seal and attested to by its Secretary.

ATTEST:

Lynn S. Borgmeier
Secretary

SHELL CHEMICAL APPALACHIA LLC

Ate S. Visser
President

SHELL CHEMICAL APPALACHIA LLC LIMITED LIABILITY COMPANY SEAL DELAWARE 2012

WITNESS:

Sylvia Reyes

WITNESS:

Terry Barrett

STATE OF TEXAS §
§
COUNTY OF HARRIS §

This instrument was acknowledged before me on the 10th day of June, 2015 by Ate S. Visser, President of Shell Chemical Appalachia LLC, a Delaware limited liability company, on behalf of said company.

DEBORA MCKIBBIN
Notary Public, State of Texas
My Commission Expires
May 17, 2016

Debora McKibbin
Notary Public in and for the State of Texas

TABLE OF CONTENTS

Section

General Information Form (GIF) (8000-PM-IT0001) 1

Application Fee 2

Acts 14/67/68/127 Notifications and Receipts 3

Evidence of newspaper publication for 4 consecutive weeks 4

PADEP NPDES Application Forms 5

- Forms 3800-PM-BPNPSM0027b/3800-PM-BPNPSM0008b
- Module 1 – Stormwater
- Module 5 – Cooling Water Intake Structures
- Chemical Additives Notification Forms
- PENNTOXSD Summary and Results

Wastewater and Stormwater Description and Diagrams 6

Post Construction Storm water Management Plan 7

Erosion and Sedimentation Control Plan 8

Source Water Physical and Biological Baseline Characterization Study 9

Section 1

General Information Form (GIF)

1300-PM-BIT0001 5/2012
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the Department.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	311950	**APS ID#**		Date Received & General Notes
Site ID#	102360	**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	**Client Type / Code**			
311950	LLC			
Organization Name or Registered Fictitious Name		**Employer ID#** (EIN)	**Dun & Bradstreet ID#**	
Shell Chemical Appalachia LLC		46-1624986		
Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
Additional Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
Mailing Address Line 1		**Mailing Address Line 2**		
300 Frankfort Road				
Address Last Line – City	**State**	**ZIP+4**	**Country**	
Monaca	PA	15601	USA	
Client Contact Last Name	**First Name**	**MI**	**Suffix**	
Sewell	H	James		
Client Contact Title		**Phone**	**Ext**	
Environmental Manager (Attorney-in-Fact)		281.731.3287		
Email Address		**FAX**		
Jim.Sewell@shell.com				

SITE INFORMATION

DEP Site ID#	**Site Name**					
102360						
EPA ID#	**Estimated Number of Employees to be Present at Site**					
Description of Site						
Petrochemical complex manufacturing ethylene and polyethylene						
County Name	**Municipality**		**City**	**Boro**	**Twp**	**State**
Beaver	Potter		☐	☐	☒	
County Name	**Municipality**		**City**	**Boro**	**Twp**	**State**
Beaver	Center		☐	☐	☒	
Site Location Line 1		**Site Location Line 2**				
300 Frankfort Road						
Site Location Last Line – City		**State**	**ZIP+4**			
Monaca		PA	15061			
Detailed Written Directions to Site						
From Pittsburgh International Airport – 376 North to Exit 39 (Monaca), turn left onto Rt 18 South and proceed for 1.5 miles, then turn right at light into plant.						
Site Contact Last Name	**First Name**		**MI**		**Suffix**	
Sewell	H		James			
Site Contact Title		**Site Contact Firm**				
Environmental Manager (Attorney-in-Fact)		Shell Chemical Appalachia LLC				
Mailing Address Line 1		**Mailing Address Line 2**				
300 Frankfort Road						

Mailing Address Last Line – City			State	ZIP+4
Monaca			PA	15601
Phone	**Ext**	**FAX**	**Email Address**	
281.731.3287			Jim.Sewell@shell.com	

NAICS Codes (Two- & Three-Digit Codes – List All That Apply) **6-Digit Code** (Optional)
32 and 22

Client to Site Relationship
OWN

FACILITY INFORMATION

Modification of Existing Facility

		Yes	No
1.	**Will this project modify an existing facility, system, or activity?**	☒	☐
2.	**Will this project involve an addition to an existing facility, system, or activity?**	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☒	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	MineDrainageTrmt/LandRecyProjLocation	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Anthracite		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Bituminous		☐	Residual Waste Operation	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Storage Tank Location	
☒	Encroachment Location (water, wetland)		☐	Water Pollution Control Facility	
☒	Erosion & Sediment Control Facility		☒	Water Resource	
☐	Explosive Storage Location		☐	Other:	

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
HGIS	40	40	17	80	20	10

Horizontal Accuracy Measure Feet 18 --or-- Meters

Horizontal Reference Datum Code
- ☐ North American Datum of 1927
- ☐ North American Datum of 1983
- ☒ World Geodetic System of 1984

Horizontal Collection Method Code eMapPA

Reference Point Code CNTAR

Altitude Feet --or-- Meters

Altitude Datum Name
- ☐ The National Geodetic Vertical Datum of 1929
- ☒ The North American Vertical Datum of 1988 (NAVD88)

Altitude (Vertical) Location Datum Collection Method Code SRVEY

Geometric Type Code POINT

Data Collection Date 5/26/12

Source Map Scale Number Inch(es) = Feet
--or-- Centimeter(s) = Meters

PROJECT INFORMATION

Project Name
Shell Franklin Proposed Peterochemical Complex

Project Description
Development of proposed petrochemical complex to produce ethylene and polyethelyne

Project Consultant Last Name	First Name	MI	Suffix

Project Consultant Title	Consulting Firm

Mailing Address Line 1	Mailing Address Line 2	
Address Last Line – City	State	ZIP+4
Phone	Ext	FAX	Email Address

Time Schedules	Project Milestone (Optional)

1.	**Have you informed the surrounding community and addressed any concerns prior to submitting the application to the Department?**	☒	Yes	☐	No
2.	**Is your project funded by state or federal grants?**	☐	Yes	☒	No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.
Aspect of Project Related to Grant
Grant Source: _____
Grant Contact Person: _____
Grant Expiration Date: _____

3.	**Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)**	☒	Yes	☐	No

Note: If "No" to Question 3, the application is not subject to the Land Use Policy.
If "Yes" to Question 3, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants are encouraged to submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1.	**Is there an adopted county or multi-county comprehensive plan?**	☒	Yes	☐	No
2.	**Is there an adopted municipal or multi-municipal comprehensive plan?**	☒	Yes	☐	No
3.	**Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?**	☒	Yes	☐	No

Note: If the Applicant answers "No" to either Questions 1, 2 or 3, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 4 and 5 below.
If the Applicant answers "Yes" to questions 1, 2 and 3, the Applicant should respond to questions 4 and 5 below.

4.	**Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation.	☒	Yes	☐	No
5.	**Have you attached Municipal and County Land Use Letters for the project?**	☒	Yes	☐	No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 and the accompanying Cultural Resource Notice Form.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No

3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐	Yes	☒	No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐	Yes	☐	No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐	Yes	☐	No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐	Yes	☐	No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage. **4.0.1 Total Disturbed Acreage** ~543	☒	Yes	☐	No
5.0	**Does the project involve any of the following?** If "Yes", respond to 5.1-5.3. If "No", skip to Question 6.0.	☒	Yes	☐	No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒	Yes	☐	No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☒	Yes	☐	No
5.3	**Floodplain Projects by the commonwealth, a Political Subdivision of the commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of stormwater or wastewater from an industrial activity to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☒	Yes	☐	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable. **8.0.1 Estimated Proposed Flow (gal/day)** ~315,000 gal/day for construction and ~35,000 gal/day for future operations	☒	Yes	☒	No
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☒	Yes	☐	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☒	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year). **10.0.1 Gallons Per Year (residential septage)** _____ **10.0.2 Dry Tons Per Year (biosolids)**	☐	Yes	☒	No

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam. **11.0.1 Dam Name**	☐	Yes	☒	No
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam. **12.0.1 Dam Name**	☐	Yes	☒	No
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?** If "Yes", identify each type of emission followed by the amount of that emission. **13.0.1 Enter all types & amounts of emissions; separate each set with semicolons.** Detailed in issued Air Permit	☒	Yes	☐	No
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes", check all proposed sub-facilities.	☒	Yes	☐	No
	14.0.1 Number of Persons Served ~14,000 based on CTWA information				
	14.0.2 Number of Employee/Guests >300				
	14.0.3 Number of Connections >5,000				
	14.0.4 Sub-Fac: Distribution System	☐	Yes	☒	No
	14.0.5 Sub-Fac: Water Treatment Plant	☐	Yes	☒	No
	14.0.6 Sub-Fac: Source	☐	Yes	☒	No
	14.0.7 Sub-Fac: Pump Station	☐	Yes	☒	No
	14.0.8 Sub Fac: Transmission Main	☐	Yes	☒	No
	14.0.9 Sub-Fac: Storage Facility	☐	Yes	☒	No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐	Yes	☒	No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project. **16.0.1 Supplier's Name** Center Township Water Authority	☒	Yes	☐	No
	16.0.2 Letter of Approval from Supplier is Attached	☐	Yes	☒	No
17.0	**Will this project involve a new or increased drinking water withdrawal from a stream or other water body?** If "Yes", should reference both Water Supply and Watershed Management. **17.0.1 Stream Name**	☐	Yes	☒	No
18.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes", indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **18.0.1 Type & Amount** No hazardous waste will be managed. All waste will beappropriately handled, packaged and shipped for disposal at off-site location	☒	Yes	☐	No
19.0	**Will your project involve the removal of coal, minerals, etc. as part of any earth disturbance activities?**	☐	Yes	☒	No
20.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **20.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
21.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No

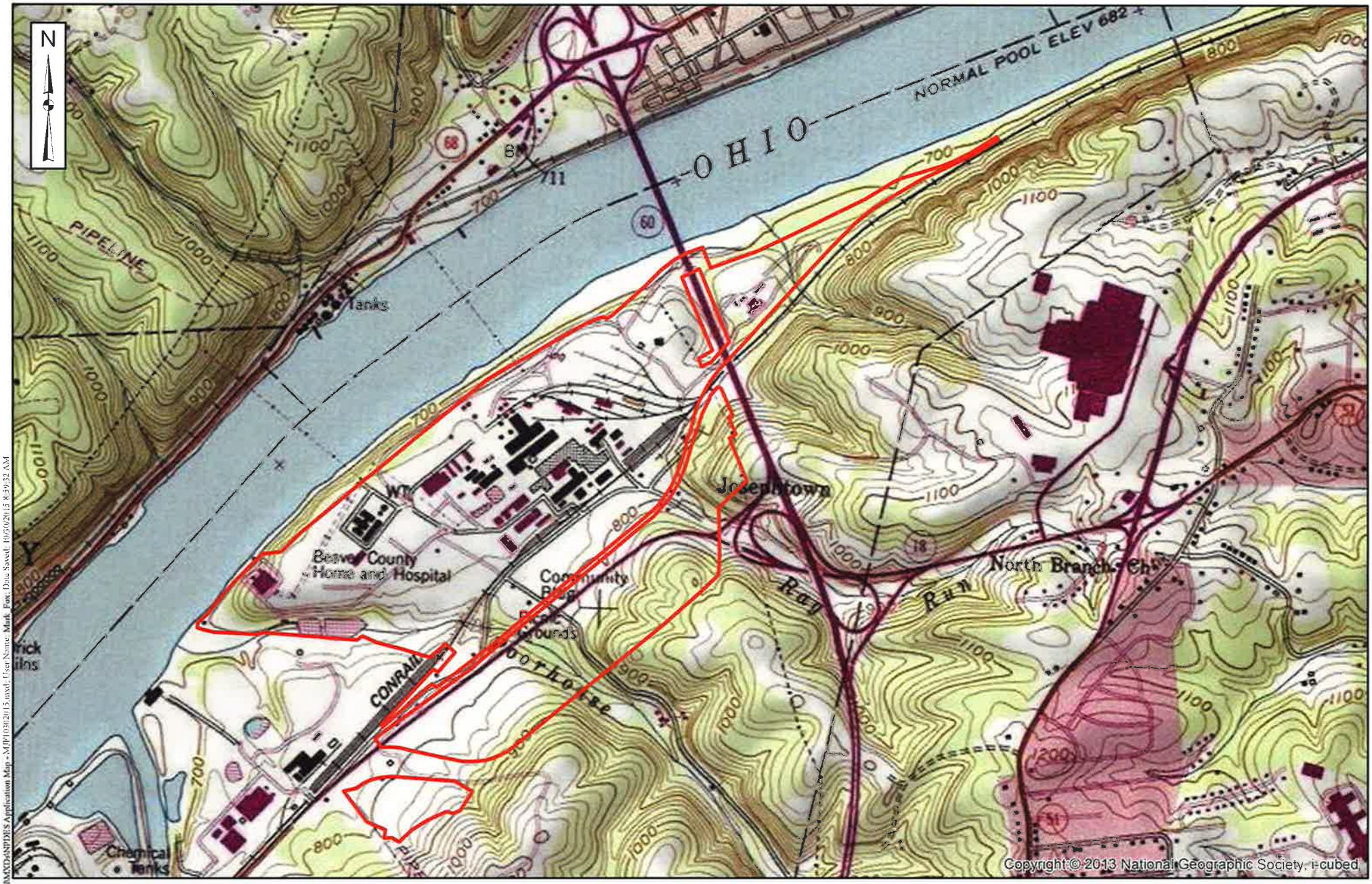
22.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.** List of tanks was included in the Air Permit application submitted to the Department	☒	Yes	☐	No
24.0	**Will the intended activity involve the use of a radiation source?**	☒	Yes	☐	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

Type or Print Name H. James Sewell

Signature | Environmental Manager (Attorney-in-Fact) **Title** | 11/2/15 **Date**



AECOM

4807 NORTH FRONT STREET, SUITE 200
HARRISBURG, PENNSYLVANIA 17110
TEL (717) 635-7901 FAX (717) 635-7902

Project Boundary

0 1,400 2,800 Feet

1 Inch = 1,393 Feet

TITLE:

PROJECT LOCATION MAP
NPDES PART I APPLICATION

SHELL CHEMICAL APPALACHIA LLC

POTTER AND CENTER TOWNSHIPS
BEAVER COUNTY, PENNSYLVANIA

NOTES:

Topographic Imagery Source:
ESRI USGS topographic maps for the United States

DRAWN BY:	FIGURE NO.:
MJF	1
APPROVED BY:	SHEET:

DATE:	PROJECT NO.:
10/30/2015	25016128

Path: Y:\GIS\Projects\Shell\Horsehead\MXD\NPDES Application Map - MJF\103020 15.mxd, User Name: Mark Fox, Date Saved: 10/30/2015 8:39:32 AM

Section 2

Application Fee

AECOM TECHNOLOGY CORPORATION

NO. 14425499

DATE 30-Oct-2015 **VENDOR NAME** COMMONWEALTH OF PENNSYLVANIA **VENDOR NO** 87590

INVOICE NO.	DESCRIPTION	INVOICE DATE	VOUCHER NO.	DISCOUNT	NET AMOUNT
CK1028155000		28-Oct-2015	854740732	0.00	5,000.00

PLEASE DETACH AND RETAIN THIS STATEMENT AS YOUR RECORD OF PAYMENT **0.00** **5,000.00**

VERIFY THE AUTHENTICITY OF THIS MULTI-TONE SECURITY DOCUMENT. CHECK BACKGROUND AREA CHANGES COLOR GRADUALLY FROM TOP TO BOTTOM.

AECOM TECHNOLOGY CORPORATION
9400 Amberglen Boulevard, Bldg C
Austin, Texas 78729-1100

WELLS FARGO BANK
115 Hospital Drive
Van Wert, OH 45891

56-382
412

NO. 14425499

CHECK DATE	CHECK NUMBER
30-Oct-2015	14425499

CHECK AMOUNT
$5,000.00

PAY: Five Thousand Dollars And Zero Cents*****

TO THE ORDER OF:
COMMONWEALTH OF PENNSYLVANIA
DEPT OF ENVIRONMENTAL PROTECTION
400 WATERFRONT DRIVE
PITTSBURGH, PA 15222
United States

AUTHORIZED SIGNATURES

⑈014425499⑈ ⑆041203824⑆960004795 3⑈

FROM: **AECOM TECHNOLOGY CORPORATION**
9400 Amberglen Boulevard, Bldg C
Austin, Texas 78729-1100

TO: **COMMONWEALTH OF PENNSYLVANIA**
DEPT OF ENVIRONMENTAL PROTECTION
400 WATERFRONT DRIVE
PITTSBURGH, PA 15222
United States

Section 3

Acts 14/67/68/127 Notifications and Receipts

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Ms. Rebecca Matsco
Chairwoman, Potter Township Supervisors
206 Mowry Road
Monaca, PA 15061

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Christie Floyd-Gabel ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Floyd-Gabel
C. Date of Delivery 11-4-15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7012 2210 0002 4671 7321

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Bill DiCioccio, Jr.
Chairman, Center Township Supervisors
224 Grange Road
Aliquippa, PA 15001

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X B Rest ☐ Agent ☐ Addressee

B. Received by (Printed Name) B. RESTAINO
C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7012 2210 0002 4671 7338

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Tony Amadio
Chairman, Beaver County Commissioners
810 Third Street
Beaver, PA 15009

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Linda Ronan ☐ Agent ☐ Addressee

B. Received by (Printed Name) Linda Ronan
C. Date of Delivery 11-5-15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7012 2210 0002 4671 7345

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

CERTIFIED MAIL

November 2, 2015

Shell Chemical Appalachia LLC

Shell Oil Company
One Shell Plaza
910 Louisiana St.
Houston, TX 77002
United States of America

Internet:www.shell.us

Mr. Tony Amadio
Chairman, Beaver County Commissioners
Beaver County Courthouse
810 Third Street
Beaver, PA 15009

Dear Mr. Amadio:

This notice is to inform you of Shell Chemical Appalachia LLC's intent to submit an application to the Pennsylvania Department of Environmental Protection (PADEP) with the Permitting and Technical Services Section, Bureau of Water Standards and Facility Regulation for the following project:

Project:	Amendment to NPDES Permit for Proposed Petrochemicals Complex
Applicant Name:	Shell Chemical Appalachia LLC
Project Location:	300 Frankfort Road, Monaca, PA 15061
Applicant Contact:	Mr. H. James Sewell
	Shell Chemical Appalachia LLC
	300 Frankfort Road
	Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter and Center Townships, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

Shell Chemical Appalachia LLC is a trading
style used
by a network of companies
of the Shell Group

Acts 67 and 68, which amended the Municipalities Planning Code to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Enclosed are the completed General Information Form (GIF) and location map for this project. PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period, PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about the land use review process, please visit www.depweb.state.pa.us, (keyword: Land Use Reviews). For more information about this permit application, please contact me at 281.731.3287.

Sincerely,

H. James Sewell
Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Rd., Shell Trailer #3
Monaca, PA 15061

Enclosures: Completed GIF and Location Map

CERTIFIED MAIL

November 2, 2015

Shell Chemical Appalachia LLC

Shell Oil Company
One Shell Plaza
910 Louisiana St.
Houston, TX 77002
United States of America

Internet:www.shell.us

Mr. Bill DiCioccio
Chairman, Center Township Supervisors
224 Grange Road
Aliquippa, PA 15001

Dear Mr. DiCioccio:

This notice is to inform you of Shell Chemical Appalachia LLC's intent to submit an application to the Pennsylvania Department of Environmental Protection (PADEP) with the Permitting and Technical Services Section, Bureau of Water Standards and Facility Regulation for the following project:

Project:	Amendment to NPDES Permit for Proposed Petrochemicals Complex
Applicant Name:	Shell Chemical Appalachia LLC
Project Location:	300 Frankfort Road, Monaca, PA 15061
Applicant Contact:	Mr. H. James Sewell Shell Chemical Appalachia LLC 300 Frankfort Road Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter and Center Townships, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written

Shell Chemical Appalachia LLC is a trading
style used
by a network of companies
of the Shell Group

notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

Acts 67 and 68, which amended the Municipalities Planning Code to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Enclosed are the completed General Information Form (GIF) and location map for this project. PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period, PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about the land use review process, please visit www.depweb.state.pa.us, (keyword: Land Use Reviews). For more information about this permit application, please contact me at 281.731.3287.

Sincerely,

H. James Sewell
Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Rd., Shell Trailer #3
Monaca, PA 15061
Jim.sewell@shell.com

Enclosures: Completed GIF and Location Map

CERTIFIED MAIL

November 2, 2015

Shell Chemical Appalachia LLC

Shell Oil Company
One Shell Plaza
910 Louisiana St.
Houston, TX 77002
United States of America

Internet:www.shell.us

Mr. Rebecca Matsco
Chairwoman, Potter Township Supervisors
206 Mowry Road
Monaca, PA 15061

Dear Ms. Matsco:

This notice is to inform you of Shell Chemical Appalachia LLC's intent to submit an application to the Pennsylvania Department of Environmental Protection (PADEP) with the Permitting and Technical Services Section, Bureau of Water Standards and Facility Regulation for the following project:

Project:	Amendment to NPDES Permit for Proposed Petrochemicals Complex
Applicant Name:	Shell Chemical Appalachia LLC
Project Location:	300 Frankfort Road, Monaca, PA 15061
Applicant Contact:	Mr. H. James Sewell Shell Chemical Appalachia LLC 300 Frankfort Road Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter and Center Townships, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written

Shell Chemical Appalachia LLC is a trading
style used
by a network of companies
of the Shell Group

notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

Acts 67 and 68, which amended the Municipalities Planning Code to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code.

Enclosed are the completed General Information Form (GIF) and location map for this project. PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period, PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about the land use review process, please visit www.depweb.state.pa.us, (keyword: Land Use Reviews). For more information about this permit application, please contact me at 281.731.3287.

Sincerely,

H. James Sewell
Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Rd., Shell Trailer #3
Monaca, PA 15061
Jim.sewell@shell.com

Enclosures: Completed GIF and Location Map

Section 4

Evidence of newspaper publication for 4 consecutive weeks

PROOF OF PUBLICATION

The **Beaver County Times, Allegheny Times, Ellwood City Ledger**, a daily newspaper of general circulation, published by BEAVER NEWSPAPERS, INC., a Pennsylvania corporation, 400 Fair Avenue, West Bridgewater, Beaver County, Pennsylvania, was established in 1946, and has been issued regularly, except legal holidays since said date.

The attached advertisement, which is exactly as printed and published, appeared in the regular issue on 10/13/15 10/20/15 10/27/15 11/03/15

BEAVER NEWSPAPERS, INC.

By Tina Bequeath

STATE OF PENNSYLVANIA,
COUNTY OF BEAVER, } **SS:**

Before me, a Notary Public in and for such county and state, personally appeared TINA BEQUEATH, who being duly sworn according to law says that she is CONTROLLER of BEAVER NEWSPAPERS, INC.; that neither affiant nor said corporation is interested in the subject matter of the attached advertisement; and that all of the allegations of the foregoing statement including those as to the time, place and character of publication are true.

Sworn to and subscribed before me this day of November 3, 2015

Debra L. Hays

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
Debra L. Hays, Notary Public
Bridgewater Boro, Beaver County
My Commission Expires June 15, 2018
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

The costs of advertising and proof, has been paid. $ 1,986.00

BEAVER NEWSPAPERS, INC.

By Judy L. Deem

BEAVER NEWSPAPERS INC. **400 FAIR AVE.** **BEAVER, PA. 15009**

NOTICE

Notice is hereby given that the Shell Chemical Appalachia LLC at 300 Frankfort Road (Trailer #7), Monaca, PA 15061, (Phone - 724.933.4979) intends to make application to the Department of Environmental Protection (DEP) for a Water Quality Management Permit for the discharge of industrial wastes in a manner which meets DEP requirements, from its proposed facility located in Potter and Center Townships, Beaver County.

This is a new discharge to an existing permit for a continuous discharge of process waters to the Ohio and intermittent discharge of Stormwater to the Ohio, Poorhouse Run and Rag Run. This application is made under the provision of the Clean Streams Law, the Act of June 22, 1937, P.L. 1987, as amended. Persons desiring additional information, or who wish to provide comment concerning this permit application should contact the Company as indicated above, or DEP at the following address: Southwest Regional Office, Regional Water Quality Manager, 400 Waterfront Drive, Pittsburgh, PA 15222-4745, (Phone 412.442.4000) after November 13, 2015.

10/13, 10/20, 10/27, 11/3/15

Section 5

PADEP NPDES Application Forms:

- Checklist
- Forms 3800-PM-BPNPSM0027b/3800-PM-BPNPSM0008b
- Module 1 – Stormwater
- Module 5 – Cooling Water Intake Structures
- Chemical Additives Notification Forms
- PENNTOXSD Summary and Results

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION FOR INDIVIDUAL PERMIT TO DISCHARGE INDUSTRIAL WASTEWATER

APPLICANT'S ✓ CHECKLIST

Applicant Name _____

Check the following list to make sure you have included all the required information. Place a checkmark in the box provided for all items completed and/or provided.

ENCLOSE THIS CHECKLIST WITH YOUR COMPLETED APPLICATION. FAILURE TO SUBMIT ALL REQUIRED INFORMATION MAY RESULT IN DENIAL OF THE APPLICATION.

	REQUIREMENTS	Check ✓ If Included	DEP Use Only
1.	Application Fee. Amount Enclosed $ 5,000	☒	☐
2.	One signed original and 2 copies of the *completed* application with all applicable Analytical Results Tables.	☒	☐
3.	One additional copy of application for ECHD (if located in Erie County).	☐	☐
4.	One copy of application mailed to Delaware River Basin Commission (if discharge is in the Delaware River Basin)	☐	☐
5.	One copy of the General Information Form (8000-PM-IT0001).	☒	☐
6.	Proper evidence of Act 14 municipal and county notifications.	☒	☐
7.	Evidence of newspaper publication for 4 consecutive weeks (new and modified discharges only)	☒	☐
8.	Copy of topographic map treatment facilities, intake structures, and outfalls.	☒	☐
9.	Site plan identifying significant site features.	☒	☐
10.	Line drawing / process flow diagram illustrating the flow of water and wastewater through the facility(ies), with a water balance.	☒	☐
11.	Chemical Additives Notification Form(s) (if applicable).	☒	☐
12.	Whole Effluent Toxicity Test Reports / WET Analysis Spreadsheet (if applicable).	☐	☐
13.	Documentation supporting variance requests (if applicable)	☐	☐
14.	Preparedness, Prevention and Contingency (PPC) Plan (optional)	☐	☐
15.	Module 1 – Stormwater, and attachments (if applicable).	☒	☐
16.	Module 2 – Groundwater Remediation, and attachments (if applicable).	☐	☐
17.	Module 3 – Aquatic Animal Production Facilities, and attachments (if applicable)	☐	☐
18.	Module 4 – Anti-Degradation, and attachments (if applicable)	☐	☐
19.	Module 5 – Cooling Water Intake Structures, and attachments (if applicable)	☒	☐
20.	Optional site-specific data: _____	☐	☐

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION FOR PERMIT AMENDMENT

Before completing this form, read the step-by-step instructions provided in this application package. This application may be used only by permittees holding an individual NPDES permit.

Type of Amendment Requested:

☐ Minor Amendment

☒ Major Amendment

DEP USE ONLY

Date Received & General Notes

Existing Permit Information:

NPDES Permit No. PA0002208

Effective Date: July 1, 2015

Expiration Date: June 30, 2020

Facility Name:

Shell Petrochemicals Complex

Municipality: Potter and Center Twp

County: Beaver

Facility Type / Fee Category:

☐ SRSTP/SFTF	☐ Major Sewage with CSO	☐ Municipal Stormwater (MS4)
☐ Minor Sewage < 0.05 MGD	☐ Minor IW without ELG	☐ IW Stormwater
☐ Minor Sewage ≥ 0.05 MGD and < 1 MGD	☐ Minor IW with ELG	☐ CAAP
☐ Major Sewage ≥ 1 MGD and < 5 MGD	☒ Major IW < 250 MGD	☐ CAFO
☐ Major Sewage > 5 MGD	☐ Major IW ≥ 250 MGD	☐ Pesticides

AMENDMENT INFORMATION

Detailed Explanation of Permit Amendment Request (see Instructions and attach additional sheets if necessary):

Shell Appalachia Chemical LLC is amending the permit to cover construction and operation of the petrochemical complex.

CLIENT/OPERATOR INFORMATION

DEP Client ID#	Client Type/Code			
311950	LLC			
Organization Name or Registered Fictitious Name		**Employer ID# (EIN)**		**Dun & Bradstreet ID#**
Shell Chemical Appalachia LLC		46-1624986		
Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
NA – Applicant is LLC				
Client Mailing Address Line 1	**Client Mailing Address Line 2**			
300 Frankfort Road				
Client Mailing Address City	**State**	**ZIP+4**	**Country**	
Monaca	PA	15061	USA	

Client Contact Last Name	First Name	MI	Suffix
Sewell			
Client Contact Title		**Phone**	**Ext**
Environmental Manager (Attorney-in-Fact)		281.731.3287	
E-mail Address			**FAX**
Jim.Sewell@shell.com			

COMPLIANCE HISTORY REVIEW

Is the facility owner or operator in violation of any DEP regulation, permit, order or schedule of compliance at this or any other facility? ☐ YES ☒ NO

If YES, list each permit, order, regulation or schedule that is in violation and provide compliance status of the permitted activity (use additional sheets to provide information on all permits).

Permit Program Permit No.

Brief Description of Non-Compliance:

Steps Taken to Achieve Compliance	Date(s) Compliance Achieved

Current Compliance Status: ☐ In Compliance ☐ In Non-Compliance

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 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. See Pa. C.S. § 4904 (relating to unsworn falsification).

H. James Sewell
Name (type or print legibly)

Environmental Manager Attorney-in-Fact
Official Title

Signature

11/6/15
Date

NOTE – Shell Appalachia Chemical LLC is proposing to amend the existing NPDES permit and as such utilized PADEP form 3800-PM-BPNPSM0027b. Due to the nature of the changes we have also attached the appropriate sections of PADEP form 3800-PM-BPNPSM0008b.

SIC Code	Primary?	Description	NAICS Code	Primary?	Description
2869	YES	Industrial Organic Chemicals, Not Elsewhere Classified (Ethylene)	325110	YES	Petrochemical Manufacturing
2821	YES	Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers (Polyethylene)	325211	YES	Plastics Material and Resin Manufacturing

OTHER ENVIRONMENTAL PERMITS

Type of Permit	Agency That Issued Permit	Date Issued
Air Permit (PSD/nonattainment)	PADEP	
Water Obstruction and Encroachment Permit/Joint Permit	PADEP	June 12, 2015
Water Obstruction and Encroachment Permit/Joint Permit	US Army Corp of Engineers	June 15, 2015
Stormwater PAG02000414017	BCCD	April 28, 2015

DISCHARGE INFORMATION

1. Attach a site plan, a line drawing with a water balance and topographic map(s) showing the treatment facility(ies), intake location(s), discharge location(s), and internal monitoring point location(s).

USGS Topographic map name: Beaver Quad

Applicant Name: Shell Chemical Appalachia LLC

2. List all discharge points (outfalls) and internal monitoring points (IMPs). If numbers were previously assigned in a permit, use those numbers. Order sequentially and use additional pages as necessary.

Outfall / IMP No.	LATITUDE			LONGITUDE			RECEIVING WATERS			
	Deg	Min	Sec	Deg	Min	Sec	Name of Receiving Waters	Ch. 93 Class.	Impaired?	TMDL?
001	40	40	22.996	-80	20	18.489	Ohio River (WWTP)	WWF	☒	☒
002	40	40	42.43	-80	19	36.01	Ohio River (East RR Pond)	WWF	☒	☒
003	40	40	36.2625	-80	19	43.6135	Ohio River (East RR Pond Overflow)	WWF	☒	☒
004	40	39	57.4943	-80	20	40.5531	Poorhouse Run (AC Pond Overflow)	WWF	☐	☐
005	40	40	50.4175	-80	19	11.217	Ohio River (Mall Lot 2)	WWF	☒	☒
006	40	39	57.17	-80	20	09.11	Poorhouse Run (South Ponds)	WWF	☐	☐
007	40	39	57.0622	-80	20	9.1604	Poorhouse Run (South Pond Overflow)	WWF	☐	☐
008	40	39	55.79	-80	20	32.92	Poorhouse Run (CR Pond)	WWF	☐	☐
009	40	39	56.2702	-80	20	32.187	Poorhouse Run (CR Pond Overflow)	WWF	☐	☐
010	40	39	54.71	-80	20	22.16	Poorhouse Run (West RR Basin)	WWF	☐	☐
011	40	40	4.0	-80	20	48.0	Ohio River (Screen Backwash)	WWF	☒	☒
012	40	39	54.3288	-80	20	21.869	Poorhouse Run (Proposed Basin Overflow)	WWF	☐	☐
013	40	40	33.88	-80	20	02.06	Ohio River (North Pond)	WWF	☒	☒
014	40	40	29.38	-80	19	58.23	Ohio River (North Pond Overflow)	WWF	☒	☒
101							Ohio River (IMP for ELG Compliance)	WWF	☒	☒
108	As needed into various storm water manholes						Poorhouse Run (CR Pond)	WWF	☐	☐

Applicant Name: Shell Chemical Appalachia LLC

3. List all outfalls and IMPs in the same order as in question 2, above, and provide the requested information. Attach additional pages as necessary. See instructions.

Outfall / IMP No.	DISCHARGE CHARACTERIZATION							Design Flow (MGD)	Average Flow During Production / Operation (MGD)	Maximum Flow During Production / Operation (MGD)
	Process	Non-Process	Stormwater	Sewage	Groundwater	AAPF	Combined			
001	☒	☒	☒	☐	☐	☐	☒	~3.75	~3.75	~3.75
002	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
003	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
004	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
005	☐	☐	☐	☐	☒	☐	☐	0	NA	NA
006	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
007	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
008	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
009	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
010	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
011	☐	☒	☐	☐	☐	☐	☐	0	NA	NA
012	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
013	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
014	☐	☐	☒	☐	☐	☐	☐	0	NA	NA
101	☒	☐	☐	☐	☐	☐	☐	~1.28	~1.28	~1.28
108	☐	☒	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			

4. List all outfalls and IMPs in the same order as in questions 2 and 3, above, and provide the requested information. Attach additional pages as necessary. See instructions.

Outfall / IMP No.	Wastewater or Stormwater Description	Discharge Type	Frequency		Batch Discharges		
			Hours / Day	Days / Week	No. Discharge Cycles/Day	Length of Discharge Cycle (Hrs)	Batch Discharge Rate (MGD)
001	Outfall 001 receives effluent from the industrial waste treatment plant, cooling tower blowdowns and treated stormwater from the accidentally contaminated stormwater pond.	Continuous	24	7	Not Applicable		
002	East Pond - See Site Plan for drainage area.	Stormwater	NA - Stormwater Only				
003	East Pond Overflow	Stormwater	NA - Stormwater Only				
004	AC Pond Overflow	Stormwater	NA - Stormwater				
005	Mall Lot 2 Ground Water						
006	South Pond - See Site Plan for drainage area.	Stormwater	NA - Stormwater Only				
007	South Pond Overflow	Stormwater	NA - Stormwater Only				
008	CR Pond – See Site plan for drainage area	Stormwater	NA - Stormwater Only				
009	CR Pond Overflow	Stormwater	NA - Stormwater Only				
010	West RR Basin - – See Site plan for drainage area	Stormwater	NA - Stormwater Only				
011	Intake back wash water						
012	West RR Basin Overflow	Stormwater	NA - Stormwater Only				
013	North Pond – See Site plan for drainage area	Stormwater	NA - Stormwater Only				
014	North Pond Overflow	Stormwater	NA - Stormwater Only				
101	Intermediate Monitoring Point at outlet of WWTP	Continuous	24	7	Not Applicable		
108	Hydrostatic Test Water	Batch - Intermittent			As needed during plant startup		

TREATMENT FACILITY INFORMATION

Complete this sheet for each existing and proposed industrial waste, sewage and/or stormwater treatment facility (one sheet per facility).

Treatment Facility Name: **Wastewater Treatment Plant**	Effluent Discharged To Outfall / IMP No**.: 001**

1. Provide a narrative description of the wastewater treatment process. Attach a line drawing or process flow diagram to the application.

The primary function of the Wastewater Treatment Plant (WWTP) is to ensure that all wastewater streams generated from the process units and utilities as well as the process paved area runoff generated from rainstorms are sufficiently treated for discharging to the Ohio River. The WWTP will consist of primary flow equalization and oil removal, followed by secondary activated sludge bioreactor (including clarifier), and tertiary sand filter.

SEE Section 6 that contains detailed description and flow diagram of WWTP

2. List each treatment unit at the facility in sequential order of treatment.

Treatment Unit Description	Method for Handling and Disposal of Solid or Liquid Residue Resulting from Treatment
Oil Removal	**Recovered Oil sent offsite**
Bioreactor Aeration	
Secondary Clarifier	**Biosludge Cake to offsite disposal**
Tertiary Sand Filter	

3. Describe any proposed upgrades to this treatment facility within the next five years.

None

4. Identify all chemicals that have been used for wastewater treatment over the past two years.

Chemical Name	Purpose	Max Usage Rate	Units
Not Applicable - New Wastewater Treatment System			

5. List any additional proposed wastewater treatment chemicals anticipated in the next five years.

Chemical Name	Purpose	Max Usage Rate	Units
Sulfuric Acid	pH adjustment	As needed	
Phosphoric Acid	Nutrients for Biotreater	As needed	
Urea	Nutrients for Biotreater	As needed	
Core Shell 71301 or Equivalent [1]	Enhance solids settling/thickening of biosludge (waste activated sludge)	As needed	
Nalco 71306 or Equivalent [1]	Improve dewatering of thickened biosludge (waste activated sludge)	As needed	

1. ***These chemicals are listed on PADEP Approved Additives excel file; however in discuss with the Department's Central Office it is Project understanding that they meet definition of wastewater treatment chemicals and are to be removed from PADEP Additive list.***

CHEMICAL ADDITIVES

1. Identify all chemical additives that have been introduced to any waste stream over the past two years.

Chemical Additive Name	Outfall / IMP No.	Purpose	Usage Frequency	Max Usage Rate	Units
New Facility – Not Applicable					

2. List all chemical additives that the applicant is requesting approval to use upon issuance of the permit by DEP. Identify the point of introduction on a line or process diagram.

Chemical Additive Name	Outfall / IMP No.	Purpose	Proposed Usage Frequency	Proposed Max Usage Rate	Units
3D Trasar 3DT177 or Equivalent	001/101	Corrosion inhibitor for recirculating cooling water	Continuous	201	lb/day
3D Trasar 3DT197 or Equivalent	001/101	Yellow metal corrosion inhibitor for recirculating cooling water	Continuous	72	lb/day
3D Trasar 3DT294 or Equivalent	001/101	Dispersant/Scale inhibitor for recirculating cooling water	Continuous	721	lb/day
Elimin-Ox or equivalent	001/101	Scavenge any residual dissolved oxygen from deaerated water	Continuous	78	lb/day
NALCO 1741 or Equivalent	001/101	pH control and corrosion inhibitor for Heat Recovery Steam Generators (HRSGs)	Continuous	219	lb/day
Nalco 71D5 PLUS or Equivalent	001/101	Antifoam for contingency foam suppression in cooling water tower	Intermittent	14	lb/day
NALCO 73550 or Equivalent	001/101	Non-ionic biodetergent for removing and dispersing microbiological-based slime and silt deposits within cooling tower fill.	Continuous	87	lb/day
NALCO H-550 or Equivalent	001/101	Non-oxidant biocide used intermittently as shock dose to prevent biological growth especially in case of hydrocarbon leak	Intermittent	Limit use so that maximum concentration of Glutaraldehyde (Nalco H 550) will not exceed WQBEL of 900 ug/L at discharge.	
Sodium Hypochlorite (12%)	001/101	Prevent biological growth in different streams	Continuous	47	
Sodium bisulfite (30%)	001/101	Scavenge any residual chlorine in feed water to demineralizers	Continuous	As Needed	
Tri-Act 1820 or Equivalent	001/101	pH adjustment of deaerated water	Continuous	As Needed	

1. ***Nalco 8140 and Nalco NALCLEAR 7768 are compounds that are on the PADEP additive list. These compounds will be utilized in the raw water treatment system as coagulant/flocculent and as such the Project does not consider these additives for purposes of this application***.

3. List all chemical additives in the same order as question 2, above, and provide the requested information. For chemical additives that are not on DEP's Approved List, submit New Chemical Additive Request Form(s) to DEP's Central Office. For chemical additives that are on DEP's Approved List but a Chemical Additives Notification Form was not previously submitted, attach a Chemical Additives Notification Form to the application.

Chemical Additive Name	On Approved List?	Notification Form Attached?	Notification Form Previously Submitted?	Notification Form Submission Date	Analytical Method
3D Trasar 3DT177 or Equivalent	☒	☒	☐	With Application	NA
3D Trasar 3DT197 or Equivalent	☒	☒	☐	With Application	NA
3D Trasar 3DT294 or Equivalent	☒	☒	☐	With Application	NA
Elimin-Ox or equivalent	☒	☒	☐	With Application	NA
NALCO 1741 or Equivalent	☒	☒	☐	With Application	NA
Nalco 71D5 PLUS or Equivalent	☒	☒	☐	With Application	NA
NALCO 73550 or Equivalent	☒	☒	☐	With Application	NA
NALCO H-550 or Equivalent	☒	☒	☐	With Application	NA
Sodium Hypochlorite (12%)	☒	☒	☐	With Application	NA
Sodium bisulfite (30%)	☒	☒	☐	With Application	NA
Tri-Act 1820 or Equivalent	☒	☒	☐	With Application	NA

PRODUCTION DATA FOR EFFLUENT LIMITATION GUIDELINES (ELGs)

Complete this section for each production line with an applicable ELG. See instructions and use additional sheets as necessary.

1. Production line and process description: **Ethylene Cracker Unit (ECU)**
2. Applicable ELG: 40 CFR: **414** Subpart: **91**
3. Is this production considered a new source? ☒ Yes ☐ No
4. Outfall / IMP No. receiving wastewater: **101**
5. Units of production measurement for ELG: **Million pounds per year**
6. Design production capacity: **1.65 million tons per year**
7. Complete the table below for the five last years of production. Report production data using the same units of measurement as reported in question 4.

Parameter	Production Years				
	20	20	20	20	20
Total Annual Production	*Not Applicable – New Facility*				
Max Monthly Production					
Month of Max Production					
Avg Annual Production					
Avg Production Hours/Day					
Avg Production Days/Month					
Avg Annual Water Usage (MGD)					
Avg Annual Wastewater Flow (MGD)					

8. Average annual production over the past five years: **Not Applicable** Units:
9. Anticipated average annual production for the next five years: **1.65** Units: **Million tons**
10. Explain the basis for the anticipated average annual production for the next five years:

Engineering Estimated based on Equipment Design and Capacity

11. Attach any pertinent information from the applicable ELG in 40 CFR that would allow DEP to appropriately determine technology-based effluent limitations.

PRODUCTION DATA FOR EFFLUENT LIMITATION GUIDELINES (ELGs)

Complete this section for each production line with an applicable ELG. See instructions and use additional sheets as necessary.

1. Production line and process description: **Polyethylene (PE) Units 1 and 2**
2. Applicable ELG: 40 CFR: **414** Subpart: **91**
3. Is this production considered a new source? ☒ Yes ☐ No
4. Outfall / IMP No. receiving wastewater: **101**
5. Units of production measurement for ELG: **Million pounds per year**
6. Design production capacity: **0.606 Million tons per year EACH**
7. Complete the table below for the five last years of production. Report production data using the same units of measurement as reported in question 4.

Parameter	Production Years				
	20	20	20	20	20
Total Annual Production	*Not Applicable – New Facility*				
Max Monthly Production					
Month of Max Production					
Avg Annual Production					
Avg Production Hours/Day					
Avg Production Days/Month					
Avg Annual Water Usage (MGD)					
Avg Annual Wastewater Flow (MGD)					

8. Average annual production over the past five years: **Not Applicable** Units:
9. Anticipated average annual production for the next five years: **0.606** Units: **Million tons per year EACH**
10. Explain the basis for the anticipated average annual production for the next five years:

Engineering Estimated based on Equipment Design and Capacity

11. Attach any pertinent information from the applicable ELG in 40 CFR that would allow DEP to appropriately determine technology-based effluent limitations.

PRODUCTION DATA FOR EFFLUENT LIMITATION GUIDELINES (ELGs)

Complete this section for each production line with an applicable ELG. See instructions and use additional sheets as necessary.

7. Production line and process description: **Polyethylene (PE) Unit 3**
8. Applicable ELG: 40 CFR: **414** Subpart: **91**
9. Is this production considered a new source? ☒ Yes ☐ No
10. Outfall / IMP No. receiving wastewater: **101**
11. Units of production measurement for ELG: **Million pounds per year**
12. Design production capacity: **0.551 Million tons per year**
7. Complete the table below for the five last years of production. Report production data using the same units of measurement as reported in question 4.

Parameter	Production Years				
	20	20	20	20	20
Total Annual Production	*Not Applicable – New Facility*				
Max Monthly Production					
Month of Max Production					
Avg Annual Production					
Avg Production Hours/Day					
Avg Production Days/Month					
Avg Annual Water Usage (MGD)					
Avg Annual Wastewater Flow (MGD)					

12. Average annual production over the past five years: **Not Applicable** Units:
13. Anticipated average annual production for the next five years: **0.551** Units: **Million tons per year**
14. Explain the basis for the anticipated average annual production for the next five years:

Engineering Estimated based on Equipment Design and Capacity

15. Attach any pertinent information from the applicable ELG in 40 CFR that would allow DEP to appropriately determine technology-based effluent limitations.

ANTI-DEGRADATION

If the applicant is proposing a new or increased discharge to High Quality (HQ) or Exceptional Value (EV) waters, Module 4 (Anti-Degradation Module) must be attached to the application. In addition, for HQ waters only, if the analysis concludes that the new or increased discharge will produce a measurable change in water quality, a social or economic justification (SEJ) must be attached if the applicant desires approval for the discharge.

1. Is the Anti-Degradation Module (Module 4) attached to the application? ☐ Yes ☒ No
2. Is a social or economic justification (SEJ) (HQ waters only) attached to the application? ☐ Yes ☒ No

VARIANCES

If the applicant is requesting a variance authorized under federal regulations at 40 CFR 122.21(m), complete the section below and attach to this application documentation necessary under federal regulations to support the variance request.

1. Description of variance requested: **NOT APPLICABLE**
2. Federal regulation authorizing the variance: _____
3. Supporting documentation attached to the application? ☐ Yes ☐ No

LABORATORY INFORMATION

Did an off-site laboratory perform any of the analyses required by this application? ☐ Yes ☐ No

If Yes, provide the information below.

Not Applicable – New Facility

Name		Analyses Performed:
Address		
Phone	( )	
Name		Analyses Performed:
Address		
Phone	( )	

POLLUTANT IDENTIFICATION AND ANALYSIS

1. Summary of Required Analyses (see instructions):

Outfall / IMP No.	Pollutant Groups which must be sampled for and analyzed							Other Pollutants Analyzed
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	
001	☒	☒	☒	☒	☒	☒	☐	
101	☒	☒	☒	☒	☒	☒		
108	☒	☒	☒	☒	☒	☒		
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	

2. Other Potentially Toxic Pollutants Known or Expected to be Present in the Discharge.

a. GC/MS "Five Peaks" Pollutants (see instructions).

Outfall / IMP No.	Group Number (3 - 6)	Chemical or Compound Name	Quantitation Limit (µg/L)	Avg Effluent Concentration (µg/L)	Max Effluent Concentration (µg/L)	No. Samples Positive / No. Analyzed
						/
						/
						/
						/
						/

b. Other Potential Pollutants.

Outfall / IMP No.	Chemical Substance or Compound Name	Reason/Suspected Reason for Presence in Discharge	Avg Concentration (µg/L)	Indicate if Presence is Known (K) or Suspected (S)
001	Glutaraldehyde	Present in biocide	900 ug/L	K

☐ If additional peaks were not available for one or more groups with the method used check here and attach an explanation of why the method was selected.

3. Additional Analysis Results Tables may be attached to provide any of the optional site-specific information discussed in Appendix A of the instructions.
Optional site-specific data is attached to this application? ☐ Yes ☒ No

WHOLE EFFLUENT TOXICITY

NOT APPLICABLE

1. Summarize the results of all Whole Effluent Toxicity (WET) tests completed in the last five years (or attach a separate sheet with these results). If required by the NPDES permit, attach a copy of DEP's WET Analysis Spreadsheet to the application (electronic transmission to DEP is acceptable) that provides replicate data for all species tested and for the most recent four consecutive tests.

   Outfall No. Tested:

   Type of tests completed: ☐ Chronic ☐ Acute

   Dilution series used: %, %, %, %, and % effluent

   Target Instream Waste Concentration (TIWC): % effluent

Test Date	Ceriodaphnia Results (% Effluent)			Pimephales Results (% Effluent)			Pass or Fail
	Survival NOEC	Reproduction NOEC	LC50	Survival NOEC	Growth NOEC	LC50	

2. Describe the status of any Phase I or II Toxicity Reduction Evaluation (if applicable):

PREPAREDNESS, PREVENTION AND CONTINGENCY (PPC) PLAN

NOT APPLICABLE – NEW FACILITY

The applicant may optionally attach its PPC Plan or related plan to the application. This information may be useful to DEP in completing its review of the application. If the PPC Plan is not attached to the application, DEP may request submission of the Plan during the review. Electronic transmission of large PPC Plans is encouraged.

Type or Description of Plan (e.g., PPC, SPCC, etc.)	Attached?	Approved by DEP?	Approval Date	Date of Latest Plan Update
	☐	☐		
	☐	☐		
	☐	☐		

COOLING WATER INTAKE STRUCTURES

Under Section 316(b) of the Clean Water Act and its implementing regulations, certain new and existing facilities with cooling water intake structures must provide specific information in its application. Module 5 of this application must be submitted by facilities that meet the regulatory definitions of new and existing facilities. Check the appropriate boxes below.

Is the facility considered a new facility as defined in 40 CFR § 125.81? ☐ Yes ☒ No
Is the facility considered an existing facility as defined in 40 CFR § 125.91? ☒ Yes ☐ No
Is Module 5 is attached to this application? ☒ Yes ☐ No

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 1

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 1 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
BOD_5 (mg/L)	47	501	23	250						
COD (mg/L)	141	1,502	105	1,126						
TOC (mg/L)	31	331	16	165						
TSS (mg/L)	71	761	36	380						
Ammonia-Nitrogen (mg/L)	5.4	38.6	2.7	19.3						
Temperature (Winter) (°F)	70	XXX	70	XXX		XXX		XXX	XXX	
Temperature (Summer) (°F)	91	XXX	91	XXX		XXX		XXX	XXX	
pH – Minimum (S.U.)	6	XXX	XXX	XXX		XXX		XXX	XXX	
pH – Maximum (S.U.)	9	XXX	XXX	XXX		XXX		XXX	XXX	
Fecal Coliform (No./100 mL)	NA	XXX	NA	XXX		XXX			XXX	
Oil and Grease (mg/L)	19	200	9	100						
TRC (mg/L)	NA	XXX	NA	XXX		XXX				
Total Phosphorus (mg/L)	0.1	0.4	0.03	0.2						
TKN (mg/L)	0.2	1.4	0.1	0.7						
Nitrite + Nitrate-Nitrogen (mg/L)	0.8	5.7	0.4	2.8						
Total Dissolved Solids (mg/L)	7,375	50,078	7,375	50,078						
Color (Pt-Co Units)	NA	XXX	NA	XXX		XXX				
Bromide (mg/L)	NA	NA	NA	NA						
Chloride (mg/L)	107	764	53.5	382						
Sulfate (mg/L)	786	5,619	393	2,809						
Sulfide (mg/L)	0.3	2.4	0.2	1.2						
Surfactants (mg/L)	NA	NA	NA	NA						
Fluoride (mg/L)	0.9	6.4	0.4	3.2						
Total Hardness (mg/L)	5	38	2.7	19						

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 2

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 2 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Aluminum, Total (µg/L)	1,397	10	699	5.0						
Chromium, Total (µg/L)	568	4.1	284	2						
Copper, Total (µg/L)	227	1.6	114	0.8						
Cyanide, Total (µg/L)	227	1.6	114	0.8						
Iron, Total (µg/L)	5,039	36	2,519	18						
Iron, Dissolved (µg/L)	5,039	36	2,519	18						
Manganese, Total (µg/L)	568	4	284	2.0						
Nickel, Total (µg/L)	57	0.4	28	0.2						
Phenols, Total (µg/L)	100	0.7	50	0.4						

1. ***Group 2 pollutants not listed above are not expected to be in wastewater based on process engineering and similar reference plants.***

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 3

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 3 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Benzene (µg/L)	501	3.6	251	1.8						
Ethylbenzene (µg/L)	200	1.4	100	0.7						
Toluene (µg/L)	251	1.8	125	0.9						

1. **Group 3** ***pollutants not listed above are not expected to be in wastewater based on process engineering and similar reference plants.***

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 4

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 4 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
2-Chlorophenol (µg/L)	***Not expected to be in wastewater based on process engineering and similar reference plants***									
2,4-Dichlorophenol (µg/L)										
2,4-Dimethylphenol (µg/L)										
4,6-Dinitro-o-Cresol (µg/L)										
2,4-Dinitrophenol (µg/L)										
2-Nitrophenol (µg/L)										
4-Nitrophenol (µg/L)										
P-Chloro-m-Cresol (µg/L)										
Pentachlorophenol (µg/L)										
Phenol (µg/L)										
2,4,6-Trichlorophenol (µg/L)										

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 5

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 5 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Acenaphthene (µg/L)	200	1.4	100	0.7						
Acenaphthylene (µg/L)	200	1.4	100	0.7						
Anthracene (µg/L)	200	1.4	100	0.7						
Benzo(*a*)Anthracene (µg/L)	200	1.4	100	0.7						
Benzo(*a*)Pyrene (µg/L)	200	1.4	100	0.7						
3,4-Benzo-fluoranthene (µg/L)	200	1.4	100	0.7						
Fluorene (µg/L)	200	1.4	100	0.7						

1. **Group 5 pollutants not listed above are not *expected to be in wastewater based on process engineering and similar reference plants*.**

ANALYSIS RESULTS TABLE

POLLUTANT GROUP 6

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 6 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Group 6 Pollutants are not expected to be in wastewater based on process engineering and similar reference plants.										

POLLUTANT GROUP 7

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 101** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 7 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Group 7 ***Pollutants are not expected to be in wastewater based on process engineering and similar reference plants.***										

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 1

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 1 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
BOD_5 (mg/L)	36	1,121	18	561						
COD (mg/L)	87	2,743	66	2,057						
TOC (mg/L)	20	620	10	310						
TSS (mg/L)	57	1,795	29	898						
Ammonia-Nitrogen (mg/L)	1.8	51	0.9	25.5						
Temperature (Winter) (°F)	95	XXX	95	XXX		XXX		XXX	XXX	
Temperature (Summer) (°F)	104	XXX	104	XXX		XXX		XXX	XXX	
pH – Minimum (S.U.)	6	XXX	XXX	XXX		XXX		XXX	XXX	
pH – Maximum (S.U.)	9	XXX	XXX	XXX		XXX		XXX	XXX	
Fecal Coliform (No./100 mL)	NA	XXX	NA	XXX		XXX			XXX	
Oil and Grease (mg/L)	10	304	5	152						
TRC (mg/L)	NA	XXX	NA	XXX		XXX				
Total Phosphorus (mg/L)	3.7	101.6	1.85	50.8						
TKN (mg/L)	0.05	1.4	0.02	0.7						
Nitrite + Nitrate-Nitrogen (mg/L)	4.7	133.9	2.4	66.9						
Total Dissolved Solids (mg/L)	3,317	91,442	3,317	91,442						
Color (Pt-Co Units)	NA	XXX	NA	XXX		XXX				
Bromide (mg/L)	NA	NA	NA	NA						
Chloride (mg/L)	313	8,624	156.6	4,312						
Sulfate (mg/L)	812	22,578	405.8	11,289						
Sulfide (mg/L)	0.1	2.4	0.1	1.2						
Surfactants (mg/L)	NA	NA	NA	NA						
Fluoride (mg/L)	1.1	31.2	0.6	15.6						
Total Hardness (mg/L)	1.3	38	0.7	19						

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 2

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 2 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Aluminum, Total (µg/L)	4,873	134	2,436	67						
Chromium, Total (µg/L)	139	4.1	70	2.0						
Copper, Total (µg/L)	55.6	1.6	27.8	0.8						
Cyanide, Total (µg/L)	55.6	1.6	27.8	0.8						
Iron, Total (µg/L)	7,577	210	3,788	105						
Iron, Dissolved (µg/L)	7,577	210	3,788	105						
Manganese, Total (µg/L)	139	4.1	69.5	2.0						
Nickel, Total (µg/L)	13.9	0.4	7.0	0.2						
Phenols, Total (µg/L)	24.5	0.7	12.3	0.4						

2. Group 2 pollutants not listed above are not expected to be in wastewater based on process engineering and similar reference plants.

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 3

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 3 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Benzene (µg/L)	123	3.6	61	0.5						
Ethylbenzene (µg/L)	49	1.4	25	0.7						
Toluene (µg/L)	61	1.8	31	0.9						

2. **Group 3 pollutants not listed above are not expected to be in wastewater based on process engineering and similar reference plants.**

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 4

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 4 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
2-Chlorophenol (µg/L)	***Group 4 pollutants not expected to be in wastewater based on process engineering and similar reference plants.***									
2,4-Dichlorophenol (µg/L)										
2,4-Dimethylphenol (µg/L)										
4,6-Dinitro-o-Cresol (µg/L)										
2,4-Dinitrophenol (µg/L)										
2-Nitrophenol (µg/L)										
4-Nitrophenol (µg/L)										
P-Chloro-m-Cresol (µg/L)										
Pentachlorophenol (µg/L)										
Phenol (µg/L)										
2,4,6-Trichlorophenol (µg/L)										

ANALYSIS RESULTS TABLE
POLLUTANT GROUP 5

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 5 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Acenaphthene (µg/L)	49	1.4	25	0.7						
Acenaphthylene (µg/L)	49	1.4	25	0.7						
Anthracene (µg/L)	49	1.4	25	0.7						
Benzo(*a*)Anthracene (µg/L)	49	1.4	25	0.7						
Benzo(*a*)Pyrene (µg/L)	49	1.4	25	0.7						
3,4-Benzo-fluoranthene (µg/L)	49	1.4	25	0.7						
Fluorene (µg/L)	49	1.4	25	0.7						

2. Group 5 pollutants not listed above are not expected to be in wastewater based on process engineering and similar reference plants.

ANALYSIS RESULTS TABLE

POLLUTANT GROUP 6

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 6 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Group 6 pollutants not expected to be in wastewater based on process engineering and similar reference plants.										

POLLUTANT GROUP 7

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 001** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 7 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Group 7 pollutants not expected to be in wastewater based on process engineering and similar reference plants.										

ANALYSIS RESULTS TABLE

POLLUTANT GROUP 1

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 105** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 1 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
TSS (mg/L)	60	NA	30	NA	NA	NA	NA	NA	NA	NA
Oil and Grease (mg/L)	30	NA	15	NA	NA	NA	NA	NA	NA	NA
TRC (mg/L)	0.5	XXX	NA	XXX	NA	XXX	NA	NA	NA	NA

POLLUTANT GROUP 2

Please read instructions carefully before completing this form.

APPLICANT NAME	Shell Chemical Appalachia LLC

☒ **Outfall / IMP Number 105** (Show location of sampling point on Line Drawing)
☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)
☐ Intake Sampling Results (Specify Source: _____)
☐ Background (Upstream) Sampling Results (Specify Location: _____)
☒ New Discharge (Basis for Information: **Engineering Estimate**)

POLLUTANT GROUP 2 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Iron, Total (µg/L)	7,000	NA	7,000	NA	NA	NA	NA	NA	NA	NA

1. **For Hydrostatic Test water the above parameters are the only Group 1, 2, 3, 4, 5, 6 or 7 pollutants expected to be present in wastewater based on process engineering and similar reference plants.**

Applicant Name: Shell Chemical Appalachia LLC

OTHER TOXIC POLLUANTS AND HAZARDOUS SUBSTANCES TABLE

Other Pollutants Which Must Be Identified If Known Or Expected To Be Present in Discharges

Please read instructions carefully before completing this form

Outfall No.	Chemical Substance or Compound	Reason for Presence in Discharge	Avg Effluent Concentration (µg/L)	Max Effluent Concentration (µg/L)	No. of Analyses	Quantitation Limit (µg/L)
001	Acetaldehyde	Present in Process wastewater	100	100		
001	Acetic Acid	Present in Process wastewater	100	100		
001	Formaldehyde	Present in Process wastewater	400	200		
001	Formic Acid	Present in Process wastewater	100	100		
001	Propionic Acid	Present in Process wastewater	100	100		
001	Sodium	Present in Process wastewater	290,000	145,000		
001	Styrene	Present in Process wastewater	10	10		
001	Xylene	Present in Process wastewater	200	100		
001	Xylenol	Present in Process wastewater	200	100		

Is the applicant requesting a hazardous substance spill reporting requirement exemption for any of the substances listed in Attachment A, Table 3 of the instructions?

☒ Yes ☐ No (If Yes, attach the information specified in the instructions).

1. ***Substance and amount are listed in table above***
2. ***Origin and source is the process wastewater***
3. ***The process wastewater is treated through bioreactor/clarifier/filter prior to discharge.***

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM APPLICATION FOR INDIVIDUAL PERMIT TO DISCHARGE INDUSTRIAL WASTEWATER

MODULE 1 – STORMWATER

1. **Applicant/Operator Name:**	**Shell Chemcial Appalachia LLC**

2. List all outfalls receiving stormwater in whole or in part and provide the requested information.

Outfall No.	Entirely Stormwater?	Drainage Area (ft^2)	% Impervious	Description of Materials/Activities in Drainage Area Exposed to Precipitation	No Exposure?
001	☐	1,515,888	100	Process Area Pads (AC Pond)	☐
002	☒	1,028,016	100	East Rail Yard (East RR Pond)	☐
003	☒	NA	NA	Overflow East Rail Yard (East RR Pond)	☐
004	☒	NA	NA	Overflow AC Pond	☐
006	☒	3,576,276	100	No Industrial Activity (South Pond)	☒
007	☒	NA	NA	Overflow South Pond	☒
008	☒	3,798,432	100	West Non-Process Areas (CR Pond)	☐
009	☒	NA	NA	Overflow CR Pond	☐
010	☒	165,528	100	West Rail Area (West RR Basin)	☐
012	☒	NA	NA	Overflow West RR Basin	☐
013	☒	4,578,156	100	East Non-Process Area and Rail Yard (North Pond)	☐
014	☒	NA	NA	Overflow North Pond	☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐
	☐				☐

3. List all outfalls receiving stormwater in the same order as question 2, above, and provide the requested information.

Outfall No.	Sampling Completed?	Representative Outfall No.	Treatment?	Description of BMPs in Drainage Area to Control Pollutants in Stormwater	PCSM?
001	☐		☒	As discussed iin the PCSM Plan, the BMP's for the project are: • Dry extended basin-- includes paved areas, asphalt roads, and ponds. Area of AC system is removed. • Water quality filters and hydrodynamic devices – Area of AC system. • Street Sweeping – All paved areas. • Reducing street imperviousness- Applicable to all pavement shoulders across the entire site.	☒
002	☐		☐		☒
003	☐		☐		☒
004	☐		☐		☒
006	☐		☐		☒
007	☐		☐		☒
008	☐		☐		☒
009	☐		☐		☒
010	☐		☐		☒
012	☐		☐		☒
013	☐		☐		☒
014	☐		☐		☒
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐
	☐		☐		☐

4. All non-stormwater discharges from these outfall(s) are identified in the Discharge Information section of the application?

☒ Yes ☐ No ☐ There are no non-stormwater discharges associated with these outfalls (If No, attach an explanation)

5. If there have been leaks or spills on-site within the past five years that have reached stormwater outfall(s), identify the outfall(s) receiving the leaks or spills, the substance(s) released, measures taken to remediate the incident(s) and preventative measure(s) taken to reduce the possibility of future incidents. Attach additional sheets as necessary.

None

6. Describe how often stormwater outfalls are inspected and routine maintenance performed, if not identified in question 3.

A program for inspection and maintenance will be developed for the proposed petrochemical complex

STORMWATER SAMPLING RESULTS

Complete the following tables for each stormwater outfall sampled for analysis.

Application is for proposed new Petrochemical Complex – no stormwater data available as representative of future outfalls at this time.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM APPLICATION FOR INDIVIDUAL PERMIT TO DISCHARGE INDUSTRIAL WASTEWATER

MODULE 5 – COOLING WATER INTAKE STRUCTURES

Applicant/Operator Name:	**Shell Appalachia Chemical LLC**

General Information

1. Number of CWISs at facility: **1**

2. Type of CWIS:

CWIS ID No.	Type (check box):			
1	☐ New Facility	☐ New Offshore O&G Facility	☒ Existing Facility	☐ BPJ Facility over 2 MGD
	☐ New Facility	☐ New Offshore O&G Facility	☐ Existing Facility	☐ BPJ Facility over 2 MGD
	☐ New Facility	☐ New Offshore O&G Facility	☐ Existing Facility	☐ BPJ Facility over 2 MGD

3. CWIS Flow Data:

CWIS ID No.	DIF (MGD)	AIF (MGD)	Max Screen Velocity (fps)	% Used for Cooling	% Mean Annual Flow
1	21.4	18	0.5	87% of AIF	0.08%

4. Type of CWIS Location:

CWIS ID No.	Type (check box):				
1	☐ Intake Canal	☐ Embayment, Bank or Cove	☐ Submerged Offshore Intake	☐ Near-shore Submerged Intake	☒ Shoreline Submerged Intake
	☐ Intake Canal	☐ Embayment, Bank or Cove	☐ Submerged Offshore Intake	☐ Near-shore Submerged Intake	☐ Shoreline Submerged Intake
	☐ Intake Canal	☐ Embayment, Bank or Cove	☐ Submerged Offshore Intake	☐ Near-shore Submerged Intake	☐ Shoreline Submerged Intake

5. Impingement Control Technology:

CWIS ID No.	Technology (check box):					
1	☐ No Controls	☒ Modified Traveling Screens	☐ Passive Intake	☐ Barrier Net	☐ Fish Diversion or Avoidance	☐ Other Technology
	☐ No Controls	☐ Modified Traveling Screens	☐ Passive Intake	☐ Barrier Net	☐ Fish Diversion or Avoidance	☐ Other Technology
	☐ No Controls	☐ Modified Traveling Screens	☐ Passive Intake	☐ Barrier Net	☐ Fish Diversion or Avoidance	☐ Other Technology

6. Entrainment Control Technology:

CWIS ID No.	Technology (check box):					
1	☐ No Controls	☐ Traveling Screens w/Fine Mesh	☐ Far Offshore Intake	☐ Passive Screens w/Fine Mesh	☒ Closed-Cycle Recirculating System	☐ Other Technology
	☐ No Controls	☐ Traveling Screens w/Fine Mesh	☐ Far Offshore Intake	☐ Passive Screens w/Fine Mesh	☐ Closed-Cycle Recirculating System	☐ Other Technology
	☐ No Controls	☐ Traveling Screens w/Fine Mesh	☐ Far Offshore Intake	☐ Passive Screens w/Fine Mesh	☐ Closed-Cycle Recirculating System	☐ Other Technology

New Facilities NOT APPLICABLE – Existing Facility
1. Identify the Track chosen to comply with 316(b) requirements: ☐ Track I – 40 CFR 125.84(b) (facilities that withdraw greater than or equal to 10 MGD) ☐ Track I – 40 CFR 125.84(c) (facilities that withdraw greater than 2 MGD and less than 10 MGD) ☐ Track II – 40 CFR 125.84(d) (comparable to Track I)
2. Provide a narrative description of the system that has been designed to reduce intake flow to a level commensurate with that that can be attained by a closed-cycle recirculating cooling water system and any engineering calculations, including documentation that make-up and blowdown flows have been minimized.
3. If the flow reduction requirement is met entirely, or in part, by reusing or recycling water withdrawn for cooling purposes in subsequent industrial processes, provide documentation that the amount of cooling water that is not reused or recycled has been minimized.
4. Provide a narrative description of the design, structure, equipment and operation used to meet the maximum through-screen design intake velocity requirement of no more than 0.5 fps.
5. Provide design calculations showing that the velocity requirement will be met at minimum ambient source water surface elevations and maximum head loss across the screens or other device.
6. Track I – Attach a Design and Construction Technology Plan. Attached: ☐ Yes ☐ No
7. Flow Requirements – Report the annual mean flow, mean low water tidal excursion distance, or a narrative description of the water body thermal stratification, with supporting documentation and engineering calculations, as applicable (see instructions).
8. Track II – Attach a Comprehensive Demonstration Study. Attached: ☐ Yes ☐ No

Source Water Physical Data

1. List the name(s) of the water body(ies) from which cooling water is or will be withdrawn.

   Ohio River

2. Provide a narrative description of the physical configuration of all source water bodies and attach scaled drawings.

   The existing intake is located within the Montgomery Pool of the Ohio River. Along the section of the Ohio River the river height and flow are controlled by numerous upstream structures, but pool level is mainly controlled by two USACE-operated Lock and Dams: Dashields (upstream) and Montgomery (downstream). River navigation is managed by several state and federal agencies; however, the USACE – Pittsburgh District oversees operation and maintenance of the Ohio River in Pennsylvania. Upriver discharge is governed by the Dashields Lock and Dam while the Montgomery Lock and Dam governs lower pool elevations and discharge downriver. When the river is at or near its normal pool elevation, the flow rate is approximately 10 thousand cubic feet per second (kcfs) and the flow velocity is approximately 0.3 miles per hour (mph).

3. Identify and characterize the source water body's hydrological and geomorphological features and methods used to determine the intake's area of influence and results of such studies.

   The Ohio River is approximately 1,300 feet wide with a maintained average depth of 10 to 15 feet in the area of the existing intake structure.

4. Attach locational maps showing the source waters. Attached: ☒ Yes ☐ No

Cooling Water Intake Structure Data

1. Provide a narrative description of the configuration of each CWIS and where it is located in the water body and in the water column.

   One (1) Shoreline submerged intake structure on the Ohio River is used. It includes two (2) travelling water screens each with a stop log and manual bar screen. The structure is configured to provide 8 ft. of submergence at low river water level and 12 ft. at normal water level.

2. Provide the latitude and longitude for each CWIS.

CWIS ID No.	Latitude			Longitude		
	DEG	MIN	SEC	DEG	MIN	SEC
1	**40**	**40**	**4.57**	**80**	**20**	**47.34**

3. Provide a narrative description of the operation of each CWIS, including design intake flows, daily hours of operation, number of days per year in operation, and seasonal changes, if applicable.

   Intake flow is expected to be in the range 18 to 21 MGD. Daily hours of operation is 24 hours and CWIS will operate 365 days a year.

4. Attach to Module 5 a flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges. Attached: ☒ Yes ☐ No

5. Attach to Module 5 engineering drawings of the CWISs. Attached: ☒ Yes ☐ No

Source Water Baseline Biological Characterization Data

1. Identify all data requested by 40 CFR 122.41(r)(4)(ii) through (vi) that are not available and efforts made to identify sources of the data.

   SEE Attached Baseline Biological Assessment Report

2. Report species (or relevant taxa) for all life stages and their relative abundance in the vicinity of the CWISs.

   SEE Attached Baseline Biological Assessment Report

3. Identify the species and life stages that would be most susceptible to impingement and entrainment.

   SEE Attached Baseline Biological Assessment Report

4. Identify and evaluate the primary period of reproduction, larval recruitment, and period of peak abundance for relevant taxa.

   SEE Attached Baseline Biological Assessment Report

5. Report data representative of the seasonal and daily activities of biological organisms in the vicinity of the CWISs.

   SEE Attached Baseline Biological Assessment Report

6. Identify all threatened, endangered and other protected species that might be susceptible to impingement and entrainment and the CWISs.

   SEE Attached Baseline Biological Assessment Report

7. Document any public participation or consultation with federal or state agencies in development of the plan.

   SEE Attached Baseline Biological Assessment Report

8. For owners or operators of existing facilities only, identify protective measures and stabilization activities that have been implemented, and a description of how these measures and activities affected the baseline water condition in the vicinity of the intake.

   Historically the only activity conducted by Horsehead in the vicinity of the intake has been periodic maintenance dredging (per Horsehead Permit E04-250). Also, the design capacity of the intake is 80 MGD which is only 0.3% of the annual mean flow of the Ohio River (approximately 25,530 MGD based on 30 yr. avg.) in the vicinity of the plant.

   Neither of these activities had any material effect on the baseline water condition in the vicinity of the intake.

9. For owners or operators of existing facilities, provide a list of fragile species at the facility as defined in 40 CFR 125.92(m).

   SEE Attached Baseline Biological Assessment Report

Cooling Water System Data

1. Provide a narrative description of the operation of the cooling water system and its relationship to CWISs.

   Pumps in CWIS are operated to pump raw river water to a water treatment plant. Treated water is pumped to two open recirculating cooling water towers. Towers are counter-flow mechanical draft towers that supply the cooling water to process units and the cogeneration power plant (users). Cooling water is returned to cooling towers from the users, cooled and cooled water is pumped back to users.

2. Identify the number of days per year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable.

   Cooling water system is operated 365 days a year.

3. Report the proportion of design intake flow for contact cooling, non-contact cooling and process uses.

   Contact Cooling: **0%** Non-Contact Cooling: **87%** Process: **13%**

4. Describe water reuse, if applicable, including cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling.

   Provisions are made to use cooling water blowdown for freeze protection of wastewater equalization tanks and to provide micronutrients for wastewater biological treatment plant.

5. Describe reductions in total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals.

   Water demand is reduced by using closed loop non-contact cooling and six cycles of concentration for the cooling towers. Steam condensate is recycled and mixed with demin water and returned to steam plant. Flow to the water treatment plant is controlled based on water demand to avoid excessive withdrawal.

6. Identify and describe any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows.

   Provisions are made to use cooling water blowdown for freeze protection of wastewater equalization tanks and to provide micronutrients for wastewater biological treatment plant.

7. Report the proportion of the source water body withdrawn, on a monthly basis.

   Less than 0.6% at lowest monthly flow as shown in Table 6 of attached biological report

8. Provide (or attach to Module 5) all design and engineering calculations prepared by a qualified professional and data to support responses to questions 1 through 7 in this section. Attached: ☒ Yes ☐ No

   Refer to attached Water Balance

9. Describe existing impingement and entrainment technologies or operational measures and a summary of their performance.

   Travelling water screens are of fish handling design. Each screen is provided with spray cleaning system with an upper fish trough and lower debris trough. From each discharge point, means to convey the aquatic organisms and debris separately to discharge locations located downstream of intake structure is provided.

Chosen Method(s) of Compliance with Impingement Mortality Standard

1. Check the appropriate box to indicate which method(s) have been selected to comply with the impingement mortality standard. Also check the appropriate box on the right to indicate whether this method applies to the facility as a whole or to a specific CWIS. If it applies to a specific CWIS, provide the ID No.

☒ 40 CFR 125.94(c)(1) – Closed-Cycle Recirculating System	☒ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(2) – 0.5 Feet Per Second Through-Screen Design Velocity	☐ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(3) – 0.5 Feet Per Second Through-Screen Actual Velocity	☐ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(4) – Existing Offshore Velocity Cap	☐ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(5) – Modified Traveling Screens	☐ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(6) – Systems of Technologies as the BTA for Impingement Mortality	☐ Facility	☐ CWIS ID:
☐ 40 CFR 125.94(c)(7) – Impingement Mortality Performance Standard	☐ Facility	☐ CWIS ID:

If options 125.94(c)(5) or 125.94(c)(6) are selected, attach an Impingement Technology Performance Optimization Study.
Attached: ☐ Yes ☒ No

2. If a BTA determination for impingement mortality under 40 CFR 125.94(c)(11) or (12), check the appropriate box and attach supporting documentation to Module 5.

   ☐ 40 CFR 125.94(c)(11) ☐ 40 CFR 125.94(c)(12) ☒ Not Applicable

Entrainment Performance Studies

Attach to Module 5 any previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies. See instructions.

Attached: ☐ Yes ☒ No

Operational Status

1. For power production or steam generation, describe each individual unit operating status, including age of each unit, capacity utilization rate for the previous 5 years, and any major upgrades completed within the past 15 years. See instructions.

   NOT APPLICABLE – Cogeneration unit will be new unit

2. Describe completed, approved or scheduled uprates and Nuclear Regulatory Commission relicensing status of each unit at nuclear facilities.

   NOT APPLICABLE

3. For process units using cooling water other than for power production or steam generation, if the applicant intends to use reductions in flow or changes in operations to meet the requirements of 40 CFR 125.95(c), describe individual production processes and product lines, operating status including age of each line, seasonal operation, any major upgrades completed within the last 15 years, and plans or schedules for decommissioning or replacement of process units or production processes and product lines.

   NOT APPLICABLE – Process units will be new unit

4. For all manufacturing facilities, describe current and future production schedules.

   Production Data is provided in NPDES Application Section for ELG

5. Explain plans or schedules for any new units planned within the next 5 years.

   NOT APPLICABLE

Additional Studies
NOT APPLICABLE – under 125 MGD

Check the appropriate boxes to indicate whether required studies for existing facilities withdrawing greater than 125 MGD (annual intake flow) are attached to Module 5.

☐ 40 CFR 122.21(r)(9) – Entrainment Characterization Study

☐ 40 CFR 122.21(r)(10) – Comprehensive Technical Feasibility and Cost Evaluation Study

☐ 40 CFR 122.21(r)(11) – Benefits Valuation Study

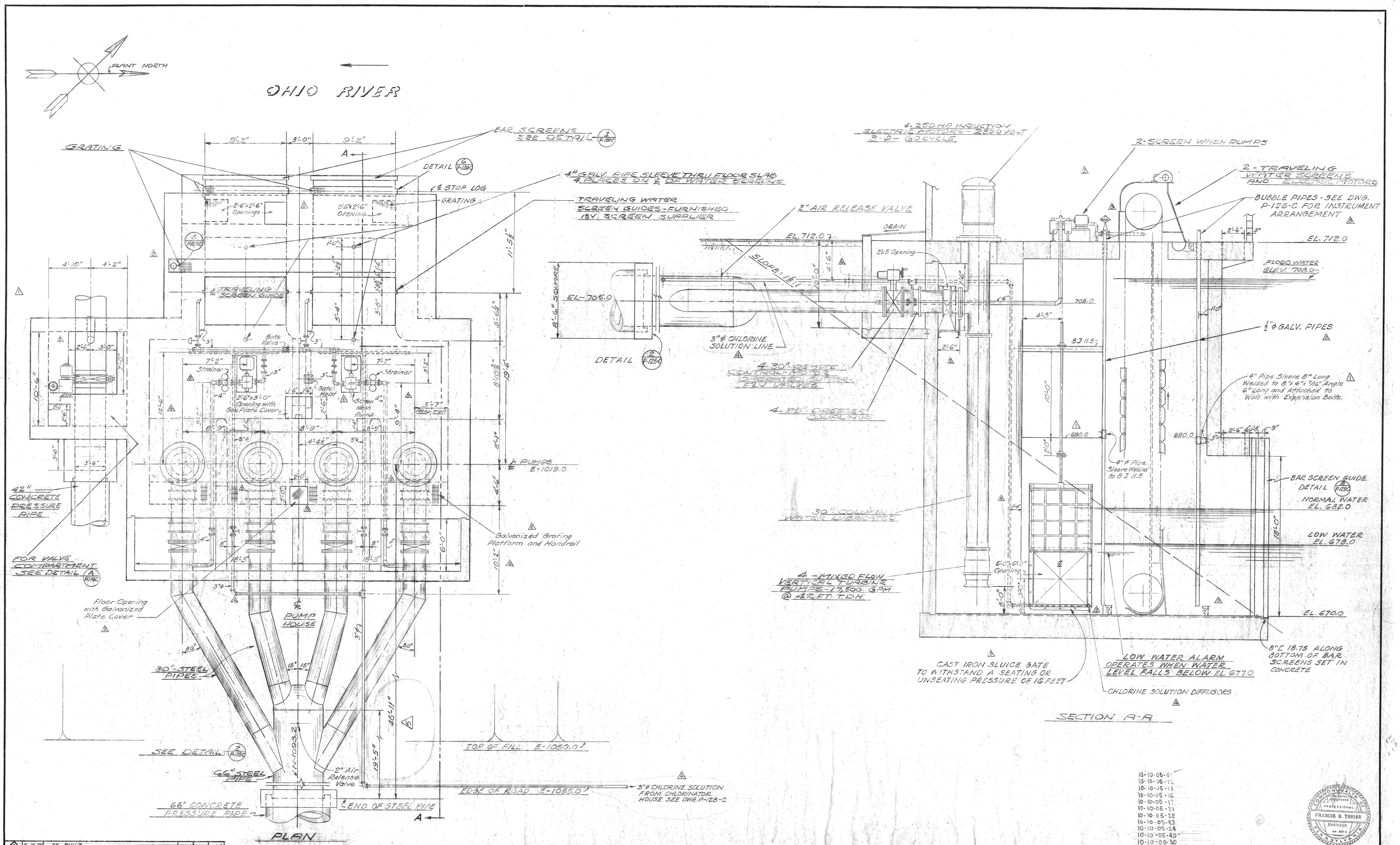
☐ 40 CFR 122.21(r)(12) – Non-Water Quality Environmental and Other Impacts Study

New Units

Identify the chosen compliance method for all new units at existing facilities. See instructions.

NOT APPLICABLE – existing CWIS

CWIS Figures



10-10-05-01
10-10-05-12
10-10-05-13
10-10-05-16
10-10-05-17
10-10-05-21
10-10-05-22
10-10-05-23
10-10-05-24
10-10-05-40
10-10-05-50
10-10-05-60

NO.	DATE	REVISION	BY	APP.	APP.
5	9-10-58	AS BUILT	NCJ		W.A.P.
4	10-28-57	Added Chlorine Solution Line	KJN		
3	9-3-57	Replaced Differential Water Level Control & Spray Water Piping - Relocated Floor Opening to Pump Compartment	KJN		
2	6-27-57	Added Working Platform at Pump Compartment & other changes published	KJN		
		Added Compartment Wall and Sluice Gate			
		Relocated Floor Opening Within Pump House			
		Added Dresser Couplers to 30" Pump Discharges			
		Reduced Opening for Traveling Water Screens			
		Relocated Sluice Gate Hoist Bracket & Pipe			
1	5-2-57	Revised 42" Valve Compartment & Transition Section	KJN		
		Relocated Floor Opening			
		Revised Circulating Water Pump Compartment Dimensions & Stop Log Slots			

REFERENCE DRAWINGS	NUMBER
RIVER PUMP STATION DETAILS	P-125-C
Condenser Cooling Water Piping-No. 18 Profile	P-118-C
Condenser Cooling Water Piping - Details	P-118-C
CONSTRUCTION STOS	CS-101
River Pump Station - Piping Details	P-126-C

NOTES

1. Operating floor overhung 2' at the sides of Pump Station as shown on this drawing; see Architectural and Structural drawings for further information.
2. PROVISION WILL BE MADE FOR 1" STATION AIR SERVICE AND 2" PLANT WATER FOR PUMP SEALS AND SERVICE

DESCRIPTION	COST ACCOUNT
PUMPHOUSE STRUCTURE	32.01000
PUMPING EQUIP.	32.11000
CONDENSER COOLING WATER	32.12000
Rev. #4 7/30/57	
Rev. #1 5/15/57; Rev. #2 2/6/57; Rev. #3 2/14/57	

WORK COVERED BY THIS DRAWING CHARGED TO COST ACCOUNT ABOVE

APPROVED FOR CONSTRUCTION
W.A.P. 8-28-57
CONSTRUCTION APPROVAL

APPROVAL		DATE
PROJECT ENGINEER	W. A. Ball	8/28/57
CHIEF ENGINEER		

THIS DRAWING IS THE PROPERTY OF KAISER ENGINEERS - DIVISION OF HENRY J. KAISER COMPANY AND IS NOT TO BE COPIED OR USED WITHOUT ITS WRITTEN PERMISSION

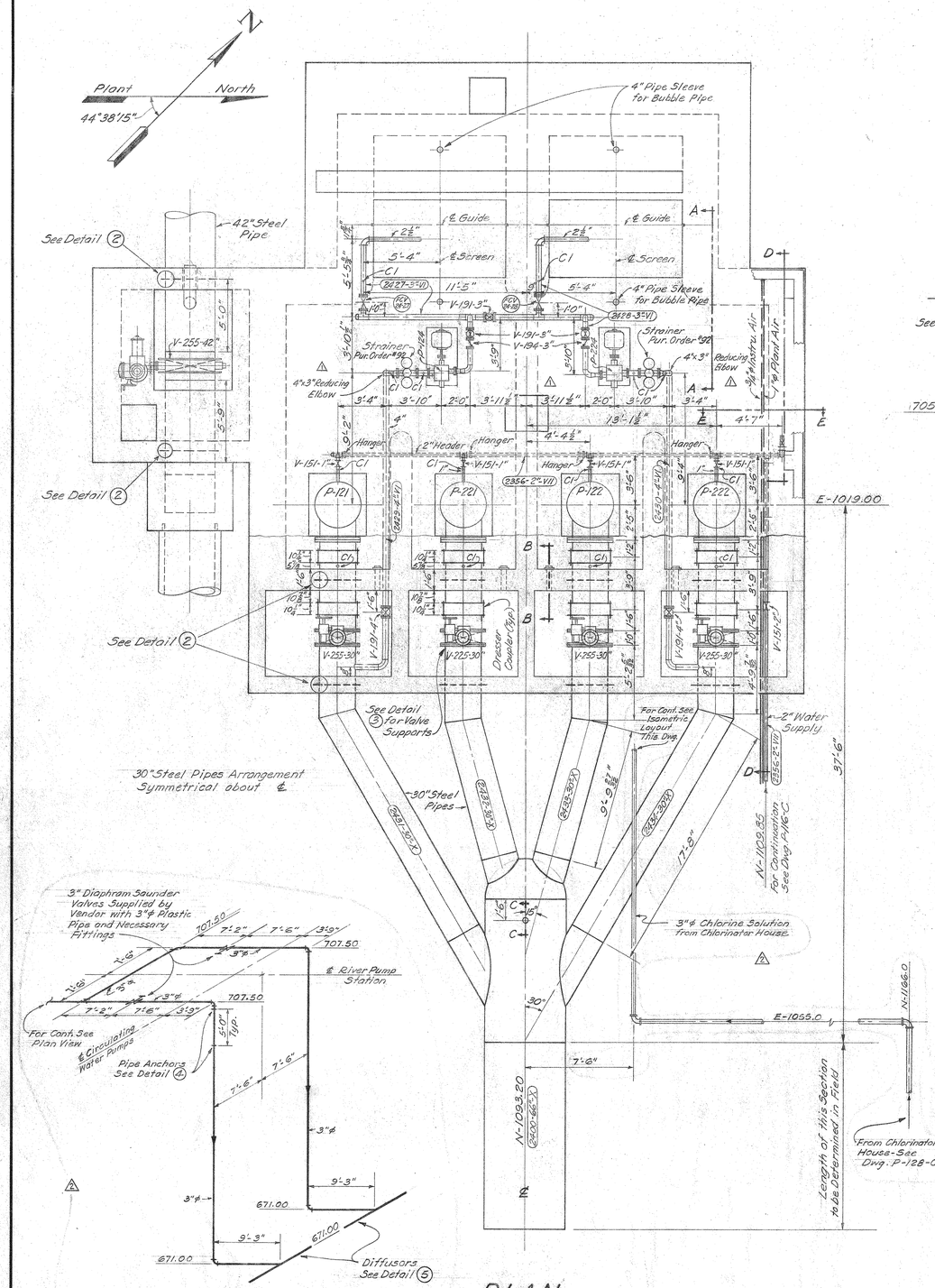
DIVISION OF HENRY J. KAISER COMPANY **KAISER ENGINEERS** OAKLAND CALIFORNIA

		DATE
SCALE	1/4" = 1 FOOT	
DRAWN BY	R. COCHRANE	2-26-57
CHECKED BY	K.J.N.	3-7-57
APPROVED BY		3-28-57
CHIEF DESIGN ENGINEER		3-27-57

FOR ST. JOSEPH LEAD COMPANY
LOCATION JOSEPHTOWN, MONACA, PA.

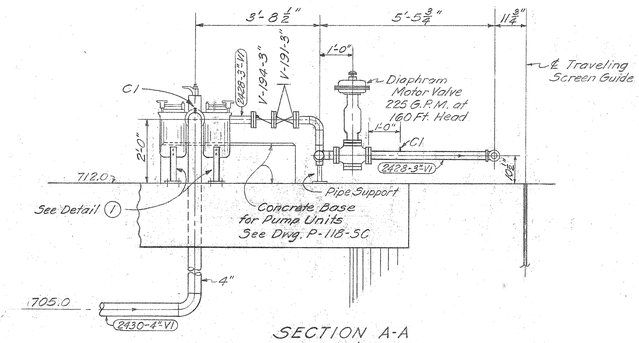
GEORGE F. WEATON STATION
RIVER PUMP STATION ARRANGEMENT

JOB № 5603 DWG. № P-124-C REVISION R-5

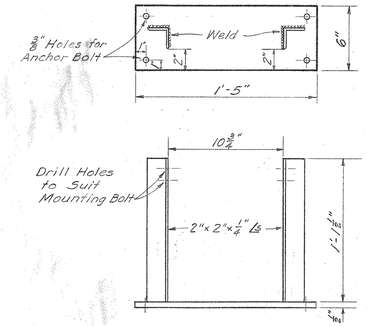


ISOMETRIC LAYOUT OF CHLORINE SOLUTION PIPING IN PUMP STATION
Scale: 1/8"=1'

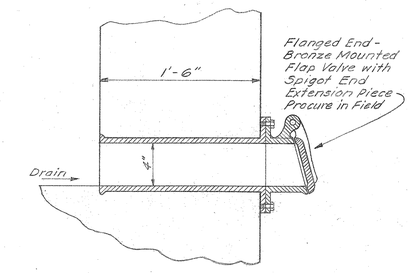
PLAN
Scale: 1/4"=1'



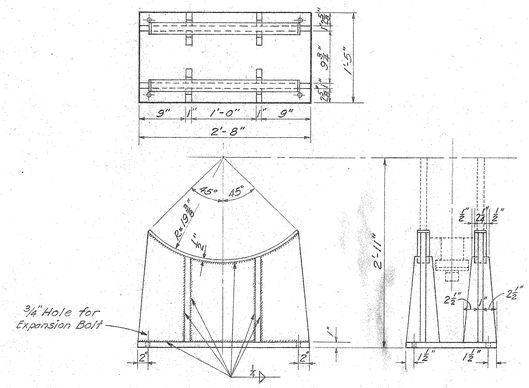
SECTION A-A
Scale: 1/2"=1'



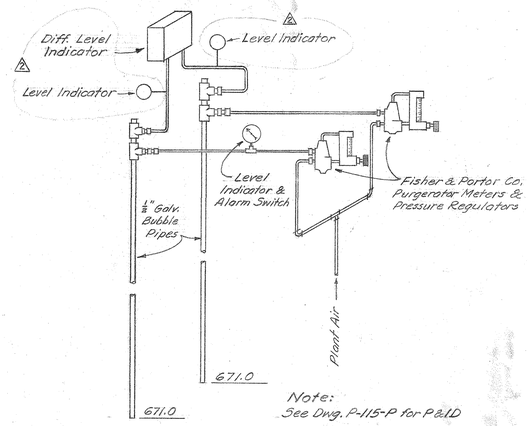
DETAIL 1
Basket Strainer Support
Scale: 2"=1'



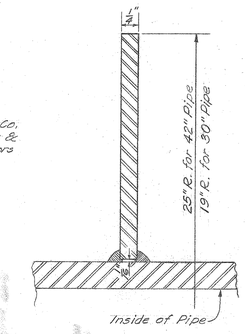
SECTION B-B
No Scale



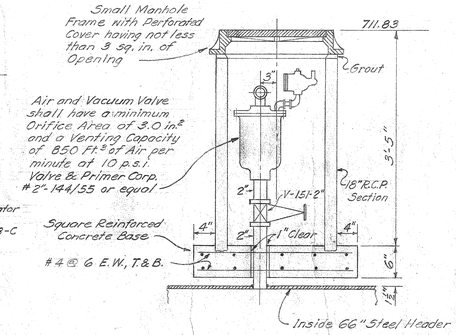
DETAIL 3
STEEL SUPPORT FOR 30" BUTTERFLY VALVES
Scale: 1"=1'



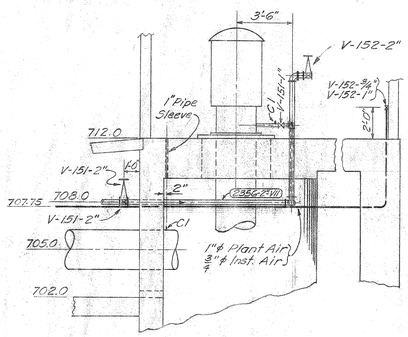
BUBBLE PIPE ARRANGEMENT
Not to Scale



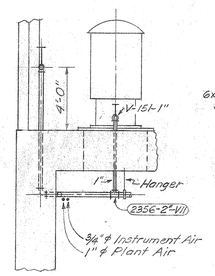
DETAIL 2
Water Stop
Not to Scale



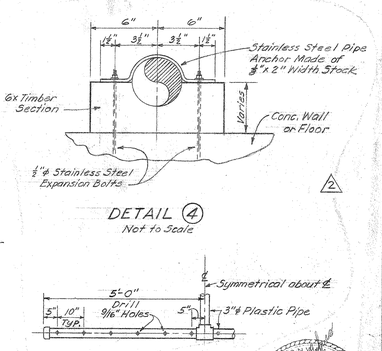
SECTION C-C
2" Combination Air & Vacuum and Air Release Valves
Scale: 1"=1'



SECTION D-D
Scale: 1/4"=1'



SECTION E-E
Scale: 1/4"=1'



DETAIL 4
Not to Scale

DETAIL 5
Scale: 1/2"=1'

NO.	DATE	REVISION	BY	APP.	APP.
2	11-6-57	Added Chlorine Solution Piping & Details. Added Level Indicators in Bubble Pipe Arrangement	KJN	WMA	
1	9-3-57	Revised Screen Spray Water Piping	KJN		

REFERENCE DRAWINGS	NUMBER
River Pump Station - Arrangement	P-124-C
River Pump Station - Details	P-125-C
Condenser Cooling Water Piping - Details	P-114-C
River Pump Station - Foundation & Floor Slabs	P-118-SC
River Pump Station - Sections & Details	P-119-SC
Condenser Cooling Water Piping - Plan & Profile	P-113-C

NOTES

1. For 30" Circulating Water Pump Discharge: Cut all flanges from 1 1/2" plate; finished to minimum 1 1/4" thickness. All flanges have 125# standard drilling and facing. All bolt holes to straddle center lines.
2. All steel pipes exposed under floor slab are to be coated and wrapped.

RIVER PUMPS & STRUCTURES 320.00.00
Rev. #1, 9/1/57; Rev. #2, 11/4/57
DESCRIPTION | COST ACCOUNT
WORK COVERED BY THIS DRAWING CHARGED TO COST ACCOUNT ABOVE

APPROVED FOR CONSTRUCTION
W. A. A. 8-20-57
CONSTRUCTION APPROVAL

APPROVAL		DATE
PROJECT ENGINEER	W. A. Ball	8/20/57
CHIEF ENGINEER		

THIS DRAWING IS THE PROPERTY OF KAISER ENGINEERS - DIVISION OF HENRY J. KAISER COMPANY AND IS NOT TO BE COPIED OR USED WITHOUT ITS WRITTEN PERMISSION.

DIVISION OF HENRY J. KAISER COMPANY
KAISER ENGINEERS OAKLAND CALIFORNIA

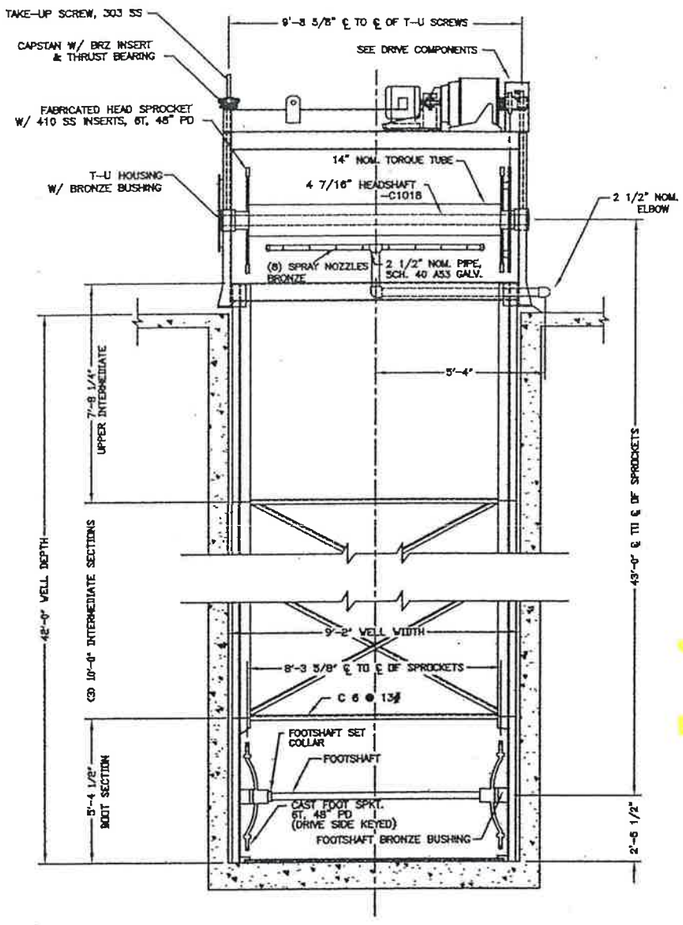
		DATE
SCALE	As Shown	
DRAWN BY	K.J.N.	8-14-57
CHECKED BY		8-15-57
APPROVED BY		8-19-57
CHIEF DESIGN ENGINEER		8-19-57

FOR ST. JOSEPH LEAD COMPANY
LOCATION JOSEPHTOWN, MONACA, PA.

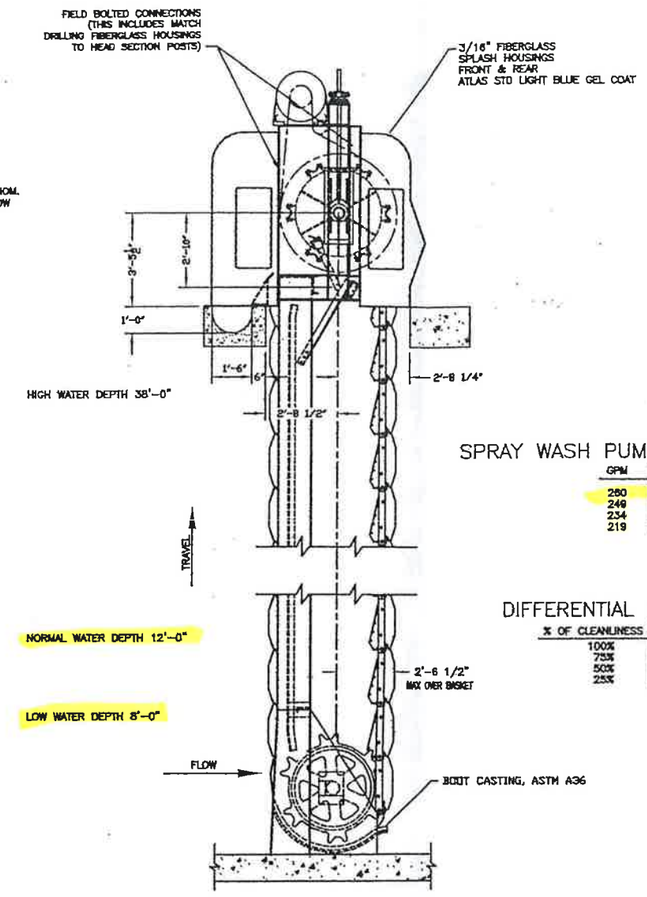
GEORGE F. WEATON STATION
RIVER PUMP STATION
PIPING DETAILS

JOB № 5603 DWG. № P-126-C REVISION R-2

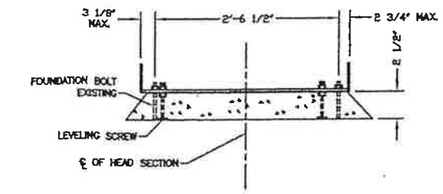
COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER FRANCIS B. TOSIAS NO. 30246



FRONT VIEW



RIGHT SIDE VIEW



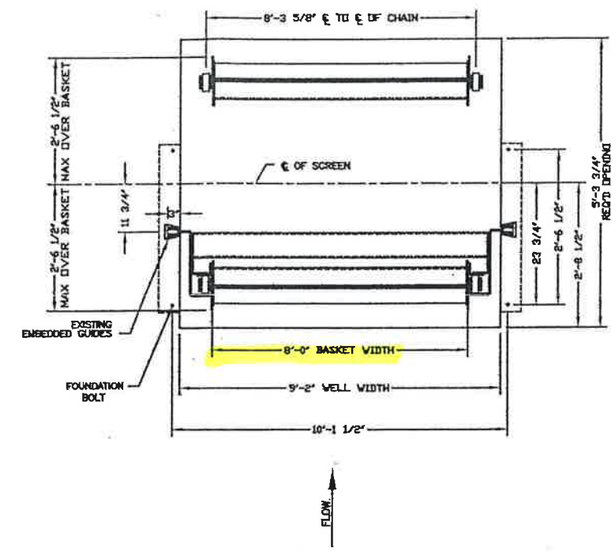
FOUNDATION DETAIL

SPRAY WASH PUMP REQUIREMENTS:

GPM	PSI
280	100
249	90
234	80
219	70

DIFFERENTIAL WATER LEVEL

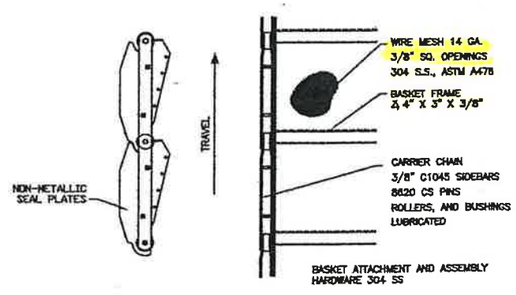
% OF CLEANLINESS	HEADLOSS IN FT.
100%	.11
75%	.23
50%	.57
25%	2.42



HORSEHEAD CORPORATION
MONACA, PA

DRIVE COMPONENTS:

MOTOR	3 HP 1750 RPM 3-PH, 230/460V, 60 HZ
REDUCER	CLASS II 6 RPM OUTPUT
DRIVE CHAIN	1.75" PITCH RC140
DRIVE SPROCKET W/SHEAR PIN DEVICE	12T
DRIVEN SPROCKET	86T



BASKET DETAIL

NOTES:

1. COATING: ALL CASTINGS AND FABRICATED STEEL PARTS SHALL BE SANDBLASTED AND COATED WITH 16 MILS OF COAL TAR EPOXY. DRIVE CHAIN SHALL RECEIVE ONE COAT OF SLUSH OIL. ANY STAINLESS STEEL, NON-FERROUS OR GALVANIZED MATERIAL SHALL REMAIN UNPAINTED.
2. ALL FRAME HARDWARE TO BE 18-8 SS.
3. SCREEN WILL PASS APPROXIMATELY 34000 GPM AT A NORMAL WATER DEPTH OF 8 FT. THRU A 100% CLEAN SCREEN AT A VELOCITY OF 2.15 FPS.
4. THE ENTIRE FRAMEWORK SHALL BE CONSTRUCTED OF ASTM A36 STEEL. EACH SECTION TO BE OF WELDED AND BOLTED CONSTRUCTION.
5. DRIVE SYSTEM IS DESIGNED TO START SCREEN UNDER A MAX. OF 5 FT. HEADLOSS.

ATLAS MANUFACTURING CO.

GENERAL ARRANGEMENT

8' X 43' 2-POST

TRAVELING WATER SCREEN

REV.	DATE	DESCRIPTION	DRAWN BY	DATE 1-30-07	DRAWING NO.	REV.
			APPROVED BY	SCALE NONE	SP07-240	

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name**:	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality**:	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County**:	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	3D Trasar 3DT177 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Corrosion inhibitor for recirculating cooling water
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	4,290
Maximum Usage Rate:	117,473 **Units**: lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013

Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name**:	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality**:	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County**:	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	3D Trasar 3DT197 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Yellow metal corrosion inhibitor for recirculating cooling water
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	23.617
Maximum Usage Rate:	647 **Units**: lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	3D Trasar 3DT294 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Dispersant/Scale inhibitor for recirculating cooling water
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	1,420
Maximum Usage Rate:	38,884 **Units:** lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3247

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	NALCO 71D5 PLUS or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Antifoam
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Intermittent (as needed)
Method of Introduction:	Manual
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
$Q_{7\text{-}10}$ Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	6.373
Maximum Usage Rate:	175 **Units:**

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name**:	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality**:	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County**:	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	Nalco 73550 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Non-ionic biodetergent for removing and dispersing microbiological-based slime and silt deposits
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	14.995
Maximum Usage Rate:	411 **Units**: lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	NALCO H-550 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Non-oxidant biocide
Location(s) of Use:	Cooling Water Tower basin
Frequency of Use:	Intermittent (as needed)
Method of Introduction:	Manual
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	0.9
Maximum Usage Rate:	Limit use so that maximum concentration of Glutaraldehyde will not exceed 0.9 mg/L at discharge
Units:	

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 6

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013

Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name**:	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality**:	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County**:	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	Tri-Act820 or equivilant
Manufacturer Name:	Nalco
Intended Use(s):	pH control of deaerated water
Location(s) of Use:	Deaerartor Storage tank
Frequency of Use:	Continuous
Method of Introduction:	Manual
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	97.466
Maximum Usage Rate:	2,669 **Units**: lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013

Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	Elimin-Ox or equivalent
Manufacturer Name:	Nalco
Intended Use(s):	Scavenge any residual dissolved oxygen from deaerated water
Location(s) of Use:	Deaerator outlet/ deaerator storage tank
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	Waste water treatment plant
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
$Q_{7\text{-}10}$ Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	125.6
Maximum Usage Rate:	3,439 **Units:** lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013

Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name**:	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality**:	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County**:	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	Nalco 1741 or Equivalent
Manufacturer Name:	Nalco
Intended Use(s):	pH control and corrision inhibitor
Location(s) of Use:	Heat Recovery Steam Generator
Frequency of Use:	Continuous
Method of Introduction:	Auto Feeder
Treatment Following Introduction:	
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	562
Maximum Usage Rate:	15,398 **Units**: lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☐ YES ☒ NO If YES, Number: _____

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3247

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	12% Sodium Hypochlorite
Manufacturer Name:	
Intended Use(s):	Prevent biological growth in different streams
Location(s) of Use:	Raw and potable Water treatment
Frequency of Use:	Intermittent
Method of Introduction:	Manual
Treatment Following Introduction:	Waste water treatment plant
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	0.206
Maximum Usage Rate:	47 **Units:** lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281.731.3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

3800-FM-BPNPSM0487 Rev. 3/2013
Instructions

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.depweb.state.pa.us/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Shell Chemical Appalachia LLC	**Facility Name:**	Shell Petrochemicals Complex
Permit No.:	PA0002208	**Municipality:**	Potter and Center Twp
Permit Effective Date:	July 1, 2015	**County:**	Beaver
Permit Expiration Date:	June 30, 2020		

Trade Name of Chemical Additive:	30% Sodium Bisulfite
Manufacturer Name:	
Intended Use(s):	Scavenge any residual chlorine in feed water to demineralizers
Location(s) of Use:	Demineralizer plant
Frequency of Use:	Intermittent
Method of Introduction:	Manual
Treatment Following Introduction:	Waste water treatment plant
Discharge Point (Outfall No.):	001
Design Flow of Discharge (MGD):	~3.8
Receiving Water Body Name:	Ohio River
Q_{7-10} Flow of Stream (cfs):	4,730
Calculated WQBEL (mg/L):	232
Maximum Usage Rate:	6,346 **Units:** lb/day

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel 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 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

H. James Sewell
Environmental Manager
Attorney-in-Fact

Phone: 281 731 3287

Date: 11/6/15

Signature of Principal Executive Officer or Authorized Agent

Chemical Additives Maximum Dosage Evaluation

	Data from PADEP Approved Chemical Additives excel file list - data pulled 10/20/2015						PENNTOX Results		
Chemical Additive Name	Manufacturer	Purpose(s)	Aquatic Life Effect Level - Acute (mg/L)	Aquatic Life Effect Level - Chronic (mg/L)	Human Health Safe Usage Concentration (mg/L)	CRL	PENNTOX Results WQBEL (ug/L)	Max Usage Rate (lb/day) [1,2]	Proposed (lb/day)
3D TRASAR 3DT177	NALCO		206	22.9	NT	No	4,290,000	117,473	201
3D TRASAR 3DT197	NALCO		1.13	0.126	NT	No	23,617	647	72
3D TRASAR 3DT294[3]	NALCO	Cooling Water Treatment	68.5	7.61	14	Yes	1,420,000	38,884	721
Elimin-Ox	NALCO	Oxygen Scavenger	6	0.67	NA	No	125,581	3,439	78
Nalco 1741	NALCO	Boiler Treatment	166	18.44	3	No	562,304	15,398	219
Nalco 71D5 Plus	NALCO		0.31	0.034	8.3	No	6,373	175	14
Nalco 73550	NALCO		0.71	0.08	NA	No	14,995	411	87
Nalco H 550[3]	NALCO	Microbicide	0.043	0.0048	2	No	900	25	See note 6
Sodium Bisulfite Solution 42% [4]	Univar		11.21	1.24	NT	No	232,419	6,364	As needed
Sodium Hypochlorite[5]	All Manufacturers		0.01	0.0011	0.21	No	206	47	47
Tri-Act 1820	NALCO	Corrosion Inhibitor	4.69	0.52	1.4	No	97,466	2,669	As needed

1 Max usage rate calculated as Flow in MGD * WQBEL in ug/L * Conversation Factor of 0.008348
2 Effluent Discharge Flow at outfall 00 3.28 MGD (Dry flow for conservatism)
3 Human Health Safe Usage based on updated NALCO data provided to PADEP 10/19/2015
4 Project proposing to use 30% sodium bisulfite solution
5 PADEP data for Sodium Hypochlorite based on 100%. Usage rate ratio of 100/12 for 12% solution.
6 Will limit usage so concentration of Glutaraldehyde (Nalco H 550) to not exceed WQBEL of 900 ug/L at discharge 001.

PENTOXSD

Modeling Input Data

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)	Apply FC
32317	**952.70**	**681.85**	**22771.80**	**0.00010**	**0.00**	☑

Stream Data

	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Rch Velocity (fps)	Rch Trav Time (days)	Tributary Hard (mg/L)	Tributary pH	Stream Hard (mg/L)	Stream pH	Analysis Hard (mg/L)	Analysis pH
Q7-10	0.21	0	4730	0	1200	15	0	0	98	7.33	0	0	0	0
Qh		0	0	0	0	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard (mg/L)	Disc pH
Outfall 001	PA0002208	3.28	0	0	0	0	0.2	0.2	0.2	62	8.5

Parameter Data

Parameter Name	Disc Conc (µg/L)	Trib Conc (µg/L)	Disc Daily CV	Disc Hourly CV	Steam Conc (µg/L)	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc (µg/L)
3D Trasar 3DT177	1E+07	0	0.5	0.5	0	0	0	0	1	0
3D Trasar 3DT197	1000000	0	0.5	0.5	0	0	0	0	1	0
3D Trasar 3DT294	1000000	0	0.5	0.5	0	0	0	0	1	0
Elimin-Ox (Carbohydrazide)	1000000	0	0.5	0.5	0	0	0	0	1	0
NALCO 1741	1000000	0	0.5	0.5	0	0	0	0	1	0
Nalco 71D5 PLUS	1000000	0	0.5	0.5	0	0	0	0	1	0
NALCO 73550	1000000	0	0.5	0.5	0	0	0	0	1	0
NALCO H-550	1000000	0	0.5	0.5	0	0	0	0	1	0
Sodium bisulfite (30%)	1000000	0	0.5	0.5	0	0	0	0	1	0
Sodium Hypochlorite (12%)	1000000	0	0.5	0.5	0	0	0	0	1	0
Tri-Act 1820	1000000	0	0.5	0.5	0	0	0	0	1	0

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)	Apply FC
32317	**951.71**	**681.67**	**22772.85**	**0.00010**	**216.00**	☑

Stream Data

	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Rch Velocity (fps)	Rch Trav Time (days)	Tributary Hard (mg/L)	Tributary pH	Stream Hard (mg/L)	Stream pH	Analysis Hard (mg/L)	Analysis pH
Q7-10	0.21	0	4730	0	1200	15	0	0	98	7.33	0	0	0	0
Qh		0	0	0	0	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard (mg/L)	Disc pH
		0	0	0	0	0	0	0	0	100	7

Parameter Data

Parameter Name	Disc Conc (µg/L)	Trib Conc (µg/L)	Disc Daily CV	Disc Hourly CV	Steam Conc (µg/L)	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc (µg/L)
3D Trasar 3DT177	0	0	0.5	0.5	0	0	0	0	1	0
3D Trasar 3DT197	0	0	0.5	0.5	0	0	0	0	1	0
3D Trasar 3DT294	0	0	0.5	0.5	0	0	0	0	1	0
Elimin-Ox (Carbohydrazide)	0	0	0.5	0.5	0	0	0	0	1	0
NALCO 1741	0	0	0.5	0.5	0	0	0	0	1	0
Nalco 71D5 PLUS	0	0	0.5	0.5	0	0	0	0	1	0
NALCO 73550	0	0	0.5	0.5	0	0	0	0	1	0
NALCO H-550	0	0	0.5	0.5	0	0	0	0	1	0
Sodium bisulfite (30%)	0	0	0.5	0.5	0	0	0	0	1	0
Sodium Hypochlorite (12%)	0	0	0.5	0.5	0	0	0	0	1	0
Tri-Act 1820	0	0	0.5	0.5	0	0	0	0	1	0

PENTOXSD Analysis Results

Hydrodynamics

SWP Basin	Stream Code:	Stream Name:
20E	32317	OHIO RIVER

RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope	Depth (ft)	Width (ft)	WD Ratio	Velocity (fps)	Reach Trav Time (days)	CMT (min)
Q7-10 Hydrodynamics											
952.700	4730	0	4730	5.07416	0.0001	15	1200	80	0.2631	0.23	1000+
951.710	4730	334.15	4395.8	NA	0	0	0	0	0	0	NA
Qh Hydrodynamics											
952.700	12101	0	12101	5.07416	0.0001	22.671	1200	52.931	0.445	0.136	1000+
951.710	12101	334.15	11767	NA	0	0	0	0	0	0	NA

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number
952.70	**Outfall 001**	**PA0002208**

AFC

Q7-10: **CCT (min)** 15 **PMF** 0.066 **Analysis pH** 7.336 **Analysis Hardness** 97.428

Parameter	Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
Sodium Hypochlorite (12%)	0	0	0	0	10	10	630.057
3D Trasar 3DT177	0	0	0	0	206000	206000	1.297E+07
Sodium bisulfite (30%)	0	0	0	0	11210	11210	706293.9
3D Trasar 3DT197	0	0	0	0	1130	1130	71196.45
NALCO 1741	0	0	0	0	166000	166000	1.045E+07
Nalco 71D5 PLUS	0	0	0	0	310	310	19531.77
NALCO H-550	0	0	0	0	43	43	2709.245
3D Trasar 3DT294	0	0	0	0	68500	68500	4310000
Elimin-Ox (Carbohydrazide)	0	0	0	0	6000	6000	378034.2
NALCO 73550	0	0	0	0	710	710	44734.05
Tri-Act 1820	0	0	0	0	4690	4690	295496.8

CFC

Q7-10: **CCT (min)** 720 **PMF** 0.2 **Analysis pH** 7.332 **Analysis Hardness** 97.807

Parameter	Stream Conc. (µg/L)	Stream CV	Trib Conc. (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
Sodium Hypochlorite (12%)	0	0	0	0	1.1	1.1	206.178
3D Trasar 3DT177	0	0	0	0	22900	22900	4290000
Sodium bisulfite (30%)	0	0	0	0	1240	1240	232419.1
3D Trasar 3DT197	0	0	0	0	126	126	23616.79
NALCO 1741	0	0	0	0	18440	18440	3450000
Nalco 71D5 PLUS	0	0	0	0	34	34	6372.783

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number
952.70	**Outfall 001**	**PA0002208**

NALCO H-550	0	0	0	0	4.8	4.8	899.687
3D Trasar 3DT294	0	0	0	0	7610	7610	1420000
Elimin-Ox (Carbohydrazide)	0	0	0	0	670	670	125581.3
NALCO 73550	0	0	0	0	80	80	14994.78
Tri-Act 1820	0	0	0	0	520	520	97466.09

THH

Q7-10: **CCT (min)** 331.176 **PMF** 0.2 **Analysis pH** NA **Analysis Hardness** NA

Parameter	Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
Sodium Hypochlorite (12%)	0	0	0	0	210	210	39361.31
	CCT based on PWS at RMI 951.71.						
3D Trasar 3DT177	0	0	0	0	NA	NA	NA
Sodium bisulfite (30%)	0	0	0	0	NA	NA	NA
3D Trasar 3DT197	0	0	0	0	NA	NA	NA
NALCO 1741	0	0	0	0	3000	3000	562304.4
	CCT based on PWS at RMI 951.71.						
Nalco 71D5 PLUS	0	0	0	0	8300	8300	1550000
	CCT based on PWS at RMI 951.71.						
NALCO H-550	0	0	0	0	2000	2000	374869.6
	CCT based on PWS at RMI 951.71.						
3D Trasar 3DT294	0	0	0	0	NA	NA	NA
Elimin-Ox (Carbohydrazide)	0	0	0	0	NA	NA	NA
NALCO 73550	0	0	0	0	NA	NA	NA
Tri-Act 1820	0	0	0	0	1400	1400	262408.7
	CCT based on PWS at RMI 951.71.						

CRL

Qh: **CCT (min)** 720 **PMF** 0.2

Parameter	Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
Sodium Hypochlorite (12%)	0	0	0	0	NA	NA	NA

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number							
952.70	**Outfall 001**	**PA0002208**							
	3D Trasar 3DT177		0	0	0	0	NA	NA	NA
	Sodium bisulfite (30%)		0	0	0	0	NA	NA	NA
	3D Trasar 3DT197		0	0	0	0	NA	NA	NA
	NALCO 1741		0	0	0	0	NA	NA	NA
	Nalco 71D5 PLUS		0	0	0	0	NA	NA	NA
	NALCO H-550		0	0	0	0	NA	NA	NA
	3D Trasar 3DT294		0	0	0	0	14000	14000	6690000
	Elimin-Ox (Carbohydrazide)		0	0	0	0	NA	NA	NA
	NALCO 73550		0	0	0	0	NA	NA	NA
	Tri-Act 1820		0	0	0	0	NA	NA	NA

PENTOXSD Analysis Results

Recommended Effluent Limitations

SWP Basin	Stream Code:	Stream Name:
20E	32317	OHIO RIVER

RMI	Name	Permit Number	Disc Flow (mgd)
952.70	Outfall 001	PA0002208	3.2800

Parameter	Effluent Limit (µg/L)	Governing Criterion	Max. Daily Limit (µg/L)	Most Stringent WQBEL (µg/L)	Most Stringent WQBEL Criterion
3D Trasar 3DT177	4290000	CFC	6690000	4290000	CFC
3D Trasar 3DT197	23616.79	CFC	36845.98	23616.79	CFC
3D Trasar 3DT294	1000000	INPUT	1560000	1420000	CFC
Elimin-Ox (Carbohydrazide)	125581.3	CFC	195927	125581.3	CFC
NALCO 1741	562304.4	THH	877285.3	562304.4	THH
Nalco 71D5 PLUS	6372.783	CFC	9942.566	6372.783	CFC
NALCO 73550	14994.78	CFC	23394.27	14994.78	CFC
NALCO H-550	899.687	CFC	1403.656	899.687	CFC
Sodium bisulfite (30%)	232419.1	CFC	362611.2	232419.1	CFC
Sodium Hypochlorite (12%)	206.178	CFC	321.671	206.178	CFC
Tri-Act 1820	97466.09	CFC	152062.8	97466.09	CFC

Section 6

Wastewater and Stormwater Description and Diagrams

SECTION 6
Wastewater and Stormwater Description and Diagrams
NPDES Application- Shell Petrochemical Complex

The following provides a description of the wastewater streams, wastewater treatment plant and stromwater management system for the proposed petrochemical complex. The following figures/diagrams are included in this section:

- Estimated effluent parameters and concentrations for outfall 001 and IMP 101.
- Wastewater balance and treatment system schematic.
- Site Drainage plan.

1.1. Wastewater Streams

The operation of the proposed petrochemical plant will result in the generation of industrial wastewater and storm water. The following effluent streams will be treated in the waste water treatment plant (WWTP):

- Process wastewater from Ethylene Cracker Unit (ECU); excluding tar/pitch from quench tower. Tar/pitch will be shipped offsite for disposal and/or reuse.
- Spent caustic generated from cracked gas caustic wash within ECU will be oxidized in Spent Caustic Treatment System, and oxidized spent caustic brine from Spent Caustic Treatment System will be sent to the WWTP for further treatment.
- Overflow water from Polyethylene (PE) units' pellet water tanks.
- Wastewater coming from open drips and drain system, maintenance pad washing, exchanger bundle cleaning, sample collection, rotary equipment drip pans, water draws from tanks, flare system, and maintenance drop out (MDO) effluents generated during maintenance activities, etc.
- Cooling tower blowdown from cooling tower unit, only in case of hydrocarbon contamination. (A portion of blow down water from cooling tower will be routed to the equalization tanks to provide necessary micro-nutrients needed for biological growth and also to utilize heat during winter, if required.)
- Accidently Contaminated (AC) stormwater runoff from process paved areas.
- Internal recycle streams like biosludge dewatering concentrate, sand filter backwash waste, and off-spec effluents.
- Boiler blowdown and neutralized regeneration waste from demineralizer plant.

1.2. Wastewater Treatment Plant

The primary function of the Wastewater Treatment Plant (WWTP) is to ensure that all wastewater streams generated from the process units and utilities as well as the process paved area runoff generated from rainstorms are sufficiently treated in compliance with the effluent limits for discharging treated effluent to the Ohio River. The wastewater treatment consists of

- Flow Equalization and Oil Removal (FEOR) tanks for removing oil and suspended solids,

- Bioreactors for removing dissolved organic contaminants
- Secondary Clarifier for clarification of biotreated effluent, and
- Tertiary filter for total suspended solids (TSS) removal.

The treated effluent from the filter will be discharged to the Ohio River through Outfall Number 001.

Various wastewater streams, as defined above, will be routed to the Flow Equalization and Oil Removal (FEOR) Tank for hydraulic flow equalization and oil removal. Besides, oil removal, some suspended solids will also be removed in FEOR tank. CWT blowdown will be normally combined with treated effluent from WWTP downstream of Internal Monitoring Point 101and the comingled stream will be discharged to Ohio River via a permitted outfall 001. However, in case of hydrocarbon contamination of the cooling tower, blowdown will be routed directly to the bioreactor for hydrocarbon removal.

The deoiled wastewater from FEOR tanks will flow to the bioreactor aeration tanks for removal of dissolved contaminants. The mixed liquor effluent from the bioreactor aeration tanks will flow to the secondary clarifiers for solids removal.

The clarified biotreated effluent from secondary clarifiers will comingle with the neutralized regeneration waste from demineralization plant. The mixed stream will flow to the tertiary sand filter for final TSS removal. The treated effluent from the sand filter will combine with CWT blowdown and finally discharge to the Ohio River.

Storm water runoff from process paved areas where there is the potential of accidental hydrocarbon or PE solids spillage will be routed to the Flow Diversion Box for regulated flow to the FEOR tanks, and excess AC water will flow to the AC pond. PE main process areas are also subject to spillage of polymer, additive powder, and pellets. Process paved area runoff water will be collected and will be screened to remove PE solids before releasing to the AC system. The collected AC water in AC Pond will be pumped at a regulated rate (in order not to upset the hydraulics of the WWTP) to the FEOR tank for treatment.

1.3. Outfall Numbering

For clarity in the future NPDES permit, we have “re-numbered” the outfalls to eliminate old, historical outfalls that no longer exist. Attached is a table that shows the existing outfalls listed in the current NPDES permit and the proposed outfall numbering sequence for the outfalls that will exist in the future permit.

1.4. Hydrostatic Test Water

Prior to commissioning, hydrostatic testing of the tanks/vessels will occur. The hydro testing water from tanks/vessels will be drained to the nearest AC catch basin and collected in the AC Pond. Since this operation will occur prior to facility being fully functional, the AC pond will not be receiving other waste/storm waters. The AC Pond has an emergency connection (Normally Closed) with the CR Pond and from that connection the collected hydro test water

will be routed to the CR Pond and then discharged to Poorhouse Run via Outfall 008, provided it meets the Hydro test Water quality. We have named the internal monitoring point 108, however the exact location will change dependent on location of nearest AC catch basin.

1.5. Domestic Wastewater Effluent

Domestic sewage generated at various occupied buildings (e.g. operations control centers and shelters, office buildings, laboratories, warehouses, maintenance shops, etc.) will be sent to Center Township Sanitary Authority (CTSA) wastewater treatment facility. Shell has obtained the approval from CTSA to connect the domestic waste generated at Petrochemical Plant to their treatment system, and this agreement is not part of the NPDES permit for the plant.

1.6. Storm Water Management

The primary function of the Storm Water Management system is to ensure that drainage networks are suitable for collecting and conveying specific effluents and runoffs from catchments and sub-catchments, and designed such that optimum segregation of different effluent streams is achieved. The attached figures show the overall site drainage plan and provides the stormwater balance.

1.6.1. Clean Rainwater (CR) system.

The Clean Rainwater system consists exclusively of areas where surface rainwater is not anticipated to be contaminated by hydrocarbons or chemicals or buoyant solids due to facility operations. CR rain water runoffs are routed via surface drain systems (e.g. ditches, culverts) and soak-aways (as appropriate) to CR ponds. The CR ponds are provided with a controlled outlet before leaving the site.

1.6.2. Accidentally Contaminated (AC) water system.

The AC system collects mainly surface water (rainfall and or firewater) from areas where spills or leakages of hydrocarbons or chemicals or solid PE pellets may be anticipated, but not expected. The philosophy is to route AC to WWTP. The AC underground network is composed of trenches, catch basins, manholes, perimeter drainage channels and pipes.

1.6.3. Curbed Continuously Contaminated (CCC) System.

The CCC system is a gravity based drainage system that manages water in local sumps. The CCC paving design shall accommodate 100% concentration and at least 24 hour exposure to the likely spilled contents. These areas shall be separated from adjacent areas by a curb or high point and shall be sized to accommodate the anticipated maximum spill volume. Two types of CCC areas are defined:

- CCC areas with a sump. Storm water collected in these areas shall be removed by truck or drain via a normally closed (NC) valve. Any spills shall be removed by truck and disposed.

- CCC/AC Areas. These areas are CCC areas, which are AC when not in use (e.g. truck loading / unloading areas). The AC connection is normally open to drain storm water to the AC system. However, during operation activities the AC connection shall be closed and any collected CCC liquids shall be diverted/evacuated/pumped to WWTP area. In other words, this area acts as if it is an AC area but the CCC criteria for permeability of the containment materials shall be met.

SECTION 6
Wastewater and Stormwater Description and Diagrams
NPDES Application- Shell Petrochemical Complex

Outfalls in Existing Permit		Proposed Revised Outfall Numbers	
001	Treated Storm water monitored at IMP 101	001	Treated process wastewater monitored at IMP 101 and noncontact cooling water
002	Treated Sanitary Wastewater	002	Storm water from East RR Pond
003	Once through non-contact cooling water	003	Overflow from East RR Pond
004	Treated Storm water runoff from process area of plant (Former Fly Ash pond/ITS)	004	Overflow from AC pond Need to have "Phased Approach" for outfall 004. Transition to "Clean Storm" after submission of validating storm water data
005	Fly ash leachate and storm water runoff	005	Ground water runoff in Mall Lot 2
		006	Storm water from South Ponds
007	Overflow from a storm water runoff collection basin	007	Overflow from South Pond
008	Storm water runoff from plant yard areas	008	Storm water from CR Pond
009	Overflow from storm water runoff collection basin	009	Overflow from CR pond
010	Storm water runoff from former coal pile area and plant yard areas	010	Storm water from West RR Basin
011	Screen back wash from power plant intake	011	Raw Water Intake Screen Backwash
		012	Overflow from West RR Basin
013	Treated storm water runoff from process area of plant and overflows from the Storm water replacement pond monitored at IMP 113	013	Outfall from North Pond Need to have "Phased Approach" for outfall 013. Transition to "Clean Storm" after submission of validating storm water data
		014	Overflow from North Pond Physically in same location as 113
017	Storm water runoff		
018	Storm water runoff		
019	Storm water runoff		
020	Storm water runoff		
021	Storm water runoff		
101	Treated Storm water runoff from process area of plant	101	IMP for wastewater treatment plant effluent (ELG Compliance)
		108	Internal Monitoring Point for Hydro Test Water Discharge through CR Pond outfall 008
104	Overflows basin 1		
113	Overflows from the Storm water replacement pond		
114	Overflows from Storm Water West Retention Pond		
204	Overflows basin 2		
304	Overflows basin 3		
404	Overflows basin 4		
504	Overflows basin 5		
604	Overflows basin 6		

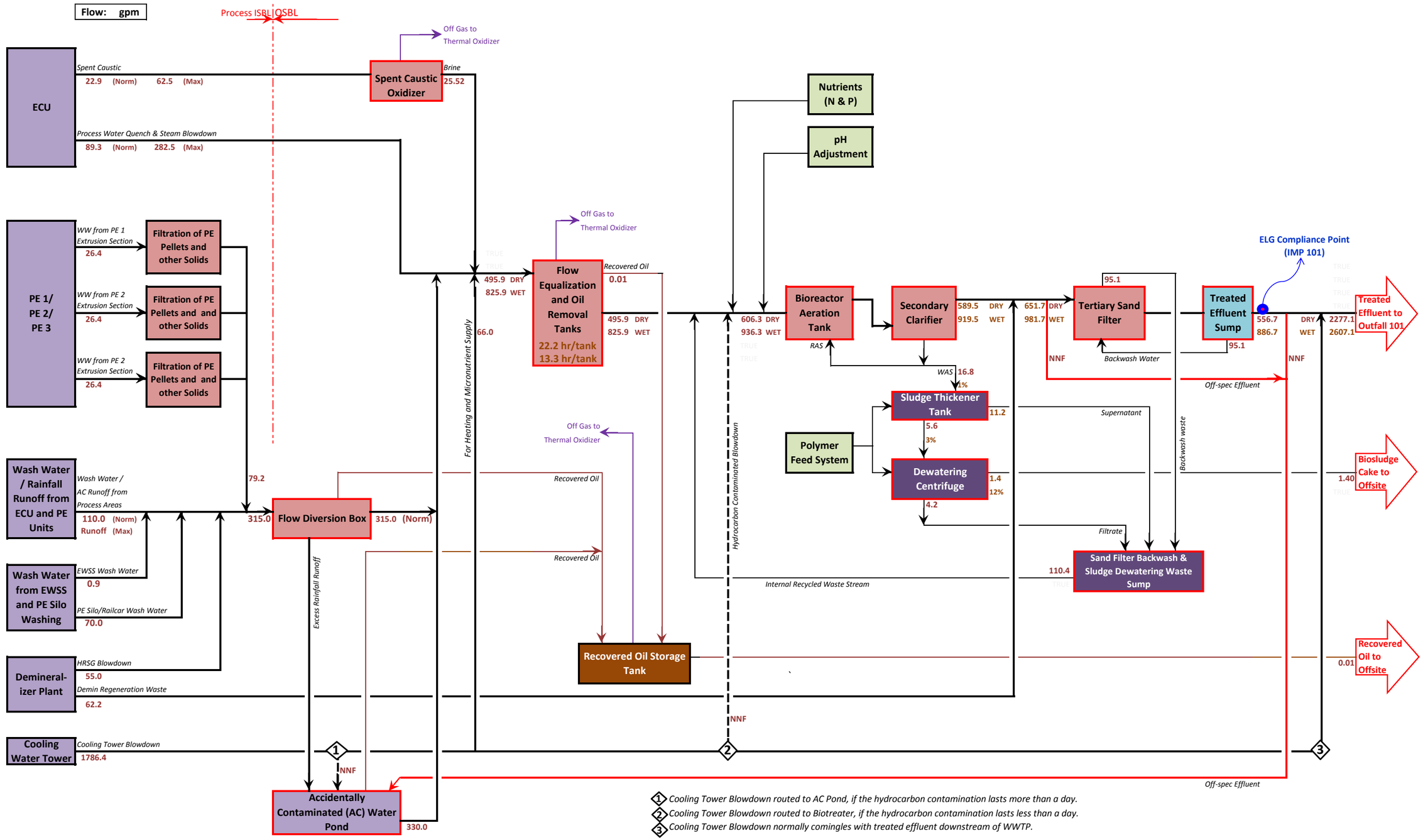
713	Overflows basin 7		
813	Overflows basin 1		

1. Outfalls are number 0XX
2. Overflows are outfalls as they do not discharge to another outfall
3. Internal Monitoring Points start with “1XX” with XX outfall that eventually discharge

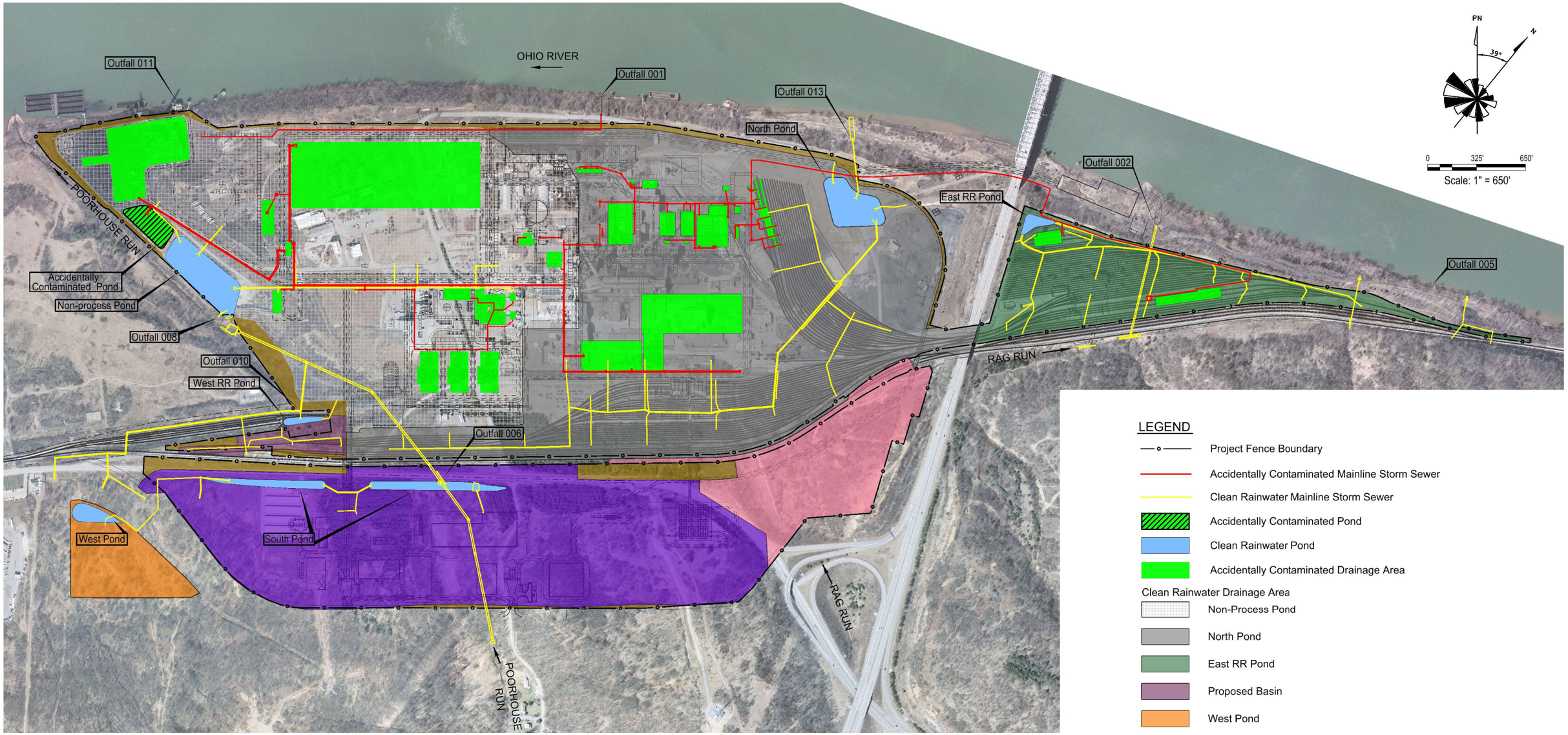
Stream Conditions	Treated Effluent from WWTP (IMP 101)						Treated Effluent + CWT Blowdown to Outfall 001					
	Daily Maximum			Monthly Maximum			Daily Maximum			Monthly Maximum		
	WET Weather Conc. (mg/L)	DRY Weather Conc. (mg/L)	*Mass Loading (lb/day)*	WET Weather Conc. (mg/L)	DRY Weather Conc. (mg/L)	*Mass Loading (lb/day)*	WET Weather Conc. (mg/L)	DRY Weather Conc. (mg/L)	*Mass Loading (lb/day)*	WET Weather Conc. (mg/L)	DRY Weather Conc. (mg/L)	*Mass Loading (lb/day)*
Flow (m3/hr)	202	127	-	202	127	-	593	518	-	593	518	-
Flow (gpm)	887	557	-	887	557	-	2,607	2,277	-	2,607	2,277	-
pH (std unit)	6.5 - 8	6.5 - 8	-	6.5 - 8	6.5 - 8	-	6.5 - 8	6.5 - 8	-	6.5 - 8	6.5 - 8	-
Temp (°C)	21 - 32	24 - 33	-	21 - 32	24 - 33	-	35 - 39	38 - 40	-	35 - 39	38 - 40	-
BOD	47	45	*501*	23	23	*250*	36	34	*1,121*	18	17	*561*
COD	141	136	*1,502*	105	102	*1,126*	87	79	*2,743*	66	59	*2,057*
TSS	71	69	*761*	36	35	*380*	57	55	*1,795*	29	27	*898*
TDS	4,690	7,375	*50,078*	4,690	7,375	*50,078*	2,916	3,317	*91,442*	2,916	3,317	*91,442*
TOC	31	31	*331*	15	16	*165*	20	18	*620*	10	9	*310*
Oil and grease	19	18	*200*	9	9	*100*	10	8	*304*	5	4	*152*
Methanol	0.1	0.1	*1.0*	0.04	0.1	*0.5*	0.03	0.03	*1.0*	0.02	0.02	*0.5*
Benzene	0.3	0.5	*3.6*	0.2	0.3	*1.8*	0.1	0.1	*3.6*	0.1	0.1	*1.8*
Phenols	0.1	0.1	*0.7*	0.03	0.1	*0.4*	0.02	0.02	*0.7*	0.01	0.01	*0.4*
3,4-Benzofluoranthene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Acenaphthene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Acenaphthylene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Acetaldehyde	0.3	0.5	*3.6*	0.2	0.3	*1.8*	0.1	0.1	*3.6*	0.1	0.1	*1.8*
Acetic Acid	0.3	0.5	*3.6*	0.2	0.3	*1.8*	0.1	0.1	*3.6*	0.1	0.1	*1.8*
Anthracene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Benzo(a)anthracene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Benzo(a)pyrene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Ethylbenzene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Fluorene	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Formaldehyde	1.0	1.5	*10.7*	0.5	0.8	*5.4*	0.3	0.4	*10.7*	0.2	0.2	*5.4*
Formic Acid	0.3	0.5	*3.6*	0.2	0.3	*1.8*	0.1	0.1	*3.6*	0.1	0.1	*1.8*
Propionic Acid	0.3	0.5	*3.6*	0.2	0.3	*1.8*	0.1	0.1	*3.6*	0.1	0.1	*1.8*
Styrene	0.0	0.1	*0.4*	0.02	0.03	*0.2*	0.01	0.01	*0.4*	0.01	0.01	*0.2*
Toluene	0.2	0.3	*1.8*	0.1	0.1	*0.9*	0.1	0.1	*1.8*	0.03	0.03	*0.9*
Xylene	0.5	0.8	*5.7*	0.3	0.4	*2.9*	0.2	0.2	*5.7*	0.1	0.1	*2.9*
Xylenol	0.5	0.8	*5.7*	0.3	0.4	*2.9*	0.2	0.2	*5.7*	0.1	0.1	*2.9*
Nitrate as N	0.5	0.8	*5.4*	0.3	0.4	*2.7*	4.1	4.7	*129.5*	2.1	2.4	*64.8*
Nitrite as N	0.02	0.03	*0.2*	0.01	0.01	*0.1*	0.14	0.16	*4.3*	0.07	0.08	*2.2*
Ammonia as N	3.6	5.4	*38.6*	1.8	2.7	*19.3*	1.6	1.8	*51.0*	0.8	0.9	*25.5*
Total Nitrogen	0.1	0.2	*1.4*	0.1	0.1	*0.7*	0.05	0.05	*1.4*	0.02	0.02	*0.7*
Total Phosphorous	0.04	0.1	*0.4*	0.02	0.03	*0.2*	3.24	3.7	*101.6*	1.62	1.85	*50.8*
Sulfide	0.2	0.3	*2.4*	0.1	0.2	*1.2*	0.1	0.1	*2.4*	0.0	0.0	*1.2*
Sulfite	0.2	0.3	*2.4*	0.1	0.2	*1.2*	0.1	0.1	*2.4*	0.0	0.0	*1.2*
Sulfate	526	786	*5,619*	263.1	393.0	*2,809*	720	812	*22,578*	360.0	405.8	*11,289*
Na2S(as Na2S)	0.1	0.1	*0.7*	0.03	0.05	*0.3*	0.02	0.02	*0.7*	0.01	0.01	*0.3*
Na2CO3	596	891	*6,366*	298	445	*3,183*	203	218	*6,366*	102	109	*3,183*
Na2SO4	1,452	2,169	*15,507*	726	1,085	*7,753*	494	531	*15,507*	247	266	*7,753*
Thiosulfates	27	41	*293*	14	21	*147*	9	10	*293*	5	5	*147*
Hardness (as CaCO3)	4	5	*38*	1.8	2.7	*19*	1.2	1.3	*38*	0.6	0.7	*19*
Alkalinity (as CaCO3)	31	47	*336*	15.7	23.5	*168*	110	125	*3,438*	54.8	62.4	*1,719*
Aluminum	0.9	1.4	*10*	0.5	0.7	*5*	4.3	4.9	*134*	2.1	2.4	*67*
Calcium	40	59	*423*	19.8	29.6	*212*	168	191	*5,263*	83.9	95.6	*2,632*
Chloride	72	107	*764*	35.8	53.5	*382*	275	313	*8,624*	137.5	156.6	*4,312*
Chromium. Total	0.4	0.6	*4.1*	0.2	0.3	*2.0*	0.1	0.1	*4.1*	0.06	0.07	*2.0*
Copper, Total	0.2	0.2	*1.6*	0.1	0.1	*0.8*	0.05	0.06	*1.6*	0.03	0.03	*0.8*
Cyanide, Total	0.2	0.2	*1.6*	0.1	0.1	*0.8*	0.05	0.06	*1.6*	0.03	0.03	*0.8*
Fluoride	0.6	0.9	*6.4*	0.3	0.4	*3.2*	1.0	1.1	*31.2*	0.5	0.6	*15.6*
Iron	3	5	*36*	1.7	2.5	*18*	7	8	*210*	3.3	3.8	*105*
Magnesium	11	17	*122*	5.7	8.5	*61*	47	54	*1,487*	23.7	27.0	*744*
Manganese, Total	0.4	0.6	*4.1*	0.2	0.3	*2.0*	0.1	0.1	*4.1*	0.1	0.1	*2.0*
Nickel, Total	0.04	0.06	*0.4*	0.02	0.03	*0.2*	0.01	0.01	*0.4*	0.01	0.01	*0.2*
Potassium	3	4	*27*	1.3	1.9	*14*	11	13	*358*	5.7	6.5	*179*
Silica (as SiO2)	5	7	*53*	2.5	3.7	*26*	20	23	*632*	10.1	11.5	*316*
Sodium	239	357	*2,551*	119	178	*1,275*	258	290	*8,094*	129	145	*4,047*

PROJECT FRANKLIN

Wastewater Balance and Treatment



1. Cooling Tower Blowdown routed to AC Pond, if the hydrocarbon contamination lasts more than a day.
2. Cooling Tower Blowdown routed to Biotreater, if the hydrocarbon contamination lasts less than a day.
3. Cooling Tower Blowdown normally comingles with treated effluent downstream of WWTP.



LEGEND

- Project Fence Boundary
- Accidentally Contaminated Mainline Storm Sewer
- Clean Rainwater Mainline Storm Sewer
- Accidentally Contaminated Pond
- Clean Rainwater Pond
- Accidentally Contaminated Drainage Area

Clean Rainwater Drainage Area

- Non-Process Pond
- North Pond
- East RR Pond
- Proposed Basin
- West Pond
- South Pond
- Rag Run
- Area Inside Fence Draining into Area Outside of Fence

Drainage Area ID	Area (acres)
Accidentally Contaminated Area	34.8
Non-Process Pond	88.0
North Pond	104.2
East RR Pond	23.6
West RR Pond	3.7
West Pond	8.1
South Pond	74.0
Rag Run	19.8
Area Inside Fence Draining Outside	14.6
Total Area	371

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia L.L.C. All Rights Reeserved.

PROJECT FRANKLIN

FIGURE B-4
DRAINAGE AREA MAP

Section 7

Post Construction Storm Water Management Plan

SHELL CHEMICAL APPALACHIA LLC

PROPOSED PETROCHEMICALS COMPLEX

Post Construction Stormwater Management (PCSM) Plan Summary

As discussed with the Department at the April 9, 2015 meeting; site development for the proposed complex is being conducted by two engineering firms – Jacobs and Bechtel. Bechtel is responsible for construction of the future plant complex; however their scope does not include two small drainage areas (DA-7 and DA-8) of the overall project that are addressed in the Jacob's PCSM. Since each PCSM Plan document must be signed by a Registered Professional Engineer, each firm has sealed their work and the two plans are attached to this section.

To assist the Department in their review of the combined plan, the following summarizes the information contained in both plans:

1. **The following are the designated Drainage Areas within the Project Limits of Disturbance**

Designation	Acres	Contractor
DA-1	111	Bechtel
DA-2	115	Bechtel
DA-3	25	Bechtel
DA-3a	4	Bechtel
DA-4	8	Bechtel
DA-5	74	Bechtel
DA-6	20	Bechtel
DA-OUT	15	Bechtel
DA-7	10.94	Jacobs
DA-8	4.79	Jacobs

2. **Peak Flow Rate Analysis**
   Table 3-1 in the Bechtel PCSM Plan provides the analysis for the pre and post peak rate flows for the 2 through 100 year storm events for the entire project area. Table 3-1 was developed from the data/calculations performed by Jacobs in their Hydrologic and Hydraulic Drainage Report that was developed and submitted in support of the Joint Permit. The Jacob's report included the upstream and downstream drainage for Rag Run and Poorhouse Run which includes the existing and proposed areas of the project. Therefore the runoff peak rate analysis done in Hydrologic and Hydraulic Drainage Report is valid for evaluating the Runoff Peak Rate Analysis for the project. As demonstrated in the Bechtel PSCM Plan, all Post-Development peak rates are less than pre-development condition demonstrating compliance with Department and Township requirements for the proposed project.

3. **Volume Analysis**
   Worksheet 4 (Change in Runoff Volume for 2-yr Storm Event) are provided in Jacob's Hydrologic and Hydraulic Drainage Report , and Bechtel's PCSM Plan. For Areas DA-7 and DA-8, the runoff volume is less in the post-development condition compared to pre-development, so these areas are not considered further in the analysis.

   For Areas DA-1 through DA-OUT the post-development volume is greater than the pre-development volume. Section 5 of the Bechtel PCSM Plan provides a discussion of the Best Management Practices (BMPs) that were incorporated and discussion of issues with BMPs not utilized. Appendix D of the Bechtel PCSM Plan contains Worksheets 11, 12 and 13 showing compliance with the Water Quality Control Guidelines.

PROJECT FRANKLIN

POST CONSTRUCTION
STORMWATER MANAGEMENT PLAN

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CHIEN D. NGUYEN
ENGINEER
NO. PE083957

11/5/2015

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

REV.	DATE	REASON FOR REVISION	BY	CK'D	APPR'D	CLIENT
000	11/05/2015	ISSUED FOR USE	AG	HS/CN	REP	--
00C	9/29/2015	ISSUED FOR APPROVAL	AG	HS/CN	REP	--
00B	9/2/2015	REISSUED FOR REVIEW	AG	HS	REP	--
00A	5/27/2015	ISSUED FOR REVIEW	AG	HS	REP	--

ECCN – EAR 99	PROJECT FRANKLIN	SHELL DOCUMENT NUMBER	REV.
		GM1-700-G0000-CX-5880-00021	000
	POST CONSTRUCTION STORMWATER MANAGEMENT PLAN	BECHTEL DOCUMENT NUMBER	REV.
		25873-001-30G-C03-00001	000
		BECHTEL PROJECT NO.: 25873-001	Page 1 of 63

Table of Contents

1 SITE DESCRIPTION AND ANALYSIS 3

1.1 Topographic Features of the Project Site and Surrounding Area..... 3
1.2 Site Soils..... 3
1.3 Project Area Runoff 3
1.4 Design Rainfall Events..... 3

2 RUNOFF VOLUME CONTROL ANALYSIS..... 5

3 RUNOFF PEAK RATE ANALYSIS 10

4 WATER QUALITY ANALYSIS..... 11

5 BMPS UTILIZED 11

5.1 Non-Structural BMPs. 11
5.2 Structural BMPs..... 11
5.3 BMP Controlled Areas 13
5.4 Thermal Impact Analysis..... 13

Appendix A- Plan Drawings
Appendix B- Location and Soil Maps
Appendix C- Rainfall Data
Appendix D- Worksheets
Appendix E- Hydrological and Hydraulic Calculation References

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

1 Site Description and Analysis

The purpose of this Post Construction Stormwater Management (PCSM) plan is to describe how the Shell Franklin Project (the "Project") will utilize best management practices to control the volume, rate, and water quality of post-construction stormwater runoff so as to protect and maintain the chemical, physical, and biological properties of surrounding surface waters. This PCSM plan was developed using the guidelines contained within the Erosion and Sediment Pollution Control Program Manual (E&S manual), Pennsylvania Department of Environmental Protection Office of Water Management, April 2000, and the PA DEP Stormwater Best Management Practices Manual December 2006.

The project involves operation of a petrochemical complex consisting of a 1500 kiloton per year ethylene cracker utilizing ethane feedstock, three units designed to convert ethylene into polyethylene end-products, an electrical cogeneration facility, waste water and raw water treatment facilities, rail yards, hydrocarbon loading and unloading facilities, and associated permanent plant support buildings. The total acreage for the development is approximately 371 acres and includes a mix of currently undeveloped areas as well as potential historic industrial areas which were previously used as a zinc smelting facility.

As discussed with the Department at several application meetings, this PCSM plan is based on the existing site conditions being defined as prior to any demolition/remediation/earth moving activities and the "post" condition as after construction of the entire petrochemical complex is complete.

1.1 Topographic Features of the Project Site and Surrounding Area

The existing site is located in Potter Township, Beaver County, Pennsylvania and bounded by the Ohio River to the northwest, Poorhouse Run stream to the south, State Route 18 to the southeast and extends 3,600 ft northeast of Interstate 376. The existing elevation within the site ranges from approximately 712 ft to 980 ft, see Figure B-2. The site currently drains in a northwesterly direction towards the Ohio River. Based on the Federal Emergency Management Agency Flood Insurance Rate Map, the 1% Annual Chance Base Flood Elevation ranges from approximately 700' to 702' through the site. The existing ground cover for the site includes a zinc processing facility with gravel and paved areas, undeveloped tracts of land and an existing paved highway, see Figure A-1.

1.2 Site Soils

Based on the information obtained from the geotechnical report, the existing soil based on the boring data consists primarily of fill and alternating layers of alluvial sands and gravels. Thickness of the existing fill would range from 1.5 to 12.0 ft. The deposited sands and gravels underlying the fills were found to be normally loose to very dense. Bedrock consists of the Allegheny Group's Freeport Formation and Conemaugh Group's Glenshaw Formation which comprise of interbedded, cyclic sequences of sedimentary rock consisting of shales, sandstones, limestones, and thin coal seams. For USDA Natural Resources Conservation Service Soil Classification Map and Description, see Figure B-3.

1.3 Project Area Runoff

The previous land usage for the project area was for a zinc processing facility with gravel and paved areas, undeveloped tracts of land, and an existing paved highway. The area of the zinc processing facility is considered a brownfield site. The present land use will be based on the scope of work for Early Works Construction. Early works consists of remediation and site preparation. Major components of Early Works Construction include disposing, reusing and stabilizing cut & fill earthwork; capping, regrading, and leveling the site for future plant construction; and providing major drainage features.

As discussed in the Act 2 Remedial Investigation/Risk Assessment Report and Cleanup Plan (ERM 2015), there are seven areas on the former Smelter Property and one area on the Fly Ash Landfill that exceed

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Site-Specific soil to groundwater standards (areas identified on ERM Figure 4-8 that are north of existing SR-18). The soils exceeding these standards which remain after any necessary re-location to facilitate future unit/building foundations or general site development will be graded smooth and covered with a 40 mil PVC geomembrane prior to installing a soil cover that is minimum 2-foot thick. One location on the former Smelter Property will be under the concrete abutment for the new bridge crossing the CSX rail line. Soils in the three northern-most areas on the former Smelter Property (described above) will be designated as "no dig zones" based on the presence of mercury above non-residential direct contact standards. These three areas will be graded smooth and a bentonite mat, or equivalent, will be installed prior to installing an 8-inch thick fiber reinforced concrete slab to create a no dig barrier. The concrete slab will be buried with unimpacted soil to match the new grade.

The "existing" site is comprised of several parcels of land, the majority of which is the former Horsehead Corporation zinc processing facility. The site itself has been an industrial complex for approximately 70 years. The Horsehead property was mostly developed with a stormwater detention pond servicing the main processing area and areas draining outfalls designated as 007 and 009. The remaining Horsehead site areas and adjacent other parcels do not have stormwater detention facilities, and the rainfall runoff flows from these areas is uncontrolled into the Ohio River, Poorhouse Run, and Rag Run.

The proposed land uses for the site will be a 1500 kiloton per year ethylene cracker unit, three polyethylene units, electricity cogeneration facility, waste water & raw water treatment facilities, rail yard, hydrocarbon loading & unloading facility and permanent plant roads & buildings. The drainage system for the proposed plant site will be incorporated into the both the Early Works, and permanent plant surface configurations with major drainage features. All unpaved areas within the plant area will be covered in gravel, see Figure A-2.

An existing drainage report[1], developed by the Early Works Contractor, determined the stormwater impacts and mitigation methods associated with the proposed conditions during early works and construction of the petrochemical facility. The drainage report determined that the proposed project does not cause adverse impacts to the existing flood hazard conditions. The drainage report evaluated the proposed culverts for Poorhouse Run and Rag Run streams, existing site conditions, proposed site conditions and detention ponds for stormwater flow and volume mitigation.

Internal drainage features for the proposed plant site will utilize the drainage system constructed by Early Works, and those constructed as part of the permanent plant surface configuration. The drainage features consist of stormwater manholes, inlets, pipes, trenches, and channels that will eventually discharge into Early Works or permanent plant drainage system. Stormwater outfall from the plant site will be discharged into permitted locations designed to retain and then release stormwater volumes. See Figure B-4 for Overall Proposed Drainage Area.

1.4 Design Rainfall Events

Rainfall data was obtained from PennDOT Drainage Manual Chapter 7, Appendix A. The manual found that different storm durations produce regional discrepancy in rainfall patterns. Five regional maps were created to represent the rainfall patterns. See Table 1.1 for 24-hour rainfall depths in Beaver County, PA.

[1] Shell Document Number GM1-102-E0000-CX-1380-00002, from 1st page of Jacobs drainage calculations.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Table 1.1: Design Rainfall Events

Storm Return Years	Precipitation (in)
1	2.04
2	2.44
5	2.99
10	3.44
25	4.09
50	4.65
100	5.24
500	6.74

2 Runoff Volume Control Analysis

The existing site was the location for a zinc processing facility that has been decommissioned and dismantled, with gravel and paved areas, undeveloped tracts of land, and an existing paved highway. The ground cover for the pre-development condition can be seen in Figure A-1. The existing site lies on the downstream side of the watershed that eventually drains into the Ohio River, Poorhouse Run and Rag Run streams.

Volume Control Guidance 1 (CG-1) will be used to determine the runoff volume required to be offset by using BMPs. This method states:

The Control Guideline 1 is applicable to any size of the Regulated Activity. Use of Control Guideline 1 (CG-1) is recommended where site conditions offer the opportunity to reduce the increase in runoff volume as follows:

> **Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year/24-hour event.**
>
> **Existing (pre-development) non-forested pervious areas must be considered meadow (good condition) or its equivalent.**
>
> **Twenty (20) percent of existing impervious area, when present, shall be considered meadow (good condition) in the model for existing conditions for redevelopment.**

The Soil Conservation Service (SCS) method will be used to calculate runoff volume. The runoff curve number was determined for each area using the SCS soil map and CN values for different types of soil and cover. The covers considered are paved (asphalt or concrete), grass and gravel areas. The 2-year 24 hour rainfall depth for the site is 2.44 inches. For summary of calculation of runoff volume for pre- and post-development runoff volumes, see Table 2.1 and Table 2.2.

Table 2.1: Pre-Development Runoff Values

Existing Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Good Condition Grass Cover	B	1707512	39.2	61	6.39	1.28	0.18	25402
DA #1 - Impervious Area - Paved	B	1318302	30.3	98	0.20	0.04	2.21	242908
DA #1 - Impervious Area - Gravel	B	841244	19.3	85	1.76	0.35	1.13	79278
DA #1 - Good Condition Grass Cover	C	362044	8.3	74	3.51	0.70	0.57	17342
DA #1 - Impervious Area - Paved	C	9301	0.2	98	0.20	0.04	2.21	1714

Electronic documents, once printed, are uncontrolled and may become outdated.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

DA #1 - Impervious Area - Gravel	C	30595	0.7	89	1.24	0.25	1.40	3575
DA #1 - 20% Impervious Area = Good Condition Grass Cover	B	539886	12.4	61	6.39	1.28	0.18	8032
DA #1 - 20% Impervious Area = Good Condition Grass Cover	C	9974	0.2	89	1.24	0.25	1.40	1166
Subtotal DA#1		**4818858**	**111**					**379416**
DA #2 - Good Condition Grass Cover	A	25685	0.6	39	15.64	3.13	0.03	68
DA #2 - Impervious Area - Paved	A	4418	0.1	98	0.20	0.04	2.21	814
DA #2 - Good Condition Grass Cover	B	583076	13.4	61	6.39	1.28	0.18	8674
DA #2 - Impervious Area - Paved	B	1489864	34.2	98	0.20	0.04	2.21	274520
DA #2 - Impervious Area - Gravel	B	311221	7.1	85	1.76	0.35	1.13	29329
DA #2 - Good Condition Grass Cover	C	1059982	24.3	74	3.51	0.70	0.57	50774
DA #2 - Impervious Area - Paved	C	266727	6.1	98	0.20	0.04	2.21	49147
DA #2 - Impervious Area - Gravel	C	612395	14.1	89	1.24	0.25	1.40	71567
DA #2 - 20% Impervious Area = Good Condition Grass Cover	A	1104	0.0	39	15.64	3.13	0.03	3
DA #2 - 20% Impervious Area = Good Condition Grass Cover	B	450271	10.3	61	6.39	1.28	0.18	6698
DA #2 - 20% Impervious Area = Good Condition Grass Cover	C	219781	5.0	74	3.51	0.70	0.57	10528
Subtotal DA#2		**5024524**	**115**					**502121**
DA #3 - Good Condition Grass Cover	C	749604	17.2	74	3.51	0.70	0.57	35906
DA #3 - Impervious Area - Paved	C	198841	4.6	98	0.20	0.04	2.21	36638
DA #3 - Impervious Area - Gravel	C	58709	1.3	89	1.24	0.25	1.40	6861
DA #3 - 20% Impervious Area = Good Condition Grass Cover	C	64387	1.5	90	1.11	0.22	1.48	7928
Subtotal DA#3		**1071541**	**25**					**87333**
DA #3a - Good Condition Grass Cover	A	121745	2.8	39	15.64	3.13	0.03	321
DA #3a - Impervious Area - Paved	A	19790	0.5	98	0.20	0.04	2.21	3646
DA #3a - Impervious Area - Gravel	A	14919	0.3	76	3.16	0.63	0.66	819
DA #3a - 20% Impervious Area = Good Condition Grass Cover	A	8677	0.2	39	15.64	3.13	0.03	23
Subtotal DA#3a		**165131**	**4**					**4809**
DA #4 - Good Condition Grass	A	283140	6.5	39	15.64	3.13	0.03	747

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Cover								
DA #4 - 20% Impervious Area = Good Condition Grass Cover	A	70785	1.6	39	15.64	3.13	0.03	187
Subtotal DA#4		**353925**	**8**					**934**
DA #5 - Good Condition Grass Cover	A	994895	22.8	39	15.64	3.13	0.03	2626
DA #5 - Impervious Area - Paved	A	124888	2.9	98	0.20	0.04	2.21	23012
DA #5 - Good Condition Grass Cover	B	37007	0.8	61	6.39	1.28	0.18	551
DA #5 - Impervious Area - Paved	B	15605	0.4	98	0.20	0.04	2.21	2875
DA #5 - Good Condition Grass Cover	C	1844788	42.4	74	3.51	0.70	0.57	88366
DA #5 - Impervious Area - Paved	C	137254	3.2	98	0.20	0.04	2.21	25290
DA #5 - 20% Impervious Area = Good Condition Grass Cover	A	31222	0.7	39	15.64	3.13	0.03	82
DA #5 - 20% Impervious Area = Good Condition Grass Cover	B	3901	0.1	61	6.39	1.28	0.18	58
DA #5 - 20% Impervious Area = Good Condition Grass Cover	C	34312	0.8	74	3.51	0.70	0.57	1644
Subtotal DA#5		**3223872**	**74**					**144504**
DA #6 - Good Condition Grass Cover	B	163717	3.8	61	6.39	1.28	0.18	2436
DA #6 - Impervious Area - Paved	B	6049	0.1	98	0.20	0.04	2.21	1115
DA #6 - Good Condition Grass Cover	C	647270	14.9	74	3.51	0.70	0.57	31005
DA #6 - Impervious Area - Gravel	C	6118	0.1	89	1.24	0.25	1.40	715
DA #6 - Impervious Area - Paved	C	28559	0.7	98	0.20	0.04	2.21	5262
DA #6 - 20% Impervious Area = Good Condition Grass Cover	B	1512	0.0	61	6.39	1.28	0.18	22
DA #6 - 20% Impervious Area = Good Condition Grass Cover	C	8669	0.2	74	3.51	0.70	0.57	415
Subtotal DA#6		**861894**	**20**					**40970**
DA OUT - Good Condition Grass Cover	A	102685	2.4	39	15.64	3.13	0.03	271
DA OUT - Impervious Area - Paved	A	27845	0.6	98	0.20	0.04	2.21	5131
DA OUT - Good Condition Grass Cover	B	163186	3.7	61	6.39	1.28	0.18	2428
DA OUT - Impervious Area - Paved	B	13810	0.3	98	0.20	0.04	2.21	2545
DA OUT - Good Condition Grass Cover	C	226859	5.2	74	3.51	0.70	0.57	10867
DA OUT - Impervious Area -	C	45612	1.0	98	0.20	0.04	2.21	8404

Electronic documents, once printed, are uncontrolled and may become outdated.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Paved								
DA OUT - Impervious Area - Gravel	C	27458	0.6	89	1.24	0.25	1.40	3209
DA OUT - 20% Impervious Area = Good Condition Grass Cover	A	6961	0.2	39	15.64	3.13	0.03	18
DA OUT - 20% Impervious Area = Good Condition Grass Cover	B	3453	0.1	61	6.39	1.28	0.18	51
DA OUT - 20% Impervious Area = Good Condition Grass Cover	C	18268	0.4	74	3.51	0.70	0.57	875
Subtotal DA OUT		**636137**	**15**					**33799**
TOTAL:		**16155883**	**371**					**1193887**

Table 2.2 presents the post-development runoff volumes with the actual changes in cover and CN values.

Table 2.2: Post-Development Runoff Volumes

Proposed Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Impervious Area - Paved	B	77181	1.8	98	0.204	0.041	2.21	14221
DA #1 - Impervious Area - Gravel	B	334699	7.7	85	1.765	0.353	1.13	31542
DA #1 - Impervious Area - Paved	C	1875723	43.1	98	0.204	0.041	2.21	345618
DA #1 - Impervious Area - Gravel	C	2531255	58.1	89	1.236	0.247	1.40	295814
Subtotal DA#1		**4818858**	**111**					**687194**
DA #2 - Impervious Area - Paved	A	290994	6.7	98	0.204	0.041	2.21	53618
DA #2 - Impervious Area - Gravel	A	1868300	42.9	76	3.158	0.632	0.66	102525
DA #2 - Impervious Area - Paved	B	952192	21.9	98	0.204	0.041	2.21	175449
DA #2 - Impervious Area - Gravel	B	1881880	43.2	85	1.765	0.353	1.13	177346
DA #2 - Impervious Area - Gravel	C	23563	0.5	89	1.236	0.247	1.40	2754
DA #2 - Impervious Area - Paved	C	7595	0.2	98	0.204	0.041	2.21	1399
Subtotal DA#2		**5024524**	**115**					**513091**
DA #3 - Impervious Area - Paved	C	66177	1.5	98	0.204	0.041	2.21	12194
DA #3 - Impervious Area - Gravel	C	1005364	23.1	89	1.236	0.247	1.40	117491
Subtotal DA#3		**1071541**	**25**					**129685**
DA #3a - Impervious Area - Paved	A	17322	0.4	98	0.204	0.041	2.21	3192
DA #3a - Impervious Area - Gravel	A	147809	3.4	76	3.158	0.632	0.66	8111
Subtotal DA#3a		**165131**	**4**					**11303**

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

DA #4 - Impervious Area - Paved	A	19045	0.4	98	0.204	0.041	2.21	3509
DA #4 - Impervious Area - Gravel	A	334880	7.7	76	3.158	0.632	0.66	18377
Subtotal DA#4		**353925**	**8**					**21886**
DA #5 - Impervious Area - Paved	A	320397	7.4	98	0.204	0.041	2.21	59036
DA #5 - Impervious Area - Gravel	A	830504	19.1	76	3.158	0.632	0.66	45575
DA #5 - Impervious Area - Paved	B	19910	0.5	98	0.204	0.041	2.21	3669
DA #5 - Impervious Area - Gravel	B	36577	0.8	85	1.765	0.353	1.13	3447
DA #5 - Impervious Area - Paved	C	885803	20.3	98	0.204	0.041	2.21	163217
DA #5 - Impervious Area - Gravel	C	1130681	26.0	89	1.236	0.247	1.40	132137
Subtotal DA#5		**3223872**	**74**					**407079**
DA #6 - Impervious Area - Paved	B	7206	0.2	98	0.204	0.041	2.21	1328
DA #6 - Impervious Area - Gravel	B	164072	3.8	85	1.765	0.353	1.13	15462
DA #6 - Impervious Area - Paved	C	39560	0.9	98	0.204	0.041	2.21	7289
DA #6 - Impervious Area - Gravel	C	651056	14.9	89	1.236	0.247	1.40	76085
Subtotal DA#6		**861894**	**20**					**100164**
DA OUT - Impervious Area - Paved	A	24578	0.6	98	0.204	0.041	2.21	20799
DA OUT - Impervious Area - Gravel	A	112879	2.6	76	3.158	0.632	0.66	1470
DA OUT - Good Condition Grass Cover	B	26780	0.6	61	6.39	1.28	0.18	398
DA OUT - Impervious Area - Paved	B	20049	0.5	98	0.204	0.041	2.21	3694
DA OUT - Impervious Area - Gravel	B	133456	3.1	85	1.765	0.353	1.13	12577
DA OUT - Impervious Area - Paved	C	33765	0.8	98	0.204	0.041	2.21	6221
DA OUT - Impervious Area - Gravel	C	284630	6.5	89	1.236	0.247	1.40	33263
Subtotal DA OUT		**636137**	**15**					**254672**
TOTAL:		**16155882**	**371**					**2125076**

Best Management practices (BMPs) have been applied to the extent possible in order to prevent an increase in total runoff volume. These BMPs are described in Section 5 of this report. In addition to the BMP's listed in section 5, gravel will be utilized instead of pavement wherever possible. As gravel allows for greater infiltration, the use of gravel instead of pavement where possible reduces the total runoff volume from 3,256,037 ft^3 (in the pavement only case) to 2,125,076 ft^3, a reduction of 35%.

While there is a net increase in runoff volume of 931,180 ft^3 in the post-development case, the runoff rate will decrease through use of multiple detention basins.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

3 Runoff Peak Rate Analysis

The data used for the Peak Rate analysis was extracted from the Hydrologic and Hydraulic drainage report of the Joint Permit application that was submitted previously to the Department and demonstrated the impacts would not affect negatively the Ohio River. This report included the upstream and downstream drainage for Rag Run and Poorhouse Run which includes the existing and proposed areas of the project. Therefore the runoff peak rate analysis done in Hydrologic and Hydraulic drainage is valid for evaluating the Runoff Peak Rate Analysis for the project. The drainage report determined that the proposed project does not cause adverse impacts to the existing flood hazard conditions at the Ohio River.

The drainage report evaluated the two watersheds that included the proposed culverts for Poorhouse Run and Rag Run streams, existing site conditions, proposed site conditions and detention ponds for stormwater flow mitigation. The drainage report utilized the SCS method in Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) to determine the 2, 10, 25, 50, and 100-year peak flows for the pre- and post- development condition. The increase in peak flow was then mitigated by the use of multiple detention basins. Flow rates for existing and proposed conditions were then imported into TUFLOW hydraulic models. Potter Township General Code Section 176 requires that detention facilities be designed such that the post-development peak runoff rates from the developed site surface conditions are controlled to the rates defined by the subarea release rate percentages for the 2, 5, 10, 25, 50, and 100-year storm frequencies. The drainage report concluded that the proposed development will not increase flow rates to the Ohio River. For a summary and comparison of the pre- and post-development conditions peak stormwater discharge rates for the watersheds that includes the proposed project, see Table 3.1.

Table 3.1: Comparison of Peak Flow Rates

Storm Return Years	Pre-Develop Condition Flows (cfs)	Post-Develop Condition Flows (cfs)	Difference (cfs)
2	742	474	-268
10	1838	1384	-454
25	2340	1855	-485
50	2742	2223	-519
100	3090	2508	-582

As can be seen, in all cases the post-development peak discharge rates are less than the pre-development rates.

Table 3.1 comprises of data summarized from the Hydrologic and Hydraulic drainage report. Excerpts from the drainage report that were used to obtain the data are shown in Appendix E. The existing condition drainage area map of the site can be seen on Exhibit 3 and 5 in Appendix E. The existing drainage flow pattern for the site drains in a northwesterly direction towards the Ohio River and Rag Run. For proposed condition, sections of Rag Run and Poorhouse Run have been culvertized and multiple detention ponds were utilized within the site boundary to control the proposed flow rate for the 2, 10, 25, 50, and 100-year storm frequencies. See Exhibit 8.1 and 10.1 in Appendix E for proposed condition drainage map.

The existing flow rates for the project outfalls were determined using the total values from drainage area OH1, OH2 and OH3 (Table 6 in Appendix E), downstream outlet flows (Appendix 10 in Appendix E) for Rag Run and Poorhouse Run. For the 2- year existing flows, the total outfall was found to be 46+131 +64 (Table 6)+233 (Appendix 10)+268 (Appendix 10)= 742 cfs. The 10, 25, 50- and 100- year were found

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

in the same manner and determined to be 92+240+122+525+859= 1,838 cfs; 116+295+151+646+1132= 2,340 cfs; 134+333+172+744+1359= 2,742 cfs and 153+372+193+823+1549= 3,090, respectively.

The proposed flow rates for the project outfalls were determined and using the total values from proposed outflows from the North Pond (Table 9 in Appendix E), downstream outlet flows (Appendix 14 in Appendix E) for culvertized Rag Run and Poorhouse Run. In the proposed conditions, OH1 area is routed to the Non Process Pond and then to Poorhouse Run Culvert. OH2 is routed to the North Pond. OH3 is routed to the East Pond and then to Rag Run Culvert. Flows for Non Process Pond and East Pond are accounted for in the downstream section in the proposed Poorhouse Run and Rag Run Culvert. For the 2- year proposed flows, the total outfall was found to be 0 (Table 9)+223 (Appendix 14)+251 (Appendix 14)= 474 cfs. The 10, 25, 50 and 100- year were found in the same manner and determined to be 25+533+826= 1,384 cfs; 42+700+1113= 1,855 cfs; 51+806+1366= 2,223 cfs and 60+903+1545= 2,508 cfs, respectively.

4 Water Quality Analysis

The recommended control guideline for total water quality control from the Pennsylvania Stormwater Best Practices is:

> **Achieve an 85 percent reduction in post-development particulate associated pollutant load (as represented by Total Suspended Solids), an 85 percent reduction in post-development total phosphorus loads, and a 50 percent reduction in post-development solute loads (as represented by NO3-N), all based on post-development land use.**

Flow chart D from Chapter 8 of the manual illustrates several pathways to water quality compliance. Attached in Appendix D is a copy of Flowchart D with this project's compliance plan highlighted. Worksheets 11, 12, and 13, located in Appendix D, demonstrate compliance with the water quality control guideline.

5 BMPs Utilized

5.1 Non-Structural BMPs.

Various non-structural BMPs will be used for the site, the BMPs included are:

BMP "5.7.1" Reducing Street Imperviousness: Asphalt pavement shoulders for the entire site from the original design have been reduced from 5' asphalt paved shoulder to 2' asphalt with 3' gravel paved shoulders. The gravel shoulder will be less impervious than the asphalt paved shoulders.

BMP "5.9.1" Street Sweeping: Street sweeping will be incorporated in the normal maintenance program and shall be done in accordance with the Pennsylvania Stormwater BMP Manual procedures. Paved areas with regular vehicular traffic will be swept on periodic intervals, (currently schedule for every 6 months)while paved areas without regular vehicular traffic (e.g. those which will be used by vehicles only in maintenance situations) will be swept following use.

Management-based activities not mentioned in Pennsylvania Stormwater BMP Manual procedures: Items to be included are training and educational programs, proper vehicle equipment fueling and washing practices, good housekeeping, and proper sanitary waste disposal.

5.2 Structural BMPs

The entire site will be heavily compacted due to the required laydown, equipment, foundation, parking, roads, buildings and heavy equipment access. Listed below are structural BMPs that were considered. BMPs being utilized are shown in bold. For each BMP that is not utilized, a brief explanation of why the BMP is not applicable to the project is provided.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

BMP “6.4.1” Pervious Pavement with Infiltration Bed, BMP “6.4.2” Infiltration Basin: Subgrade for the proposed site will be compacted to no less than 95% of the maximum dry density and will contain as much as 80% fines which will tend to severely limit infiltration. The BMPs require the subgrade to be uncompacted and should not be placed on areas of recent fill or compacted fill.

BMP “6.4.3” Subsurface Infiltration Bed, BMP “6.4.4” Infiltration Trench, BMP “6.4.5” Rain Garden/Bioretention, BMP “6.4.6” Dry Well / Seepage Pit, BMP “6.4.7” Constructed Filter, BMP “6.4.8” Vegetated Swale, BMP “6.4.9” Vegetated Filter Strip, BMP “6.4.10” Infiltration Berm & Retentive Grading: Subgrade for the proposed site will be compacted to no less than 95% of the maximum dry density and will contain as much as 80% fines which will tend to severely limit infiltration . The BMPs require the subgrade to be uncompacted.

BMP “6.5.1” Vegetated Roof: Buildings for the site are pre-engineered building with gable and hip (sloped) roof. Pitch on roof will be too steep to use vegetative roof. Design for flat-topped buildings were considered but had no cost saving. Building contractor recommended and designed buildings with gable and hip roof. Also, buildings are design for typical dead and live loads, incorporating load for the vegetative loads would have economic impacts to the project.

BMP “6.5.2” Runoff Capture & Reuse: Adding storage containers to store and reuse stormwater were considered but no applicable reuse was found for the project site. Based on the design criteria for the facility, there is minimal opportunity for incorporating grassing in open areas. Using the stormwater for firewater tanks and cooling water would require the stormwater to be processed to meet required water quality specifications.

BMP “6.6.1” Constructed Wetland: Constructed wetlands required drainage area of at least 10 acres (5 acres for “pocket” wetlands) or some means of sustaining constant inflow. Drainage area if created for wetlands would be less than 10 acres and will not meet the requirements.

BMP “6.6.2” Wet Pond/Retention Basin: Due to the site constraint, dry detention basins were used to mitigate post-development conditions flow. To incorporate wet pond/retention basin into design would require more plot space which will have economical and design impacts to the project.

BMP “6.6.3” Dry Extended Detention Basin: Dry extended detention basins have been incorporated in the project site. The basins were designed so that the post-development peak runoff rates will not exceed pre-development peak runoff rates for the 2, 10, 25, 50, and 100-year storm frequencies. All detention ponds have a valve box at the outfall and stormwater will be visually inspected for contaminant prior to release. Net volume reduction or storage will not be considered for structural BMP volume credits. Drainage area #1, 2, 3, 3a, 4, 5 will be routed to detention ponds.

BMP “6.6.4” Water Quality Filters & Hydrodynamic Devices: Water quality filters have been incorporated in to the design. Area where polyethylene pellets are produced and handled will have a pellet separator to remove pellets before entering the storm sewer system. The storm system for the process area will have a different storm system from the clean rainwater storm system. Accidentally Contaminated stormwater from the process areas will be treated in the wastewater treatment plant. The total area of the site draining from the process area is approximately 34.8 acres.

BMP “6.7.1” Riparian Buffer Restoration: Due to the limited plot space, riparian buffer restoration is not considered for the site.

BMP “6.7.2” Landscape Restoration, BMP 6.7.3 Soil Amendment & Restoration: Per the request of the owner, the proposed site will have no grassing and open areas will be covered with gravel. Landscape restoration and soil amendment & restoration are not considered for the site.

Electronic documents, once printed, are uncontrolled and may become outdated.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

BMP 6.7.4 Floodplain Restoration: Project site is not located within floodplain.

5.3 BMP Controlled Areas

Table 5.1 presents the BMP controlled areas:

Table 5.1: BMP Controlled Areas

Area Name	BMP	Area (sf)
DA #1	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	4818371
DA #2	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	4962254
DA #3	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	1146920
DA #4	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	353925
DA #5	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	3372289
Total BMP Area		14653759
Total Project Area BMP Drainage %		15504379 95%

5.4 Thermal Impact Analysis

Thermal impact is not anticipated for the site. All stormwater will drain into an underground storm sewer system and eventually be detained in a detention pond prior to discharge at the outfalls.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Plan Preparer

Name of Preparer: Ari Gordin
Education:

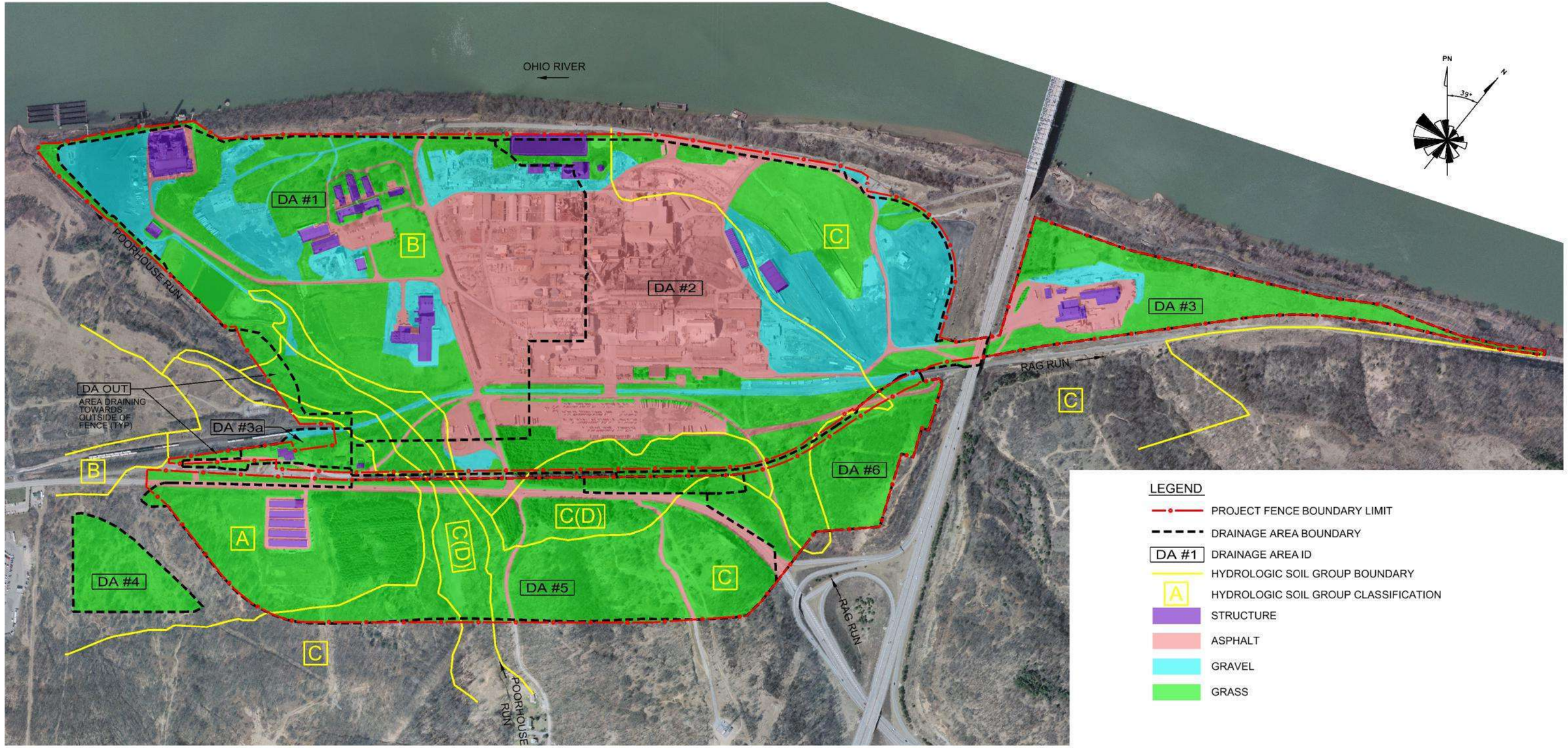
2004-2009
Georgia Institute of Technology
B.S. Chemistry

2009-2014
Georgia Institute of Technology
Ph.D. Materials Science and Engineering

Employment: Bechtel Oil, Gas & Chemicals, Inc.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

APPENDIX A: Plan Drawings



0 325' 650'

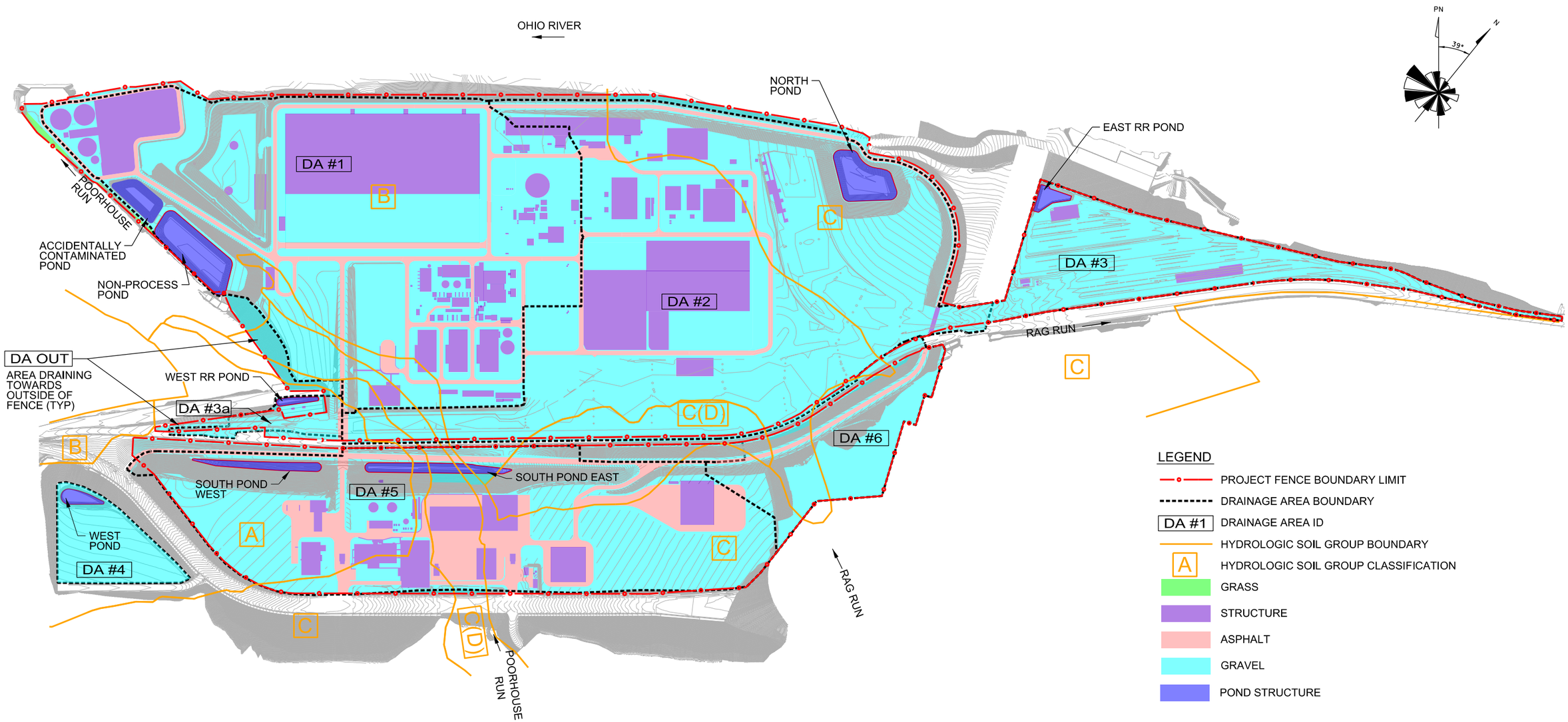
Scale: 1" = 650'

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

FIGURE A-1
SITE PRE-DEVELOPMENT CONDITIONS



LEGEND

- PROJECT FENCE BOUNDARY LIMIT
- DRAINAGE AREA BOUNDARY
- DA #1 DRAINAGE AREA ID
- HYDROLOGIC SOIL GROUP BOUNDARY
- A HYDROLOGIC SOIL GROUP CLASSIFICATION
- GRASS
- STRUCTURE
- ASPHALT
- GRAVEL
- POND STRUCTURE

0 325' 650'

Scale: 1" = 650'

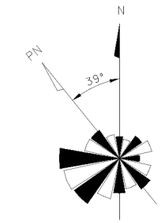
Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

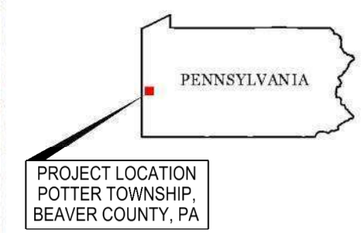
FIGURE A-2
SITE POST-DEVELOPMENT CONDITIONS

APPENDIX B: Location and Soil Maps



LEGEND

PROJECT FENCE BOUNDARY LIMIT



0 500' 1000'

Scale: 1" = 1000'

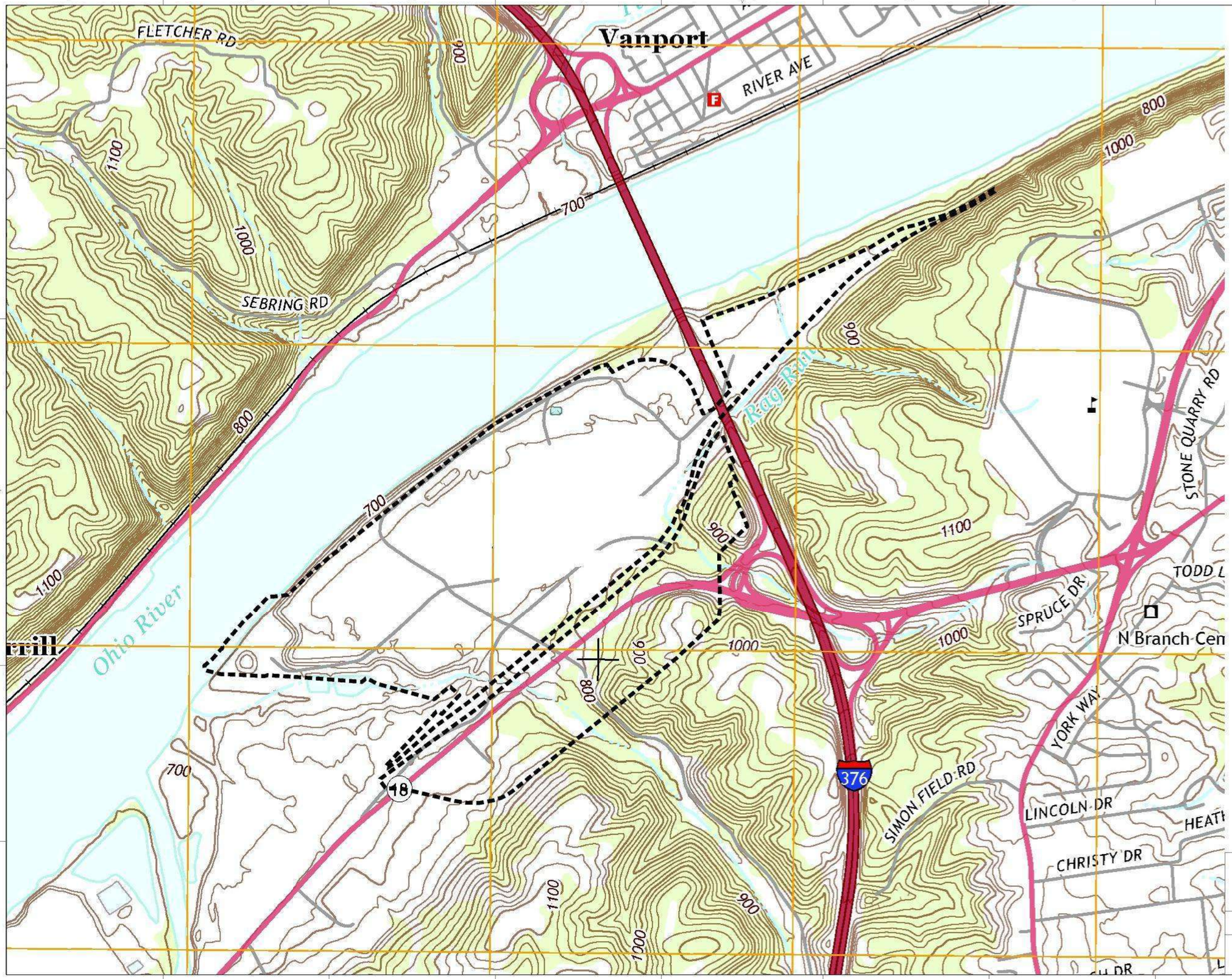
Aerial Info: PAMAP Mosaic Beaver 2006 sid

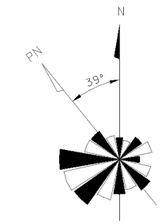
Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

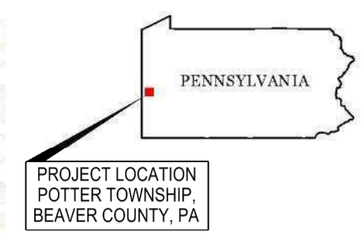
FIGURE B-1
PROJECT SITE AREA INCLUDING BOUNDARY





LEGEND

PROJECT FENCE BOUNDARY LIMIT



0 500' 1000'

Scale: 1" = 1000'

Background Info: Beaver Quadrangle, Pennsylvania - Beaver Co., 7.5 - Minute Series

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

FIGURE B-2
USGS TOPOGRAPHIC MAP
WITH PROJECT AREA

Hydrologic Soil Group Description Based on USDA Web Soil Survey

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

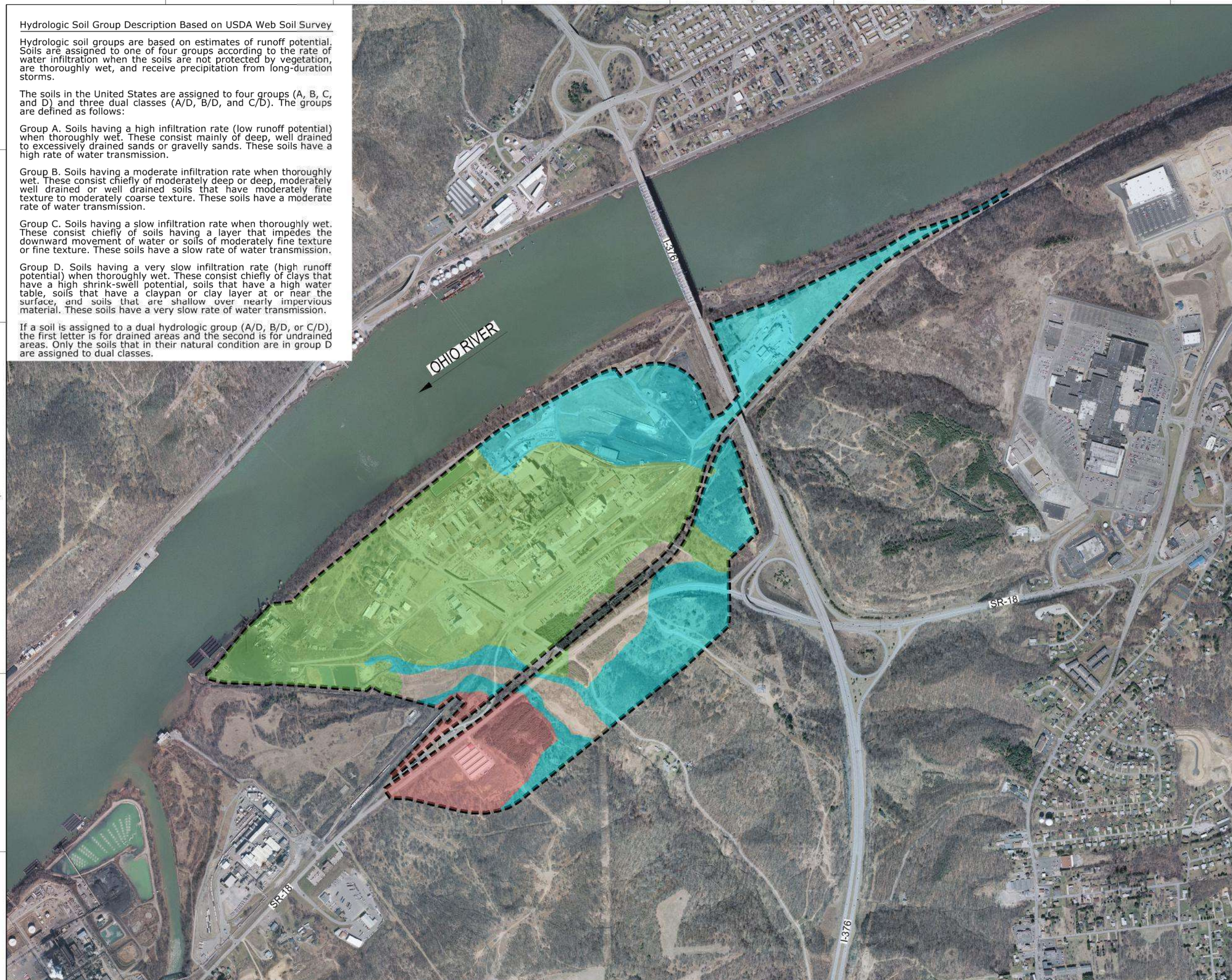
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

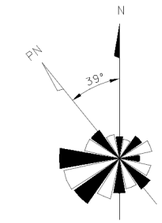
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.





LEGEND

PROJECT FENCE BOUNDARY LIMIT

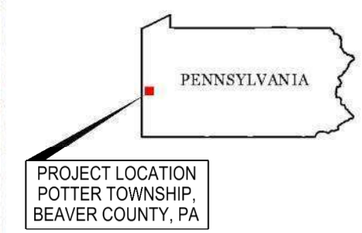
HYDROLOGIC SOIL GROUP CLASSIFICATION

GROUP A

GROUP B

GROUP C

GROUP C/D



0 500' 1000'

Scale: 1" = 1000'

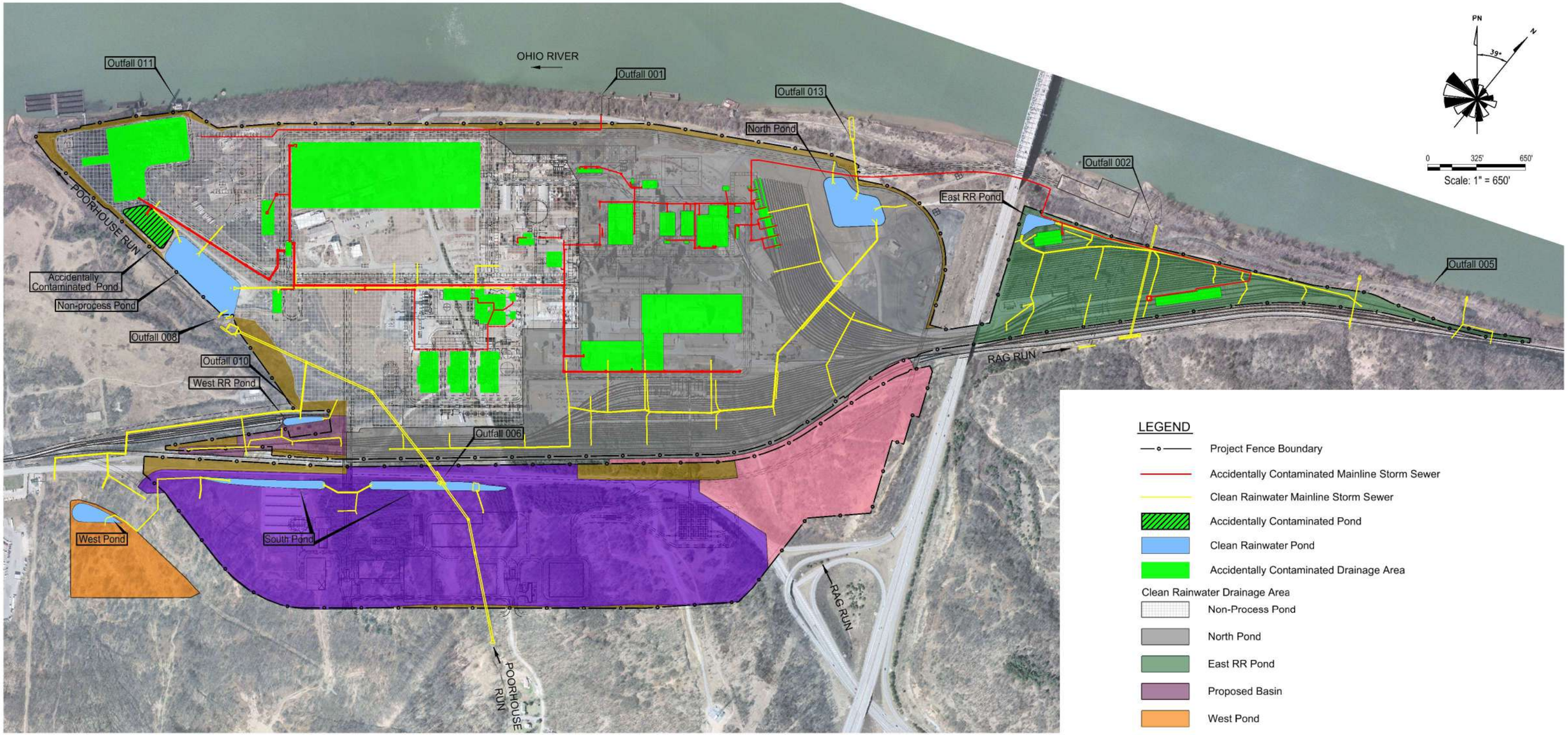
Aerial Info: PAMAP Mosaic Beaver 2006 sid

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

FIGURE B-3
SOILS MAP



LEGEND

- Project Fence Boundary
- Accidentally Contaminated Mainline Storm Sewer
- Clean Rainwater Mainline Storm Sewer
- Accidentally Contaminated Pond
- Clean Rainwater Pond
- Accidentally Contaminated Drainage Area

Clean Rainwater Drainage Area

- Non-Process Pond
- North Pond
- East RR Pond
- Proposed Basin
- West Pond
- South Pond
- Rag Run
- Area Inside Fence Draining into Area Outside of Fence

Drainage Area ID	Area (acres)
Accidentally Contaminated Area	34.8
Non-Process Pond	88.0
North Pond	104.2
East RR Pond	23.6
West RR Pond	3.7
West Pond	8.1
South Pond	74.0
Rag Run	19.8
Area Inside Fence Draining Outside	14.6
Total Area	371

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia L.L.C. All Rights Reeserved.

PROJECT FRANKLIN

FIGURE B-4
DRAINAGE AREA MAP

APPENDIX C: Rainwater Data

5-Minute through 24-Hour Rainfall Depths for Beaver County (Inches)

Rainfall Duration	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 min	0.32	0.39	0.46	0.51	0.59	0.65	0.71
10 min	0.5	0.6	0.71	0.8	0.91	0.99	1.06
15 min	0.62	0.74	0.88	0.98	1.12	1.22	1.32
30 min	0.82	0.99	1.2	1.37	1.59	1.75	1.92
60 min	1.01	1.23	1.53	1.77	2.08	2.32	2.57
2 hr	1.09	1.32	1.65	1.92	2.29	2.6	2.94
3 hr	1.2	1.45	1.81	2.1	2.52	2.87	3.25
6 hr	1.37	1.64	2.04	2.37	2.84	3.19	3.56
12 hr	1.69	2.02	2.49	2.91	3.52	3.97	4.46
24 hr	2.04	2.44	2.99	3.44	4.09	4.65	5.24

Note: Rainfall data was obtain from PennDOT Drainage Manual Chapter 7, Appendix A.

APPENDIX D: Worksheets

Worksheet 1: General Site Information	Provided.
Worksheet 2: Sensitive Natural Resources	Provided.
Worksheet 3: Non-structural BMP Credits	Not applicable. No credits claimed.
Worksheet 4: Change in Runoff Volume for 2-YR storm event	Provided.
Worksheet 5: Structural BMP Volume Credits	Not Applicable. No credits claimed.
Worksheet 6: Small Site/Small Impervious Area Exception for Peak Rate Mitigation Calculations	Not applicable.
Worksheet 7: Calculation of Runoff Volumes for CG-2 Only	Not Applicable.
Worksheet 8: Structural BMP Volume Credits	Not Applicable. No credits claimed.
Flow Chart D: Water Quality Process	Provided.
Worksheet 10: Water Quality Compliance for Nitrate	Not Applicable (CG-1 not met).
Worksheet 11: BMPs for Pollution Prevention	Provided.
Worksheet 12: Water Quality Analysis of Pollutant Loading from All Disturbed Areas	Provided.
Worksheet 13: Pollutant Reduction through BMP Applications	Provided.

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: _____

Project Name: Shell Franklin

Municipality: Potter Township

County: Beaver County

Total Area (acres): 371

Major River Basin: Ohio

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/default.htm#newtopics

Watershed: _____

Sub-Basin: _____

Nearest Surface Water(s) to Receive Runoff: Ohio River, Poorhouse Run, Rag Run

Chapter 93 - Designated Water Use: WWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Chapter 303(d) List? Yes [X] No [ ]

http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm

List Causes of Impairment:

PCB, pesticides, dioxins

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes [ ] No [X]

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

Existing or planned drinking water supply? Yes [ ] No [X]

If yes, distance from proposed discharge (miles): _____

Approved Act 167 Plan? Yes [ ] No [X]

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html

Existing River Conservation Plan? Yes [ ] No [X]

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies			
Floodplains			
Riparian Areas			
Wetlands			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15% - 25%			
Steep Slopes, over 25%			
Other:			
Other:			
TOTAL EXISTING:			

Due to previous use as a zinc processing facility, a portion of the site is considered a brownfield site. There are no significant natural resources such as wetlands, woodlands, or natural water courses present in the proposed project disturbance.

WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Shell Franklin
Drainage Area: 371 acres
2-Year Rainfall: 2.44 in

Total Site Area: 371 acres
Protected Site Area: 0 acres
Managed Area: 371 acres

Existing Conditions:

Existing Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Good Condition Grass Cover	B	1707512	39.2	61	6.39	1.28	0.18	25402
DA #1 - Impervious Area - Paved	B	1318302	30.3	98	0.20	0.04	2.21	242908
DA #1 - Impervious Area - Gravel	B	841244	19.3	85	1.76	0.35	1.13	79278
DA #1 - Good Condition Grass Cover	C	362044	8.3	74	3.51	0.70	0.57	17342
DA #1 - Impervious Area - Paved	C	9301	0.2	98	0.20	0.04	2.21	1714
DA #1 - Impervious Area - Gravel	C	30595	0.7	89	1.24	0.25	1.40	3575
DA #1 - 20% Impervious Area = Good Condition Grass Cover	B	539886	12.4	61	6.39	1.28	0.18	8032
DA #1 - 20% Impervious Area = Good Condition Grass Cover	C	9974	0.2	89	1.24	0.25	1.40	1166
Subtotal DA#1		**4818858**	**111**					**379416**
DA #2 - Good Condition Grass Cover	A	25685	0.6	39	15.64	3.13	0.03	68
DA #2 - Impervious Area - Paved	A	4418	0.1	98	0.20	0.04	2.21	814
DA #2 - Good Condition Grass Cover	B	583076	13.4	61	6.39	1.28	0.18	8674
DA #2 - Impervious Area - Paved	B	1489864	34.2	98	0.20	0.04	2.21	274520
DA #2 - Impervious Area - Gravel	B	311221	7.1	85	1.76	0.35	1.13	29329
DA #2 - Good Condition Grass Cover	C	1059982	24.3	74	3.51	0.70	0.57	50774
DA #2 - Impervious Area - Paved	C	266727	6.1	98	0.20	0.04	2.21	49147
DA #2 - Impervious Area - Gravel	C	612395	14.1	89	1.24	0.25	1.40	71567
DA #2 - 20% Impervious Area = Good Condition Grass Cover	A	1104	0.0	39	15.64	3.13	0.03	3
DA #2 - 20% Impervious Area = Good Condition Grass Cover	B	450271	10.3	61	6.39	1.28	0.18	6698
DA #2 - 20% Impervious Area = Good Condition Grass Cover	C	219781	5.0	74	3.51	0.70	0.57	10528
Subtotal DA#2		**5024524**	**115**					**502121**
DA #3 - Good Condition Grass Cover	C	749604	17.2	74	3.51	0.70	0.57	35906
DA #3 - Impervious Area - Paved	C	198841	4.6	98	0.20	0.04	2.21	36638
DA #3 - Impervious Area - Gravel	C	58709	1.3	89	1.24	0.25	1.40	6861
DA #3 - 20% Impervious Area = Good Condition Grass Cover	C	64387	1.5	90	1.11	0.22	1.48	7928
Subtotal DA#3		**1071541**	**25**					**87333**
DA #3a - Good Condition Grass Cover	A	121745	2.8	39	15.64	3.13	0.03	321
DA #3a - Impervious Area - Paved	A	19790	0.5	98	0.20	0.04	2.21	3646
DA #3a - Impervious Area - Gravel	A	14919	0.3	76	3.16	0.63	0.66	819
DA #3a - 20% Impervious Area = Good Condition Grass Cover	A	8677	0.2	39	15.64	3.13	0.03	23
Subtotal DA#3a		**165131**	**4**					**4809**
DA #4 - Good Condition Grass Cover	A	283140	6.5	39	15.64	3.13	0.03	747
DA #4 - 20% Impervious Area = Good Condition Grass Cover	A	70785	1.6	39	15.64	3.13	0.03	187

Subtotal DA#4		**353925**	**8**					**934**
DA #5 - Good Condition Grass Cover	A	994895	22.8	39	15.64	3.13	0.03	2626
DA #5 - Impervious Area - Paved	A	124888	2.9	98	0.20	0.04	2.21	23012
DA #5 - Good Condition Grass Cover	B	37007	0.8	61	6.39	1.28	0.18	551
DA #5 - Impervious Area - Paved	B	15605	0.4	98	0.20	0.04	2.21	2875
DA #5 - Good Condition Grass Cover	C	1844788	42.4	74	3.51	0.70	0.57	88366
DA #5 - Impervious Area - Paved	C	137254	3.2	98	0.20	0.04	2.21	25290
DA #5 - 20% Impervious Area = Good Condition Grass Cover	A	31222	0.7	39	15.64	3.13	0.03	82
DA #5 - 20% Impervious Area = Good Condition Grass Cover	B	3901	0.1	61	6.39	1.28	0.18	58
DA #5 - 20% Impervious Area = Good Condition Grass Cover	C	34312	0.8	74	3.51	0.70	0.57	1644
Subtotal DA#5		**3223872**	**74**					**144504**
DA #6 - Good Condition Grass Cover	B	163717	3.8	61	6.39	1.28	0.18	2436
DA #6 - Impervious Area - Paved	B	6049	0.1	98	0.20	0.04	2.21	1115
DA #6 - Good Condition Grass Cover	C	647270	14.9	74	3.51	0.70	0.57	31005
DA #6 - Impervious Area - Gravel	C	6118	0.1	89	1.24	0.25	1.40	715
DA #6 - Impervious Area - Paved	C	28559	0.7	98	0.20	0.04	2.21	5262
DA #6 - 20% Impervious Area = Good Condition Grass Cover	B	1512	0.0	61	6.39	1.28	0.18	22
DA #6 - 20% Impervious Area = Good Condition Grass Cover	C	8669	0.2	74	3.51	0.70	0.57	415
Subtotal DA#6		**861894**	**20**					**40970**
DA OUT - Good Condition Grass Cover	A	102685	2.4	39	15.64	3.13	0.03	271
DA OUT - Impervious Area - Paved	A	27845	0.6	98	0.20	0.04	2.21	5131
DA OUT - Good Condition Grass Cover	B	163186	3.7	61	6.39	1.28	0.18	2428
DA OUT - Impervious Area - Paved	B	13810	0.3	98	0.20	0.04	2.21	2545
DA OUT - Good Condition Grass Cover	C	226859	5.2	74	3.51	0.70	0.57	10867
DA OUT - Impervious Area - Paved	C	45612	1.0	98	0.20	0.04	2.21	8404
DA OUT - Impervious Area - Gravel	C	27458	0.6	89	1.24	0.25	1.40	3209
DA OUT - 20% Impervious Area = Good Condition Grass Cover	A	6961	0.2	39	15.64	3.13	0.03	18
DA OUT - 20% Impervious Area = Good Condition Grass Cover	B	3453	0.1	61	6.39	1.28	0.18	51
DA OUT - 20% Impervious Area = Good Condition Grass Cover	C	18268	0.4	74	3.51	0.70	0.57	875
Subtotal DA OUT		**636137**	**15**					**33799**
TOTAL:		**16155883**	**371**					**1193887**

Developed Conditions:

Proposed Cover Type/Condition	**Soil Type**	**Area (sf)**	**Area (ac)**	**CN**	**S**	**Ia (0.2*S)**	**Q Runoff (in)**	**Runoff Volume (ft^3)**
DA #1 - Impervious Area - Paved	B	77181	1.8	98	0.204	0.041	2.21	14221
DA #1 - Impervious Area - Gravel	B	334699	7.7	85	1.765	0.353	1.13	31542
DA #1 - Impervious Area - Paved	C	1875723	43.1	98	0.204	0.041	2.21	345618
DA #1 - Impervious Area - Gravel	C	2531255	58.1	89	1.236	0.247	1.40	295814
Subtotal DA#1		**4818858**	**111**					**687194**
DA #2 - Impervious Area - Paved	A	290994	6.7	98	0.204	0.041	2.21	53618
DA #2 - Impervious Area - Gravel	A	1868300	42.9	76	3.158	0.632	0.66	102525
DA #2 - Impervious Area - Paved	B	952192	21.9	98	0.204	0.041	2.21	175449
DA #2 - Impervious Area - Gravel	B	1881880	43.2	85	1.765	0.353	1.13	177346
DA #2 - Impervious Area - Gravel	C	23563	0.5	89	1.236	0.247	1.40	2754
DA #2 - Impervious Area - Paved	C	7595	0.2	98	0.204	0.041	2.21	1399
Subtotal DA#2		**5024524**	**115**					**513091**

DA #3 - Impervious Area - Paved	C	66177	1.5	98	0.204	0.041	2.21	12194
DA #3 - Impervious Area - Gravel	C	1005364	23.1	89	1.236	0.247	1.40	117491
Subtotal DA#3		**1071541**	**25**					**129685**
DA #3a - Impervious Area - Paved	A	17322	0.4	98	0.204	0.041	2.21	3192
DA #3a - Impervious Area - Gravel	A	147809	3.4	76	3.158	0.632	0.66	8111
Subtotal DA#3a		**165131**	**4**					**11303**
DA #4 - Impervious Area - Paved	A	19045	0.4	98	0.204	0.041	2.21	3509
DA #4 - Impervious Area - Gravel	A	334880	7.7	76	3.158	0.632	0.66	18377
Subtotal DA#4		**353925**	**8**					**21886**
DA #5 - Impervious Area - Paved	A	320397	7.4	98	0.204	0.041	2.21	59036
DA #5 - Impervious Area - Gravel	A	830504	19.1	76	3.158	0.632	0.66	45575
DA #5 - Impervious Area - Paved	B	19910	0.5	98	0.204	0.041	2.21	3669
DA #5 - Impervious Area - Gravel	B	36577	0.8	85	1.765	0.353	1.13	3447
DA #5 - Impervious Area - Paved	C	885803	20.3	98	0.204	0.041	2.21	163217
DA #5 - Impervious Area - Gravel	C	1130681	26.0	89	1.236	0.247	1.40	132137
Subtotal DA#5		**3223872**	**74**					**407079**
DA #6 - Impervious Area - Paved	B	7206	0.2	98	0.204	0.041	2.21	1328
DA #6 - Impervious Area - Gravel	B	164072	3.8	85	1.765	0.353	1.13	15462
DA #6 - Impervious Area - Paved	C	39560	0.9	98	0.204	0.041	2.21	7289
DA #6 - Impervious Area - Gravel	C	651056	14.9	89	1.236	0.247	1.40	76085
Subtotal DA#6		**861894**	**20**					**100164**
DA OUT - Impervious Area - Paved	A	24578	0.6	98	0.204	0.041	2.21	20799
DA OUT - Impervious Area - Gravel	A	112879	2.6	76	3.158	0.632	0.66	1470
DA OUT - Good Condition Grass Cover	B	26780	0.6	61	6.39	1.28	0.18	398
DA OUT - Impervious Area - Paved	B	20049	0.5	98	0.204	0.041	2.21	3694
DA OUT - Impervious Area - Gravel	B	133456	3.1	85	1.765	0.353	1.13	12577
DA OUT - Impervious Area - Paved	C	33765	0.8	98	0.204	0.041	2.21	6221
DA OUT - Impervious Area - Gravel	C	284630	6.5	89	1.236	0.247	1.40	33263
Subtotal DA OUT		**636137**	**15**					**254672**
TOTAL:		**16155882**	**371**					**2125076**

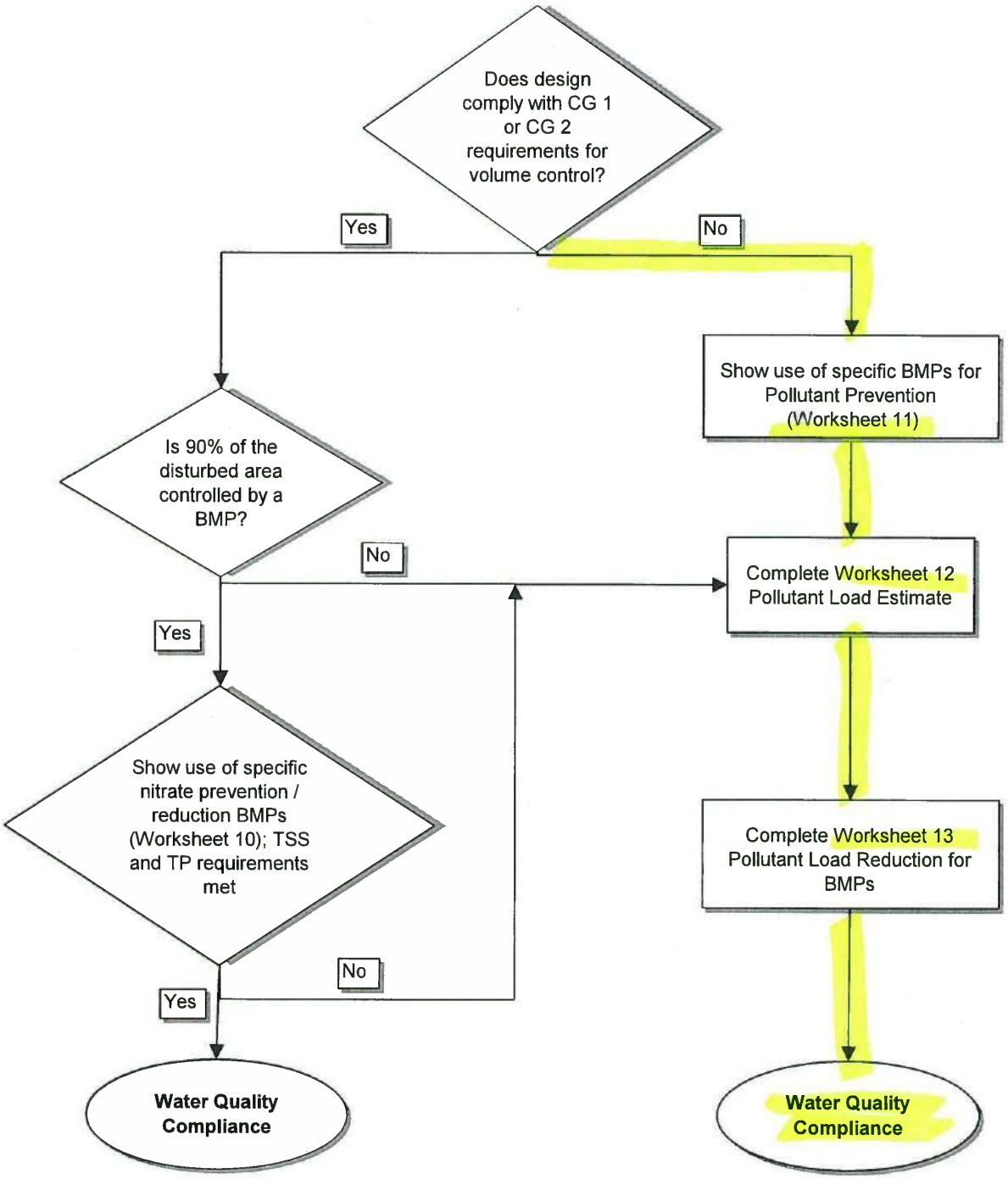
2-Year Volume Increase (ft3):	931189

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

Flow Chart D
Water Quality Process



WORKSHEET 11. BMPS FOR POLLUTION PREVENTION

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 BMPs are provided across the site. "Provided across the site" is taken to mean that the specifications for that BMP set forward in Chapters 5 and 6 are satisfied.

BMPs FOR POLLUTANT PREVENTION:

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.4.3 - Protect / Utilize Natural Flow Pathways in Overall Stormwater Planning and Design		
NS BMP 5.5.1 - Cluster Uses at Each Site; Build on the Smallest Area Possible		
NS BMP 5.6.1 - Minimize Total Disturbed Area - Grading		
NS BMP 5.6.2 - Minimize Soil Compaction in Disturbed Areas		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)		
NS BMP 5.7.1 - Reduce Street Imperviousness	X	
NS BMP 5.7.2 - Reduce Parking Imperviousness		
NS BMP 5.8.1 - Rooftop Disconnection		
NS BMP 5.8.2 - Disconnection from Storm Sewers		
NS BMP 5.9.1 - Street Sweeping	X	
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2- Landscape Restoration		
Structural BMP 6.7.3- Soils Amendment and Restoration		

WORKSHEET 12. WATER QUALITY ANALYSIS OF POLLUTANT LOADING FROM ALL DISTURBED AREAS

TOTAL SITE AREA (AC)	371
TOTAL DISTURBED AREA (AC)	357
DISTURBED AREA CONTROLLED BY BMPs (AC)	357

TOTAL DISTURBED AREAS:

	LAND COVER CLASSIFICATION	POLLUTANT			COVER (Acres)	RUNOFF VOLUME (AF)	POLLUTANT LOAD		
		TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*			TSS** (LBS)	TP** (LBS)	NO_3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17					
	Meadow	47	0.19	0.3					
	Fertilized Planting Area	55	1.34	0.73					
	Native Planting Area	55	0.40	0.33					
	Lawn, Low-Input	180	0.40	0.44					
	Lawn, High-Input	180	2.22	1.46					
	Golf Course Fairway/Green	305	1.07	1.84					
	Grassed Athletic Field	200	1.07	1.01					
Impervious Surfaces	Rooftop	21	0.13	0.32	10.3	1.89	107.32	0.664	1.635
	High Traffic Street / Highway	261	0.40	0.83					
	Medium Traffic Street	113	0.33	0.58					
	Low Traffic / Residential Street	86	0.36	0.47	79.6	14.667	3405.7	14.256	18.613
	Res. Driveway, Play Courts, etc.	60	0.46	0.47					
	High Traffic Parking Lot	120	0.39	0.60					
	Low Traffic Parking Lot	58	0.15	0.39					
						TOTAL LOAD	3513	14.92	20.248
						REQUIRED REDUCTION (%)	85%	85%	50%
						REQUIRED REDUCTION (LBS)	2986	12.68	10.12

Net: Gravel (251 Acres)
Pond (16.3 Acres)

Note: All paved areas have been classified as "low traffic/residential street."

* Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]

** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: Dry Extended Basin

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	322

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

	LAND COVER CLASSIFICATION	POLLUTANT					POLLUTANT LOAD**		
		TSS EMC (mg/l)	TP EMC (mg/l)	Nitrate-Nitrite EMC (mg/l as N)	COVER (Acres)	RUNOFF VOLUME (AF)	TSS*** (LBS)	TP*** (LBS)	NO_3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17					
	Meadow	47	0.19	0.3					
	Fertilized Planting Area	55	1.34	0.73					
	Native Planting Area	55	0.40	0.33					
	Lawn, Low-Input	180	0.40	0.44					
	Lawn, High-Input	180	2.22	1.46					
	Golf Course Fairway/Green	305	1.07	1.84					
	Grassed Athletic Field	200	1.07	1.01					
Impervious Surfaces	Rooftop	21	0.13	0.32	10.3	1.893	107.32	0.664	1.635
	High Traffic Street / Highway	261	0.40	0.83					
	Medium Traffic Street	113	0.33	0.58					
	Low Traffic / Residential Street	86	0.36	0.47	44.9	8.271	1920.5	8.039	10.496
	Res. Driveway, Play Courts, etc.	60	0.46	0.47					
	High Traffic Parking Lot	120	0.39	0.60					
	Low Traffic Parking Lot	58	0.15	0.39					
						TOTAL LOAD TO THIS BMP TYPE	2027.8	8.704	12.13
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE 9-3 (%)	60	40	20
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	1216.7	3.48	2.43

Net: Gravel (251 Acres)
Pond (16.3 Acres)

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)			
REQUIRED REDUCTION FROM WS12 (LBS)			

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: Water Quality Filters & Hydrodynamic Devices

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	34.7

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

	LAND COVER CLASSIFICATION	POLLUTANT			COVER (Acres)	RUNOFF VOLUME (AF)	POLLUTANT LOAD**		
		TSS EMC *(mg/l)*	TP EMC *(mg/l)*	Nitrate-Nitrite EMC *(mg/l as N)*			TSS*** (LBS)	TP*** (LBS)	NO_3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17					
	Meadow	47	0.19	0.3					
	Fertilized Planting Area	55	1.34	0.73					
	Native Planting Area	55	0.40	0.33					
	Lawn, Low-Input	180	0.40	0.44					
	Lawn, High-Input	180	2.22	1.46					
	Golf Course Fairway/Green	305	1.07	1.84					
	Grassed Athletic Field	200	1.07	1.01					
Impervious Surfaces	Rooftop	21	0.13	0.32					
	High Traffic Street / Highway	261	0.40	0.83					
	Medium Traffic Street	113	0.33	0.58					
	Low Traffic / Residential Street	86	0.36	0.47	34.7	6.396	1485.2	6.217	8.117
	Res. Driveway, Play Courts, etc.	60	0.46	0.47					
	High Traffic Parking Lot	120	0.39	0.60					
	Low Traffic Parking Lot	58	0.15	0.39					
						TOTAL LOAD TO THIS BMP TYPE	1485.2	6.217	8.117
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE 9-3 (%)	60	50	20
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	891.1	3.109	1.623

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)			
REQUIRED REDUCTION FROM WS12 (LBS)			

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

WORKSHEET 13. POLLUTANT REDUCTION THROUGH BMP APPLICATIONS*

** FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTANT REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET.*

BMP TYPE: Streetsweeping

DISTURBED AREA CONTROLLED BY THIS BMP TYPE (AC)	79.6

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

	LAND COVER CLASSIFICATION	POLLUTANT			COVER (Acres)	RUNOFF VOLUME (AF)	POLLUTANT LOAD**		
		TSS EMC (mg/l)	TP EMC (mg/l)	Nitrate-Nitrite EMC (mg/l as N)			TSS*** (LBS)	TP*** (LBS)	NO_3 (LBS)
Pervious Surfaces	Forest	39	0.15	0.17					
	Meadow	47	0.19	0.3					
	Fertilized Planting Area	55	1.34	0.73					
	Native Planting Area	55	0.40	0.33					
	Lawn, Low-Input	180	0.40	0.44					
	Lawn, High-Input	180	2.22	1.46					
	Golf Course Fairway/Green	305	1.07	1.84					
	Grassed Athletic Field	200	1.07	1.01					
Impervious Surfaces	Rooftop	21	0.13	0.32					
	High Traffic Street / Highway	261	0.40	0.83					
	Medium Traffic Street	113	0.33	0.58					
	Low Traffic / Residential Street	86	0.36	0.47	79.6	14.667	3405.7	14.256	18.613
	Res. Driveway, Play Courts, etc.	60	0.46	0.47					
	High Traffic Parking Lot	120	0.39	0.60					
	Low Traffic Parking Lot	58	0.15	0.39					
						TOTAL LOAD TO THIS BMP TYPE	3405.7	14.256	18.613
						POLLUTANT REMOVAL EFFICIENCIES FROM TABLE 9-3 (%)	85	85	50
						POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS)	2895	12.12	9.3

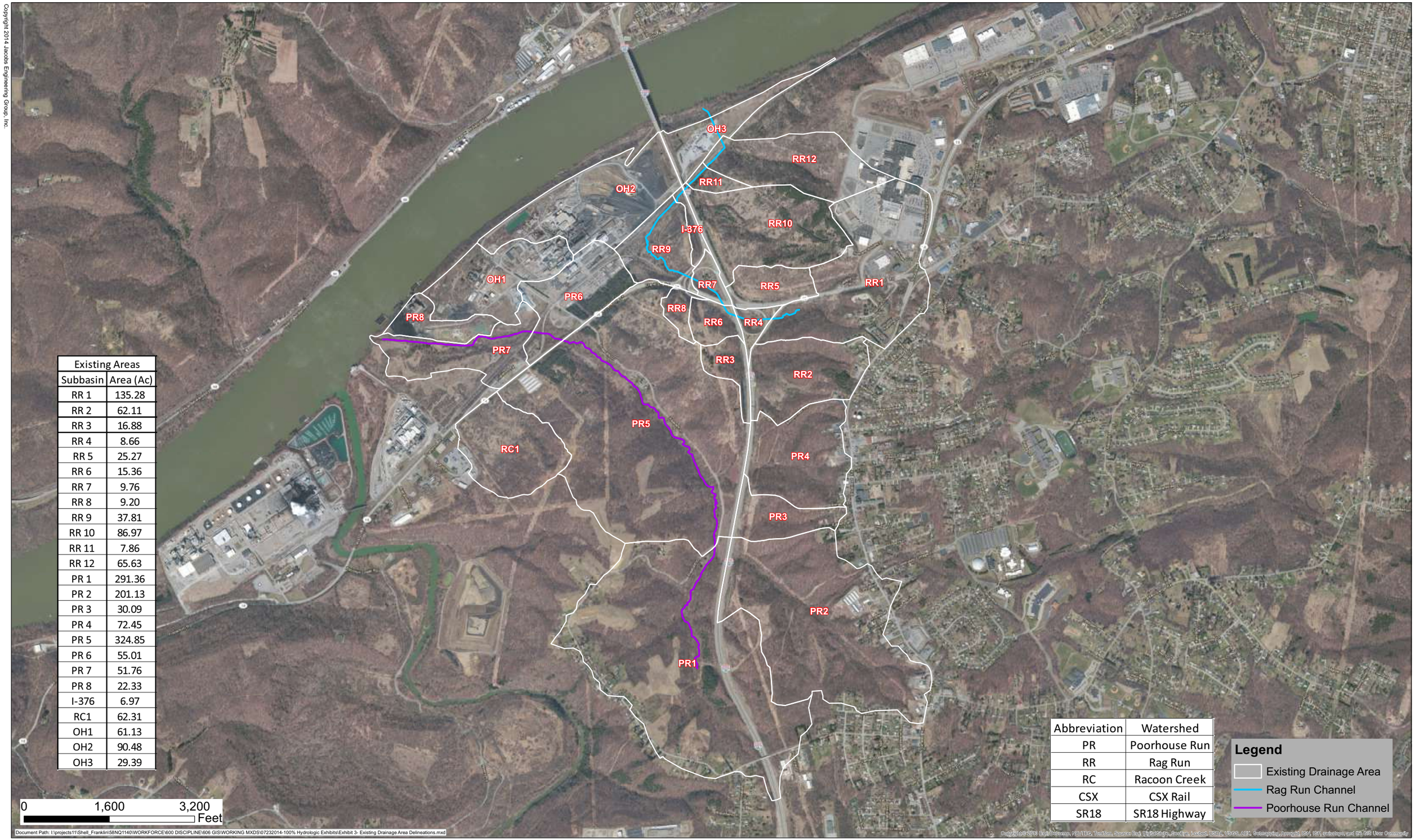
POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS)	5003	18.71	13.36
REQUIRED REDUCTION FROM WS12 (LBS)	2986	12.68	10.12

** Pollutant Load = [EMC, mg/l] X [Volume, AF] X [2.7, Unit Conversion]
*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area

Note: All paved areas have been classified as "low traffic/residential street." Paved areas which expect regular vehicular traffic will be swept periodically as described in the PCSM text. Paved areas which do not expect regular vehicular traffic (e.g. those which will only be used by vehicles during maintenance) will be swept after use.

APPENDIX E: Hydrological and Hydraulic References

Copyright 2014 Jacobs Engineering Group, Inc.



Existing Areas	
Subbasin	Area (Ac)
RR 1	135.28
RR 2	62.11
RR 3	16.88
RR 4	8.66
RR 5	25.27
RR 6	15.36
RR 7	9.76
RR 8	9.20
RR 9	37.81
RR 10	86.97
RR 11	7.86
RR 12	65.63
PR 1	291.36
PR 2	201.13
PR 3	30.09
PR 4	72.45
PR 5	324.85
PR 6	55.01
PR 7	51.76
PR 8	22.33
I-376	6.97
RC1	62.31
OH1	61.13
OH2	90.48
OH3	29.39

Abbreviation	Watershed
PR	Poorhouse Run
RR	Rag Run
RC	Racoon Creek
CSX	CSX Rail
SR18	SR18 Highway

Document Path: I:\projects11\Shell_Franklin\58NQ1140\WORKFORCE\600 DISCIPLINE\606 GIS\WORKING MXDS\07232014-100% Hydrologic Exhibits\Exhibit 3- Existing Drainage Area Delineations.mxd

Exhibit 3

JACOBS

Existing Conditions Hydrology: Drainage Area Delineations

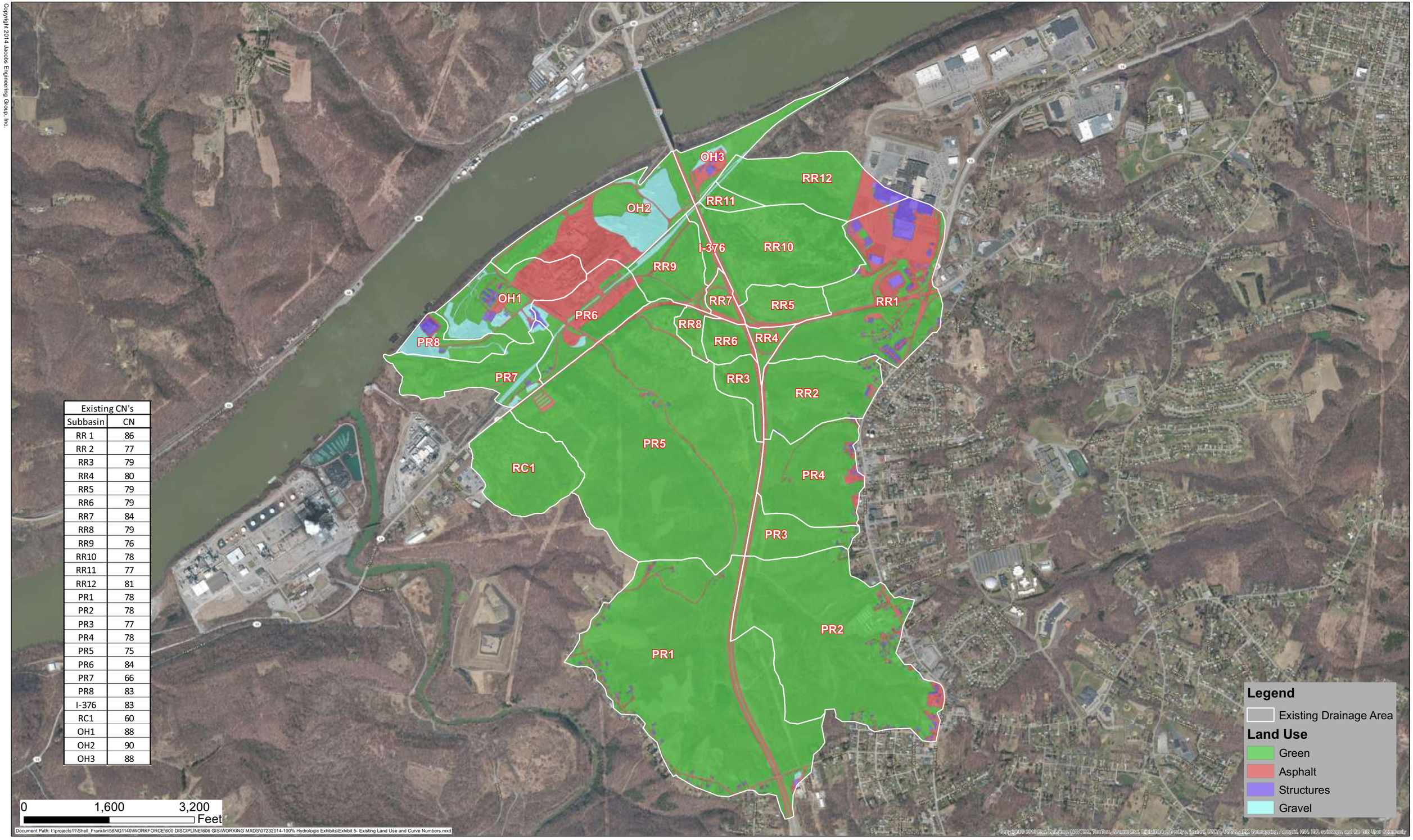
Project No.	58NQ1140	Original size	22" x 34"
Drawn By	JVK		Notes: Not intended for construction. For permit use only.
Approved By	DEC		
Revised By	JDF		
Date	10/2/2014		

N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX

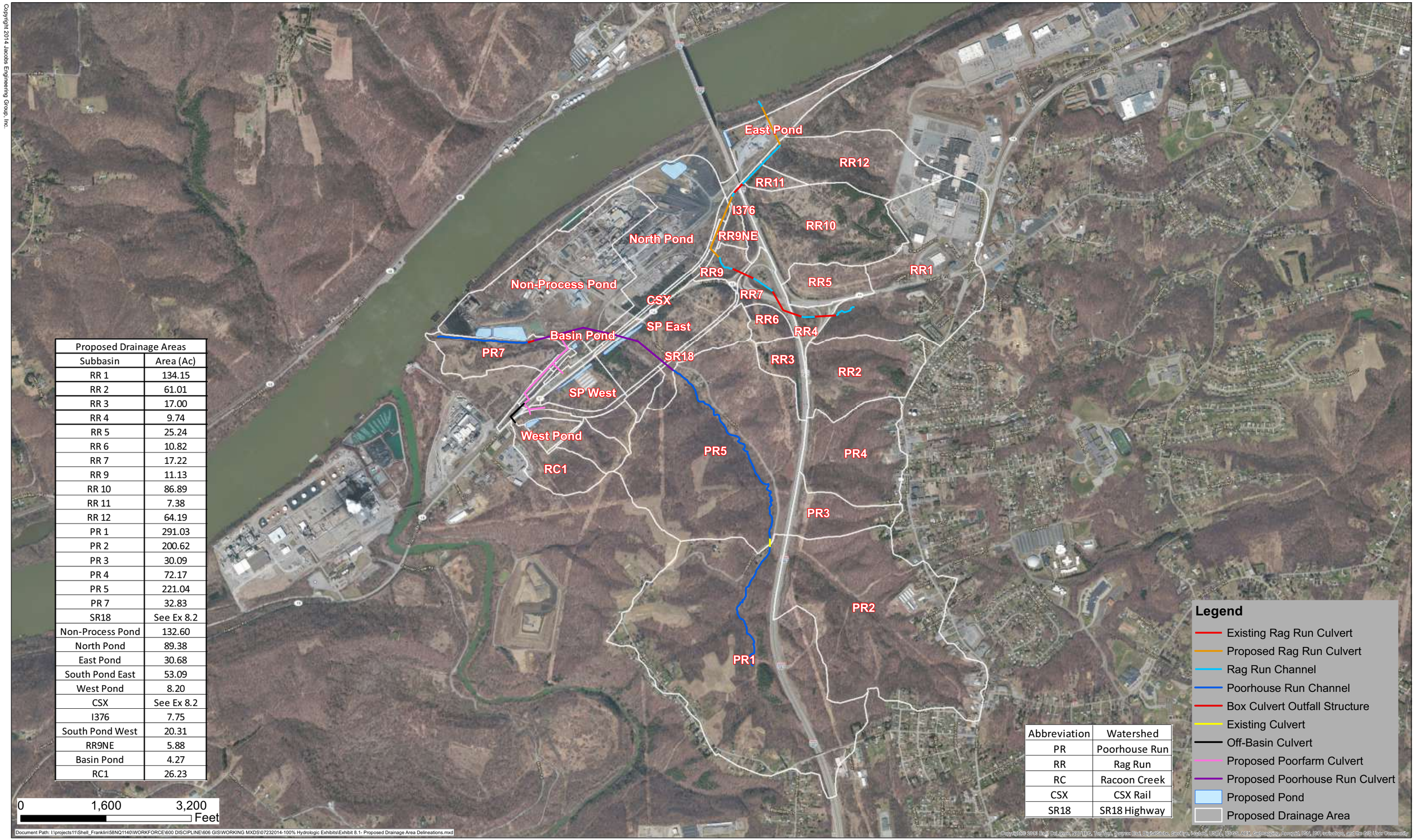
Copyright 2014 Jacobs Engineering Group, Inc.



Existing CN's	
Subbasin	CN
RR 1	86
RR 2	77
RR3	79
RR4	80
RR5	79
RR6	79
RR7	84
RR8	79
RR9	76
RR10	78
RR11	77
RR12	81
PR1	78
PR2	78
PR3	77
PR4	78
PR5	75
PR6	84
PR7	66
PR8	83
I-376	83
RC1	60
OH1	88
OH2	90
OH3	88

Exhibit	JACOBS	Existing Conditions Hydrology: Land Use and Curve Numbers	Project No. 58NQ1140	Original size 22" x 34"	N	HORSEHEAD CORPORATION	SHELL PROPOSED PETROCHEMICAL COMPLEX
5			Drawn By JVK	Notes: Not intended for construction. For permit use only.			25873-001-30G-00001, Rev 000, Page 39 of 63
			Approved By DEC				
			Revised By JDF				
			Date 10/2/2014				

Copyright 2014 Jacobs Engineering Group, Inc.



Proposed Drainage Areas	
Subbasin	Area (Ac)
RR 1	134.15
RR 2	61.01
RR 3	17.00
RR 4	9.74
RR 5	25.24
RR 6	10.82
RR 7	17.22
RR 9	11.13
RR 10	86.89
RR 11	7.38
RR 12	64.19
PR 1	291.03
PR 2	200.62
PR 3	30.09
PR 4	72.17
PR 5	221.04
PR 7	32.83
SR18	See Ex 8.2
Non-Process Pond	132.60
North Pond	89.38
East Pond	30.68
South Pond East	53.09
West Pond	8.20
CSX	See Ex 8.2
I376	7.75
South Pond West	20.31
RR9NE	5.88
Basin Pond	4.27
RC1	26.23

Abbreviation	Watershed
PR	Poorhouse Run
RR	Rag Run
RC	Racoon Creek
CSX	CSX Rail
SR18	SR18 Highway

Exhibit 8.1

JACOBS

Proposed Conditions Hydrology: Drainage Area Delineations

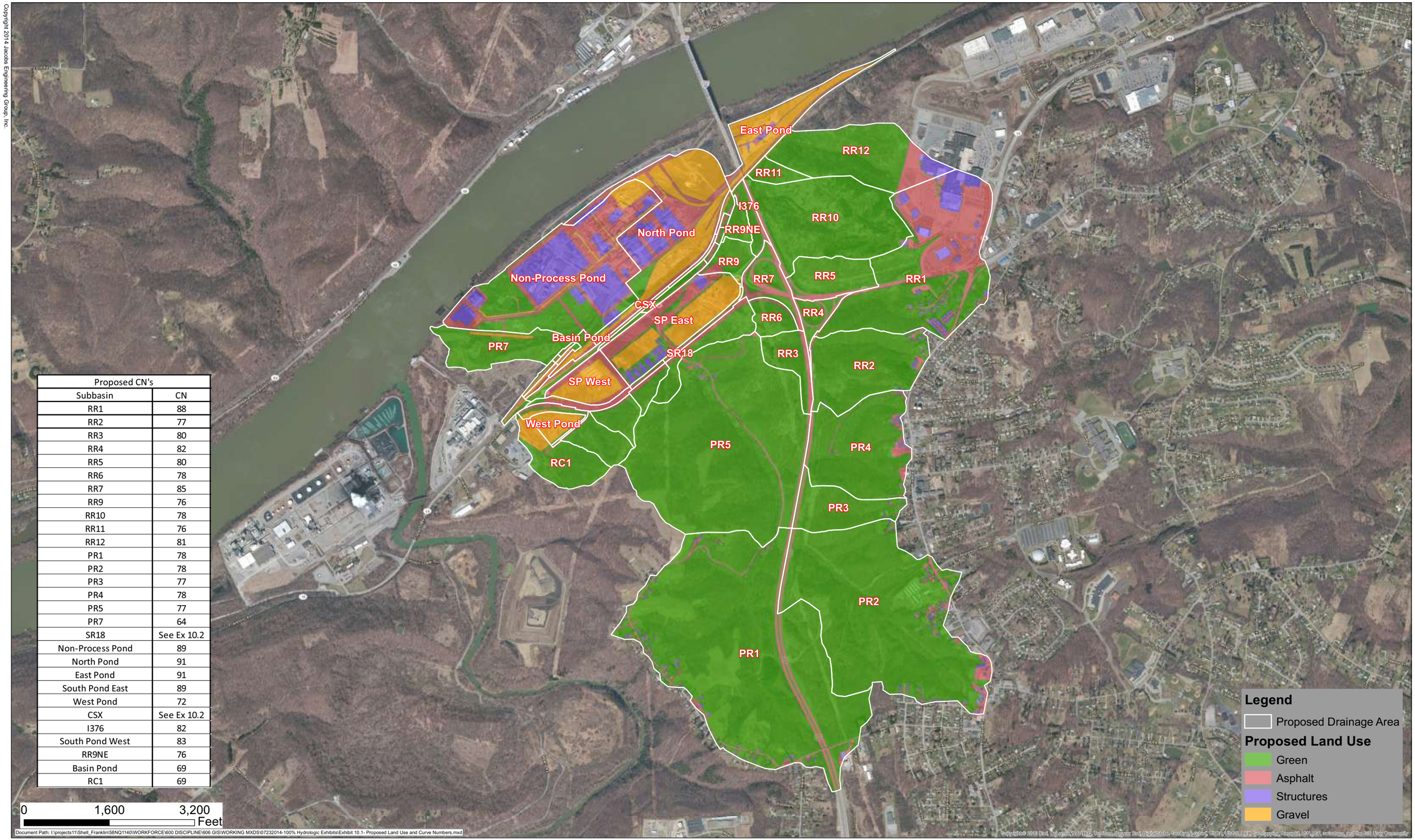
Project No.	58NQ1140	Original size	22" x 34"
Drawn By	JVK		Notes: Not intended for construction. For permit use only.
Approved By	DEC		
Revised By	JDF		
Date	10/2/2014		

N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX

Copyright 2014 Jacobs Engineering Group, Inc.



Proposed CN's	
Subbasin	CN
RR1	88
RR2	77
RR3	80
RR4	82
RR5	80
RR6	78
RR7	85
RR9	76
RR10	78
RR11	76
RR12	81
PR1	78
PR2	78
PR3	77
PR4	78
PR5	77
PR7	64
SR18	See Ex 10.2
Non-Process Pond	89
North Pond	91
East Pond	91
South Pond East	89
West Pond	72
CSX	See Ex 10.2
I376	82
South Pond West	83
RR9NE	76
Basin Pond	69
RC1	69

Document Path: I:\projects11\Shell_Franklin\58NQ1140\WORKFORCE\600 DISCIPLINE\606 GIS\WORKING MXDS\07232014-100% Hydrologic Exhibits\Exhibit 10.1- Proposed Land Use and Curve Numbers.mxd

Exhibit
10.1

JACOBS

Proposed Conditions Hydrology: Land Use and Curve Numbers

Project No.	58NQ1140	Original size	22" x 34"
Drawn By	JVK		Notes: Not intended for construction. For permit use only.
Approved By	DEC		
Revised By	JDF		
Date	10/2/2014		

N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX

Table 6: Existing Drainage Area Peak Flows						
Drainage Area	*Area (Ac)*	*Peak Flows (cfs)*				
		100-YR	*50-YR*	*25-YR*	*10-YR*	*2-YR*
RR12	65.63	231.7	200.9	170.7	130.1	55.6
I-376	6.97	33.6	29.4	25.3	19.6	9.1
OH1	61.13	152.6	134.2	116.2	92.2	45.8
OH2	90.48	372.2	333.4	294.7	240.3	130.9
OH3	29.3	192.5	171.7	150.9	121.6	64.4
RC1	62.31	116.5	87.8	61.8	32.6	1.8

H. Existing Site Drainage and Detention

The existing site does not detain stormwater runoff for extreme events. Internal site drainage mostly occurs through storm sewers. The existing site has three temporary holding ponds adequate to control the runoff from the 2-yr event. Runoff in excess of the 2-yr event flows uncontrolled to the Ohio River. Exhibit 7 shows the permitted stormwater outfalls for the current site.

I. PA StreamSTATS

Utilizing the PA StreamSTATS web-based GIS tool, drainage area contributing to flow in Poorhouse Run was generated. Subsequently the drainage area was used within the web-based tool to estimate peak flows using the Regression Equations per Scientific Investigations Report 2008-5102[2]. The output of the web application is included as Appendix 4. Key findings from the web-based GIS tool are outlined below:

- Drainage area delineated by the web-based GIS tool is similar to the delineation as shown in Exhibit 3 for existing Poorhouse Run and Rag Run watersheds;
- The total drainage area estimated by the program is outside the recommended range for the regression equations to be valid; and
- The 100-yr peak flow estimated by the program has a 36% prediction error. There is no justification for a direct comparison to the flows obtained by a more detailed hydrologic study.

IV. Proposed Condition Hydrology

As part of the early works preparation for the proposed project, existing drainage features and drainage areas could be impacted. The proposed condition hydrology study will establish flow rates to compare to the base condition and determine any potential impacts upstream or downstream of the project area.

[2] Issued by U.S. Geological Survey

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1788	772.77	Channel36	194.7	1643	771.65
1643	771.65	Channel37	194.2	1540	770.67
1540	770.67	Channel38	213.3	1441	769.16
1441	769.16	Channel39	213.1	1338	766.76
1338	766.76	Culvert7	212.8	1238	764.66
1238	764.66	Channel40	212.8	1165	762.38
1165	762.38	Channel41	212.7	1118	760.98
1118	760.98	Channel42	212.5	1029	759.07
1029	759.07	Channel43	212.1	991	758.64
991	758.64	Culvert8	211.6	287	694.81
287	694.81	Channel44	233.0	161	694.10
161	694.10	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	773.05	Channel37	453.6	1540	772.12
1540	772.12	Channel38	496.4	1441	771.11
1441	771.11	Channel39	496.1	1338	770.74
1338	770.74	Culvert7	495.9	1238	766.02
1238	766.02	Channel40	495.8	1165	763.63
1165	763.63	Channel41	495.8	1118	762.67
1118	762.67	Channel42	495.7	1029	762.19
1029	762.19	Channel43	495.2	991	762.12
991	762.12	Culvert8	494.9	287	696.14
287	696.14	Channel44	525.0	161	694.10
161	694.10	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	774.27	Channel37	577.2	1540	773.84
1540	773.84	Channel38	624.6	1441	773.54
1441	773.54	Channel39	623.1	1338	773.43
1338	773.43	Culvert7	624.0	1238	766.49
1238	766.49	Channel40	624.1	1165	764.72
1165	764.72	Channel41	624.1	1118	764.17
1118	764.17	Channel42	624.2	1029	763.61
1029	763.61	Channel43	624.2	991	763.58
991	763.58	Culvert8	624.2	287	699.52
287	699.52	Channel44	646.3	161	699.50
161	699.50	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	775.56	Channel37	655.5	1540	775.34
1540	775.34	Channel38	717.6	1441	775.19
1441	775.19	Channel39	713.8	1338	775.14
1338	775.14	Culvert7	711.5	1238	766.47
1238	766.47	Channel40	711.4	1165	765.42
1165	765.42	Channel41	710.7	1118	765.02
1118	765.02	Channel42	710.4	1029	764.58
1029	764.58	Channel43	710.5	991	764.56
991	764.56	Culvert8	710.6	287	700.99
287	700.99	Channel44	744.4	161	700.63
161	700.63	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	776.84	Channel37	736.1	1540	776.71
1540	776.71	Channel38	791.2	1441	776.62
1441	776.62	Channel39	789.5	1338	776.58
1338	776.58	Culvert7	789.6	1238	767.03
1238	767.03	Channel40	789.6	1165	765.99
1165	765.99	Channel41	789.6	1118	765.67
1118	765.67	Channel42	789.4	1029	765.31
1029	765.31	Channel43	789.1	991	765.29
991	765.29	Culvert8	788.9	287	701.01
287	701.01	Channel44	822.7	161	701.00
161	701.00	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	784.13	Channel 43	257.8	6045	780.09
6045	780.09	Channel 44	257.8	5900	777.02
5900	777.02	Channel 45	258.2	5755	773.30
5755	773.30	Channel 46	258.5	5601	770.82
5601	770.82	Channel 47	258.7	5427	765.80
5427	765.80	Channel 48	258.8	5288	762.15
5288	762.15	Channel 49	258.7	5090	759.14
5090	759.14	Channel 50	258.6	4937	751.90
4937	751.90	Channel 51	258.0	4732	747.98
4732	747.98	Culvert 2	257.2	4585	743.59
4585	743.59	Channel 52	256.9	4448	741.33
4448	741.33	Channel 53	265.7	4309	738.61
4309	738.61	Channel 54	265.6	4257	736.83
4257	736.83	Culvert 3	265.4	4232	736.38
-	-	Culvert 3 Road	0.0	-	-
4232	736.38	Channel 55	265.2	4111	734.76
4111	734.76	Culvert 4	264.9	3993	730.29
3993	730.29	Channel 56	265.2	3718	726.24
3718	726.24	Channel 57	267.6	3516	722.68
3516	722.68	Channel 58	268.2	3025	714.15
3025	714.15	Channel 59	268.3	2747	710.01
2747	710.01	Channel 60	268.2	2485	702.23
2485	702.23	Channel 61	267.2	2269	700.20
2269	700.20	Channel 62	266.1	1991	697.82
1991	697.82	Channel 63	284.6	1489	693.08
1489	693.08	Channel 64	267.5	1106	693.00
1106	693.00	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6392	789.09	Channel 42	813.7	6229	785.91
6229	785.91	Channel 43	813.6	6045	781.60
6045	781.60	Channel 44	813.4	5900	778.17
5900	778.17	Channel 45	812.8	5755	774.49
5755	774.49	Channel 46	812.2	5601	771.77
5601	771.77	Channel 47	811.0	5427	766.95
5427	766.95	Channel 48	809.2	5288	763.37
5288	763.37	Channel 49	806.5	5090	759.97
5090	759.97	Channel 50	805.0	4937	753.33
4937	753.33	Channel 51	805.9	4732	751.14
4732	751.14	Culvert 2	808.6	4585	744.88
4585	744.88	Channel 52	809.1	4448	742.43
4448	742.43	Channel 53	840.1	4309	740.02
4309	740.02	Channel 54	844.0	4257	739.63
4257	739.63	Culvert 3	843.5	4232	739.31
-	-	Culvert 3 Road	0.0	-	-
4232	739.31	Channel 55	842.7	4111	739.10
4111	739.10	Culvert 4	841.8	3993	731.79
3993	731.79	Channel 56	841.4	3718	727.93
3718	727.93	Channel 57	856.1	3516	724.33
3516	724.33	Channel 58	854.9	3025	715.46
3025	715.46	Channel 59	852.5	2747	711.05
2747	711.05	Channel 60	850.5	2485	704.84
2485	704.84	Channel 61	850.3	2269	702.10
2269	702.10	Channel 62	852.3	1991	699.76
1991	699.76	Channel 63	858.0	1489	693.87
1489	693.87	Channel 64	858.7	1106	693.00
1106	693.00	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	786.52	Channel 43	1076.6	6045	782.08
6045	782.08	Channel 44	1078.8	5900	778.54
5900	778.54	Channel 45	1081.1	5755	774.79
5755	774.79	Channel 46	1083.4	5601	772.07
5601	772.07	Channel 47	1084.9	5427	767.32
5427	767.32	Channel 48	1086.9	5288	763.76
5288	763.76	Channel 49	1088.4	5090	760.25
5090	760.25	Channel 50	1089.0	4937	753.84
4937	753.84	Channel 51	1089.4	4732	752.49
4732	752.49	Culvert 2	1087.3	4585	745.33
4585	745.33	Channel 52	1086.9	4448	743.03
4448	743.03	Channel 53	1122.7	4309	742.49
4309	742.49	Channel 54	1115.3	4257	742.44
4257	742.44	Culvert 3	1112.5	4232	742.29
-	-	Culvert 3 Road	0.0	-	-
4232	742.29	Channel 55	1107.8	4111	742.23
4111	742.23	Culvert 4	1104.8	3993	732.30
3993	732.30	Channel 56	1105.4	3718	728.42
3718	728.42	Channel 57	1123.8	3516	724.76
3516	724.76	Channel 58	1125.4	3025	715.86
3025	715.86	Channel 59	1126.4	2747	711.47
2747	711.47	Channel 60	1126.8	2485	705.58
2485	705.58	Channel 61	1126.8	2269	702.70
2269	702.70	Channel 62	1126.7	1991	700.24
1991	700.24	Channel 63	1131.4	1489	698.61
1489	698.61	Channel 64	1131.6	1106	698.00
1106	698.00	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	787.15	Channel 43	1417.4	6045	782.60
6045	782.60	Channel 44	1418.7	5900	778.91
5900	778.91	Channel 45	1419.7	5755	775.14
5755	775.14	Channel 46	1420.4	5601	772.31
5601	772.31	Channel 47	1420.7	5427	767.70
5427	767.70	Channel 48	1420.4	5288	764.14
5288	764.14	Channel 49	1418.7	5090	760.54
5090	760.54	Channel 50	1417.3	4937	754.62
4937	754.62	Channel 51	1399.9	4732	753.90
4732	753.90	Culvert 2	1390.7	4585	746.54
4585	746.54	Channel 52	1384.9	4448	746.07
4448	746.07	Channel 53	1407.9	4309	746.00
4309	746.00	Channel 54	1370.9	4257	745.99
4257	745.99	Culvert 3	1360.0	4232	745.67
-	-	Culvert 3 Road	0.0	-	-
4232	745.67	Channel 55	1341.4	4111	745.65
4111	745.65	Culvert 4	1333.8	3993	732.68
3993	732.68	Channel 56	1333.8	3718	728.81
3718	728.81	Channel 57	1356.7	3516	725.09
3516	725.09	Channel 58	1357.0	3025	716.15
3025	716.15	Channel 59	1356.7	2747	711.81
2747	711.81	Channel 60	1356.2	2485	706.12
2485	706.12	Channel 61	1354.9	2269	703.11
2269	703.11	Channel 62	1353.7	1991	700.61
1991	700.61	Channel 63	1358.7	1489	698.60
1489	698.60	Channel 64	1358.6	1106	698.00
1106	698.00	Outfall			

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	787.60	Channel 43	1717.8	6045	782.99
6045	782.99	Channel 44	1714.2	5900	779.12
5900	779.12	Channel 45	1711.1	5755	775.41
5755	775.41	Channel 46	1711.0	5601	772.50
5601	772.50	Channel 47	1714.0	5427	767.99
5427	767.99	Channel 48	1717.7	5288	764.43
5288	764.43	Channel 49	1721.2	5090	760.77
5090	760.77	Channel 50	1723.2	4937	755.79
4937	755.79	Channel 51	1715.3	4732	755.36
4732	755.36	Culvert 2	1706.7	4585	749.42
4585	749.42	Channel 52	1681.8	4448	749.33
4448	749.33	Channel 53	1671.6	4309	749.31
4309	749.31	Channel 54	1587.9	4257	749.31
4257	749.31	Culvert 3	1567.1	4232	748.78
-	-	Culvert 3 Road	37.4	-	-
4232	748.78	Channel 55	1528.5	4111	748.78
4111	748.78	Culvert 4	1513.4	3993	732.95
3993	732.95	Channel 56	1512.8	3718	729.10
3718	729.10	Channel 57	1541.4	3516	725.36
3516	725.36	Channel 58	1540.4	3025	716.33
3025	716.33	Channel 59	1539.2	2747	712.05
2747	712.05	Channel 60	1538.3	2485	706.51
2485	706.51	Channel 61	1538.9	2269	703.41
2269	703.41	Channel 62	1539.6	1991	700.90
1991	700.90	Channel 63	1548.2	1489	700.08
1489	700.08	Channel 64	1548.6	1106	700.00
1106	700.00	Outfall			

Table 9: Proposed Drainage Area Peak Flows						
Drainage Area	*Area (Ac)*	*Peak Flows (cfs)*				
		100-YR	*50-YR*	*25-YR*	*10-YR*	*2-YR*
PR 1	291.03	591.25	499.85	413.13	302.56	110.58
PR 2	200.62	490.15	416.59	345.93	254.65	94.57
PR 3	30.09	91.51	77.94	64.78	47.57	17.40
PR 4	72.17	300.77	257.46	215.07	160.29	62.55
PR 5	221.04	514.95	435.23	359.32	261.91	93.10
PR 7	32.83	50.38	39.42	29.41	17.71	2.33
RR 1	134.15	393.11	346.95	301.82	240.54	121.05
RR 2	61.01	96.58	80.85	66.07	47.61	16.44
RR 3	17.00	55.05	47.45	40.07	30.27	12.41
RR 4	9.74	45.77	39.88	34.05	26.17	11.81
RR 5	25.24	56.72	48.42	40.47	30.23	11.96
RR 6	10.82	28.42	24.20	20.14	14.85	5.56
RR 7	17.22	87.50	77.18	66.88	52.70	25.86
RR 9	11.13	43.40	36.79	30.43	22.24	7.93
RR 10	86.89	182.52	154.51	127.79	93.64	34.33
RR 11	7.38	20.13	17.02	14.03	10.19	3.53
RR 12	64.19	226.61	196.50	166.92	127.25	54.34
I-376	7.75	33.63	29.36	25.12	19.37	8.64
RR 9 NE	5.88	22.93	19.44	16.08	11.75	4.19
SR18-1	5.22	35.20	31.91	28.59	23.84	14.33
SR18-2	5.19	18.28	14.87	11.67	7.69	1.51
SR18-3	14.70	56.87	47.71	39.00	27.90	9.00
SR18-4	9.96	41.64	35.56	29.61	21.80	8.16
SR18-5	1.36	9.63	8.67	7.70	6.33	3.65
SR18-6	6.35	26.18	22.41	18.79	14.00	5.44
SR18-7	3.19	21.45	19.33	17.20	14.17	8.18
SR18-8	19.43	90.94	78.27	65.83	49.33	20.08
NON-PROCESS POND	102.15	33.90	20.77	12.42	6.06	0.00
NORTH POND	110.80	59.50	50.99	41.54	25.42	0.00
SOUTH POND - WEST	20.30	N/A	N/A	N/A	N/A	N/A
SOUTH POND - EAST	53.16	217.21	158.19	108.56	52.49	0.00

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6737	905.55	Channel 1	120.5	6681	900.06
6681	900.06	Channel 2	120.4	6569	894.97
6569	894.97	Channel 3	120.2	6437	888.52
6437	888.52	Channel 4	119.9	6364	887.11
6364	887.11	Channel 5	120.1	6275	882.99
6275	882.99	Culvert 1	119.6	5899	864.80
5899	864.80	Channel 6	119.6	5816	860.56
5816	860.56	Channel 7	122.5	5744	858.94
5744	858.94	Channel 8	152.9	5707	858.84
5707	858.84	Channel 9	152.8	5650	856.65
5650	856.65	Culvert 2	153.4	4878	831.17
4878	831.17	Channel 10	158.7	4772	827.50
4772	827.50	Channel 11	158.8	4677	824.38
4677	824.38	Channel 12	163.4	4595	821.35
4595	821.35	Channel 13	163.4	4493	818.81
4493	818.81	Channel 14	163.6	4443	818.75
4443	818.75	Culvert 3	163.9	4015	808.08
4015	808.08	Channel 15	164.2	3896	805.53
3896	805.53	Channel 16	166.3	3773	803.34
3773	803.34	Channel 17	166.3	3634	797.80
3634	797.80	Box Culv 1	164.4	RR MH1	774.85
RR MH1	774.85	Box Culv 2	164.0	RR MH2	774.12
RR MH2	774.12	Box Culv 3	164.0	RR MH3	773.37
RR MH3	773.37	Box Culv 4	164.5	RR MH4	772.73
RR MH4	772.73	Box Culv 5	165.5	2346	772.28
2346	772.28	Channel 18	168.9	2257	772.27
2257	772.27	Culvert 4	169.0	2033	767.68
2033	767.68	Channel 19	202.8	1974	767.48
1974	767.48	Channel 20	204.7	1896	767.18
1896	767.18	Channel 21	204.7	1790	766.25
1790	766.25	Channel 22	204.7	1644	764.97
1644	764.97	Channel 23	204.8	1541	764.15
1541	764.15	Channel 24	223.6	1442	763.24
1442	763.24	Channel 25	223.7	1353	762.38
1353	762.38	Channel 26	223.8	1235	760.69
1235	760.69	Channel 27	223.9	1166	760.66
1166	760.66	Channel 28	223.8	1119	760.56
1119	760.56	Channel 29	223.6	1030	760.51
1030	760.51	Channel 30	223.3	1001	760.50
1001	760.50	Culvert 6a	223.0	RRO MH1	746.92
RRO MH1	746.92	Culvert 6b	222.9	RRO MH2	745.08
RRO MH2	745.08	Culvert 6c	222.5	RRO MH3	701.19
RRO MH3	701.19	Culvert 6d	222.5	Culvert HW	701.00
Culvert HW	701.00	Channel 31	222.5	213	701.00
213	701.00	Channel 32	222.5	160	701.00
160	701.00	Channel 33	222.5	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6737	906.45	Channel 1	239.7	6681	900.83
6681	900.83	Channel 2	241.4	6569	895.55
6569	895.55	Channel 3	239.7	6437	889.40
6437	889.40	Channel 4	239.1	6364	887.03
6364	887.03	Channel 5	238.9	6275	885.23
6275	885.23	Culvert 1	238.0	5899	865.45
5899	865.45	Channel 6	237.7	5816	861.26
5816	861.26	Channel 7	245.2	5744	859.54
5744	859.54	Channel 8	328.2	5707	859.35
5707	859.35	Channel 9	328.5	5650	859.07
5650	859.07	Culvert 2	329.1	4878	831.62
4878	831.62	Channel 10	340.9	4772	827.91
4772	827.91	Channel 11	340.9	4677	824.81
4677	824.81	Channel 12	352.7	4595	821.79
4595	821.79	Channel 13	352.8	4493	821.38
4493	821.38	Channel 14	353.1	4443	821.35
4443	821.35	Culvert 3	353.4	4015	808.62
4015	808.62	Channel 15	353.5	3896	806.03
3896	806.03	Channel 16	359.3	3773	803.64
3773	803.64	Channel 17	359.3	3634	800.35
3634	800.35	Box Culv 1	356.0	RR MH1	777.49
RR MH1	777.49	Box Culv 2	355.3	RR MH2	777.04
RR MH2	777.04	Box Culv 3	358.0	RR MH3	776.53
RR MH3	776.53	Box Culv 4	360.3	RR MH4	775.87
RR MH4	775.87	Box Culv 5	362.9	2346	775.22
2346	775.22	Channel 18	370.9	2257	775.22
2257	775.22	Culvert 4	372.2	2033	769.05
2033	769.05	Channel 19	463.1	1974	768.88
1974	768.88	Channel 20	468.3	1896	768.57
1896	768.57	Channel 21	468.3	1790	767.67
1790	767.67	Channel 22	468.2	1644	766.52
1644	766.52	Channel 23	468.0	1541	765.85
1541	765.85	Channel 24	519.8	1442	765.23
1442	765.23	Channel 25	518.8	1353	764.82
1353	764.82	Channel 26	517.2	1235	764.49
1235	764.49	Channel 27	515.2	1166	764.40
1166	764.40	Channel 28	513.8	1119	764.37
1119	764.37	Channel 29	512.2	1030	764.34
1030	764.34	Channel 30	512.4	1001	764.34
1001	764.34	Culvert 6a	512.4	RRO MH1	750.45
RRO MH1	750.45	Culvert 6b	512.4	RRO MH2	748.27
RRO MH2	748.27	Culvert 6c	532.8	RRO MH3	702.09
RRO MH3	702.09	Culvert 6d	532.8	Culvert HW	701.00
Culvert HW	701.00	Channel 31	532.8	213	701.00
213	701.00	Channel 32	532.8	160	701.00
160	701.00	Channel 33	532.8	95	701.00
95	701.00	Outfall			

APPENDIX 14

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6737	906.78	Channel 1	301.3	6681	901.14
6681	901.14	Channel 2	301.1	6569	895.86
6569	895.86	Channel 3	300.6	6437	889.61
6437	889.61	Channel 4	300.5	6364	887.21
6364	887.21	Channel 5	299.8	6275	886.28
6275	886.28	Culvert 1	298.5	5899	865.71
5899	865.71	Channel 6	298.1	5816	861.54
5816	861.54	Channel 7	308.0	5744	860.48
5744	860.48	Channel 8	422.1	5707	860.41
5707	860.41	Channel 9	422.4	5650	860.32
5650	860.32	Culvert 2	422.6	4878	831.90
4878	831.90	Channel 10	437.9	4772	828.12
4772	828.12	Channel 11	437.9	4677	824.98
4677	824.98	Channel 12	453.8	4595	822.83
4595	822.83	Channel 13	453.7	4493	822.68
4493	822.68	Channel 14	453.3	4443	822.66
4443	822.66	Culvert 3	453.2	4015	808.77
4015	808.77	Channel 15	453.1	3896	806.22
3896	806.22	Channel 16	460.6	3773	803.75
3773	803.75	Channel 17	460.5	3634	801.49
3634	801.49	Box Culv 1	455.9	RR MH1	780.65
RR MH1	780.65	Box Culv 2	456.7	RR MH2	779.87
RR MH2	779.87	Box Culv 3	456.8	RR MH3	778.85
RR MH3	778.85	Box Culv 4	457.0	RR MH4	777.75
RR MH4	777.75	Box Culv 5	460.1	2346	776.69
2346	776.69	Channel 18	469.6	2257	776.69
2257	776.69	Culvert 4	470.4	2033	769.68
2033	769.68	Channel 19	593.9	1974	769.53
1974	769.53	Channel 20	601.3	1896	769.25
1896	769.25	Channel 21	601.6	1790	768.52
1790	768.52	Channel 22	601.9	1644	767.78
1644	767.78	Channel 23	602.3	1541	767.44
1541	767.44	Channel 24	672.3	1442	767.18
1442	767.18	Channel 25	670.3	1353	767.03
1353	767.03	Channel 26	667.7	1235	766.90
1235	766.90	Channel 27	665.0	1166	766.86
1166	766.86	Channel 28	663.0	1119	766.84
1119	766.84	Channel 29	662.6	1030	766.83
1030	766.83	Channel 30	662.9	1001	766.83
1001	766.83	Culvert 6a	663.0	RRO MH1	752.12
RRO MH1	752.12	Culvert 6b	663.1	RRO MH2	749.92
RRO MH2	749.92	Culvert 6c	699.6	RRO MH3	702.90
RRO MH3	702.90	Culvert 6d	699.6	Culvert HW	701.01
Culvert HW	701.01	Channel 31	699.5	213	701.01
213	701.01	Channel 32	699.6	160	701.01
160	701.01	Channel 33	699.6	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6737	907.01	Channel 1	346.6	6681	901.33
6681	901.33	Channel 2	346.4	6569	896.11
6569	896.11	Channel 3	345.6	6437	889.70
6437	889.70	Channel 4	345.6	6364	887.59
6364	887.59	Channel 5	344.2	6275	887.01
6275	887.01	Culvert 1	342.6	5899	865.88
5899	865.88	Channel 6	342.3	5816	861.72
5816	861.72	Channel 7	353.9	5744	861.30
5744	861.30	Channel 8	493.2	5707	861.26
5707	861.26	Channel 9	493.2	5650	861.21
5650	861.21	Culvert 2	493.1	4878	832.07
4878	832.07	Channel 10	511.1	4772	828.32
4772	828.32	Channel 11	511.1	4677	825.11
4677	825.11	Channel 12	530.1	4595	823.68
4595	823.68	Channel 13	529.6	4493	823.59
4493	823.59	Channel 14	528.5	4443	823.58
4443	823.58	Culvert 3	527.9	4015	808.88
4015	808.88	Channel 15	527.6	3896	806.35
3896	806.35	Channel 16	536.6	3773	803.82
3773	803.82	Channel 17	536.4	3634	802.32
3634	802.32	Box Culv 1	533.3	RR MH1	784.91
RR MH1	784.91	Box Culv 2	534.0	RR MH2	783.77
RR MH2	783.77	Box Culv 3	534.1	RR MH3	782.25
RR MH3	782.25	Box Culv 4	534.2	RR MH4	780.60
RR MH4	780.60	Box Culv 5	537.9	2346	778.97
2346	778.97	Channel 18	547.7	2257	778.96
2257	778.96	Culvert 4	548.3	2033	770.35
2033	770.35	Channel 19	696.7	1974	770.23
1974	770.23	Channel 20	704.9	1896	770.02
1896	770.02	Channel 21	704.6	1790	769.52
1790	769.52	Channel 22	703.9	1644	769.10
1644	769.10	Channel 23	702.9	1541	768.91
1541	768.91	Channel 24	778.7	1442	768.78
1442	768.78	Channel 25	774.9	1353	768.70
1353	768.70	Channel 26	770.2	1235	768.63
1235	768.63	Channel 27	768.5	1166	768.61
1166	768.61	Channel 28	767.5	1119	768.60
1119	768.60	Channel 29	766.3	1030	768.59
1030	768.59	Channel 30	764.6	1001	768.59
1001	768.59	Culvert 6a	763.9	RRO MH1	753.87
RRO MH1	753.87	Culvert 6b	763.8	RRO MH2	750.90
RRO MH2	750.90	Culvert 6c	805.9	RRO MH3	704.09
RRO MH3	704.09	Culvert 6d	805.9	Culvert HW	701.99
Culvert HW	701.99	Channel 31	805.9	213	701.01
213	701.01	Channel 32	805.9	160	701.01
160	701.01	Channel 33	806.0	95	701.00
95	701.00	Outfall			

APPENDIX 14

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	907.22	Channel 1	392.8	6681	901.51
6681	901.51	Channel 2	392.6	6569	896.33
6569	896.33	Channel 3	392.1	6437	889.81
6437	889.81	Channel 4	391.9	6364	888.09
6364	888.09	Channel 5	389.6	6275	887.71
6275	887.71	Culvert 1	387.7	5899	866.04
5899	866.04	Channel 6	388.0	5816	862.49
5816	862.49	Channel 7	403.1	5744	862.11
5744	862.11	Channel 8	565.8	5707	862.09
5707	862.09	Channel 9	564.6	5650	862.06
5650	862.06	Culvert 2	563.8	4878	832.24
4878	832.24	Channel 10	584.5	4772	828.47
4772	828.47	Channel 11	584.5	4677	825.28
4677	825.28	Channel 12	606.8	4595	824.89
4595	824.89	Channel 13	602.8	4493	824.68
4493	824.68	Channel 14	596.5	4443	824.64
4443	824.64	Culvert 3	597.0	4015	808.99
4015	808.99	Channel 15	597.6	3896	806.45
3896	806.45	Channel 16	606.6	3773	803.89
3773	803.89	Channel 17	606.7	3634	803.22
3634	803.22	Box Culv 1	603.8	RR MH1	788.05
RR MH1	788.05	Box Culv 2	603.6	RR MH2	786.60
RR MH2	786.60	Box Culv 3	603.5	RR MH3	784.67
RR MH3	784.67	Box Culv 4	603.4	RR MH4	782.56
RR MH4	782.56	Box Culv 5	607.9	2346	780.39
2346	780.39	Channel 18	618.6	2257	780.39
2257	780.39	Culvert 4	618.3	2033	771.44
2033	771.44	Channel 19	792.6	1974	771.37
1974	771.37	Channel 20	801.5	1896	771.25
1896	771.25	Channel 21	800.1	1790	770.99
1790	770.99	Channel 22	798.1	1644	770.78
1644	770.78	Channel 23	795.6	1541	770.69
1541	770.69	Channel 24	883.4	1442	770.63
1442	770.63	Channel 25	877.9	1353	770.59
1353	770.59	Channel 26	871.2	1235	770.55
1235	770.55	Channel 27	868.2	1166	770.53
1166	770.53	Channel 28	866.4	1119	770.53
1119	770.53	Channel 29	864.0	1030	770.52
1030	770.52	Channel 30	860.9	1001	770.52
1001	770.52	Culvert 6a	861.1	RRO MH1	755.69
RRO MH1	755.69	Culvert 6b	861.8	RRO MH2	751.76
RRO MH2	751.76	Culvert 6c	903.0	RRO MH3	704.83
RRO MH3	704.83	Culvert 6d	903.0	Culvert HW	701.03
Culvert HW	701.03	Channel 31	903.0	213	701.01
213	701.01	Channel 32	903.0	160	701.01
160	701.01	Channel 33	903.0	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Main Channel Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6034	783.85	Channel 43	245.3	5850	780.30
5850	780.30	Channel 44	244.7	5794	780.27
5794	780.27	Box Culv 1	245.8	PR MH 1	772.37
PR MH 1	772.37	Box Culv 2	246.0	PR MH 2	765.52
PR MH 2	765.52	Box Culv 3	245.8	PR MH 3	753.48
PR MH 3	753.48	Box Culv 4	245.7	PR MH 4	752.44
PR MH 4	752.44	Box Culv 5	245.8	PR MH 5	747.27
PR MH 5	747.27	Box Culv 6	245.2	PR MH 6	740.46
PR MH 6	740.46	Box Culv 7	244.4	PR MH 7	732.33
PR MH 7	732.33	Box Culv 8	249.5	Headwall	721.07
Headwall	721.07	Headwall	263.6	Basin US	710.17
Basin US	710.17	Basin	251.1	Basin DS	710.15
Basin DS	710.15	Orifice	243.4	Tran US	709.96
-	-	Weir	6.60	-	-
Tran US	709.96	Transition	247.5	Tran DS	709.96
Tran DS	709.96	Channel 64	250.6	2747	709.94
2747	709.94	Channel 65	250.0	2485	702.11
2485	702.11	Channel 66	250.8	2269	700.45
2269	700.45	Channel 67	250.9	1991	700.04
1991	700.04	Channel 68	251.1	1489	700.00
1489	700.00	Channel 69	251.2	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	752.74	OB 1	8.1	OBL MH 2	750.92
OBL MH 2	750.92	OB 2	8.3	OBL MH 1	750.45
OBL MH 1	750.45	OB 3	10.4	PF MH 5	750.36
PFL MH 3	768.62	PFL 2	13.9	PF MH 4	755.29
Inlet 62	762.40	PFL 1a	0.7	Inlet 69	752.85
Inlet 69	752.85	PFL 1b	0.8	PF MH 9	746.04
PF MH 3	759.27	PF 1	17.3	PF MH 4	755.29
PF MH 4	755.29	PF 2	28.4	PF MH 5	750.36
PF MH 5	750.36	PF 3	39.7	PF MH 6	750.03
PF MH 6	750.03	PF 4	40.2	PF MH 7	749.60
PF MH 7	749.60	PF 5	42.5	PF MH 8	749.15
PF MH 8	749.15	PF 6	41.6	PF MH 9	746.04
PF MH 9	746.04	PF 7	40.3	PF BEND	745.22
PF BEND	745.22	PF 8	41.4	PF MH 10	744.50
PF MH 10	744.50	PF 9	42.9	PR MH 7	732.33
PR MH 7	732.33				

Proposed TUFLOW Hydraulic Model Results

6034	786.06	Channel 43	743.5	5850	784.95
5850	784.95	Channel 44	744.4	5794	784.95
5794	784.95	Box Culv 1	743.8	PR MH 1	777.03
PR MH 1	777.03	Box Culv 2	743.1	PR MH 2	770.18
PR MH 2	770.18	Box Culv 3	742.3	PR MH 3	758.77
PR MH 3	758.77	Box Culv 4	792.8	PR MH 4	757.50
PR MH 4	757.50	Box Culv 5	792.9	PR MH 5	752.34
PR MH 5	752.34	Box Culv 6	792.8	PR MH 6	745.54
PR MH 6	745.54	Box Culv 7	793.1	PR MH 7	737.57
PR MH 7	737.57	Box Culv 8	821.7	Headwall	722.83
Headwall	722.83	Headwall	781.9	Basin US	711.74
Basin US	711.74	Basin	831.9	Basin DS	711.86
Basin DS	711.86	Orifice	533.8	Tran US	711.02
-	-	Weir	290.1	-	-
Tran US	711.02	Transition	824.4	Tran DS	711.01
Tran DS	711.01	Channel 64	823.3	2747	710.95
2747	710.95	Channel 65	822.7	2485	704.78
2485	704.78	Channel 66	828.2	2269	702.04
2269	702.04	Channel 67	825.3	1991	700.32
1991	700.32	Channel 68	825.5	1489	700.03
1489	700.03	Channel 69	826.2	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	754.08	OB 1	34.6	OBL MH 2	753.04
OBL MH 2	753.04	OB 2	36.2	OBL MH 1	752.91
OBL MH 1	752.91	OB 3	42.5	PF MH 5	752.77
PFL MH 3	769.16	PFL 2	23.5	PF MH 4	756.59
Inlet 62	763.01	PFL 1a	4.1	Inlet 69	753.59
Inlet 69	753.59	PFL 1b	4.7	PF MH 9	748.06
PF MH 3	760.49	PF 1	52.7	PF MH 4	756.59
PF MH 4	756.59	PF 2	74.1	PF MH 5	752.77
PF MH 5	752.77	PF 3	111.4	PF MH 6	752.26
PF MH 6	752.26	PF 4	114.5	PF MH 7	751.51
PF MH 7	751.51	PF 5	119.4	PF MH 8	751.04
PF MH 8	751.04	PF 6	124.5	PF MH 9	748.06
PF MH 9	748.06	PF 7	129.1	PF BEND	747.20
PF BEND	747.20	PF 8	128.6	PF MH 10	746.48
PF MH 10	746.48	PF 9	131.3	PR MH 7	737.57
PR MH 7	737.57				

Proposed TUFLOW Hydraulic Model Results

6034	787.73	Channel 43	985.3	5850	787.34
5850	787.34	Channel 44	984.3	5794	787.34
5794	787.34	Box Culv 1	984.8	PR MH 1	779.43
PR MH 1	779.43	Box Culv 2	984.6	PR MH 2	772.57
PR MH 2	772.57	Box Culv 3	984.1	PR MH 3	762.94
PR MH 3	762.94	Box Culv 4	1057.4	PR MH 4	760.51
PR MH 4	760.51	Box Culv 5	1058.5	PR MH 5	755.36
PR MH 5	755.36	Box Culv 6	1058.7	PR MH 6	748.56
PR MH 6	748.56	Box Culv 7	1058.9	PR MH 7	740.74
PR MH 7	740.74	Box Culv 8	1084.5	Headwall	723.42
Headwall	723.42	Headwall	1030.8	Basin US	712.39
Basin US	712.39	Basin	1097.7	Basin DS	712.56
Basin DS	712.56	Orifice	619.6	Tran US	711.44
-	-	Weir	466.1	-	-
Tran US	711.44	Transition	1085.4	Tran DS	711.44
Tran DS	711.44	Channel 64	1085.8	2747	711.37
2747	711.37	Channel 65	1096.8	2485	705.62
2485	705.62	Channel 66	1111.4	2269	702.66
2269	702.66	Channel 67	1111.5	1991	700.52
1991	700.52	Channel 68	1111.8	1489	700.04
1489	700.04	Channel 69	1112.6	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	754.96	OB 1	51.5	OBL MH 2	754.56
OBL MH 2	754.56	OB 2	53.0	OBL MH 1	754.26
OBL MH 1	754.26	OB 3	58.9	PF MH 5	753.95
PFL MH 3	769.40	PFL 2	28.3	PF MH 4	757.18
Inlet 62	763.31	PFL 1a	6.7	Inlet 69	753.96
Inlet 69	753.96	PFL 1b	7.7	PF MH 9	749.03
PF MH 3	761.06	PF 1	75.1	PF MH 4	757.18
PF MH 4	757.18	PF 2	101.1	PF MH 5	753.95
PF MH 5	753.95	PF 3	147.0	PF MH 6	753.28
PF MH 6	753.28	PF 4	151.1	PF MH 7	752.39
PF MH 7	752.39	PF 5	157.5	PF MH 8	751.82
PF MH 8	751.82	PF 6	166.9	PF MH 9	749.03
PF MH 9	749.03	PF 7	177.5	PF BEND	748.19
PF BEND	748.19	PF 8	178.9	PF MH 10	747.53
PF MH 10	747.53	PF 9	186.9	PR MH 7	740.74
PR MH 7	740.74				

6034	790.49	Channel 43	1228.8	5850	790.38
5850	790.38	Channel 44	1190.7	5794	790.38
5794	790.38	Box Culv 1	1192.1	PR MH 1	782.47
PR MH 1	782.47	Box Culv 2	1192.1	PR MH 2	775.62
PR MH 2	775.62	Box Culv 3	1192.1	PR MH 3	768.12
PR MH 3	768.12	Box Culv 4	1284.9	PR MH 4	764.12
PR MH 4	764.12	Box Culv 5	1286.4	PR MH 5	759.20
PR MH 5	759.20	Box Culv 6	1290.1	PR MH 6	752.22
PR MH 6	752.22	Box Culv 7	1290.1	PR MH 7	744.73
PR MH 7	744.73	Box Culv 8	1329.5	Headwall	723.90
Headwall	723.90	Headwall	1370.4	Basin US	713.03
Basin US	713.03	Basin	1323.5	Basin DS	713.16
Basin DS	713.16	Orifice	684.2	Tran US	711.83
-	-	Weir	644.0	-	-
Tran US	711.83	Transition	1329.3	Tran DS	711.83
Tran DS	711.83	Channel 64	1329.2	2747	711.76
2747	711.76	Channel 65	1348.3	2485	706.39
2485	706.39	Channel 66	1362.7	2269	703.13
2269	703.13	Channel 67	1362.7	1991	700.74
1991	700.74	Channel 68	1364.4	1489	700.07
1489	700.07	Channel 69	1366.2	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	757.00	OB 1	63.1	OBL MH 2	756.40
OBL MH 2	756.40	OB 2	65.2	OBL MH 1	755.99
OBL MH 1	755.99	OB 3	71.9	PF MH 5	755.61
PFL MH 3	769.59	PFL 2	31.6	PF MH 4	757.58
Inlet 62	763.52	PFL 1a	8.8	Inlet 69	754.24
Inlet 69	754.24	PFL 1b	10.2	PF MH 9	749.57
PF MH 3	761.44	PF 1	92.7	PF MH 4	757.58
PF MH 4	757.58	PF 2	122.2	PF MH 5	755.61
PF MH 5	755.61	PF 3	186.6	PF MH 6	754.34
PF MH 6	754.34	PF 4	191.7	PF MH 7	753.24
PF MH 7	753.24	PF 5	201.3	PF MH 8	752.40
PF MH 8	752.40	PF 6	196.1	PF MH 9	749.57
PF MH 9	749.57	PF 7	207.2	PF BEND	748.76
PF BEND	748.76	PF 8	208.2	PF MH 10	748.11
PF MH 10	748.11	PF 9	217.2	PR MH 7	744.73
PR MH 7	744.73				

Proposed TUFLOW Hydraulic Model Results

5850	793.17	Channel 44	1337.5	5794	793.17
5794	793.17	Box Culv 1	1340.7	PR MH 1	785.52
PR MH 1	785.52	Box Culv 2	1341.3	PR MH 2	779.24
PR MH 2	779.24	Box Culv 3	1340.0	PR MH 3	773.49
PR MH 3	773.49	Box Culv 4	1448.0	PR MH 4	768.87
PR MH 4	768.87	Box Culv 5	1465.9	PR MH 5	763.83
PR MH 5	763.83	Box Culv 6	1469.9	PR MH 6	756.26
PR MH 6	756.26	Box Culv 7	1466.3	PR MH 7	747.91
PR MH 7	747.91	Box Culv 8	1496.3	Headwall	724.22
Headwall	724.22	Headwall	1525.7	Basin US	713.38
Basin US	713.38	Basin	1480.4	Basin DS	713.56
Basin DS	713.56	Orifice	722.6	Tran US	712.09
-	-	Weir	771.8	-	-
Tran US	712.09	Transition	1491.9	Tran DS	712.09
Tran DS	712.09	Channel 64	1491.7	2747	712.01
2747	712.01	Channel 65	1523.6	2485	706.77
2485	706.77	Channel 66	1545.8	2269	703.42
2269	703.42	Channel 67	1544.9	1991	700.90
1991	700.90	Channel 68	1545.0	1489	700.08
1489	700.08	Channel 69	1544.6	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	761.37	OB 1	76.4	OBL MH 2	760.43
OBL MH 2	760.43	OB 2	79.9	OBL MH 1	759.63
OBL MH 1	759.63	OB 3	88.8	PF MH 5	758.82
PFL MH 3	769.78	PFL 2	35.0	PF MH 4	759.12
Inlet 62	763.74	PFL 1a	11.1	Inlet 69	754.52
Inlet 69	754.52	PFL 1b	12.8	PF MH 9	750.84
PF MH 3	761.81	PF 1	111.0	PF MH 4	759.12
PF MH 4	759.12	PF 2	130.0	PF MH 5	758.82
PF MH 5	758.82	PF 3	213.3	PF MH 6	757.23
PF MH 6	757.23	PF 4	220.0	PF MH 7	755.46
PF MH 7	755.46	PF 5	228.1	PF MH 8	754.44
PF MH 8	754.44	PF 6	236.1	PF MH 9	750.84
PF MH 9	750.84	PF 7	248.7	PF BEND	749.89
PF BEND	749.89	PF 8	248.6	PF MH 10	748.86
PF MH 10	748.86	PF 9	258.3	PR MH 7	747.91
PR MH 7	747.91				

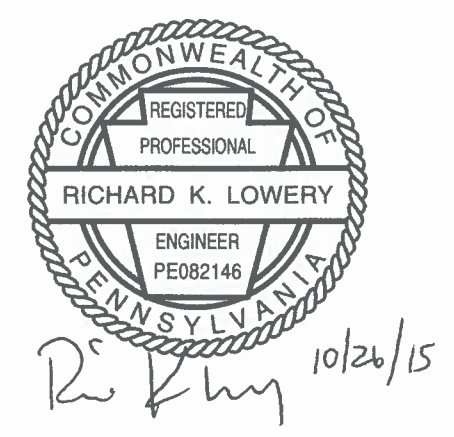
Drainage Areas 7 and 8 Summary

Drainage Area (DA) 7 is a mix of gravel, asphalt (impervious), and green cover in the existing condition. This area will be disturbed during Early Works. With the exception of the asphalted portion of the heavy haul road that runs through DA 7, the area will be hydroseeded after grading is completed. The post-construction condition is asphalt (impervious) and green cover. The 2-year, 24-hour storm volume is less in the post-construction condition than in the pre-construction condition. The runoff rates for the 2, 10, 25, 50 and 100-year storms are also less in the post-construction condition than in the pre-construction condition. Therefore, no BMPs are required for either volume or rate control.

Drainage Area (DA) 8 is green cover in the existing condition. This area will be disturbed during Early Works, but the area will be hydroseeded after grading is completed. The post-construction condition is also green cover. The 2-year, 24-hour storm volume is less in the post-construction condition than in the pre-construction condition. The runoff rates for the 2, 10, 25, 50 and 100-year storms are also less in the post-construction condition than in the pre-construction condition. Therefore, no BMPs are required for either volume or rate control.

See the following attachments for further information:

- Worksheet 4 for DA 7
- Worksheet 4 for DA 8
- HMS Input
- Table 1: Comparison of Peak Flow Rates
- Additional Drainage Areas Figure



Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Shell Franklin
Drainage Area: DA 7
2-Year Rainfall: 2.44 in

Total Site Area: 10.94 acres
Protected Site Area: 0 acres
Managed Area: 10.94 acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Green	B	128066.40	2.94	79	2.66	0.53	0.80	8511.0
Green	C	248292.00	5.70	86	1.63	0.33	1.19	24718.5
Gravel	B	8276.40	0.19	85	1.76	0.35	1.13	780.0
Gravel	C	89298.00	2.05	89	1.24	0.25	1.40	10435.8
Impervious	C	2613.60	0.06	98	0.20	0.04	2.21	481.6
TOTAL:		476546.40	10.94					44926.8

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Green	B	118047.60	2.71	61	6.39	1.28	0.18	1756.1
Green	C	316681.20	7.27	74	3.51	0.70	0.57	15169.2
Impervious	B	17859.60	0.41	98	0.20	0.04	2.21	3290.8
Impervious	C	23958.00	0.55	98	0.20	0.04	2.21	4414.5
TOTAL:		476546.40	10.94					24630.6

2-Year Volume Increase (ft3): 0.0

2-Year Volume Increase = Developed Conditions Runoff Volume – Existing Conditions Runoff Volume

1. Runoff (in) = Q = $(P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Shell Franklin
Drainage Area: DA 8
2-Year Rainfall: 2.44 in

Total Site Area: 4.79 acres
Protected Site Area: 0 acres
Managed Area: 4.79 acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Green	A	164221.20	3.77	68	4.71	0.94	0.36	4954.8
Green	C	44431.20	1.02	86	1.63	0.33	1.19	4423.3
TOTAL:		208652.40	4.79					9378.1

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Green	A	164221.20	3.77	39	15.64	3.13	0.03	433.5
Green	C	44431.20	1.02	74	3.51	0.70	0.57	2128.3
TOTAL:		208652.40	4.79					2561.8

2-Year Volume Increase (ft3): 0.0

2-Year Volume Increase = Developed Conditions Runoff Volume – Existing Conditions Runoff Volume

1. Runoff (in) = Q = $(P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

Subbasin Area [Area WS]

Show Elements: All Elements Sorting: Alphabetic

Subbasin	Area (MI2)
DA_7_Exist	0.017098
DA_7_Prop	0.017098
DA_8_Exist	0.007488
DA_8_Prop	0.007488

Apply Close

*Areas Calculated in ArcGIS

Curve Number Loss [Area WS]

Show Elements: All Elements Sorting: Alphabetic

Subbasin	Initial Abstraction (IN)	Curve Number	Impervious (%)
DA_7_Exist		85	0.0
DA_7_Prop		73	0.0
DA_8_Exist		72	0.0
DA_8_Prop		46	0.0

Apply Close

*CN obtained from USGS HSG soil data and Existing and Proposed Land Cover Values from PADEP Drainage Manual

SCS Transform[Area WS]

Show Elements: All Elements Sorting: Alphabetic

Subbasin	Lag Time (MIN)
DA_7_Exist	6.0
DA_7_Prop	6.0
DA_8_Exist	6.0
DA_8_Prop	6.0

Apply Close

*Lag time based on a minimum Tc time of 10 min.

Precipitation

Met Name: 2YR

Probability:	50 Percent
Input Type:	Partial Duration
Output Type:	Annual Duration
Intensity Duration:	5 Minutes
Storm Duration:	1 Day
Intensity Position:	50 Percent
Storm Area (MI2)	
*5 Minutes (IN)	0.39000
*15 Minutes (IN)	0.74000
*1 Hour (IN)	1.2300
*2 Hours (IN)	1.3200
*3 Hours (IN)	1.4500
*6 Hours (IN)	1.6400
*12 Hours (IN)	2.0200
*1 day (IN)	2.4400
2 Days (IN)	
4 Days (IN)	
7 Days (IN)	
10 Days (IN)	

*Rainfall Data obtained from PADEP Drainage Manual (2-yr, 24hr shown only)

Table 1: Comparison of Peak Flow Rates				
Drainage Area	**Storm Event**	**Pre-Development Condition Flows (cfs)**	**Post-Development Condition Flows (cfs)**	**Difference (cfs)**
DA7	2	16.4	5.6	-10.8
	10	33.5	18.4	-15.1
	25	42.5	26	-16.5
	50	49.1	32	-17.1
	100	55.6	38.3	-17.3
DA 8	2	2.1	0	-2.1
	10	7.6	0.1	-7.5
	25	10.8	0.5	-10.3
	50	13.4	1.1	-12.3
	100	16.1	2	-14.1

Copyright 2014 Jacobs Engineering Group, Inc.

Exhibit	JACOBS	Additional Drainage Areas	Project No.	58NQ1140	Original size	22" x 34"	N	SHELL PROPOSED PETROCHEMICAL COMPLEX
			Drawn By	JVK				
			Approved By					
			Revised By					
			Date	9/30/2015				

Section 8

Erosion and Sedimentation Control Plan

PROJECT FRANKLIN

MAIN WORKS
EROSION AND SEDIMENT CONTROL PLAN

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CHIEN D. NGUYEN
ENGINEER
NO. PE083957

10/23/2015

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

REV.	DATE	REASON FOR REVISION	BY	CK'D	APPR'D	CLIENT
000	10/28/2015	ISSUED FOR USE	CDN	PKM	RP	--
00C	09/30/2015	ISSUED FOR APPROVAL	CDN	PKM	RP	--
00B	08/26/2015	REISSUED FOR REVIEW	CDN	PKM	RP	--
00A	05/27/2015	ISSUED FOR REVIEW	CDN	TT	RP	--

	PROJECT FRANKLIN	SHELL DOCUMENT NUMBER	REV.
		GM1-700-G0000-CX-5880-00022	000
	MAIN WORKS EROSION AND SEDIMENT CONTROL PLAN	BECHTEL DOCUMENT NUMBER	REV.
		25873-001-30G-C01-00002	000
ECCN: EAR 99		BECHTEL PROJECT NO.: 25873-001	Page 1 of 27

Table of Contents

1 INTRODUCTION 3
2 EXISTING TOPOGRAPHIC FEATURES 3
3 SOIL TYPES USE LIMITATION AND RESOLUTIONS 4
4 TYPES OF EARTH DISTURBANCE ACTIVITY 4
5 CHARACTERISTIC OF SURFACE WATER FROM PROJECT SITE 4
6 SEQUENCING OF BEST MANAGEMENT PRACTICE 5
7 BEST MANAGEMENT PRACTICE DESIGN AND MAINTENANCE 5
8 POTENTIAL THERMAL IMPACTS TO SURFACE WATER 6

Exhibit 1 - Site Location
Exhibit 2 - USDA NRCS Soil Classification Map and Description
Exhibit 3 - Overall Drainage Area Map
Exhibit 4 - Erosion and Sediment Control Plans
Exhibit 5 - Plan Preparer Recorded of Training and Experience in E&S Pollution Control Methods and Techniques

Electronic documents, once printed, are uncontrolled and may become outdated.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

1 INTRODUCTION

The purpose of this Transitional Main Works Erosion and Sediment (E&S) Control Plan is to demonstrate containment of soil disturbance due to site development activities from Main Works Start-up to Plant Operations. Erosion and Sediment control prior to Main Works Start-up (Early Works E&S Control Plan) is by Others. See Exhibit 1 for the site location.

The site includes areas with and without potential historic industrial activities. Site areas with potential historic industrial activities will meet NPDES (National Pollutant Discharge Elimination System) Permit PA0002208 release criteria.

The Plant Startup phase is to verify and test mechanical, electrical, and instrumentation equipment until all systems and components are accepted by the Owner/Client. Startup assures the plant is ready for commissioning and operations.

The Early Works E&S Control Plan covers traditional construction activities necessary to improve 141 acres of the site currently undeveloped south of SR18. The Early Works E&S Control Plan does not cover the potential historic industrial areas of the site north of SR18. This area is permitted under NPDES Permit PA0002208 and is considered a brownfield site.

Early Works development includes earthwork, erosion stabilization, construction laydown areas, temporary facilities, roadways, drainage structures, interim water treatment plants, parking areas and rail systems. Additional development not covered by the Early Works E&S Control Plan nor the NPDES Permit PA0002208 will be covered in this Main Works E&S Control Plan.

This transitional Main Works E&S Control Plan includes the construction of a 1500 kilo ton per annum ethylene cracker, three polyethylene units, cogeneration facility, waste water & raw water treatment facilities, rail yard, hydrocarbon loading & unloading facilities and permanent plant buildings. The total area for development is approximately 371 acres.

This plan has been prepared assuming that the facility has demonstrated compliance with the existing NPDES permit during Early Works such that no Interim Treatment System (ITS) is required for treatment of stormwater during Main Works.

A timeline for the E&S control plan is shown below in Figure 1.

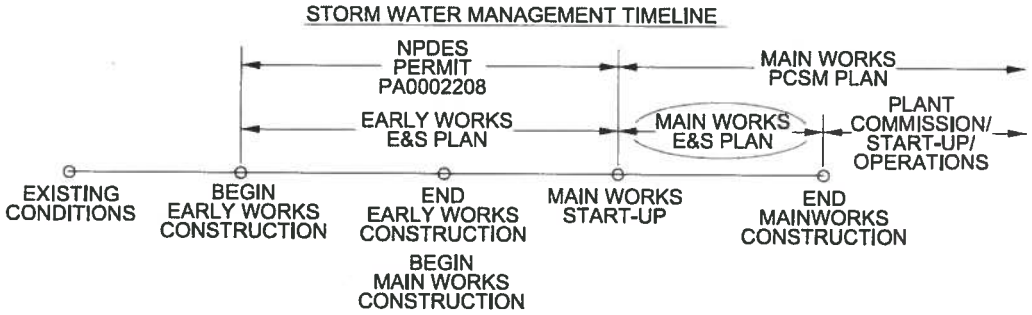


Figure1: Storm Water Management Timeline

2 EXISTING TOPOGRAPHIC FEATURES

The existing site is located in Potter Township, Beaver County, Pennsylvania and bounded by the Ohio River to the northwest, Poorhouse Run stream to the south, State Route 18 to the southeast and extends approximately 3,600 ft northeast of Interstate 376. The existing elevation within the site ranges

Electronic documents, once printed, are uncontrolled and may become outdated.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

from approximately 712 ft to 980 ft. The site currently drains in a northwesterly direction towards the Ohio River. Based on the Federal Emergency Management Agency Flood Insurance Rate Map, the 1% Annual Chance Base Flood Elevation ranges from approximately 700 ft to 702 ft through the site. The site included a zinc processing facility (which has been decommissioned and dismantled), gravel and paved areas, undeveloped tracts of land and an existing paved highway.

3 SOIL TYPES USE LIMITATION AND RESOLUTIONS

Based on the information obtained from the geotechnical report, the existing soil consists primarily of fill and alternating layers of alluvial sands and gravels. Thickness of the existing fill ranges from 1.5 to 12.0 ft. The deposited sands and gravels underlying the fills were found to be normally loose to very dense. Bedrock consists of the Allegheny Group's Freeport Formation and Conemaugh Group's Glenshaw Formation which comprise of interbedded, cyclic sequences of sedimentary rock consisting of shales, sandstones, limestones, and thin coal seams. For USDA Natural Resources Conservation Service Soil Classification Map and Description, see Exhibit 2.

Soils excavated during Main Works construction will be stockpiled within the site and tested in accordance with ASTM standards before being used as fill. All re-graded areas will have proper Best Management Practice (BMP) in place to capture sediments until adequate surfacing or slope protections are established. If geologic or soils conditions that have potential to cause pollutions is encountered during construction activities, proper BMP will be used to avoid or reduce the effect of the pollutants.

4 TYPES OF EARTH DISTURBANCE ACTIVITY

The past land uses for the project area comprises of a zinc processing facility with gravel and paved areas, undeveloped tracts of land and an existing paved highway. The area of the zinc processing facility has been decommissioned and dismantled and is considered a brownfield site. The present land use will be based on the Early Works construction. Major components of Early Works construction consist of excavation, fill, and stabilizing cut & fill surfaces, leveling the site for future plant construction and providing major drainage features (including contours, swales, culverts and detention ponds).

The proposed land uses for the site will be an ethylene cracker unit, polyethylene units, cogeneration facility, waste water & raw water treatment facilities, rail yard, hydrocarbon loading & unloading facility and permanent plant roads & buildings. See Exhibit 3 – "Proposed Site Plan" for limits of Main Works disturbance and overall drainage layout. All unpaved areas within the plant area will be managed to control soil erosion.

5 CHARACTERISTIC OF SURFACE WATER FROM PROJECT SITE

The existing site lies on the downstream side of the watershed that eventually drains into the Ohio River, Poorhouse Run and Rag Run streams. Water protected use classification for part of Ohio River at the site location and Poorhouse Run stream were classified as Warm Water Fishes (WWF) based on Pennsylvania Code Chapter 93. The site is not within High Quality (HQ) or Exceptional Value (EV) waters protection areas. The 1% Annual Chance Base Flood Elevation ranges from approximately 700' to 702' through the site. Based on U.S. Fish & Wildlife Service National Wetlands Inventory (NWS), there are some areas within the site that are classified as wetlands mitigated during Early Works. The classification codes and areas located within the existing site are PUBHx (0.61 ac), PUBKx (2.53 ac), PUSAh (3.09 ac) and PUSAx (1.21 ac). Classification code information can be found on NWS website.

A drainage report has been developed by Early Works Contractor to determine the storm water impacts and mitigation methods associated with the proposed conditions. The drainage report determined that the proposed project does not cause adverse impacts to the existing flood hazard conditions. The drainage report evaluated the proposed culverts for Poorhouse Run and Rag Run streams, existing site conditions, proposed site conditions and detention ponds for stormwater flow mitigation.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

The internal Main Works drainage system consists of storm water manholes, inlets, pipes, trenches, and channel that will ultimately discharge into Early Works drainage system. See Exhibit 3 for overall proposed drainage area boundary.

6 SEQUENCING OF BEST MANAGEMENT PRACTICE

During the overall construction period of the site, Early Works erosion and sediment control activities will both overlap and end as Main Works Construction activities begin and proceed to startup and commissioning.

Early Works activities will have existing E&S controls in place in areas where Main Works construction has not commenced. The site perimeter BMP and rock construction entrance by Early Works will still be in use and will be maintained and modified as needed. Due to the extent of the project site, the site will be completed in sequence. The site will be turned over to Main Works Construction in sequence after initial site preparation by Early Works Construction. Before Main Works starts, additional E&S BMPs will be in place to prevent impacts into the receiving storm water system. If any contaminated soils are encountered during Main Works Construction, those activities will cease for that area until the contaminated soil is properly disposed of or treated.

The following sequence of major Best Management Practice activities will be implemented after Early Works activities have completed and turned over to Main Works Construction:

Phase 1:
Install new rock construction entrance, perimeter silt fences, inlet protections and rock filter dams as required if not provided by Early Works Contractor. Main Works Construction will perform excavation and installation of foundations, pile driving and erection of structures. All soil removed during excavation will be stockpile and used onsite. During or after foundations are completed in a given work area, the underground piping systems will be installed including pre-cast concrete manholes and catch basins. Proper silt fences and inlet protections will be installed after completion of manhole and catch basin bottoms. Backfilling will begin immediately upon completion of the testing and inspection of the underground piping systems within a work area.

Phase 2:
Final grade elevation will be established through cut and fill activities. Main Works includes:

- Construct permanent channel & trenches and finish manhole/ inlet tops.
- Install standard silt fences, inlet protections and rock filter dams if not provided in Phase 1.
- Install pipe rack, above ground piping and erect buildings.
- Complete area paving, ground surfacing & perimeter road surfacing after heavy lifting equipment access have ceased in the work area.
- Stabilized all regraded with proper surfacing.

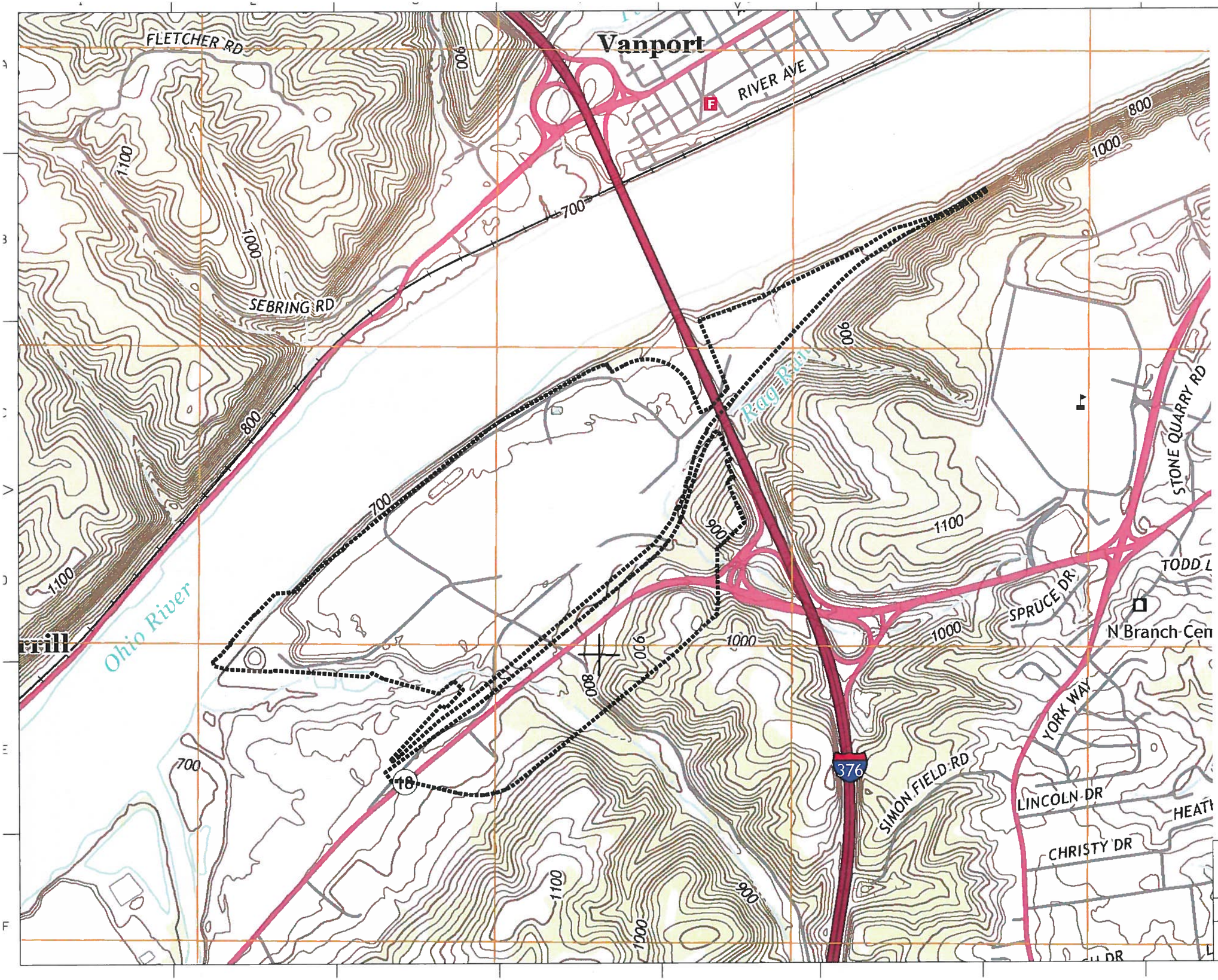
When all construction activities are completed and the work area is stabilized, temporary sediment and erosion control structures will be removed and any soils disturbed will be repaired. At this time, the permanent plant surfaces (i.e. paving, gravel, asphalt roads) will be in place and the Post Construction Stormwater Management Plan will control stormwater management at the site.

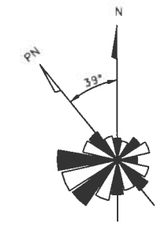
7 BEST MANAGEMENT PRACTICE DESIGN AND MAINTENANCE

The designs of BMPs were based on Early Works initial site preparation. The initial site preparation includes construction of drainage ditches, storm water sewer systems and detention ponds. BMPs were then incorporated into the provided drainage system. Slope stabilization, channel lining and outfall protection were also provided by the Early Works contractor. Pennsylvania Department of Environmental Protection standards will be used to install all BMPs.

Electronic documents, once printed, are uncontrolled and may become outdated.

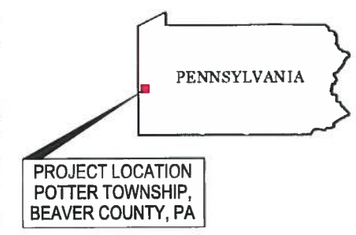
Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.





LEGEND

PROJECT FENCE BOUNDARY LIMIT



25873-001-30G-C01-00002, Rev 0, Page 7 of 27

0 500' 1000'

Scale: 1" = 1000'

Background Info: Beaver Quadrangle, Pennsylvania - Beaver Co., 7.5 - Minute Series

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EXHIBIT 1
SITE LOCATION

Hydrologic Soil Group Description Based on USDA Web Soil Survey

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

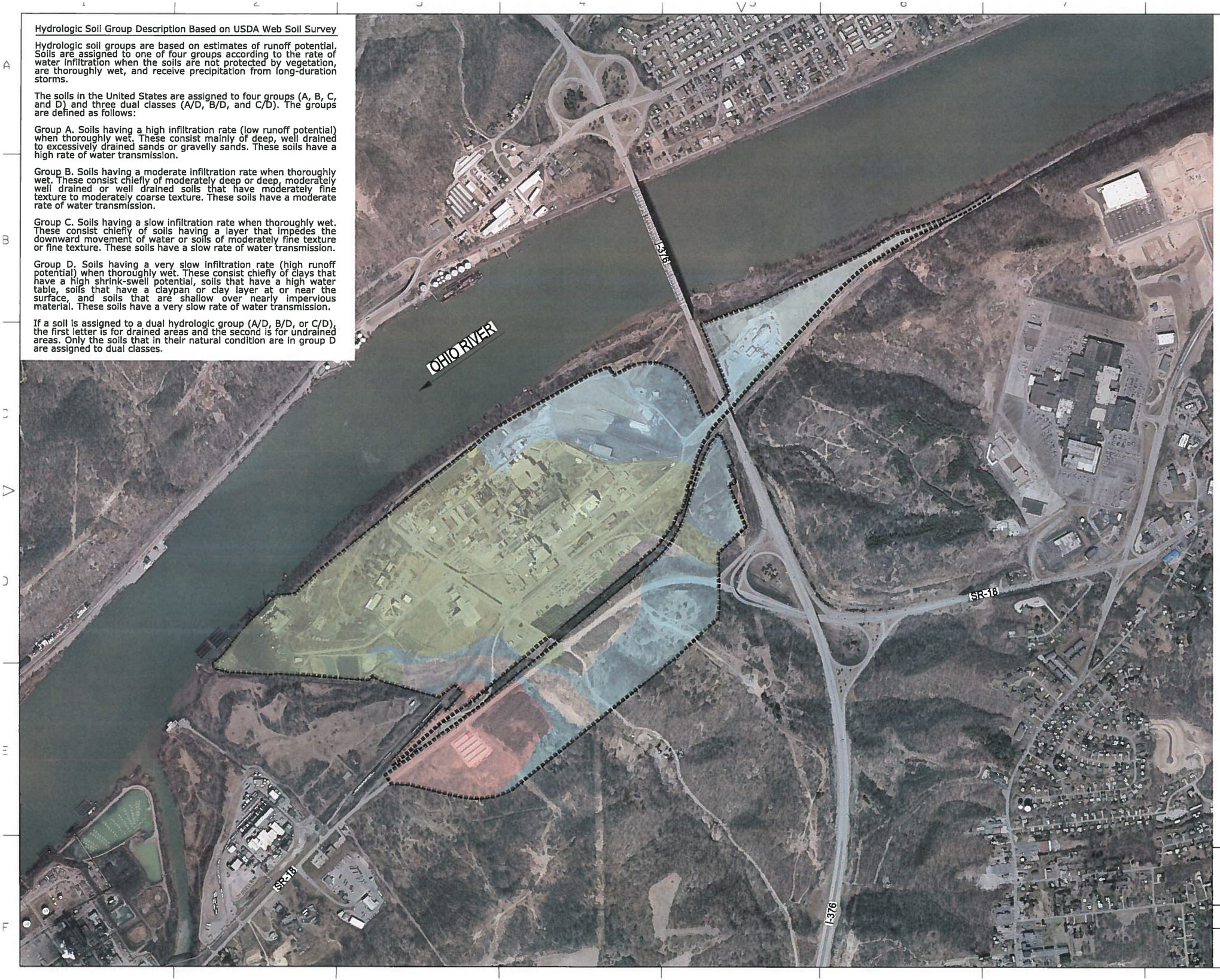
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

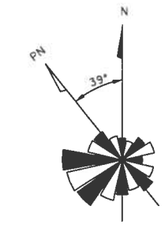
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



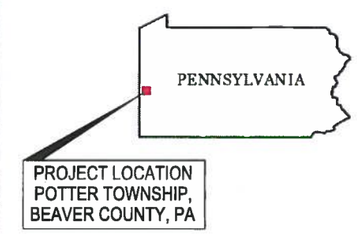


LEGEND

PROJECT FENCE BOUNDARY LIMIT

HYDROLOGIC SOIL GROUP CLASSIFICATION

- GROUP A
- GROUP B
- GROUP C
- GROUP C/D



25873-001-30G-C01-00002, Rev 0, Page 8 of 27

0 500' 1000'

Scale: 1" = 1000'

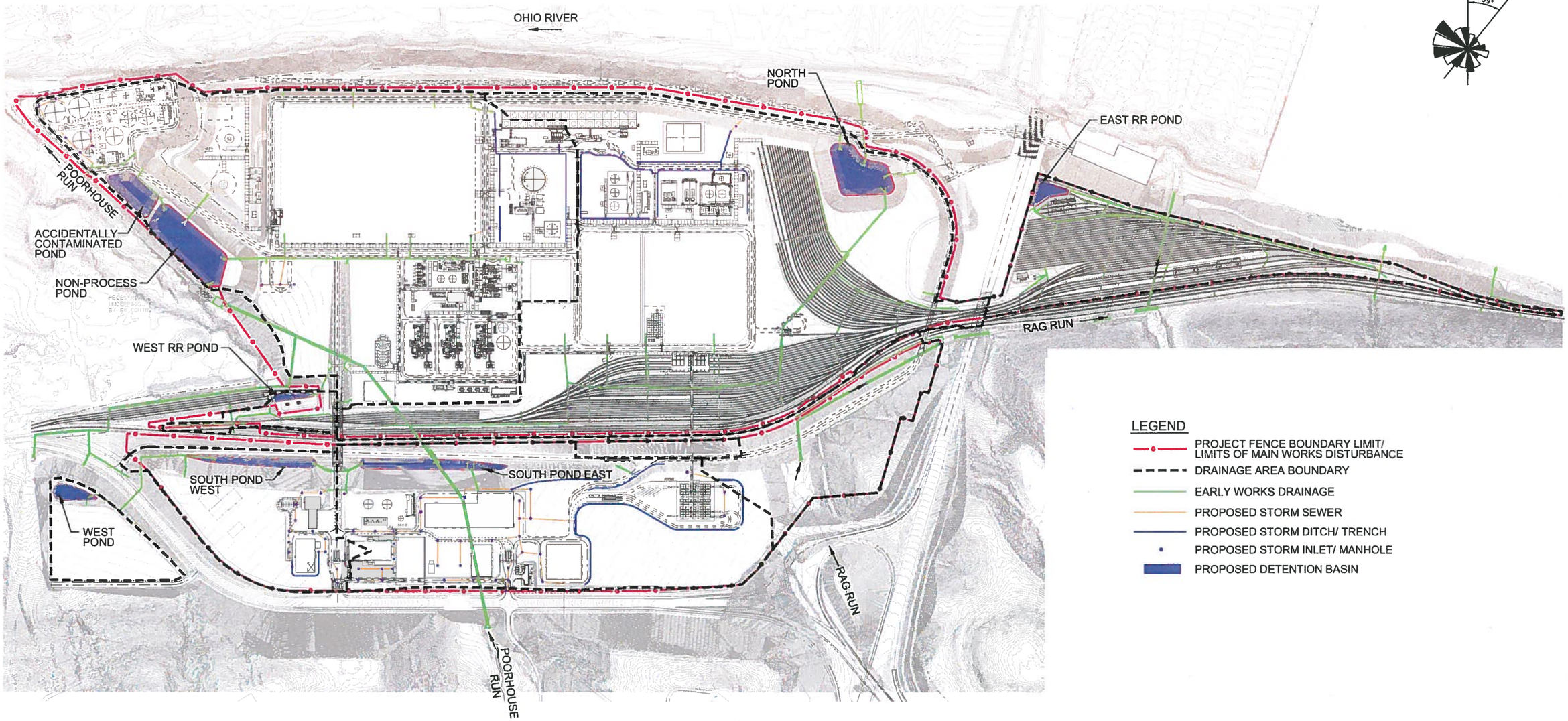
Aerial Info: PAMAP Mosaic Beaver 2006 sid

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EXHIBIT 2
USDA NRCS SOIL CLASSIFICATION
MAP AND DESCRIPTION



LEGEND

- PROJECT FENCE BOUNDARY LIMIT/ LIMITS OF MAIN WORKS DISTURBANCE
- DRAINAGE AREA BOUNDARY
- EARLY WORKS DRAINAGE
- PROPOSED STORM SEWER
- PROPOSED STORM DITCH/ TRENCH
- PROPOSED STORM INLET/ MANHOLE
- PROPOSED DETENTION BASIN

25873-001-30G-C01-00002, Rev 0, Page 9 of 27

0 325' 650'

Scale: 1" = 650'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

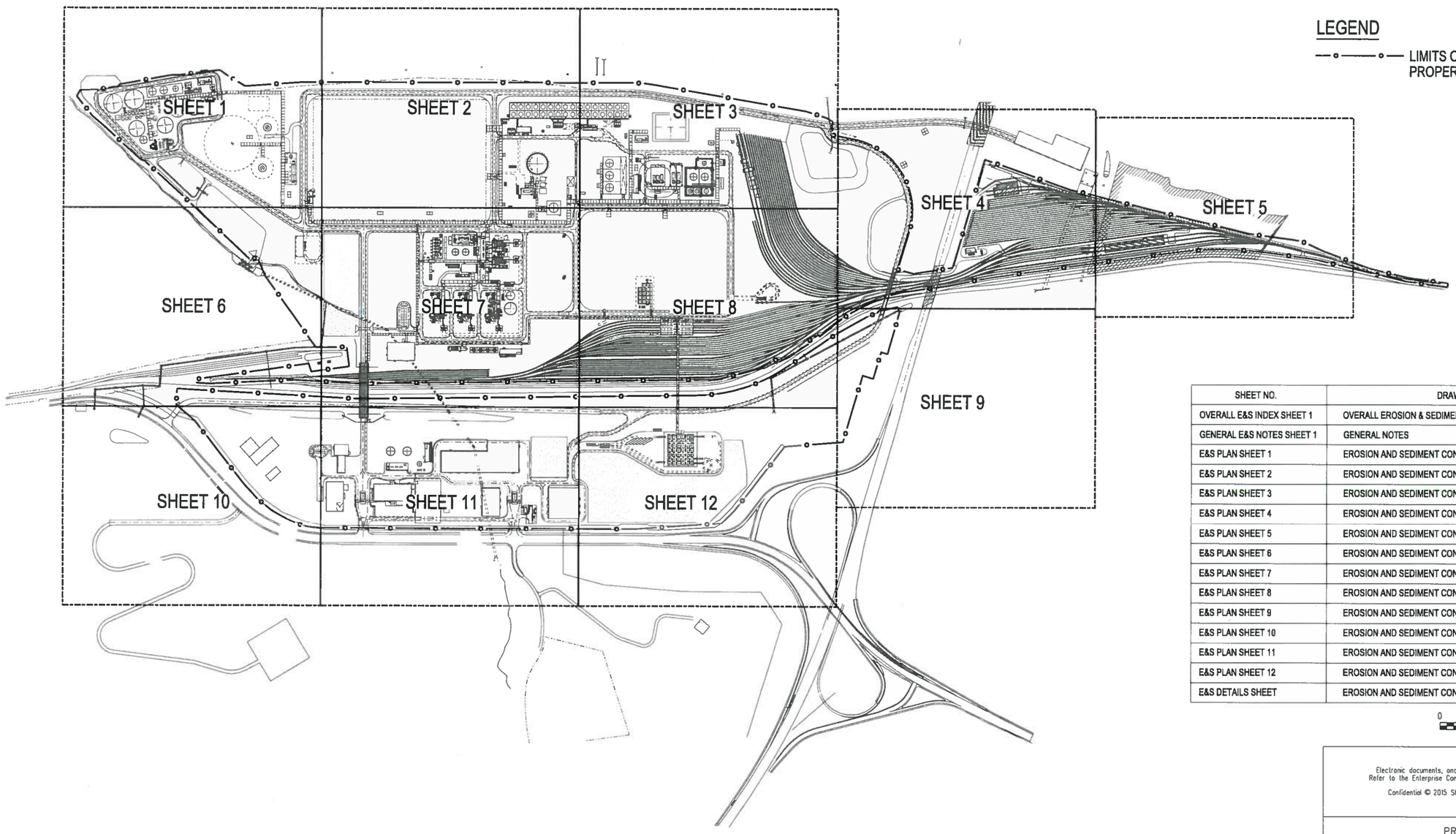
EXHIBIT 3
PROPOSED SITE PLAN

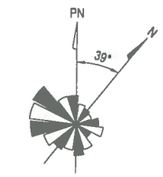
Exhibit 4

Erosion and Sediment Control Plans

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.





LEGEND

—o——o— LIMITS OF DISTURBANCE/ PROPERTY FENCE BY EARLY WORKS

SHEET NO.	DRAWING TITLE
OVERALL E&S INDEX SHEET 1	OVERALL EROSION & SEDIMENT CONTROL KEY PLAN &INDEX SHEET
GENERAL E&S NOTES SHEET 1	GENERAL NOTES
E&S PLAN SHEET 1	EROSION AND SEDIMENT CONTROL PLAN SHEET 1 OF 12
E&S PLAN SHEET 2	EROSION AND SEDIMENT CONTROL PLAN SHEET 2 OF 12
E&S PLAN SHEET 3	EROSION AND SEDIMENT CONTROL PLAN SHEET 3 OF 12
E&S PLAN SHEET 4	EROSION AND SEDIMENT CONTROL PLAN SHEET 4 OF 12
E&S PLAN SHEET 5	EROSION AND SEDIMENT CONTROL PLAN SHEET 5 OF 12
E&S PLAN SHEET 6	EROSION AND SEDIMENT CONTROL PLAN SHEET 6 OF 12
E&S PLAN SHEET 7	EROSION AND SEDIMENT CONTROL PLAN SHEET 7 OF 12
E&S PLAN SHEET 8	EROSION AND SEDIMENT CONTROL PLAN SHEET 8 OF 12
E&S PLAN SHEET 9	EROSION AND SEDIMENT CONTROL PLAN SHEET 9 OF 12
E&S PLAN SHEET 10	EROSION AND SEDIMENT CONTROL PLAN SHEET 10 OF 12
E&S PLAN SHEET 11	EROSION AND SEDIMENT CONTROL PLAN SHEET 11 OF 12
E&S PLAN SHEET 12	EROSION AND SEDIMENT CONTROL PLAN SHEET 12 OF 12
E&S DETAILS SHEET	EROSION AND SEDIMENT CONTROL DETAILS SHEET

0 400' 800'
SCALE 1" = 800'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

OVERALL EROSION & SEDIMENT CONTROL KEY PLAN & INDEX SHEET

GENERAL NOTES

1. All earth disturbances, including clearing and grubbing as well as cuts and fills shall be done in accordance with the approved E&S plan. A copy of the approved drawings (stamped, signed and dated by the reviewing agency) must be available at the project site at all times. The reviewing agency shall be notified of any changes to the approved plan prior to implementation of those changes. The reviewing agency may require a written submittal of those changes for review and approval at its discretion.

2. At least 7 days prior to starting any earth disturbance activities, including clearing and grubbing, the owner and/or operator shall invite all contractors, the landowner, appropriate municipal officials, the E&S plan preparer, the PCSM plan preparer, the licensed professional responsible for oversight of critical stages of implementation of the PCSM plan, and a representative from the local conservation district to an on-site preconstruction meeting.

3. At least 3 days prior to starting any earth disturbance activities, or expanding into an area previously unmarked, the Pennsylvania One Call System Inc. shall be notified at 1-800-242-1776 for the location of existing underground utilities.

4. All earth disturbance activities shall proceed in accordance with the sequence provided on the plan drawings. Deviation from that sequence must be approved in writing from the local conservation district or by the Department prior to implementation.

5. Areas to be filled are to be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots and other objectionable material.

6. Clearing, grubbing, and topsoil stripping shall be limited to those areas described in each stage of the construction sequence. General site clearing, grubbing and topsoil stripping may not commence in any stage or phase of the project until the E&S BMPs specified by the BMP sequence for that stage or phase have been installed and are functioning as described in this E&S plan.

7. At no time shall construction vehicles be allowed to enter areas outside the limit of disturbance boundaries shown on the plan maps. These areas must be clearly marked and fenced off before clearing and grubbing operations begin.

8. Topsoil required for the establishment of vegetation shall be stockpiled at the location(s) shown on the plan maps(s) in the amount necessary to complete the finish grading of all exposed areas that are to be stabilized by vegetation. Each stockpile shall be protected in the manner shown on the plan drawings. Stockpile heights shall not exceed 35 feet. Stockpile slopes shall be 2H:1V or flatter.

9. Immediately upon discovering unforeseen circumstances posing the potential for accelerated erosion and/or sediment pollution, the operator shall implement appropriate best management practices to minimize the potential for erosion and sediment pollution and notify the local conservation district and/or the regional office of the Department.

10. All building materials and wastes shall be removed from the site and recycled or disposed of in accordance with the Department's Solid Waste Management Regulations at 25 Pa. Code 260.1 et seq., 271.1, and 287.1 et. seq. No building materials or wastes or unused building materials shall be burned, buried, dumped, or discharged at the site.

11. All off-site waste and borrow areas must have an E&S plan approved by the local conservation district or the Department fully implemented prior to being activated.

12. The contractor is responsible for ensuring that any material brought on site is clean fill. Form FP-001 must be retained by the property owner for any fill material affected by a spill or release of a regulated substance but qualifying as clean fill due to analytical testing.

13. All pumping of water from any work area shall be done according to the procedure described in this plan, over undisturbed vegetated areas.

14. Vehicles and equipment may neither enter directly nor exit directly from lots (specify lot numbers) onto (specify road name.

15. Until the site is stabilized, all erosion and sediment BMPs shall be maintained properly. Maintenance shall include inspections of all erosion and sediment BMPs after each runoff event and on a weekly basis. All preventative and remedial maintenance work, including clean out, repair, replacement, regrading, reseeding, remulching and renetting must be performed immediately. If the E&S BMPs fail to perform as expected, replacement BMPs, or modifications of those installed will be required.

16. A log showing dates that E&S BMPs were inspected as well as any deficiencies found and the date they were corrected shall be maintained on the site and be made available to regulatory agency officials at the time of inspection.

17. Sediment tracked onto any public roadway or sidewalk shall be returned to the construction site by the end of each work day and disposed in the manner described in this plan. In no case shall the sediment be washed, shoveled, or swept into any roadside ditch, storm sewer, or surface water.

18. All sediment removed from BMPs shall be disposed of in the manner described on the plan drawings.

19. Areas which are to be topsoiled shall be scarified to a minimum depth of 3 to 5 inches —6 to 12 inches on compacted soils —prior to placement of topsoil. Areas to be vegetated shall have a minimum 4 inches of topsoil in place prior to seeding and mulching. Fill outslopes shall have a minimum of 2 inches of topsoil.

20. All fills shall be compacted as required to reduce erosion, slippage, settlement, subsidence or other related problems. Fill intended to support buildings, structures and conduits, etc. shall be compacted in accordance with local requirements or codes.

21. All earthen fills shall be placed in compacted layers not to exceed 9 inches in thickness.

22. Fill materials shall be free of frozen particles, brush, roots, sod, or other foreign or objectionable materials that would interfere with or prevent construction of satisfactory fills.

23. Frozen materials or soft, mucky, or highly compressible materials shall not be incorporated into fills.

24. Fill shall not be placed on saturated or frozen surfaces.

25. Seeps or springs encountered during construction shall be handled in accordance with the standard and specification for subsurface drain or other approved method.

26. All graded areas shall be permanently stabilized immediately upon reaching finished grade. Cut slopes in competent bedrock and rock fills need not be vegetated. Seeded areas within 50 feet of a surface water, or as otherwise shown on the plan drawings, shall be blanketed according to the standards of this plan.

27. Immediately after earth disturbance activities cease in any area or subarea of the project, the operator shall stabilize all disturbed areas. During non-germinating months, mulch or protective blanketing shall be applied as described in the plan. Areas not at finished grade, which will be reactivated within 1 year, may be stabilized in accordance with the temporary stabilization specifications. Those areas which will not be reactivated within 1 year shall be stabilized in accordance with the permanent stabilization specifications.

28. Permanent stabilization is defined as a minimum uniform, perennial 70% vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion. Cut and fill slopes shall be capable of resisting failure due to slumping, sliding, or other movements.

29. E&S BMPs shall remain functional as such until all areas tributary to them are permanently stabilized or until they are replaced by another BMP approved by the local conservation district or the Department.

30. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the owner and/or operator shall contact the local conservation district for an inspection prior to removal/conversion of the E&S BMPs.

31. After final site stabilization has been achieved, temporary erosion and sediment BMPs must be removed or converted to permanent post construction stormwater management BMPs. Areas disturbed during removal or conversion of the BMPs shall be stabilized immediately. In order to ensure rapid revegetation of disturbed areas, such removal/conversions are to be done only during the germinating season.

32. Upon completion of all earth disturbance activities and permanent stabilization of all disturbed areas, the owner and/or operator shall contact the local conservation district to schedule a final inspection.

33. Failure to correctly install E&S BMPs, failure to prevent sediment-laden runoff from leaving the construction site, or failure to take immediate corrective action to resolve failure of E&S BMPs may result in administrative, civil, and/or criminal penalties being instituted by the Department as defined in Section 602 of the Pennsylvania Clean Streams Law. The Clean Streams Law provides for up to $10,000 per day in civil penalties, up to $10,000 in summary criminal penalties, and up to $25,000 in misdemeanor criminal penalties for each violation.

34. Concrete wash water shall be handled in the manner described on the plan drawings. In no case shall it be allowed to enter any surface waters or groundwater systems.

35. All channels shall be kept free of obstructions including but not limited to fill, rocks, leaves, woody debris, accumulated sediment, excess vegetation, and construction material/wastes.

36. Underground utilities cutting through any active channel shall be immediately backfilled and the channel restored to its original cross-section and protective lining. Any base flow within the channel shall be conveyed past the work area in the manner described in this plan until such restoration is complete.

37. Channels having riprap, Reno mattress, or gabion linings must be sufficiently over-excavated so that the design dimensions will be provided after placement of the protective lining.

38. Sediment basins and/or traps shall be kept free of all construction waste, wash water, and other debris having potential to clog the basin/trap outlet structures and/or pollute the surface waters.

39. Sediment basins shall be protected from unauthorized acts by third parties.

40. Any damage that occurs in whole or in part as a result of basin or trap discharge shall be immediately repaired by the permittee in a permanent manner satisfactory to the municipality, local conservation district, and the owner of the damaged property.

41. Upon request, the applicant or his contractor shall provide an as-built (record drawing) for any sediment basin or trap to the municipal inspector, local conservation district or the Department.

42. Erosion control blanketing shall be installed on all slopes 3H:1V or steeper within 50 feet of a surface water and on all other disturbed areas specified on the plan maps and/or detail sheets.

43. Fill material for embankments shall be free of roots, or other woody vegetation, organic material, large stones, and other objectionable materials. The embankment shall be compacted in maximum 12" layered lifts at 90% density.

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

GENERAL NOTES

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME:$FILES$

DRAWING LIMITS

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

IPSC
IPFB

RF

IPFB

DRAWING LIMITS

MATCHLINE - DRAWING SHEET 2

MATCHLINE - DRAWING SHEET 6

PN

39°

N

LEGEND

—o—	PROPERTY FENCE
--SF--	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 1 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILE$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

DRAWING LIMITS

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

MATCHLINE - DRAWING SHEET 1

MATCHLINE - DRAWING SHEET 3

MATCHLINE - DRAWING SHEET 7

PN

39°

N

LEGEND

- PROPERTY FENCE
- STANDARD SILT FENCE
- STORM MANHOLE
- STORM INLET
- STORM SEWER
- STORM DITCH
- STORM TRENCH
- IPFB — FILTER BAG INLET PROTECTION
- IPSC — STONE & CONCRETE BLOCK INLET PROTECTION
- RF — ROCK FILTER
- RCE — ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 2 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

DRAWING LIMITS

MATCHLINE - DRAWING SHEET 2

MATCHLINE - DRAWING SHEET 4

MATCHLINE - DRAWING SHEET 8

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

IPFB

PN

39°

N

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 3 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

DRAWING LIMITS

MATCHLINE - DRAWING SHEET 3

MATCHLINE - DRAWING SHEET 8

MATCHLINE - DRAWING SHEET 5

MATCHLINE - DRAWING SHEET 9

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

IPFB

IPFB

IPFB

RF

PN

39°

N

LEGEND

—o—	PROPERTY FENCE
--SF--	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 4 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME:$FILES$

DRAWING LIMITS

MATCHLINE - DRAWING SHEET 4

DRAWING LIMITS

IPFB

IPFB

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

DRAWING LIMITS

PN

N

39°

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL
PLAN SHEET 5 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

MATCHLINE - DRAWING SHEET 1

DRAWLING LIMITS

MATCHLINE - DRAWING SHEET 7

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

MATCHLINE - DRAWING SHEET 10

PN

39°

N

LEGEND

- PROPERTY FENCE
- STANDARD SILT FENCE
- STORM MANHOLE
- STORM INLET
- STORM SEWER
- STORM DITCH
- STORM TRENCH
- IPFB — FILTER BAG INLET PROTECTION
- IPSC — STONE & CONCRETE BLOCK INLET PROTECTION
- RF — ROCK FILTER
- RCE — ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 6 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

MATCHLINE - DRAWING SHEET 2

MATCHLINE - DRAWING SHEET 6

MATCHLINE - DRAWING SHEET 8

MATCHLINE - DRAWING SHEET 11

IPFB

IPSC

RF

SF

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

PN

39°

N

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 7 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

MATCHLINE - DRAWING SHEET 3

MATCHLINE - DRAWING SHEET 7

MATCHLINE - DRAWING SHEET 4

MATCHLINE - DRAWING SHEET 9

MATCHLINE - DRAWING SHEET 12

IPFB

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

PN

N

39°

LEGEND

—o—	PROPERTY FENCE
---SF---	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL
PLAN SHEET 8 OF 12

MATCHLINE - DRAWING SHEET 4

MATCHLINE - DRAWING SHEET 8

MATCHLINE - DRAWING SHEET 12

DRAWING LIMITS

DRAWING LIMITS

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

PN

N

39°

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

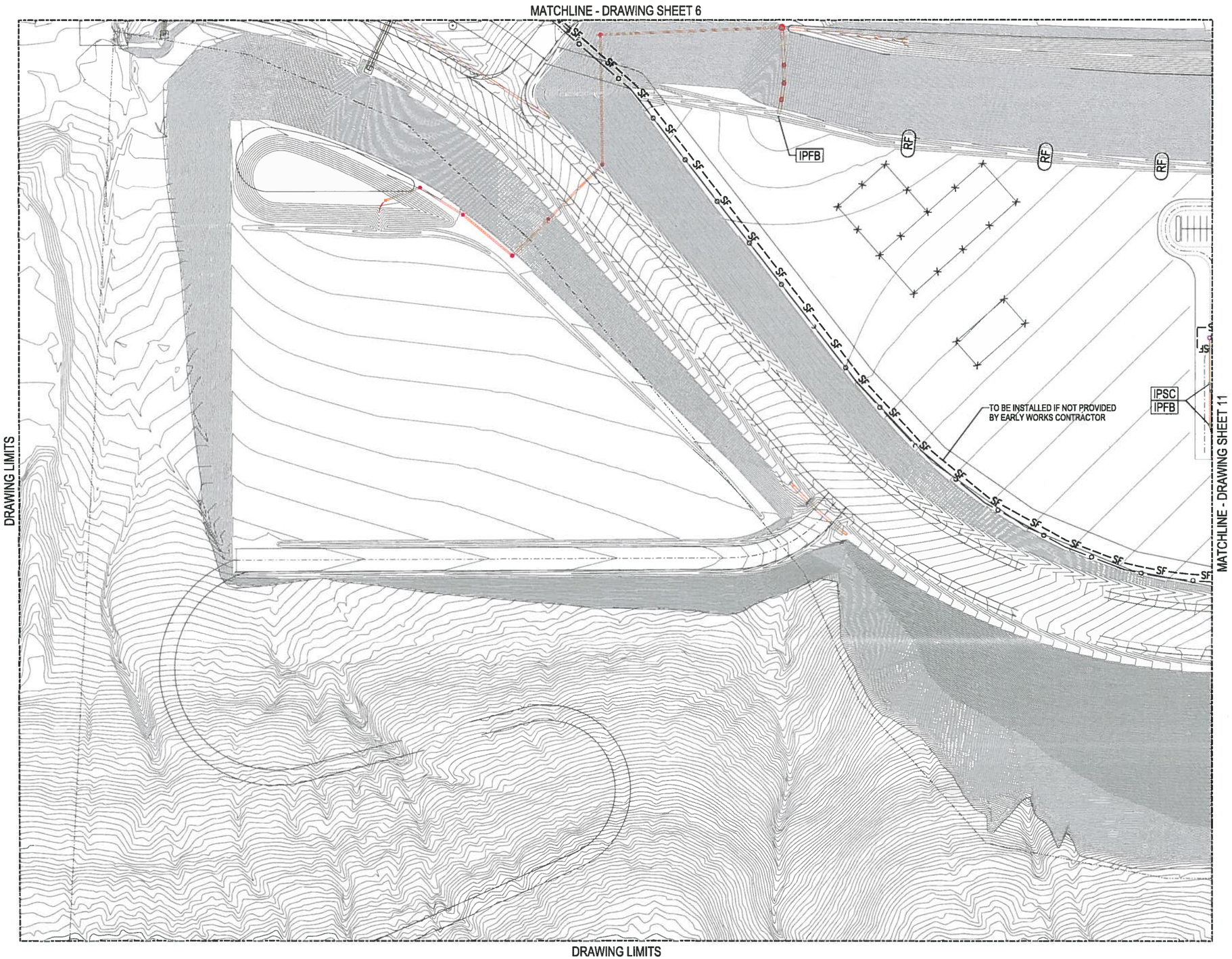
Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

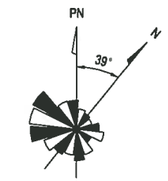
Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL
PLAN SHEET 9 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILE1$ $PLTDRVS$ $PENTABLE$ FILENAME:$FILES$





LEGEND

- PROPERTY FENCE
- STANDARD SILT FENCE
- STORM MANHOLE
- STORM INLET
- STORM SEWER
- STORM DITCH
- STORM TRENCH
- IPFB — FILTER BAG INLET PROTECTION
- IPSC — STONE & CONCRETE BLOCK INLET PROTECTION
- RF — ROCK FILTER
- RCE — ROCK CONSTRUCTION ENTRANCE

0 80' 160'
SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL
PLAN SHEET 10 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

MATCHLINE - DRAWING SHEET 7

MATCHLINE - DRAWING SHEET 10

MATCHLINE - DRAWING SHEET 12

DRAWING LIMITS

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS C NTRACTOR

PN

39°

N

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
	STORM MANHOLE
	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 11 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME: $FILES$

MATCHLINE - DRAWING SHEET 8

MATCHLINE - DRAWING SHEET 11

MATCHLINE - DRAWING SHEET 9

DRAWING LIMITS

DRAWING LIMITS

TO BE INSTALLED IF NOT PROVIDED BY EARLY WORKS CONTRACTOR

PN

39°

N

LEGEND

—— o ——	PROPERTY FENCE
- - - SF - - -	STANDARD SILT FENCE
o	STORM MANHOLE
o	STORM INLET
	STORM SEWER
	STORM DITCH
	STORM TRENCH
IPFB	FILTER BAG INLET PROTECTION
IPSC	STONE & CONCRETE BLOCK INLET PROTECTION
RF	ROCK FILTER
RCE	ROCK CONSTRUCTION ENTRANCE

0 80' 160'

SCALE 1" = 160'

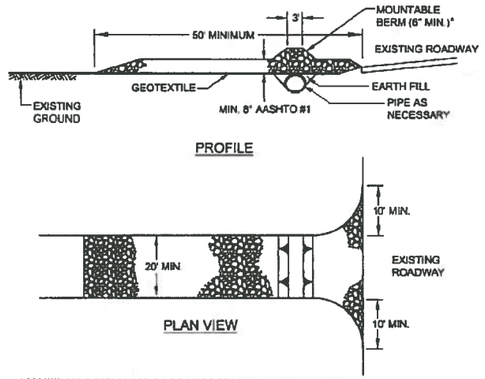
Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL PLAN SHEET 12 OF 12

$USERNAME$ MM-DD-YY :: HH:MM $FILEL$ $PLTDRVS$ $PENTABLE$ FILENAME:$FILES$

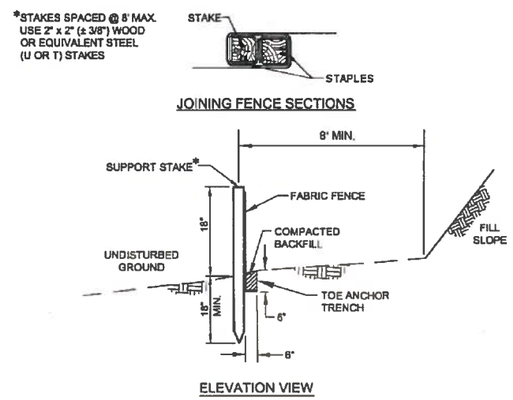


* MOUNTABLE BERM USED TO PROVIDE PROPER COVER FOR PIPE

Modified from Maryland DOE

Note:
1. Remove topsoil prior to installation of rock construction entrance. Extend rock over full width of entrance.
2. Runoff shall be diverted from roadway to a suitable sediment removal BMP prior to entering rock construction entrance.
3. Mountable berm shall be installed wherever optional culvert pipe is used and proper pipe cover as specified by manufacturer is not otherwise provided. Pipe shall be sized appropriately for size of ditch being crossed.
4. Maintenance: Rock construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. A stockpile shall be maintained on site for this purpose. All sediment deposited on paved roadways shall be removed and returned to the construction site immediately. If excessive amounts of sediment are being deposited on roadway, extend length of rock construction entrance by 50 foot increments until condition is alleviated or install wash rack. Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.

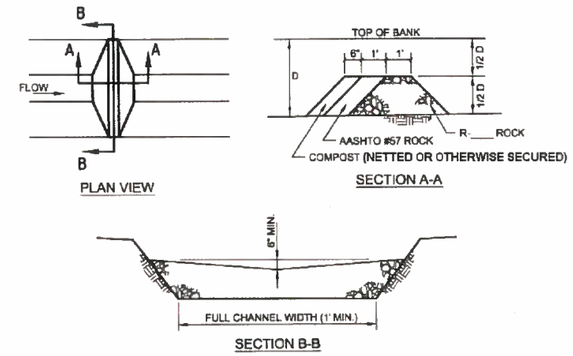
STANDARD CONTRUCTION DETAIL #3-1
Rock Construction Entrance



PA DEP

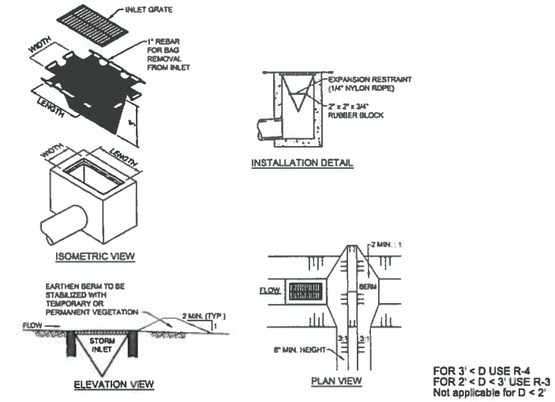
Note:
1. Fabric shall have the minimum properties as shown in Table 4.3.
2. Fabric width shall be 30" minimum. Stakes shall be hardwood or equivalent steel (U or T) stakes.
3. Silt fence shall be placed at level existing grade. Both ends of the fence shall be extended at least 8 feet up slope at 45 degrees to the main fence alignment (see Figure 4.1 PA DEP Erosion and Sediment Pollution Control Program Manual).
4. Sediment shall be removed when accumulations reach half the aboveground height of the fence.
5. Any section of silt fence which has been undermined or topped shall be immediately replaced with a rock filter outlet (Standard Construction Detail # 4-6).
6. Fence shall be removed and properly disposed of when tributary area is permanently stabilized

STANDARD CONTRUCTION DETAIL #4-7
Standard Silt Fence (18" High)



Note:
1. Sediment shall be removed when accumulations reach 1/2 the height of the filter.
2. Immediately upon stabilization of each channel, installer shall remove accumulated sediment, remove rock filter, and stabilize disturbed areas.

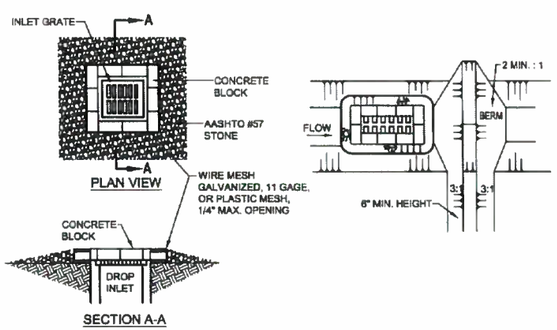
STANDARD CONTRUCTION DETAIL #4-14
Rock Filter



FOR 3' < D USE R-4
FOR 2' < D < 3' USE R-3
Not applicable for D < 2'

Note:
1. Maximum drainage area =½acre.
2. Inlet protection shall not be required for inlet tributary to sediment basin or trap. Berms shall be required for all installations. .
3. Rolled earthen berm in roadway shall be maintained until roadway is stoned. Road subbase berm on roadway shall be maintained until roadway is paved. Earthen berm in channel shall be maintained until permanent stabilization is completed or remain permanently.
4. At a minimum, the fabric shall have a minimum grab tensile strength of 120 lbs., a minimum burst strength of 200 psi, and a minimum trapezoidal tear strength of 50 lbs. Filter bags shall be capable of trapping all particles not passing a No. 40 sieve.
5. Inlet filter bags shall be inspected on a weekly basis and after each runoff event. Bags shall be emptied and rinsed or replaced when half full or when flow capacity has been reduced so as to cause flooding or bypassing of the inlet. Damaged or clogged bags shall be replaced. A supply shall be maintained on site for replacement of bags. All needed repairs shall be initiated immediately after the inspection. Dispose accumulated sediment as well as all used bags according to the plan notes.
6. Do not use on major paved roadways where ponding may cause traffic hazards.

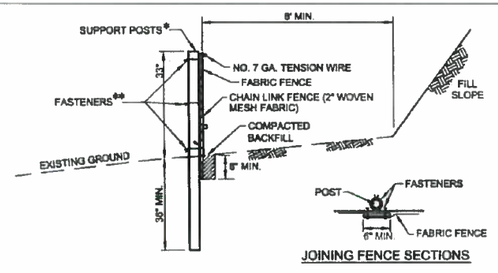
STANDARD CONTRUCTION DETAIL #4-16
Filter Bag Inlet Protection - Type M Inlet



Adapted from Maine DEP

Note:
1. Maximum drainage area =1 acre.
2. Inlet protection shall not be required for inlet tributary to sediment basin or trap. Berms shall be required for all installations not located at a low point.
3. Rolled earthen berm in roadway shall be provided and maintained immediately down gradient of the protected inlet until roadway is stoned. Road subbase berm on roadway shall be maintained until roadway is paved. Earthen berm in channel shall be maintained until permanent stabilization is completed or to remain permanently.
4. Top of block shall be at least 6 inches below adjacent roads if ponded water would pose a safety hazard to traffic.
5. Sediment shall be removed when it reaches half the height of the stone. Damaged or clogged installations shall be repaired or replaced immediately.
6. For systems discharging to HQ or EV surface water, a 6 inch thick compost layer shall be securely anchored on outside and over top of stone. Compost shall meet the standards in Table 4.2 of PA DEP Erosion and Sediment Pollution Control Program Manual.

STANDARD CONTRUCTION DETAIL #4-18
Stone and Concrete Block Inlet Protection - Type M Inlet



*POSTS SPACED @ 10' MAX. USE 2 1/2" DIA. HEAVY DUTY GALVANIZED OR ALUMINUM POSTS.

**CHAIN LINK TO POST FASTENERS SPACED @ 14" MAX. USE NO. 9 GA. ALUMINUM WIRE OR NO. 9 GALVANIZED STEEL PRE-FORMED CLIPS. CHAIN LINK TO TENSION WIRE FASTENERS SPACED @ 60" MAX. USE NO. 13.5 GA. GALVANIZED STEEL WIRE. FABRIC TO CHAIN FASTENERS SPACED @ 24" MAX C. TO C.

PA DEP

Note:
1. Fabric shall have the minimum properties as shown in Table 4.3.
2. Filter fabric width shall be 42" minimum.
3. Posts shall be installed using a posthole drill.
4. Chain link shall be galvanized No. 11.5 Ga. steel wire with 2 ¼" opening, No. 11 Ga. aluminum coated steel wire in accordance with ASTM-A-491, or galvanized No. 9 Ga. steel wire top and bottom with galvanized No. 11 Ga. steel intermediate wires. No. 7 gage tension wire to be installed horizontally through holes at top and bottom of chain-link fence or attached with hog rings at 5' (max.) centers.
5. Silt fence shall be placed at existing level grade. Both ends of the fence shall be extended at least 8 feet upslope at 45 degrees to main barrier alignment (Figure 4.1 PA DEP Erosion and Sediment Pollution Control Program Manual).
6. Sediment shall be removed when accumulations reach half the aboveground height of the fence.
7. Fence shall be removed and properly disposed of when tributary area is permanently stabilized.

STANDARD CONTRUCTION DETAIL #4-10
Super Silt Fence

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

PROJECT FRANKLIN

EROSION AND SEDIMENT CONTROL DETAILS SHEET

Exhibit 5

Plan Preparer Recorded of Training and Experience in E&S Pollution Control Methods and Techniques

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

STANDARD E&S WORKSHEET # 22
PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES

NAME OF PLAN PREPARER: CHIEN D. NGUYEN

FORMAL EDUCATION:

Name of College or Technical Institute: UNIVERSITY OF HOUSTON

Curriculum or Program: CIVIL ENGINEERING

Dates of Attendance: **From:** 08-1999 **To:** 12-2005

Degree Received BACHELOR OF SCIENCE AND MASTER OF CIVIL ENGINEERING

OTHER TRAINING:

Name of Training:	BEST MANAGEMENT PRACTICE	EARTHWORK FUNDAMENTAL
Presented By:	CHARLES ORTIZ	DONALD GERKEN
Date:	2003	09-24-2012

EMPLOYMENT HISTORY:

Current Employer: BECHTEL

Telephone: 713-235-2000

Former Employer: ENTECH CIVIL ENGINEER, INC.

Telephone: 281-945-0069

RECENT E&S PLANS PREPARED:

Name of Project:	QUEENSTON BLVD.	CEDAR BAYOU TERMINAL & PIPELINE PROJECT	WEST HOUSTON CHURCH OF CHRIST
County:	HARRIS	HARRIS	HARRIS
Municipality:	HCPID	HCPID	HCPID
Permit Number:	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
Approving Agency:	HCPID	HCPID	HCPID

Electronic documents, once printed, are uncontrolled and may become outdated.
Refer to the Enterprise Content Management System (ECMS) for the current revision.

Confidential © 2015 Shell Chemical Appalachia LLC. All Rights Reserved.

Section 9

Source Water Physical and Biological Baseline Characterization Study

Shell Proposed Petrochemicals Complex
Beaver County, Pennsylvania

Source Water Physical and Biological Baseline Characterization Study – Montgomery Pool, Ohio River

November 2015

Prepared for:

Shell Chemical Appalachia LLC

Prepared by:

AECOM

Harrisburg, PA

SOURCE WATER PHYSICAL AND BIOLOGICAL BASELINE CHARACTERIZATION STUDY – MONTGOMERY POOL, OHIO RIVER

Prepared for:

Shell Chemical Appalachia LLC

Prepared by:

AECOM

Harrisburg, PA

November 2015

Table of Contents

1 Introduction 1

1.1 Purpose 1

1.1.1 Site Location 1

1.1.2 Regulatory Requirements 3

2 Resources Utilized 4

2.1 ORSANCO 2010: 2010 Ohio River Pool Assessments – Montgomery, Racine and John T. Myers 5

2.2 PFBC 2010: Three Rivers Management Plan, a Strategy for Managing Fisheries Resources of the Allegheny, Monongahela, and Ohio Rivers 5

2.3 USACE. 2014: Upper Ohio Navigation Study, Pennsylvania Draft Feasibility Report and Integrated Environmental Impact Statement - Emsworth, Dashields, and Montgomery Locks and Dams 5

2.1 ENSR. 2008: 316(b) Best Professional Judgment for Best Technology Available Report – NOVA Chemicals-AES Beaver Valley Generating Station 6

3 Project Area Summary 6

3.1 PA Ohio River setting 6

3.2 Montgomery Pool 6

3.3 Depth 7

3.4 Water Quality 7

3.5 Temperature Regimes 11

3.6 Flow Regimes 12

4 Source Water Baseline Biological Characterization 14

4.1 Surveys of Fish Community in the Montgomery Pool 15

4.2 2006 – 2007 Impingement Study at NOVA Chemicals/AES Beaver Valley Generating Station 19

4.3 Unionid (Mussel) Community in the Montgomery Pool 20

4.3.1 Threatened & Endangered (T&E) Species Identified or Potentially to Reside in Montgomery Pool 21

4.3.2 Reproduction (Spawning and Recruitment) and Seasonality 23

4.4 Species Susceptible to Impingement or Entrainment at the Site 23

4.5 Life Histories of Important Taxa 25

4.5.1 Smallmouth bass (Edwards et al. 1983) 25

4.5.2 Sauger 26

4.5.3 Freshwater drum 26

4.5.4 Bluegill 27

4.5.5 Gizzard shad 27

4.5.6 Cyprinidae spp. (Shiners and minnows) 29

4.5.7 Redhorse sp. (Moxostoma sp.) 30

4.5.8 White Bass 30

5 Summary and Conclusions 31

6 References 32

List of Figures

Figure 1: Location of the Proposed Petrochemicals Complex on the Montgomery Pool for the Ohio River in Pennsylvania (Original from PFBC 2010, Figure 5.8) 2

Figure 2: Location of Shell CWIS 2

Figure 3: Specific Conductivity at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490). 8

Figure 4: pH at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490). 9

Figure 5: Dissolved Oxygen Measurements at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490). 10

Figure 6: Temperature at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490). 11

Figure 7: Lock Chamber Rotenone Fisheries Results from Montgomery Locks and Dam 1957 – 2005 with a Line of Best Fit Indicating Greater Fish Species Diversity over Time. 15

Figure 8: Raw Number of Fish Collected by Family in Electrofishing Samples in 2006 And 2010 in Montgomery Pool, Ohio River. Note, the Herrings and Shads Family Is Represented by a Single Species, Gizzard Shad. 18

Figure 9: Number of Fish Collected Per Impingement Sampling Event at NOVA Chemical's / AES Beaver Valley Generating Station (2006 - 2007) (ENSR 2008) 19

List of Tables

Table 1: Mean Monthly Specific Conductance at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the mean of monthly average values reported by the USGS. 8

Table 2: Mean Monthly pH at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS. 9

Table 3: Mean Monthly Dissolved Oxygen at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS. 10

Table 4: Mean Monthly Temperature at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS. 11

Table 5: ORSANCO's water quality criteria for temperature for the Upper, Middle and Lower Ohio River (ORSANCO 2013) 12

Table 6: Summary of Ohio River Flow Characteristics near Montgomery Locks and Dam (From BVPS (2007) Table 2.2.1) 14

Table 7: Species Observed in Historical Sampling in Montgomery Pool and Number Of Fish Collected by Species During the Most Recent ORSANCO Electrofishing Sampling Events, 2006 and 2010. Data from PFBC 2010, ORSANCO 2007 and 2010. 16

Table 8: Raw Number of Fish Collected in Impingement Sampling at NOVA Chemical's / AES Beaver Valley Generating Station (2006 - 2007) (ENSR 2008) 20

Table 9: Recent Live and Fresh Dead Unionid Species Observed in the Pennsylvania Pools of the Ohio River 20

Table 10: Unionid Records for the Upper Ohio River in Pennsylvania 21

Table 11: Factors Effecting Susceptibility to Impingement or Entrainment 24

Table 12: Potentially Susceptible Fish Species to Impingement and Entrainment in the Montgomery Pool. 24

Table 13: Smallmouth Bass Life History Data - Spawning and Early Life Stages 25

Table 14: Sauger Life History Data - Spawning and Early Life Stages 26

Table 15: Freshwater Drum Life History Data - Spawning and Early Life Stages 26

Table 16: Bluegill Life History Data - Spawning and Early Life Stages 27

Table 17: Gizzard Shad Life History Data - Spawning and Early Life Stages 29

Table 18: Shiner sp. Life History Data - Spawning and Early Life Stages 29

Table 19: Redhorse sp. Life History Data - Spawning and Early Life Stages 30

Table 20: White Bass. Life History Data - Spawning and Early Life Stages 31

List of Abbreviations

BVPS	Beaver Valley Power Station
°C	Temperature degrees Celsius
cfs	cubic feet per second
CWA	Clean Water Act
CWIS	Cooling Water Intake Structure
ft.	feet
mg/L	milligrams per liter
MGD	million gallons per day
mORFIn	Modified Ohio River Fish Index
mS/cm	microsiemens per centimeter
NPDES	National Pollutant Discharge Elimination System
ORSANCO	Ohio River Valley Water Sanitation Commission
PADEP	Pennsylvania Department of Environmental Protection
PCB	polychlorinated biphenyls
PFBC	Pennsylvania Fish and Boat Commission
PNDI	Pennsylvania Natural Diversity Inventory
Shell	Shell Chemical Appalachia LLC
SIR	Species Impact Review
T&E	Threatened & Endangered
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WWF	Warm Water Fishes
YOY	Young-of-the-year (fish)

1 Introduction

AECOM developed this source water physical and biological baseline characterization report for the Montgomery Pool on the Ohio River in the vicinity of Shell Chemical Appalachia LLC's (Shell) proposed petrochemicals complex (facility) in Beaver County, Pennsylvania. Shell plans to use the existing (i.e., former Horsehead Corporation) Cooling Water Intake Structure (CWIS) to provide industrial supply water from the Ohio River to the proposed facility. The existing CWIS is designed to provide up to 80 million gallons per day (MGD) of water. With appropriate modifications, Shell plans to use the existing CWIS to provide approximately 20 MGD of water to the proposed facility.

This document was developed following the requirements under the Clean Water Act (CWA) 316(b) Rule for Existing Facilities, and is based upon published literature and available biological and fisheries data. It is the objective of this report to provide the Pennsylvania Department of Environmental Protection (PADEP) with sufficient data to support compliance with 316(b) without the need to collect additional data.

1.1 Purpose

The primary purpose of this report is to identify and characterize the physical properties and biological community of the Ohio River in the vicinity of the CWIS. Operation of the CWIS has the potential to impact aquatic communities due to impingement or entrainment. Impingement is the physical interaction between fishes or other organisms and the intake screens such that escape is not possible. The impinged organisms are carried by the screen to a return sluiceway that deposits impinged organisms back into the source water body. Life stages of fish typically seen in impingement studies range from juvenile to adult. Entrainment is when small organisms that are able to fit through the intake screens are drawn into and through the cooling water system. These organisms may experience high sheer forces, elevated temperature, or chemical stressors before passing out of the system through the discharge of cooling water tower blowdown. Fish eggs and larvae, very small juvenile fish, and larval freshwater mussel (unionids; referred to as glochidia) are susceptible to entrainment. This report identifies aquatic species most susceptible to impingement and entrainment from operation of the CWIS.

1.1.1 Site Location

The proposed facility is located along the left descending bank of the Ohio River immediately west of the town of Monaca, Pennsylvania (**Figure 1**). The site resides on the Montgomery Pool of the Ohio River which is entirely within the state of Pennsylvania. The Beaver River flows into the Montgomery Pool from the north, upstream of the site. Raccoon Creek enters the Montgomery Pool along the left descending bank approximately 2,100 feet downstream of the Shell CWIS (**Figure 2**). The existing CWIS will be inspected, repaired if needed, and modified with new equipment to serve the proposed facility. Section 5, Module 5 of the Part I National Pollutant Discharge Elimination System (NPDES) application provides the mechanical design details.

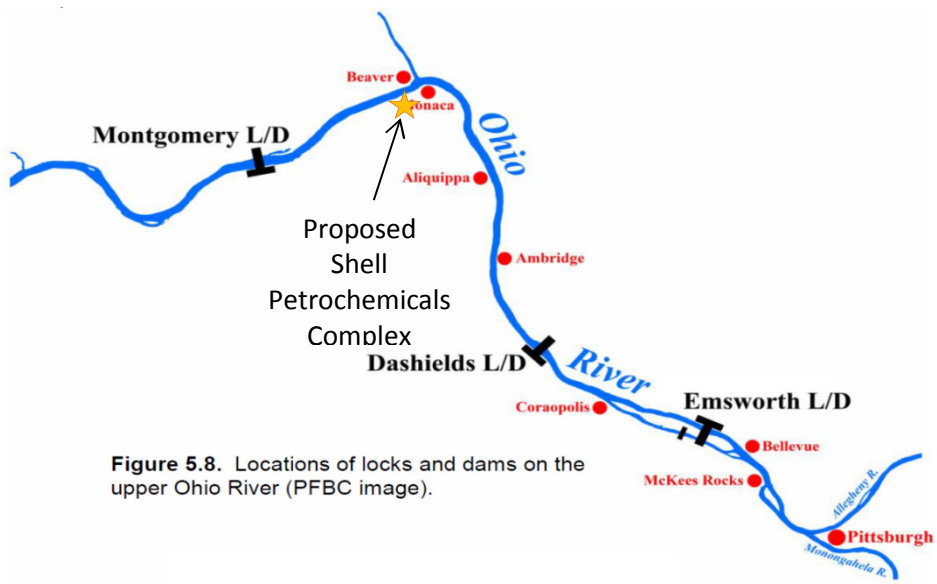


Figure 1: Location of the Proposed Petrochemicals Complex on the Montgomery Pool for the Ohio River in Pennsylvania (Original from PFBC 2010, Figure 5.8)

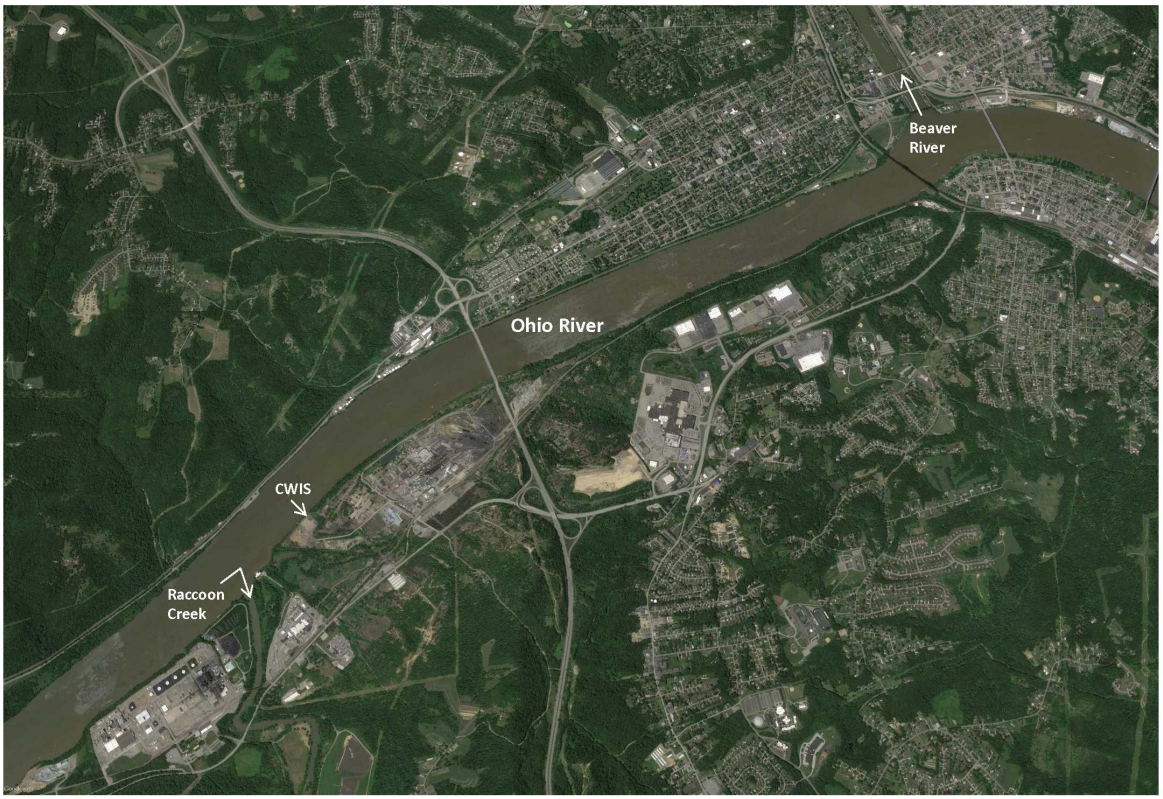


Figure 2: Location of Shell CWIS

1.1.2 Regulatory Requirements

This section summarizes the relevant CWIS definitions promulgated by the United States Environmental Protection Agency (USEPA) under the authority of the CWA section 316(b) to demonstrate that the proposed petrochemical complex will be regulated as an Existing Facility under CWIS regulations. In accordance with the 316(b) rule, this report provides source water physical data (§122.21(r)(2)) and baseline biological characterization data (§122.21(R)(4)).

On May 19, 2014, USEPA released a pre-publication version of a Final Rule with new CWIS regulations for Existing Facilities that included the following definition at 40 CFR Part 125.92(k):

> ***Existing facility*** *means any facility that commenced construction as described in 40 CFR 122.29(b)(4) on or before January 17, 2002 (or July 17, 2006 for an offshore oil and gas extraction facility) and any modification of, or any addition of a unit at such a facility.*[1] *A facility built adjacent to another facility would be a new facility while the original facility would remain as an existing facility for purposes of this subpart. A facility cannot both be an existing facility and a new facility as defined at §125.83.*

On December 18, 2001, USEPA published the Final Phase I Rule with CWIS regulations for New Facilities that included the following definitions at 40 CFR Part 125.83:

> ***Cooling water intake structure*** *means the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the U.S. The cooling water intake structure extends from the point at which water is withdrawn from the surface water source up to, and including, the intake pumps.*
>
> ***Existing Facility*** *means any facility that is not a* ***New Facility;*** *and*
>
> ***New Facility*** *means any building, structure, facility, or installation that meets the definition of a "new source" or "new discharger" in 40 CFR 122.2 and 122.29(b)(1), (2), and (4) and is a greenfield or standalone facility; commences construction after January 17, 2002; and uses either a newly constructed cooling water intake structure, or an existing cooling water intake structure whose design capacity is increased to accommodate the intake of additional cooling water.*[2] *New facilities include only "greenfield" and "standalone" facilities. A greenfield facility is a facility that is constructed at a site at which no other source is located, or that totally replaces the process or production equipment at an existing facility (see 40 CFR 122.29(b)(1)(i) and (ii)).*[3] *A stand-alone facility is a new, separate facility that is constructed on property where an existing facility is located and whose processes are substantially independent of the existing facility at the same site (see 40 CFR 122.29(b)(1)(iii)).*[4] *New facility does not include new units that are added to a facility for purposes of the same general industrial operation (for example, a new peaking unit at an electrical generating station).*
>
> *(1) Examples of "new facilities" include, but are not limited to the following scenarios:*

[1] The site meets the definition of an Existing Facility.
[2] The proposed petrochemicals complex will decrease total water intake from approximately 80 MGD to approximately 20 MGD.
[3] The proposed petrochemicals complex will not be a greenfield facility.
[4] The proposed petrochemical complex will not be a stand-alone facility.

(i) A new facility is constructed on a site that has never been used for industrial or commercial activity. It has a new cooling water intake structure for its own use.

(ii) A facility is demolished and another facility is constructed in its place. The newly-constructed facility uses the original facility's cooling water intake structure, but modifies it to increase the design capacity to accommodate the intake of additional cooling water.[5]

(iii) A facility is constructed on the same property as an existing facility, but is a separate and independent industrial operation. The cooling water intake structure used by the original facility is modified by constructing a new intake bay for the use of the newly constructed facility or is otherwise modified to increase the intake capacity for the new facility.

(2) Examples of facilities that would not be considered a "new facility" include, but are not limited to, the following scenarios:

(i) A facility in commercial or industrial operation is modified and either continues to use its original cooling water intake structure or uses a new or modified cooling water intake structure. [6]

(ii) A facility has an existing intake structure. Another facility (a separate and independent industrial operation), is constructed on the same property and connects to the facility's cooling water intake structure behind the intake pumps, and the design capacity of the cooling water intake structure has not been increased.[7] *This facility would not be considered a "new facility" even if routine maintenance or repairs that do not increase the design capacity were performed on the intake structure.*

As described by the above regulatory definitions and examples, the CWIS regulations that apply to an intake structure are not dependent on whether the intake structure is new or existing but whether the proposed facility is new or existing *and if a modification to increase capacity occurs.* Per the above regulatory citations, Shell's proposed petrochemicals facility meets the definition of an Existing Facility.

2 Resources Utilized

A literature and fisheries data search for the Montgomery Pool yielded a variety of published results. The water quality of the Ohio River is considered to be in a state of slow recovery and is being monitored throughout its length. Data were obtained from the Ohio River Valley Water Sanitation Commission (ORSANCO), the Pennsylvania Fish and Boat Commission (PFBC), 316(b) reports from

[5] This example best represents the demolition of the former Horsehead facility and construction of Shell's proposed petrochemical facility. The Shell facility will use Horsehead's original intake structure. Rather than increasing design capacity, the proposed Shell facility will decrease the intake's design capacity from approximately 80 MGD to approximately 20 MGD. As a result, Shell's proposed facility will not be considered a New Facility.

[6] Shell's proposed petrochemicals complex meets the designated criteria and would not be considered a New Facility.

[7] Since the proposed facility will not increase the existing intake's design capacity, the proposed facility will not be considered a New Facility.

nearby facilities, and published studies. The list of available reports and studies were discussed with both PADEP and PFBC staff.

The following subsections provide brief summaries of the pertinent information collected from these resources.

2.1 ORSANCO 2010: 2010 Ohio River Pool Assessments – Montgomery, Racine and John T. Myers.

ORSANCO (2010) presents the results of biological sampling on three Ohio River pools. Data collected are standardized throughout the Ohio River study area and different pools are sampled each year. Data collected include fish abundance from electrofishing surveys, instream habitat characterizations at multiple locations within each pool, and water quality and hydrology measurements at the time of fish surveys. These data are used to assess the biological condition of each pool using a scoring system known as the Modified Ohio River Fish Index (mORFIn). The summarized data presented in this document provide the most recent fish abundance data, substrate characterization data, and overall biological health assessment for the Montgomery Pool. The overall biological condition of the Montgomery Pool in 2010 was "Good" with over forty species of fish collected and only two of fifteen sampled locations receiving a health rating below "Fair". The Montgomery Pool was found to meet its aquatic life-use designation.

2.2 PFBC 2010: Three Rivers Management Plan, a Strategy for Managing Fisheries Resources of the Allegheny, Monongahela, and Ohio Rivers

PFBC (2010) presents a comprehensive approach to managing fisheries resources in the Allegheny, Monongahela and Ohio Rivers within Pennsylvania. A wide breadth of knowledge about the rivers is summarized including: physiography and land use surrounding the rivers, geology and climate, channel morphology and historical dredging effects, hydrology, water quality, instream habitat characteristics, and fish and other biota assemblages. The document provided much of the background information needed to characterize the biology of the Montgomery Pool and offered insight into historical uses of the Ohio River that affected the biology of the river.

2.3 USACE. 2014: Upper Ohio Navigation Study, Pennsylvania Draft Feasibility Report and Integrated Environmental Impact Statement - Emsworth, Dashields, and Montgomery Locks and Dams

United States Army Corps of Engineers (USACE) 2014 presents a feasibility study to identify the long term plan for maintaining reliable navigation in the Upper Ohio River. Information pertinent to the aquatic biology of the Montgomery Pool is found in Section 3.3.2 of that report and includes: physiography and hydrology of the Upper Ohio River pool, bathymetric information and substrate characterization, water quality, and fish and other biota assemblages. This report also provided results of a larval and juvenile fish study that included sampling in the Montgomery Pool. The results of the study indicated that the Montgomery Pool is a functioning spawning and nursery ground for many species found in the Pool as adults.

2.1 ENSR. 2008: 316(b) Best Professional Judgment for Best Technology Available Report – NOVA Chemicals-AES Beaver Valley Generating Station

ENSR (2008) contains the only record of an impingement study performed on the Montgomery Pool. The Study was conducted in 2006 through 2007 and 46, 24-hour sampling events were conducted. A total of 48,231 fish were collected during the study representing 20 taxa. Greater than 99 percent of the fish collected were gizzard shad and most fish were in the age-0 size class. Greatest impingement rates were observed in July and August.

3 Project Area Summary

The proposed project area is located along the left descending riverbank between Ohio River miles 27.0 to 29.5 in Potter and Center Townships Beaver County, Pennsylvania (immediately west of the town of Monaca). The project area is located entirely within the Montgomery Pool and is approximately two miles upriver from the Montgomery Locks and Dam located at river mile 31.7. The Ohio River is formed from the confluence of the Allegheny and Monongahela Rivers and is the only navigable river in North America with river miles numbered from its origin. The Montgomery Pool is approximately 18.5 miles long and the third Pool on the Ohio River. The Proposed project area is within the last downstream quarter of the pool.

3.1 PA Ohio River setting

The Ohio River begins in the city of Pittsburgh, Pennsylvania with the confluence of the Allegheny and Monongahela Rivers. It is the second largest river system in the United States, based on annual discharge with forty miles located in the state of Pennsylvania. Municipal and industrial wastes deposited into the River throughout the 1800s and early- to mid-1900s resulted in widespread water quality degradation and habitat destruction. Beginning in the 1970's state and federal efforts focused on increasing water quality in the River and have resulted in increased fish populations and native species reclaiming native ranges (PFBC 2010).

Although the aquatic community in the Pennsylvania portion of the Ohio River has shown positive trends since the 1970's, it is still negatively impacted by the lock and dam system that inhibits movement of fish and other organisms along the length of the River. These locks and dams have largely eliminated instream riparian habitat throughout the Pennsylvania portion of the Ohio River (PFBC 2010). Additional alterations to instream habitat have resulted from commercial sand and gravel dredging and dredging conducted to facilitate commercial navigation. Finally, the Ohio River is still impacted from persistent contaminants such as polychlorinated biphenyls (PCBs), chlordane and mercury that have prompted the Pennsylvania Department of Environmental Control to publish fish consumption advisories that include Do Not Eat Advisories for catfish and carp in the Ohio River (PFBC 2010).

3.2 Montgomery Pool

The Montgomery Pool is bound upstream by the Dashields Locks and Dam and downstream by the Montgomery Locks and Dam. The pool is gently graded and averages approximately 1,400 ft. wide and 25 ft. deep. Although the terrestrial habitat adjacent to the Pool is predominantly classified as deciduous forest or pasture/crop land, the water body is heavily influenced by the nearby Pittsburgh metropolitan area. High volumes of commercial barge traffic and recreational users are common on all Ohio River Pools in Pennsylvania. Benthic substrate within the Montgomery Pool is relatively coarse

with boulder, cobble and gravel making up approximately 45 percent of the bottom, sand accounting for another 40 percent and only 13 percent of the substrate described as fines (ORSANCO 2010). Habitat along the shoreline has been largely altered with large rocks and boulders to prevent erosion. However, fallen trees provide significant shoreline aquatic habitat for fish. Small amounts of submerged aquatic vegetation have been noted within the Pool (ORSANCO 2010). The Beaver River, entering from the right descending back across from the town of Monaca, Pennsylvania is the only major tributary entering the Montgomery Pool (PFBC 2010). Raccoon Creek (a minor tributary) enters the Montgomery Pool along the left descending bank approximately 2,100 feet downstream of the CWIS (**Figure 2**).

3.3 Depth

Based on multi-beam side-scan sonar surveys in the Pennsylvania portion of the Ohio River, the deepest locations are dredge pits created by commercial sand and gravel dredging (USACE 2014, PFBC 2010). While the dredge pits are present throughout the Dashields, Montgomery, and New Cumberland Pools, deep pits (>60 ft.) are only present in the New Cumberland Pool. Dashields and Montgomery Pools are more evenly graded with typical water depths reaching 22 ft. to 24 ft. (USACE 2014) although greater depths have been observed (40 ft. – 50 ft.) (URS 2014). Within the Montgomery pool, the channel is confined within a relatively narrow, steep-walled valley (PADEP 2010).

3.4 Water Quality

Water quality parameters pH, dissolved oxygen, and specific conductance are monitored at the Montgomery Dam by the United States Geological Survey (USGS) (USGS station 03108490). Specific conductance and pH are monitored year-round and dissolved oxygen is monitored during the warmer months (approximately from April through October). The following discussion uses the most recent "approved" five year data set from the USGS[8].

Specific conductance at the Montgomery Dam generally ranges from 200 microsiemens per centimeter (mS/cm) to 600 mS/cm throughout the year (**Figure 3**). Departures from this range are rare. Monthly average specific conductance ranges from 293 mS/cm to 424 mS/cm with lower values occurring during high flow months and higher values occurring during lower flow months in the summer and fall (**Table 1**). Published water quality standards for specific conductance for the Ohio River have not been identified.

[8] USGS recorded data are initially listed as "provisional" until they have been reviewed and pass through a quality assurance process. After this process they are considered "approved". Data used in this report are from 10/2009 through 10/2014.

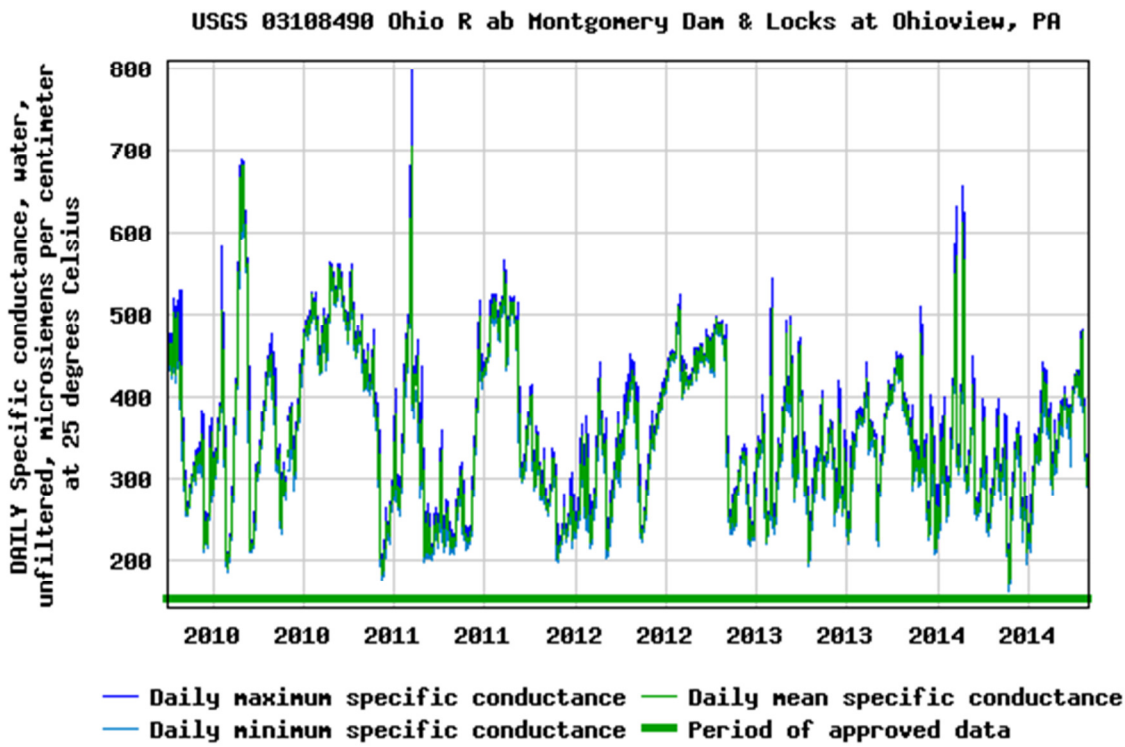


Figure 3: Specific Conductivity at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490).

Table 1: Mean Monthly Specific Conductance at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the mean of monthly average values reported by the USGS.

Month	Mean Monthly Specific Conductance (mS/cm at 25 °C) (10/2009 – 10/2014)
January	316
February	371
March	315
April	321
May	293
June	338
July	410
August	424
September	412
October	419
November	317
December	265

The pH at the Montgomery Dam generally ranges from 7.0 to 8.0 throughout the year (**Figure 4**). Departures from this range are generally in the 8.0 to 9.0 range. Monthly average pH is stable with average values near 7.5 (**Table 2**). ORSANCO's water quality standard for pH is >6.0 and <9.0 (ORSANCO 2014). Based on the most recent five year data set from USGS monitoring station at Montgomery Locks and Dam, pH is within the acceptable range.

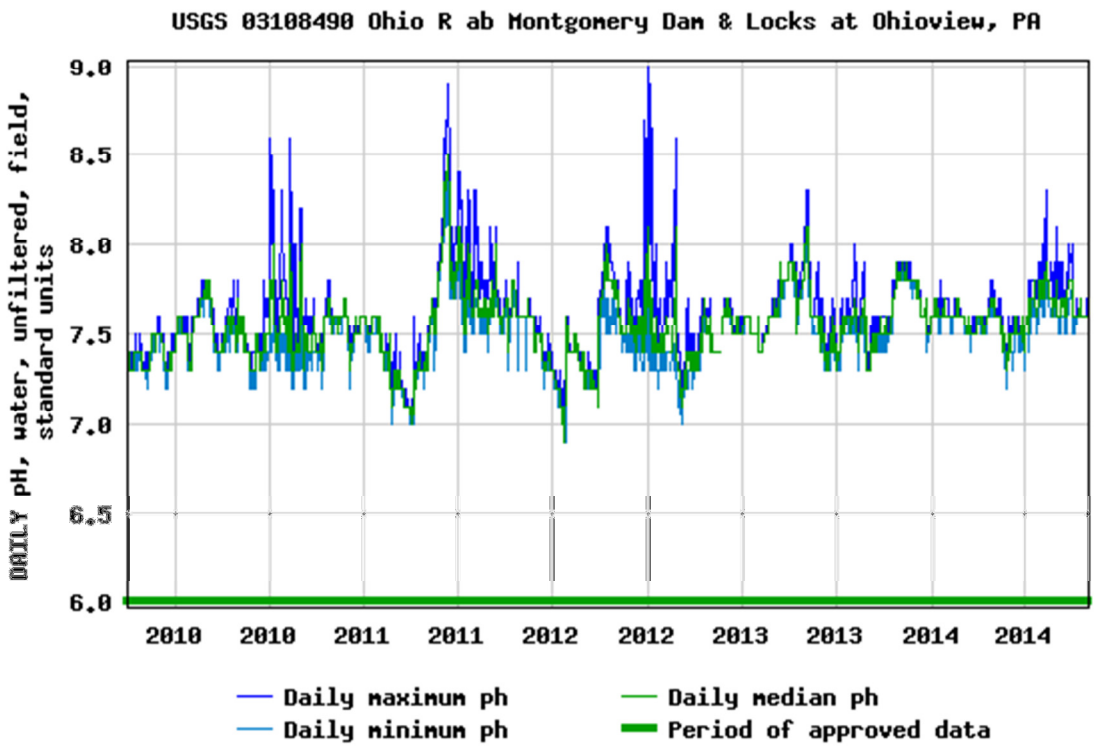


Figure 4: pH at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490).

Table 2: Mean Monthly pH at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS.

Month	Mean Monthly pH (Standard Units) (10/2009 – 10/2014)
January	7.49
February	7.50
March	7.45
April	7.59
May	7.58
June	7.60
July	7.61
August	7.59
September	7.52
October	7.54
November	7.57
December	7.49

Dissolved oxygen trends lower in warmer months and higher in cooler months with levels rarely dropping below 6.0 milligrams per liter (mg/L). In 2013 and 2014, dissolved oxygen readings rarely dropped below 8.0 mg/L (**Figure 5**). Minimum average dissolved oxygen is observed during July (7.8 mg/L) (**Table 3**). ORSANCO's water quality standard for dissolved oxygen is > 4.0 mg/L for acute

exposure and > 5.0 mg/L for chronic exposure. Dissolved oxygen levels below or near 5.0 mg/L were recorded in 2010 and 2012. However, levels did not fall to 4.0 mg/L and did not remain near 5.0 mg/L for a long period. Dissolved oxygen levels appear to be within ORSANCO's water quality standards at the USGS monitoring station at Montgomery Locks and Dam (ORSANCO 2014).

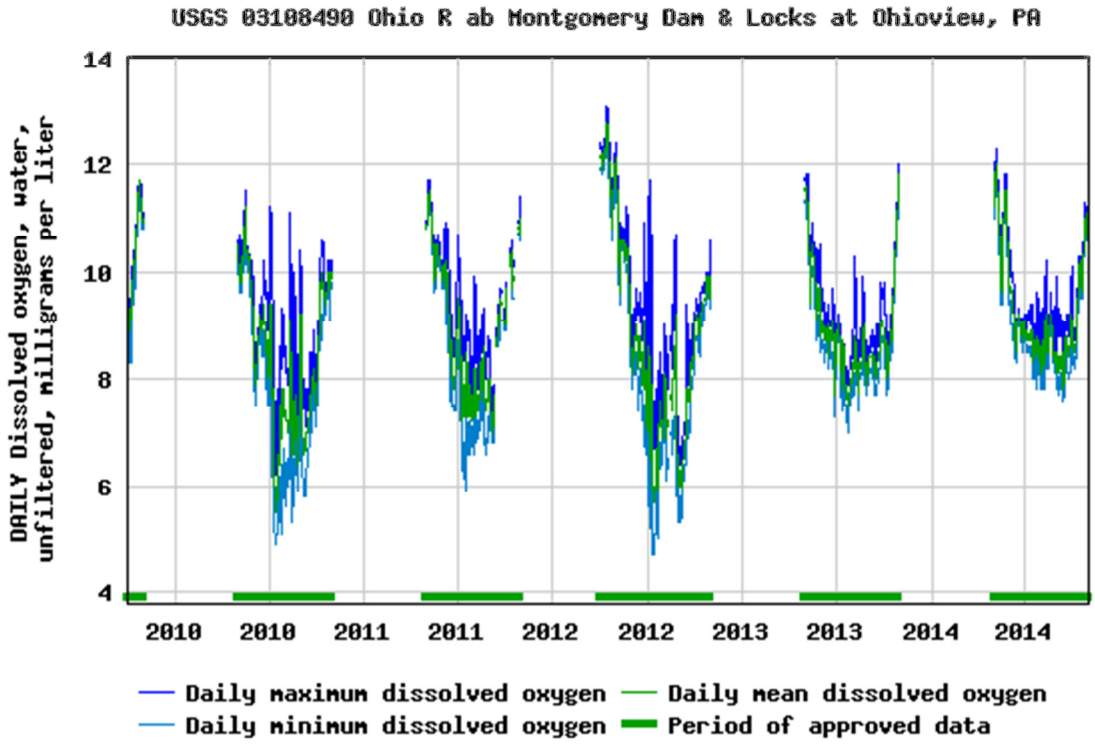


Figure 5: Dissolved Oxygen Measurements at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490).

Table 3: Mean Monthly Dissolved Oxygen at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS.

Month	Mean Monthly Dissolved Oxygen (mg/L) (10/2009 – 10/2014)
January	---
February	---
March	---
April	12
May	10.4
June	8.8
July	7.8
August	8
September	8
October	9.8
November	---
December	---

Note: "---" indicates parameter was not measured

3.5 Temperature Regimes

Water temperature follows seasonal trends that are fairly consistent from year to year (**Figure 6**). Maximum water temperature is generally observed during July and August (monthly mean temperature of 26.4°C and 25.7°C for July and August, respectively (

Table 4)). Annual absolute maximum temperatures range from about 30°C to 25°C (USGS 2015). Minimum annual temperatures are generally at or near 0°C and observed in January or February. ORSANCO's water quality criteria for temperature are based on the region of the Ohio River and the Julian date (**Table 5**) (ORSANCO 2013). The most recent analysis of temperature data collected at the USGS Station at Montgomery Locks and Dam indicate that from 2009 through 2013, 0.2% of days exceeded the temperature water quality standard and all exceedances occurred in 2012 (ORSANCO 2014).

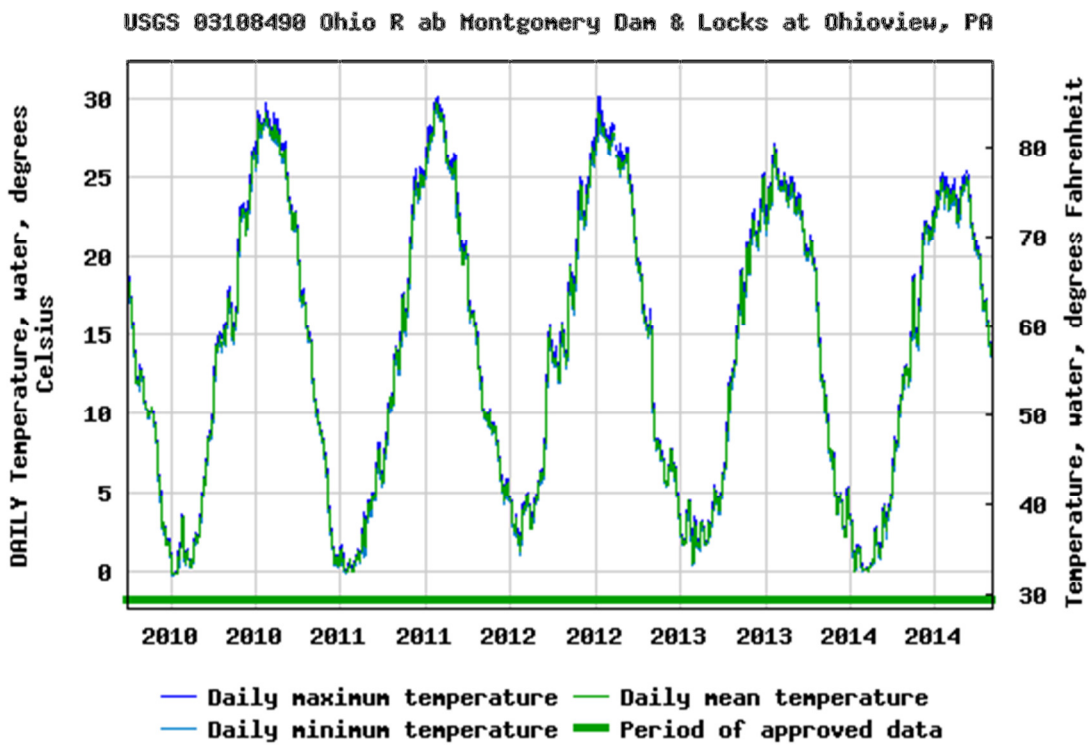


Figure 6: Temperature at Montgomery Dam and Locks from 10/2009 through 10/2014 (USGS 03108490).

Table 4: Mean Monthly Temperature at Montgomery Locks and Dam from 10/2009 through 10/2014 (USGS 03108490). Value is the Mean of Monthly Average Values Reported by the USGS.

Month	Mean Monthly Temperature (°C) (10/2009 – 10/2014)
January	1.4
February	1.9
March	5.6
April	11.5
May	17

Month	Mean Monthly Temperature (°C) (10/2009 – 10/2014)
June	23.2
July	26.4
August	25.7
September	22.7
October	16.1
November	9
December	4.2

Table 5: ORSANCO's water quality criteria for temperature for the Upper, Middle and Lower Ohio River (ORSANCO 2013)

Julian Day	MP 0 to MP 341	MP 341.1 to MP 606.8	MP 606.9 to MP 981
1 - 49	47.1 – 0.086 * Julian Day	47.2 – 0.024 * Julian Day	50.1 – 0.047 * Julian Day
50 - 166	26.6 + 0.328 * Julian Day	34.1 + 0.311 * Julian Day	34.8 + 0.269 * Julian Day
167 - 181	87	87	87
182 - 243	89	89	89
244 - 258	87	87	87
259 - 366	160.8 – 0.300 * Julian Day	176.7 – 0.346 * Julian Day	164.5 – 0.308 * Julian Day

3.6 Flow Regimes

There are no discharge monitoring stations located on the Montgomery Pool. Beaver Valley Power Station (BVPS), just south of Montgomery Locks and Dam, provided an analysis of available flow data that is applicable to the proposed site due to its proximity (approximately 6.5 river miles downstream of the proposed site) and that there are no major tributaries between the two locations. The analysis uses flow data from the closest upstream discharge monitoring station on the Ohio (USGS station 0308600) and a discharge monitoring station on the only major tributary to the Ohio River between the site and the Ohio River discharge monitoring station(USSG Station 03107500 on the Beaver River). The analysis is summarized below (

Table 6) (BVPS 2007).

Based on a 30 year data set, annual mean flow near the site is approximately 39,500 cubic feet per second (cfs). Monthly average flows range from 16,500 cfs in August to 69,900 cfs in March. Flows are generally highest from December through April and lowest in August and September. The 7Q10[9], a descriptor of potential lowest expected flow rate is 5,290 cfs. Table 6 provides flow statistics from this analysis provided by BVPS (2007). For the purpose of developing effluent limits for NPDES permits within the Montgomery Pool, PADEP uses a more conservative 7Q10 of 4,730 cfs as input to their PENTOXSD model per ORSANCO requirements for the Ohio River from Pittsburgh (River Mile 0.0) to the Montgomery Dam (River Mile 31.7).

[9] The 7Q10 is the period of lowest stream flow during a seven-day interval that is expected to occur once every 10 years.

Table 6: Summary of Ohio River Flow Characteristics near Montgomery Locks and Dam (From BVPS (2007) Table 2.2.1)

SUMMARY OF OHIO RIVER FLOW CHARACTERISTICS NEAR MONTGOMERY LOCKS AND DAM[a]													
Monthly Average Flow (cfs)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Min	11,618	24,113	37,987	30,478	18,638	7,387	7,327	5,730	6,025	5,549	7,194	10,548	27,239
Max	91,624	98,337	116,315	104,796	101,267	81,578	55,868	48,947	42,106	56,360	95,006	96,835	59,884
Mean	50,064	57,196	69,944	59,745	42,635	30,738	21,805	16,526	17,610	21,561	35,536	51,771	39,503
Daily Flow Frequency by Percentile (cfs)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
1%	9,630	9,768	14,800	15,050	9,900	5,574	4,993	4,654	4,735	5,020	4,640	6,500	5,348
10%	16,230	18,580	33,140	24,360	14,850	8,710	7,370	6,408	6,257	7,490	10,910	19,380	8,850
50%	42,290	46,760	64,910	54,200	35,460	22,960	14,520	11,600	11,530	14,970	30,620	46,830	30,330

7-Day Low Flows by Recurrence Interval (cfs)			
2-yr	5-yr	10-yr	25-yr
7,070	5,850	5,290	4,750

[a] Based on U.S. Geological Survey flow data from gauging stations at Sewickley (0308600, river mile 11.8) on the Ohio River and at Beaver Falls (03107500) on the Beaver River for the period of record 1971 – 2000

Flood events are common in the Pennsylvania section of the Ohio River due to high local topographic relief, confined river channels, highly sloped river valleys, and a high percentage of precipitation resulting in runoff (PFBC 2010). Although flooding has occurred at any time of year, the period between November through April is particularly prone to these events due to frozen or saturated soils in the drainage area (PFBC 2010).

4 Source Water Baseline Biological Characterization

The length of the Ohio River is divided into 19 Pools created by navigation locks and dams. Sampling of the fish community has been conducted on the Ohio River since the 1950's. From 1957 through 2005 rotenone surveys were conducted at lock chambers where all fish were killed and collected for the study. From 1991 through the present, electrofishing surveys were conducted at sampling locations along the length of each Pool. Under either survey type, each Pool was not surveyed every year (i.e., pools may be surveyed once every several years and not annually). The most recent survey of the Montgomery Pool was an electrofishing survey conducted in 2010 by ORSANCO. The bulk of the fisheries data below has been collected from the ORSANCO fish population database (http://www.orsanco.org/fish-population).

The lock and dam structures on the Ohio River are barriers to upstream fish passage, although fish may have a limited opportunity to pass upstream when the locks are operated. These navigation pools are considerably deeper, have lower water velocities, are more lake-like and have less complex instream habitats than that of tributary rivers such as the Allegheny (PFBC 2010). Substrates in the pools have been altered by dredging, both to improve navigation and for commercial dredging of gravel and sand (PFBC 2010). Although the dredged deeper water of the navigation channels provide less complex habitat overall, deep pools with higher water velocity created at the tail waters of the navigation dams provide substantial habitat for walleye and sauger (PFBC 2010).

Shallow water habitat is limited in the Montgomery Pool due to dredging activities (PFBC 2010). However, significant shoreline habitat has been created through placement of manmade structures (rock gabions, pilings, bridge abutments, abandoned barges and large boulder riprap shoreline structures). These structures provide increased habitat complexity which can be utilized by many aquatic species, predator and prey (PFBC 2010). Shallow backwater channels provide warm still water habitat during normal flows with access to the main river channel. The Montgomery Slough is an example of this type of feature and is located just upstream of the Montgomery Locks and Dam. Two tributary waterways feed into the Montgomery Pool near the proposed site: the Beaver River (upstream) and Raccoon Creek (downstream). These streams can provide river dwelling fish additional opportunity for feeding, spawning areas and nursery areas.

The current fish community in the Montgomery Pool is described by the Commonwealth of Pennsylvania (2015) as a warm water fishery (WWF). The Commonwealth of Pennsylvania defines a warm water fishery in general terms as "[waters that serve to provide] maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat." These waters tend to support most fishes except those such as trout or other salmonids that may not be able to survive in the water body due to summertime water temperatures.

4.1 Surveys of Fish Community in the Montgomery Pool

The fish community in the Ohio River Basin was greatly reduced in the first half of the 20th century due to domestic, mining and industrial pollution (USACE 2014). Populations of pollutant-intolerant species were greatly reduced and tolerant species such as gizzard shad, bullhead catfish, freshwater drum, and common carp increased in abundance (USACE 2014). However, due to efforts by state and federal agencies, fish community abundance in Montgomery Pool has been steadily improving since the 1950s and 1960s (**Figure 7** – data from PFBC 2010) (USACE 2014, PFBC 2010). Rotenone studies at the Montgomery Locks have shown that overall species richness has an increasing trend through 2005 (when lock chamber rotenone surveys ceased). Sport and commercially valuable fish species showed the greatest increase in abundance and many native species that were extirpated from portions of the Ohio River have reclaimed historical ranges (USACE 2014).

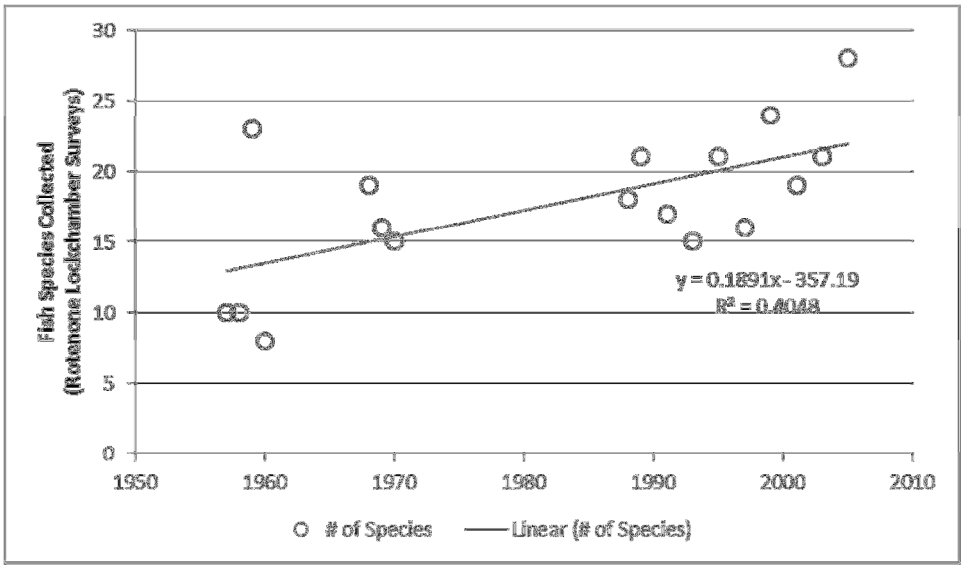


Figure 7: Lock Chamber Rotenone Fisheries Results from Montgomery Locks and Dam 1957 – 2005 with a Line of Best Fit Indicating Greater Fish Species Diversity over Time.

The most recent electrofishing surveys of the Montgomery Pool occurred in 2006 and 2010 (ORSANCO 2007 and 2010). While comparisons between the two years may not be straightforward due to river discharge differences between the sampling events, they do provide recent data on the current fish assemblage in the Montgomery Pool. Approximately 40 taxa were collected during both surveys (ORSANCO 2007 and 2010). The most numerous taxa between the surveys were gizzard shad, golden redhorse, silver redhorse, smallmouth buffalo, bluegill, smallmouth bass and sauger. **Table 7** provides total catch by species for the 2006 and 2010 surveys along with a list of species that have been noted in Montgomery Pool in historical sampling (PFBC 2010, ORSANCO 2007 and 2010).

Table 7: Species Observed in Historical Sampling in Montgomery Pool and Number Of Fish Collected by Species During the Most Recent ORSANCO Electrofishing Sampling Events, 2006 and 2010. Data from PFBC 2010, ORSANCO 2007 and 2010.

Family Common Name	Scientific Name	Historical Presence Noted	2006 Electrofishing Survey	2010 Electrofishing Survey
Polyodontidae (Paddlefishes)				
Paddlefish	*Polyodon spathula* [M]	X		
Lepisosteidae (Gars)				
Longnose gar	*Lepisosteus osseus* [M]	X	10	8
Hiodontidae (Mooneyes)				
Goldeye	*Hiodon alosoides* [M]	X		
Mooneye	*Hiodon tergisus* [M]	X	6	7
Anguillidae (Freshwater Eels)				
American eel	*Anguilla rostrata* [M]	X		
Clupeidae (Herrings & Shads)				
Skipjack herring	*Alosa chrysochloris* [M]	X		
Gizzard shad	*Dorosoma cepedianum*	X	266	4,058
Cyprinidae (Minnows)				
Goldfish	*Carassius auratus* [I]	X		
Central stoneroller	*Campostoma anomalum*	X		
Grass carp	*Ctenopharyngodon idella* [I]	X		
Spotfin shiner	*Cyprinella spiloptera*	X	1	35
Common carp	*Cyprinus carpio* [I]	X	44	44
Striped shiner	*Luxilus chrysocephalus*	X		
Silver chub	*Macrhybopsis storeriana*	X	12	32
Golden shiner	*Notemigonus crysoleucas*	X		
Emerald shiner	*Notropis atherinoides*	X	8	171
River shiner	*Notropis blennius* [E]	X		
Bigeye shiner	*Notropis boops*	X		
Silverjaw minnow	*Notropis buccatus*	X		
Spottail shiner	*Notropis hudsonius* [I]	X		9
Silver shiner	*Notropis photogenis*	X		
Rosyface shiner	*Notropis rubellus*	X		
Sand shiner	*Notropis stramineus*	X		
Mimic shiner	*Notropis volucellus*	X	13	
Channel shiner	*Notropis wickliffi*	X		159
Bluntnose minnow	*Pimephales notatus*	X		21
Fathead minnow	*Pimephales promelas*	X		
Blacknose dace	*Rhinichthys atratulus*	X		
Creek chub	*Semotilus atromaculatus*	X		
Catostomidae (Suckers)				
River carpsucker	*Carpiodes carpio*	X	13	28
Quillback	*Carpiodes cyprinus* [M]	X	30	25

Family Common Name	Scientific Name	Historical Presence Noted	2006 Electrofishing Survey	2010 Electrofishing Survey
Highfin carpsucker	*Carpiodes velifer* [M]	X	37	14
White sucker	*Catostomus commersonii* [M]	X		1
Northern hog sucker	*Hypentelium nigricans* [M]	X	3	7
Smallmouth buffalo	*Ictiobus bubalus* [M]	X	217	79
Black buffalo	*Ictiobus niger*	X		3
Bigmouth buffalo	*Ictiobus cyprinellus* [E, M]	X		1
Silver redhorse	*Moxostoma anisurum* [M]	X	157	132
Smallmouth redhorse	*Moxostoma breviceps* [M]	X	110	25
River redhorse	*Moxostoma carinatum*	X	3	8
Black redhorse	*Moxostoma duquesnii* [M]	X		9
Golden redhorse	*Moxostoma erythrurum* [M]	X	227	282
Ictaluridae (Catfishes)				
White catfish	*Ameiurus catus* [I]	X		
Yellow bullhead	*Ameiurus natalis*	X		
Brown bullhead	*Ameiurus nebulosus*	X		
Channel catfish	*Ictalurus punctatus* [M]	X	34	17
Stonecat	*Noturus flavus*	X		
Flathead catfish	*Pylodictis olivaris* [M]	X	11	12
Esocidae (Pikes)				
Northern pike	*Esox lucius* [M]	X		
Tiger muskellunge	*Esox lucius x Esox masquinongy* [I]	X		
Muskellunge	*Esox masquinongy*	X		
Percopsidae (Trout-perches)				
Trout-perch	*Percopsis omiscomaycus*	X		
Atherinopsidae (New World Silversides)				
Brook silverside	*Labidesthes sicculus*	X		1
Fundulidae (Topminnows)				
Banded killifish	*Fundulus diaphanus*	X		
Moronidae (Temperate Basses)				
White perch	*Morone americana* [I, M]	X		
White bass	*Morone chrysops* [M]	X	36	
Hybrid striped bass	*Morone chrysops x Morone saxatilis* [I]	X		
Unidentified Morone sp.	*Morone* sp. [I]			27
Centrarchidae (Sunfishes)				
Rock bass	*Ambloplites rupestris*	X	8	8
Green sunfish	*Lepomis cyanellus*	X	2	
Pumpkinseed	*Lepomis gibbosus*	X	2	2
Warmouth	*Lepomis gulosus* [E]	X		
Bluegill	*Lepomis macrochirus*	X	216	58
Redear sunfish	*Lepomis microlophus* [I]	X	4	
Smallmouth bass	*Micropterus dolomieu* [M]	X	185	210
Spotted bass	*Micropterus punctulatus*	X	15	5
Largemouth bass	*Micropterus salmoides* [M]	X	8	8
White crappie	*Pomoxis annularis*	X		1
Black crappie	*Pomoxis nigromaculatus*	X	6	1
Percidae (Perches)				
Greenside darter	*Etheostoma blennioides*	X	2	1
Rainbow darter	*Etheostoma caeruleum*	X	4	
*Bluebreast darter	*Etheostoma camurum* [T]	X		
Fantail darter	*Etheostoma flabellare*	X	1	
*Spotted darter	*Etheostoma maculatum* [T]	X		
Johnny darter	*Etheostoma nigrum*	X		

Family Common Name	Scientific Name	Historical Presence Noted	2006 Electrofishing Survey	2010 Electrofishing Survey
*Tippecanoe darter	*Etheostoma tippecanoe* [T]	X		
Banded darter	*Etheostoma zonale*	X	1	
Logperch	*Percina caprodes*	X	67	47
Channel darter	*Percina copelandi*	X	1	
Yellow perch	*Perca flavescens*	X	4	
Blackside darter	*Percina maculata*	X		
River darter	*Percina shumardi*	X		
Sauger	*Sander canadensis* [M]	X	243	92
Saugeye	*Sander canadensis x Sander vitreus*	X		
Walleye	*Sander vitreus* [M]	X	11	21
Sciaenidae (**drums**)				
Freshwater drum	*Aplodinotus grunniens* [M]	X	47	84

Notes:
C = Species is listed as *Candidate* under 58 Pennsylvania Code Chapter 75.
E = Species is listed as *Endangered* under 58 Pennsylvania Code Chapter 75.
I = Introduced species.
M = Species is considered migratory (Wilcox *et al*. 2004).
T = Species is listed as *Threatened* under 58 Pennsylvania Code Chapter 75.
*** =** Bluebreast, spotted and tippecanoe darters are under consideration for de-listing (44 Pa.B. 7876)[10]

Grouping data by family reveals that gizzard shad, suckers, minnows, sunfishes and perches comprise the majority of the fish assemblage during both the 2006 survey and the 2010 survey (**Figure** 8). ORSANCO (2010) postulated that gizzard shad and minnows (primarily emerald shiner) were more numerous in 2010 due to lower river flows that made sampling for these fish more effective.

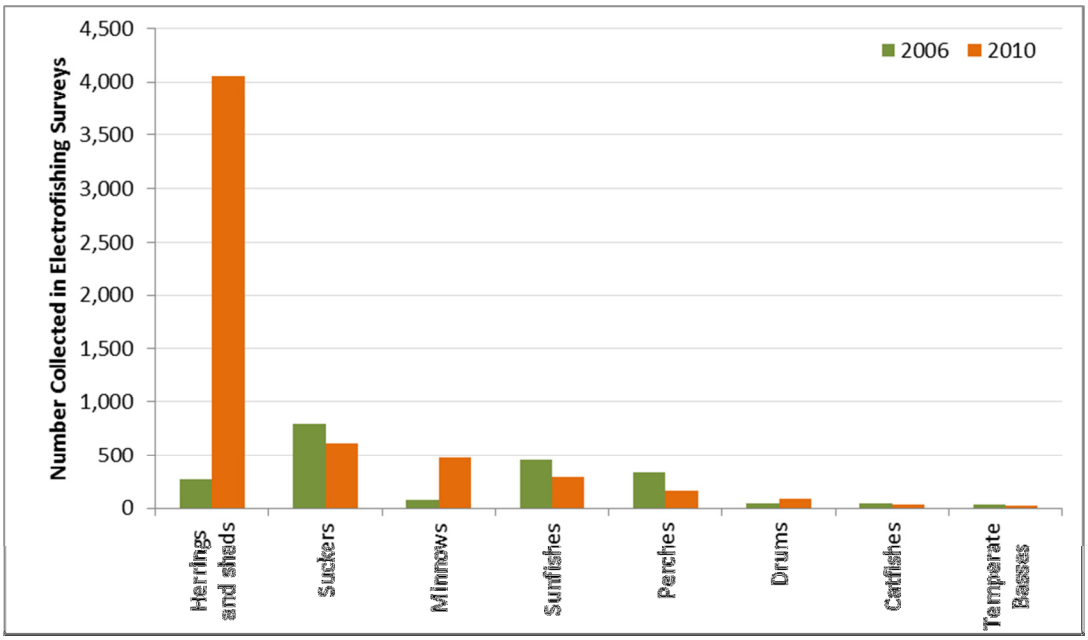


Figure 8: Raw Number of Fish Collected by Family in Electrofishing Samples in 2006 And 2010 in Montgomery Pool, Ohio River. Note, the Herrings and Shads Family Is Represented by a Single Species, Gizzard Shad.

[10] Proposed Rulemaking – Pennsylvania Fish and Boat Commission [58 PA. CODE CH. 75] - Fishing; Endangered Species . Saturday, December 20, 2014. URL: http://www.pabulletin.com/secure/data/vol44/44-51/2621.html

Larval fishes are generally present from March through September in the Upper Ohio River (USACE 2014). Young-of-the-year (YOY) fishes (juveniles) occur concurrently with larval fishes and are present as larval fishes grow. A study of larval and YOY fishes conducted by Pennsylvania State University in 2008 and 2009 yielded 61 species and included several threatened or endangered fishes (Stauffer et. al. 2010 reported in USACE 2014). Tippecanoe darter and bluebreast darter individuals (PA threatened Species) were specifically collected in Montgomery Pool. Fifteen larval sport fish species were also collected indicating that spawning is occurring successfully throughout the upper Ohio River and the three rivers area (USACE 2010).

4.2 2006 – 2007 Impingement Study at NOVA Chemicals/AES Beaver Valley Generating Station

A year-long impingement study was conducted at the NOVA Chemicals/AES Beaver Valley Generating Station cooling water intake structure on the Montgomery Pool in 2006 – 2007. Twenty taxa were collected during 46, 24-hour sampling events. Over 99 percent of the fish collected were gizzard shad and most fish were in the YOY life stage. Impingement rates were greatest in July and August (**Figure 9**).

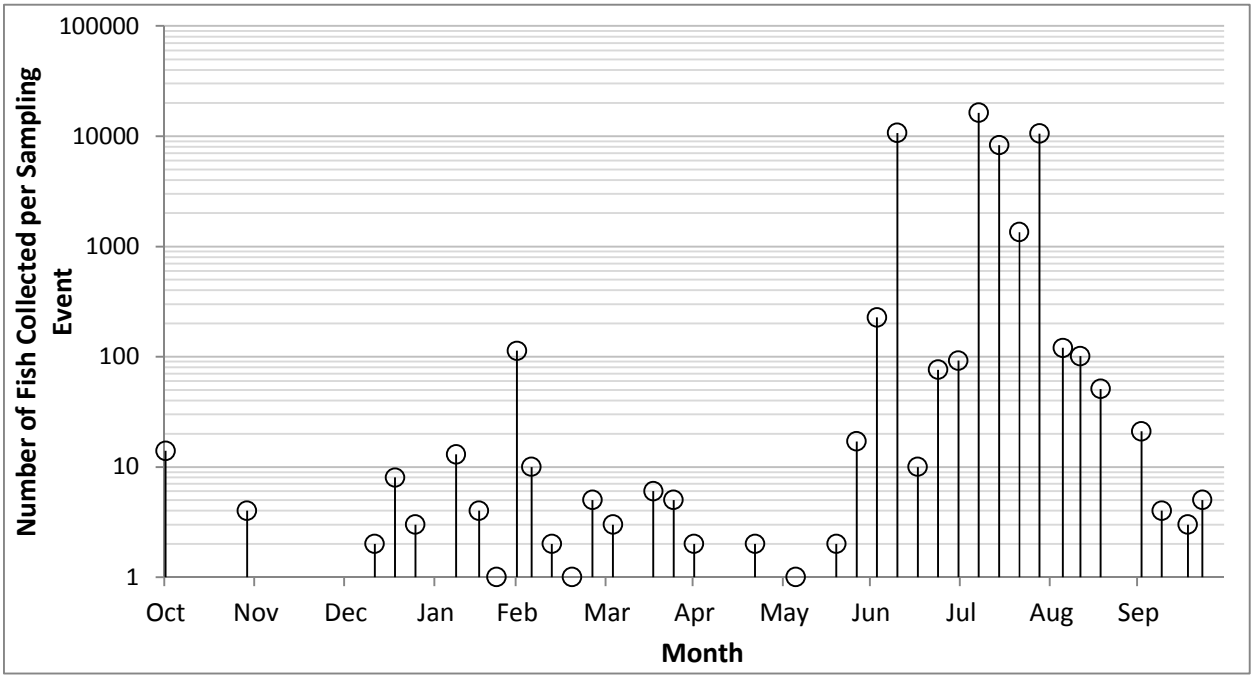


Figure 9: Number of Fish Collected Per Impingement Sampling Event at NOVA Chemical's / AES Beaver Valley Generating Station (2006 - 2007) (ENSR 2008)

Gizzard shad, freshwater drum, white bass, bluegill, and channel catfish were the most frequently collected species (**Table 8**). No taxon besides gizzard shad represented more than 0.5 percent of the total number of fish collected suggesting that impingement of fish from future cooling water intake structures on the Montgomery Pool may be largely dominated by this species. No taxon currently (7/2015) listed as Threatened or Endangered in the State of Pennsylvania was collected during this study.

Table 8: Raw Number of Fish Collected in Impingement Sampling at NOVA Chemical's / AES Beaver Valley Generating Station (2006 - 2007) (ENSR 2008)

Species	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Gizzard shad	-	8	129	8	3	-	9	10,941	36,393	260	37	**47,788**
Freshwater drum	-	1	-	-	2	-	2	35	147	7	3	**197**
White bass	-	-	-	2	3	-	5	173	1	-	-	**184**
Bluegill	-	1	-	1	2	-	-	-	6	1	3	**14**
Channel catfish	-	1	-	-	2	1	-	2	2	3	1	**12**
Sauger	-	1	2	3	-	-	-	-	-	-	1	**7**
White crappie	-	-	-	1	3	-	-	-	2	-	-	**6**
Quillback carpsucker	-	-	-	-	-	1	-	-	2	-	-	**3**
Common carp	-	-	-	-	-	-	2	-	-	-	-	**2**
Emerald shiner	-	-	-	-	-	-	-	1	1	-	-	**2**
Flathead catfish	-	-	-	1	-	-	-	-	-	-	1	**2**
Striped bass	-	-	-	-	-	-	-	1	-	1	-	**2**
Black crappie	-	-	-	-	-	-	-	-	-	-	1	**1**
Largemouth bass	-	-	-	1	-	-	-	-	-	-	-	**1**
Mimic shiner	-	-	-	-	-	-	1	-	-	-	-	**1**
Rainbow smelt	-	-	-	-	1	-	-	-	-	-	-	**1**
Silver chub	-	-	-	-	-	-	-	-	1	-	-	**1**
Silver redhorse	-	-	-	-	-	-	1	-	-	-	-	**1**
Silver shiner	-	-	-	1	-	-	-	-	-	-	-	**1**
Smallmouth bass	-	1	-	-	-	-	-	-	-	-	-	**1**
Monthly Total	**-**	**13**	**131**	**18**	**16**	**2**	**20**	**11,153**	**36,555**	**272**	**47**	**48,227**

4.3 Unionid (Mussel) Community in the Montgomery Pool

According to data provided by PFBC, there are 14 unionid species known to occur in the Montgomery Pool (**Table 9**) (PFBC, 2013). These data are a compilation of survey data and species encounters from a variety of survey efforts from 2001 to 2012. Of the 14 species known to occur in the Montgomery Pool, seven are listed as riverine species indicative of lotic (flowing water) systems with stable habitat. Fragile papershell (*Leptodea fragilis*), mapleleaf (*Quadrula. quadrula*), and pink heelsplitter (*Potamilus alatus*) are considered habitat generalists and are not indicative of riverine species.

Table 9: Recent Live and Fresh Dead Unionid Species Observed in the Pennsylvania Pools of the Ohio River

Species	Common Name	Emsworth	Dashields	Montgomery	New Cumberland
Actinonaias ligamentina	Mucket	-	-	X	X
Alasmidonta marginata	Elktoe	-	-	X	-
Amblema plicata	Three-ridge	-	-	X	-
Anodonta suborbiculata	Flat floater	-	-	-	X
Elliptio dilatata	Spike	-	-	X	X[2]
Lampsilis siliquoidea	Fatmucket	X	-	-	X
Lasmigona complanata	White heelsplitter	-	-	X	X
Lasmigona costata	Fluted-shell	-	X	X	X
Leptodea fragilis	Fragile papershell	-	X[1]	X	X
Ligumia recta	Black Sandshell	-	-	X	X
Obliquaria reflexa	Threehorn wartyback	-	X	X	X

Species	Common Name	Emsworth	Dashields	Montgomery	New Cumberland
Potamilus alatus	Pink heelsplitter	X[1]	X	X	X
Pyganodon grandis	Giant floater	-	-	X	X
Quadrula quadrula	Mapleleaf	-	X	X	X
Truncilla donaciformis	Fawnsfoot	-	X	X	X
Truncilla truncata	Deertoe	-	-	-	X
Utterbackia imbecillis	Paper pondshell	-	-	X	X
Total		**2**	**6**	**14**	**15**

[1] Denotes fresh dead record
[2] Denotes species recently re-introduced

In 2013, URS (now AECOM) performed a study designed to assess the existing mussel community between river miles 27.0 and 29.5 near the proposed cooling water intake structure (URS 2014). Ten species of mussels were observed during the study. No State or Federally listed threatened or endangered mussel species were identified through the Pennsylvania Natural Diversity Inventory (PNDI), or Species Impact Review (SIR) reviews. In addition, no State or Federally listed threatened or endangered mussel species were found during the field study.

4.3.1 Threatened & Endangered (T&E) Species Identified or Potentially to Reside in Montgomery Pool

One bigmouth buffalo was collected in electrofishing samples in 2010 (ORSANCO 2010) and tippecanoe darter and bluebreast darter larvae were collected from the Montgomery Pool in 2008-2009. Bigmouth buffalo are listed as endangered in Pennsylvania while tippecanoe darter and bluebreast darter are listed as threatened[11].

Two other endangered fish species (river shiner and warmouth) and one other threatened species (spotted darter)[11] have been documented in the Montgomery Pool in historical sampling (PFBC 2010). No other Pennsylvania listed threatened, endangered or candidate species have been identified in the Montgomery Pool.

Historically, 53 species of unionids have been recorded within the upper Ohio River drainage basin within Pennsylvania (**Table 10**; Taylor, 1989; PFBC, 2013). There are ten federally endangered species listed within the Ohio River drainage basin in Pennsylvania. The PFBC lists seven state endangered species (some overlap with federal listings) and one state threatened species within the Ohio River drainage basin in Pennsylvania; two of the seven species listed are federally endangered species that had historical occurrences in the Ohio River in Beaver County (USFWS, 2013). None of these species has recent observations in the main stem Pennsylvania portion of the Ohio River. The most recent recording of a state and/or federally listed threatened or endangered unionid species in the Montgomery Pool of the Ohio River was noted by Arnold E. Ortmann, circa 1919.

Table 10: Unionid Records for the Upper Ohio River in Pennsylvania

Species	Common Name	Federal Status[1]	PA Status[1,2]	Montgomery Pool[1,2]	Ohio River[1,3]
Subfamily Ambleminae					
Amblema plicata	Threeridge	-	-	O	R
Cyclonaias tuberculata	Purple Wartyback	-	-	-	R
Elliptio crassidens	Elephantear	-	-	-	R
Elliptio dilatata	Spike	-	-	O	R

[11] Bluebreast, spotted and tippecanoe darters are under consideration for de-listing (44 Pa.B. 7876).

Species	Common Name	Federal Status[1]	PA Status[1,2]	Montgomery Pool[1,2]	Ohio River[1,3]
Fusconaia flava	Wabash Pigtoe	-	-	-	R
Fusconaia subrotunda	Longsolid	-	-	-	R
Plethobasus cooperianus	Orangefoot Pimpleback	E	-	-	H
Plethobasus cyphyus	Sheepnose	E	-	-	R
Pleurobema clava	Clubshell	E	E	-	H
Pleurobema cordatum	Ohio Pigtoe	-	-	-	R
Pleurobema plenum	Rough Pigtoe	E	-	-	O
Pleurobema rubrum	Pyramid Pigtoe	-	-	-	H
Pleurobema sintoxia	Round Pigtoe	-	-	-	H
Quadrula cylindrica cylindrica	Rabbitsfoot	PT	E	-	H
Quadrula metanevra	Monkeyface	-	-	-	R
Quadrula pustulosa	Pimpleback	-	-	-	R
Quadrula quadrula	Mapleleaf	-	-	O	R
Quadrula verrucosa	Pistolgrip	-	E	-	H
Subfamily Anodontinae					
Alasmidonta marginata	Elktoe	-	-	O	O
Pyganodon grandis	Giant Floater	-	-	O	R
Utterbackia imbecillis	Paper Pondshell	-	-	O	R
Anodonta suborbiculata	Flat Floater	-	-	-	O
Anodontoides ferussacianus	Cylindrical Papershell	-	-	-	H
Lasmigona complanata	White Heelsplitter	-	-	O	R
Lasmigona compressa	Creek Heelsplitter	-	-	-	R
Lasmigona costata	Flutedshell	-	-	O	H
Simpsonaias ambigua	Salamander Mussel	-	E	-	O
Strophitus undulatus	Creeper	-	-	-	R
Subfamily Lampsilinae					
Actinonaias ligamentina	Mucket	-	-	O	R
Cyprogenia stegaria	Fanshell		-	-	H
Ellipsaria lineolata	Butterfly	-	-	-	R
Epioblasma torulosa rangiana	Northern riffleshell	E	E	-	H
Epioblasma triquetra	Snuffbox	E	E	-	H
Lampsilis abrupta	Pink Mucket	E	-	-	R
Lampsilis cardium	Plain Pocketbook	-	-	-	O
Lampsilis fasciola	Wavyrayed Lampmussel	-	-	-	H
Lampsilis ovata	Pocketbook	-	-	-	H
Lampsilis siliquoidea	Fatmucket	-	-	-	R
Leptodea fragilis	Fragile Papershell	-	-	O	R
Ligumia recta	Black Sandshell	-	-	O	R
Obliquaria reflexa	Threehorn Wartyback	-	-	O	R
Obovaria olivaria	Hickorynut	-	-	-	H
Obovaria retusa	Ring Pink	-	-	-	H
Obovaria subrotunda	Round Hickorynut	-	-	-	R
Potamilus alatus	Pink Heelsplitter	-	-	O	R
Potamilus ohiensis	Pink Papershell	-	-	-	R
Ptychobranchus fasciolaris	Kidneyshell	-	-	-	H
Toxolasma parvus	Lilliput	-	-	-	R
Truncilla donaciformis	Fawnsfoot	-	-	O	R
Truncilla truncata	Deertoe	-	-	-	H
Villosa fabalis	Rayed Bean	E	E	-	O
Villosa iris	Rainbow	-	-	-	R

Species	Common Name	Federal Status[1]	PA Status[1,2]	Montgomery Pool[1,2]	Ohio River[1,3]
	Total Records	9	7	14	53

[1]E = endangered; T = threatened; PT = Proposed Threatened; O = live record; H = pre 1920; R = recent

[2] PAFBC (unpublished data, 2013)

[3]Taylor (1989) records of mussels in the Upper Ohio River miles zero to 300

4.3.2 Reproduction (Spawning and Recruitment) and Seasonality

Most fish species in the Ohio River drainage spawn in the spring and summer (Ross et al 1982, Auer 1983, Becker 1982). Recruitment of larvae occurs from late spring into early fall. Certain species such as shiner and minnows may mature within their first year. Based on the life histories compiled for potentially susceptible fish species in Section 4.2, May through June is typically the period of greatest spawning activity in the Upper Ohio River. A larval and YOY fish study performed in the upper Ohio River in 2008 and 2009 during the months of March through September yielded 61 species (USACE 2014, Stauffer 2010). Only seven of these species were represented solely by adults suggesting that successful spawning of the majority of collected fish species was occurring throughout the surveyed area (USACE 2014).

Freshwater unionids require a fish host to complete their life cycle. Many species of unionids have separate sexes for adult males and females. However, some species are hermaphroditic and may self-fertilize. Once fertilized, the female adults release tiny glochidia (parasitic larva) into the water column. The parasitic larva requires a specific host (typically fish) to attach to and continue development. The larva attach to gills and/or fins of the host fish where they become blood parasites for a period before transforming into juvenile unionids. The juveniles then release from the host fish and fall into the substrate where they grow into adults. The intermediate fish host is integral to the dispersal and survival of unionids in the systems in which they live. The Pink Heelsplitter and the Fragile Papershell are thought to use the Freshwater Drum as an intermediate host while the Mapleleaf is thought to use the Flathead Catfish and the Channel Catfish as its host. According to the Three Rivers Management Plan, both the Flathead Catfish and Freshwater Drum are common fish species observed in the Montgomery Pool (PFBC, 2010).

4.4 Species Susceptible to Impingement or Entrainment at the Site

For Existing Facilities, fragile species are defined in 40 CFR 125.92(m):

> *Fragile species* means those species of fish and shellfish that are least likely to survive any form of impingement. For purposes of this subpart, *fragile species* are defined as those with an impingement survival rate of less than 30 percent, including but not limited to alewife, American shad, Atlantic herring, Atlantic long-finned squid, Atlantic menhaden, bay anchovy, blueback herring, bluefish, butterfish, gizzard shad, grey snapper, hickory shad, menhaden, rainbow smelt, round herring, and silver anchovy.

Susceptibility to impingement or entrainment is dependent on a number of biotic and abiotic factors, as shown in Table 11. Potential exists for state threatened and endangered fish species observed in the Montgomery Pool to be impinged or entrained. However, it is highly unlikely based on the observed habitat at the location of the existing structure. Additionally, over 99% of the species collected at the nearby Nova Chemical facility were gizzard shad (a fragile but non-listed fish species). The tippecanoe and bluebreast darters were recently proposed for delisting by the PFBC in July 2010.

Table 11: Factors Effecting Susceptibility to Impingement or Entrainment

Category	Factor Type	Factors	Source
Impingement	Abiotic Factors	Water temperature, dissolved oxygen, turbidity, cooling water intake design, and intake velocities.	Baker (2007)
	Biotic Factors	Swimming ability, body shape, size, diel and seasonal movements, and health of the organism.	Baker (2007)
Entrainment	Abiotic Factors	Intake location, water volume used for cooling, velocity at intake, and screen mesh size.	Graham et al. (2008)
	Biotic Factors	Organism size, swimming ability, swimming behavior (pelagic or benthic), diurnal behavior, and spawning habitat.	Graham et al. (2008)

Water quality abiotic factors listed in Table 11 are documented and discussed in Section 3.4. Discussion of species that are most susceptible to impingement or entrainment at the proposed site is focused on documented abundance in the Montgomery Pool and known life history characteristics of those species.

The following taxa and groups are considered to be susceptible to potential impingement or entrainment at the CWIS based on available fish community data, recreational importance, and an understanding of life history of the fishes in the Montgomery Pool, (**Table 12**):

Table 12: Potentially Susceptible Fish Species to Impingement and Entrainment in the Montgomery Pool.

Taxa	Reasoning
Smallmouth bass	Smallmouth bass are one of the most sought after species in the Upper Ohio River/Three Rivers area and the fishery has supported national bass fishing tournaments (PFBC 2010). One of the most abundant recreationally targeted fish in both the 2006 and 2010 ORSANCO electrofishing surveys. Susceptible based on abundance and the presence of persistent populations within the Pool.
Sauger	Sauger is one of the most sought after species in the Upper Ohio River/Three Rivers area and, along with walleye, have developed into a popular fishery (PFBC 2010). In Montgomery Pool, Sauger was more abundant than walleye in surveys conducted by the PFBC from 1990 through 2008 (PFBC 2010). Susceptible based on abundance and the presence of persistent populations within the Pool.
Freshwater drum	A recreational fishery exists for freshwater drum in Montgomery Pool (PFBC 2010). Freshwater drum eggs and larvae are highly susceptible to entrainment due to their buoyant, free floating nature.
Bluegill	Bluegill is the most abundant panfish collected in electrofishing sampling of the Montgomery Pool in 2006 and 2010. Although sunfish are nest builders, the larvae are motile and are susceptible to entrainment. Juvenile and adult bluegill are regularly observed in impingement samples in many freshwater settings.
Gizzard shad	Gizzard shad were the most numerous fish in the 2010 electrofishing sampling of Montgomery Pool and were the most numerous fish collecting in impingement sampling by many power generating facilities on the Ohio River (EPRI 2009). This species can be abundant and be impinged in large numbers, especially during the late fall and winter months when they can experience mortality due to cold water temperature (EPRI 2009).

Taxa	Reasoning
Cyprinidae spp. (shiners and minnows)	Shiner and minnow spp. were abundant in the 2010 electrofishing sampling of Montgomery Pool. Two species, emerald shiner and channel shiner comprised the bulk of the Cyprinidae spp. collected. This group of fish is an important part of the food web for recreationally important species including black bass species, walleye, sauger, and pike/muskellunge. Susceptible based on abundance and the presence of persistent populations within the Pool. Species within this group are generally susceptible to impingement or entrainment throughout their lives due to their small size.
Redhorse sp. (*Moxostoma* spp.)	Redhorse sucker species were the second most numerically dominant group in the 2006 and 2010 electrofishing surveys of Montgomery Pool. Golden redhorse and silver redhorse were consistently abundant between surveys. Although relatively few of these fish are collected in impingement sampling surveys on the Ohio River (EPRI 2009), they are included due to their abundance in the aquatic community surveys. Susceptible based on abundance and the presence of persistent populations within the Pool.
White Bass	Although absent or not abundant during the ORSANCO electrofishing surveys conducted in 2006 and 2010, white bass were the third most abundant species in impingement sampling during the NOVA Chemicals / AES Beaver Valley Generating Station investigation in 2006-2007. This species was primarily collected during July and averaged about four inches in length (YOY life stage). Susceptible based on observed impingement at a nearby cooling water intake.

4.5 Life Histories of Important Taxa

Life history details for taxa or group of taxa potentially susceptible to impingement or entrainment at the proposed site have been gathered from peer reviewed articles, regional and state agency documents, and books containing life history and identification keys. General behavior and preferred habitat details are provided in the text and spawning and early life history details are provided in the tables for each taxa or grouping. See Sections 4.5.5 (Gizzard shad) and 4.5.6 (Cyprinidae spp.) for a discussion of fragile species in the Montgomery Pool.

4.5.1 Smallmouth bass (Edwards et al. 1983)

Smallmouth bass of all life stages exhibit a negative phototaxis and tend to seek some cover away from the light, utilizing submerged debris, vegetation, boulders, etc. Smallmouth bass tend to reside near the edge of the stream's current during the day. Their movement also tends to be restricted to a single pool during a season. Juveniles reside in shallow water, moving into deeper water as adults. Spawning and early life stage information is given in **Table 13**.

Table 13: Smallmouth Bass Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Smallmouth bass	Mid May – June	55-75°F	June - July	Eggs- Demersal and adhesive eggs laid in a nest, protected by the male. Hatch in 2.25-9.5 days. Larvae – Remain in nest for 6-15 days, remain in school above the nest protected by the male for as long as 28 days. High mortality rate after leaving the nest due to predation.

From Becker (1983).

4.5.2 Sauger

Sauger in large rivers are found in backwaters and mouths of slow moving tributaries (Smith 1979). In the Montgomery Pool, they have been noted to be present in the plunge pool created by the Dashields Dam (PFBC 2010). Juvenile sauger prey upon small invertebrates while adults are generally piscivorous (Schell et. al. 2004, Smith 1979). Spawning occurs around April and occurs over gravel or cobble substrate. Females can generally deposit between 5,000 and 40,000 eggs (Auer 1982, Smith 1979). Spawning occurs at night (Becker 1982). Eggs are demersal and adhesive and hatching may take three weeks (Smith 1979). Sauger have been found spawning in habitat immediately downstream of Ohio River navigational dams (Vallazza et. al. 1984 as referenced in Schell et. al. 2004). Spawning and early life stage information is given in **Table 14**.

Table 14: Sauger Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Sauger	April – Early May	39-54°F	May - June	Eggs – Eggs harden in water are demersal and adhesive prior to hardening – semi-buoyant and non-adhesive after hardening. Eggs are round and 1.0 mm to 1.5 mm in length. YOY – juvenile fish in the Ohio River attain a length of at least 8 inched within the first year.

From Becker (1983), Auer (1982) and Schell et. al. (2004).

4.5.3 Freshwater drum

Freshwater drum are primarily a benthic fish. Younger fish (under 20 millimeters) feed in the water column on zooplankton, while adults may occasionally feed on YOY fish in the water column (Ross et al. 2001). Freshwater drum demonstrate 24-hour cyclical in their movements (Rypel and Mitchell 2007). During the day, drum reside in deeper waters, while at night, their densities increase along shorelines (Rypel and Mitchell 2007). Juvenile (age 0 – age 1) drum have the highest presence on the shoreline at night, possibly as a method of predation avoidance (Rypel and Mitchell 2007). Freshwater drum also have shown feeding behavior in the water column during the day, but primarily benthic activity at night (Rypel and Mitchell 2007). It is also possible that freshwater drum shoreline density increases at night due to macroinvertebrate drift also increasing at night. They spawn in the water column, and have planktonic larvae and eggs (Ross et al. 2001). Freshwater drum spawn in the main channel in large rivers such as the Ohio River, generally far from the shore (Wallus and Simon 2006). Eggs are buoyant to semi-buoyant and drift with the current (Wallus and Simon 2006). Spawning and early life stage information is given in **Table 15**.

Table 15: Freshwater Drum Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Freshwater drum [b]	June – August	64-77°F	June - September	Eggs – May be buoyant to semi-buoyant. Deposited in open waters. Hatch between 22 and 36 hours. Most abundant in early summer. Vertical distribution in the water column appears to be uniform in the day, but denser towards the bottom at night. Larvae – Buoyant or semi-buoyant, mostly relying on current transportation. Horizontal swimming

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
				and feeding behavior begins after 6 days post hatching. Yolk sac larvae abundant near surface during daylight, however, post-yolk sac drum more abundant near surface at night. Young of year spend most time on bottom.

From Becker (1983) and Wallus and Simon (2006).

4.5.4 Bluegill

Bluegill of all life stages are opportunistic feeders, feeding on zooplankton and aquatic insects throughout the water column. Bluegill will move into deeper waters during the summer to seek cooler water, as well as during the winter to seek warmer water (Stuber et al. 1982). Young bluegill and other sunfish display behavior where they tend to reside in shallow waters or shoreline during the day, retreating to deeper water at night to avoid predation (Rypel and Mitchell 2007). Spawning and early life stage information is given in **Table 16**.

Table 16: Bluegill Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Bluegill	Late May – Early August; Peak in June	67-80°F	June - September	Eggs – Demersal and adhesive eggs laid in a nest, protected by the male. Bluegill nests are in colonies of 40-50 nests. Hatch in 32.5-71 hours. Larvae – Free swimming 3 days after hatching. Larvae per nest up to 67,000 reported.

From Becker (1983) and Auer (1982).

4.5.5 Gizzard shad

Gizzard shad is considered an open water species, usually residing at or near the surface year round (Miller 1960). Juveniles tend to congregate in shallow water near shore in mid-summer (Miller 1960). Populations tend to peak from late summer to early fall due to the inclusion of YOY (Miller 1960). YOY shad exhibit shoaling behavior, but begin to disperse in the fall (Miller 1960). Shoaling behavior tends to cease after the shad reach 1 year old (Miller 1960). King et al. (2010) describes gizzard shad as an open water, pelagic species demonstrating a negative rheotaxic response to flow and sensitivity to low temperatures and drastic changes in water temperatures. Gizzard shad have also been found to congregate near warm water discharges from industrial facilities during cooler water periods (King et al. 2010). Yu and Peters (2003) documented higher numbers of gizzard shad collected in nighttime electrofishing samples indicating that that gizzard shad may reside higher in the water column at night. Gizzard shad spawning activity also only occurs during nighttime (Miller 1960). Spawning and early life stage information is given in

Table 17.

Table 17: Gizzard Shad Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Gizzard shad	Late April - August	50-70°F	Late April - August	Eggs - Demersal, adhesive, hatch in 36-95 hours. Larvae – Exhibit upward swimming and downward settling behavior, poor swimming ability for several weeks after hatching.

From Becker (1983).

4.5.6 Cyprinidae spp. (Shiners and minnows)

Fishes of the Family Cyprinidae are the largest and most widely distributed family in North America. Certain members of the family can reach considerable sizes and may support commercial fisheries in certain regions. However, the majority of the species in the family are relatively small in size, but extremely diverse. They can make up a large portion of this mid-water biomass in many streams. These smaller Cyprinids are important forage for predatory fish and some can be used as indicators of water quality (Smith 1979). Two species, emerald shiner and channel shiner, were the most abundant Cyprinidae spp. collected in electrofishing sampling of the Montgomery Pool in 2010 when river flows were low and conditions were conducive for collections of smaller fish (ORSANCO 2010). Spawning and early life stage information for these species is given in **Table 18**.

The emerald shiner has been noted to be the most abundant fish in large North American River systems (Smith 1979). This small fish (up to 3.5 in) aggregates into large schools in mid- or surface-waters. Its food consists of small aquatic or terrestrial insects, small crustaceans and algae (Smith 1979). Spawning occurs in the summer, but may commence as early as late May (Becker 1983). Eggs (about 900 to 5,400 per female) are broadcast spawned over sand or gravel substrate free of detritus (Auer 1982). Emerald shiner likely mature within the first year of life (Smith 1979).

The channel shiner has relatively recently been distinguished from the mimic shiner. Both fish occur sympatrically and have overlapping physical characteristics. Hrabik (1996) provides a good summary of what is known about the channel shiner. The channel shiner is generally restricted to large rivers and the lower portions of larger streams. It is often found along the shoreline over mud sand and gravel substrates. Little more is documented for the channel shiner since it had been identified as mimic shiner for so long.

Table 18: Shiner sp. Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Emerald shiner	Late May – Early August	68.2 – 73.8°F, triggered at 72°F	June-August	Eggs – Large (3.0 to 3.3 mm diameter; Demersal, non-adhesive. Larvae – Remain near bottom for 72-96 hours, then become planktonic within the upper 2 m of water, drifting with currents. Fry gather into large schools.
Channel Shiner*	May - July	No Data	June - September	Eggs – Demersal and adhesive until after water hardening. About 1.0 mm in diameter. Three day incubation period. Larvae – Growth is rapid and fish can reach sexual maturity within the year.

From Becker (1983) and Auer (1982).

* Data from mimic shiner a similar species occurring sympatrically with channel shiner.

4.5.7 Redhorse sp. (Moxostoma sp.)

Redhorse are a group of sucker-mouthed fishes in the family Moxostoma. Sucker play an important ecological role in the early stages of the freshwater food web. They feed mostly on aquatic insects, mollusks and crustaceans collected from the substrate. They may make up most of the fish biomass in many streams and they can be a valuable forage fish for larger predatory sport fish (Becker 1983). Spawning and early life stage information for these species is given in **Table 19**.

Golden redhorse are a benthic species, feeding primarily in shallow areas with slow current. Feeding increases throughout the day, significantly increasing after sunset, and peaks an hour before midnight. Golden redhorse tend to retain high site fidelity for most of the year, but have been recorded to travel distances of 13 to 55 km. Movements tend to be minimal during low water periods of mid-summer. Fish will occupy shallow shoals during spawning events in late spring. Spawning activity occurs only during daytime hours (Ross et. al. 1982).

Silver redhorse are very similar in appearance to the golden redhorse and share some of the same life history traits. The Silver redhorse prefers slower currents and fine substrates as can be found in long deep pools in medium to large rivers (Ross et. al 1982 and Smith 1979). Spawning occurs in the spring over gravel in shallow riffles or deep runs (Ross et al. 1982).

Table 19: Redhorse sp. Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
Golden redhorse	May	60-72°F	Late May - June	Eggs – Laid in shallow runs/ripples over gravel. Young of year are 25-45 mm by early august (southern Wisconsin).
Silver Redhorse	April - May	Not specified	May - June	Eggs – Demersal and adhesive, about 3.4 mm in diameter. Yellow in color. Hatching occurs in 5 to 6 days. Larvae – Most growth is observed in July, August and early September. Demersal.

[a] From Becker (1983).

4.5.8 White Bass

White bass are a temperate bass species that can be found throughout the Mississippi River drainage. They prefer open waters of reservoirs or medium to large rivers with slow to moderate currents (Becker 1983). White bass are targeted by recreational fishermen and are governed as panfish in Pennsylvania (PFBC 2005). White bass are prolific and considerable changes in abundance can be observed from year to year (PFBC 2005). Young feed on zooplankton, but transition to a mainly piscivorous diet as they grow (Becker 1983).

Table 20: White Bass. Life History Data - Spawning and Early Life Stages

Species	Spawning Period	Spawning Temperature	Larval Recruitment	Life History Notes
White Bass	April-June	55-79°F	May-June	Eggs – demersal eggs are scattered at or near the surface preferably over firm sand or gravel bottoms. Eggs are 0.7 – 1.2 mm in diameter. Larvae – Larvae less than 4 days old swim vertically throughout the water column, but maintained horizontal position on day 4. Larvae feed on zooplankton.

[a] From Becker (1983).

5 Summary and Conclusions

This assessment summarizes what is currently known concerning the physical and biological aspects of the Montgomery Pool. The aquatic community has been thoroughly studied by ORSANCO since the 1950's. The most recent assessment of the Montgomery Pool is that it meets its aquatic life-use designation. Further information about the early life history of fish residing in the Montgomery Pool is provided by USACE (2014) and Stauffer et al. (2010). The physical characteristics of the Montgomery Pool are dominated by manmade modifications (e.g., Lacks and Dams and dredging) that are on-going and well documented.

The aquatic community of Montgomery Pool was severely degraded in the first half of the 20th century, but has rebounded slowly to its present condition. Native species, once extirpated, have regained their historical ranges and ORSANCO has scored the overall biological condition of the Pool in 2010 as "Good". Despite the heavy modification of the River's hydrology, 85 species of fish have been documented from the Montgomery Pool since the 1950's.

The effects of power facility cooling water withdrawals on the Ohio River have been studied (Perry et al. 2002) and based on analysis of losses of fish at multiple facilities along the length of the Ohio River the authors concluded that in most cases, entrainment and impingement losses have little to no effect on fish populations. Continued annual monitoring of the aquatic community at a power station near the proposed petrochemicals complex (Beaver Valley Power Station on the New Cumberland Pool) as detailed in FirstEnergy Nuclear Operating Company (2014) has documented that no adverse environmental impacts have been evident resulting from station operation. In addition, a year-long impingement study performed within 1.5 miles of the proposed petrochemicals site in 2006-2007 showed that the vast majority of fish impinged (>99 percent) were gizzard shad (an extremely prolific forage fish species). Less than 1 percent of the fish collected were of direct value to recreational fishermen (ENSR 2008).

Data presented herein from the various studies on the Upper Ohio River provide sufficient data to estimate which species may be impacted by impingement or entrainment due to the site CWIS. Additional biological surveys or hydrological studies are not necessary to describe the physical and biological aspects of the source waterbody.

6 References

Auer, N.A. (ed.) 1982. Identification of larval fishes of the Great Lakes Basin with emphasis on the Lake Michigan drainage. Spec. Publ. 82-3, Great Lakes Fish. Comm., Ann Arbor, MI, 744 pp.

Baker, J.L. 2007. Health of Fish Impinged On Cooling-Water Intake Screens. Auburn University. Auburn, AL. May, 2007.

Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press. Madison, WI.

Beaver Valley Power Station (BVPS). 2007. Units 1 and 2 License Renewal Application. Appendix E – Environmental Report. 312 pp.

Commonwealth of Pennsylvania. 2015. Chapter 93. Water Quality Standards – Designated Uses and Water Quality Criteria, §93.9w. Drainage List W. - Ohio River Basin in Pennsylvania. URL: http://www.pacode.com/secure/data/025/chapter93/s93.9w.html

Edwards, E. A., G. Gebhart, and O. E. Maughan. 1983. Habitat Suitability Information: Smallmouth Bass. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-82/10.36. 47pp.

Electric Power Research Institute (EPRI). 2009. Ohio River Ecological Research Program: Impingement Mortality Characterization Study at 15 Power Stations. EPRI, Palo Alto, CA, American Electric Power Company, Columbus, OH, American Municipal Power, Columbus, OH, Allegheny Energy Supply Company, Greensburg, PA, Buckeye Power, Inc., Columbus, OH, Dayton Power & Light, Dayton, OH, Duke Energy, Plainfield, IN, E.ON U.S. (Louisville Gas & Electric), Louisville, KY, E.ON U.S. (Western Kentucky Energy Corporation), Henderson, KY, Ohio Valley Electric Corporation/Indiana- Kentucky Electric Corporation, Piketon, OH, Owensboro Municipal Utilities, Owensboro KY, Tennessee Valley Authority, Chattanooga, TN: 2009. 1018540.

ENSR. 2008. 316(b) Best Professional Judgment for Best Technology Available Report – NOVA Chemicals-AES Beaver Valley Generating Station. Prepared for: NOVA Chemicals, Inc. AES Beaver Valley Cogeneration, Inc. 227 pp.

FirstEnergy Nuclear Operating Company. 2014. Beaver Valley Power Station, 2014 Annual Environmental Operating Report. Non Radiological – Units No. 1 and 2. 500 pp.

Graham, L.F., Dorin, M., Lin, P. 2008. Understanding Entrainment at Coastal Power Plants: Informing a Program To Study Impacts and Their Reduction. Prepared for California Energy Commission. CEC-500-2007-120. March, 2008.

Hrabik, R. 1996. Taxonomic and distributional status of *Notropis volucellus* and *Notropis wickliffi* in the Mississippi River drainage: A literature review. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1996. LTRMP 96-S001. 15 pp.

King, R.G, Seegert, G, Vondruska, J, Perry, E.S, and Dixon, D.A. 2010. Factors Influencing Impingement at 15 Ohio River Power Plants. North American Journal of Fisheries Management. 30:1149-1175, 2010.

Miller, R.R. 1960. Systematic and Biology of the Gizzard shad (Dorosoma cepedianum) and Related Fishes. Fishery Bulletin 173. Fish and Wildlife Service. Volume 60. 1960.

Normandeau Associates Inc. and URS Corporation (Normandeau and URS). 2008. Detailed Characterization of the Aquatic Resources and Impingement Mortality at the Peach Bottom

Atomic Power Station for Peach Bottom Atomic Power Station. Prepared for Exelon. October, 2008.

Ohio River Valley Water Sanitation Commission (ORSANCO). 2010. 2010 Ohio River Pool Assessments – Montgomery, Racine and John T. Myers. ORSANCO Biological Programs. 19 pp.

Ohio River Valley Water Sanitation Commission (ORSANCO). 2013. Pollution Control Standards for Discharges to the Ohio River, 2013 Revision. 66 pp.

Ohio River Valley Water Sanitation Commission (ORSANCO). 2014. Assessment of Ohio River Water Quality Conditions. June, 2014. 75 pp.

Ortmann 1919. A Monograph of the Naiades of Pennsylvania, Part 3: Systematic Account of the Genera and Species. Memoirs of the Carnegie Museum. 8(1): 1-385 (with 21 plates).

Pennsylvania Fish and Boat Commission (PFBC). 2005. White Bass Management and Fishing in Pennsylvania. URL: http://www.fishandboat.com/pafish/bass_white/00whbass_overview.htm.

Pennsylvania Fish and Boat Commission (PFBC). 2010. Three Rivers Management Plan, A Strategy for Managing Fisheries Resources of the Allegheny, Monongahela, and Ohio Rivers. Bureau of Fisheries Management Division Area 8. 172 pp.

Pennsylvania Fish and Boat Commission (PFBC). 2013. Unpublished Data. Mussel Species of the Montgomery Pool of the Ohio River. 2013.

Perry, E., G. Seegert, J. Vondruska, T. Lohner, and R. Lewis. 2002. Modeling Possible Cooling-Water Intake System Impacts on Ohio River Fish Populations. The Scientific World Journal. 2002;2(S1):58–80.

Ross, S.T, Brenneman, W.M, Slack, W.T, O'Connell, M.T, and Peterson, T.L. 2001. The Inland Fishes of Mississippi. University Press of Mississippi. 2001.

Rypel, A.L, and Mitchell, J.B. 2007. Summer Nocturnal Patterns in Freshwater Drum (Aplodinotus grunniens). American Midland Naturalist. Vol. 157, No. 1 (Jan., 2007), pp. 230-234

Schell, S. A., R. S. Hale, S. M. Xenakis, C. J. O'Bara, D. T. Henley, T. C. Stefanavage, and L. D. Frankland. Ohio River Percid Investigation: Ohio River Fisheries Management Team, Technical Committee Final Report No. 2004.1, Ohio Department of Natural Resources, Division of Wildlife, Columbus, OH.

Smith, P.W. 1979. The Fishes of Illinois. Urbana, IL: University of Illinois Press, 314 pp.

Stauffer, J.R. Jr., R Taylor, R Cleaver Yoder, B Lorson, K M. Taylor, and B Fost. 2010. Larval and Young of Year Fish Survey of the Upper Ohio River System, PA. 396 pp.

Taylor, R.W. 1989. Changes in freshwater mussel populations of the Ohio River: 1,000 BP to recent times. *Ohio Journal of Science* 89(5):188-191.

URS. 2014. Shell Proposed Petrochemicals Complex Freshwater Mussel (Unionidae) Survey Report, Ohio River Mile 27.0 – 29.5 Beaver County, Pennsylvania. Prepared for Shell Chemical Appalachia, LLC. February 2014.

USACE. 2014. Upper Ohio Navigation Study, Pennsylvania Draft Feasibility Report and Integrated Environmental Impact Statement - Emsworth, Dashields, and Montgomery Locks and Dams. US Army Corps of Engineers, Pittsburgh District. 378 pp.

Vallazza, J. M., J. W. Deller, W. E. Lynch and D. L. Johnson. 1994. Seasonal behavior, movements, and habitat preferences of hybrid striped bass and sauger in the Ohio River. Final Report for the Ohio Department of Natural Resources, Division of Wildlife, Fish Management in Ohio, Federal Aid in Sport Fish Restoration Project F-69-P.

Wilcox, D.B., E.L. Stefanik, D.E. Kelner, M.A. Cornish, D.J. Johnson, I.J. Hodgins, S.J. Zigler, and B.L. Johnson. 2004. Improving fish passage through navigation dams on the upper Mississippi River system. Environmental Report 54. Upper Mississippi River – Illinois Waterway System Navigation Study. Interim Report. U.S. Army Corps of Engineers.

Yu, S.L Peters, E.J. 2003. Diel and seasonal abundance of fishes in the Platte River, Nebraska, USA. Fisheries Science. 2003, 69:154-160.