Big Rivers
ELECTRIC CORPORATION

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February 7, 2020

VIA HAND DELIVERY

RECEIVED

FEB 07 2020

PUBLIC SERVICE
COMMISSION

Hon. Kent A. Chandler
Executive Director
Public Service Commission
211 Sower Boulevard, P.O. Box 615
Frankfort, Kentucky 40602-0615

Re: *In the Matter of: Application of Big Rivers Electric Corporation for Approval of its 2020 Environmental Compliance Plan, Authority to Recover Costs through a Revised Environmental Surcharge and Tariff, the Issuance of a Certificate of Public Convenience and Necessity for Certain Projects, and Appropriate Accounting and Other Relief*—Case No. 2019-00435

Dear Mr. Chandler:

Enclosed for filing on behalf of Big Rivers Electric Corporation ("*Big Rivers*") are an original and ten (10) copies of: (i) Big Rivers' application for approval of its 2020 Environmental Compliance Plan, a certificate of public convenience and necessity, and other relief; (ii) a motion for confidential treatment; and (iii) a motion for a deviation from certain filing requirements.

807 KAR 5:001 Section 15(2)(d) requires the filing of one (1) electronic copy in portable document format ("PDF") and two (2) copies in paper medium of maps, plans, specifications, and drawings. The maps, plans, specifications, and drawings included in Big Rivers' application are being filed pursuant to the motion for confidential treatment and are not subject to public disclosure under KRS 61.878(1)(m), which protects "records the disclosure of which would have a reasonable likelihood of threatening the public safety by exposing a vulnerability in preventing, protecting against, mitigating, or responding to a terrorist act . . ." As such, and pursuant to 807 KAR 5:001 Section 13(2)(a)(3), also enclosed are one (1) confidential electronic copy in PDF format, and one (1) confidential paper copy, of the maps, plans, specifications, and drawings.

Please feel free to contact me should you have any questions regarding this filing.

Sincerely,

Tyson Kamuf
Corporate Attorney,
Big Rivers Electric Corporation
tyson.kamuf@bigrivers.com

cc: Service List
Hon. Edward T. Depp
Hon. M. Evan Buckley
Hon. R. Brooks Herrick

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

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BIG RIVERS ELECTRIC CORPORATION

**APPLICATION OF BIG RIVERS ELECTRIC CORPORATION
FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN,
AUTHORITY TO RECOVER COSTS THROUGH A REVISED
ENVIRONMENTAL SURCHARGE AND TARIFF,
THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND
NECESSITY FOR CERTAIN PROJECTS,
AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435**

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COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

MOTION OF BIG RIVERS ELECTRIC CORPORATION FOR CONFIDENTIAL PROTECTION

1. Big Rivers Electric Corporation ("Big Rivers") hereby moves the Kentucky Public Service Commission (the "Commission"), pursuant to KRS 61.878 and 807 KAR 5:001 Section 13, to grant confidential protection to certain information contained in Big Rivers' Application submitted contemporaneously herewith in the above-styled matter. The information for which Big Rivers seeks confidential protection is hereinafter referred to as the "Confidential Information." Primarily, the Confidential Information pertains to sensitive estimated and proposed pricing information, financial model outputs, projected budgetary and operations and maintenance ("O&M") costs, detailed facility and operational information, proprietary third-party work product, and critical energy infrastructure information.

2. One (1) copy of the pages containing Confidential Information, with the Confidential Information highlighted with transparent ink, printed on yellow paper, or otherwise marked "CONFIDENTIAL," is being filed under seal in hardcopy format with this motion. 807 KAR 5:001 Section 13(2)(a). Big Rivers is also filing with this motion one (1) CONFIDENTIAL CD. The CONFIDENTIAL CD is confidential in its entirety, and the confidential nature of this material is so-indicated on the yellow label affixed to the CD.

3. If and to the extent the Confidential Information becomes generally available to the public, whether through filings required by other agencies or otherwise, Big Rivers will notify the Commission and have its confidential status removed. 807 KAR 5:001 Section 13(10)(b).

4. As discussed below, the Confidential Information is entitled to confidential treatment pursuant to KRS 61.878(1)(c)(1), which protects "records confidentially disclosed to an agency or required by an agency to be disclosed to it, generally recognized as confidential or proprietary, which if openly disclosed would permit an unfair commercial advantage to competitors of the entity that disclosed the records." In addition, a portion of the Confidential Information also is entitled to confidential treatment under to KRS 61.878(1)(m), which protects "records the disclosure of which would have a reasonable likelihood of threatening the public safety by exposing a vulnerability in preventing, protecting against, mitigating, or responding to a terrorist act . . ." Because the Confidential Information falls within one or both of these exceptions to the disclosure requirement of the Kentucky Open

Records Act, it is entitled to confidential treatment in this proceeding. 807 KAR 5:001 Section 13(2)(a)(1).

I. Big Rivers Faces Actual Competition

5. Big Rivers competes in the wholesale power markets to sell energy it produces in excess of its Members' needs. Big Rivers' ability to successfully compete in the wholesale power markets is dependent upon a combination of its ability to negotiate the maximum price for the power sold and its ability to keep its cost of production as low as possible. If Big Rivers' cost of producing a kilowatt-hour of energy increases, its competitive position against other power producers is adversely affected.

6. Big Rivers also competes for reasonably priced credit in the credit markets, and its ability to compete is directly impacted by its financial results. Lower revenues and any events that adversely affect Big Rivers' margins will adversely affect its financial results and potentially impact the price it pays for credit. A competitor armed with Big Rivers' proprietary and confidential information will be able to increase Big Rivers' costs or decrease Big Rivers' revenues, which could in turn affect Big Rivers' apparent creditworthiness. A utility the size of Big Rivers that operates generation and transmission facilities will always have periodic cash and borrowing requirements for both anticipated and unanticipated needs. Big Rivers expects to be in the credit markets on a regular basis in the future, and it is imperative that Big Rivers improve and maintain its credit profile.

7. As is evidenced by these economic pressures, Big Rivers has "competitors" as contemplated under KRS 61.878(1)(c)(1) and faces actual competition from other market participants.

II. The Confidential Information is Generally Recognized as Confidential or Proprietary

8. The Confidential Information for which Big Rivers seeks confidential treatment under KRS 61.878(1)(c)(1) is generally recognized as confidential or proprietary under Kentucky law. As noted above, much of the Confidential Information throughout the Application and its Exhibits reflects specific estimated cost and savings information related to the projects Big Rivers proposes to pursue as part of this proceeding, including projected capital costs, financing costs, and costs related to ongoing fixed and variable O&M. The Confidential Information also includes sensitive commercial bids and related budgetary information utilized by Big Rivers in connection with anticipated work (Exhibits Pullen-2, Pullen-3, Pullen-4, and Pullen-5) and proprietary financial modeling performed by Big Rivers as part of conducting economic analyses (Exhibit Smith-2). In the Direct Testimony of Mr. Michael T. Pullen, Big Rivers' Vice President of Production (Exhibit G), the Confidential Information includes the expected operating characteristics of Big Rivers' generation facilities (*see* estimated Equivalent Unplanned Outage Rate (EUOR) at p. 21) and confidential detail about Big Rivers' proposed special contract with Nucor Corporation presently pending before the Commission in Case No. 2019-

00365[1] (*see* anticipated load information at p. 6; this information is also contained in the Direct Testimony of Mr. Paul G. Smith, Big Rivers' Chief Financial Officer, at p. 9). Finally, the Confidential Information includes the proprietary reports and data of third-party consultants obtained by Big Rivers (Exhibit Hoydick-2, Hoydick-3, Yoder-2, Yoder-3, and Yoder-4), each of which is replete with operational and financial information and conclusions that detail Big Rivers' facilities and other detailed inner workings. The public disclosure of these reports will inevitably inure to the benefit of the cooperative's competitors, which would gain valuable, non-public information about the cooperative's business and facilities, as well as access to proprietary third-party expertise and analysis of the cooperative. Information such as this is generally recognized as confidential or proprietary.[2]

9. The Confidential Information is not publicly available, is not disseminated within Big Rivers except to those employees and professionals with a legitimate business need to know and act upon the information, and is not disseminated to others without a legitimate need to know and act upon the

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[1] *In the Matter of the Electronic Joint Application of Big Rivers Electric Corporation and Meade County Rural Electric Cooperative Corporation for (1) Approval of Contracts for Electric Service with Nucor Corporation; and (2) Approval of Tariff* (filed Sept. 26, 2019). The Commission granted confidential protection for this and related information by Order entered Jan. 22, 2020, in that docket.

[2] *See, e.g., Hoy v. Kentucky Indus. Revitalization Authority*, 907 S.W.2d 766, 768 (Ky. 1995) ("It does not take a degree in finance to recognize that such information concerning the inner workings of a corporation is 'generally recognized as confidential or proprietary'"); *Marina Management Servs. v. Cabinet for Tourism, Dep't of Parks*, 906 S.W.2d 318, 319 (Ky. 1995) (unfair commercial advantage arises simply from "the ability to ascertain the economic status of the entities without the hurdles systemically associated with the acquisition of such information about privately owned organizations"); Case No. 2019-00115, *In the Matter of: Electronic Application of Grayson County Water District for a Deviation from Meter Testing Requirements of 807 KAR 5:066, Section 16(1)*, Order (Ky. P.S.C. September 19, 2019) (granting confidential protection for proprietary product produced by a third party that was not available to the general public/required membership to obtain and was generally recognized as confidential).

information. As such, the Confidential Information is generally recognized as confidential and proprietary.

III. Disclosure of the Confidential Information Would Permit an Unfair Commercial Advantage to Big Rivers' Competitors

10. Disclosure of the Confidential Information would afford Big Rivers' competitors an unfair commercial advantage. As discussed above, Big Rivers faces actual competition in the power markets and in the credit markets. It is likely that Big Rivers would suffer competitive injury if the Confidential Information were publicly disclosed, and the information should therefore be subject to confidential treatment.

11. In Case No. 2018-00056, the Commission granted confidential treatment to pricing information provided by Cumberland Valley Electric, Inc. ("Cumberland Valley").[3] In that case, the Commission recognized "that the specific cost information may be used to the financial detriment of Cumberland Valley and its ratepayers by allowing potential future vendors to bid just under the cost of its current vendor, which, in turn, would place Cumberland Valley at a competitive disadvantage." Likewise, disclosure of the Confidential Information would afford Big Rivers' contractors, vendors, and competitors access to cost and operational parameters which are material to Big Rivers, thereby allowing them to manipulate contract negotiations and bidding processes. If Big Rivers' potential vendors or

[3] *In the Matter of: Application of Cumberland Valley Electric, Inc. for Commission Approval for a Certificate of Public Convenience and Necessity to Install an Advanced Metering Infrastructure (AMI) System Pursuant to KRS 807 KAR 5:001 and KRS 278.020* (Ky. P.S.C. May 9, 2018).

competitors are privy to detailed information about the cooperative's estimated expenses, operations and maintenance activities, and related information about the inner-workings of the cooperative and its generation assets, the advantage they gain is a competitive disadvantage to Big Rivers, its Member-Owners, and the customers they serve. This is especially true given that Big Rivers faces actual competition in the electricity markets.

12. In Case No. 2003-00054, the Commission likewise granted confidential treatment to contractor bids submitted to Union Light, Heat & Power Company ("ULH&P"). ULH&P argued, and the Commission implicitly accepted, that if the bids it received were publicly disclosed, contractors on future work could use the bids as a benchmark, which would likely lead to the submission of higher bids.[4] The Commission also implicitly accepted ULH&P's further argument that the higher bids would lessen ULH&P's ability to compete with other gas suppliers, under the assumption that higher bids would lead to high prices, and higher prices would lead to higher rates.

13. Similarly, public disclosure of fixed costs and other projected budgetary and O&M costs would give power producers and marketers with which Big Rivers competes in the wholesale power markets insight into Big Rivers' cost of producing power. Knowledge of this information would give those power producers and marketers an unfair competitive advantage because they could use that information

[4] *See In the Matter of: Application of Union Light, Heat & Power Company for Confidential Treatment* (Ky. P.S.C. Aug. 4, 2003).

to potentially underbid Big Rivers in wholesale transactions, reducing Big Rivers' revenue and impairing Big Rivers' ability to compete in the wholesale power and credit markets. Further, any competitive pressure that adversely affects Big Rivers' revenue and margins could make the company appear less creditworthy and thus impair its ability to compete in the credit markets.

14. Thus, Big Rivers' competitiveness will be adversely affected if potential counterparties and competitors are provided with Big Rivers' private, proprietary, and commercially-sensitive information. Accordingly, the public disclosure of the Confidential Information Big Rivers seeks to protect pursuant to KRS 61.878(1)(c)(1) would provide Big Rivers' competitors with an unfair commercial advantage.

IV. Disclosure of the Confidential Information Would Have a Reasonable Likelihood of Threatening Public Safety

15. Certain of the Confidential Information contains detailed information that depicts or describes the location, layout, configuration and operation of critical energy infrastructure, specifically Big Rivers' generating facilities. This Confidential Information is contained in the maps provided at Exhibit C and the drawings, maps, plans, and specifications appended to direct testimony submitted herein. If publicly disclosed, this Confidential Information could be utilized to commit or further a terrorist act, including the intimidation or coercion of all or part of the civilian population and the disruption of public utility and other critical systems. The public release of such Confidential Information has a reasonable likelihood of threatening the public safety, particularly because it reflects detailed, precise, and highly-technical information about the configuration and operations of valuable

infrastructure upon which many individuals and businesses rely. Pursuant to KRS 61.878(1)(m), the records should be exempt from public disclosure.

V. Time Period

16. With respect to the critical energy infrastructure information for which Big Rivers seeks confidential protection under KRS 61.878(1)(m), Big Rivers requests that the Confidential Information be protected indefinitely, at least as long as the relevant facilities are in service. Big Rivers also requests confidential protection indefinitely for the third-party work product and specific bid information reflected in Exhibits Pullen-2, Pullen-3, Pullen-4, Hoydick-2, Hoydick-3, Yoder-2, Yoder-3, and Yoder-4. Moreover, with respect to the information provided concerning Big Rivers' agreement with Nucor, Big Rivers seeks confidential protection indefinitely because for so long as Big Rivers is in the wholesale power market, the public disclosure of the confidential terms of the Agreement could be used to Big Rivers' competitive disadvantage. Finally, Big Rivers requests that the remaining Confidential Information contained in the Application and testimonies remain confidential for a period of five (5) years, which will allow that Confidential Information to become sufficiently historic such that its public disclosure would not provide competitors with an advantage in the marketplace.

VI. Conclusion

17. Based on the foregoing, the Confidential Information is entitled to confidential protection. If the Commission disagrees, then the Commission should hold an evidentiary hearing to protect Big Rivers' due process rights and to supply

the Commission with a complete record to enable it to reach a decision with regard to this matter. *See Utility Regulatory Com'n v. Kentucky Water Service Co., Inc.*, 642 S.W.2d 591 (Ky. App. 1982).

WHEREFORE, Big Rivers respectfully requests that the Commission classify and protect as confidential the Confidential Information.

This 7th day of February, 2020.

Respectfully submitted,

BIG RIVERS ELECTRIC CORPORATION

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FEB 07 2020

PUBLIC SERVICE COMMISSION

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	**Case No. 2019-00435**

MOTION OF BIG RIVERS ELECTRIC CORPORATION FOR PERMISSION TO DEVIATE FROM COMMISSION RULE

1. Big Rivers Electric Corporation ("Big Rivers") hereby moves the Kentucky Public Service Commission (the "Commission"), pursuant to 807 KAR 5:001 Section 22, to permit Big Rivers to deviate from the requirements of 807 KAR 5:001 Section 15(2)(d)(2).

2. Big Rivers' has contemporaneously submitted herewith its Application in the above-styled matter wherein, *inter alia*, the cooperative requests that the Commission grant a Certificate of Public Convenience and Necessity ("CPCN") for certain of the projects proposed as part of Big Rivers' 2020 Environmental Compliance Plan (the "2020 Plan"). Pursuant to the rules of the Commission, and specifically 807 KAR 5:001 Section 15(2)(d)(2), an applicant seeking a CPCN for the construction or extension of any plant, equipment, property, or facility must submit

with its application *"plans and specifications and drawings of the proposed plant, equipment, and facilities."*

3. With its Application, Big Rivers has provided multiple maps, plans, technical drawings, specifications, and other documents describing and depicting the proposed activities and facilities the cooperative seeks to include within its 2020 Plan. The proposed projects are at various stages of the engineering and design process, and no construction has begun with respect to any proposed plant, equipment, property, or facility, consistent with KRS 278.020.[1] While Big Rivers and its consultants continue to complete and refine engineering plans and drawings, the documentation thus far provided remains primarily preliminary in nature. Big Rivers intends to supplement its Application filed herein as more detailed plans and specifications become available during this proceeding.

4. Out of an abundance of caution, Big Rivers requests the Commission's permission to deviate from 807 KAR 5:001 Section 15(2)(d)(2) to the extent the rule requires the submission of fully-detailed or final specifications and drawings related to Big Rivers' proposed projects. Big Rivers believes it has complied or substantially complied with the Commission's rules in this respect, but also asserts good cause

[1] For certain of its proposed projects, identified in the Application as Project 13-3, Project 14, Project 15 and Project 16, Big Rivers does not believe a CPCN is necessary. Project 13-3, concerning closure of the coal ash pond owned by the City of Henderson, is outside the scope of KRS 278.020; Projects 14, 15, and 16, which concern compliance efforts at the cooperative's special waste landfills and surface impoundments, are ordinary extensions of existing systems in the usual course of Big Rivers' business, and thus also do not require a CPCN under KRS 278.020. These matters are discussed in detail in the Application and accompanying testimony. To the extent the Commission determines a CPCN is required for those projects, and thus the requirements of 807 KAR 5:001 Section 15(2)(d)(2) are applicable, Big Rivers requests permission to deviate from those requirements as necessary.

exists to grant the requested relief in light of the materials already submitted and Big Rivers' representation regarding further supplementation of the record to the extent possible and appropriate.

WHEREFORE, Big Rivers respectfully requests that the Commission permit the deviation requested herein, as necessary.

This 7th day of February, 2020.

Respectfully submitted,

BIG RIVERS ELECTRIC CORPORATION

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ORIGINAL

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

APPLICATION

and

APPLICATION EXHIBITS

FILED: February 7, 2020

ORIGINAL

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

APPLICATION

Comes now Big Rivers Electric Corporation ("Big Rivers" or "the Company"), by counsel, pursuant to KRS 278.020, KRS 278.183, KRS 278.220, 807 KAR 5:001, 807 KAR 5:011 and other applicable law, and for its Application in the above-captioned matter, respectfully states as follows.

Introduction

1. Consistent with KRS 278.183, Big Rivers seeks approval from the Kentucky Public Service Commission ("Commission") of the Company's 2020 Environmental Compliance Plan (the "2020 Plan"), which includes several projects necessary to ensure the Company's coal-fired generation facilities remain compliant with applicable federal, state, and local environmental requirements. Big Rivers requests the current recovery by surcharge of the reasonable costs it has incurred and

will incur in connection with the 2020 Plan projects, as well as the grant of a Certificate of Public Convenience and Necessity ("CPCN"), as required under KRS 278.020, for certain of the proposed 2020 Plan projects. Big Rivers further seeks: (i) approval to begin settlement of existing asset retirement obligations ("AROs") and amortization of corresponding regulatory assets related to the required closure of coal ash ponds at the Green Station and Reid/HMP&L Station Two; (ii) authority to establish and amortize a regulatory asset for the income statement impacts associated with forthcoming ARO-related liabilities arising from the Company's Coleman Station ash ponds; (iii) approval to begin amortization of an existing regulatory asset reflecting deferred costs of compliance with the Disposal of Coal Combustion Residuals ("CCR") from Electric Utilities Rule ("CCR Rule"); and (iv) approval to establish a regulatory asset for the reasonable expenses incurred in developing and pursuing the relief requested herein and the recovery of those expenses over a reasonable period.

2. The projects Big Rivers proposes to pursue as part of the 2020 Plan include:

i. the replacement and upgrade of the existing flue gas desulfurization ("FGD") system and related equipment necessary for environmental compliance at the Company's coal-fired, single-unit 417 MW D.B. Wilson Station ("Wilson Station") utilizing the FGD presently in place at Big Rivers' Kenneth C. Coleman Station ("Coleman Station"), as well as updated dewatering facilities and wastewater treatment ("WWT") improvements (herein "Project 12");

ii. the closure of three coal ash pond sites utilized by the Company's coal-fired generation facilities (herein "Project 13"), specifically:

- closure of the coal ash pond at the Company's Robert D. Green Station ("Green Station") and associated repurposing of a portion thereof as a new Water Mass Balancing Pond ("WMB Pond"), as well as the modification of the Green Station's FGD WWT systems for upset and maintenance conditions (herein "Project 13-1");

- closure of the Coleman Station's three coal ash ponds, known as the as the South Pond, Sluice Pond, and North Pond (herein "Project 13-2"); and

- closure of the coal ash pond owned by the city of Henderson, Kentucky ("City of Henderson"), and formerly utilized in connection with the operation of Big Rivers' Robert A. Reid Station ("Reid Station") and Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("HMP&L Station Two") (herein "Project 13-3");

iii. the installation of a final cover system for the Wilson Station's Phase 1 CCR landfill ("Project 14"); and

iv. the installation of a perimeter drainage system and implementation of other groundwater and non-groundwater protection measures at the Green Station's CCR landfill ("Project 15").

3. Big Rivers also seeks to include for recovery in its 2020 Plan certain costs associated with completed and ongoing projects undertaken by the Company to comply with the CCR Rule at the Wilson, Green, and Reid/HMP&L Stations (herein "Project 16"). Project 16 reflects expenses incurred by the Company during and after 2015 that have been deferred as part of the regulatory assets (the "CCR Regulatory Assets") approved by the Commission in Case No. 2015-00333.[1]

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[1] *In the Matter of: Application of Big Rivers Electric Corporation for Authority to Establish Regulatory Assets for Expenses Related to the Coal Combustion Residuals Rule* (Ky. P.S.C. Jan. 5, 2016).

4. The projects that comprise the 2020 Plan are the result of environmental requirements applicable to coal combustion wastes and by-products from facilities utilized for production of energy from coal.[2] As a generator that has historically relied predominantly upon coal-fired assets, Big Rivers must ensure continued compliance with, *e.g.*, the CCR Rule, the Effluent Limitation Guidelines and Standards for the Steam Electric Power Generating Point Source Category ("ELG Rule"), and the Kentucky Pollutant Discharge Elimination System ("KPDES") permitting authority. Moreover, Big Rivers' reliable production of affordable energy from coal, both historically and prospectively, also requires the Company's compliance with many other federal and state requirements, including the federal Clean Air Act ("CAA") and the multitude of relevant rules and programs promulgated thereunder by the U.S. Environmental Protection Agency ("EPA"), including Title V operating permit requirements and the Mercury and Air Toxics Standards ("MATS"). The 2020 Plan reflects Big Rivers' careful and thorough approach to addressing the environmental compliance challenges presented by the relevant regulatory framework.

5. As detailed in this Application and in the testimony and other documents provided herewith, each component of the 2020 Plan has been examined by Big Rivers and its expert consultants to ensure it is a reasonable, necessary, and cost-effective course of action to achieve current and future compliance with relevant law. The 2020 Plan projects also reflect the Company's sensible and responsible approach to addressing existing and imminent obligations while maintaining a

[2] *See* KRS 278.183(1).

dependable and diverse capacity profile. Consistent with KRS Chapter 278 and this Commission's regulations and precedent, Big Rivers requests an Order granting the relief requested herein.

Overview of Big Rivers Electric Corporation

6. Big Rivers is a rural electric generation and transmission cooperative established under KRS Chapter 279. It is headquartered in Henderson, Kentucky. Big Rivers owns, operates and maintains electric generation and transmission facilities, and it purchases, transmits, and sells electricity at wholesale. It exists for the principal purpose of providing the wholesale electricity requirements of its three distribution cooperative Member-Owners: Jackson Purchase Energy Corporation ("JPEC"), Kenergy Corp. ("Kenergy"), and Meade County Rural Electric Cooperative Corporation ("MCRECC") (collectively, the "Members" or "Member-Owners"). The Members, in turn, provide retail electric service to their approximately 118,000 distribution cooperative member-owners located in all or parts of 22 western Kentucky counties: Ballard, Breckenridge, Caldwell, Carlisle, Crittenden, Daviess, Graves, Grayson, Hancock, Hardin, Henderson, Hopkins, Livingston, Lyon, Marshall, McCracken, McLean, Meade, Muhlenberg, Ohio, Union, and Webster.

7. Big Rivers presently owns 1,444 MW of predominately coal-fired generation at three locations: the Wilson Station located near Centertown, Kentucky; the Coleman Station near Hawesville, Kentucky; and the Sebree Station located in Sebree, Kentucky. Big Rivers has also contracted for 178 MW of hydroelectric

capacity from the Southeastern Power Administration ("SEPA"), as well as maintains several small solar arrays (totaling 120 kW direct current) for educational purposes.

8. Big Rivers' Wilson Station consists of a single pulverized coal unit with a total rated net generating capacity of 417 MW. It includes a Foster Wheeler boiler, Westinghouse turbine generator, and an FGD system comprised of four horizontal absorbers first commercialized in 1986. A total of 105 skilled employees are involved in the operation of the Wilson Station, which has proven to be a reliable source of baseload generation for Big Rivers and its Members for many decades.

9. Big Rivers' Coleman Station consists of three pulverized coal units with a total rated net generating capacity of 443 MW. Each unit includes a boiler and turbine generator commercialized between 1969 and 1972. The FGD system present at the Coleman Station is of the Wheelabrator Air Pollution Control design and includes a single vertical absorber first commercialized in May of 2007. In May of 2014, the Coleman Station was idled and is presently incapable of operating in compliance with relevant environmental regulation (most notably, MATS). Big Rivers is planning to retire the Coleman Station by the end of 2020.

10. The Sebree Station includes multiple generating plants, specifically the Green Station, the Reid Station, and HMP&L Station Two. The Green Station consists of two coal-fired units with a combined total rated net generating capacity of 454 MW. The Reid Station includes a natural gas-fired combustion turbine (net capacity of 65 MW), as well as a coal-fired unit first commercialized in 1966 (net capacity of 45 MW, idled since April of 2016). HMP&L Station Two includes two coal-

fired units owned by the City of Henderson that were retired effective February 1, 2019.[3]

11. Big Rivers presently maintains coal ash ponds at the Coleman and Sebree Stations and special waste landfills at the Wilson and Sebree Stations. These facilities are a consequence of Big Rivers' production of energy from coal and are the focus of significant environmental regulation in light of the CCR and other waste materials they contain.

12. Big Rivers is a member of Midcontinent Independent System Operator, Inc. ("MISO") and participates in that Regional Transmission Organization's ("RTO") real-time and day ahead markets. After ensuring the satisfaction of its native load, Big Rivers capitalizes on its available capacity in a number of ways. For instance, Big Rivers has successfully received Commission approval to execute wholesale full-requirements purchased power contracts with entities in the State of Nebraska through 2026.[4] Further, Big Rivers has negotiated an agreement to satisfy the full

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[3] As the Commission is aware, between 1970 and 2019 Big Rivers operated and maintained HMP&L Station Two as an independent contractor and purchased a portion of the facility's 312 MW capacity. Big Rivers and the City of Henderson also shared (and continue to share) certain facilities at the Sebree Station, pursuant to the parties' Joint Facilities Agreement originally executed in 1970. While most of the relevant contracts ("Station Two Contracts") have terminated by their terms, Big Rivers remains obligated for a portion of certain costs—such as those related to the closure of the Station Two coal ash pond—under the Joint Facilities Agreement. *See* Case No. 2018-00146, *In the Matter of: Notice of Termination of Contracts and Application of Big Rivers Electric Corporation for a Declaratory Order and for Authority to Establish a Regulatory Asset* (Ky. P.S.C. Aug. 29, 2018); Case No. 2019-00269, *In the Matter of: Application of Big Rivers Electric Corporation for Enforcement of Rate and Service Standards* (filed July 31, 2019). This matter is discussed in detail in the Direct Testimony of Mr. Michael T. Pullen, Big Rivers' Vice President of Production, submitted herewith at Exhibit E.

[4] *See* Case No. 2014-00134, *Big Rivers Electric Corporation Filing of Wholesale Contracts Pursuant to KRS 278.180 and 807 KAR 5:011 §13* (Ky. P.S.C. July 21, 2015).

capacity and energy requirements of Owensboro Municipal Utilities through 2026.[5] It also provides dispatchable power to nine communities which are members of the Kentucky Municipal Energy Agency (KyMEA) into 2029.[6] Additionally, Big Rivers owns, operates and maintains approximately 1,297 miles of lines and related infrastructure, which provides for the transmission of power to its Members and third-party entities consistent with the MISO tariff.

General Requirements

13. Pursuant to 807 KAR 5:001 Section 14(1), Big Rivers states that its mailing address is P.O. Box 24, 201 Third Street, Henderson, Kentucky, 42419. Big Rivers' electronic mail address for purposes of this proceeding is regulatory@bigrivers.com.

14. Pursuant to 807 KAR 5:001, Section 14(1), Big Rivers states that this Application and the supporting exhibits, which are incorporated herein by reference, contain fully the facts on which the relief requested by Big Rivers is based.

15. Pursuant to 807 KAR 5:001, Section 14(2), Big Rivers states that it is a Kentucky non-profit cooperative corporation, in good standing, and it was incorporated on June 14, 1961.

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[5] A copy of this contract, effective July 27, 2018, is available via the Commission's online library: https://www.psc.ky.gov/Home/Library?type=Tariffs&folder=Electric%5CBig%20Rivers%20Electric%20Corporation%5CContracts (last accessed February 5, 2020).

[6] *See* Case No. 2016-00306, *Filing of Agreement for the Purchase and Sale of Firm Capacity and Energy between Big Rivers Electric Corporation and the Kentucky Municipal Energy Agency* (Ky. P.S.C. Dec. 12, 2016).

16. Pursuant to KRS 278.183(2), Big Rivers provided the Commission at least thirty (30) days' advanced notice of the Company's intent to file this Application.[7] Big Rivers has also publicly posted and mailed to each of its Members a written notice containing specific information about this filing, consistent with 807 KAR 5:011, Section 8.[8]

Environmental Compliance at Big Rivers

17. Big Rivers has historically relied on the output of coal-fired resources to supply the wholesale electric requirements of its Member-Owners and satisfy off-system load. Although the Company's generation portfolio has changed and continues to evolve, Big Rivers is compelled to maintain compliant operations and maintenance of its coal-fired facilities consistent with increasingly-stringent environmental standards and restrictions. The Company's more-significant undertakings in this respect have been the subject of previous proceedings before this Commission and were approved for inclusion in earlier Big Rivers' Environmental Compliance Plans.

The 2007 Plan and 2012 Plan

18. Big Rivers was first authorized to implement an environmental surcharge by Order of this Commission entered June 26, 2008, in Case No. 2007-

[7] This notice was provided by letter dated December 2, 2019, and a copy is attached hereto as Exhibit A.

[8] This notice was posted and mailed on February 7, 2020, and a copy is attached hereto as Exhibit B.

00460.[9] This initial Environmental Compliance Plan (the "2007 Plan") included three projects or programs designed to ensure compliance with emissions standards governing sulfur dioxide (SO_2), nitrous oxides (NO_x), and sulfur trioxide (SO_3), respectively. Big Rivers was authorized by the Commission to recover by surcharge its reagent costs, emissions allowances, and similar variable operations and maintenance expenses associated with these compliance programs, and it continues to do so at present.

19. Big Rivers' second Environmental Compliance Plan was approved in Case No. 2012-00063 (the "2012 Plan").[10] The 2012 Plan, as initially proposed, included eight (8) projects developed for compliance primarily with the Cross State Air Pollution Rule ("CSAPR") and MATS. These proposed projects included the installation of new FGD equipment and technology at the Wilson Station, modernized selective catalytic reduction ("SCR") equipment and technology at the Green Station, and an upgraded FGD system at HMP&L Station Two. However, due in significant part to the last-minute vacatur of CSAPR,[11] the 2012 Plan as-approved ultimately

[9] Case No. 2007-00460, *Application of Big Rivers Electric Corporation for Approval of an Environmental Compliance Plan and Environmental Surcharge Tariff* (Ky. P.S.C. June 26, 2008).

[10] Case No. 2012-00063, *Application of Big Rivers Electric Corporation for Approval of its 2012 Environmental Compliance Plan, for Approval of its Amended Environmental Cost Recovery Surcharge Tariff, for Certificates of Public Convenience and Necessity, and for Authority to Establish a Regulatory Account* (Ky. P.S.C. Oct. 1, 2012).

[11] *See id.*, at 17 ("On August 21, 2012, one day before the formal evidentiary hearing in this matter, the D.C. Circuit Court of Appeals, in the case of *EME Homer City Generation, L.P. v. Environmental Protection Agency*, rendered an opinion vacating CSAPR and ordering the EPA to continue to implement CAIR until the agency can promulgate a replacement program, which will maintain the status quo as to emission reduction requirements. As a result of this decision, Big Rivers, pursuant to the Settlement Agreement, agreed to withdraw the three CSAPR-related projects from its 2012 Plan.").

included just four (4) projects, consisting of the installation of activated carbon injection and dry sorbent injection systems at the Coleman, Wilson, and Green Stations and continuous emissions monitoring at those plants and at HMP&L Station Two. The dry sorbent injection system was not ultimately installed at the Coleman Station due to the idling of the station in 2014.

20. Costs associated with Big Rivers' 2007 Plan and 2012 Plan have been and continue to be recovered from ratepayers through operation of the environmental surcharge mechanism ("ESM") detailed in Big Rivers' filed tariff. The environmental surcharge is adjusted monthly to ensure the current recovery of Commission-approved environmental compliance costs, as set forth in KRS 278.183. The ESM provides for monthly adjustments based on a percent of revenues equal to the difference between the environmental compliance costs in the base period and in the current period. The surcharge includes costs for reagent, emissions allowances, and similar variable operation and maintenance expenses associated with the SO_2, SO_3 and NO_x compliance programs from the 2007 Plan as well as the return of and on the four projects related to activated carbon injection, dry sorbent injection, and continuous emissions monitoring included in the 2012 Plan. In its most recent review, the Commission found reasonable and approved the amounts billed by Big Rivers through its environmental surcharge for the period of August 1, 2018, through January 31, 2019, without any adjustments.[12]

[12] *See* Case No. 2019-00172, *In the Matter of: An Electronic Examination By The Public Service Commission Of The Environmental Surcharge Mechanism Of Big Rivers Electric Corporation For The Six-Month Billing Period Ending January 31, 2019, And The Passthrough Mechanism Of Its Three Member Distribution Cooperatives* (Ky.P.S.C. October 25, 2019).

Continued Compliance Efforts

21. Since the Commission's approval of the projects comprising the 2012 Plan, Big Rivers has continued to undertake various environmental compliance efforts in the usual course of business with respect to its coal-fired generation resources. For example, at the Wilson Station, Big Rivers has installed groundwater monitoring wells, conducted groundwater data analysis, ensured special waste containment, and incorporated a new leachate collection and treatment system. Similarly, at the Green Station, Big Rivers has constructed a collection trench and an interceptor trench within the Green Station's landfill to ensure leachate is properly collected and treated. These and additional smaller projects, referred to herein collectively as Project 16, have been undertaken by Big Rivers as necessary to ensure continued compliance with the CCR Rule and related applicable requirements. The costs of these projects have been and continue to be deferred by Big Rivers as part of the CCR Regulatory Assets approved in Case No. 2015-00333.

22. In Case No. 2015-00333, Big Rivers also sought and was granted authority to establish regulatory assets for the income statement impacts (including gains, losses, depreciation and accretion expense) resulting from AROs related to its Green and Reid/Station Two ash ponds (the "Green ARO Regulatory Asset" and "Reid/Station Two ARO Regulatory Asset," respectively). Big Rivers recognized AROs for those ash ponds upon publication of the CCR Rule in April of 2015, as required by the Rural Utilities Service Uniform System of Accounts ("RUS USoA"), which is the established system of accounts kept by Big Rivers under KRS 278.220.

23. In addition to the ash ponds at the Green Station and Reid/Station Two, Big Rivers also maintains ash ponds at its Coleman Station. Because the Coleman Station was idled at the time the CCR Rule was published and has remained idled since, its ash ponds have historically been exempt from regulation as inactive impoundments at an inactive facility (also known as "legacy ponds").[13] As a result, Big Rivers was not required to recognize an ARO with respect to the Coleman Station ash ponds in 2015.

New and Expanded Environmental Compliance Requirements

24. As the Commission is aware, Big Rivers and other coal-based electric generators face a complicated and ever-changing regulatory landscape that requires constant planning, analysis, and adaptation. This fact is evidenced by the events surrounding Big Rivers' most-recent environmental compliance plan case. There, a U.S. Court of Appeals decision vacating CSAPR significantly altered the scope of the Company's 2012 Plan; two years later, however, the U.S. Supreme Court would reverse the lower court's holding, leading to the effective reinstatement of CSAPR and its limitations on sulfur dioxide (SO_2) and oxides of nitrogen (NO_X) emissions.[14]

25. More recently, on August 21, 2018, the U.S. Court of Appeals for the District of Columbia Circuit vacated and remanded a number of provisions within the CCR Rule, including those that exempt legacy ponds (like those at the Coleman

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[13] *See* 40 C.F.R. § 257.50(e).

[14] *Environmental Protection Agency et al. v. EME Homer City Generation, L. P., et al.*, 572 U.S. 489 (2014).

Station) from regulation.[15] The EPA is presently examining the path forward for implementation of this decision,[16] and it is also expected that the ponds will be subject to the Kentucky Administrative Regulations (KAR) for special waste facilities or forthcoming state regulations specifically applicable to disposal of CCR. In light of these developments, Big Rivers has thoroughly examined its Coleman Station ash ponds and requests the Commission's permission to pursue a sensible approach to those forthcoming obligations.

26. Consistent with its efforts to provide safe, cost-effective, and reliable wholesale electric power, Big Rivers continuously monitors and evaluates the federal, state, and local environmental requirements applicable to the coal combustion wastes and by-products of its generation resources. Big Rivers' 2020 Plan includes only reasonable measures necessary and appropriate to ensure continued environmental compliance at the Wilson, Green, Coleman, and Reid/HMP&L Station Two facilities, and it reflects the careful, detailed internal and external scrutiny demanded by the important matters under examination.

The 2020 Plan

27. Big Rivers' 2020 Environmental Compliance Plan consists of five primary Projects and a number of identified sub-projects, each reflecting a reasonable

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[15] *Util. Solid Waste Activities Grp. (USWAG) v. EPA*, 901 F.3d 414 (D.C. Cir. 2018) ("Because the administrative record belies the EPA's stated reason for its reactive, rather than preventative, approach—the inability to identify the responsible parties—the Rule's legacy ponds exemption is unreasoned, arbitrary, and capricious.").

[16] *See* RIN: 2050-AH11, *Disposal of CCR from Electric Utilities; A Holistic Approach to Closure Part B: Alternate Demonstration for Unlined Surface Impoundments; Implementation of Closure; Legacy Units.*

and cost-effective approach to satisfying environmental obligations imposed upon facilities utilized for the production of energy from coal. The 2020 Environmental Compliance Plan Summary, which catalogues each Project's most-relevant details (including pertinent facility, applicable environmental authority(ies), established or anticipated project completion date, and cost information) is attached to this Application as Exhibit C. While each of the projects proposed for inclusion in the 2020 Plan is thoroughly described below and in the accompanying testimony, the projects are, in brief, as follows:

- **PROJECT 12 – WILSON FGD/WWT SYSTEM IMPROVEMENTS.** In order to comply with rules promulgated by the EPA under the CAA, including but not limited to CSAPR and MATS, coal-fired generation facilities generally require an FGD/absorber system that meets or exceeds specified emissions standards. The Wilson Station's existing FGD system has exceeded its expected useful life, represents dated and ineffective technology, and requires significant ongoing investment to operate and maintain. To address these and other issues, Big Rivers seeks to replace and upgrade the FGD system at the Wilson Station. After careful review of design conditions and extensive due diligence, Big Rivers has determined that the size and design of the FGD/absorber system presently in place at the Coleman Station—which is roughly twenty (20) years newer than the Wilson Station's FGD and represents favorable and proven technology—can effectively satisfy the flue gas conditions for the Wilson Unit 1 boiler. Fundamentally, Project 12 consists of recycling the Coleman Station FGD/absorber system by moving it to the Wilson Station and rebuilding it utilizing a combination of existing parts and infrastructure and new equipment, including an updated gypsum dewatering system and wastewater treatment facilities. This project will achieve ongoing environmental compliance at the Wilson Station, maximize the Station's value and ensure the continued availability of its baseload coal-fired generating capacity in a reasonable and least-cost manner. The estimated capital cost for this project is [redacted] (excluding capitalized interest), and ongoing operations and maintenance ("O&M") expenses are expected to be [redacted] annually.

- **PROJECT 13 – CLOSURE OF ASH PONDS.** As the Commission is aware, facilities utilized for the production of energy from coal produce CCR, which generally consists of fly ash, bottom ash, boiler slag and FGD material. The containment, maintenance and disposal of CCR materials by Kentucky utilities are governed chiefly by the CCR Rule, the ELG Rule, and KPDES discharge limitations and requirements.
  - **Project 13-1: Green Ash Pond Closure, WMB Pond, WWT Systems.** Project 13-1 is comprised of undertakings primarily designed to ensure compliance with the CCR Rule and limitations prescribed by the Green Station's relevant KPDES permit. The

Green Station's existing ash pond will be closed by using a hybrid approach of capping in place approximately 450,000 cubic yards of the total 1,000,000 cubic yards of CCR material estimated to be in the ash pond footprint by consolidating and covering it along existing berms within the pond. The remaining 550,000 cubic yards will be removed and relocated to the existing on-site permitted special waste landfill. A new, lined WMB pond (totaling approximately 17-acres in size) will be constructed in place of the removed CCR material, and new chemical treatment equipment will be installed at the WMB Pond to meet the expected KPDES discharge requirements at the relevant outfall. Additionally, the Green Station's current WWT system will be modified to contain maintenance activities by the addition of a new "thickener overflow" pond in place of one of the coal pile runoff ponds. The estimated capital cost for this project is [redacted] (excluding capitalized interest). The annual O&M expense resulting from this project is estimated at approximately [redacted], due primarily to chemical consumption costs.

- **Project 13-2: Coleman Ash Ponds Closure.** The Company's Coleman Station includes three coal ash ponds, designated as the North Pond (approximately sixty (60) acres in size), the Sluice Pond (approximately forty-nine (49) acres in size), and the South Pond (approximately ninety-four (94) acres in size). As discussed, while the current CCR Rule does not presently require the closure of these legacy ash ponds, Big Rivers expects that legal obligation to arise in the near term; when it does, Big Rivers proposes to close these ponds by capping them in place with a cover system, as outlined in the CCR Rule. The estimated capital cost for this project is [redacted] (excluding capitalized interest); following completion of this project, estimated O&M expenses related to the closed ash ponds are expected to be approximately [redacted] annually.

- **Project 13-3: HMP&L Station Two Ash Pond Closure.** In light of the retirement of the HMP&L Station Two generating units in February of 2019, the CCR Rule requires the timely closure of the ash pond located at that facility. Big Rivers proposes as Project 13-3 to close the approximately 24-acre ash pond by capping it in place with a cover system, as outlined in the CCR Rule. The total estimated capital cost of Project 13-3 (excluding capitalized interest) is [redacted], of which Big Rivers' projected share is [redacted]; following completion of this project, estimated O&M expenses related to the closed ash pond are expected to be approximately [redacted] annually, with [redacted] representing the projected share of Big Rivers annually.

- **PROJECT 14 – WILSON LANDFILL PHASE 1 FINAL COVER.** Project 14 concerns Phase 1 of the Wilson Station's permitted special waste landfill. While the 103-acre Phase 1 landfill stopped accepting special waste in 2010, Big Rivers is required to monitor and maintain the landfill to ensure compliance with regulations governing CCR storage/disposal and groundwater protection. Project 14 includes the construction of an engineered synthetic geo-membrane liner to serve as the final cover system for the Phase 1 landfill. It is designed to mitigate rain water penetration of the landfill into groundwater, thereby advancing the goal of full compliance with corrective action requirements of the CCR Rule. The estimated capital cost for this project is [redacted] (excluding capitalized interest). The annual O&M expense resulting from this project is estimated at approximately [redacted].

- **PROJECT 15 – GREEN LANDFILL PERIMETER DRAINAGE SYSTEM.** Project 15 concerns the Green Station's CCR landfill. The project is designed to reduce lithium levels in groundwater, and it involves the construction of a perimeter drainage system to convey non-groundwater seepage to a target manhole located on the northeastern corner of the landfill. The project also includes the removal of coal ash run-off from the sedimentation pond located to the south of the Green Landfill. The estimated capital cost for this project totals [redacted];

however, similar to decommissioning costs associated with Reid/HMP&L Station Two, the City of Henderson is expected to be obligated for its proportional share of these costs, thereby reducing Big Rivers' projected financial responsibility to approximately [redacted]. Following project completion, O&M expenses associated with this project are expected to be [redacted] annually, with Big Rivers' share being approximately [redacted] annually.

- **PROJECT 16 – CCR ENVIRONMENTAL COMPLIANCE.** Project 16 includes a series of efforts undertaken by Big Rivers to ensure ongoing compliance with the CCR Rule at its coal-fired generating stations. These projects include the installation of groundwater monitoring wells, CCR pile containment measures, installation of leachate collection and treatment systems, and the development of numerous engineering studies and technical analyses to comply with the CCR Rule. These projects have been pursued in the usual course of Big Rivers' business since 2015, and each is more fully detailed in the Direct Testimony of Mr. Pullen, and specifically at Exhibit Pullen-3. The costs of the undertakings which comprise Project 16 have been deferred by Big Rivers as part of the CCR Regulatory Assets established in Case No. 2015-00333. These compliance costs are expected to total approximately [redacted] following the completion of ongoing projects later this year.

28. As stated, the projects included in Big Rivers' proposed 2020 Plan reflect reasonable and cost-effective measures necessary to ensure continued environmental compliance at existing and former coal-fired generation facilities. To promote the best interests of its Member-Owners and consistent with its obligations under law, Big Rivers considered and evaluated reasonable alternatives to its 2020 Plan, most notably with respect to Project 12 involving the Wilson Station's FGD.

29. The Wilson Station lies at the heart of Big Rivers' generation fleet. It is a single-unit coal-fired 417 MW workhorse that has provided baseload energy for Big Rivers' Members and others for almost forty (40) years. Big Rivers has invested significantly in the Wilson Station's facilities and operations; for instance, the Wilson Station is equipped with Selective Catalytic Reduction (SCR) technologies and its closed cooling water system represents Best Available Control Technology (BACT). Big Rivers' investment in the Wilson Station has allowed it to enjoy economic sales within MISO, high capacity factors, and low forced outage rates, among other benefits.

30. Unlike much of the plant's other equipment and facilities, the Wilson Station's existing FGD is ineffective and at the end of its useful life. The FGD must be addressed to ensure the Wilson Station's future as a compliant, reliable, competitive cornerstone of the Big Rivers generation fleet. Big Rivers has concluded that utilizing the Coleman Station's FGD at the Wilson Station (Project 12) presents an excellent opportunity for cost-effective, long-term compliance.

31. As alternatives to Project 12, Big Rivers also examined in detail whether other options for the Wilson Station's FGD, including its continued operation as-is and its replacement with a new FGD, presented favorable economic and operational outcomes. The financial modeling conducted, which is further described in the Direct Testimony of Mr. Paul Smith and particularly at Exhibit Smith-2, represents an economic comparison of the estimated capital, fixed O&M and variable O&M for each option. Based on this analysis, recycling the FGD/absorber system at Coleman Station and moving it to the Wilson Station proved to be the reasonable, least cost option.

32. Big Rivers also thoroughly evaluated the reasonableness and cost-effectiveness of the other projects that comprise its 2020 Plan. Though the CCR Rule does not permit considerable latitude in deciding whether to address the maintenance, storage and disposal of CCR, Big Rivers examined multiple avenues for achieving compliance with applicable rules. At the Green Station, for example, Big Rivers and its expert consultants examined both the complete closure of the ash pond and the chosen hybrid approach to closure; by electing to pursue the latter method, Big Rivers is expected to save approximately [redacted] in project costs.[17] Similarly, the final cover system selected for Phase 1 of the Wilson Landfill

[17] The hybrid closure-in-place option was selected because it is the lower cost option that is expected to meet compliance requirements. As the project proceeds, the Kentucky Division of Waste Management will review these plans in detail and may require modifications, with which Big Rivers will be required to comply. While the existing plan is based on internal and retained experts' best professional judgement and interpretation of the regulations at the time of this filing, Big Rivers seeks the Commission's permission to proceed with the ash pond closure method required by relevant state and federal authorities.

(Project 14) represents a significant savings compared to the other alternatives considered. As further evidenced in the testimony and reports appended hereto, Big Rivers conducted significant due diligence to ensure its 2020 Plan reflects only reasonable, necessary expenditures that do not result in wasteful duplication of facilities.

33. Big Rivers has committed significant internal and external expertise and resources to examine the status quo and various possible avenues for present and future environmental compliance. Based on these analyses, Big Rivers believes its 2020 Plan fully satisfies relevant requirements and represents the most prudent course of action to address environmental compliance across the Company's coal-fired generation portfolio.

Requests for Relief

34. Big Rivers believes each of the projects contained in its proposed 2020 Plan satisfies applicable law and precedent for cost recovery by environmental surcharge, consistent with KRS 278.183. Big Rivers requests a CPCN for the construction activities planned as part of the 2020 Plan that require Commission pre-approval, as well as the accounting and ratemaking treatment associated with the 2020 Plan as described herein and in the attached testimony.

Issuance of Certificate of Public Convenience and Necessity

35. To obtain a CPCN pursuant to KRS 278.020, a utility must demonstrate a need for the facilities it proposes to construct and an absence of wasteful

duplication.[18] These requirements ensure a utility avoids unreasonable or excessive investments by, among other things, confirming the applicant has performed a thorough review of available alternatives.[19]

36. Big Rivers believes that two of the projects proposed for inclusion in the 2020 Plan, Projects 12 and 13, require the Commission's preapproval through the issuance of a CPCN prior to commencing construction.[20] Each of these projects reflect necessary efforts by Big Rivers to ensure continued compliance with federal, state, and local environmental mandates addressing the consequences of production of energy from coal. Project 12 employs cost-effective means to address deepening deficiencies with the Wilson Station's existing FGD which challenge the Station's continued environmental compliance and therefore threaten the future availability of its valuable and reliable baseload generating capacity; further, Project 12 includes the installation of updated dewatering technologies and WWT facilities that will

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[18] *Kentucky Utilities Co. v. Pub. Serv. Comm'n*, 252 S.W.2d 885 (Ky. 1952).

[19] Case No. 2005-00142, *Joint Application of Louisville Gas and Electric Company and Kentucky Utilities Company for a Certificate of Public Convenience and Necessity for the Construction of Transmission Facilities in Jefferson, Bullitt, Meade, and Hardin Counties, Kentucky* (Ky. P.S.C. Sept. 8, 2005).

[20] With respect to Project 13-3 (concerning closure of the HMP&L Station Two ash pond), Big Rivers believes, consistent with the Commission's holding in Big Rivers' earlier environmental compliance plan case, that the activities proposed for execution at HMP&L Station Two do <u>not</u> require prior approval from the Commission. *See* Case No. 2012-00063, n. 10, *supra*, at 19 ("Lastly, and consistent with our ruling in Case No. 93-065, the Commission finds that Project 11 (installing emission control monitors at Station Two) does not require a CPCN in light of the fact that Station Two is wholly owned by the City of Henderson and is therefore exempt from the requirements of KRS 278.020(1).") (internal citation omitted). While Big Rivers is obligated to pay its proportional share of the costs of closure of the City of Henderson's Station Two ash pond consistent with the parties' agreement, the closure of the ash pond concerns property and facilities wholly owned by the City of Henderson and is thus outside the scope of KRS 278.020. However, should the Commission find Project 13-3 does require Commission preapproval, Big Rivers requests that it be granted.

minimize landfilled waste and help ensure compliance with the ELG Rule. Project 13 proposes to responsibly address the Company's coal ash ponds and water treatment facilities utilizing reasonable, least cost means, as well as responsibly address existing and future AROs and related regulatory assets. Neither of these projects represents an "excessive investment in relation to efficiency" or "an unnecessary multiplicity of physical properties[;]"[21] rather, each project was thoroughly investigated and selected following considerable due diligence to determine the best option for Big Rivers and its Member-Owners.

37. With respect to Projects 14 and 15, which concern the installation of a final cover system for Phase 1 of the Wilson Station's landfill and a perimeter drainage system and other facilities at the Green Station's landfill, respectively, Big Rivers requests a finding from the Commission that no CPCN is required. Pursuant to KRS 278.020(1)(a), Commission pre-approval is required before a utility may "...begin the construction of any plant, equipment, property, or facility for furnishing [utility service] to the public..." However, excepted from the CPCN requirement are "[o]rdinary extensions of existing systems in the usual course of business."[22] Commission regulation 807 KAR 5:001, Section 15(3), defines the exception as follows:

> A certificate of public convenience and necessity shall not be required for extensions that do not create wasteful duplication of plant, equipment, property, or facilities, or conflict with the existing certificates or service of other utilities operating in the same area and under the jurisdiction of the commission that are in the general or

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[21] *Kentucky Utilities Co., supra,* 252 S.W.2d at 891.

[22] KRS 278.020(1)(a)(2).

contiguous area in which the utility renders service, and that do not involve sufficient capital outlay to materially affect the existing financial condition of the utility involved, or will not result in increased charges to its customers.

38. Project 14's estimated capital cost of approximately [redacted] represents a relatively insignificant portion of Big Rivers' net utility plant (approximately [redacted]) and will not materially impact Big Rivers' existing financial condition. Likewise, Project 15's total estimated cost of [redacted] (of which Big Rivers' share has been calculated to be [redacted]), also represents a relatively minor capital outlay for Big Rivers (approximately [redacted] of the cooperative's net utility plant) to address its existing facilities. These projects, themselves, will also have a minor or negligible impact on the amounts collected each month through the Environmental Surcharge, as evidenced by the Direct Testimony of Mr. John Wolfram submitted herewith. For these reasons, Big Rivers is not required to obtain a CPCN for Project 14 or Project 15 under KRS 278.020. However, should the Commission find either or both of these projects does require Commission preapproval under KRS 278.020, a CPCN is requested as necessary.

39. Pursuant to 807 KAR 5:001, Section 15(2)(a), the facts relied upon to show that the proposed construction or extension is or will be required by public convenience or necessity are set forth in this Application and in the exhibits hereto. In support of this Application, Big Rivers submits testimony from the following:

- Mr. Michael T. Pullen, Vice President of Production for Big Rivers, who provides testimony at Exhibit E addressing, among other things, Big Rivers' generation portfolio and strategic profile, the cooperative's past and present efforts to comply with environmental regulation, the due diligence undertaken to determine which projects to pursue and propose for inclusion in Big Rivers' 2020 Plan, the details of each Plan project, and how the 2020 Plan will position Big Rivers for continued success;

- Mr. Paul G. Smith, Chief Financial Officer for Big Rivers, who provides testimony at Exhibit F addressing, among other things, the capital and O&M costs of the 2020 Plan, Big Rivers' plans for financing the 2020 Plan costs, and accounting and financial aspects of the 2020 Plan, including testimony related to the settlement of relevant AROs/regulatory assets by environmental surcharge recovery;
- Mr. Michael T. Hoydick, Director of Technology & Sales for Amec Foster Wheeler Industrial Power Company, Inc. ("AFWIPC"), who provides testimony at Exhibit G addressing, among other things, AFWIPC's role in the development and proposed pursuit by Big Rivers of Project 12, involving the retrofit and upgrade of Wilson Station's existing FGD system utilizing, in part, equipment from Big Rivers' idled Coleman Station;
- Mr. Samuel E. Yoder, P.E., Energy Division Project Manager at Burns & McDonnell Engineering Company, Inc. ("Burns & McDonnell"), who provides testimony at Exhibit H describing the

detailed investigation and analysis undertaken by his firm with respect to Project 13, involving Green Station's ash pond and WWT systems, Coleman Station's ash ponds, and HMP&L Station Two's ash pond; and

- Mr. John Wolfram, Principal with Catalyst Consulting LLC, who provides testimony at Exhibit I addressing, among other things, the estimated cost and rate impact of the proposed 2020 Plan, the environmental surcharge tariff, and the monthly reporting form amendments that are necessary to reflect the 2020 Plan.

40. Pursuant to 807 KAR 5:001, Section 15(2)(b), Big Rivers states that it is in the process of obtaining all environmental permits and approvals necessary for the proposed projects, which permits and approvals are more fully detailed in the testimony of Mr. Pullen.

41. Pursuant to 807 KAR 5:001, Section 15(2)(c), a full description of the proposed location, route, or routes of each proposed project is contained in the testimonies of Mr. Pullen, Mr. Hoydick, and Mr. Yoder, and also reflected in the maps attached as Exhibit D hereto and incorporated herein by reference. A description of the manner of construction of each project is also set forth fully in testimony, with specific detail contained in the reports sponsored by Mr. Hoydick and Mr. Yoder. There are no public utilities, corporations or persons with whom the proposed construction or extension is likely to compete.

42. Pursuant to 807 KAR 5:001, Section 15(2)(d), Big Rivers is providing herewith hardcopy and electronic versions of: (i) maps to suitable scale showing the location or route of the proposed construction or extension, as well as the location to scale of like facilities owned by others located anywhere within the map area with adequate identification as to the ownership of the other facilities (see Exhibit D); and (ii) plans and specifications and drawings of the proposed plant, equipment, and facilities (see Direct Testimonies of Mr. Pullen, Mr. Hoydick, and Mr. Yoder, and specifically the reports appended thereto).

43. Pursuant to 807 KAR 5:001, Section 15(2)(e), Big Rivers states that it intends to finance the costs of the 2020 Plan utilizing general cash reserves and working capital, to the extent possible, and to externally finance the capital costs proposed in this application with a long-term loan(s) from the RUS. If such a loan(s) is not available, Big Rivers expects to pursue financing from financial institutions, including the National Rural Utilities Cooperative Finance Corporation ("CFC"), which have expressed an interest in managing Big Rivers' access to capital markets via a private placement or a public offering. As necessary under KRS 278.300, Big Rivers will seek approval of financing related to the 2020 Plan costs in a subsequent proceeding. Further discussion of the financing related to the 2020 Plan is provided in the testimony of Mr. Smith.

44. Pursuant to 807 KAR 5:001, Section 15(2)(f), Big Rivers describes each project's impact to annual costs of operation in this Application and in the testimony of Mr. Pullen and Mr. Smith.

Approval of the 2020 Plan and Revised Environmental Surcharge

45. KRS 278.183, commonly known as the Environmental Surcharge Statute, provides at section (1) that a utility "shall be entitled to the current recovery of its costs of complying with . . . those federal, state, or local environmental requirements which apply to coal combustion wastes and by-products from facilities utilized for production of energy from coal. . . ." This cost recovery mechanism is only available following the submission "to the commission [of] a plan, including any application required by KRS 278.020(1), for complying with the applicable environmental requirements. . . ."[23] The Commission must, *inter alia*, "[c]onsider and approve the plan and rate surcharge if the commission finds the plan and rate surcharge reasonable and cost-effective for compliance. . . ."[24]

46. Big Rivers' 2020 Environmental Compliance Plan includes five primary Projects and a number of identified sub-projects, each reflecting a reasonable and cost-effective approach to satisfying environmental obligations imposed upon facilities utilized for production of energy from coal. The total estimated capital costs and O&M expenses associated with the 2020 Plan projects are reflected in the 2020 Environmental Compliance Plan Summary attached hereto as Exhibit C. Additional detail with respect to the 2020 Plan costs and Big Rivers' proposed recovery of same is provided throughout this Application and the testimonies submitted herewith, particularly those sponsored by Mr. Smith and Mr. Wolfram.

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[23] KRS 278.183(2).

[24] *Id.*

47. Further pursuant to KRS 278.183, Big Rivers seeks to continue to recover through its environmental surcharge “a reasonable return on construction and other capital expenditures” included in its environmental rate base under its environmental surcharge tariff. Big Rivers proposes to calculate this return in the same manner as it does with respect to the 2012 Plan—apply a Times Interest Earned Ratio (“TIER”) of 1.24 to its current weighted average cost of debt, calculated each month based on its actual outstanding long-term debt and related interest expense during the month.

48. Big Rivers proposes to include within the costs of its 2020 Plan the professional, consultant, and related expenses incurred to evaluate and pursue the compliance projects described in this Application (following the establishment of a regulatory asset and amortization of those costs, as described below). Further detail regarding the due diligence, environmental, engineering, accounting, reporting, and rate considerations relevant to Big Rivers’ 2020 Plan is contained throughout this Application and the testimonies submitted herewith.

49. Finally, although Big Rivers does not seek to revise its environmental surcharge tariff in connection with the relief sought, Big Rivers does request the Commission's approval to appropriately revise its ESM monthly environmental surcharge reporting forms following the Commission’s decision in this matter. The proposed forms reflecting the relief requested by Big Rivers are attached to the Direct Testimony of Mr. Wolfram as Exhibit Wolfram-4.

Approval of Accounting Practices/Treatment and Related Relief

<u>Project 13-1 and Project 13-3</u>

50. The completion by Big Rivers of Project 13-1 and Project 13-3, which involve the closure of the ash ponds at Green Station and HMP&L's Station Two, respectively, will serve to settle certain earlier-recognized AROs concerning those facilities. As of December 31, 2019, Big Rivers' ARO liability balances were approximately $25.3 million for the Green ash pond and $9.4 million for its share of the Reid/Station Two ash pond, which reflect the present values of the estimated future cash flows required to close the ash ponds per the updated cost studies prepared by Burns & McDonnell. Under applicable accounting rules, the precise amount of the ARO will be determined as Big Rivers expends funds toward the ash pond closures.

51. As mentioned, this Commission previously approved Big Rivers' establishment of regulatory assets for the income statement impacts (including gains, losses, depreciation and accretion expense) resulting from AROs related to the Green Station ash pond and HMP&L Station Two ash pond for 2015 and subsequent years.[25] In order to match ESM revenue with expense, Big Rivers proposes to recover the costs of ash pond closure reflected in Project 13-1 and Project 13-3 through non-levelized amortization of the actual ash pond closure spending-to-date allocable over a rolling 10-year period. This method ensures that cost recovery through the ESM is based on

[25] *Application of Big Rivers Electric Corporation for Authority to Establish Regulatory Assets for Expenses Related to the Coal Combustion Residuals Rule* (Ky. P.S.C. Jan. 5, 2016).

actual project spending while also allowing Big Rivers to match its amortization expense with ESM revenue.

Project 13-2

52. Concerning Project 13-2, Big Rivers expects to recognize an ARO liability with respect to the Coleman Station ash ponds upon expansion of the published CCR Rule to include legacy ponds. The RUS USoA requires the asset retirement cost to be depreciated over the useful life of the related asset that gives rise to the obligation. Moreover, Financial Accounting Standards Board Accounting Standards Codification 14 ("ASC") Topic 410-20, *Asset Retirement Obligations*, likewise requires AROs to be recognized at fair value when incurred and capitalized as part of the related long-lived asset. The liability is accreted to its present value each period, and the capitalized cost is depreciated over the useful life of the related asset. When the asset is retired, the entity settles the obligation for its recorded amount or incurs a gain or loss.

53. In light of the foregoing, Big Rivers expects to record depreciation expense for the ARO-related assets and accretion expense for the ARO-related liabilities each month following initial recognition of the Coleman Station ash ponds ARO, just as it has done with respect to the Green and Reid/Station Two ash ponds. As with the AROs for the green and Reid/Station Two ash ponds, mandated accounting treatment would force Big Rivers' financial statements to experience a mismatch of revenues and expenses during the period in which it is recognizing ARO-related expenses but not yet collecting revenue through rates. To avoid this outcome,

and consistent with the Commission's treatment of the same issue for the Green and Reid/Station Two ash pond AROs, Big Rivers requests authority to establish regulatory assets (the "Coleman ARO Regulatory Asset") for the ARO-related depreciation expense and accretion expense, respectively, immediately upon the impending recognition of the ARO related to the Coleman ash ponds. Big Rivers also requests that it be permitted to record as part of the regulatory assets any prospective adjustments to the amounts for ARO-related depreciation and accretion expense associated with the ARO balances, as changes to the underlying cost estimates and timing will impact these amounts. This treatment will appropriately defer recognition of these ARO expenses until recovery of the actual costs through the ESM. When Project 13-2 commences and costs begin to be incurred, Big Rivers requests authority to recover as an expense through its ESM the amortization of the Coleman Station actual spend-to-date over a rolling 10-year period in the same manner as requested with respect to the Green Station and Reid/Station Two.

54. The authority of the Commission to allow utilities to establish regulatory assets arises under the Commission's plenary authority to regulate utilities under KRS 278.040 and the Commission's authority to establish a system of accounts for utilities under KRS 278.220. The Commission has historically approved regulatory assets where a utility has incurred (1) an extraordinary, nonrecurring expense which could not have reasonably been anticipated or included in the utility's planning; (2) an expense resulting from a statutory or administrative directive; (3) an expense in relation to an industry-sponsored initiative; or (4) an extraordinary or

nonrecurring expense that over time will result in a saving that fully offsets the cost.[26] Big Rivers' request to establish the Coleman Station ARO Regulatory Asset falls under the second category, as the ARO-related depreciation and accretion expenses will result from the directives of the CCR Final Rule and the accounting requirements of the RUS USoA and ASC Topic 410-20.

Project 16

55. With respect to Project 16, Big Rivers proposes to amortize the entire balance of the CCR Regulatory Assets over a fixed, 10-year period. As discussed in the testimony of Mr. Smith, this balanced approach is designed to minimize impact to ratepayers' bills while allowing the Company to gradually recover costs it has necessarily and prudently incurred for environmental compliance.

2020 Plan Preparation Expenses

56. Finally, Big Rivers has incurred costs in developing this Application, and it will incur additional costs to prosecute this case. These costs primarily stem from the retention of experts in the legal, regulatory, and engineering professions. In particular, the costs include Big Rivers' attorney and consultant fees, along with the fees of the engineering consultants that were retained to evaluate the compliance options available to Big Rivers. These costs are significant relative to the level of outside services costs built into Big Rivers' base rates. However, they are necessary and prudent, and Big Rivers should have the opportunity to recover them consistent

[26] Case No. 2008-00436, *Application of East Kentucky Power Cooperative, Inc. for an Order Approving Accounting Practices to Establish a Regulatory Asset Related to Certain Replacement Power Costs Resulting from Generation Forced Outages* (Ky. PSC Dec. 23, 2008), at 4.

with KRS 278.183. As such, Big Rivers requests that the Commission grant it the authority to establish a regulatory asset for its actual costs (and accruals for estimated amounts until actual costs can be determined) associated with this case, to amortize those costs over three years, and to recover those costs through the environmental surcharge. This is consistent with the method proposed and approved for recovery of costs related to Big Rivers' 2012 Plan.[27] If the Commission does not authorize the recovery of all of the relevant costs through the environmental surcharge, Big Rivers alternatively requests that the Commission grant Big Rivers the authority to establish a regulatory asset to defer the costs for possible recovery if approved by the Commission in a future proceeding.

Conclusion

57. As the Commission is aware, Big Rivers and other generation and transmission utilities face significant statutory and regulatory requirements as a consequence of producing energy from coal in Kentucky. Big Rivers and its teams of retained experts have committed significant time and resources to evaluating and planning the reasonable, cost-effective strategies reflected in the 2020 Plan, and the costs of each project at issue are appropriate for recovery through the Company's environmental surcharge. Based on the facts as reflected in this Application and its exhibits, Big Rivers requests that the Commission approve the 2020 Plan and grant the associated relief requested herein.

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[27] *See* fn. 9, *supra*.

WHEREFORE, Big Rivers requests an Order from the Commission:

1. Approving Big Rivers' 2020 Plan and proposed changes to its environmental surcharge billing and monthly reporting forms;
2. Authorizing Big Rivers' recovery of the costs associated with the 2020 Plan through Big Rivers' environmental surcharge;
3. Issuing Big Rivers a CPCN for Projects 12 and 13 of the 2020 Plan;
4. Finding that Projects 14 and 15 of the 2020 Plan do not require a CPCN or, alternatively, issuing a CPCN for the projects;
5. Authorizing Big Rivers, upon the revision of the CCR Rule to include legacy ash ponds and the recognition by Big Rivers of the Coleman Station ash pond ARO, to establish the Coleman ARO Regulatory Asset;
6. Authorizing the amortization through the environmental surcharge of the Green ARO Regulatory Asset, Reid/Station Two ARO Regulatory Asset, and Coleman ARO Regulatory Asset;
7. Authorizing the amortization through the environmental surcharge of CCR Regulatory Assets (Project 16);
8. Authorizing the establishment and amortization of a regulatory asset reflecting Big Rivers' costs of preparing and prosecuting this case; and
9. Granting Big Rivers all other relief to which it may appear entitled.

This 7th day of February, 2020.

Respectfully submitted,

BIG RIVERS ELECTRIC CORPORATION

Tyson Kamuf
201 Third Street, P.O. Box 24
Henderson, Kentucky 42419-0024
Phone: (270) 827-2561 Fax: (270) 844-6417
Email: tyson.kamuf@bigrivers.com

DINSMORE & SHOHL LLP

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Counsel to Big Rivers Electric Corporation

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

VERIFICATION

I, Michael T. ("Mike") Pullen, Vice President, Production for Big Rivers Electric Corporation, hereby state that I have read the foregoing Application and that the statements contained therein are true and correct to the best of my knowledge and belief, on this the 7th day of February, 2020.

Mike Pullen
Michael T. ("Mike") Pullen
Vice President, Production
Big Rivers Electric Corporation

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by Michael T. ("Mike") Pullen on this the 7th day of February, 2020.

Kathie R. Daly
Notary Public, Kentucky State at Large
My Commission Expires October 31, 2020

Dinsmore

Legal Counsel.

DINSMORE & SHOHL LLP
101 South Fifth Street ^ Suite 2500 ^ Louisville, KY 40202
www.dinsmore.com

RECEIVED
DEC 02 2019
PUBLIC SERVICE COMMISSION

Edward T. Depp
(502) 540-2347 (direct) ^ (502) 525-2207 (fax)
tip.depp@dinsmore.com

December 2, 2019

Via Hand Delivery
Gwen R. Pinson
Executive Director
Kentucky Public Service Commission
P.O. Box 615
211 Sower Boulevard
Frankfort, KY 40602

Re: Big Rivers Electric Corporation / 2020 Environmental Compliance Plan
Case No. 2019-00 435 - Notice of Intent

Dear Ms. Pinson:

On behalf of Big Rivers Electric Corporation ("Big Rivers"), please accept this letter as notice, pursuant to KRS 278.183(2), of the cooperative's intent to file, on or after January 2, 2020, an Application seeking approval of its 2020 Environmental Compliance Plan ("2020 Plan"). The Application will further request, among other things, the authority to recover costs associated with the 2020 Plan through a revised Environmental Surcharge and Tariff, the issuance of a Certificate of Public Convenience and Necessity for certain projects comprising the 2020 Plan, and appropriate accounting and other relief.

A copy of this notice has been sent via mail or e-mail to the individuals identified on the attached service list. Big Rivers respectfully requests that the following individuals be included on the Commission's service list in this proceeding:

Edward T. Depp
R. Brooks Herrick
M. Evan Buckley
Dinsmore & Shohl LLP
tip.depp@dinsmore.com
brooks.herrick@dinsmore.com
evan.buckley@dinsmore.com

Tyson Kamuf
Roger Hickman
Big Rivers Electric Corporation
tyson.kamuf@bigrivers.com
roger.hickman@bigrivers.com

Thank you, and please call if you have any questions.

Respectfully submitted,

DINSMORE & SHOHL LLP

Edward T. Depp

SERVICE LIST

Office of the Attorney General
Utility Rate Intervention Division
700 Capital Avenue
Suite 20
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Jeff Hohn, CEO
Kenergy Corp.
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Marty Littrell
President & CEO
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P.O. Box 489
Brandenburg, KY 40108-0489

Tom Brite, Esq.
Brite & Hopkins PLLC
107 South Main Street
Hardinsburg, Kentucky 40143

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	**Case No. 2019-00435**

<u>CERTIFICATE OF NOTICE TO THE PUBLIC</u>

To the Public Service Commission, Frankfort, Ky.

Pursuant to the Rules Governing Tariffs (effective June 2, 1982), I hereby certify that I, Roger D. Hickman, Regulatory Affairs Manager for Big Rivers Electric Corporation (the "<u>Company</u>"), a utility furnishing wholesale electric service within the Commonwealth of Kentucky, which on the 7th day of February, 2020, filed with the Kentucky Public Service Commission an application seeking approval of the Company's 2020 Environmental Compliance Plan and proposed changes to the billing forms the Company uses to calculate the rates it charges through its Environmental Surcharge tariff rider. The addition of the 2020 Plan will impact the amount of the rates charged under Big Rivers' Environmental Surcharge tariff.

I further certify that notice to the public of the filing of the Company's application has been given in all respects as required by Section 8 of 807 KAR 5:011, as follows:

On the 7th day of February, 2020, the attached notice was posted at the Company's place of business, 201 Third Street, Henderson, Kentucky 42420, and will be kept open to public inspection in conformity with the requirements of Section 8 of 807 KAR 5:011.

On the 7th day of February, 2020, the attached notice, and a hyperlink to the location on the Public Service Commission's web site where the tariff filing will be available, were posted on the Company's website, www.bigrivers.com, and will remain posted in conformity with the requirements of Section 8 of 807 KAR 5:011.

On the 7th day of February, 2020, the attached typewritten notice was mailed to each of the three customers of the Company.

Given under my hand this the 7th day of February, 2020.

Roger D. Hickman

Roger D. Hickman
Regulatory Affairs Manager
Big Rivers Electric Corporation

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by Roger D. Hickman as Regulatory Affairs Manager for Big Rivers Electric Corporation on this the 7th day of January, 2020.

Notary Public, Kentucky State at Large

My Commission Expires October 31, 2020

Big Rivers
ELECTRIC CORPORATION

201 Third Street
P.O. Box 24
Henderson, KY 42419-0024
270-827-2561
www.bigrivers.com

February 7, 2020

Mr. Gregory H. Grissom
President and CEO
Jackson Purchase Energy Corporation
2900 Irvin Cobb Drive, P. 0. Box 4030
Paducah, KY 42002-4030

Mr. Jeffrey A. Hohn
President and CEO
Kenergy Corp.
3111 Fairview Drive, P. 0. Box 1389
Owensboro, KY 42302-1389

Mr. Martin W. Littrel
President and CEO
Meade County RECC
1351 Hwy. 79, P. 0. Box 489
Brandenburg, KY 40108-0489

Re: *In the Matter of: Application of Big Rivers Electric Corporation for Approval of its 2020 Environmental Compliance Plan, Authority to Recover Costs through a Revised Environmental Surcharge and Tariff, the Issuance of a Certificate of Public Convenience and Necessity for Certain Projects, and Appropriate Accounting and Other Relief, Kentucky Public Service Commission Case No. 2019-00435*

Gentlemen:

Big Rivers Electric Corporation ("Big Rivers") hereby provides notice that, on this date, it has filed with the Kentucky Public Service Commission in the above-referenced matter an application for approval of its 2020 plan for additional projects needed to comply with the federal Clean Air Act as amended and those federal, state, or local environmental requirements which apply to coal combustion wastes and by-products from facilities utilized for production of energy from coal (the "2020 Plan").

Big Rivers' application to the Public Service Commission also includes (i) a request for approval of revisions to the forms Big Rivers uses to calculate the rates charged through its Environmental Surcharge tariff to allow Big Rivers to recover the capital and operating costs associated with the 2020 Plan, (ii) a request that the Public Service Commission grant Big Rivers a certificate of public convenience and necessity for certain of the projects included in the 2020 Plan, and (iii) a request for approval of the accounting and ratemaking treatment associated with the 2020 Plan.

A copy of the application, which includes the 2020 Plan and the revised Environmental Surcharge monthly reporting forms, is enclosed. Big Rivers proposes that the revised monthly reporting forms become effective upon the Public Service Commission's issuance of a final order in Case No. 2019-00435. *Big Rivers is not proposing any changes to its current Environmental Surcharge tariff, but the addition of the 2020 Plan will impact the amount charged through its Environmental Surcharge tariff.* The estimated incremental impact per customer class, in both dollars and as a percent, resulting from the addition of the 2020 Plan is shown on the enclosed schedule.

A person may examine Big Rivers' application at the Public Service Commission's offices located at 211 Sower Boulevard, Frankfort, Kentucky, Monday through Friday, 8:00 a.m. to 4:30 p.m., or through the Commission's web site at http://psc.ky.gov. Comments regarding the filing may be submitted to the Public Service Commission through its web site or by mail to Public Service Commission, Post Office Box 615, Frankfort, Kentucky 40602.

The rates contained in this notice are the rates proposed by Big Rivers but that the Public Service Commission may order rates to be charged that differ from the proposed rates contained in this notice. A person may submit a timely written request for intervention to the Public Service Commission, Post Office Box 615, Frankfort, Kentucky 40602, establishing the grounds for the request including the status and interest of the party. If the Commission does not receive a written request for intervention within thirty (30) days of the initial mailing of this notice, the Commission may take final action on the filing.

Sincerely yours,

Tyson Kamuf
Corporate Attorney

Enclosures

cc: Hon. Mark David Goss
Hon. J. Christopher Hopgood
Hon. Thomas C. Brite

Big Rivers Electric Corporation
2020 Environmental Compliance Plan
Estimated Member Billing Impact

Rate Class	2019 Annual Usage MWH	2019 Annual Billings $	2019 Annual Rate $/MWH	2023 Incr Rate $/MWH	New Rate $/MWH	New Billings $	Annual Increase $	Annual Increase %	Monthly Usage MWH	Monthly Increase $	Monthly Increase %
Rurals RDS	2,261,069	$195,139,886	86.30	2.09	88.40	$199,868,449	$4,728,562	2.42%	188,422	$394,047	2.42%
Large Industrials LIC	946,070	$61,139,947	64.63	1.58	66.20	$62,631,580	$1,491,633	2.44%	78,839	$124,303	2.44%

Big Rivers Electric Corporation
Case No. 2019-00435
2020 Environmental Compliance Plan

Project Number	Primary Pollutant(s)	Control Facility	Plant	Primary Environmental Regulation	Permit	Projected Completion	Projected Capital Cost[1] ($ Million)	Projected Annual O&M ($ Million)
12	SO_2 / ELG	Relocation of Flue Gas Desulfurization (FGD / Scrubber) with Dewatering and Wastewater Treatment (WWT)	Coleman / Wilson	Clean Air Act, Cross State Air Pollution Rule (CSAPR); Effluent Limitations Guidelines ("ELG")	**Wilson Title V Permit** V-16-013 modification (Authority to Construct and Operate a new Wet FGD ("WFGD")); **Coleman Title V Permit** V-08-019 modification (Remove Scrubber from Permit)	2022	[redacted]	[redacted]
13-1	CCR / ELG	Ash Pond Closure, WMB Pond, Wasterwater Treatment	Green	Coal Combustion Residuals ("CCR") Rule; Effluent Limitations Guidelines ("ELG")	Kentucky Pollutant Discharge Elimination System ("KPDES") Permit KY0001929	2027	[redacted]	[redacted]
13-2	CCR	Ash Pond Closures	Coleman	CCR Rule	KPDES Permit KY0001937	2029	[redacted]	[redacted]
13-3	CCR	Ash Pond Closure[2]	Reid/ HMP&L Station Two	CCR Rule	KPDES Permit KY0001929	2024	[redacted]	[redacted]

Big Rivers Electric Corporation
Case No. 2019-00435
2020 Environmental Compliance Plan

Project Number	Primary Pollutant(s)	Control Facility	Plant	Primary Environmental Regulation	Permit	Projected Completion	Projected Capital Cost[1] ($ Million)	Projected Annual O&M ($ Million)
14	CCR	Phase 1 Landfill Final Cover	Wilson	CCR Rule	Solid Waste Permit SW09200004	2021	[redacted]	[redacted]
15	CCR / ELG	Landfill Permiter Drainage System[2]	Green	CCR Rule; ELG	Solid Waste Permit SW11700007	2020	[redacted]	[redacted]
16	CCR	CCR Regulatory Assets[2, 3]	Wilson, Green, Reid/HMP&L Station Two	CCR Rule	KPDES Permit KY0001929; Solid Waste Permits SW11700007, SW09200004	2020	*Not Applicable*	[redacted]
							$ 232.34	$ 8.676

[1] Capital costs exclude capitalized interest.

[2] Costs exclude HMP&L share of capital and O&M.

[3] Total costs deferred through CCR Regulatory Assets, which Big Rivers proposes to amortize over 10 years, are projected to total approximately [redacted]

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEFN	)))))))))	Case No. 2019-00435

CONFIDENTIAL DOCUMENT

Application Exhibit D - Maps
Filed in hardcopy form and on electronic media
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION
PETITION FOR CONFIDENTIAL TREATMENT

ORIGINAL

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

DIRECT TESTIMONY

OF

MICHAEL T. PULLEN
VICE PRESIDENT OF PRODUCTION

ON BEHALF OF

BIG RIVERS ELECTRIC CORPORATION

FILED: February 7, 2020

Application Exhibit E

DIRECT TESTIMONY

OF

MICHAEL T. PULLEN

I. INTRODUCTION

Q. Please state your name, business address and occupation.

A. My name is Michael T. Pullen. My business address is 201 Third Street, Henderson, Kentucky 42420. I am the Vice President of Production for Big Rivers Electric Corporation ("Big Rivers" or the "Company").

Q. Please summarize your education and professional experience.

A. I graduated from the University of Mississippi in 1985 with a Bachelor of Science in Electrical Engineering and Murray State University in 2005 with a Masters of Business Administration. I am a registered Professional Engineer in the Commonwealth of Kentucky. I worked at Electric Energy, Inc. from 1990 to 2014. I served in a variety of engineering, maintenance, and operation roles including Group Supervisor Maintenance; Manager Systems-Dispatch; Manager, Generation; and Director, Operations. I also was employed by Ameren Illinois from 2014 to 2015 and served in substation construction management. I assumed my current role with Big Rivers in February 2015.

Q. Please summarize your duties at Big Rivers.

A. As the Vice President of Production for Big Rivers, I direct all activities related to the operation and maintenance of the cooperative's coal and gas-fired generating facilities, including fuel procurement and management, power station engineering and construction, and environmental compliance.

Q. Have you previously testified before the Kentucky Public Service Commission ("Commission")?

A. Yes. I provided written and oral testimony in Case No. 2016-00278, in which Big Rivers sought and obtained an Order from the Commission declaring that Big Rivers was not responsible for certain costs associated with the operation of Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("HMP&L Station Two"). I also responded to requests for information in Case No. 2018-00146, in which Big Rivers sought and obtained, among other things, an Order from the Commission confirming that certain contracts between Big Rivers and the City of Henderson/HMP&L (the "Station Two Contracts") had terminated.[1]

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[1] *In the Matter of: Notice of Termination of Contracts and Application of Big Rivers Electric Corporation for a Declaratory Order and for Authority to Establish a Regulatory Asset* (Ky. P.S.C. Aug. 29, 2018);

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is first to provide an overview of Big Rivers' generation portfolio and strategic profile, as well as the cooperative's past and present efforts to comply with environmental regulation. I will describe the due diligence undertaken to determine which projects to pursue and propose for inclusion in Big Rivers' 2020 Environmental Compliance Plan ("2020 Plan"), the details of each proposed project and subproject, and how the 2020 Plan will position Big Rivers for continued compliance and success.

Q. Please identify the other witnesses that will testify on behalf of Big Rivers and the areas each testimony will address.

A. In addition to my testimony, Big Rivers presents testimony of the following witnesses:

- Mr. Paul G. Smith, Chief Financial Officer for Big Rivers, who provides detailed discussion of the accounting and financial aspects of the 2020 Plan, including matters related to existing and proposed regulatory assets and the prudent recovery of relevant costs through Big Rivers' Environmental Surcharge Mechanism ("ESM");
- Mr. Michael T. Hoydick, Director of Technology & Sales for Amec Foster Wheeler Industrial Power Company, Inc. ("AFWIPC"), who provides testimony addressing, among other things, the Cost Study his firm

prepared for the design, supply, and installation of new and repurposed Flue Gas Desulfurization ("FGD") and associated dewatering and wastewater treatment ("WWT") systems at Big Rivers' D.B. Wilson Station ("Wilson Station");

- Mr. Samuel E. Yoder, P.E., Energy Division Project Manager at Burns & McDonnell Engineering Company, Inc. ("Burns & McDonnell"), who provides testimony describing the detailed investigation and analysis undertaken by his firm with respect to environmental compliance efforts at Big Rivers' Kenneth C. Coleman Station ("Coleman Station"), as well as at the Sebree Station, which includes Big Rivers' Robert A. Reid Station ("Reid Station"), Robert D. Green Station ("Green Station"), and Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("HMP&L Station Two"); and
- Mr. John Wolfram, principal with Catalyst Consulting LLC, who provides testimony addressing, among other things, the estimated cost and rate impact of the proposed 2020 Plan, the tariff, and reporting form amendments that are necessary to reflect the 2020 Plan.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

- Exhibit Pullen-1: Professional Summary

- Exhibit Pullen-2: Project 12 Alternative Detail Documentation (prepared by Synthetic Materials, LLC ("Synmat"))
- Exhibit Pullen-3: Project 14 Alternatives Analysis and Cost Summary
- Exhibit Pullen-4: Project 15 Detail Documentation (prepared by AECOM Technical Services, Inc.)
- Exhibit Pullen-5: Project 16 Detail Documentation

II. BACKGROUND

Q. Please provide an overview of the Big Rivers' system and the business it conducts.

A. Big Rivers is a rural electric generation and transmission cooperative established under KRS Chapter 279 and headquartered in Henderson, Kentucky. Big Rivers owns, operates and maintains electric generation and transmission facilities, and it also purchases, transmits, and sells electricity at wholesale. It exists for the principal purpose of providing the wholesale electricity requirements of its three distribution cooperative Member-Owners: Jackson Purchase Energy Corporation ("JPEC"), Kenergy Corp. ("Kenergy"), and Meade County Rural Electric Cooperative Corporation ("MCRECC") (collectively, the "Members" or "Member-Owners"). The Members, in turn, provide retail electric service to approximately 118,000 consumer-members located in all or parts of 22 western Kentucky counties: Ballard, Breckenridge, Caldwell, Carlisle, Crittenden, Daviess, Graves, Grayson, Hancock, Hardin, Henderson, Hopkins, Livingston, Lyon, Marshall, McCracken, McLean, Meade, Muhlenberg, Ohio, Union, and Webster.

Q. Is Big Rivers governed by a Board of Directors?

A. Yes. The affairs of the Company are guided by a six (6) member Board of Directors ("Board"), with two (2) representatives from each of JPEC, Kenergy, and MCRECC. The Board is responsible for overseeing the operations of the cooperative and ensuring Big Rivers remains a safe, reliable, and cost-effective source of wholesale electric power.

Q. Please describe Big Rivers' generation fleet.

A. Big Rivers maintains a portfolio of available generation resources that currently includes coal-fired, gas-fired, and hydro-powered facilities. The Company's coal-fired generation resources include its Wilson Station, consisting of a single pulverized coal unit near Centertown, Kentucky (net capacity of 417 MW); the Reid Station, which includes both one (1) coal-fired unit (net capacity of 65 MW, presently idled) ("Reid Unit 1") and a natural gas-fired combustion turbine (net capacity of 65 MW); and its Green Station, consisting of two (2) coal-fired units (net capacity of 454 MW). Big Rivers also presently maintains its Coleman Station, which consists of three (3) pulverized coal units near Hawesville, Kentucky (net capacity of 443 MW), though that station has been idled since 2014. Big Rivers also formerly obtained power from HMP&L Station Two, which is co-located at the Sebree Station with the Reid and Green Stations, but the relevant contracts terminated by their terms in 2018. Additionally, Big Rivers enjoys 178 MW of contracted hydroelectric capacity from the Southeastern Power Administration. Finally, Big Rivers maintains several small solar arrays (totaling 120 kW direct current), the purpose of which is educational in nature.

Q. **How does the Company's existing generating capacity compare to the demand of its Member-Owners and Big Rivers' other customers?**

A. As the Commission is aware, Big Rivers' native load decreased substantially following the departure of two large smelter customers from the Company's system in 2013-2014. The combined load of the two smelters was approximately 850 MW. Since the exit of the smelters, Big Rivers' native load has grown primarily due to an expansion of an industrial facility and currently stands at approximately 660 MWs; however, as discussed in the testimony of Mr. Paul G. Smith, Chief Financial Officer for Big Rivers, the Company has taken many steps to maximize the value of its generation resources by, among other things, marketing excess capacity to non-Members via power purchase agreements and the regional transmission organization operated by

Midcontinent Independent System Operator, Inc. ("MISO"). In addition, presently pending before the Commission in Case No. 2019-00365[2] is a request for approval of contracts to provide electric service to a new facility in Brandenburg, Meade County, Kentucky, to be owned and operated by Nucor Corporation ("Nucor"). Nucor's planned $1.35 billion steel plate mill is expected to result in 400 direct jobs, over 2,600 indirect jobs, $189 million in annual labor income, $14.3 million in annual state and local tax revenues, and approximately $360 million in annual gross domestic product once fully operational. The facility is expected to increase Big Rivers' native load by [redacted]. These and similar efforts by Big Rivers have significantly reduced (and, according to near-term forecasts through 2023/24, actually eliminated) the Company's excess generating capacity.

Q. Are the Coleman Station, Reid Unit 1, and HMP&L Station Two units currently operating?

A. No. As a result of relevant authorities' stringent regulation of coal-fired generation facilities, coupled with the Company's decreased load requirements following the departure of the smelters' load and other factors, the Company's Coleman Station has been idled since 2014, and the Company's Reid Unit 1

[2] *In the Matter of the Electronic Joint Application of Big Rivers Electric Corporation and Meade County Rural Electric Cooperative Corporation for (1) Approval of Contracts for Electric Service with Nucor Corporation; and (2) Approval of Tariff* (filed Sept. 26, 2019).

has been idled since 2016. In the coming months, Big Rivers anticipates retiring its Coleman Station and Reid Unit 1 in conjunction with its system-wide approach to responsibly address existing coal-fired generation assets and related liabilities. As discussed further in the testimony of Mr. Smith, Big Rivers has taken great strides towards balancing its capacity and load since the exit of the smelters in 2013-2014, consistent with its Load Concentration Analysis and Mitigation Plan ("Load Mitigation Plan") and subsequent Management Audit Action Plan. Big Rivers' plan to retire the Coleman Station and Reid Unit 1 will allow it to responsibly address its remaining obligations in a reasoned and equitable manner, as well as ensure Big Rivers' members continue to benefit from the Company's extensive efforts to achieve a full financial recovery from the loss of significant load less than 6 years ago.

HMP&L Station Two was retired effective February 1, 2019. As the Commission is aware, for nearly fifty (50) years Big Rivers operated and maintained HMP&L Station Two as an independent contractor and purchased a portion of the facility's 312 MW capacity. Big Rivers and the City of Henderson also shared (and continue to share) certain facilities at the Sebree Station, pursuant to the parties' Joint Facilities Agreement originally executed in 1970. While most of the relevant contracts have terminated by their terms, Big Rivers remains obligated for a portion of certain costs—such as those related to the closure of the Station Two coal ash pond—under the Joint Facilities Agreement.[3]

Q. Does Big Rivers anticipate any other changes to its capacity profile in the near term?

A. Yes. As discussed in Case No. 2019-00365, Big Rivers anticipates entering into a solar power purchase agreement ("PPA") in connection with providing service to the new Nucor facilities described above. These efforts are expected to allow Big Rivers to maintain supply and demand balance, as well as result in a more diverse portfolio of coal, natural gas, solar, and hydro power. Consequently, Big Rivers will be well-positioned for the future as regulations and commodity costs change while still allowing its Members to enjoy the value of the existing investment in coal-fired resources.

[3] *See* Case No. 2018-00146, *In the Matter of: Notice of Termination of Contracts and Application of Big Rivers Electric Corporation for a Declaratory Order and for Authority to Establish a Regulatory Asset* (Ky. P.S.C. Aug. 29, 2018); Case No. 2019-00269, *In the Matter of: Application of Big Rivers Electric Corporation for Enforcement of Rate and Service Standards* (filed July 31, 2019).

III. ENVIRONMENTAL COMPLIANCE AT BIG RIVERS

Q. Does Big Rivers and its Board of Directors engage in strategic planning, particularly with respect to its generation resources and relevant environmental regulation?

A. Yes, Big Rivers designs and prioritizes its operations consistent with a Strategic Plan, and the Company is constantly evaluating the impact of new and changing environmental regulation on its generation resources. Big Rivers typically begins each year by surveying senior management, Station managers, the Board, and the chief executive officer of each Member-Owner on issues related to the strategy of the Company. These issues include the operation and maintenance of the generating units, supply side diversity, environmental compliance, and company strengths and weaknesses. The survey results are tabulated and reviewed by senior management during an all-day workshop. The Strategic Plan is then updated, presented to the Board for further review and input, and ultimately adopted by the Board each year. In addition, management discusses relevant environmental updates with the Board several times throughout the year to ensure the cooperative's leadership is well-informed with respect to the environmental challenges faced by Big Rivers.

Q. Please provide an overview of the environmental laws and regulations applicable to Big Rivers as a power producer with coal-fired generation facilities.

A. As the Commission is aware, Big Rivers and other coal-based electric generators face a complicated and ever-changing regulatory landscape that requires constant planning, analysis, and adaptation. During just the past decade, Big Rivers has faced compliance challenges emanating from, among other authorities, the Cross-State Air Pollution Rule ("CSAPR"), Mercury and Air Toxics Standards ("MATS"), the Disposal of Coal Combustion Residuals ("CCR") from Electric Utilities Rule ("CCR Rule"), and the Steam Electric Power Generating Effluent Guidelines and Standards ("ELG Rule"). As discussed in more detail below, federal, state and local authorities require Big Rivers to pursue both small and large projects to maintain compliant operations; the Company continuously monitors and evaluates applicable requirements as a vitally-important part of its business.

Q. Has Big Rivers previously applied to the Kentucky Public Service Commission for approval of an Environmental Compliance Plan?

A. Yes, on two (2) occasions. Big Rivers was first authorized to implement an environmental surcharge, pursuant to KRS 278.183, by Order of the Commission entered June 26, 2008, in Case No. 2007-00460. This initial

Environmental Compliance Plan (the "2007 Plan") included three projects or programs designed to ensure compliance with emissions standards governing sulfur dioxide (SO_2), nitrous oxides (NO_x), and sulfur trioxide (SO_3), respectively. Big Rivers was authorized by the Commission to recover by surcharge its reagent costs, emissions allowances, and similar variable operation and maintenance expenses associated with these compliance programs, and it continues to do so at present.

Big Rivers' second Environmental Compliance Plan was approved in Case No. 2012-00063 (the "2012 Plan"). The 2012 Plan, as initially proposed, included eight (8) projects developed for compliance primarily with the CSAPR and MATS rules. These proposed projects included the installation of updated FGD equipment and technology at the Wilson Station, modernized Selective Catalytic Reduction ("SCR") equipment and technology at the Green Station, and upgraded FGD systems at Station Two. However, due in part to the last-minute vacatur of CSAPR by the United States Court of Appeals for the District of Columbia Circuit,[4] the 2012 Plan as-approved ultimately included just four (4) projects, consisting of the installation of activated carbon injection and dry sorbent injection systems at the Coleman, Wilson, and Green Stations

[4] *EME Homer City Generation, L.P. v. Environmental Protection Agency, et al.*, 696 F. 3d 7 (D.C. Cir. August 21, 2012). On April 29, 2014, the Supreme Court of the United States reversed and remanded the decision of the D.C. Circuit vacating CSAPR. *Environmental Protection Agency et al. v. EME Homer City Generation, L. P., et al.*, 572 U.S. 489 (2014).

and continuous emissions monitoring at those Stations and at HMP&L Station Two. These projects were completed in April 2016 at the Wilson, Green, and HMP&L Stations at a total cost of approximately $28 million. The dry sorbent injection system was not installed at the Coleman Station due to the idling of that station in 2014.

Q. Have the costs associated with environmental compliance projects undertaken by Big Rivers in recent years been expensed as incurred?

A. Not necessarily. In Case No. 2015-00333,[5] Big Rivers sought and was granted authority to establish a regulatory asset for the income statement impacts (including gains, losses, depreciation and accretion expense) resulting from Asset Retirement Obligations ("AROs") related to its Green and Reid/Station Two ash ponds for 2015 and subsequent years (the "Green ARO Regulatory Asset" and "Reid/Station Two ARO Regulatory Asset," respectively). Additionally, Big Rivers was authorized to defer as a regulatory asset the actual CCR-compliance costs it incurred beginning in 2015 and thereafter (the "CCR Regulatory Assets"). As explained in more detail in the testimonies of Mr. Smith and Mr. Wolfram, Big Rivers proposes to address as part of its 2020 Plan each of these regulatory assets originating in Case No. 2015-00333, as

[5] *In the Matter of: Application of Big Rivers Electric Corporation for Authority to Establish Regulatory Assets for Expenses Related to the Coal Combustion Residuals Rule* (Ky. P.S.C. Jan. 5, 2016).

well as establish and amortize a regulatory asset (the "Coleman ARO Regulatory Asset") for costs associated with forthcoming ARO-related liabilities arising from the Company's Coleman Station ash ponds.

Q. Please summarize the relief requested by Big Rivers in this proceeding.

A. Big Rivers requests the current recovery by surcharge of the reasonable costs it has incurred and will incur in connection with the 2020 Plan projects, as well as the grant of a Certificate of Public Convenience and Necessity ("CPCN"), as required under KRS 278.020, for certain of the proposed 2020 Plan projects. Big Rivers further seeks: (i) approval to begin amortization of the Green ARO Regulatory Asset and Reid/Station Two ARO Regulatory Asset with corresponding settlement of the related AROs; (ii) authority to establish and amortize the Coleman ARO Regulatory Asset; (iii) approval to begin amortization of the CCR Regulatory Assets; and (iv) approval to establish a regulatory asset for the reasonable expenses incurred in developing and pursuing the relief requested herein and the recovery of those expenses over a reasonable period.

IV. The 2020 Plan

Q. Please provide an overview of the projects proposed for inclusion in Big Rivers' 2020 Environmental Compliance Plan.

A. Big Rivers' 2020 Environmental Compliance Plan includes completed, ongoing, and proposed environmental compliance projects at the Wilson Station, Green Station, Coleman Station, and Reid/HMP&L Station Two. Each of these facilities was or is utilized for production of energy from coal, and thus each must comply with extensive environmental requirements applicable to coal combustion wastes and by-products.

The completed and ongoing projects included in the 2020 Plan, which are included under Project 16, arose from CCR-related compliance efforts at the Wilson, Green, and HMP&L Stations and reflect expenses incurred during and after 2015 that were deferred by Big Rivers as part of the CCR Regulatory Assets established in Case No. 2015-00333.

With respect to proposed projects, Big Rivers seeks to: (i) replace the Wilson Station's FGD with the existing scrubber now maintained at the idled Coleman Station, as well as install associated gypsum dewatering systems and wastewater treatment facilities (Project No. 12); (ii) close the coal ash pond at the Company's Green Station and repurpose a portion thereof as a new Water Mass Balancing Pond ("WMB Pond"), as well as modify the Green Station's FGD wastewater treatment ("WWT") systems for upset and maintenance conditions (Project 13-1); (iii) close the three ash ponds at the Coleman Station (Project No. 13-2); (iv) close the ash pond at Reid/HMP&L Station Two (Project No. 13-3); (v) install a final cover system for the Wilson Station's Phase 1 CCR landfill (Project 14); and (vi) install a perimeter drainage system and undertake other groundwater and non-groundwater protection measures at the Green Station's landfill (Project 15), consistent with applicable law.

Q. Did Big Rivers communicate with its Member-Owners during the planning and development of the 2020 Plan and this proceeding?

A. Yes. In addition to the normal day-to-day discussions between the employees of Big Rivers and its Member-Owners, Big Rivers' Board consists of representatives of its Member-Owners, and thus updated information is regularly flowing to JPEC, Kenergy, and MCRECC. Big Rivers' Board unanimously approved the Company's pursuit of the 2020 Plan by resolution dated December 20, 2019. Additionally, discussion of the Company's generation resources and environmental compliance is included at each annual meeting of the Company, at which each Member's full board is present. Big Rivers also provided notice of the intended filing of this proceeding to its Member-Owners and the Commission, as evidenced by the copies of the relevant notices provided herewith at Exhibit B to Big Rivers' Application.

Q. Please explain the Environmental Compliance Plan Summary provided at Exhibit C to Big Rivers' Application.

A. The Environmental Compliance Plan Summary is a high-level overview of Big Rivers' 2020 Plan. It reflects each of the major undertakings associated with the 2020 Plan delineated by the project number assigned for reference in this proceeding, and catalogues each project's most-relevant information (including pertinent facility, applicable environmental authority(ies), anticipated project completion date and cost information). While Big Rivers' Application and accompanying testimony provide full details regarding the due diligence, environmental, engineering, accounting, reporting, and rate considerations relevant to the 2020 Plan, the summary provided at Exhibit C provides a concise digest of the environmental compliance undertakings that comprise the 2020 Plan.

A. PROJECT 12 – WILSON STATION (FGD/WWT)

Q. Please describe the existing FGD system at Big Rivers' Wilson Station.

A. The Wilson Station's existing FGD system has been in operation since approximately late 1986. The scrubbers at the Wilson Station are of the first generation of wet FGDs installed on utility boilers for SO_2 emission control. The system is comprised of four (4) horizontal flow wet scrubbers that treat flue gas from the Wilson Station's boiler with an alkaline reagent to "scrub" acid gasses from the gas stream prior to release to the atmosphere. The current FGD system is limestone based and unoxidized and produces a calcium sulfite waste product.

Q. Why does Big Rivers seek to retrofit and upgrade the existing FGD system at the Wilson Station?

A. The Wilson Station's FGD system is a critical component of environmental compliance at the coal-fired facility. Its primary purpose is to remove sulfur dioxide (SO_2) produced from the combustion process from the unit's flue gas exhaust. Historically, the Wilson FGD has achieved an average 92% removal rate.

Importantly, and as further described in the testimony of Mr. Hoydick, the design of the FGD system now in place at the Wilson Station is considered obsolete due to performance limitations and operational problems, such as gas flow maldistribution. Such issues have been observed at the Wilson Station; in fact, the Wilson Station has operated under an SO_2 allocation deficit annually since 2017 under CSAPR (40 CFR Part 97), as reflected in the chart on the following page.

Big Rivers Electric Corporation D. B. Wilson Station			
Compliance Year	CSAPR SO_2 Allocations	Annual SO_2 Emissions	Annual Deficit
2019	3,614	5,217	(1,603)
2018	3,614	5,082	(1,468)
2017	3,614	5,815	(2,201)

Q. Has Big Rivers incurred penalties as a result of the Wilson Station exceeding its SO_2 allocations under CSAPR?

A. Not yet, but it could unless action is taken to address the Station's emissions. Under CSAPR, Big Rivers is afforded emissions allowances on a system-wide basis, such that a "pool" of allowances is available to share for the coal-fired units at the Wilson, Coleman, and Reid Stations. As the Coleman units have been idled since 2014 and Reid Unit 1 since 2016, the Wilson Station has been able to utilize a greater proportion of the system's total allowances than it would otherwise be capable of utilizing. However, as discussed above, Big Rivers anticipates retiring the Coleman Station and Reid Unit 1 later this year, and thus it is expected that the allowances from Coleman will cease in 2020 and Reid 1 will cease in 2021. If the Wilson Station's SO_2 emissions exceed allowances in the future, Big Rivers will be forced to acquire additional allowances in the marketplace (assuming they are available) or face penalties.

Q. Are there other reasons Big Rivers seeks to replace the Wilson Station's FGD?

The operations and maintenance expense associated with the Wilson Station's existing FGD system is substantial and will continue to increase if the system is not replaced. As detailed in the testimony of Mr. Smith, Big Rivers has concluded, following the evaluation of multiple alternatives, that it would not be economic to proceed with the Wilson Station's existing FGD system as-is.

Q. What can be expected if the Wilson Station's existing FGD further deteriorates or fails?

A. Further deterioration of the existing FGD at Wilson Station will directly drive large capital projects. Examples of those projects include, but are not limited to, inlet duct nozzle replacement, inlet duct replacement, outlet duct replacement, new stack liner, new ceramic liner in FGD modules, structural steel replacement, and cable tray and power supply replacement. As the FGD continues to deteriorate or fail, Wilson's estimated Equivalent Unplanned Outage Rate (EUOR) is expected to increase by [redacted].

Q. Did Big Rivers seek to replace or upgrade the Wilson Station's FGD systems as part of its 2012 Plan?

A. Yes. Big Rivers initially proposed as part of Case No. 2012-00063 to replace the Wilson Station's existing FGD absorber with a new absorber that was essentially identical to the absorber presently at the Coleman Station. The estimated capital investment related to the project totaled approximately $139 million (2012$). However, shortly before the evidentiary hearing in that matter, the D.C. Circuit Court of Appeals entered a decision vacating the primary environmental driver for the project, CSAPR. Big Rivers agreed as part of the settlement of Case No. 2012-00063 to withdraw its request with respect to the Wilson Station's FGD. Roughly two years later, however, the U.S. Supreme Court reversed the lower court's holding, leading to the effective reinstatement of CSAPR and its limitations on sulfur dioxide (SO_2) and oxides of nitrogen (NO_X) emissions.[6]

Q. Please describe the existing FGD system at Big Rivers' Coleman Station.

A. The Coleman Station's existing FGD system was supplied by Wheelabrator Air Pollution Control / Siemens Environmental Equipment and first

[6] *Environmental Protection Agency et al. v. EME Homer City Generation, L. P., et al.*, 572 U.S. 489 (2014).

commercialized in 2006. The system is comprised of a single, vertical flow wet scrubber, with two Dual Flow Trays in series that treats flue gas from the Coleman Station's three boilers with an alkaline reagent (crushed limestone) to "scrub" acid gasses from the gas stream prior to release to the atmosphere. The Coleman FGD system process is limestone based and forced oxidation, which produces a calcium sulfate waste product known as gypsum. When the Coleman Station was generating, the FGD's associated gypsum dewatering facilities reduced waste by producing a commercial-grade gypsum for beneficial reuse in future products like wallboard and cement.

Q. Please describe the primary components of Project 12.

A. As part of Project 12, Big Rivers seeks to replace the existing horizontal absorber modules at the Wilson Station with the absorber module that is currently at the idled Coleman Station. After careful review of the design conditions, it was determined that the Coleman absorber size and design could adequately satisfy the flue gas conditions for the Wilson Unit 1 boiler, thereby avoiding the need to purchase an entirely new system for Wilson Station. The project will utilize a combination of existing infrastructure and new equipment, including an updated gypsum dewatering system and wastewater treatment facilities. Further detail regarding Project 12 is provided in the testimony of Mr. Hoydick, and particularly within the *D.B. Wilson Station Flue*

Gas Desulfurization System with Dewatering and Water Treatment Cost Study appended to his testimony.

Q. Does Big Rivers intend to relocate the Coleman Station's gypsum dewatering system along with its FGD?

A. No. Big Rivers has determined it is more cost-effective to install new such facilities rather than to relocate and continue on with the Coleman Station's existing gypsum dewatering system. To make this determination, Big Rivers requested that Mr. Hoydick and AFWIPC include in their report a feasibility and cost analysis for recycling the Coleman Station's dewatering system for reuse at the Wilson Station. While the design and general arrangement of the Coleman Station's existing dewatering components are compatible with the upgraded Wilson Station, the relevant vacuum filters are too large to be effectively accommodated within the Wilson site's existing infrastructure. For this reason, Big Rivers also examined whether the installation of a new, less expansive, but comparably-effective system could be installed in an existing building at the Wilson Station. The attached documentation provided at Exhibit Pullen-2 reflects a proposal obtained from Synmat showing a significant savings over the approach initially examined as part of the AFWIPC cost study appended to Mr. Hoydick's testimony.

Q. Please describe the proposed wastewater treatment facilities that comprise a portion of Project 12.

A. Once dewatered, the gypsum by-product resulting from operation of the FGD requires treatment to avoid the landfill and meet commercial-grade standards. This means that a chloride purge stream is required to maintain FGD chlorides at or below certain thresholds to help ensure compliance with the federal Effluent Limitation Guidelines and state KPDES permit. The WWT system consists of a series of physical and chemical unit processes designed to reduce the level of suspended solids and metals thru precipitation and filtration, including an ultrafiltration system to meet effluent discharge characteristics.

Q. Please describe how the proposed project will leverage existing facilities and assets to achieve cost-effective compliance.

A. A primary goal of Big Rivers with respect to Project 12 is to optimize the overall cost for the project by effectively reusing major pieces of equipment from the Coleman Station wherever appropriate. This equipment includes the absorber module including most absorber internals, absorber recycle pumps/motors, absorber 48" FRP recycle suction and discharge pipes, oxidation air blowers/motors, relevant electrical switchgear, motor control centers and distributed controls system cabinets. Moreover, existing equipment at the Wilson Station was evaluated for possible reuse in order to minimize project costs. It was determined that the existing booster fans and limestone grinding systems, among many other components, can be reused at the Wilson Station with minimal modification. Overall, it is estimated that Big Rivers can save approximately [redacted] by utilizing existing equipment as part of the Wilson FGD retrofit and upgrade project compared to installing a new FGD and associated equipment.

Q. What is the anticipated capital cost of this project?

A. The cost study prepared by Mr. Hoydick and his team at AFWIPC estimate a total cost for the project at approximately [redacted]. However, that estimate is based on the relocation and reinstallation of not only the Coleman FGD, but also its dewatering systems; and as evidenced by the Synmat proposal provided at Exhibit Pullen-2, the installation of a new system in an existing building at the Wilson Station will significantly reduce project costs. Based on this latter approach, the total estimated capital cost for Project 12 is [redacted] (excluding capitalized interest of [redacted]).

Q. What is the estimated annual cost of operation after the proposed facilities are placed into service?

A. Big Rivers estimates annual O&M expense resulting from Project 12 to be [redacted] beginning in 2023.

Q. What impact will Project 12 have on the Wilson Station's capacity and O&M costs?

A. Replacing the FGD systems at Wilson Station will decrease the station's capacity by approximately five megawatts due to the larger recycle pump motors and oxidation blowers associated with the replacement FGD. However, the fixed O&M cost will decrease by an average of approximately [redacted] annually, and Wilson's non-fuel variable O&M cost will decrease by an average of [redacted], through 2035.

Q. What is the projected schedule and timeline for this project?

A. The full project, including obtaining necessary approvals, detailed engineering and design, procurement of materials and services, and construction is expected to be completed immediately following the FGD tie-in during the spring 2022 planned outage of the Wilson 1 unit. Big Rivers plans to complete detailed engineering work for Project 12 in 2020 to allow for competitive bidding of the construction and procurement work as soon as practicable. The bids will be evaluated based on cost, schedule, conformance to bid specifications, and demonstrated experience in safely and efficiently doing this type of work. Once underway, dismantling of the absorber at the Coleman Station is expected to take approximately fourteen (14) weeks, with erection of the absorber at the Wilson Station encompassing approximately twenty-two

(22) weeks. The absorber is planned to be reconstructed in reverse order of how it was deconstructed, which allows for piling and foundation work at the Wilson Station to be undertaken simultaneously with deconstruction of the Coleman FGD.

Q. Besides authorization from this Commission, what permits or approvals are necessary in connection with this project?

A. Big Rivers is required to obtain approval for a construction permit under the Company's Title V permit and to demonstrate that the upgraded FGD will not increase emissions. Big Rivers will also be required to renew its Kentucky Pollutant Discharge Elimination System ("KPDES") permit due to the fact that a new water treatment facility will be constructed under the ELG standard. Finally, Big Rivers will be required to obtain approval for a Special Waste Beneficial Reuse Registered Permit-by-Rule for the disposal of gypsum and fly ash. Copies of permits related to the 2020 Plan will be filed with the Commission as available, consistent with 807 KAR 5:001, Section 15(2).

Q. What other options did Big Rivers examine for the Wilson Station?

A. The existing FGD at Wilson is outdated and at the end of its useful life. To ensure that utilizing the existing Coleman FGD was the most cost effective choice for replacing the Wilson FGD, Big Rivers evaluated two scenarios in addition to the proposed project, including the continued operation of the Station as-is and the replacement of Wilson's FGD with a new FGD. The economic analyses conducted by the Company are further discussed in the testimony of Mr. Smith, Big Rivers' Chief Financial Officer.

Q. Please describe the notable advantages and disadvantages of each of the options considered.

A. For the scenario to continue the operation of the Station as-is, O&M cost, Capital Cost, and Equivalent Unplanned Outage rates would all increase. In addition, "as-is" operation would likely result in additional environmental liability as system-wide emission allowances decrease following the idling of the Coleman and Reid Stations. For the scenario to replace the FGD with a new FGD, the new FGD would lower fixed O&M cost, lower non-fuel variable O&M cost, and reduce the amount of special waste disposal in the landfill. However, as previously explained in this testimony, the reuse of the Coleman FGD at Wilson reduces the fixed O&M by an average of approximately [redacted] annually and non-fuel variable O&M cost by an average of [redacted] through 2035. Given these savings, the least cost option, and that chosen by Big Rivers, is to recycle the FGD at Coleman Station and move it to the Wilson Station.

Q. Will the Wilson Station be well-suited for future utilization and compliance if the proposed project is pursued?

A. Yes. Replacing the Wilson Station's existing FGD will support the station's continued availability as a competitive generation resource while reducing Big Rivers' costs. Equipping the Wilson Station with newer FGD technology will also increase SO_2 removal efficiency, thereby eliminating the allocation deficit Big Rivers has experienced in recent years under CSAPR. Moreover, the gypsum dewatering and WWT treatment systems planned as part of Project 12 will maximize the value of the Wilson Station, reduce waste and help ensure ongoing compliance with relevant regulations governing special wastes and effluent limitations.

Q. How does the removal and repurposing of the Coleman Station's FGD system impact that Station?

A. As discussed, the Coleman Station has not operated in more than five (5) years and Big Rivers plans to retire the Coleman Station by the end of 2020. By removing and repurposing its FGD system, the net book value of the Coleman Station will decrease by approximately $23.3 million, resulting in decreased unrecovered costs at the time of retirement.

B. PROJECT 13 – CLOSURE OF ASH PONDS

Q. Please describe Project 13.

A. Like many other electric utilities throughout Kentucky and the United States, Big Rivers is obligated to ensure its ash ponds are appropriately contained and closed consistent with law. Big Rivers seeks to responsibly address all its ash ponds as part of the 2020 Plan, including those at Green (Project 13-1), Coleman (Project 13-2), and Reid/HMP&L Station Two (Project 13-3).

i. Project 13-1

Q. What is Project 13-1?

A. Project 13-1 is comprised of undertakings primarily designed to ensure compliance with the CCR Rule and limitations prescribed by the Green Station's relevant KPDES permit. The Green Station's existing ash pond will be closed by using a hybrid approach of capping in place approximately 450,000 cubic yards of the total 1,000,000 cubic yards of CCR material estimated to be in the ash pond footprint by consolidating and covering it along existing berms within the pond. The remaining 550,000 cubic yards will be removed and relocated to the existing on-site permitted special waste landfill. A new, lined WMB pond (totaling approximately 17-acres in size) will be constructed in place of the removed CCR material, and new chemical treatment equipment will be installed at the WMB Pond to meet the expected KPDES discharge requirements at the relevant outfall. Additionally, the Green Station's current WWT system will be modified to contain maintenance activities by the addition of a new "thickener overflow" pond in place of one of the coal pile runoff ponds.

Engineering, construction, timeline, cost, and other information concerning Project 13 is detailed in the *Green Station CCR / ELG Compliance Project Definition Report* prepared by Burns & McDonnell and attached to the testimony of Mr. Samuel Yoder.

Q. What are the principal environmental drivers underlying the proposed closure of the Green Station's Ash Pond and its conversion to a WMB Pond?

A. The CCR Rule requires all ash ponds that do not meet the siting requirements for separation between the bottom of the ash pond and the top elevation of groundwater by at least five feet must be closed (40 C.F.R. 257.60(a)). The Green Station ash pond does not meet this requirement, and thus its ash pond must be closed consistent with the CCR Rule. The deadline for compliant closure under the current CCR Rule is October 31, 2029, which includes the provision to cease receiving CCR material by October 31, 2024 (these dates are based on the current CCR regulation and will likely change when the proposed rule becomes final later this year). Because the ash pond has historically received waste water from areas of the Station, such as floor drains and stormwater runoff, in addition to sluiced ash, a WMB Pond is needed for the continuing waste water flows. The pond will be modified by segregating the ash to one side of the pond and closing it in place, and the remaining area will be used as a waste water pond for storm water runoff and process water discharge.

Q. What are the principal environmental drivers underlying the modification of the Green Station's WWT system?

A. In order to meet requirements governing wastewater discharge as regulated by the federal Effluent Limitation Guidelines and state KPDES permit, the Green Station must be equipped with a wastewater treatment system to regulate pond pH, alkalinity, total suspended solids, and assist in the removal of arsenic and iron that originates primarily from the coal pile runoff stream, boiler blowdowns, and miscellaneous site drains.

Q. What is the estimated capital cost for this project?

A. The estimated capital cost for this project is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted].

Q. Please describe Project 13-1's expected impact to operations and maintenance costs for Big Rivers.

A. The annual O&M expense resulting from the chemical treatment systems and ongoing monitoring costs associated with the WMB pond and WWT system are estimated at approximately [redacted], due primarily to chemical consumption costs.

Q. Please describe the contracting approach Big Rivers intends to take in order to complete the construction of this project.

A. Big Rivers anticipates utilizing multiple contracts to complete this work. Big Rivers will utilize an Owner's Engineer to develop the construction and major equipment specifications to be procured. Competitive bidding will be performed to award the contracts based on cost, experience, safety record, and scheduling requirements.

Q. Besides authorization from this Commission, what permits or approvals are necessary in connection with these projects?

A. The current KPDES permit already contains the requirements to meet when dewatering the ash pond to convert it to a WMB pond. Big Rivers will notify the Kentucky Division of Waste Management and prepare a solid waste permit application to transfer the water discharge permit to a solid waste permit.

Q. What other options did Big Rivers examine for the Green Station?

A. Big Rivers engaged Burns & McDonnell to estimate both the complete removal of the Green Station's ash pond's CCR, also known as a clean closure, as well as a closure-in-place. The hybrid closure-in-place option was selected because it was the lower cost option that is expected to meet compliance requirements. As the project proceeds, the Kentucky Division of Waste Management will review these plans in detail and may require modifications, with which Big Rivers will be required to comply. While the existing plan is based on internal and retained experts' best professional judgement and interpretation of the regulations at the time of this filing, Big Rivers seeks the Commission's permission to proceed with the ash pond closure method required by relevant state and federal authorities.

ii. Project 13-2

Q. Please describe Project 13-2.

A. Project 13-2 involves the closure of the Coleman Station's three coal ash ponds by capping them in place with a cover system, as outlined in the CCR Rule.

Q. Please describe the Coleman Station's Ash Ponds.

A. The existing ash ponds at the Coleman Station are designated as the South Pond, Sluice Pond, and North Pond. The North Pond is approximately sixty

(60) acres in size with an overflow pond located off of the north perimeter berm. The Sluice Pond covers approximately forty-nine (49) acres of the Coleman Station and was primarily utilized as the sluice discharge location for bottom ash and fly ash. The main portion of the South Pond is approximately ninety-four (94) acres in size and located to the south and west of the main powerblock area; an additional area, which has been beneficially used for parking, laydown, and by-product stack out, consists of approximately thirteen (13) acres located north/across of the main Station entrance road from the South Pond main area.

Q. What are the principal environmental drivers underlying the proposed closure of the Coleman Station's Ash Ponds?

A. Big Rivers' proposed closure of the Coleman Station's Ash Ponds is driven by the stringent regulation of CCR by relevant authorities. At the federal level, compliance efforts are typically pursued in conformance with the CCR Rule and related regulations; notably, though, the CCR Rule as finalized by the EPA in 2015 exempted from regulation inactive surface impoundments at inactive power Stations (also known as "legacy ponds"). *See* 40 C.F.R. § 257.50(e). Because the Coleman Station's units have not operated (and its ash ponds have not received CCR) since before the CCR Rule became effective, the closure of the relevant ash ponds has historically been outside of regulatory constraints.

However, on August 21, 2018, the United States Court of Appeals for the District of Columbia Circuit vacated and remanded a number of provisions within the CCR Rule, including those that exempt legacy ponds from regulation. *Util. Solid Waste Activities Grp. (USWAG) v. EPA*, 901 F.3d 414 (D.C. Cir. 2018) ("Because the administrative record belies the EPA's stated reason for its reactive, rather than preventative, approach—the inability to identify the responsible parties—the Rule's legacy ponds exemption is unreasoned, arbitrary, and capricious.").

The EPA is presently examining the path forward for implementation of the *USWAG* decision (*see* RIN: 2050-AH11, *Disposal of CCR from Electric Utilities; A Holistic Approach to Closure Part B: Alternate Demonstration for Unlined Surface Impoundments; Implementation of Closure; Legacy Units*). It is also expected that the ponds will be subject to the Kentucky Administrative Regulations (KAR) for special waste facilities or forthcoming state regulations specifically applicable to disposal of CCR.

Q. Is Project 13-2 designed to comply with the anticipated rules governing legacy ash ponds?

A. Yes. It is expected that legacy ash ponds will be subject to the CCR Rule in substantially the same manner as other ash ponds; therefore, it has been assumed that the three ponds will be capped in place with the cover system as outlined in the CCR Rule. The CCR Rule's prescribed cover system, for unlined impoundments, consists of 18 inches of clay infiltration layer, and 6 inches of topsoil that is capable of sustaining vegetation.

Q. What is the likelihood that legal challenges or other factors significantly delay (or result in the total frustration of) the federal government's regulation of legacy ash ponds?

A. As made evident by Big Rivers' last environmental compliance plan proceeding (when, the day before the formal evidentiary hearing, CSAPR was vacated by the D.C. Circuit Court of Appeals), it is impossible to know for certain how the rules and regulations governing coal combustion wastes and by-products from facilities utilized for production of energy from coal may change. However, Big Rivers takes seriously its responsibilities to both its Member-Owners and the environment, and to that end continually invests significant time and resources into researching, pursuing and achieving cost-effective compliance. Once the CCR Rule is formally revised, the closure of the Coleman Station ash ponds is a necessary and prudent course of action. Should the anticipated regulation of legacy ash ponds like those at the Coleman Station not occur or significantly differ from that expected, Big Rivers will reevaluate its plans to proceed.

Q. What is the anticipated capital cost and impact to annual O&M associated with this project?

A. The estimated total capital cost of this project, including contingency and owner's costs, is [redacted]. This amount does not include capitalized interest of approximately [redacted], which results in a total project cost of approximately [redacted]. Ongoing O&M costs for the closed ponds are expected to remain equal to those currently experienced for the ponds as part of the idled facility, and they are expected to be approximately [redacted] per year to cover costs such as mowing, well monitoring, wildlife control inspection, and ground maintenance.

Q. What is the estimated timeline for this project?

A. From start to finish, the closure of the Coleman Station ash ponds is expected to take approximately five (5) years. This schedule includes roughly five months for detailed engineering design and 3 months for a bid process. The overall construction schedule, which was developed based on 8-hour, 5-day work weeks, reflects the volume of the CCR material to be graded and consolidated on-site. The estimated daily grading production rate of moving wet CCR material within the ponds is 3,500 cubic yards, assuming the use of two excavators and eight haul trucks. This estimate is based on other CCR unit closure projects with which Burns & McDonnell has been involved.

Installation of the infiltration layer will be limited or will cease during the winter months because of the potential for freeze-thaw cracking and desiccation of the cohesive system.

Q. Please describe the contracting approach Big Rivers intends to take in order to complete the construction of this project.

A. The contracting plan developed for this project is for a single engineering contract to develop specifications, grading plans, and provide contract administration support and a single civil construction contract to execute the project based on the engineered plan drawings. The civil contractor will execute the earthwork, dewatering and treatment, CCR consolidation, and capping system placement. The contractor may subcontract and coordinate specialty items of the scope such as, but not limited to clearing and grubbing, geomembrane installation, dewatering and treatment and erosion control. Big Rivers expects this approach will be advantageous because it provides the Company with more control over the design and execution of the project while ensuring the most competitive contractor is utilized.

Q. Besides authorization from this Commission, what permits or approvals are necessary in connection with this project?

A. Big Rivers will need to modify its current KPDES permit to discharge water from the Coleman Ash Ponds during closure. Additionally, Big Rivers will notify and submit a permit application to the Division of Waste Management to transfer the ponds from the KPDES permit to a solid waste permit for the closed-in-place section.

iii. Project 13-3

Q. Please describe Project 13-3.

A. In light of the retirement of the HMP&L Station Two generating units in February of 2019, the CCR Rule requires the timely closure of the ash pond located at that facility. Big Rivers proposes as Project 13-3 to close the approximately 24-acre ash pond by capping it in place with a cover system, as outlined in the CCR Rule.

Q. Please describe the Reid/Station Two Ash Pond.

A. The ash pond jointly utilized by Big Rivers' Reid Station and HMP&L Station Two was in operation for approximately forty (40) years, during which it received predominately sluiced bottom ash generated by the Reid/HMP&L

coal-fired units. The ash pond is approximately 24 acres in surface area, and is partially incised with a berm above grade on the south, east and west sides.

Q. Please describe the primary components of Project 13-3.

A. The ash pond utilized by the Reid Station and HMP&L Station Two at the Sebree Station will be capped in place with a cover system as outlined by the CCR Rule. Like at the Coleman Station, this system will consist of 18 inches of a clay infiltration layer and 6 inches of topsoil that is capable of sustaining vegetation.

Q. Did Big Rivers engage third party experts to assist in evaluating and planning this project?

A. Yes, Mr. Yoder and Burns & McDonnell were engaged to assist with this project as well. Mr. Yoder and his team have prepared a report detailing the scope and cost of the ash pond closure project at the Sebree Station and provided engineering information for use by Big Rivers in evaluating feasibility, budgeting, and related planning issues. Among other information, the *Reid/HMP&L – CCR Pond Closure Evaluation* prepared by Burns & McDonnell discusses the assumptions, conceptual design, contracting approach, schedule, and cost estimates for the defined ash pond closure project.

Q. Will costs associated with this project be shared by HMP&L?

A. Yes. Big Rivers presently has an application pending before the Commission in Case No. 2019-00269 to enforce the rates and service standards contained in the Station Two Contracts between the Company and the City of Henderson ("Henderson"). Pursuant to the Station Two Contracts, Henderson is contractually obligated to pay its share of current and future HMP&L Station Two decommissioning costs, including any ongoing environmental monitoring, remediation and permitting costs relating to Station Two and facilities jointly used by the parties pursuant to their Joint Facilities Agreement. The subject ash pond is listed as a city-owned joint use facility under the Joint Facilities Agreement currently in effect between the parties, and Henderson has previously indicated its willingness to share in the decommissioning costs related to the closing of the ash pond. Based on the parties' agreement and their respective proportional share of capacity costs during the life of Station Two, Big Rivers is responsible for 77.24%, and Henderson for 22.76%, of the Station Two decommissioning costs. Should the Company be unable to recover from Henderson as it expects, Big Rivers requests authority to recover through its ESM the costs it actually incurs.

Q. What is the anticipated capital cost and annual O&M associated with this project?

A. The total estimated capital cost of Project 13-3 is [redacted], of which Big Rivers' projected share is [redacted]. This amount does not include capitalized interest of approximately [redacted], which results in a total project cost for Big Rivers of approximately [redacted]. Following completion of this project, estimated O&M expenses related to the closed ash pond are expected to be approximately [redacted] annually, with [redacted] representing the projected share of Big Rivers annually.

Q. What is the estimated schedule and timeline for this project?

A. Based on the date generation last occurred at the Station and consistent with the CCR Rule, the closure of the relevant ash pond is required to be completed by April 17, 2024. The anticipated closure timeline, including permitting and engineering, is estimated to be completed in just over two (2) years.

Q. Does Big Rivers intend to use a similar contracting approach with respect to this ash pond closure project as that planned for the Coleman Station project?

A. No, as this ash pond is owned by the City of Henderson. While Big Rivers' expertise and leadership are expected to spearhead this project, the award of any contract(s) is expected to be through the City and HMP&L. Municipal purchasing requirements, including public notice and public opening of bids, are expected to govern.

Q. What permits or approvals are necessary in connection with this project?

A. Because the ash pond is owned by the City of Henderson, the closure of the ash pond will be subject to HMP&L's approval and oversight. The closure plan will also be submitted to the Kentucky Division of Waste Management for review and comment. Finally, the KPDES permit will need to be revised as part of the closure process.

C. <u>PROJECT 14 – WILSON LANDFILL PHASE 1 FINAL COVER</u>

Q. Please describe Project 14.

A. Project 14 involves the construction of an engineered synthetic geo-membrane liner to serve as the final cover system for Phase 1 of the Wilson Station's permitted special waste landfill. The project is designed to mitigate rain water penetration of the landfill into the groundwater. The system will have down drains constructed of hydro-binder, a cement like material to direct rain water away from the landfill. The synthetic geo-membrane liner will require the installation of toe drains around the base of the landfill to direct any water to the leachate landfill collection system, thereby advancing the goal of full compliance with corrective action requirements of 401 KAR 45:160.

Q. Please describe the Phase 1 Wilson Landfill.

A. Big Rivers owns and operates a special waste landfill at the Wilson Station that was constructed in two stand-alone phases, Phase I and II, for the disposal of utility wastes including CCR. Phase I of the landfill contains an estimated 7.24 million tons of special wastes from the production of energy from coal, including flyash, bottom ash, and stabilized scrubber wastes. In total, Phase 1 has a surface area of approximately 103 acres. It reached capacity and stopped accepting waste in 2010.

Q. What are the primary environmental requirements driving this project?

A. KRS 224.50-760 governs the disposal of special waste, including utility wastes. The Kentucky Energy and Environment Cabinet promulgated 401 KAR Chapter 45 to implement its duty to regulate the disposal of special wastes. 401 KAR 45:110 contains the technical and operating requirements for special waste landfills. 46 KAR 45:110, Section 1(4) specifies that one design requirement is "the permeability of the liner material" and that "[t]he liner shall assure containment of the waste on site and compliance with 401

KAR 30:031." In addition to other corrective action measures being undertaken at Wilson Station, the Kentucky Division of Waste Management will require Big Rivers to install a new liner at the Wilson Phase I landfill in order for it to be considered compliant with 401 KAR Chapter 45.

Q. **Did Big Rivers consider alternative avenues for compliance, in addition to the approach selected as Project 14?**

A. Yes. In order to address the issues with containment described above, Big Rivers evaluated multiple options for compliance. A first option considered by Big Rivers was a conventional cap or traditional multilayer cover. This system employs a Microspike Geomembrane layer beneath a Geocomposite to minimize the penetration of water through the landfill. A second option considered by Big Rivers was a microdrain system. This approach utilizes a Microdrain layer beneath a Nonwoven Geotextile layer. While both of these alternatives would be expected to satisfy regulatory requirements, up-front costs and ongoing maintenance requirements do not compare favorably to the selected capping method. Unlike the selected approach, both a conventional cap and a microdrain system require the soil now atop the landfill to be stripped and then replaced on top of the liner system. Both of these alternative systems require 24" of protective cover soil on top of the installed liner; while the existing Phase 1 landfill has an average of 18" of soil now, Big Rivers would be required to acquire and place approximately 83,000 cubic yards of additional soil to complete the soil cap. Moreover, once the soil placement is complete, Big Rivers would be required to sow and maintain grass and complete additional erosion control measures continually. As reflected in Exhibit Pullen-3, the estimated capital costs associated with these alternatives significantly exceed the estimated capital cost of the selected system. Moreover, ongoing O&M costs associated with the selected option (approximately [redacted] annually) are much more favorable than the other options.

Q. Please describe the manner in which Project 14 will be completed.

A. Project 14 will begin with site preparations including drainage modifications and surface adjustments. Once the landscape is complete, the synthetic cover system will be installed. This system is rolled onto the surface of the landfill, similar to turf onto a football field. The synthetic cover will create an impervious barrier diverting runoff to dedicated down drains that collect into the allocated KPDES-permitted collection pond. Once the cover is completed, toe drains will be installed at the perimeter of the landfill to collect runoff from the lower slope and further alleviate any existing pockets of water contained within the landfill. These drains will also flow to the allocated KPDES-permitted collection pond.

Q. What is the anticipated capital cost associated with this project?

A. The estimated capital cost for this project is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted]. This figure is based on quotes obtained by Big Rivers for site preparation, the cover material, installation, drainage facilities and associated work, as reflected in the attached Exhibit Pullen-3.

Q. What is the estimated timeline for this project?

A. Detailed Engineering specifications/drawings are expected to be completed by June 1, 2020, which includes review and comment by the Kentucky Division of Waste Management. Bid specifications and contractor selection process would then occur between June 1, 2020 and July 31, 2020. This schedule gives an anticipated start of construction date of August 10, 2020. The project is expected to be completed by June 1, 2021.

Q. Please describe the contracting approach Big Rivers intends to take in order to complete the construction of this project.

A. Similar to the Green Station ash pond closure and associated projects, Big Rivers intends to utilize a multiple-contract approach to complete this work. Big Rivers will utilize an Owner's Engineer to develop the construction and major equipment specifications to be procured, and competitive bidding will be performed to award the contracts based on cost, experience, safety record, and scheduling requirements.

Q. What permits or approvals are necessary in connection with this project?

A. Project 14 requires review and comment of project plans by the Kentucky Division of Waste Management, which will be provided as they become available.

D. <u>PROJECT 15 – GREEN LANDFILL PERIMETER DRAINAGE SYSTEM</u>

Q. Please describe Project 15.

A. Project 15 concerns the Green Station's CCR landfill. It is designed to reduce lithium levels in groundwater and control other non-groundwater releases. The project includes the construction of a perimeter drainage system to convey non-groundwater seepage to a target manhole located on the northeastern corner of the landfill, thus reducing any potential for seepage impacts on groundwater. The target manhole will subsequently pump the landfill material to a permitted outfall under Big Rivers' KPDES permit. The project also involves the removal of coal ash run-off from the sedimentation pond located to the south of the Green Landfill, which is projected to result in the reduction of lithium concentrations to levels below the groundwater protection standards in the currently affected monitoring wells, thereby advancing the goal of full compliance with corrective action requirements of the CCR Rule.

Q. Is the City of Henderson also required to share in the costs of this project?

A. Yes. Henderson is obligated to share in those Green landfill costs that are attributable to the HMP&L Station Two waste in the landfill, based upon the percentage of waste in the landfill attributable to Henderson's share of waste generated by Station Two. As of December 31, 2018, Henderson owned 12% of the waste in the landfill, and is therefore expected to pay 12% of the costs of Project 15. Again, however, should the Company be unable to recover from Henderson as it expects, Big Rivers requests authority to recover through its ESM the costs it actually incurs.

Q. What is the anticipated capital cost and impact to annual O&M associated with this project?

A. The estimated capital cost of Project 15 is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted]. Annual O&M costs associated with this project are expected to be approximately [redacted].

Additional detail with respect to Project 15 is provided in Exhibit Pullen-4, which is a cost summary prepared by AECOM Technical Services, Inc.

Q. What is the estimated timeline for this project?

A. Detailed Engineering specifications/drawings are expected to be completed by June 1, 2020, which includes review and comment by the Kentucky Division of Waste Management. Bid specifications and contractor selection process would then occur between June 1, 2020 and July 31, 2020. This schedule gives an anticipated start of construction date of August 10, 2020. The project is expected to be completed by December 31, 2020.

Q. Please describe the contracting approach Big Rivers intends to take in order to complete the construction of this project.

A. Similar to the Green Station ash pond closure and associated projects, Big Rivers intends to utilize a multiple-contract approach to complete this work. Big Rivers will utilize an Owner's Engineer to develop the construction and major equipment specifications to be procured, and competitive bidding will be performed to award the contracts based on cost, experience, safety record, and scheduling requirements.

Q. What permits or approvals are necessary in connection with this project?

A. Project 15 requires review and comment of project plans by the Kentucky Division of Waste Management.

E. <u>PROJECT 16 – CCR ENVIRONMENTAL COMPLIANCE</u>

Q. Please describe Project 16.

A. Project 16 includes a series of efforts undertaken by Big Rivers to ensure ongoing compliance with the CCR Rule at its coal-fired generating stations. At the Wilson Station, Big Rivers has installed groundwater monitoring wells, conducted groundwater data analysis, ensured special waste containment, and incorporated a new leachate collection and treatment system. Similarly, at the Green Station, Big Rivers has constructed a collection trench and an interceptor trench within the Green Station's landfill to ensure leachate is properly collected and treated. These and additional smaller projects, referred to herein collectively as Project 16, have been undertaken by Big Rivers in the usual course of its business, and each is more fully detailed in Exhibit Pullen-5. This exhibit includes a description of each project, relevant environmental regulations, and installation/cost information.

Q. Has Big Rivers completed all CCR-related compliance efforts reflected in Project 16 and Exhibit Pullen-5?

A. No. As noted in Exhibit Pullen-5, certain undertakings included as part of Project 16 (primarily leachate collection and treatment efforts at the Wilson and Green Stations) remain ongoing and relevant costs have not been finalized. These projects are expected to be completed in the coming months with all costs finalized by July 31, 2020. Big Rivers commits to providing updated cost information with respect to ongoing projects under Project 16 during the pendency of this case.

Q. Are each of the undertakings that comprise Project 16 reasonable and cost-effective for compliance with applicable environmental requirements?

A. Yes. Project 16 includes costs related to design assessments, technical reports, groundwater monitoring, leachate collection systems, and other efforts undertaken by the Company since 2015. These costs were incurred to ensure Big Rivers' compliance with environmental regulations governing CCR, particularly those requirements set forth in 40 C.F.R. §257.

V. CONCLUSION

Q. Please summarize the relief requested by Big Rivers in this proceeding.

A. Big Rivers requests the current recovery by surcharge of the reasonable costs it has incurred and will incur in connection with the 2020 Plan projects, as well as the grant of a CPCN for certain of the proposed 2020 Plan projects. Big Rivers further requests authority to proceed with the accounting and ratemaking treatment associated with the 2020 Plan as described in Big Rivers' Application and its attached testimony.

Q. Does Big Rivers believe all of the projects proposed for inclusion in its 2020 Plan require a CPCN?

A. No. With respect to Project 13-3, Big Rivers intends to contribute towards the closure of Station Two's ash pond, as it is required to do pursuant to the parties' agreement; however, as the Commission is aware, Station Two is wholly owned by the City of Henderson and is therefore exempt from the requirements of KRS 278.020(1). For this reason, Big Rivers requests a finding from the Commission consistent with its holding in Big Rivers' earlier environmental compliance plan case (Case No. 2012-00063)—specifically, that the undertakings Big Rivers proposes to pursue at HMP&L Station Two do not require a CPCN. Alternatively, if the Commission finds Project 13-3 does require a CPCN, Big Rivers requests a CPCN for that project, as well.

In addition, Projects 14 and 15, which concern the installation of a final cover system for Phase 1 of the Wilson Station's landfill and a perimeter drainage system and other facilities at the Green Station's landfill, respectively, are relatively-minor undertakings pursued by Big Rivers as ordinary extensions of existing systems in the usual course of business. Project 14's estimated capital cost of approximately [redacted] represents a relatively insignificant portion of Big Rivers' net utility plant ([redacted]) and will not materially impact Big Rivers' existing financial condition. Likewise, Project 15's total estimated cost of [redacted], of which Big Rivers' share has been calculated to be [redacted], also represents a relatively minor capital outlay for Big Rivers ([redacted] of the cooperative's net utility plant). These Projects, themselves, will also have a minor or negligible impact on the amount of the ES, as discussed in the Direct Testimony of Mr. John Wolfram. For these reasons, Big Rivers is not required to obtain a CPCN for Project 14 or Project 15 under KRS 278.020 and requests a Commission determination reflecting that conclusion.

Finally, the relatively-minor undertakings that comprise Project 16 (and for which regulatory assets were authorized in Case No. 2015-00333) have also been pursued by Big Rivers as ordinary extensions of its existing systems in the usual course of business; based on this fact, Big Rivers asserts that a CPCN was not and is not required for the relevant activities.

Q. Does this conclude your testimony?

A. Yes.

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

VERIFICATION

I, Michael T. ("Mike") Pullen, verify, state, and affirm that I prepared or supervised the preparation of the Direct Testimony filed with this Verification, and that Direct Testimony is true and accurate to the best of my knowledge, information, and belief formed after a reasonable inquiry

Mike Pullen

Michael T. ("Mike") Pullen

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by Michael T. ("Mike") Pullen on this the 6th day of February, 2020.

Katherine Risley

Notary Public, Kentucky State at Large

My Commission Expires October 31, 2020

Professional Summary

Michael T. Pullen
Vice President Production
Big Rivers Electric Corporation
201 Third Street
Henderson, KY 42420
Phone: 270-844-6186

Professional Experience

Big Rivers Electric Corporation
Vice President Production – 2015 to present

Ameren Illinois – 2014-2015
Management Substation Construction

Electric Energy, Inc. – 1990-2014
Director Operations
Manager Generation
Manager Systems-Dispatch
Group Supervisor Maintenance

Education

Master of Business Administration
Murray State University

Bachelor of Science Electrical Engineering
University of Mississippi

Case No. 2019-00435

Exhibit Pullen-2

Project 12 Alternative Detail Documentation

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	**Case No. 2019-00435**

CONFIDENTIAL DOCUMENT

Exhibit Pullen-2
Direct Testimony of Michael T. Pullen
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT

Case No. 2019-00435

Exhibit Pullen-3

Project 14 Alternatives Analysis and Cost Summary

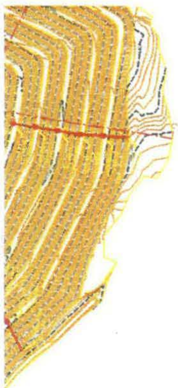
In the Matter of:

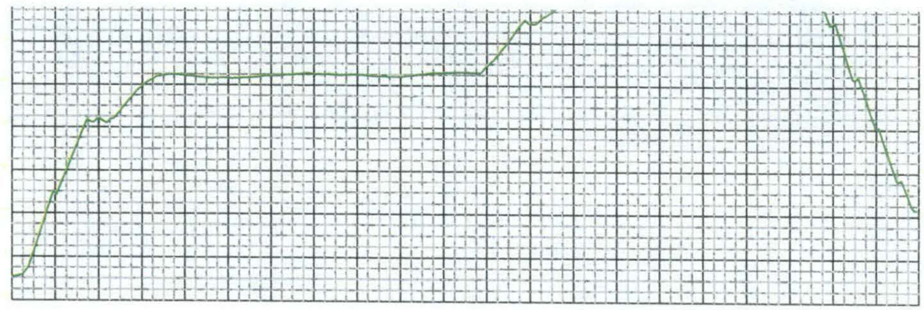
APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)))))))))	**Case No. 2019-00435**

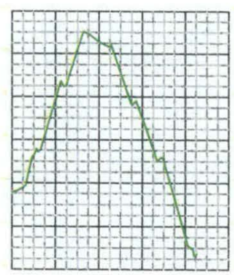
CONFIDENTIAL DOCUMENT

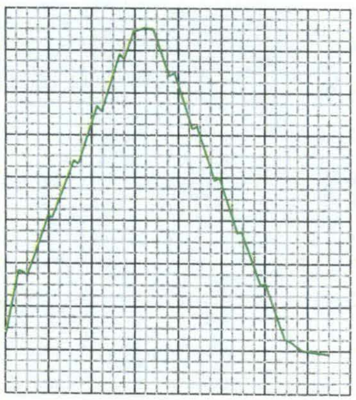
Exhibit Pullen-3
Pages 1 through 3 of 63
FILED: February 7, 2020

<u>INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT</u>









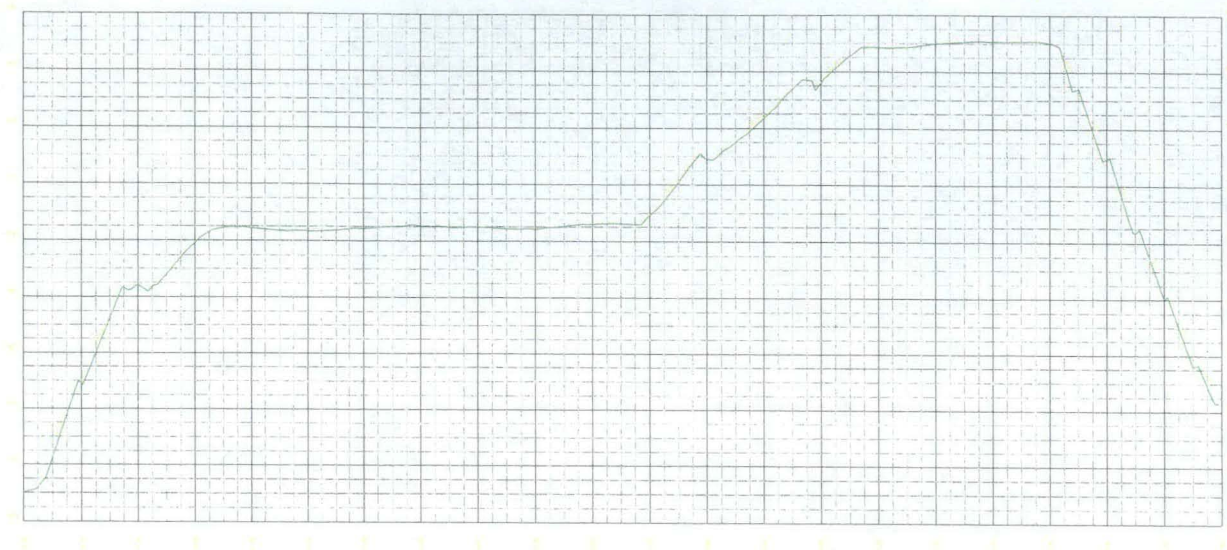
ASSOCIATED ENGINEERS, INC.

BIG RIVERS ELECTRIC CORPORATION
BIG RIVERS - DB WILSON PHASE I
CENTERTOWN, KY

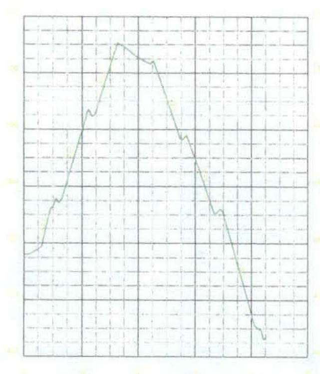
AS-BUILT PLAN VIEW

SHEET NUMBER

1



CROSS SECTION A-A'



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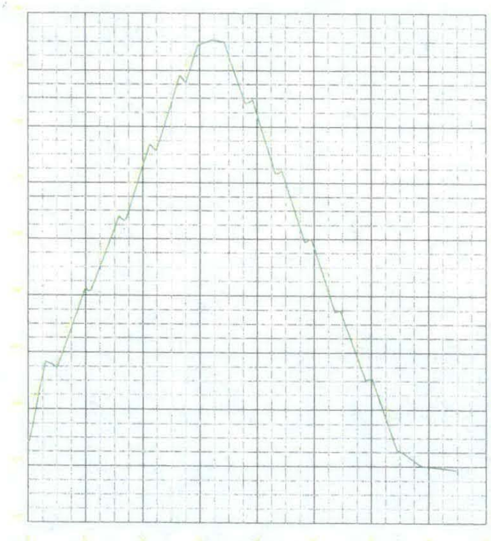


CROSS SECTION C-C'

ASSOCIATED ENGINEERS, INC.
ENGINEERS • GEOLOGISTS • SURVEYORS

JOB NO	12-0037
DRAWN BY	P.B.
CHECKED BY	M.C.
DATE	07/16/2012

BIG RIVERS ELECTRIC CORPORATION
BIG RIVERS - DB WILSON PHASE I
CENTERTOWN, KY

AS-BUILT CROSS SECTIONS

SHEET NUMBER

1

ClosureTurf®

Design Guidelines Manual

May 2019

WatershedGeo®
Unearthing Solutions

Table of Contents

1.0 Introduction

Closure*Turf* ® is a patented, 3 Component System* that serves as the final cover system on landfills. **Closure***Turf* ®

Component 1 - An Agru Super Gripnet®, AGRU MicroDrain

Or (AGRU MicroSpike geomembrane)

Component 2 - An Engineered Turf

Component 3 - A sand infill (or alternatively, HydroBinder® infill)

*A Watershed Geosynthetics patented (patent no. 8,585,322) gas collection system is a separate component to be utilized on sites that produce gas emissions. Pressure Relief Valves are provided at one per acre of **Closure***Turf*® on landfills where gas emissions are expected. Engineer of Record is responsible for matching the gas system design to the flow properties of each site.

In addition to the **Closure***Turf*® Design Guidelines document, product specific Installation Guidelines documents as well as Specifications and other technical data are also available at www.watershedgeo.com.

1.1 Purpose and Scope

This manual contains guidance to aid in the design of final landfill closures utilizing **Closure***Turf* ® as the primary final cover system. General Design Guidelines are covered in the main text, and product specific items are found on the Product Data Sheets. As with any landfill liner design, it is imperative that a proper design be combined with a proper installation of these products. See Figure 1 below.

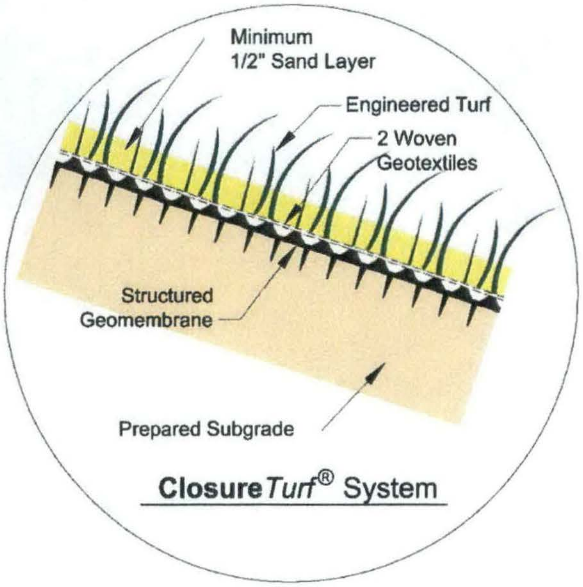


Figure 1: **Closure***Turf*® System

This manual is provided as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for any changes and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

2.0 Landfill Cover Design Best Practices using **Closure***Turf*®

Closure*Turf* ® is a product that is used as the final surface on landfills and Coal Combustion Residual (CCR) covers. Since the final application of the product should be as maintenance free as possible, certain best practices for cover design should be implemented in advance of final closure. Over the long term, a large amount of settlement both at the base of the landfill and the differential settlement of some waste profiles can cause grades to reverse and cause pockets where surface water may not drain properly. The following sections will look at specific closure cover design techniques meant to make a **Closure***Turf*® cover system as maintenance free as possible. Additionally, this manual explains specific unique methods to mitigate storm water issues that have not been addressed before **Closure***Turf*® was available in the marketplace.

2.1 Typical Landfill Cross Section

Typical closed landfills range in side slope from 2H:1V to 4H:1V (Horizontal:Vertical). Over time, these slopes settle yet usually will not reverse grade due to their initial steeper slope. However, problems may arise when the top deck of the landfill has been designed with very slight slopes (typically less than 5%). Settlement calculations must be done for both the expected base settlement of the landfill and the expected differential settlement of the waste profile within a given landfill. Typically, a coal ash type of waste will not have the differential settlement that a municipal solid waste (MSW) type of landfill waste will have. However, over time the combination of base settlement and differential settlement can be surprising.

The settlement problem can become more of an issue when diversion berms have been placed on the side slopes. Settlement calculations are one key to a good, long lasting design. Figure 2 shows typical settlement design concerns when planning for a **Closure***Turf* ® cover system.

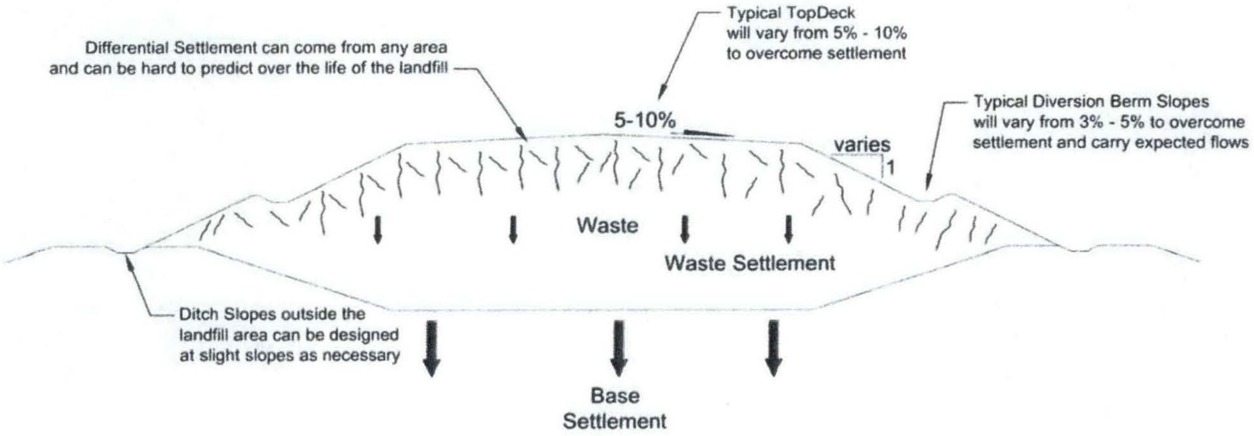


Figure 2: Typical Landfill Cross Section

2.2 Diversion Berms and Benches

Diversion berms and benches on **Closure***Turf* ® cover systems should be designed as regulatory requirements dictate. For channel slopes between 3 and 5%, and where shear is less than 0.8 pounds per square foot (psf), sand or gravel infill may be used. When benches are utilized, stone may be placed in the bench to alleviate cold weather bridging along the inverted grade. Figure 3 shows a typical Diversion Berm scenario.

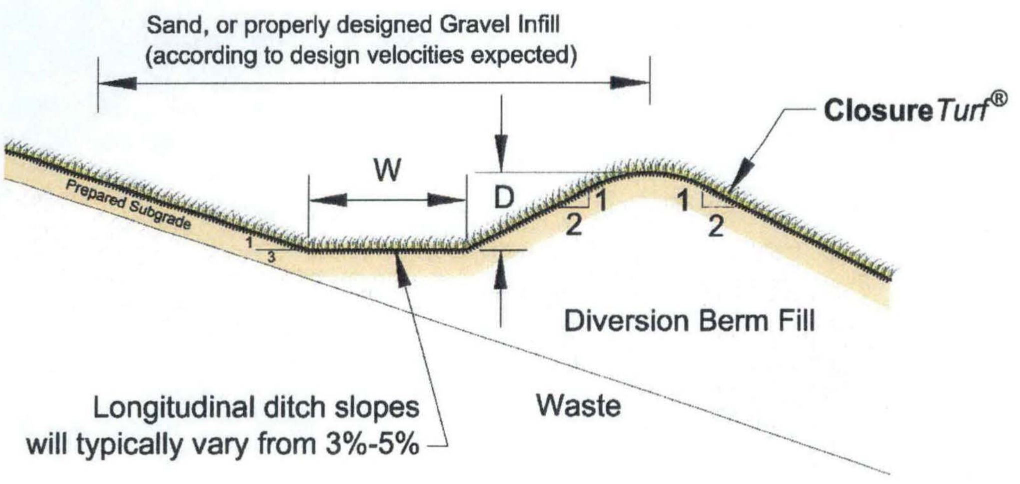


Figure 3: Typical Diversion Berm

2.2.1 Benchless Design with **Closure***Turf*®

Extensive testing of sand infill has shown that a coarser, more well graded sand will greatly increase the distance required between drainage structures. This improvement to the sand infill allows for a benchless design that leaves diversion berms and down slope channels out of the design completely, or at least greatly reduce the need. This is an innovative improvement to the product that will raise the Time of Concentration (Tc) values.

By utilizing ClosureTurf ®, the designer enjoys the savings gained from not having to account for the 67 cubic yards of sediment storage, and not having to design for Water Quality Volumes (W_Q).

2.3 Landfill Access

The **Closure***Turf* ® cover system can be driven upon under certain stress conditions. Extra care will need to be used according to the load placed on the system. As shown in Figure 5, areas that receive a higher amount of light traffic will require 1 inch of sand and/or 4 to 6 inches of gravel to act as a cushion layer between the sand and vehicle contact. Detailed calculations of three different vehicle loads are in Section 6.0 Survivability/ Drivability Calculations.

A Typical Light Access Road is shown in Figure 4. Where heavier and more frequent travel is required, refer to the Heavy Access Road in Figure 5. This is a typical detail and will need to be designed for actual loads by the professional engineer of record.

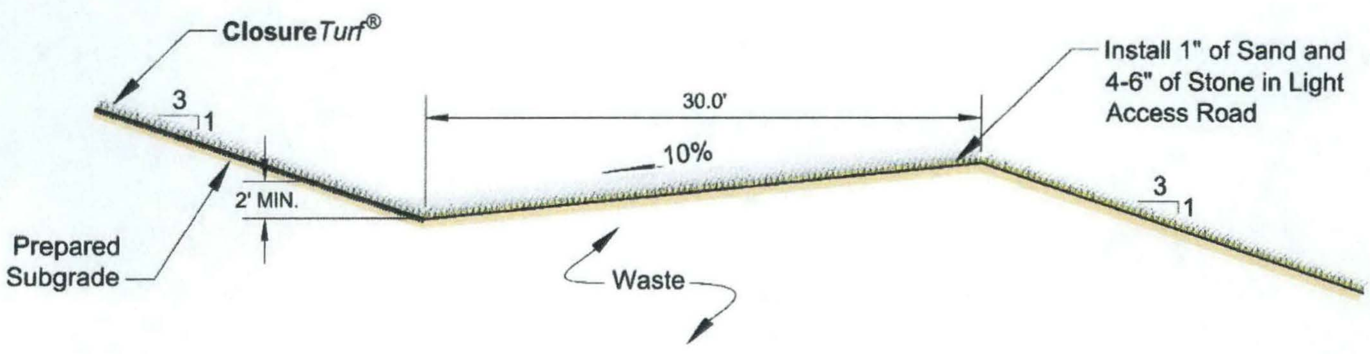


Figure 4: Light Vehicle Access Road Section

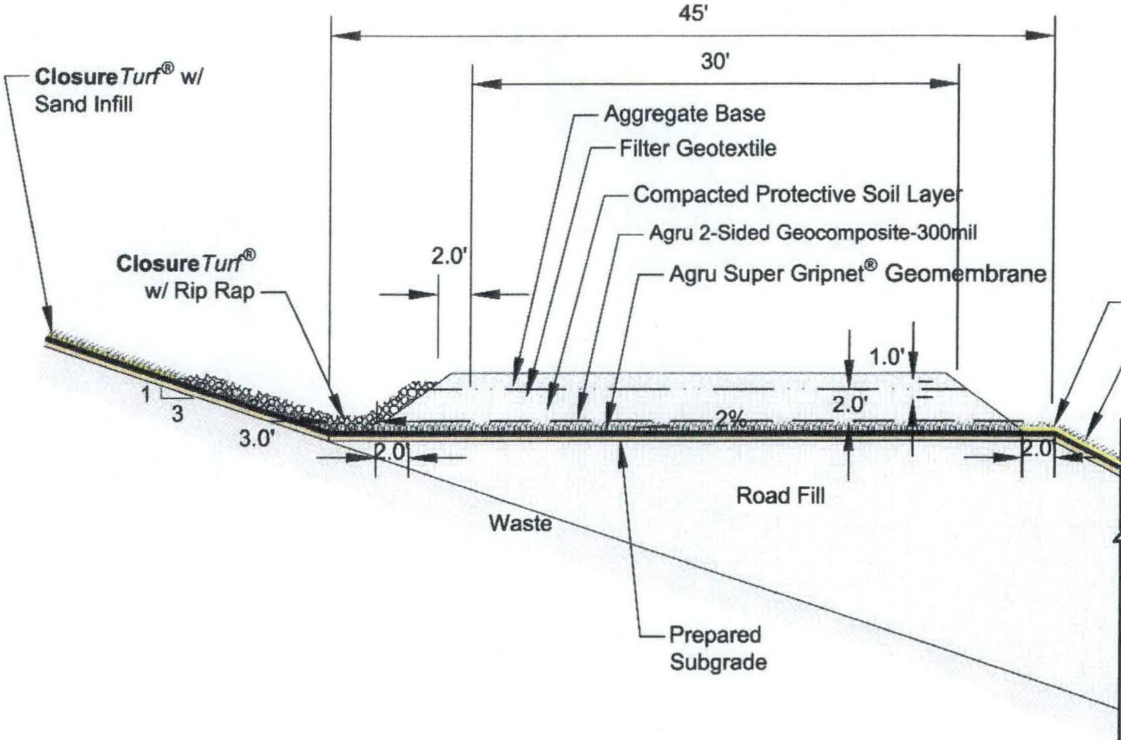


Figure 5: Landfill Access Road Section

2.4 Anchor Trenches

ClosureTurf® only relies on the anchor trenches to serve as a termination point. Top anchor trenches should be backfilled as quickly as practical after Engineered Turf Component is installed (prior to sand infill placement).

Vertical anchor trenches as well as anchor trenches along the toe will not be backfilled until sand infill of the engineered turf is in place, unless previously approved by the POR. Anchor trench dimensions will be shown in the drawings.

Backfilling or sand bag loading the bottom and side anchor trenches should be considered and applied when cool temperatures are anticipated to assist with creep reduction.

When HDPE material is utilized, additional anchoring methods may be required to reduce wrinkling due to the overnight contraction of the material. Contraction of the HDPE material may be site specific/seasonal and should be discussed onsite to develop an effective method to alleviate potential issues.To get a final aesthetic look that reduces wrinkling, the product needs to be installed and allowed to relax over the course of construction while the infill is finalized. At this point, the anchor trenches may be filled and compacted. Note that all anchor trench designs will need to be reviewed and approved by the engineer. Examples shown are typical scenarios only. The project engineer is responsible for designing the proper size anchor trench for the specific site conditions.

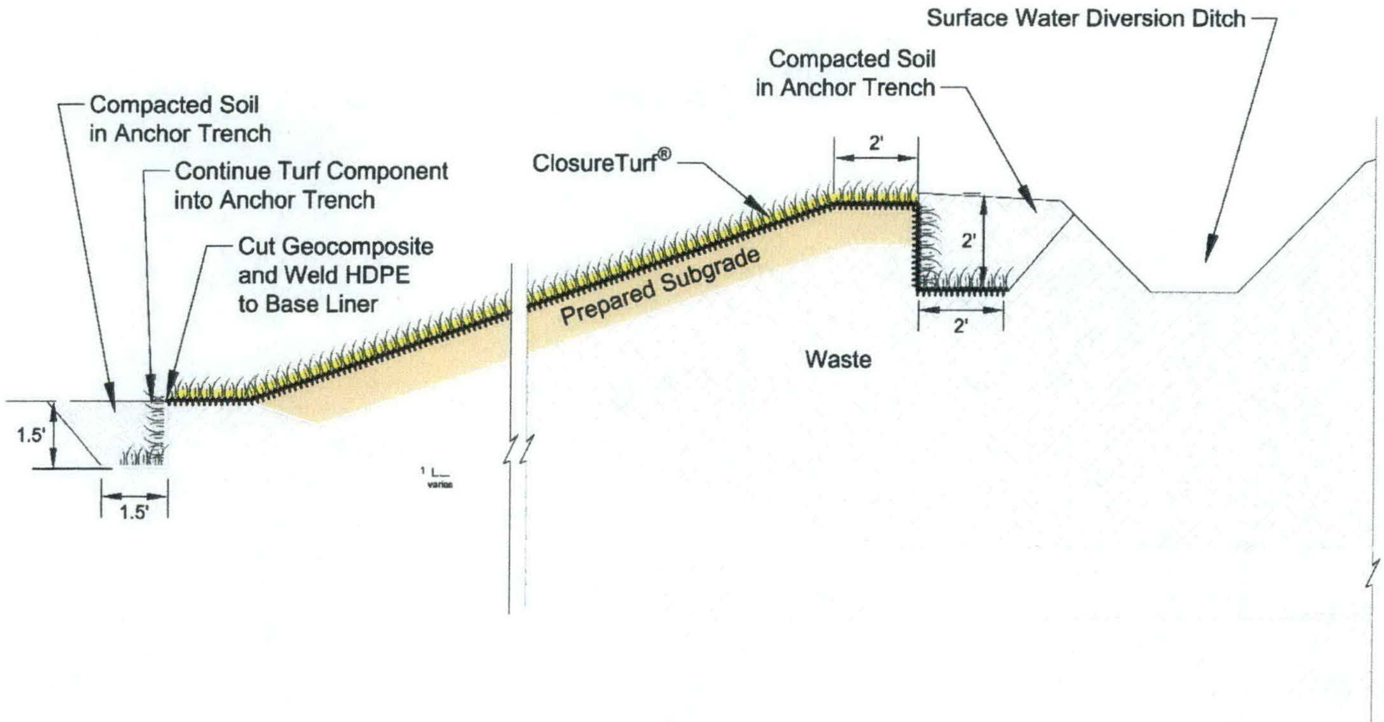


Figure 6: Typical **Closure***Turf* ® Anchor Trenches at Top and Bottom of Slope

2.6 Closure*Turf*® with Stone Infill for Ditches

When **Closure***Turf* ® is installed in ditches and stone infill is placed in lieu of sand infill, bridging due to large temperature swings can be alleviated while providing adequate protection from shear. See Figure 7.

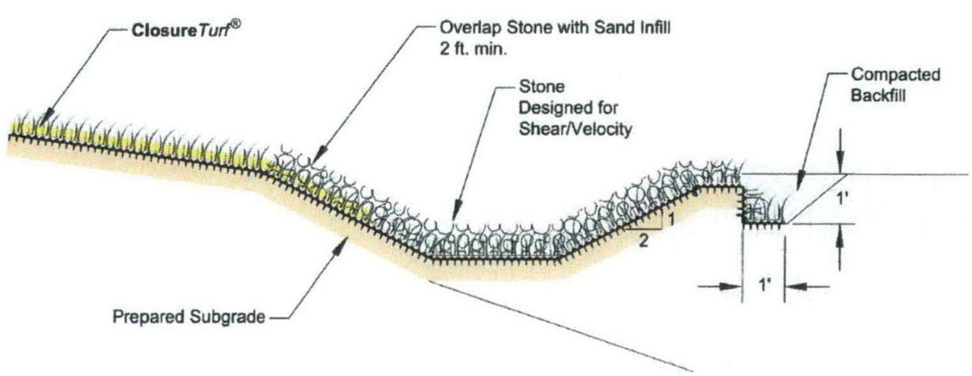
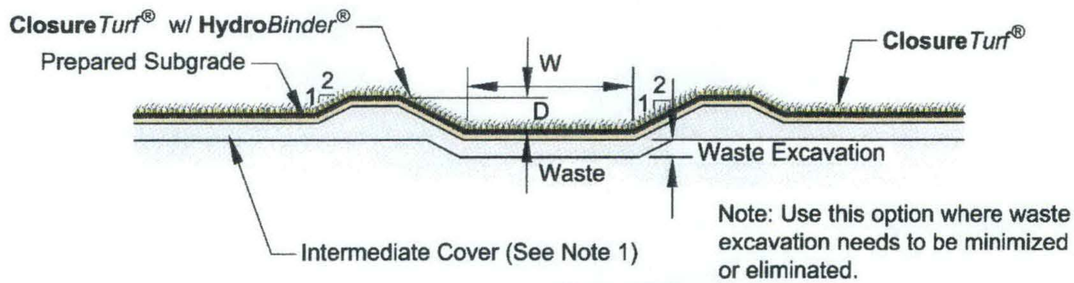


Figure 7: Typical **Closure***Turf* ® with Stone Infilled Ditch

2.6.1 **Closure***Turf*® with **Hydro***Binder*® Infill for Downslope Channels

Closure*Turf*® downslope channels are easily constructed by changing the infill to **Hydro***Binder*®. Following the **Hydro***Binder*® Installation procedures, final placement of **Hydro***Binder*® is fast and effective. Figure 9 shows typical downslope channel sections and how they may be designed according to whether waste will be removed. Figure 9 shows the typical **Hydro***Binder*® infill placement area for downslope channels.

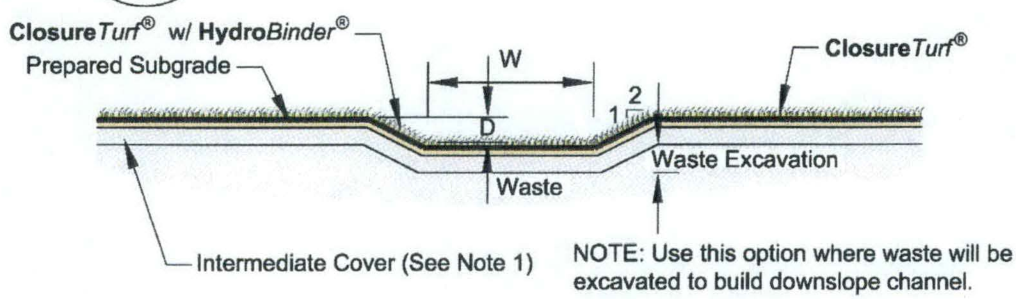
Important: When **Hydro***Binder*® is utilized, it is important not to block the flow that occurs in the Super Gripnet® with heavy structures such as Rip Rap Check Dams.



Option 1

A/1 Downslope Channel Section

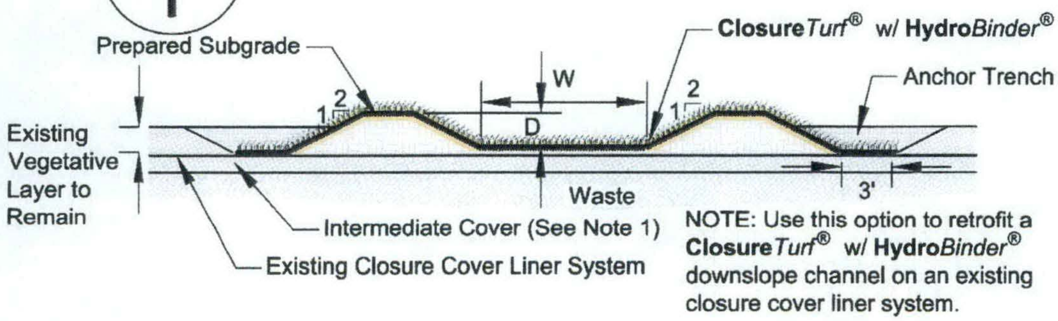
N.T.S.



Option 2

A/1 Downslope Channel Section

N.T.S.



Option 3 - Retrofit

A/1 Downslope Channel Section

N.T.S.

Figure 8: Typical Downslope Channel Sections

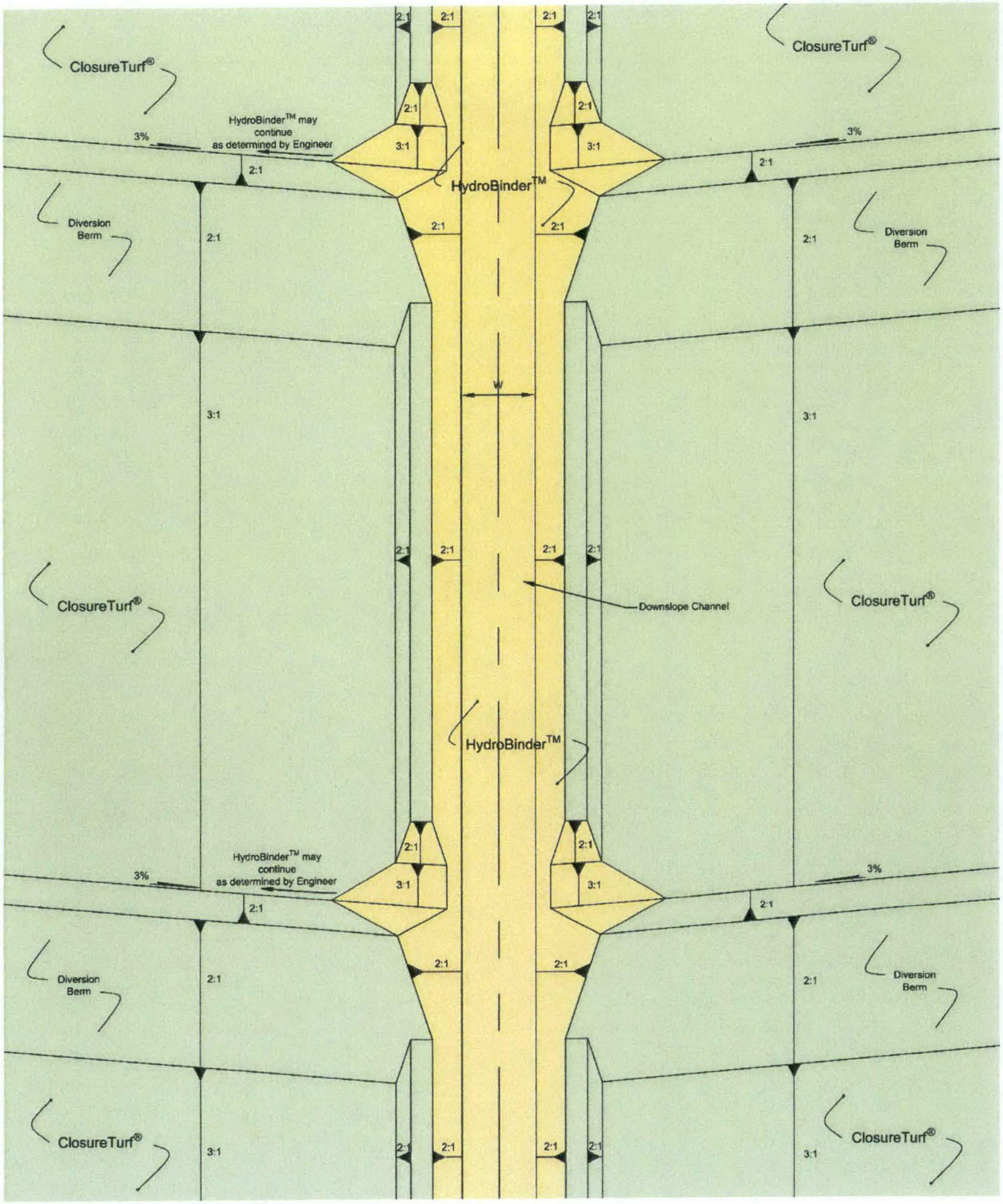


Figure 9: Typical **Hydro***Binder*® Infill Placement in Downslope Channels

2.7 Energy Dissipation

As with any landfill closure, proper energy dissipation at the base of the **Closure***Turf*® with **Hydro***Binder*® downslope channels is necessary. Internal energy dissipators, stilling basins, scour holes or a combination of these may be necessary to properly convey high surface water velocities at the toe of slope and/or around sharp angles. Downslope channel velocities are typically high. **Hydro***Binder*® infilled **Closure***Turf*® will be able to better handle these high velocities and will not fail under very high shear stresses. Proper energy dissipation techniques can be found in FHWA Circular Number 14 (HEC 14) "Hydraulic Design of Energy Dissipators for Culverts and Channels," Sept. 1983, revised 1995. See Section 5.0 Hydrology for further hydrologic parameters.

Important: Because longer drainage lengths are possible with **Closure***Turf*®, the requirement to concentrate water in benches to get it off the cover system may be eliminated or greatly reduced. The ability to maintain sheet flow for extended distances is a major advantage to utilizing **Closure***Turf*®. Less diversion berms and downslope channels will mean longer Travel Time values and will help to alleviate peak storm timing.

3.0 Product Data Sheets

Closure *Turf*® w/50 mil SuperGripnet®

ClosureTurf®

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	50 (1.27)	50 (1.27)
Thickness (min. avg.), mil (mm)	ASTM D5994	47.5 (1.21)	47.5 (1.21)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	42.5 (1.08)	42.5 (1.08)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
Friction Spike Height (min. avg.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV	See Below	
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	110 (19.3)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	12
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	105 (18.4)	110 (19.3)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	30 (133)	38 (169)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

ENGINEERED TURF COMPONENT (CT)

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	1500 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	2,100 MD / 1,600 XD lb./ft. (MARV)
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.05% 6 in./hr. Rainfall
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs (projected)
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft^3/ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft^3/s/ft
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolanic Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥20 oz. / sq. yd. (≥ 32 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft^2	m2	lbs	kg
Super Gripnet®	50	1.25	23	7	500	152	11,500	1,068	~4000	~1814
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	~1000	~454

04-2019-0

ClosureTurf® w/60 mil SuperGripnet®

ClosureTurf

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	60 (1.52)	60 (1.52)
Thickness (min. avg.), mil (mm)	ASTM D5994	57 (1.46)	57 (1.46)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	51 (1.30)	51 (1.30)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
Friction Spike Height (min. avg.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	132 (23.1)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	12
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	126 (22.1)	132 (23.1)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	40 (178)	42 (187)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	70 (311)	90 (400)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

ENGINEERED TURF COMPONENT (CT)

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	1500 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	2,100 MD / 1,600 XD lb./ft. (MARV)
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.05% 6 in./hr. Rainfall
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs (projected)
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft^3/ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 $ft^3/s/ft$
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolanic Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥20 oz. / sq. yd. (≥ 32 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft^2	m2	lbs	kg
Super Gripnet®	60	1.50	23	7	500	152	11,500	1,068	~4000	~1814
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	~1000	~454

04-2019-0

Closure *Turf*® w/50 mil MicroDrain® Liner

ClosureTurf

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	50 (1.25)	50 (1.25)
Thickness (min. avg.), mil (mm)	ASTM D5994	47.5 (1.19)	47.5 (1.19)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	42.5 (1.06)	42.5 (1.06)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
MicroSpike Asperity Height (min. avg.), mil (mm)	ASTM D7466	20 (0.51)	20 (0.51)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	110 (19.3)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	12
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	105 (18.4)	110 (19.3)
Elongation@Break (min. avg.), lbs. %(GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	30 (133)	38 (169)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

ENGINEERED TURF COMPONENT (CT)

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	1500 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	2,100 MD / 1,600 XD lb./ft. (MARV)
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.05% 6 in./hr. Rainfall
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
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Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft^3/ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 $ft^3/s/ft$
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolanic Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥20 oz. / sq. yd. (≥ 32 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft^2	m2	lbs	kg
MicroDrain®	50	1.25	23	7	500	152	11,500	1,068	~4000	~1814
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	~1000	~454

04-2019-0

Closure *Turf*® w 40 mil MicroSpike®

ClosureTurf®

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	40 (1.02)	40 (1.02)
Thickness (min. avg.), mil (mm)	ASTM D5994	38 (0.97)	38 (0.97)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	34 (0.86)	34 (0.86)
Asperity Height (min. avg.), mil (mm)	ASTM D7466	20 (0.51)	20 (0.51)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	88 (15.4)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	12
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	112 (19.6)	88 (15.4)
Elongation@Break (min. avg.), %(GL=2.0 in.)	ASTM D6693, Type IV	400	350
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	25 (111)	30 (133)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	50 (222)	90 (400)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

ENGINEERED TURF COMPONENT (CT)

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	1500 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	2,100 MD / 1,600 XD lb./ft. (MARV)
Rainfall Induced Erosion	ASTM D6459	Infill Loss 0.05% 6 in./hr. Rainfall
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability (Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs (projected)
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft^3/ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft^3/s/ft
Internal Friction of Combined Components	ASTM D5321	21°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolanic Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥20 oz. / sq. yd. (≥ 32 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft^2	m2	lbs	kg
MicroSpike®	40	1.0	23	7	750	229	17,250	1603	~3900	~1769
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	~1000	~454

4.0: Stability

The sand infill is held in place by the coarse sand and the unique structure of the engineered turf that traps the sand to anchor and ballast it to the surface it covers.

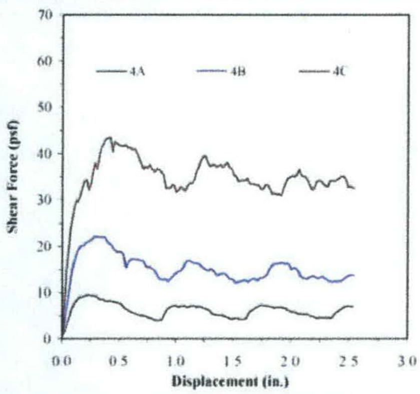
4.1: Interface Direct Shear Testing

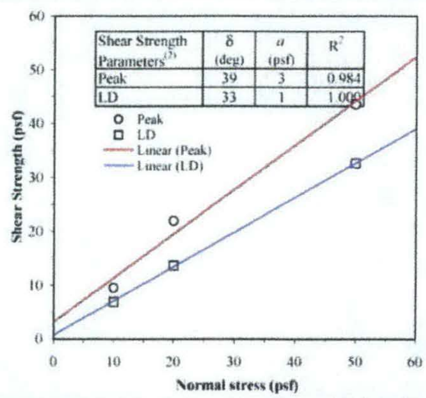
Below are test results of the Interface Direct Shear Testing done on the **Closure***Turf*® product as it relates to Super Gripnet® geomembrane to Engineered Turf interface.

Low Normal Shear Box

CLOSURETURF LANDFILL COVER SYSTEM
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand nominally compacted
Engineered Turf with grass side (green yarns) up/
Agru 50 mil LLDPE Super Gripnet geomembrane with studs side up/
Lower Shear Box: Concrete sand





Test No	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Lower Soil			Upper Soil			GCL		Shear Strengths		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ω_i (%)	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
4A	12 x 12	10	0.04	10	24	-	-	-	-	-	-	-	-	-	-	10	7	(1)
4B	12 x 12	20	0.04	20	24	-	-	-	-	-	-	-	-	-	-	22	14	(1)
4C	12 x 12	50	0.04	50	24	-	-	-	-	-	-	-	-	-	-	44	33	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the geotextile of the artificial grass and studs side of the geomembrane
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

SGI TESTING SERVICES, LLC

DATE OF TEST	5/15/2010
FIGURE NO.	C-4
PROJECT NO.	SGI10007
DOCUMENT NO.	
FILE NO.	

Figure 10: Interface Direct Shear with Low Normal Stress at 10, 20 and 50 (psf). Engineered Turf and Agru 50 mil LLDPE Super Gripnet®.

4.2: Wind Uplift

A study was performed on the wind uplift reactions by the Georgia Tech Research Institute. The **Closure***Turf*® product indicated very small uplift (i.e. less than 0.13 psf) when exposed to 120mph winds. This is in contrast with other exposed geomembranes where extensive anchoring is required even for 50mph winds.

Closure*Turf*® technology provides features that help mitigate the forces of wind, such as a porous surface to break vacuum and turf blades that will increase the aerodynamic turbulent flow boundary conditions and blades bending/reacting against the wind causing a resistance to the uplift component.

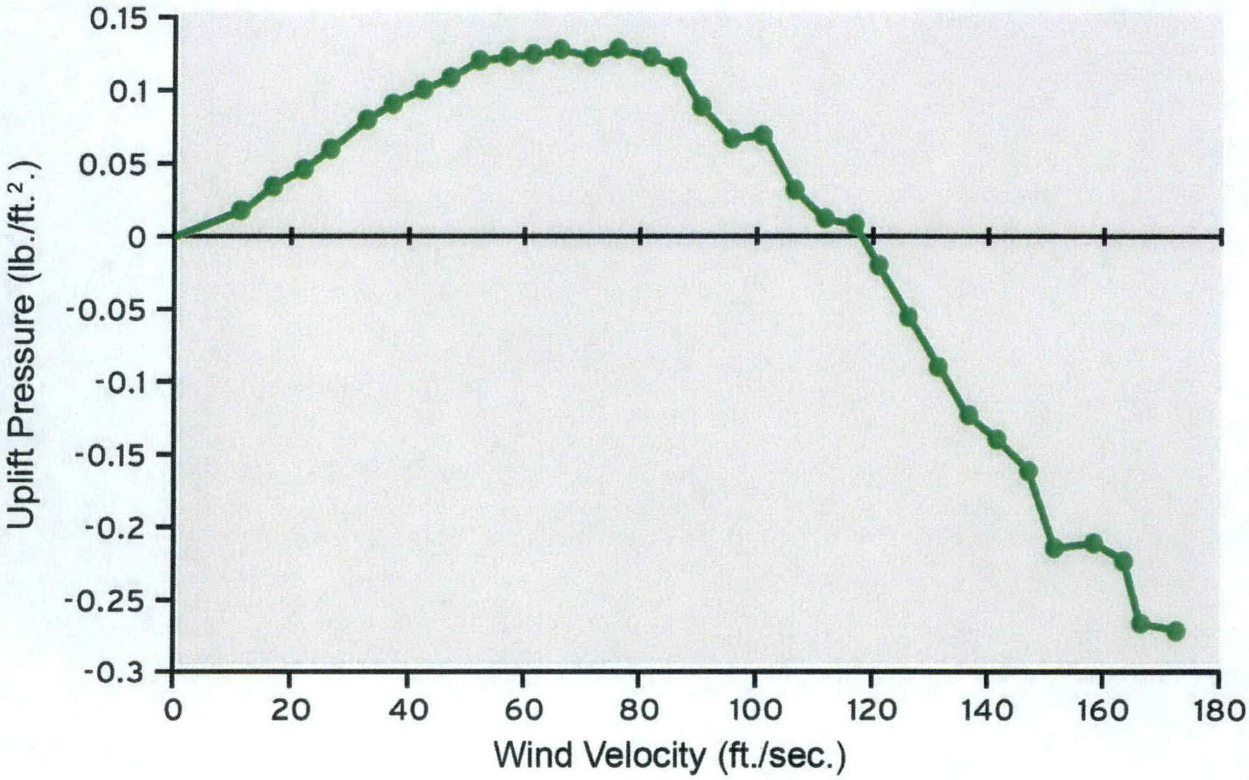


Figure 11: Georgia Tech Research Institute Wind Tunnel Chart Uplift Pressure vs. Wind Velocity

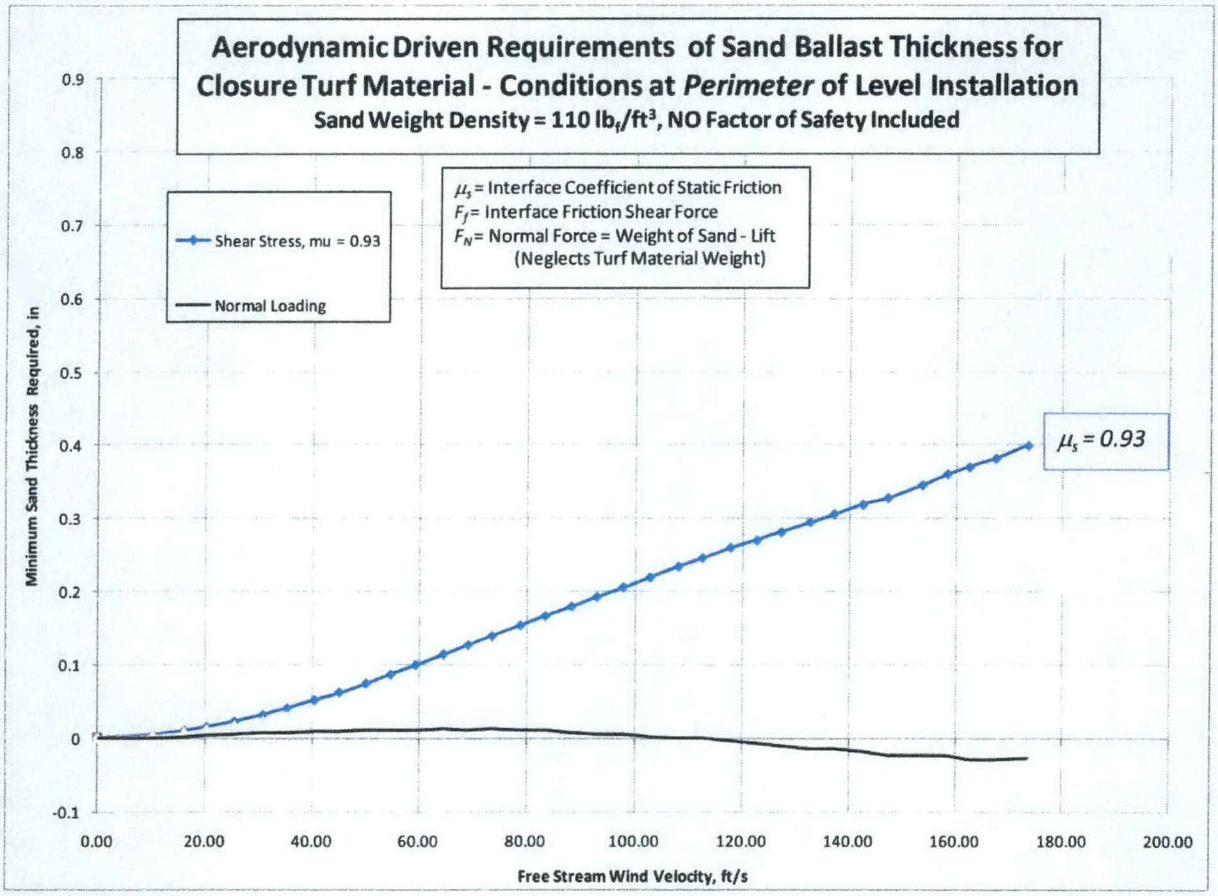


Figure 12: Sand Ballast Minimum Requirement at the Perimeter of Engineered Turf Installation

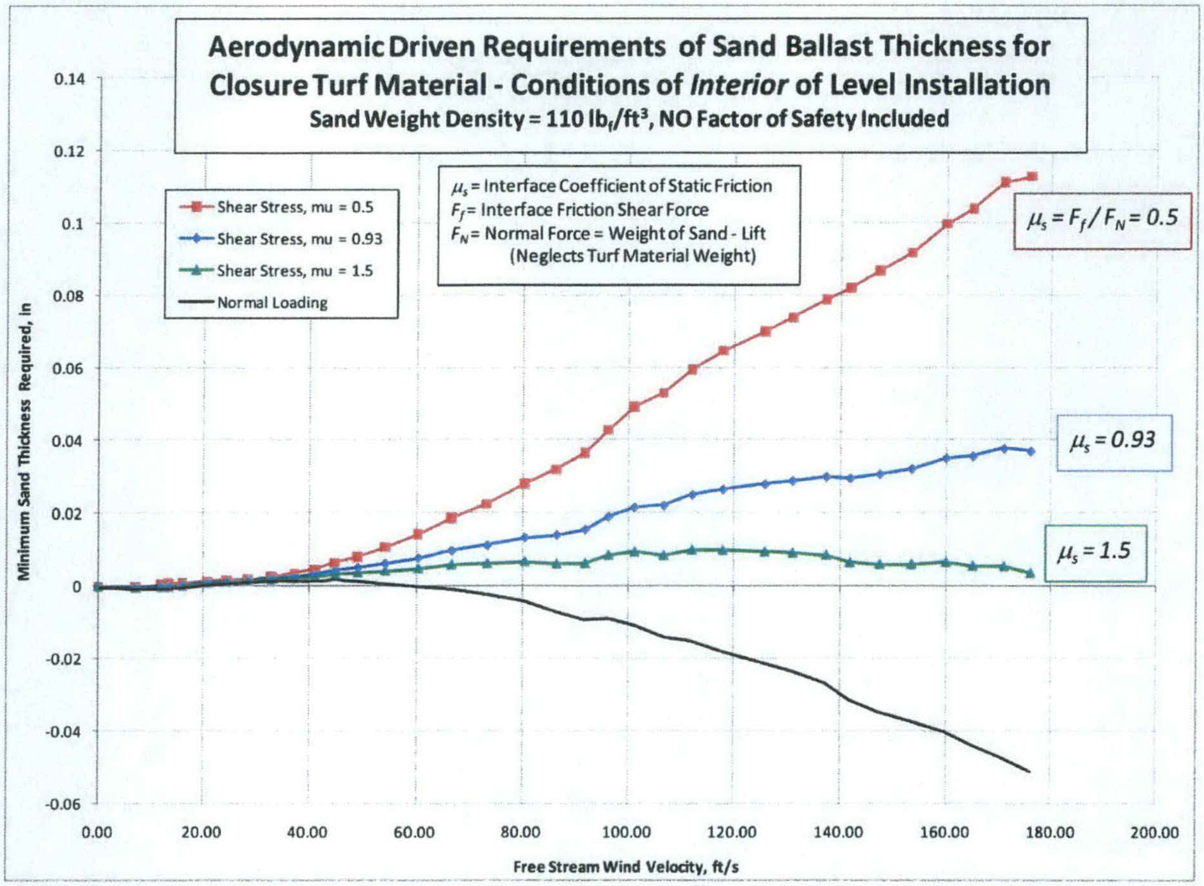


Figure 13: Minimum Sand Ballast Requirement in the Interior of Engineered Turf Installation

4.5 Closure*Turf*® Grain Size Curve Parameters

Closure*Turf*® requires that specialized mixture of sand infill be placed in the engineered turf. The sand utilized for **Closure***Turf*® will be approved and supplied by WatershedGeo®. If for some reason WatershedGeo does not supply the sand infill, the sand procured by others will be evaluated ASTM D6460 and demonstrate cumulative sand material loss of less than 0.1 inch during flow conditions with a shear stress equal to or greater than 0.80 psf or minimum required shear stress per the Engineer of Record, whichever is greater.

Example particle size distributions that range between a typical manufactured sand and the ASTM #9 aggregate as presented in Figure 14 have been shown to meet the performance criteria as described above.

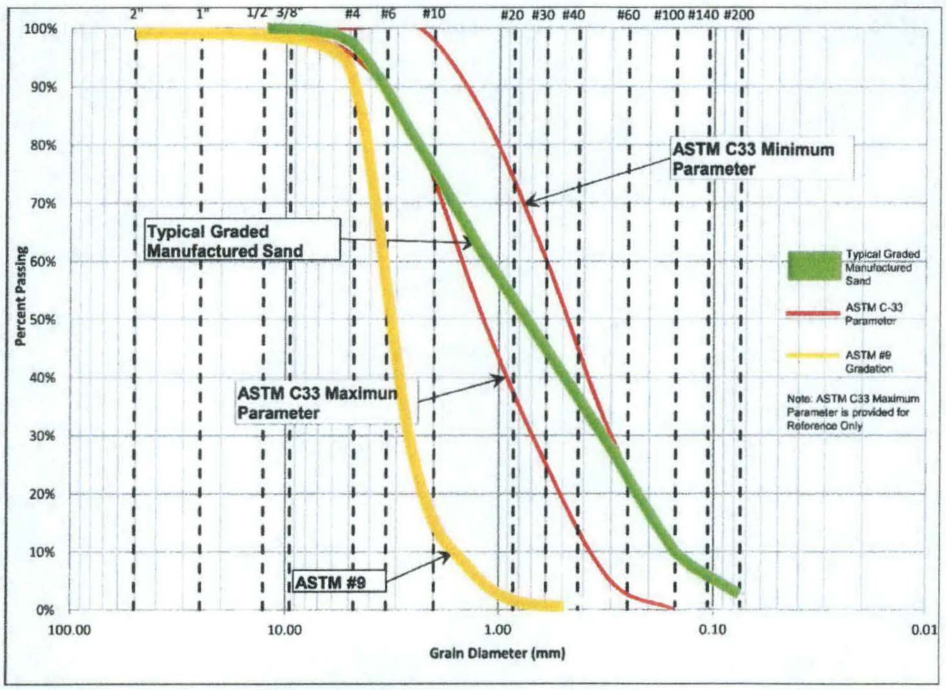


Figure 14: Example Infill Gradations

5.0 Hydrology

5.1 DE-tention, Not RE-tention

Any **Closure***Turf*® design will be able to take advantage of the Detention of storm water rather than the erosion control method of Retaining storm water. With **Closure***Turf*®, storm water is simply 'DE'-tained long enough to mitigate downstream flooding. This allows space in the pond previously allocated for sediment storage and Water Quality Volumes to be used only for the safe conveyance of the design storm event.

5.2 **Closure***Turf®* Hydrology Parameters

Currently, many regulatory agencies are requiring run-off curve numbers (CN) of 95-98 for a typical landfill closure. The **Closure***Turf®*'s CN has been determined to be between 92 and 95. This number was derived by TRI Environmental, Inc. and Colorado State University Hydraulics Laboratory in separate tests. Table 2 below shows the typical TR-55 design parameters for Hydrology using **Closure***Turf®*.

Closure*Turf®* **Hydrology**		
	TR-55 Data	
	Curve Number Depends on Rain Intensity	92[1] - 95
Sheet Flow	Manning's n	0.11
	Flow Length	100'
	2yr-24hr Rain	SCS
	Land Slope	design
	Flow Length	design
	Slope	design
Shallow Concentrated Flow	Surface (paved/unpaved)	Unpaved
	X-Sect Area	ft^2
	Wetted Perimeter	Linear Feet
	Channel Slope	ft/ft
Channel Flow	Manning's n	0.02
	Flow Length	design
	Flow Length	design

1. CN ranging from 92 in High Intensity Rainfalls to 95 in normal rainfall events.

Table 2: **Closure***Turf®* TR-55 Data

The engineered turf portion of **Closure***Turf®* will have a Manning's 'n' under sheet flow that is 0.12 on slopes greater than 10% and 0.22 on slopes less than 10%. In most cases, the travel time for sheet flow will have the greatest impact to the overall Tc.

5.3 Drainage Length

Critical slope length is defined as the drainage length between the top of slope and benches or swales where the system will discharge the flow. Maximum drainage lengths will vary according to the storm event designed for and the region in question. Testing has shown sand losses of less than 0.05 inches with shear stresses exceeding 1.0.

By utilizing the simple shear equation γds where γ= the weight of water (62.4 lbs/ft^3); d = depth (ft) and s = slope (ft./ft.), the sand will perform better where this simple shear is less than 1.0.

Regulations usually require adherence a particular storm event. Since storm events such as the 100 yr 24 hr event only produce fractions of inches of total rainfall per hour, the designer will need adhere to a higher intensity, shorter time period event such as the 100 year 1 hour event to reduce the likelihood of inundating the sand on steeper slopes when this occurs.

6.0 Survivability / Drivability Calculations

An evaluation of drivability was completed by SGI Testing Services. Additionally, an independent Vehicle Travel Design was completed. Parameters from those reports are used in the examples below.

Problem:

1. Evaluate the puncture resistance/material survivability of the Closure*Turf*® system.

Vehicle Details:

A. Kubota Crawler Dumper Weight = 6,000 lbs
B. Kubota 1,300 lbs plus payload of 1,600 lbs Weight = 2,900 lbs
C. Pick-Up Truck, Loaded Weight = 6,000 lbs
D. Rubber Tire Bobcat Weight = 3,000 lbs
E. Tire Pressure = 30 – 40 psi

A. Evaluate the puncture resistance of Closure*Turf*® geotextiles under the tire pressure of access equipment.

First, using a pick-up truck with a weight of 8,000 lbs and a contact tire area of 0.53ft² or a 0.82 ft diameter circle area determine the tire contact pressure.

Weight per Wheel = 8,000 lbs/4 wheels = 2,000 lbs/ wheel

$$\text{Tire Contact Pressure} = \frac{\text{Weight per Tire}}{\text{Contact Area}} = \frac{2{,}000\text{lbs}}{0.54\text{ft}^2} = 3{,}703\ \text{lbs/ft}^2 = 26\ \text{psi}$$

Tire Contact Pressure = 26 psi ≈ 30 psi **OK**

Then estimate the average strength of the geotextiles. The mean strength of the **Closure***Turf*® engineered turf in machine direction, Tensile MD, is shown on Figure 19 and the mean strength of the **Closure***Turf*® engineered turf in cross-machine direction, Tensile XD is on Figure 20 below.

$$T_{avg} = \frac{\text{Tensile MD} + \text{Tensile XD}}{2} = \frac{2055 + 1802}{2} = 1928.5\ \text{lb./ft.} = 161\ \text{lb./in.}$$

Subject: Travel way braking resistance		

OBJECTIVE:

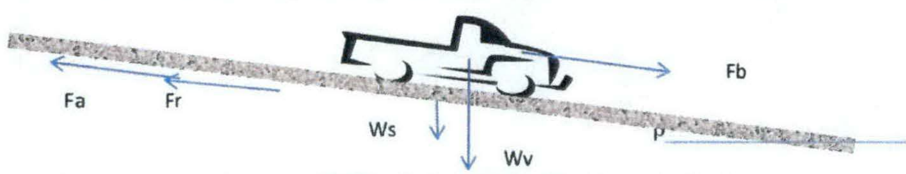
The proposed ClosureTurf™ product has been claimed to withstand vehicle traffic "without damage." This calculation determines the adequacy of the ClosureTurf™ final cover system resistance to vehicle use during the postclosure period. Travel speeds while on the the proposed final cover system should be limited to 15 MPH or lower. It is dependent on the friction angles determined within the proposed artificial turf. Regular post-closure maintenance travel will consist of an ATV and pick-up trucks. Fire Protection Districts may request site access in event of local wildfires. Fire fighting equipment types would be wildland type tankers to incident command vehicles. GVWR for these loaded (with water) vehicles can be as high as 55,000 pounds, 40,000 lbs on dual rear axles/wheels. Typical tire pressure ratings for these vehicles can be as high as 120 psi.

CALCULATIONS:

Bench vehicle slide potential

From interface friction testing by WGS

	Fric. Ang. ϕ	Adhesion c	
Foundation soil vs. SGN (spiked) Res. friction angle =	44.0	118.3	
Ballast sand vs. Engineered turf Res. friction angle =	36.0	1.0	
"Grass" GT vs. SGN stud (from CTL) Res.friction angle =	**33.0**	**32.0**	**<=Use**



Assume a tire contact area of **83.3 sq.in**.for this calculation (eq. to 120 psi)
Assume a bench fill depth of **1.0 inches** and material weight of **110 pcf**.
Assume maximum bench slope at 10%

<u>Driving Forces:</u>

Ws = Weight of Roadway = 83.3 sq.in/144 x 0.5/12 x 110 pcf =	5 lbs
Wv = Vehicle Tire Load = 10,000 lbs (dual wheel rear axle)	
Fb = static friction force on the turf product (assumed as the lowest friction angle)	
Assuming dead stop time is 2 sec, a = $\Delta v/t$ = 15 MPH / 2 sec =	11 ft/sec^2
Vehicle tire load mass, m = 10000/g =	311 slugs
Fb = ma =Vehicle Braking force =	3,416 lbs

<u>Resisting Forces:</u>

Fr = Frictional Force = (Wv + Ws) X cosβ X tanϕ_{min}
Fa = Adhesion force = Bench width X Bench length X $\cancel{c}_{min}$ (neglect c)

	Static	Dynamic
Driving Force	(Ws +Wv)sinβ	Static + Fb
	996	4,412
Fr =	6,465	6,465
FS = Resisting Forces/Driving forces		
=	6.5	1.5
	Okay	Okay

CONCLUSION:

The engineered turf based final cover system will resist sliding forces on benches from vehicle travel from the friction resistance alone. This calculation considered the worse case scenario of local fire district water tender vehicles traveling on the topdeck roadways. The occurence of heavy fire equipmment travel will be only in times of local fire events hence rare.

7.0 Gas Management Plan

Landfills produce emissions continually and have no "on or off" switch to prevent gas releases from occurring as a result of poorly tuned gas collection systems, system malfunction or even during construction phases of the landfill. It must be acknowledged by the engineer of record and operators who incorporate **Closure***Turf*® that emissions are continuous in landfills and a method of managing the emissions are a responsible part of the design and operation of a landfill. A gas management plan will be developed by the design engineer. The application and design concept of the gas venting systems described in this document are covered under U.S. Patent No. 8,585,322.

7.1 Minimum Requirements

The gas management plan will include at a minimum, the use of provided **Closure***Turf*® Pressure Relief Valves, (See Figure 17) to meet the specific needs of the intended site. The minimum required gas emission venting devices will be installed at a rate of at least one vent per acre of installed **Closure***Turf*® (See Figure 15). Watershed Geosynthetics LLC supplies the minimum number of Pressure Relief Valves with delivery of the **Closure***Turf*® product. The valves must be installed on sites that produce gas to validate any warranties. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves as well as any other design elements required for the site.

Pressure Relief Valves are designed to convey a maximum of 50 SCFM (Standard Cubic Feet Per Minute) under 1 inch of water column. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves required for the site.

7.2 Surficial Collection Design (Where Applicable)

While it should be noted that not all projects will incorporate a surficial collection design, the **Closure***Turf*® System serves as an effective tool for control of fugitive emissions and can be incorporated into a conventional gas collection system or in some cases as a standalone gas collection and control system. A **Closure***Turf*® surficial collection design will incorporate the use of surficial collection strips (See Figure 16) that provide high flow capacity and a larger radius of influence. The system design will also incorporate the surficial collection foot (See Figure 18) that serves as a wellhead base, geomembrane interface and gas conveyance path from the strips to the collection wellhead (not provided by **Watershed***Geo*®).

7.2.1 Surficial Strips (Where Applicable)

Surficial strips are to be placed prior to the placement of geomembrane. Surficial Strips may consist of SuperGripnet®, single sided geocomposite or other techniques that will allow for the proper flow of gas without causing ballooning. The placement of the strips will be determined by the design engineer and included in the gas management plan.

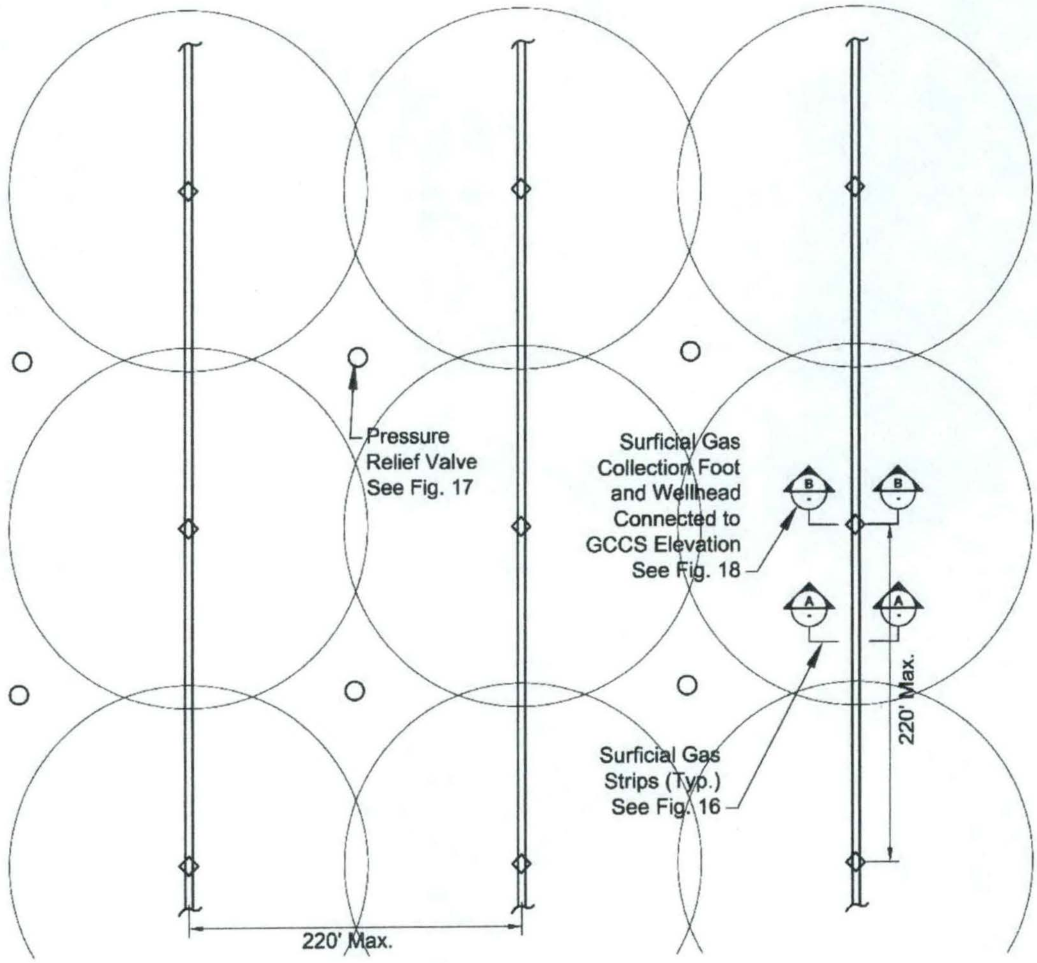


Figure 15: Typical Surficial Collection Strip Placement

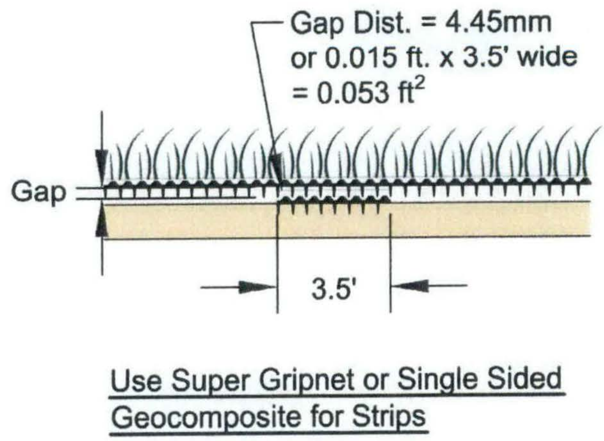


Figure 16: Effective Cross Sectional Area: Surficial Strips

7.2.2 **Closure***Turf*® Pressure Relief Valve

The Pressure Relief Valve is a mandatory component of the **Closure***Turf*® System. The primary purpose of this component is to provide for necessary release of pressure in the event the gas collection system malfunctions. The number of Pressure Relief Valves required will be determined by the POR and installed during construction of the **Closure***Turf*® System.

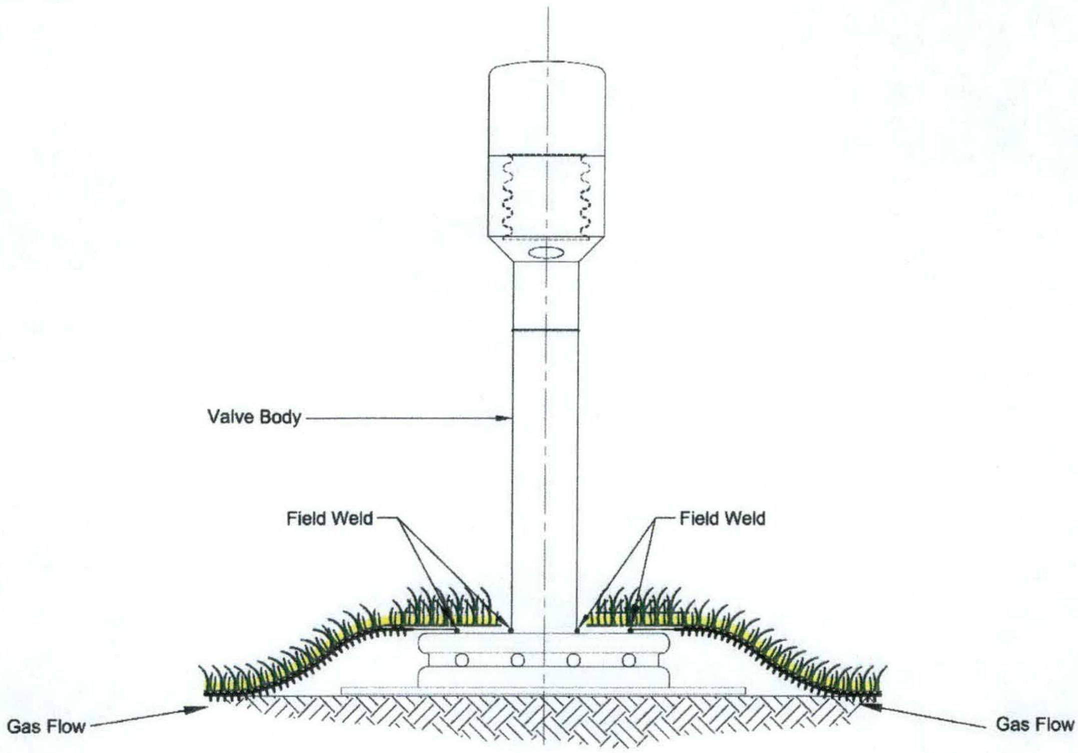


Figure 17: **Closure***Turf*® PE Pressure Relief Valve (Patent Pending)

7.2.3 Closure*Turf*® Collection Foot

This device is designed to be the interface between the surficial collection strips, the geomembrane and a gas collection wellhead (not provided). The unit allows vacuum to flow in from beneath the geomembrane and from the surficial collection strips to create a larger radius of influence for gas collection. Placement will be determined by the gas collection system design

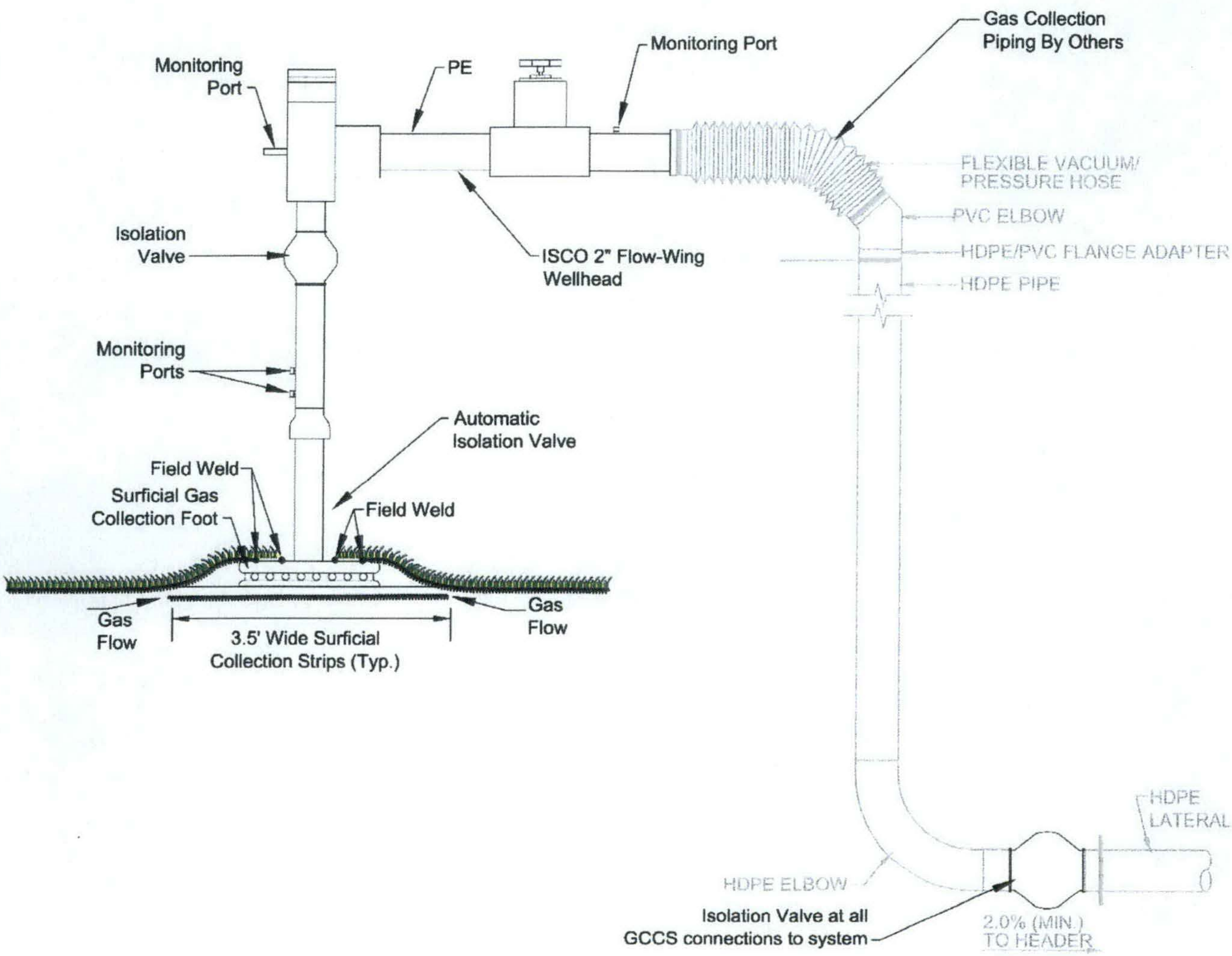


Figure 18: **Closure***Turf*® Surficial Collection Foot Connection to GCCS System

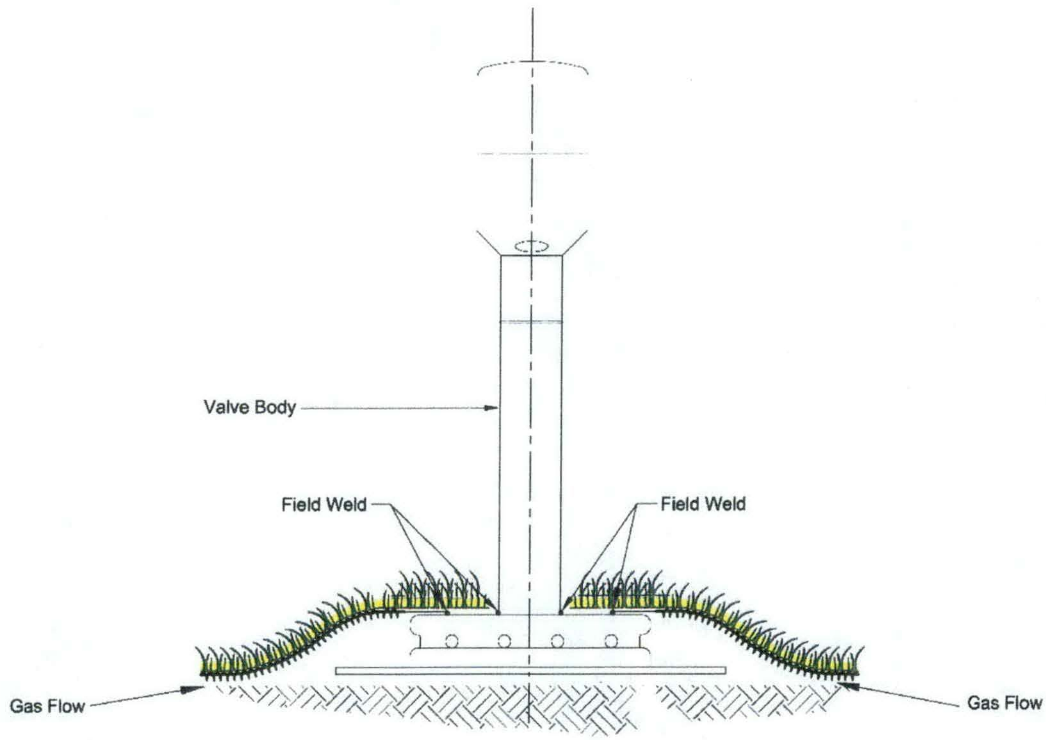


Figure 19: **Closure***Turf*® Passive Gas Vent

8.0 References

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2. U.S. Army Corps of Engineers, *Slope Stability, Engineering and Design Manual*. EM 1110- 2-1902, October 31, 2003.
3. Technical Paper No. 40, SCS USDA, May 1961.
4. Georgia Tech Research Institute (GTRI), *Wind Tunnel Testing of ClosureTurf®*. June 2010.
5. Kashiwayanagi, M., Sato, M., & Takimoto, J., *Six-Year Performance of Synthetic-Rubber-Sheet Facing for the Upper Pond of Seawater Pumped Storage Hydropower Plant*. Proceedings of the Eighth International Conference on Geosynthetics, Yokohama, Japan, Vol. 2 pp. 607-601, 2006.
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WatershedGeo™ Unearthing Solutions

Technical Note

Design Life of ClosureTurf®

The ClosureTurf® Final Cover System is projected to last well over one hundred (100) years, provided it is installed and maintained in accordance with Watershed Geosynthetics' standard specifications. This duration exceeds the current post-closure regulatory period of 30 years by more than 3 times. During that time, the average maintenance cost of the ClosureTurf system will be roughly 10 to 20% of the cost for maintenance of a traditional soil cover system.

ClosureTurf Components

To better understand system longevity, it is helpful to break down the system into its components and explain the function of each component. A cross-section of the ClosureTurf system is shown in Figure 1 to aid the discussion.

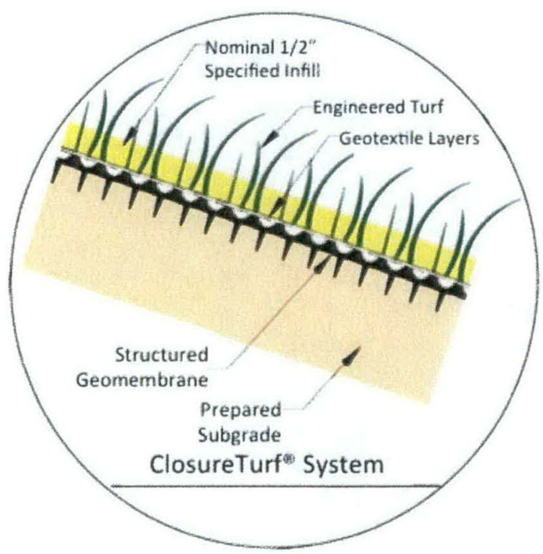

Figure 1. ClosureTurf® Cross-Section

Starting at the prepared subgrade and moving vertically through the cross-section of the system, the first component is the structured geomembrane. The structural geomembrane layer creates an impermeable hydraulic barrier providing the actual environmental containment. Moving upward through the cross-section, the second component is the engineered turf layer. The engineered turf layer is comprised of two distinct parts: (1) a double-layer woven geotextile backing with enhanced ultraviolet (UV) resistance; and (2) polyethylene turf fibers (or yarns) tufted into the woven geotextiles. The third, and final, component of the ClosureTurf system is the specified infill. The specified infill is an angular, specifically graded sand resting on the geotextile backing and within the individual turf fibers of the engineered turf layer.

WG WatershedGeo™ Unearthing Solutions

UV Protection

The geomembrane is covered by the engineered turf and sand protecting the geomembrane from UV exposure. Based upon research by Geosynthetic Institute (GSI) [Koerner et al., 2011 and Koerner et al., 2012], a covered geomembrane has an expected lifetime (i.e., a half-life) of several hundred years. The sand infill and turf fibers provide UV shielding of the geotextile backing of the engineered synthetic turf. With the sand infill in place, the geotextile backing will remain intact and in place covering the structured geomembrane, allowing the geomembrane to realize its full design life. The sole component of the ClosureTurf system exposed to UV is the turf fibers.

Longevity of Turf Fibers

Longevity of the turf fibers dictates the design life of the ClosureTurf system. UV longevity testing on the turf fibers indicates the half-life is projected to be over two hundred years, as presented in Attachment 1, *Literature Review and Assessment of ClosureTurf® UV Longevity* prepared by Geosyntec Consultants. At year 100, the turf fibers are projected to have approximately 60% of the original tensile strength. The average tensile strength of virgin turf fibers is approximately 35 lbs per fiber. Therefore, the tensile strength at year 100 is projected to be approximately 20 lbs per fiber, which is significantly greater than the estimated minimum tensile strength necessary for the turf fibers to perform in application (i.e., approximately 2.5 to 3.5 lbs per fiber). Turf fiber tensile strength values over time compared to the required service value are presented in Figure 2.

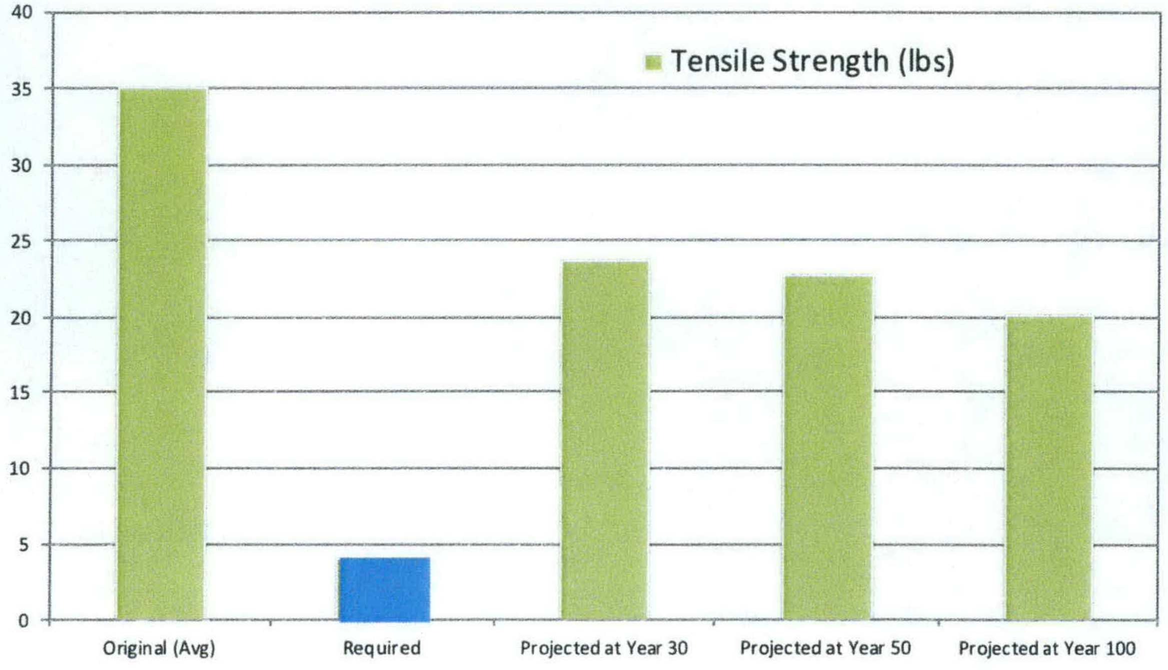

Figure 2. ClosureTurf® Fiber Tensile Strength

Field samples of turf fibers have been collected and tested for tensile strength at an independent laboratory. Samples were collected at two ClosureTurf installations, the LaSalle-Grant Landfill in Louisiana and the Saufley Field Road Landfill in Florida. The field sample turf exposure times ranged from five to eight years. The retained tensile strength of the turf field samples was compared with the laboratory UV testing results in New River, Arizona, as presented in Figure 3. Field performance of the engineered turf tensile strength matches or exceeds results from laboratory testing of UV exposure.

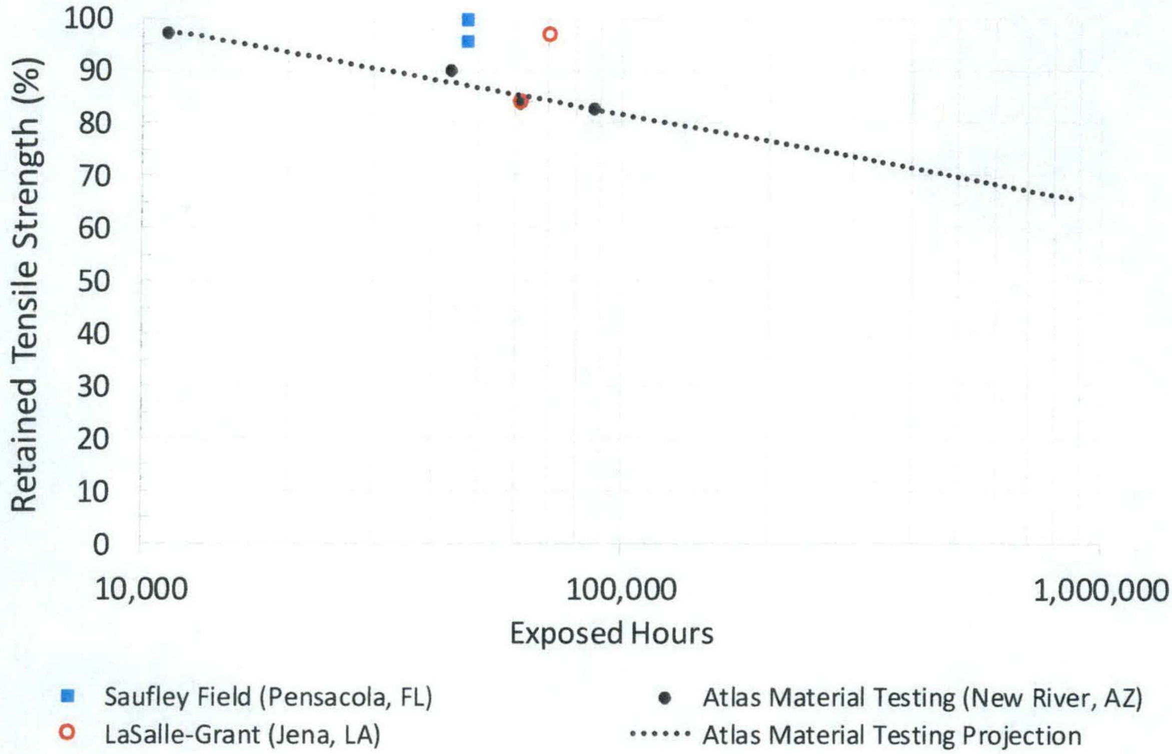

Figure 3. ClosureTurf® Fiber Tensile Strength, Field Performance

Maintenance Cost

As with any closure system, regular maintenance activities are required with the ClosureTurf system. Standard maintenance activities include, primarily, periodic visual inspection (e.g., once per quarter or once per year) and localized sand placement to cover exposed geotextile backing, as needed, at five-year intervals. The average maintenance cost for the system will typically be 10 to 20% of the cost for maintenance of a traditional soil cover system. Watershed Geosynthetic's experience with existing ClosureTurf installations suggests an average budgetary amount for maintenance is \$150 to \$250 per acre per year. As a comparison, a typical soil cover system has an estimated average maintenance cost of \$1,200 to \$1,500 per acre per year.

References

Koerner, R.M., Hsuan, G.Y., and Koerner G.R. (2011), "Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions," GRI White Paper #6, Original: June 7, 2005 Updated: February 8, 2011.

Koerner, R.M., Koerner G.R., Hsuan, G.Y., and Wong, W.K. (2012), "Lifetime Prediction of Laboratory UV Exposed Geomembranes: Part I - Using a Correlation Factor," GRI White Paper #42, January 3, 2012.

WatershedGeo™
Unearthing Solutions

Attachment 1

Literature Review and Assessment of ClosureTurf® UV Longevity

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Subject: Literature Review and Assessment of ClosureTurf® UV Longevity

Dear Mr. Urrutia:

Watershed Geosynthetics, Inc. (Watershed) has patented an alternative landfill closure system termed, ClosureTurf®. ClosureTurf® consists of high-density polyethylene (HDPE) grass blades tufted through a polypropylene (PP) geotextile backing which overlies Super Gripnet®, an HDPE or linear low-density polyethylene (LLDPE) geomembrane manufactured by AGRU America Inc. The addition of a layer of sand ballast during installation completes the system. The sand ballast provides cover for the lower portion of the HDPE grass blades, the PP geotextile backing, and the Super Gripnet® (Figure 1). The ClosureTurf® system, therefore, is a "hybrid" closure system in the sense that it is neither a traditional soil cover or an exposed geomembrane. ClosureTurf® has been used to close a number of landfills throughout the United States. A select list of sites where it has been used is shown in Table 1. Applications extend to other facilities as well, such as capping of coal ash ponds.

Watershed has requested that Geosyntec Consultants, Inc. (Geosyntec) provide an assessment of the longevity of the ClosureTurf® system with regard to UV degradation. Since ClosureTurf® has elements (i.e., the HDPE grass blades) that are permanently exposed to UV radiation, this assessment will be particularly focused on the exposed portion of the system. However, the UV longevity of the PP geotextile backing and HDPE geomembrane will also be addressed by reference.

Geosyntec's approach to this assessment has been to conduct a literature review of pertinent documents available (journal papers, white papers, presentations, etc.), distill the results of the review, and perform limited analysis. This report concludes with a summary of the review and analysis along with brief discussion for recommendations.

EXECUTIVE SUMMARY

The UV longevity assessment of the ClosureTurf® system (Figure 1) began with a literature review. In general, relatively little published information was discovered regarding exposed HDPE grass blade degradation. The information that is available consists of retained tensile strength test results of HDPE grass blades after exposure (1, 5, 7 and 10 years) at a field test facility in New River, Arizona (Watershed, 2014). Extrapolation of this data by Watershed (2014) resulted in a prediction of 65% retained tensile strength after 100 years of service. In addition, Richgels *et al* (2015) published half-life (i.e., 50% retained tensile strength) predictions of exposed HDPE grass blades using a laboratory data release from the Geosynthetics Institute (GSI) on HDPE geomembrane strips exposed to UV lamp irradiation. Richgels *et al* (2015) obtains an upper bound and lower bound half-life predictions of 247 years and 176 years, respectively. Extrapolation of the field data from New River, Arizona yielded a half-life of 216 years.

Geosyntec checked the calculations shown in Richgels *et al* (2015) and obtained 277 years and 214 years for the upper and lower bound estimates of HDPE grass blade half-life. Differences in the results between Geosyntec and Richgels *et al* (2015) are attributed to rounding. Geosyntec attempted to repeat these calculations for actual performance requirements (i.e., 12.5% of original tensile strength) of the HDPE grass blades rather than a randomly assigned half-life, however the predictions resulted in service lives that were too lengthy to be reasonable. The most likely explanation is that the laboratory data has not degraded enough to allow for service life predictions using 12.5% retained tensile strength. Future data releases from GSI will aid in providing more accurate predictions below the half-life.

Based on Richgels *et al* (2015) predictions, as well as the prediction given in Watershed (2014) it appears that the half-life of the HDPE grass blades exposed to Arizona-like conditions is on the order of 100 years. These results are promising; however additional field test data is needed to improve the half-life predictions, particularly since half-life predictions for exposed HDPE geomembrane are also approximately 100 years (Koerner *et al*, 2015). Understanding the differences in weathering between HDPE grass blades in a synthetic turf and an HDPE geomembrane will provide additional insight into the similar half-life predictions of the two geosynthetics. Finally, the service life of the HDPE grass blades in the ClosureTurf® system should ideally be based on its performance requirements rather than a half-life which will result in a longer service life prediction.

In addition to the HDPE grass blades, there are two unexposed elements of the ClosureTurf® system: (i) the PP geotextile backing for turf component; and (ii) the Super Gripnet® which consist of a HDPE geomembrane (see Figure 1).

Watershed has incorporated UV degradation inhibitors into the PP geotextile backing which, according to Watershed has lead to an improvement in UV resistance by a factor of 14 over the original prediction of 65% retained tensile strength after 100 years (Watershed, 2014). Koerner (2011) has estimated that covered HDPE geomembrane will have a half-life of 446 years at 20 degrees Celsius and 265 years at 25 degrees Celsius.

Therefore, the most critical component of the ClosureTurf® appears to be the exposed HDPE grass blades when it comes to UV degradation. However, degradation of the HDPE grass blades to unserviceable levels can be remediated by replacement of the turf component of the ClosureTurf® system.

BACKGROUND AND LITERATURE REVIEW SUMMARY

In total, Geosyntec has reviewed approximately 40 technical documents to date. The database is a combination of documents provided to Geosyntec by Watershed as well as documents collected by Geosyntec. A complete reference list of the documents in the database can be made available upon request.

In general, relatively little information was found on the topic of exposed HDPE grass blades with respect to degradation due to UV radiation. The documents that were obtained and reviewed are listed below.

1. Field test data provided by Watershed from the New River, Arizona testing facility on the HDPE grass blades (Watershed, 2014).

2. Testing results (Atlas-MTS) discussing the UV longevity of polyethylene and polypropylene grass used for outdoor European athletic facilities.

3. Technical paper by Richgels, *et al.* (2015a) published in the conference proceedings for Geosynthetics 2015 in Portland, Oregon.

4. Presentation by Richgels., C. at the Geosynthetics Conference for 2015 in Portland, Oregon (Richgels, 2015b).

5. Presentation by Diguilio, D. at the Northern New England SWANA Conference on 25 September 2013 (Diguilio, 2013).

The following documents on the topic of HDPE Geomembrane degradation due to UV exposure were reviewed and found to contain useful information regarding this assessment.

1. Geosynthetic Research Institute (GRI) White Paper #6 (Koerner *et al.*, 2011). This white paper contained degradation data (% retained strength and elongation) on laboratory aged samples of 1.5 mm HDPE geomembrane. Aging was completed using a UV Fluorescent device per ASTM D7238 at 70 degrees Celsius (^{o}C).

2. Geosynthetic Institute (GSI) webinar presentation by Koerner *et al.*, (2015). This presentation contained a slide that compared predicted (laboratory vs. field) half-life of geomembranes of various resins, including HDPE, as well as a suggestion for estimating lower bound half-life.

3. Journal paper authored by Rowe *et al.* (2010) published in the Journal of Geotechnical and Geoenvironmental Engineering.

DISCUSSION OF DOCUMENTS AND DATA

The data from the New River, AZ testing facility on the artificial grass component of ClosureTurf® (Watershed, 2014) appears to be the only data set of its kind in our compiled database. The data consists of tensile property testing from field samples exposed to the Arizona environment at approximate exposure periods of 1, 5, 7 and 10 years. At each of the four exposure periods, 20 samples were tested for a total of 80 tests. The average values for tensile strength retained at each corresponding time period is 97%, 90%, 84% and 83%, respectively (Figure 2).

One additional data point was found in the Atlas-MTS document. That data point indicated that approximately 90% of tensile strength of polyethylene grass would be available after 20 years of field exposure assuming average European climatic conditions (temperature, irradiance, etc.). However, the average European irradiance is approximately one-half to one-third that of Arizona (Figure 3) notwithstanding temperature effects. Therefore, the Atlas-MTS data point will be consistent with the data from the New River, AZ facility in the 7 to 10 year time frame once adjusted for the relative levels of exposure and temperature between Europe and Arizona. As such, this data point will not extend the exposure duration covered by the New River, AZ data.

The paper and corresponding presentation by Richgels (2015a, 2015b) utilized the laboratory data released from the GSI on UV degradation of HDPE samples to make upper and lower bound estimates of the field half-life of the HDPE grass blades. The upper bound method utilizes Arrhenius modeling of lab data to project exposure times at half-life to site temperatures combined with ratios of UV irradiance between the laboratory lamp and monthly average irradiance at New River, AZ to develop half-life loss per month. A similar procedure using a linear extrapolation (rather than Arrhenius) was demonstrated for a lower bound estimate. The Watershed (2014) field data set was plotted in between the upper and lower bound estimates. This method is further discussed in the section below titled, "HDPE Grass Blade Service Life Calculations".

Koerner *et al*. (2011) discusses the UV longevity of both exposed and unexposed geomembranes made from various resins, including HDPE based on GSI's laboratory testing program. This document is particularly useful in regard to the ClosureTurf® elements that are considered non-exposed (i.e., the PP geotextile backing for the turf component and the underlying HDPE geomembrane).

The presentation by Koerner *et al*. (2015) includes estimates of half-life of exposed HDPE geomembranes as well as a recommendation for linear data extrapolation as a lower bound limit that was implemented by Richgels (2015b).

PERFORMANCE REQUIREMENTS

The definition of service life of an HDPE (or other resin) geosynthetic (grass blades and geotextiles/geomembranes) typically invokes the half-life criteria. However, the half-life criteria is arbitrary and while useful as a general indicator for comparison it does not directly relate to any aspect of field performance for ClosureTurf® or any other geosynthetic. Therefore it is more appropriate to define the service life in terms of field requirements placed on the material.

HDPE Grass Blades

For the case of the HDPE grass blades on the ClosureTurf® system, tensile strength requirements fall in the range of 2.5 to 3.5 lbs, based on applied loads of pullout forces from equipment operation and water runoff forces (Diguilo, 2013). The ClosureTurf® HDPE grass blades are manufactured with 20 lbs. of tensile strength immediately following the process (Diguilo, 2013). Therefore, without considering a factor of safety, the required tensile strength of the HDPE grass blade is equal to approximately 12.5% to 17.5% of original strength capacity.

PP Geotextile Backing and HDPE Geomembrane

Performance requirements for the PP geotextile backing and HDPE geomembrane depend on more site-specific parameters (e.g., steepness of slopes, seismicity, etc.) than the HDPE grass blades. Therefore until a parametric study is completed which will define the performance requirements over a range of expected conditions, the half-life will have to be used as a benchmark for degradation of the PP geotextile and HDPE geomembrane.

HDPE GRASS BLADE SERVICE LIFE CALCULATIONS

In order to develop a prediction for the longevity of the HDPE grass blades with respect to UV degradation, Geosyntec implemented the method found in Richgels (2015a, 2015b) for two levels of retained tensile strength. The first level is the 50% of tensile strength, or half-life, criterion that is commonly used as a benchmark for geosynthetic service life. Geosyntec performed this calculation to compare our results with the results presented by Richgels (2015a, 2015b). Once the half-life estimates were calculated, Geosyntec attempted to repeat the calculations using a retained tensile strength of 12.5% of an HPDE grass blade.

Half-Life Estimation (50% of Retained Strength)

The assessment utilized by Richgels (2015a, 2015b) begins with a laboratory data release from GSI (Figure 4). The data includes retained tensile strength of HDPE samples that have been incubated under a UV lamp at elevated temperatures, which accelerates the UV weathering process in accordance with ASTM D7238.

As mentioned, the GSI data includes samples tested at three elevated temperatures: (i) 80 degrees Celsius (°C); (ii) 70°C; and (iii) 60°C. The testing program appears to have originally included only the 70°C data, with the 80 °C and 60°C testing added at a later date (therefore, weathering is not as advanced). The 70°C data set has reached approximately 66%, while the 80°C and 60°C data sets have reached approximately 78% and 86%, respectively. Nonetheless, logarithmic extrapolations to 50% retained strength were performed for each data set. The amount of exposure time (on a log scale) corresponding to the 50% retained strength plotted vs. the inverse of the corresponding temperature (80°C, 70°C and 60°C) is shown in Figure 5. Figure 5 allows for extrapolation to find the laboratory exposure time required to achieve 50% retained strength at temperatures lower than the test temperatures (i.e., actual field temperatures).

Once the curve is defined relating any temperature to a level of laboratory lamp exposure, the remaining task is to develop a relationship between laboratory exposure and field exposure for a particular site. In this case, the testing site in New River, AZ where Watershed has performed tests on HDPE grass blades, was selected.

Richgels (2015a, 2015b) presents monthly averages at the site for: (i) peak turf temperature; and (ii) irradiance as a fraction of the laboratory lamp irradiance. Using these two values for a given month combined with the Arrhenius model, an estimate of half-life loss per month is obtained. Summation of the half-life lost per month over a year yields the annual half-life loss. The inverse of the annual half-life loss is the predicted half-life in years. Using this method, Richgels obtains a half-life of approximately 247 years, while Geosyntec obtained a half-life of 277 years using the same data (Table 2). The difference is attributable to rounding errors in the logarithmic projections.

Following the suggestion of Koerner *et al.* (2015), Richgels (2015b) treated the results of the half-life mentioned above as an upper bound estimate. For the lower bound estimate, Koerner *et al.* (2015) suggests performing a linear extrapolation of the laboratory data to lower field temperatures, rather than using the Arrhenius model.

With the linear extrapolation, the ratio of monthly irradiance to laboratory lamp irradiance is scaled linearly to calculate the number of months required to reach half-life at 80C, 70C and 60C. Linear extrapolations per month are made from the elevated temperatures to the corresponding peak turf temperature in that month. The resulting half-life loss per month is summed to obtained half-life loss per year. The inverse of that result is the half-life in years. Richgels (2015b) calculates a half-life of 176 years using this linear model. Geosyntec's calculation using the same data resulted in a half-life of 214 years (Table 3 and Figure 6). The difference in the calculations is approximately the same as with the calculation using the Arrhenius (logarithmic) model.

Figure 7 shows the calculated upper (Arrhenius - logarithmic) and lower (linear) bound curves calculated by Richgels (2015b) along with the field data on the HDPE grass blades provided by Watershed (2014). As shown in Figure 7, the trend line fit to the field data falls in between the upper and lower bound curves produced by Richgels (2015b). Note that the first point from the field data at approximately 1 year is omitted from the trend line. This is because the first data point is assumed to be within the anti-oxidant phase of degradation rather than the polymer oxidation stage as suggested by Rowe *et al.* (2010). Additional discussion regarding the stages of degradation for polyolefin materials can be found in CUR 243 (2012).

Service Life Estimation Based on Performance Requirements (12.5% of Retained Strength)

Geosyntec repeated the calculations discussed above for the estimation of half-life, but extrapolated the GSI laboratory data down to 12.5% rather than 50% at 80C, 70C and 60C. Upper bound

(Arrhenius – logarithmic) and lower bound (linear) estimates were 2,500 years and 2,043 years, respectively.

These estimates of service life are simply too large to be reasonable. A likely explanation is that the samples tested at 80C, 70C and 60C have not degraded enough to produce accurate predictions at 12.5% retained strength. As previously mentioned, the data for 80C has reached 78% retained strength; the data for 70C has reached 66% retained strength; and the data for 60C has reached 86% retained strength. Therefore, the extrapolation for each of these data sets to 50% retained strength will be much more accurate than extrapolations to 12.5%. In addition, small uncertainties in log-based extrapolations will greatly influence results.

For these reasons, it is not practical or useful at this time to quantitatively assess service life in terms of actual performance requirements when those requirements are substantially below the half-life. There is some value, however in a qualitative use of performance requirements in comparisons with half-life estimates (i.e., to establish the factor of safety remaining at 50% degradation).

SUMMARY AND CONCLUSIONS

Geosyntec's literature review of approximately 40 documents yielded few sources of UV degradation data for exposed HDPE grass blades. Relevant data that was found included the field test data from the New River, AZ testing facility provided by Watershed (2014) and one data point from Atlas-MTS. The Atlas-MTS data point indicated that HDPE grass blades in average European climatic conditions would retain approximately 90% of its original strength after 20 years of field exposure. Taking into account the differences in temperature and UV irradiance between New River, AZ and European averages, the data point is consistent with the New River, AZ test data in the 7 to 10 year range.

Following the method presented in Richgels (2015a, 2015b) for HDPE grass blades, Geosyntec calculated an upper bound half-life of 277 years compared with Richgels 247 years using the Arrhenius (semi-log) extrapolations to site temperatures and ratio of laboratory lamp to field irradiance. Geosyntec calculated a lower bound half-life based on linear temperature extrapolations, as suggested by Koerner *et al*. (2015), of 214 years compared with 176 years obtained by Richgels (2015b). The differences between Geosyntec and Richgels calculations were attributed to rounding. As shown in Figure 7, the field data from New River, AZ suggests a half-life of 216 years when considering only the last three data points (i.e., polymer oxidation stage).

Another prediction of HDPE grass blade degradation is included in Watershed (2014) using the same (New River, AZ) field data. That prediction of retained tensile strength at 100 years of service life is 65%.

Therefore, it appears that the half-life of the HDPE grass blades will be on the order of 100 years based on the existing field data set and extrapolation methods found in the literature and presented herein. The results are promising; however additional field test data is needed to improve the half-life prediction, particularly since the half-life predictions for exposed HDPE geomembranes are also approximately 100 years (Koerner, 2015). Half-life predictions presented herein will also need to be revisited when additional labratory data is released from the GSI testing program.

Geosyntec attempted to calculate the service life of the HDPE grass blades using 12.5% of retained strength, rather than an arbitrarily assigned half-life. However, the calculation resulted in unreasonably long service life. This result is likely due to uncertainties in extrapolating the laboratory data released from GSI down to the 12.5% retained strength level. The data release has degraded to 78%, 66% and 86% for the 80 °C, 70 °C, and 60 °C test temperatures. Therefore, extrapolations to 50% may be warranted while extrapolations to 12.5% may not be until additional lab data is available. That being said, it should be recognized that half-life, or 50% of retained strength, has a factor of safety of 2.8 to 4.0 when considering the tensile capacity performance requirements of HDPE grass blades.

With regard to the unexposed elements of the ClosureTurf® system, Watershed (2014) indicates that the retained tensile strength of the PP geotextile backing prior to the addition of UV inhibitors is 65% after 100 years. This estimate is based on exhumed samples of the geotextile from the LaSalle-Grant Landfill in Louisiana. According to Watershed (2014), the addition of proprietary UV inhibitors to the PP geotextile backing has led to an improvement in UV resistance by a factor of 14. The final geosynthetic in the ClosureTurf® system is the covered HDPE geomembrane. Koerner (2011) estimates that the half-life of a covered HDPE geomembrane is 446 years at 20C, and 265 years at 25C. Furthermore, the degradation of the unexposed elements of the ClosureTurf® system invoke the half-life criteria. As discussed with regard the exposed HPDE grass blades, actual performance requirements should ideally be used to determine system longevity. However, the existing testing programs need to be allowed to degrade further before projections to lower values are made.

It is worth reiterating that applications of ClosureTurf® in areas of the United States where the UV irradiance and the temperatures are lower will result in longer half-life predictions than discussed above. In some cases (e.g., the Northeastern States), the differences will likely be quite large when compared with Arizona.

Finally, once UV degradation of the most susceptible component of ClosureTurf® (i.e., the exposed HDPE grass blades) does result in a tensile break, replacement of the HDPE grass and PP geotextile backing can be performed.

CLOSING

Geosyntec appreciates the opportunity to assist Watershed in the development of its ClosureTurf® products. Questions and comments may be directed to either of the undersigned at 678-202-9500.

Sincerely,

Will Tanner, P.E.
Project Engineer

Ming Zhu, Ph.D., P.E.
Senior Engineer

Attachments: References
Tables
Figures

Copies to: Bill Gaffigan (Geosyntec)
Mike Ayers (Watershed)

REFERENCES

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Koerner, R., Koerner, G., and Hsuan, Y. (2015) "Lifetime Predictions of Covered and Exposed Geomembranes". Webinar GSI-W14, January 14, 2015.

Richgels, C., Ayers, M., and Urrutia, J., (2015a) "Estimation of Geographic Ultraviolet Radiation Levels and Impact on Geosynthetic Cover Systems". Proceedings of Geosynthetics 2015, Portland Oregon, February 15-18, 2015.

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Rowe, K., Islam, M., Hsuan, Y., (2010) "Effects of Thickness of the Aging of HDPE Geomembranes". Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 136(2), p.299-309.

Watershed Geosynthetics, (2014) "Technical Submittal for ClosureTurf™ – Alternative Final Cover, Closure of Municipal Soild Waste Landfill Units", December 2, 2014.

TABLES

Table 1. Selected Sites where ClosureTurf® has been Installed.

Select ClosureTurf® Installations				
Installation	**Type**	**Acres**	**State**	**Year**
Progressive - Weatherford	Public – MSW	8.5	Texas	2010
Progressive - Timberland	Public - MSW	4	Louisiana	2011
Crazy Horse (Salinas SWA – Monterey)	City – MSW	65	California	2012
Saufley Landfill (Escambia)	Public – C&D	22.5	Florida	2012
Georgia Pacific	Independent	70	Georgia	2013
Berkeley County Landfill	City - MSW	12	South Carolina	2013
Lanchester Landfill (Chester)	City - MSW	7	Pennsylvania	2013
Tangipahoa Parish	City – MSW	22	Louisiana	2013
Sandtown – (Berkeley County)	City – MSW	4	Delaware	2013
Si-County Landfill	EPA – Region 6	5	Texas	2014
Holcim Cement Landfill (Kiln Dust)	Independent	46	New York	2015

Table 2. HDPE Grass Blade Upper Bound Half-Life Calculations (Geosyntec)

Month	UV Lamp On(1) (hrs/day)	Peak Turf Temp(2) (C)	Peak Turf Temp (K)	Peak Turf Temp (1/K)	Reaction Rate(3)	Lab Half-Life(4) (lamp hrs)	Field Equivalent(5) (days)	Field Equivalent(6) (months)	Half Life Loss per Month(7)
January	4.00	27.99	301.14	0.0033	-15.67	6385286	1596322	51494	1.94196E-05
February	4.94	27.96	301.11	0.0033	-15.67	6401982	1296604	46307	2.15949E-05
March	6.13	33.94	307.09	0.0033	-15.11	3632197	593012	19129	5.22755E-05
April	6.94	40.58	313.73	0.0032	-14.50	1983742	285945	9531	0.000104915
May	7.25	51.21	324.36	0.0031	-13.58	792646	109330	3527	0.000283544
June	7.31	61.52	334.67	0.0030	-12.75	344593	47124	1571	0.00063662
July	6.94	66.82	339.97	0.0029	-12.34	228887	32993	1064	0.000939599
August	7.00	64.80	337.95	0.0030	-12.50	267230	38176	1273	0.000785841
September	6.94	59.43	332.58	0.0030	-12.91	406208	58553	1889	0.000529439
October	5.88	47.74	320.89	0.0031	-13.88	1062504	180852	5834	0.000171411
November	4.56	36.38	309.53	0.0032	-14.88	2899472	635501	21183	4.72069E-05
December	3.69	24.68	297.83	0.0034	-15.99	8826208	2393548	77211	1.29515E-05
Lab	20							**Yearly Half-life Loss(8)**	0.003604818
								Half-life(9) (years)	277.41

Notes:

(1) UV Lamp On (hours per day) is given in Richgels (2015a, 2015b).
(2) Peak Turf Temps for New River, AZ given in Richgels (2015a, 2015b).
(3) Reaction Rate is calculated from the regression curve shown in Figure 4 for the upper bound (logarithmic) case.
(4) Lab half-life in hours is equal to 1/e^(Reaction Rate).
(5) Field equivalent (days) is calculated by dividing the lab half-life in hours by the UV lamp on hours per day.
(6) Field equivalent in days is converted to months using the given days in that particular month.
(7) Half-life loss per month is the inverse of the corresponding field equivalent in months.
(8) The yearly half-life loss is the sum of each individual months half-life loss.
(9) The half-life in years is the inverse of the yearly half-life loss.

Table 3. HDPE Grass Blade Lower Bound Half-Life Calculations (Geosyntec)

Month	UV Lamp On[1] (hours/day)	Months @ 80 C[2]	Months @ 70 C[2]	Months @ 60 C[2]	Peak Turf Temp[3] (C.)	Half-life Months (from Regression)	Half-life Loss per month
January	4.00	692	1507	3078	27.99	6948	0.000143933
February	4.94	620	1352	2761	27.96	6256	0.000159849
March	6.13	452	984	2010	33.94	4059	0.00024637
April	6.94	412	898	1834	40.58	3213	0.000311281
May	7.25	382	832	1698	51.21	2248	0.000444747
June	7.31	391	852	1740	61.52	1580	0.000633027
July	6.94	399	869	1775	66.82	1237	0.00080834
August	7.00	395	861	1759	64.80	1371	0.000729293
September	6.94	412	898	1834	59.43	1826	0.000547629
October	5.88	471	1026	2095	47.74	3070	0.000325779
November	4.56	627	1365	2788	36.38	5321	0.000187929
December	3.69	750	1635	3339	24.68	7945	0.000125871
Lab	20					**Yearly Half-life Loss**	0.00466405
						Half-life (years)	214.41

Notes:

(1) UV Lamp On (hours per day) is given in Richgels (2015a, 2015b).

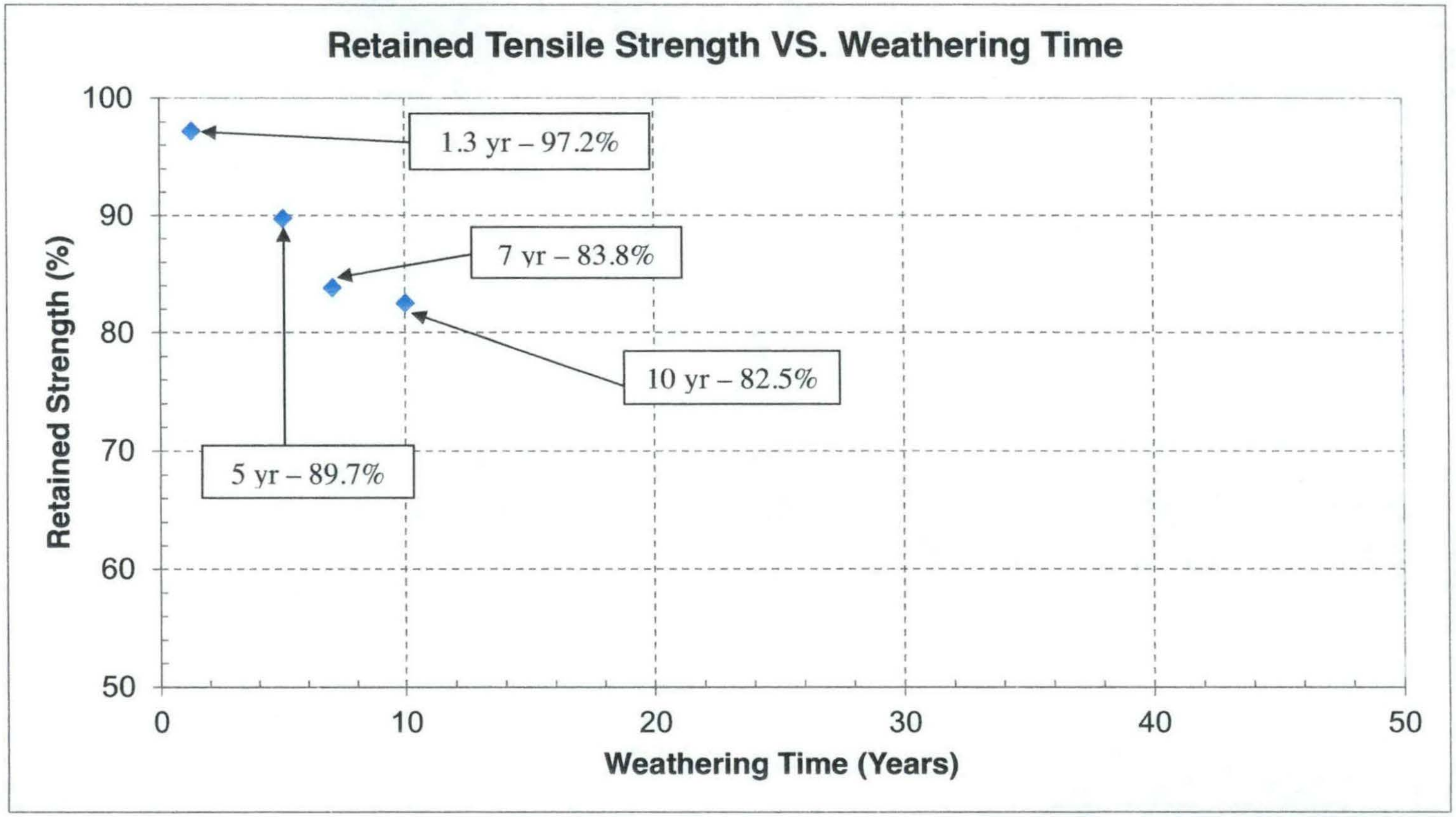
(2) The months required at each temperature is calculated using the regressions from Figure 4 for each temperature, projected down to half-life, then dividing the lamp-hours at half-life by the UV lamp on hours per day for a given month. Once this calculation is done for 80, 70 and 60 C, a linear regression (as shown in Figure 5) is used to obtain the half-life months at the corresponding peak turf temp.

(3) Peak turf temperatures given in Richgels (2015a, 2015b).

FIGURES

Note: The sand ballast infill is not shown in the sample photo on the left, but is shown in a field application photo on the right.

ClosureTurf® Components Watershed Geosynthetics – ClosureTurf® UV Assessment	
Geosyntec consultants	Figure 1
Kennesaw, GA	23-April-2015



Field Test Data (Watershed, 2014)
New River, AZ Atlas Testing Facility
Watershed Geosynthetics – ClosureTurf® UV Assessment

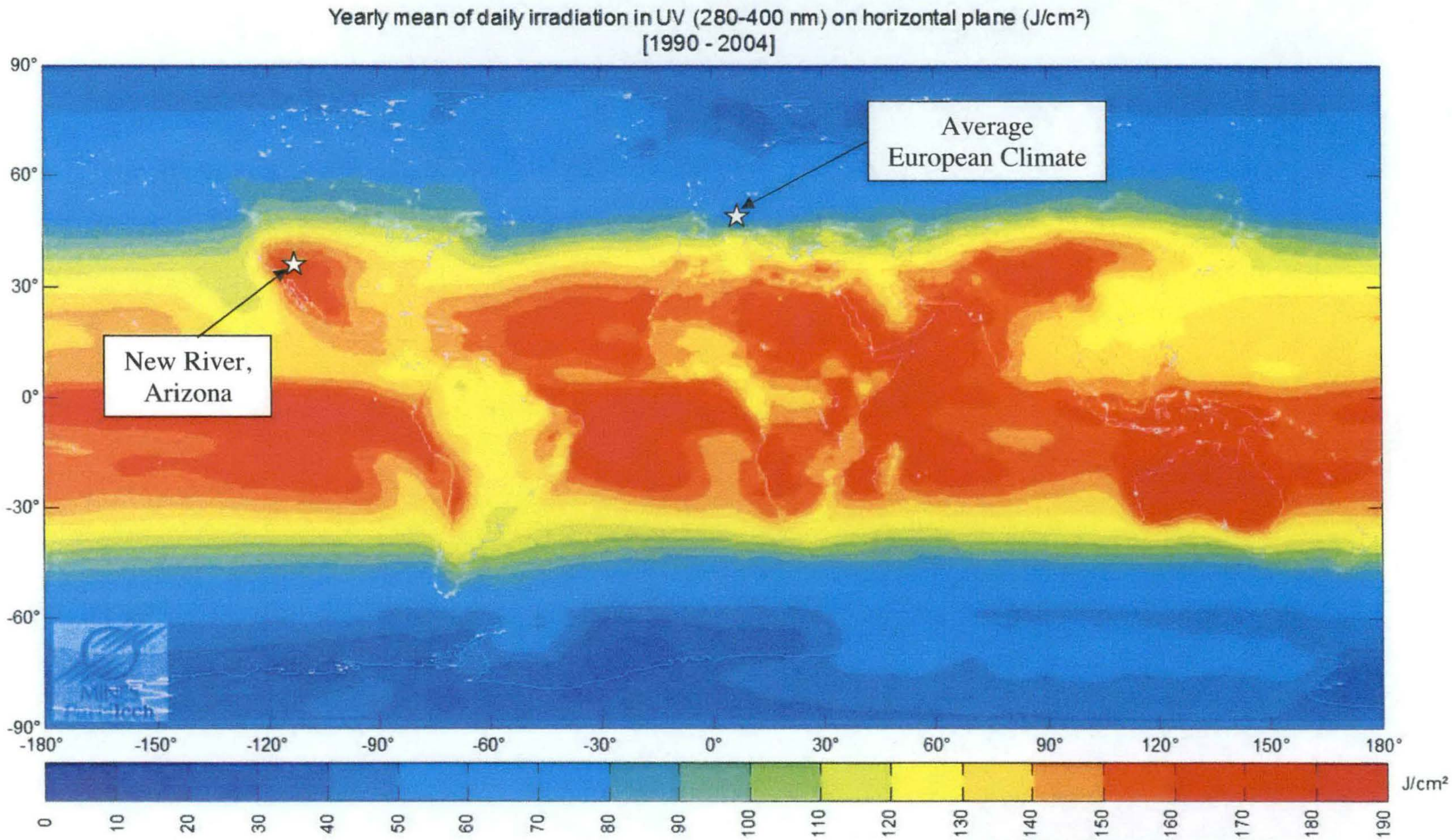
Geosyntec consultants

Figure 2

Kennesaw, GA | 25-April-2015

Notes:

1. The first data point at Weathering Time of 1.3 years is considered to be within the initial stage of UV degradation (i.e., anti-oxidant depletion), rather than polymer oxidation which is represented by the final three data points.
2. Each data point represents the average result of 20 tensile break tests.



1 J/cm^2 = 4.755 ft-lbs/in^2

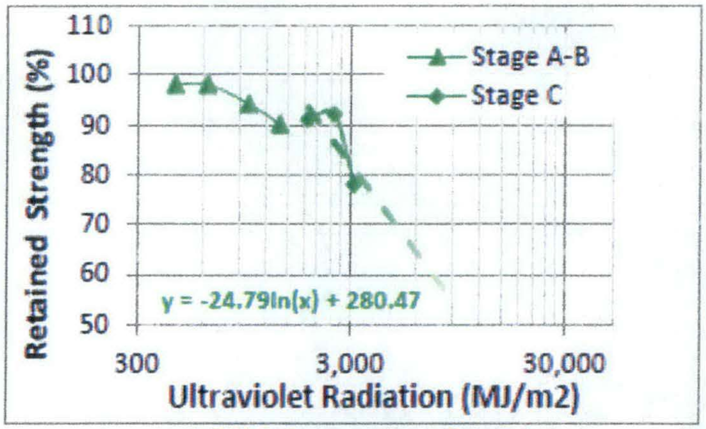
Yearly Irradiation in the Ultraviolet Range

Watershed Geosynthetics – ClosureTurf® UV Assessment

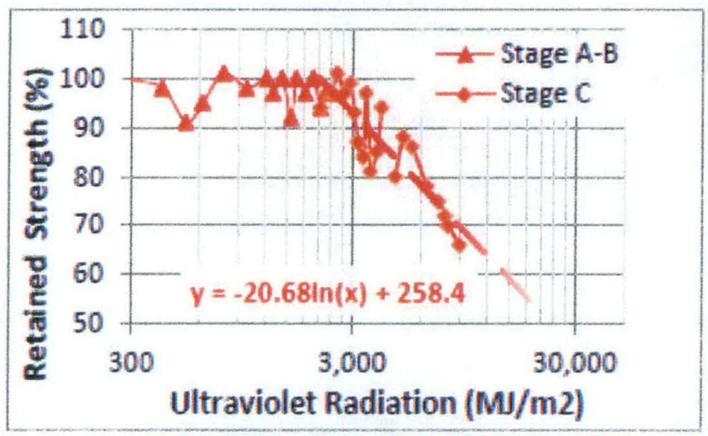
Geosyntec consultants

Figure 3

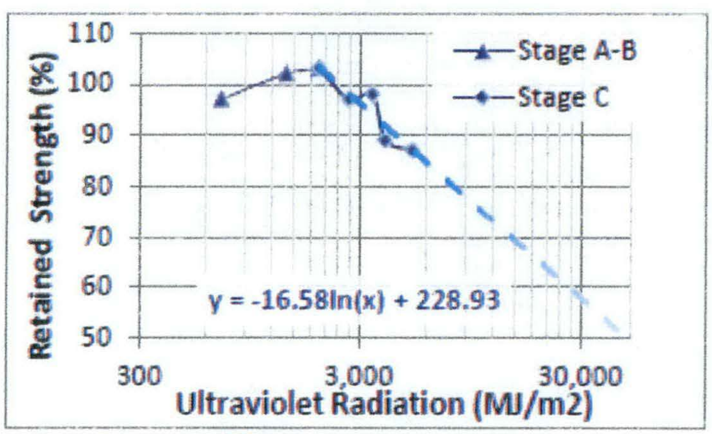
Kennesaw, GA | 23-April-2015



a) 80°C Temperature Dataset

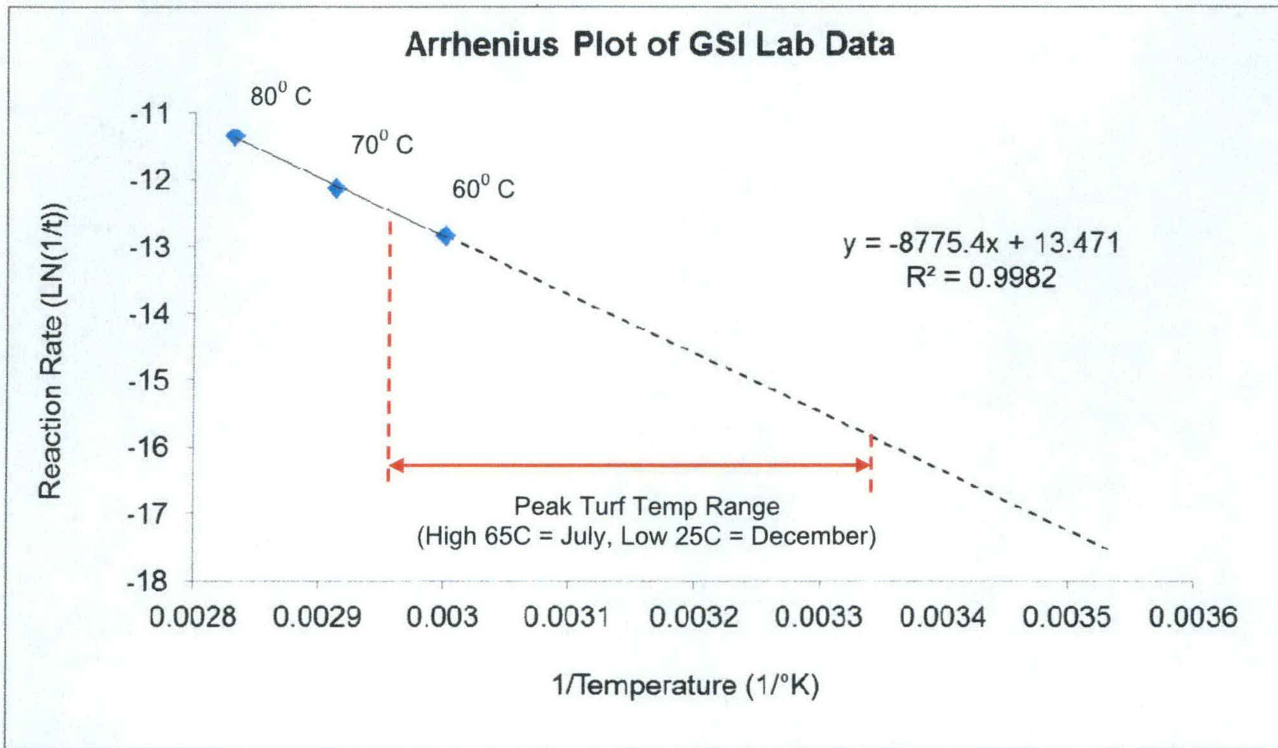


b) 70°C Temperature Dataset



c) 60°C Temperature Dataset

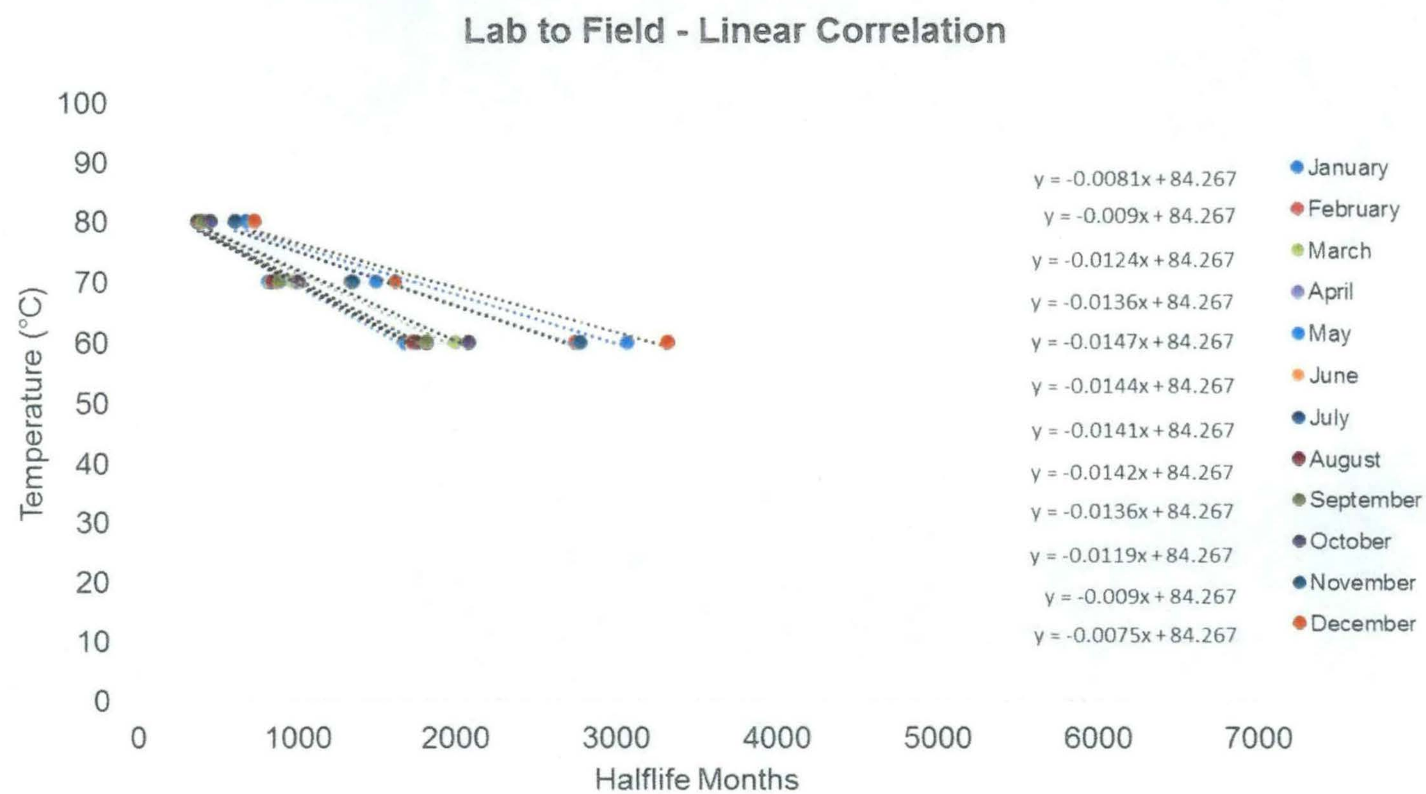
GSI Data Release - Three Stage Oxidation of HDPE for Different Temperatures Watershed Geosynthetics – ClosureTurf UV Assessment		
Geosyntec consultants		Figure 4
Kennesaw, GA	23-April-2015	



Note: Richgels (2015b) mentions that the use of peak turf temperature is conservative since it only occurs for approximately one hour per day.

Arrhenius Plot of Lab Data Watershed Geosynthetics – ClosureTurf UV Assessment		
Geosyntec consultants		Figure 5
Kennesaw, GA	23-April-2015	

Case No. 2019-00435
Exhibit Pullen-3
Direct Testimony of Michael T. Pullen



Note: Each month was projected down to the peak turf temperature given in Table 3 to get the half-life months. The inverse of half-life months is half-life loss per month. The sum of all the half-life losses for each month in a year is the yearly half-life loss, the inverse of which is the half-life.

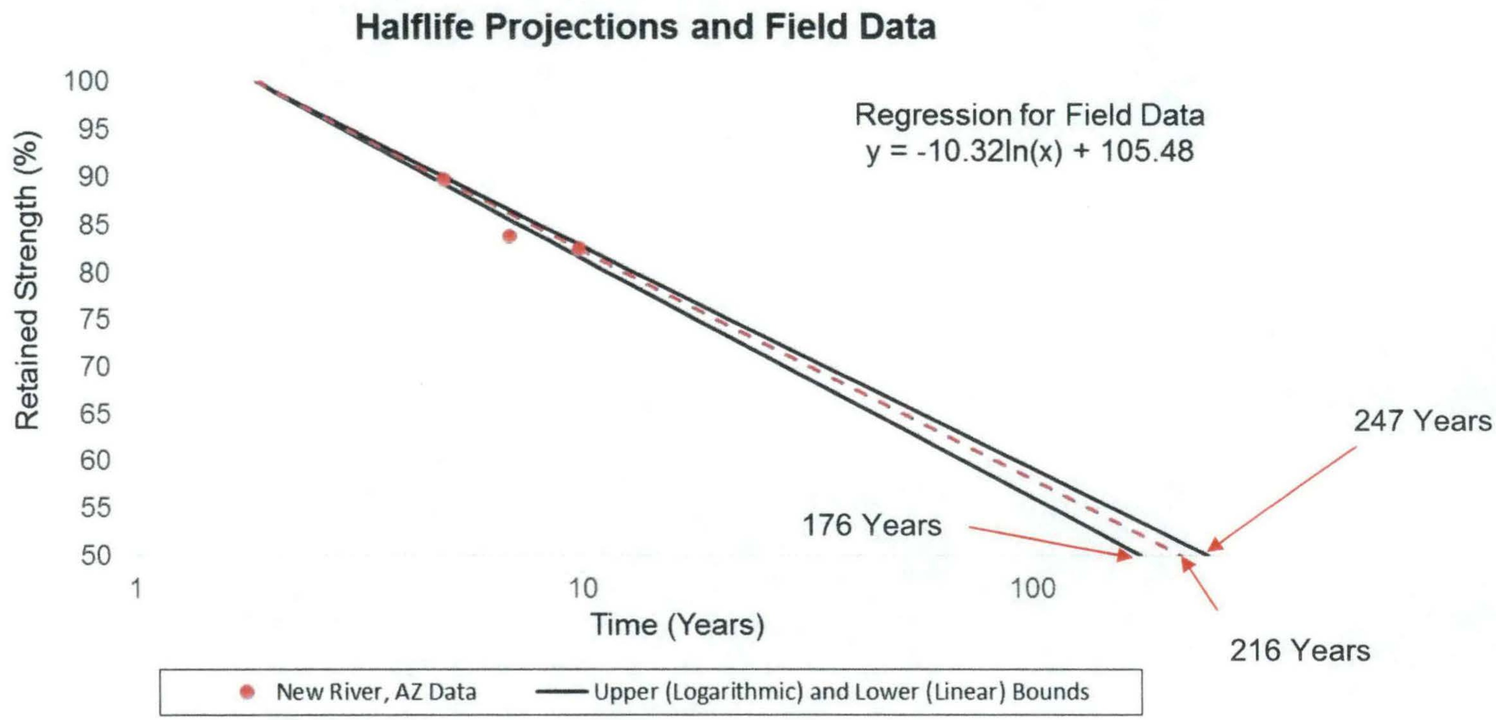
Linear Extrapolations for Half-life Months

Watershed Geosythetics – ClosureTurf® UV Assessment

Geosyntec consultants

Figure 6

Kennesaw, GA | 23-April-2015



Halflife Projections (Richgels, 2015a, 2015b)
Upper and Lower Bound Estimates
Watershed Geosythetics – ClosureTurf® UV Assessment

Geosyntec consultants

Figure 7

Kennesaw, GA | 23-March-2015

Note: Geosyntec calculated an upper bound half-life of 277 years and a lower bound half-life of 214 years using the same data and method. Difference between Geosyntec and Richgels calculations are attributed to rounding.

Case No. 2019-00435

Exhibit Pullen-4

Project 14 Cost Summary

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEFN	)	Case No. 2019-00435

CONFIDENTIAL DOCUMENT

Exhibit Pullen-4
Direct Testimony of Michael T. Pullen
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION
PETITION FOR CONFIDENTIAL TREATMENT

Case No. 2019-00435

Exhibit Pullen-5

Project 16 – CCR Regulatory Asset Detail

Big Rivers Electric Corporation
Coal Combustion Residuals Incremental Costs

Green Station Total	[redacted]
Reid / Station Two Total (net)	1,006,201.42
Wilson Station Total	[redacted]
TOTAL PROJECT 16	

Big Rivers Electric Corporation
Green Station - Coal Combustion Residuals Incremental Costs

	Costs [1]	Environmental Compliance Plan Description
A	$ 4,831.00	Development of a technical engineering report which demonstrates the surface impoundments do not evidence placement of CCR material above the uppermost aquifer and require closure, as required by 40 C.F.R. §257.60.
A	97,166.95	Development of a technical report which demonstrates the surface impoundments as well as landfills are not located within an unstable area and meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.64.
A	1,800.00	Development of CCR Impoundment Liner Design Assessments to determine if existing CCR surface impoundment was constructed with a liner that meets specifications in the CCR rule, as required by 40 C.F.R. §257.71.
A	107,336.60	Development of Structural Integrity Criteria for Existing CCR Surface Impoundments Hazard Potential Classification, History of Construction, Safety Factor Assessment, Structural Stability Assessments, and Emergency Action Plan (EAP) that details emergency response actions by Big Rivers in the event of a surface impoundment failure, as required by 40 C.F.R. §257.73.
A	420.75	Development of Fugitive Dust Control Plan implementation and Annual CCR fugitive dust control report, as required by 40 C.F.R. §257.80.
A	9,690.09	Development of run-on and run-off control system plan for landfills to collect and control run-on and run-off flow created during storm related events, as required by 40 C.F.R. §257.81.
A	12,100.00	Development of Hydrologic and Hydraulic Capacity Assessment and Initial Inflow Design Flood Control System Plans for surface impoundments, as required by 40 C.F.R. §257.82.
A	93,199.98	Development of CCR annual inspection reports detailing visual inspections of CCR storage units (impoundments and landfills) conducted by P.E., to ensure design, construction, and maintenance of CCR unit is consistent with recognized and good engineering standards, as required by 40 C.F.R. §257.83/257.84.
A	1,040,147.31	Corrective action implemented at the Green Landfill to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G200E - Eastern Trench).
A	778,448.13	Corrective action implemented at the Green Landfill to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G201E - Northwest Trench).

Big Rivers Electric Corporation
Green Station - Coal Combustion Residuals Incremental Costs

Costs [1]		Environmental Compliance Plan Description
A	288,806.36	Groundwater monitoring sampling, selection of a statistical method certification for groundwater analyses and analysis for surface impoundments groundwater monitoring. Statistical evaluation of groundwater monitoring data collected to identify statistically significant evidence of contamination (if any). Preparation of an Annual Groundwater Monitoring and Corrective Reports for surface impoundments and landfill, detailing status of ongoing groundwater monitoring, corrective actions conducted, and planned actions. An assessment groundwater monitoring program for landfills and surface impoundment based on statistical evaluation of groundwater data. These item were performed as required by 40 C.F.R. §257.90/257.91/257.93/257.95.
A	60,111.27	Assessment of corrective measures technical report completed for lithium detected at Reid/HMP&L surface impoundment and Green Landfill. The report details various options available as well as provides notice of semiannual progress reports to be made available until selection of remedy is determined and report provided, as required by 40 C.F.R. §257.96.
A	89,344.56	Closure and Post Closure Care Plans developed for Green landfill, Green surface impoundment, Reid HMP&L surface impoundment, and Wilson Station landfill, as required by 40 C.F.R. §257.102.
P	[redacted]	Corrective action implemented at the Green Landfill to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G200E - Eastern Trench).
P		Corrective action to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G201E - Northwest Trench)
		Total

Note(s): 1.- A = Actual (2015-2019); P = Projected (2020)

Big Rivers Electric Corporation
Reid / Station Two - Coal Combustion Residuals Incremental Costs

Costs [1]		Environmental Compliance Plan Description
A	$ 4,655.45	Development of a technical engineering report which demonstrates the surface impoundments do not evidence placement of CCR material above the uppermost aquifer and require closure, as required by 40 C.F.R. §257.60.
A	7,795.45	Development of a technical report which demonstrates the surface impoundments are not located within a wetland and meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.61.
A	2,555.45	Development of a technical report which demonstrates the surface impoundments are not located within a fault area zone and meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.62.
A	10,500.45	Development of a technical report which demonstrates the surface impoundment are located within a seismic impact zone and determines if the surface impoundment structural components meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.63.
A	6,795.47	Development of a technical report which demonstrates the surface impoundments as well as landfills are not located within an unstable area and meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.64.
A	1,800.00	Development of CCR Impoundment Liner Design Assessments to determine if existing CCR surface impoundment was constructed with a liner that meets specifications in the CCR rule, as required by 40 C.F.R. §257.71.
A	74,969.00	Development of Structural Integrity Criteria for Existing CCR Surface Impoundments Hazard Potential Classification, History of Construction, Safety Factor Assessment, Structural Stability Assessments, and Emergency Action Plan (EAP) that details emergency response actions by Big Rivers in the event of a surface impoundment failure, as required by 40 C.F.R. §257.73.
A	16,500.00	Development of Hydrologic and Hydraulic Capacity Assessment and Initial Inflow Design Flood Control System Plans for surface impoundments, as required by 40 C.F.R. §257.82.
A	53,226.93	Development of CCR annual inspection reports detailing visual inspections of CCR storage units (impoundments and landfills) conducted by P.E., to ensure design, construction, and maintenance of CCR unit is consistent with recognized and good engineering standards, as required by 40 C.F.R. §257.83/257.84.
A	637,456.72	Corrective action implemented at the Green Landfill to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G200E - Eastern Trench).
A	477,113.34	Corrective action implemented at the Green Landfill to ensure seeps are properly collected and treated as required by 40 C.F.R. §257.84 and 90 (BP19G201E - Northwest Trench).

Big Rivers Electric Corporation
Reid / Station Two - Coal Combustion Residuals Incremental Costs

Costs [1]		Environmental Compliance Plan Description
A	140,622.13	Groundwater monitoring sampling, selection of a statistical method certification for groundwater analyses and analysis for surface impoundments groundwater monitoring. Statistical evaluation of groundwater monitoring data collected to identify statistically significant evidence of contamination (if any). Preparation of an Annual Groundwater Monitoring and Corrective Reports for surface impoundments and landfill, detailing status of ongoing groundwater monitoring, corrective actions conducted, and planned actions. An assessment groundwater monitoring program for landfills and surface impoundment based on statistical evaluation of groundwater data. These item were performed as required by 40 C.F.R. §257.90/257.91/257.93/257.95.
A	29,319.48	Assessment of corrective measures technical report completed for lithium detected at Reid/HMP&L surface impoundment and Green Landfill. The report details various options available as well as provides notice of semiannual progress reports to be made available until selection of remedy is determined and report provided, as required by 40 C.F.R. §257.96.
A	11,491.26	Closure and Post Closure Care Plans developed for Green landfill, Green surface impoundment, Reid HMP&L surface impoundment, and Wilson Station landfill, as required by 40 C.F.R. §257.102.
	$ 1,474,801.13	**Gross Total**
	(468,599.71)	**Less Amount Allocated to Henderson Municipal Power & Light**
	$ 1,006,201.42	**Net Total**

Note(s): 1.- A = Actual (2015-2019); P = Projected (2020)

Big Rivers Electric Corporation
Wilson Station - Coal Combustion Residuals Incremental Costs

Costs [1]		Environmental Compliance Plan Description
A	$ 65,945.05	Development of a technical report which demonstrates the surface impoundments as well as landfills are not located-within an unstable area and meet certification requirements (performance criteria) by professional engineer (P.E.), as required by 40 C.F.R. §257.64. Costs for the period 2015 to 2019
A	420.75	Development of Fugitive Dust Control Plan implementation and Annual CCR fugitive dust control report, as required by 40 C.F.R. §257.80. Costs for the period 2015 to 2019
A	9,353.06	Development of run-on and run-off control system plan for landfills to collect and control run-on and run-off flow created during storm related events, as required by 40 C.F.R. §257.81. Costs for the period 2015 to 2019
A	43,661.00	Development of CCR annual inspection reports detailing visual inspections of CCR storage units (impoundments and landfills) conducted by P.E., to ensure design, construction, and maintenance of CCR unit is consistent with recognized and good engineering standards, as required by 40 C.F.R. §257.83/257.84. Costs for the period 2015 to 2019
A	203,063.50	Groundwater monitoring sampling and analysis, selection of a statistical method certification for groundwater analyses and analysis for surface impoundments groundwater monitoring. Statistical evaluation of groundwater monitoring data collected to identify statistically significant evidence of contamination (if any). Preparation of an Annual Groundwater Monitoring and Corrective Reports: for surface impoundments and landfill, detailing status of ongoing groundwater monitoring, corrective actions conducted, and planned actions. An assessment groundwater monitoring program for landfills and 1 surface impoundment based on statistical evaluation of groundwater data. These item were performed as required by 40 C.F.R. §257.90/257.91/257.93/257.95
A	45,257.91	Assessment of corrective measures technical report completed for cobalt detected at Wilson landfill. The report details various options available as well as provides notice of semiannual progress reports to be made available until selection of remedy is determined and report provided, as required by 40 C.F.R. §257.96
A	10,047.20	Closure and Post Closure Care Plans developed for Green landfill, Green surface impoundment, Reid HMP&L surface impoundment, and Wilson Station landfill, as required by 40 C.F.R. §257.102
A	3,803,386.00	Seep analyses, leachate pilot treatment system design, consulting, operation and maintenance and permanent leachate collection and treatment system design and construction to satisfy the requirements of the Wilson Phase I landfill Agreed Order ("Agreed Order")
A	7,613.33	Phase I landfill Closure Plan is to meet the requirements in 401 KAR 45:110
A	84,361.66	Wilson Phase I landfill 401 KAR 45:160 groundwater assessment plan.
P	[redacted]	Leachate collection system (trench and basin) installation, as required by Agreed Order
P	[redacted]	Leachate Treatment System process design, equipment supply and mechanical installation as required by Agreed Order

Big Rivers Electric Corporation
Wilson Station - Coal Combustion Residuals Incremental Costs

Costs [1]		Environmental Compliance Plan Description
P	[redacted]	Leachate Treatment System power feed, floor slab and foundation, building supply and erection, and electrical controls installation as required by Agreed Order
P		Collection basin expansion and collection trench extension as required by Agreed Order
P		Engineering and miscellaneous expense related to leachate collection and treatment as required by Agreed Order
		TOTAL

Note(s): 1.- A = Actual (2015-2019); P = Projected (2020)

ORIGINAL

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	**Case No. 2019-00435**

DIRECT TESTIMONY

OF

PAUL G. SMITH
CHIEF FINANCIAL OFFICER

ON BEHALF OF

BIG RIVERS ELECTRIC CORPORATION

FILED: February 7, 2020

Application Exhibit F

DIRECT TESTIMONY

OF

PAUL G. SMITH

I. INTRODUCTION

Q. Please state your name, business address and occupation.

A. My name is Paul G. Smith, and my business address is 201 Third Street, Henderson, Kentucky 42420. I am the Chief Financial Officer ("CFO") for Big Rivers Electric Corporation ("Big Rivers").

Q. Please summarize your education and professional experience.

A. I received a Bachelor of Science degree in Industrial Management from Purdue University and a Masters of Business Administration degree, with honors, from the University of Chicago. I am a Certified Public Accountant in the State of Ohio and a member of the American Institute of Certified Public Accountants. I am a past member of the Edison Electric Institute ("EEI") Economic Regulation and Competition Committee and the EEI Budgeting and Financial Forecasting Committee.

I began my career in 1982 as a public accountant in the Chicago office of Deloitte & Touche, and from 1984 to 1987 in the Indianapolis office of Crowe, Chizek & Co. Beginning in 1987, I held various analyst and managerial positions with Duke Energy Corporation and its predecessor companies, in Budgets and Forecasts, Rates and Regulatory Affairs, Investor Relations, and the International Business Unit. Beginning in 2001, I was appointed to various executive level positions, including General Manager of Budgets and Forecasts with responsibility for Cinergy Corp.'s financial planning and analysis department, Vice President of Rates with responsibility for all state and federal regulated rate matters, including revenue requirements, cost of service and rate design for Duke Energy Kentucky, Inc. and Duke Energy Ohio, Inc., and Vice President of Retail Marketing with responsibility for all activities to launch a start-up competitive retail energy business.

In 2012, I joined NextEra Energy Transmission, the competitive transmission development subsidiary of NextEra Energy, Inc., as Senior Director of Business Management. My responsibilities included managing all financial activities for the competitive transmission business, including accounting and financial reporting, budgeting and financial planning, and corporate development analytics. In addition, I was responsible for the compliance function and directing the preparation of state, Regional Transmission Organization, and Federal Energy Regulatory Commission ("FERC") revenue requirement filings.

In 2018, I accepted the position of CFO at Big Rivers.

Q. Please summarize your duties at Big Rivers.

A. As CFO, I am responsible for all financial, regulatory, strategic planning and risk management activities. Such activities include accounting and financial reporting, payroll, budgets, finance, tax, rates and regulatory affairs, risk management and strategic planning.

Q. Have you previously testified before the Kentucky Public Service Commission ("Commission")?

A. Yes, I testified on behalf of Big Rivers in Case No. 2019-00269[1] in which the Company requested that the Commission enforce the series of contracts between Big Rivers and the City of Henderson and the City of Henderson Utility Commission (collectively, "HMP&L") related to the William L. Newman Station Two ("Station Two") generating plant and associated facilities, and in Case No. 2018-00146,[2] in which the Commission found, among other things, that various Station Two contracts had terminated. I have also testified on behalf of Duke Energy Kentucky, Inc., including in Case No. 2006-00172,[3] in

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[1] *In the Matter of: Application of Big Rivers Electric Corporation for Enforcement of Rate and Service Standards* (filed July 31, 2019).

[2] *In the Matter of: Notice of Termination of Contracts and Application of Big Rivers Electric Corporation for a Declaratory Order and for Authority to Establish a Regulatory Asset* (Ky. P.S.C. Aug. 29, 2018).

[3] *An Adjustment of the Electric Rates of the Union Light, Heat and Power Company D/B/A Duke Energy Kentucky, Inc.* (Ky. P.S.C. Dec. 21, 2006).

which Duke sought an increase in rates, and in Case No. 2008-00495,[4] in which Duke sought approval of energy efficiency programs and an energy efficiency rider. Most recently, I submitted testimony in support of the Joint Application filed by Big Rivers and Meade County Rural Electric Cooperative Corporation in Case No. 2019-00365,[5] which is presently pending before the Commission and involves a request for approval of contracts to provide electric service to a new facility to be developed by Nucor Corporation ("Nucor") in Brandenburg, Meade County, Kentucky. I have also testified before The Public Utilities Commission of Ohio, the Indiana Utility Regulatory Commission, and FERC. My professional experience is summarized in Exhibit Smith-1.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to provide detailed discussion of Big Rivers' proposed 2020 Environmental Compliance Plan (the "2020 Plan") from a financial and accounting perspective. I will discuss, among other things, the capital and operation and maintenance ("O&M") costs of the 2020 Plan, Big Rivers' plans for financing the 2020 Plan costs, and the cooperative's proposed

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[4] *In the Matter of: Application of Duke Energy Kentucky, Inc. for Approval of Energy Efficiency Plan including an Energy Efficiency Rider and Portfolio of Energy Efficiency Programs* (Ky. P.S.C. Jan. 29, 2010).

[5] *In the Matter of: Electronic Joint Application of Big Rivers Electric Corporation and Meade County Rural Electric Cooperative Corporation for (1) Approval of Contracts for Electric Service with Nucor Corporation; and (2) Approval of Tariff* (filed Sept. 26, 2019).

return on its 2020 Plan. I will also describe Big Rivers' proposals with respect to existing and proposed regulatory assets and the prudent recovery of relevant costs through Big Rivers' Environmental Surcharge ("ES").

Q. Are you sponsoring any exhibits?

A. Yes. The following exhibits were prepared by me or under my supervision:

- Exhibit Smith-1: Professional Summary and
- Exhibit Smith-2: Analysis of FGD Alternatives for Wilson Unit 1.

II. BACKGROUND

Q. Please briefly describe Big Rivers' generation portfolio.

A. Big Rivers' generation portfolio has consisted predominately of coal-fired assets at three locations: the D.B. Wilson Station ("Wilson Station") located near Centertown, Kentucky; the Kenneth C. Coleman Station ("Coleman Station") near Hawesville, Kentucky; and the Sebree Station in Sebree, Kentucky, which includes the Robert D. Green Station ("Green Station"), the Robert A. Reid Station ("Reid Station"), and Station Two. Certain of these assets on which Big Rivers formerly relied are not presently operating due to environmental regulation, decreased load, uneconomic power market prices and other factors. Specifically, the Coleman Station has been idled since 2014, the Reid Station's coal-fired unit has been idled since 2016, and the Station Two units were retired effective February 1, 2019.

Q. How has the native load served by the Company changed in recent years?

A. As the Commission is aware, in 2013 one of two large smelter customers left Big Rivers' system. In 2014, the second smelter exited Big Rivers' system. The combined load of the two smelters was approximately 850 MW, and losing more than one-half of its load obviously had an impact on the revenues and operations of the Company. Since the exit of the smelters, Big Rivers' native load has grown modestly and presently stands at approximately 660 MWs.

Q. Please explain how Big Rivers has addressed its excess generation capacity since the exit of the smelters' load in 2013-2014.

A. Even before the smelters left Big Rivers' system, the Company was examining and implementing strategies for mitigating the negative impacts of a decrease in load. These strategies were set forth in a Load Concentration Analysis and Mitigation Plan ("Load Mitigation Plan") developed by Big Rivers and included, among other things, seeking rate increases; marketing excess power on short-term, mid-term, and long-term bases when market prices were favorable; evaluating bilateral sales agreements and wholesale power contracts; expanding existing load on Big Rivers' system; attracting new industrial load to Big Rivers' service territory; and reducing costs and optimizing existing assets.

Q. Please detail how the Load Mitigation Plan has developed in the years since the loss of the smelter loads.

A. The Load Mitigation Plan has evolved into a Business Plan, which is a dynamic process strategically leveraging Big Rivers' assets to achieve its mission to safely deliver competitive and reliable wholesale power and cost-effective shared services desired by its Member-Owners. Consistent with its Business Plan, Big Rivers continues to expand power marketing efforts across the Commonwealth and the Midwest, securing short-term and long-term contracts for its excess energy. Also as a result of Big Rivers' Business Plan, the Company has been successfully selling economic energy within the markets maintained by the Midcontinent Independent System Operator, Inc. ("MISO").

Q. Please describe Big Rivers' efforts with respect to off-system sales growth.

A. After ensuring the satisfaction of its native load, Big Rivers capitalizes on its available capacity in a number of ways; for instance, Big Rivers has successfully received Commission approval to execute wholesale full-requirements purchased power contracts with entities in the State of Nebraska through 2026. Further, Big Rivers has negotiated an agreement to satisfy the full capacity and energy requirements of Owensboro Municipal Utilities through 2026. Big Rivers also provides dispatchable power to nine communities which are members of the Kentucky Municipal Energy Agency ("KyMEA") into 2029.

Q. Has Big Rivers also worked to increase its native load?

A. Yes. Among other things, Big Rivers has developed and implemented an economic development rate ("EDR") to encourage manufacturers and similar load centers to locate and operate in the Western Kentucky region. The first EDR contracts involved a planned ~$350 million expansion of production facilities by Aleris Rolled Products Manufacturing, Inc. in Kenergy Corp.'s service territory.[6] In addition, presently pending before the Commission in Case No. 2019-00365 is a request for approval of contracts to provide electric service to Nucor's new facility in Brandenburg, Meade County, Kentucky. Nucor's planned $1.35 billion steel plate mill is expected to result in 400 direct jobs, over 2,600 indirect jobs, $189 million in annual labor income, $14.3 million in annual state and local tax revenues, and approximately $360 million

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[6] *See* Case No. 2016-00117, *In the Matter of: Joint Application of Kenergy Corp. and Big Rivers Electric Corporation for Approval of Contracts* (Ky. P.S.C. June 30, 2016).

in annual gross domestic product once fully operational. The facility is expected to increase Big Rivers' native load by [redacted].

Q. What are some other recent steps Big Rivers has taken to address the impacts to its system that resulted from the loss of the smelter load?

A. While Big Rivers has certainly attempted to replace the revenue lost with the departure of the smelter load, it has also coupled those efforts with significant cost-saving measures, and an economic review of its generation portfolio to identify strategic supply-side actions. Such cost-saving measures include the difficult but necessary reduction of its workforce from over 600 employees to less than 400 employees today. Moreover, in Case No. 2018-00146,[7] Big Rivers sought and obtained a declaratory order from the Commission ratifying the Company's determination that the HMP&L Station Two units were no longer capable of producing economically-competitive generation, thus confirming Big Rivers' exit from that costly arrangement (though the Company maintains certain obligations under the parties' Joint Facilities Agreement, as discussed herein).

[7] *See* fn. 2, *supra*.

Q. Have these efforts and others improved Big Rivers' financial performance in recent years?

A. Yes, Big Rivers' financial metrics have improved significantly in recent years. The following is a table showing the positive trend for several key financial metrics:

Metric	2016	2017	2018	2019*
Net Margins	$12.9	$13.0	$15.2	$16.7
TIER	1.31	1.32	1.39	1.45
Debt Service	1.23	1.22	1.22	1.60
FFO/Debt	2.2%	4.0%	5.2%	9.0%
Leverage Ratio	10.3	9.8	9.2	6.7

*Unaudited

Q. Has Big Rivers completed its pursuit of a full financial recovery from the loss of the smelters' load in 2013-2014?

A. Not yet. Big Rivers has regained an investment grade rating with one of the three rating agencies, but continues to aggressively seek an investment grade rating from the other two agencies. To do so, Big Rivers anticipates retiring its Coleman Station and Reid Unit 1 this year in conjunction with its system-wide approach to responsibly address existing coal-fired generation assets and related liabilities. Big Rivers' plan to soon retire the Coleman Station and Reid Unit 1 will allow it to confront its remaining obligations in a reasoned and equitable manner, while ensuring Big Rivers' customers continue to benefit from the Company's extensive efforts to achieve a full financial recovery from the loss of such significant load roughly six years ago.

Q. To what extent does environmental compliance impact the expenses of the cooperative?

A. Costs incurred by Big Rivers to ensure ongoing compliance with environmental rules and regulations are significant. As the Commission is aware, coal-fired generation facilities are constantly facing new and changing guidelines (*e.g.*, the Disposal of Coal Combustion Residuals ("CCR") from Electric Utilities Rule ("CCR Rule"), and the Effluent Limitation Guidelines ("ELG") and Standards for the Steam Electric Power Generating Point Source Category ("ELG Rule")) that require careful planning and, at times, substantial investment by the cooperative. Big Rivers continually reviews and updates its compliance strategies and evaluates all compliance measures for reasonableness and cost-effectiveness.

Q. Does Big Rivers recover expenses associated with environmental compliance through its base rates?

A. Yes and no. Big Rivers' existing base rates went into effect February 1, 2014, consistent with their approval by the Commission in Case No. 2013-00199. Though the approved rates were based on a fully-forecasted test year that included certain expenses associated with environmental compliance, the base rates did not include any costs related to the initial Environmental Compliance Plan approved in Case No. 2007-00460 (the "2007 Plan") or the second Environmental Compliance Plan approved in Case No. 2012-00063 (the "2012 Plan"). Further, no costs proposed in the 2020 Plan are currently recovered in Big Rivers' base rates.

Q. Please explain Big Rivers' recovery of environmental compliance costs through its ES.

A. KRS 278.183, commonly known as the Environmental Surcharge Statute, provides at section (1) that a utility "*shall be entitled to the current recovery of its costs of complying with . . . those federal, state, or local environmental requirements which apply to coal combustion wastes and by-products from facilities utilized for production of energy from coal. . . .*" This cost recovery mechanism is only available following the Commission's approval of a reasonable and cost-effective plan for compliance submitted by the utility. Big Rivers has recovered certain costs of environmental compliance through its ES following approval of the 2007 Plan.

Q. What costs are associated with Big Rivers' 2007 Plan?

A. The costs of the programs which comprise the 2007 Plan include variable O&M expenses related to emissions compliance (*e.g.*, reagents and allowances) at Big Rivers' coal-fired generation facilities. These costs have been and continue to be recovered by Big Rivers through its ES. In 2019, Big Rivers incurred expenses of approximately $18.9 million in connection with the programs of the 2007 Plan, approximately $13.6 million of which was recovered from Members through the ES.

Q. Are costs associated with other compliance projects presently recovered through Big Rivers' ES?

A. Yes. The 2012 Plan, as approved, included four (4) projects, consisting of the installation of activated carbon injection and dry sorbent injection systems at Big Rivers' Coleman Station, Wilson Station, and Green Station, as well as continuous emissions monitoring at those Stations and at HMP&L Station Two. The capital and O&M expenses associated with the 2012 Plan projects (excluding installations planned for the Coleman Station which were not pursued due to the idling of the plant in 2014), as well as property taxes, insurance, and depreciation related to the relevant facilities, were/are recovered by Big Rivers through its ES.

Q. Does Big Rivers rely on its ES to ensure its revenues are sufficient to cover its costs of environmental compliance?

A. Yes. As intended, KRS 278.183 ensures the current recovery of Commission-approved environmental compliance costs by Big Rivers. In 2019, environmental cost recovery through the ES represented approximately 7.6 percent of Big Rivers' revenue from its Members.

Q. Did the Commission authorize Big Rivers to earn a return on the capital costs incurred as part of the 2012 Plan?

A. Yes. Consistent with KRS 278.183, Big Rivers proposed in 2012 to recover through the ES a return on its investment in the pollution control facilities and equipment related to the 2012 Plan. To calculate the rate of return, Big Rivers applies a Times Interest Earned Ratio ("TIER") of 1.24 to the average cost of debt for the environmental compliance plan projects approved as part of the 2012 Plan. As I discuss below, Big Rivers proposes to continue this methodology going forward.

Q. Outside of those projects contained within the 2007 Plan and 2012 Plan, how does Big Rivers typically account for its costs of complying with environmental regulations?

A. Many of Big Rivers' costs associated with environmental compliance are expensed annually as typical operational outlays. However, in accordance with generally accepted accounting principles Big Rivers has also recognized Asset Retirement Obligations ("AROs") related to certain environmental compliance obligations, and the Commission has approved the establishment of regulatory assets for the deferral of those ARO-related expenses as well as other expenses incurred for compliance with new environmental regulations not yet included in Big Rivers' existing environmental compliance plan.

Q. What is an ARO?

A. Pursuant to KRS 278.220, the Commission has adopted a uniform system of accounts for Big Rivers that was issued by the United States Department of Agriculture, Rural Utilities Service ("RUS"). The RUS Uniform System of Accounts ("RUS USoA") defines an asset retirement obligation as "*a liability for the legal obligation associated with the retirement of a tangible long-lived asset that a company is required to settle as a result of an existing or enacted law, statute, ordinance, or written or oral contract or by legal construction of a contract under the doctrine of promissory estoppel.*"

Q. Has Big Rivers recognized AROs on its financial statements related to its coal-fired generation facilities?

A. Yes. As I discuss later in my testimony, Big Rivers has recognized AROs with respect to its obligations associated with the eventual closures of the Green and Reid/Station Two coal ash ponds located at the Sebree Station in Robards, Kentucky.

Q. Does Big Rivers maintain regulatory assets relating to the Green and Reid/Station Two ash pond AROs?

A. Yes. In Case No. 2015-00333,[8] Big Rivers sought and was granted authority to establish a regulatory asset for the income statement impacts (including gains, losses, depreciation and accretion expense) resulting from AROs related to its Green and Reid/Station Two ash ponds (the "Green ARO Regulatory Asset" and "Reid/Station Two ARO Regulatory Asset," respectively). Additionally, Big Rivers was authorized to defer as regulatory assets the actual CCR-compliance costs it incurred in connection with its coal-fired facilities (the "CCR Regulatory Assets"). The projects which comprise the CCR Regulatory Assets are collectively delineated in the 2020 Plan as Project 15.

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[8] *Application of Big Rivers Electric Corporation for Authority to Establish Regulatory Assets for Expenses Related to the Coal Combustion Residuals Rule* (Ky. P.S.C. Jan. 5, 2016).

III. <u>2020 PLAN DETAIL</u>

Q. Please describe Big Rivers' 2020 Plan.

A. Big Rivers' 2020 Environmental Compliance Plan consists of five primary Projects and a number of identified sub-projects, each reflecting a reasonable and cost-effective approach to satisfying environmental obligations imposed upon facilities utilized for the production of energy from coal. While the engineering, environmental, and construction details of these projects are more thoroughly examined in the testimony of other witnesses, I summarize the projects below and discuss each from a financial perspective.

Q. Has Big Rivers provided an exhibit which summarizes the key details of the 2020 Plan?

A. Yes, Exhibit C to Big Rivers' Application provides a high-level overview of Big Rivers' 2020 Plan. It reflects each of the major undertakings associated with the 2020 Plan delineated by the project number assigned for reference in this proceeding, and catalogues each project's most-relevant information (including pertinent facility, applicable environmental authority(ies), anticipated project completion date and cost information).

Q. Please describe how Big Rivers intends to finance the costs of its 2020 Plan.

A. Big Rivers will utilize general cash reserves and working capital, to the extent possible, to cover the operating costs of its 2020 Plan. Big Rivers plans to externally finance the capital costs proposed in this application with a long-term loan(s) from the RUS. The RUS typically offers the most attractive debt terms, including incrementally lower interest rates. If such loan is not available, several financial institutions, including the National Rural Utilities Cooperative Finance Corporation ("CFC"), have expressed an interest in managing Big Rivers' access to capital markets via a private placement or a public offering. As necessary under KRS 278.300, Big Rivers will seek approval of financing related to the 2020 Plan costs in a subsequent proceeding.

A. PROJECT 12 – WILSON FGD/WWT SYSTEM IMPROVEMENTS

Q. Please describe Project 12.

A. Fundamentally, Project 12 consists of recycling the Coleman Station's FGD/absorber system by disassembling the absorber at the Coleman Station, moving it to the Wilson Station, and rebuilding it utilizing a combination of existing parts and infrastructure and new equipment. Big Rivers will also update the FGD's dewatering facilities and make wastewater treatment

("WWT") improvements, as detailed in the testimonies of Mr. Pullen and Mr. Hoydick.

Q. What is the estimated capital cost of Project 12?

A. The estimated capital cost of Project 12 is approximately [redacted]. The addition of capitalized interest of approximately [redacted] results in a total estimated project cost of [redacted].

Q. Did Big Rivers evaluate alternative options to determine whether Project 12 was cost effective?

A. Yes. As described in more detail in Mr. Pullen's testimony, the existing FGD at Wilson Station is at the end of its useful life and needs to be replaced. The relatively new FGD at the idled Coleman Station presents a unique opportunity for Big Rivers to maximize the value of Coleman Station by utilizing a proven, efficient asset to replace the Wilson FGD. To ensure this plan was cost effective, Big Rivers compared utilizing the Coleman FGD against the continued operation of the existing FGD, and against the replacement of Wilson's FGD with a new FGD.

Q. Did Big Rivers perform economic analyses to determine the least cost option to maintain environmental compliance at the Wilson Station?

A. Yes. As part of Big Rivers due diligence with respect to Project 12, the Company examined in detail the relative costs and benefits projected to be associated with each course of action. The economic scrutiny performed is described in more detail in Exhibit Smith-2, Analysis of FGD Alternatives for Wilson Unit 1.

Q. Please summarize the modeling conducted by Big Rivers.

A. The financial modeling of the Project 12 alternatives represents an economic comparison of the estimated capital, fixed O&M and variable O&M for each option. The Net Present Value ("NPV") analysis conducted by Big Rivers examined outcomes over three time periods, specifically 2023 to 2035, 2023 to 2043, and 2023 In Perpetuity. Relevant assumptions, sensitivities examined, and detailed results are further described in Exhibit Smith-2.

Q. Please summarize the results of the modeling.

A. Based on the economic analysis performed, recycling the FGD/absorber system at Coleman Station and moving it to the Wilson Station is the least cost option. Constructing an entirely new FGD system at Wilson Station was the second most economical solution, and continuing to operate and maintain the existing

Wilson FGD was the least economical solution. Additionally, operating and maintaining the existing Wilson FGD imposes the greatest risk profile. Due to the deterioration of the aged facility, a significant unplanned outage or catastrophic failure is not implausible. Combined with potential damage to the generating unit, the forced and potentially long-term outage of Wilson Station could have significant financial consequences that exceed the cost of a new FGD.

Q. **Does Big Rivers propose to earn a return of and on the capital costs of Project 12 in the ES?**

A. Yes, Big Rivers proposes to earn a return of the Project 12 capital cost over the remaining useful life of the Wilson Station, and to earn a return on the declining unrecovered balance consistent with past approved environmental compliance plan capital projects. This return is calculated at the TIER applied in the currently-effective ES, as authorized by the Commission in Case No. 2012-00063. Big Rivers believes the continued use of a 1.24 TIER is reasonable and appropriate because it is necessary to preserve cost-effectiveness for the Members, it helps ensure satisfaction of debt service coverage requirements, and it will support Big Rivers in its efforts to regain investment-grade credit ratings. This TIER reflects a conservative approach, and is less than the applicable TIER benchmarks reflected in the recent settlement of Case No. 2018-00146.[9]

Q. How will Big Rivers' books reflect the repurposing of the Coleman Station scrubber at Wilson Station?

A. The Coleman Station scrubber has a current net book value of $74.7 million as of December 31, 2019, of which $23.3 million represents the net book value of the components and equipment to be relocated to Wilson Station. When transferred and placed in-service at Wilson Station, the net book value of that portion being relocated will be reclassified as an incremental increase in the used and useful plant investment at Wilson Station. The reclassification of the net book value reduces Coleman Station's unrecovered net investment to be proposed as a regulatory asset when that station is retired.

Q. Does the proposed 2020 Plan result in the retirement of any Big Rivers' assets?

A. Yes. Portions of the existing Wilson FGD system that cannot be reused with the Coleman FGD that is being moved to the Wilson Station will soon be retired. As of December 31, 2019, the net book value of the plant to be retired

[9] *See* fn. 2, *supra*.

totaled $26 million. At the time of retirement, the net book value will be charged to accumulated depreciation in accordance with the RUS USoA.

Q. Please summarize the ES treatment that Big Rivers requests regarding Project 12.

A. For Project 12, Big Rivers requests the authority to add to its environmental rate base the capital costs of the project, including capitalized interest and the undepreciated net book value of the components and equipment being moved from Coleman Station, as well as the authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and to recover that depreciation expense through the ES. Big Rivers also plans to continue recovery through its ES of the ongoing variable O&M costs associated with the relevant FGD (reagents, disposal costs, allowances, and other consumables, primarily), which recovery was authorized by the Commission as part of the 2007 Plan.

B. PROJECT 13 – CLOSURE OF ASH PONDS

Q. Please describe Project 13.

A. Like many other electric utilities throughout Kentucky and the United States, Big Rivers is obligated to ensure its ash ponds are appropriately contained and closed consistent with law. Big Rivers seeks to responsibly address all its ash ponds as part of the 2020 Plan, including those at Green (Project 13-1), Coleman (Project 13-2), and Reid/HMP&L Station Two (Project 13-3).

i. <u>Project 13-1</u>

Q. What is Project 13-1?

A. As more fully discussed in Mr. Pullen's testimony, Project 13-1 is comprised of undertakings primarily designed to ensure compliance with the CCR Rule and limitations prescribed by the Green Station's relevant Kentucky Pollutant Discharge Elimination System ("KPDES") permit. The project primarily includes components necessary to satisfy retirement obligations related to the Green Station's ash pond, as well as certain water treatment equipment outside the scope of the ARO related to the ash pond.

Q. What is the estimated capital cost for this project?

A. The estimated capital cost for this project is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted].

Q. What portion of the capital cost of Project 13-1 is related to closure of the Green ash pond?

A. Of the total estimated capital cost for Project 13-1, [redacted] relates to the closure of the Green ash pond in satisfaction of asset retirement obligations.

The balance of the projected capital cost, roughly [redacted], reflects costs related to the associated WMB pond and water treatment that are outside the scope of the ARO for the ash ponds.

Q. What was Big Rivers' ARO liability balance for the Green ash pond as of December 31, 2019?

A. As of December 31, 2019, Big Rivers' ARO liability balance was $25.3 million for the Green ash pond, which reflects the present value of the estimated future cash flows required to close the ash pond per the updated cost studies prepared by Burns & McDonnell.

Q. How does Big Rivers propose to recover the costs of this project through its ES?

A. Big Rivers proposes to recover the capital costs of ash pond closure reflected in Project 13-1 (the Green ARO Regulatory Asset) through non-levelized amortization of the actual ash pond closure spending-to-date, allocable over a rolling 10-year period. This method ensures that cost recovery from Members through the ES is based on actual project spending while also allowing Big Rivers to match its amortization expense with ES revenue. With respect to the Project 13-1 capital costs that are not included in the ash pond ARO (approximately [redacted]), Big Rivers requests the authority to add those capital costs to its environmental rate base, including capitalized interest, the authority to depreciate that plant utilizing the approved Green Station depreciation rates, and to recover that depreciation expense through the ES.

Q. Does Big Rivers seek to recover ongoing O&M related to this project?

A. Yes. The annual O&M expense resulting from this project is estimated at approximately [redacted], due primarily to chemical consumption costs. Big Rivers seeks to recover this amount as an expense through its ES.

ii. <u>Project 13-2</u>

Q. What is Project 13-2?

A. As more fully discussed in Mr. Pullen's testimony, Project 13-2 involves the closure of the Coleman Station's three coal ash ponds, designated as the North Pond (approximately sixty (60) acres in size), the Sluice Pond (approximately forty-nine (49) acres in size), and the South Pond (approximately ninety-four (94) acres in size).

Q. What is the estimated capital cost for this project?

A. The estimated total capital cost of this project, including contingency and owner's costs, is [redacted]. This amount does not include capitalized interest of approximately [redacted], which results in a total project cost of approximately [redacted].

Q. Has Big Rivers recognized AROs related to its Coleman Station ash ponds?

A. No. Unlike the Green and Reid/Station Two facilities, the ash ponds at the Coleman Station were inactive at the time the CCR Rule was originally published. As a result, Big Rivers was not then required to recognize an ARO with respect to the Coleman Station ash ponds.

Q. Has the CCR Rule expanded to include the coal ash ponds at the Coleman Station?

A. Not yet, but it is expected to soon. As discussed in the testimony of Mr. Pullen, a 2018 decision of the U.S. Court of Appeals for the D.C. Circuit vacated and remanded a number of provisions within the CCR Rule, including those that exempt from regulation inactive impoundments at inactive facilities (also known as "legacy ponds") like Coleman Station. The U.S. Environmental Protection Agency is presently examining the path forward for implementation of the decision, and it is expected that legacy ponds will face the same or substantially similar closure requirements as currently-regulated ash ponds. It is also expected that these ponds will be subject to the Kentucky

Administrative Regulations (KAR) for special waste facilities or forthcoming state regulations specifically applicable to disposal of CCR.

Q. Does Big Rivers expect to recognize an ARO for the Coleman Station ash ponds?

A. Yes, upon publication of the updated CCR Rule that includes regulation of legacy ash ponds. The RUS USoA requires Big Rivers to recognize an ARO liability in the period in which it is incurred, and the amount recognized for the liability and an associated asset retirement cost must be stated at the fair value of the asset retirement obligation. Likewise, Financial Accounting Standards Board Accounting Standards Codification 14 ("ASC") Topic 410-20, *Asset Retirement Obligations*, requires AROs to be recognized at fair value when incurred and capitalized as part of the related long-lived asset. The liability is accreted to its present value each period, and the capitalized cost is depreciated over the useful life of the related asset. When the asset is retired, the entity settles the obligation for its recorded amount or incurs a gain or loss.

Q. What is the amount of the ARO Big Rivers expects to recognize with respect to the Coleman ash ponds?

A. Big Rivers expects to record an ARO liability based on the present value of the cost estimate provided by Burns & McDonnell, [redacted].

Q. Please further explain the income statement impacts Big Rivers must record upon recognition of an ARO for the Coleman Station ash ponds.

A. The RUS USoA requires the asset retirement cost to be depreciated over the useful life of the related asset that gives rise to the obligation. Therefore, Big Rivers expects to record depreciation expense for the ARO-related assets and accretion expense for the ARO-related liabilities each month following initial recognition of the ARO, just as it has done with respect to the Green and Reid/Station Two ash ponds. Importantly, as a result of this mandated accounting treatment, Big Rivers' financial statements will experience a mismatch of revenues and expenses during the period in which it is recognizing ARO-related expenses but not yet collecting revenue through rates.

To avoid this outcome, Big Rivers requests authority to establish a regulatory asset (the "Coleman ARO Regulatory Asset") once the ARO related to the Coleman ash ponds is recognized. Big Rivers also requests that it be permitted to record as part of the regulatory assets any prospective adjustments to the amounts for ARO-related depreciation and accretion expense associated with the ARO balances, as changes to the underlying cost estimates and timing will impact these amounts. This treatment will appropriately defer recognition of these ARO expenses until recovery of the actual costs through the ES. This will ultimately allow Big Rivers to match its revenues and expenses in each relevant accounting period.

Q. Is this approach consistent with that approved in Case No. 2015-00333?

A. Yes.

Q. Please summarize the ES treatment that Big Rivers requests regarding Project 13-2.

A. When Project 13-2 commences and costs begin to be incurred, Big Rivers requests authority to recover as an expense through its ES the amortization of the Coleman Station ARO Regulatory Asset over a rolling 10-year period as actual costs are incurred, which is the same manner of recovery as requested with respect to the Green ARO Regulatory Asset and Reid/Station Two ARO Regulatory Asset. Big Rivers also requests to recover ongoing O&M expense related to Project 13-2 through its ES, which is estimated to total [redacted] annually.

iii. Project 13-3

Q. What is Project 13-3?

A. In light of the retirement of the HMP&L Station Two generating units in February of 2019, the CCR Rule requires the timely closure of the ash pond located at that facility. Big Rivers proposes as Project 13-3 to close the approximately 24-acre ash pond by capping it in place with a cover system, as outlined in the CCR Rule.

Q. What is the estimated capital cost for this project?

A. The total estimated capital cost of Project 13-3 is [redacted]. As discussed further in the testimony of Mr. Pullen, the City of Henderson is responsible for 22.76% of these costs based on the parties' agreement and their respective proportional share of capacity costs during the life of Station Two. Thus, Big Rivers' projected share of the capital cost of this project is [redacted]. This amount does not include capitalized interest of approximately [redacted], which results in a total project cost for Big Rivers of approximately [redacted]. Should the Company be unable to recover from Henderson as it expects, Big Rivers requests authority to recover through its ES the costs it actually incurs.

Q. What is Big Rivers' current ARO liability balance for the Reid/Station Two ash pond as of December 31, 2019?

A. As of December 31, 2019, Big Rivers' ARO liability balance was $9.3 million for its share of the Reid/Station Two ash pond, which reflect the present values of the estimated future cash flows required to close the ash ponds per the updated cost studies prepared by Burns & McDonnell.

Q. How does the cost of this project relate to the existing Reid/Station Two ARO Regulatory Asset established in Case No. 2015-00333?

A. As I described earlier, Big Rivers' established the Reid/Station Two ARO Regulatory Asset for the income statement impacts related to its Station Two ash ponds. Just like Big Rivers proposes for Project 13-1 and Project 13-2, Big Rivers proposes cost recovery of Project 13-3 through non-levelized amortization based on actual ash pond closure spending, allocable over a rolling 10-year period, in order to match ES revenue with expense.

Q. Does Big Rivers seek to recover ongoing O&M related to this project?

A. Yes, Big Rivers seeks to recover its share of ongoing O&M related to this project (estimated at [redacted] annually) as an expense through its ES. Again, should the Company be unable to recover from Henderson as it expects, Big Rivers requests authority to recover through its ES the costs it actually incurs.

C. PROJECT 14 – WILSON LANDFILL PHASE 1 FINAL COVER

Q. Please describe Project 14.

A. Project 14 involves the construction of an engineered synthetic geo-membrane liner to serve as the final cover system for Phase 1 of the Wilson Station's permitted special waste landfill. As discussed in the testimony of Mr. Pullen, Big Rivers examined multiple options for compliance with respect to the Phase

1 landfill, and Project 14 as-proposed represents the reasonable, least-cost alternative.

Q. What is the estimated capital cost and annual O&M associated with this project?

A. The estimated capital cost for this project is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted]. The annual O&M expense resulting from this project is estimated at approximately [redacted].

Q. Will the costs of Project 14 materially impact Big Rivers' financial condition?

A. No. The total estimated capital cost of Project 14 represents a relatively minor capital outlay for Big Rivers and will not materially impact the cooperative's financial condition. Project 14 reflects a relatively insignificant portion of Big Rivers' net utility plant (approximately [redacted]) and will have a minor or negligible impact on the amount of the ES, as discussed in the Direct Testimony of Mr. John Wolfram.

Q. Please summarize the ES treatment that Big Rivers requests regarding Project 14.

A. Big Rivers requests the authority to add to its environmental rate base the capital costs of the project, including capitalized interest, as well as the authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and to recover that depreciation expense through the ES. Big Rivers also requests authority to recover the on-going O&M expense associated with the project through the ES.

D. **PROJECT 15 – GREEN LANDFILL PERIMETER DRAINAGE SYSTEM**

Q. Please describe Project 15.

A. Project 15 concerns the Green Station's CCR landfill and is designed to reduce lithium levels in groundwater and control other, non-groundwater releases. The project includes the construction of a perimeter drainage system to direct non-groundwater seepage and the removal of coal ash run-off from the sedimentation pond located to the south of the Green Landfill.

Q. What is the estimated capital cost associated with this project?

A. The estimated capital cost of Project 15 is [redacted] plus capitalized interest of [redacted] for a total cost of [redacted].

Q. Is HMP&L also required to share in the costs of this project?

A. Yes. HMP&L is obligated to share in those Green landfill costs that are attributable to the HMP&L Station Two waste in the landfill, based upon the percentage of waste in the landfill attributable to Henderson's share of waste generated by Station Two. As of December 31, 2018, Henderson owned 12% of the waste in the landfill, and is therefore expected to pay 12% of the costs of Project 15. As a result, the capital cost to Big Rivers for this project is anticipated to be approximately [redacted]. Again, however, should this Commission or another authority determine that the cost-share allocation is different than expected, Big Rivers requests authority to recover through its ES all costs for which it is deemed responsible.

Q. Please describe Project 15's expected impact to operations and maintenance costs for Big Rivers.

A. Annual O&M costs associated with this project are expected to be approximately [redacted], with Big Rivers' share totaling approximately [redacted] annually.

Q. Will the costs of Project 15 materially impact Big Rivers' financial condition?

A. No. The total estimated capital cost of Project 15 represents a relatively insignificant portion of Big Rivers' net utility plant ([redacted]) and will not materially impact Big Rivers' existing financial condition. Project 15, itself, will also have a minor or negligible impact on the amount of the ES, as discussed in the Direct Testimony of Mr. John Wolfram.

Q. Please summarize the ES treatment that Big Rivers requests regarding Project 15.

A. For Project 15, Big Rivers requests authority to add to its environmental rate base its allocated share of the total capital costs of the project, including capitalized interest; authority to depreciate that plant utilizing the approved Green Station depreciation rates and to recover that depreciation expense through the ES; and authority to recover the on-going O&M expense associated with the project through the ES.

E. PROJECT 16 – CCR ENVIRONMENTAL COMPLIANCE

Q. Please describe Project 16.

A. Project 16 includes a series of efforts undertaken by Big Rivers to ensure ongoing compliance with the CCR Rule at its coal-fired generating stations. These projects have been and are being pursued in the usual course of Big Rivers' business since 2015, and each is more fully detailed in Mr. Pullen's testimony. The costs that comprise Project 16 have been and continue to be deferred by Big Rivers as part of the CCR Regulatory Assets.

Q. When does Big Rivers anticipate it will complete the ongoing projects that comprise the CCR Regulatory Assets?

A. Big Rivers anticipates that the ongoing projects reflected in the CCR Regulatory Assets will be completed by July 31, 2020. In total, Big Rivers projects that the balance of the CCR Regulatory Assets will be approximately [redacted] at that time. This amount does not reflect costs for which Henderson is responsible, as detailed in the testimony of Mr. Pullen at Exhibit Pullen-5. As with Project 13-3 and Project 15, Big Rivers requests authority to recover through its ES all costs it actually incurs under Project 16, in the event Henderson does not fulfill its payment obligations.

Q. Please explain how Big Rivers proposes to recover the incremental CCR Regulatory Assets through its ES.

A. Big Rivers proposes to amortize the entire balance of the incremental CCR Regulatory Assets over a fixed, 10-year (120-month) period. This balanced approach is designed to minimize impact to ratepayers' bills while allowing the Company to gradually recover costs it has necessarily and prudently incurred for environmental compliance.

F. OTHER / GENERAL

Q. Please summarize the depreciation or amortization rates that will be used in the calculation of the depreciation or amortization expense for the capital projects in the 2020 Plan?

A. Big Rivers is proposing to depreciate or amortize the 2020 Plan capital projects as follows:

- Project 12 –Wilson FGD/WWT System: Depreciation of the capital investment utilizing the approved Wilson Station depreciation rates.
- Project 13-1 – Green Ash Pond/WBM Pond/WWT: With respect to ARO-related costs, non-levelized amortization based on actual ash pond closure spending, allocable over a rolling 10-year period; for non-ARO costs, depreciation of the capital investment utilizing the approved Green Station depreciation rates.
- Project 13-2 and 13-3 – Coleman and Station Two: Non-levelized amortization based on actual ash pond closure spending, allocable over a rolling 10-year period.
- Project 14 – Wilson Phase 1 Landfill Final Cover: Depreciation of the capital investment utilizing the approved Wilson Station depreciation rates.

- <u>Project 15 – Green Landfill Drainage System</u>: Depreciation of the capital investment utilizing the approved Green Station depreciation rates.
- <u>Project 16 – CCR Regulatory Assets</u>: Levelized amortization of the regulatory assets over a 10-year period.

Q. Please further explain the regulatory asset related to developing this Application that Big Rivers proposes to establish as part of this proceeding.

A. Big Rivers has incurred costs in developing this Application, and it will incur additional costs to prosecute this case. These costs primarily stem from the retention of experts in the legal, regulatory, and engineering professions. These costs, which total an estimated $1.1 million, are significant relative to the level of outside services costs built into Big Rivers' base rates. However, they are necessary and prudent, and Big Rivers should have the opportunity to recover them. Therefore, as it did in connection with its 2012 Plan, Big Rivers seeks to establish a regulatory account for its actual costs (and accruals for estimated amounts until actual costs can be determined) associated with this case, to amortize those costs over three years, and to recover those costs through the ES.

IV. REQUEST FOR RELIEF

Q. Please summarize the relief requested by Big Rivers in this proceeding.

A. Big Rivers seeks:

1. Approval of the 2020 Plan;
2. The issuance of a CPCN for certain of the 2020 Plan projects;
3. Authority to recover the costs of the 2020 Plan through the existing Environmental Surcharge tariff;
4. Authority to begin recovering through its ES the aforementioned Green ARO Regulatory Asset, Reid/Station Two ARO Regulatory Asset, and CCR Regulatory Assets established in Case No. 2015-00333, and the corresponding settlement of the Green and Reid/Station Two ash pond AROs;
5. Authority to establish a regulatory asset for the income statement impacts associated with forthcoming ARO-related liabilities related to the Coleman Station ash ponds;
6. With respect to Project 12, authority to add to its environmental rate base the capital costs of the project, the undepreciated net book value of the plant being moved from Coleman Station, and capitalized interest; authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and recover that depreciation expense through the

ES; and continued recovery of the on-going variable O&M expense associated with the FGD through the ES;

7. With respect to Project 13-1: authority to include in the ES as an expense the amortization of the Green ARO Regulatory Asset over a rolling 10-year period; authority to add to its environmental rate base the non-ARO costs that are reflected in Project 13-1, authority to depreciate that plant utilizing the approved Green Station depreciation rates and recover that depreciation expense through the ES; and recovery of ongoing O&M as an expense through the ES;
8. With respect to Project 13-2: authority, upon the revision of the CCR Rule to include legacy ash ponds and the recognition by Big Rivers of the Coleman Station ARO, to establish a regulatory asset for the income statement impacts associated with the ARO-related liabilities arising from the Coleman Stations ash ponds; authority to include in the ES as an expense the amortization of the Coleman ARO Regulatory Asset over a rolling 10-year period; and authority to recover the on-going O&M expense associated with the project through the ES;
9. With respect to Project 13-3: authority to include in the ES as an expense the amortization of the Reid/Station Two ARO Regulatory Asset over a rolling 10-year period, as well as authority to recover the on-going O&M expense associated with the project through the ES;

10. With respect to Project 14: authority to add to its environmental rate base the capital costs of the project and capitalized interest; authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and recover that depreciation expense through the ES; and authority to recover the on-going O&M expense associated with the project through the ES;
11. With respect to Project 15: authority to add to its environmental rate base the capital costs of the project and capitalized interest; authority to depreciate that plant utilizing the approved Green Station depreciation rates and recover that depreciation expense through the ES; and authority to recover the on-going O&M expense associated with the project through the ES;
12. With respect to Project 16: authority to include in the ES as an expense the amortization of the CCR Regulatory Assets over a fixed 10-year period; and
13. Authority to establish a regulatory asset for the expenses incurred in developing and pursuing the relief requested, and to include in the ES as an expense the amortization of the regulatory asset over a fixed three-year period.

Q. Does Big Rivers anticipate the costs associated with these projects to negatively impact its financial position?

A. No, as intended, KRS 278.183 ensures the current recovery of Commission-approved environmental compliance costs by Big Rivers. Accordingly, the significant capital and annual operating costs to comply with CSAPR, the CCR rule, ELG regulations and other authorities should not negatively impact Big Rivers' financial position.

Q. What is your recommendation to the Commission in this case?

A. For the reasons described in my testimony and elsewhere throughout this filing, I recommend that the Commission find the 2020 Plan to be reasonable and grant Big Rivers all of the requested relief.

Q. Does this conclude your testimony?

A. Yes.

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF CASE NO. 2019-00435

VERIFICATION

I, Paul G. Smith, verify, state, and affirm that I prepared or supervised the preparation of the Direct Testimony filed with this Verification, and that Direct Testimony is true and accurate to the best of my knowledge, information, and belief formed after a reasonable inquiry

Paul Smith

Paul G. Smith

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by Paul G. Smith on this the 6th day of February, 2020.

Kathern R. Gray

Notary Public, Kentucky State at Large

My Commission Expires October 31, 2020

Professional Summary

Paul G. Smith
Vice President and Chief Financial Officer
Big Rivers Electric Corporation
201 Third Street
Henderson, KY 42420
Phone: 270-844-6194

Professional Experience

Big Rivers Electric Corporation
Vice President and Chief Financial Officer – 2018 to present

NextEra Energy Transmission
Senior Director Business Management – 2012-2018

Duke Energy
Vice President Retail Marketing – 2010-2011
Vice President Rates – 2006-2009
General Manager Budgets & Forecasts – 2001-2005
Manager UK Distribution Price Control – 1998-2000
Manager Revenue Requirements – 1996-1997
Various Financial Positions of increasing responsibility – 1987-1995

Crowe, Chizek & Co (CPA) – 1984-1986

Touche, Ross & Co (CPA) – 1982 - 1983

Education

Master of Business Administration
University of Chicago

Bachelor of Science Industrial Management (Computer Science Minor)
Purdue University

Case No. 2019-00435

Exhibit Smith–2

Analysis of Alternatives for Wilson Unit 1

Big Rivers Electric Corporation
Analysis of FGD Alternatives for Wilson Unit 1
January 2020

I. Executive Summary

In order to comply with the rules promulgated by the EPA under the Clean Air Act, coal-fired generation facilities generally require an FGD and absorber system that meets or exceeds specified emissions standards. The existing FGD at the Wilson Station has exceeded its expected useful life, represents relatively dated and ineffective technology, and requires significant ongoing investment to operate and maintain. Big Rivers undertook the instant analysis to consider options for addressing this issue on a least-cost basis.

Big Rivers evaluated the following alternatives for continuing to meet the environmental requirements:

A) Replacing the existing FGD system at the Wilson Station utilizing FGD facilities presently in place at Big Rivers' Kenneth C. Coleman Station ("Coleman Station");
B) Retaining the existing Wilson FGD system;
C) Replacing the Wilson FGD system with a 100% new FGD system;

The Plexos model was utilized for the base case inputs where all three Wilson options were economically committed and dispatched, and determined the data to be used in the least-cost option analysis.

The Net Present Value ("NPV") analysis considers the cost and revenue data from the model for each case on an annual basis. The net cost is the difference between the sum of all costs and the sum of all revenues for each year for each case.

The least cost option remains the same for the three time periods, 2023-2035, 2023-2043 and 2023 to perpetuity. Moving the Coleman scrubber to Wilson Station represents the least cost option.

Based on the analyses described herein, Big Rivers will be able to meet the applicable environmental requirements at the Wilson Station by the replacement and upgrade of the existing FGD system with the FGD system presently in place at Coleman Station. This option provides the lowest net present value of net costs, both in the base case and in almost all of the sensitivity study scenarios evaluated.

Big Rivers Electric Corporation
Analysis of FGD Alternatives for Wilson Unit 1
January 2020

II. Introduction

In order to comply with the rules promulgated by the U.S. Environmental Protection Agency ("EPA") under the Clean Air Act ("CAA"), including but not limited to the Mercury and Air Toxics Standards ("MATS"), coal-fired generation facilities generally require a Flue Gas Desulphurization ("FGD") and absorber system that meets or exceeds specified emissions standards. The existing FGD system at the D.B. Wilson Station ("Wilson Station") has exceeded its expected useful life, represents relatively dated and ineffective technology, and requires significant ongoing investment to operate and maintain. Big Rivers undertook the instant analysis to consider options for addressing this issue on a least-cost basis.

III. Alternatives

Big Rivers evaluated the following alternatives for continuing to meet the environmental requirements:

A) Replacing the existing FGD system at Wilson Station utilizing FGD facilities presently in place at Big Rivers' Kenneth C. Coleman Station ("Coleman Station");
B) Retaining the existing Wilson FGD system;
C) Replacing the Wilson FGD system with a new FGD system;

Key capital cost assumptions for each alternative include the following (all in 2023 dollars)

A) Wilson Coleman Scrubber: [redacted]
B) Wilson Existing Scrubber: No build cost but plant fixed costs are higher to maintain existing scrubber
C) Wilson New Scrubber: [redacted]

Other cost and operating assumptions are detailed in the Appendix.

IV. Analysis

Big Rivers analyzed the operation of the three alternatives using its current production models. Big Rivers uses Energy Exemplar's production cost modeling software Plexos to thoroughly model planning alternatives on a comparative basis.

For this study, the Plexos model was utilized for the base case inputs where all three Wilson options were economically committed and dispatched. The Plexos model was also utilized to determine the data to be used in the least-cost option analysis.

The Wilson model analyzes the three options and determines the least-cost option. Additional details on the general functionality of the Plexos models were provided in Chapter 7 of the 2017 Integrated Resource Plan. The models consider both capital costs and operations and maintenance ("O&M") costs. The capital costs include build cost for environmental compliance. The capital costs were included with the fixed O&M costs. The models summarize capital costs, environmental costs, production costs, and revenues (both pool revenue and capacity revenue) at the given inputs provided into the models. This allows the determination of costs, revenues, and net revenues on an annual basis.

The model results include annual information for the period from 2023 to 2035 with the 2035 data being normalized for planned outage schedule/costs. This permits the analysis of a twenty (20) year study period which also reflects the date for the end of the all service requirement with the Member-Owners. The data may also be used for an "in perpetuity" study period.

Key inputs to the models include the following:

1) Energy Locational Marginal Price ("LMP") prices – from ACES (9-9-19 Prices);
2) Energy Capacity prices – from Big Rivers/ACES;
3) Fuel Oil prices – from ACES (September 2019 prices);
4) Coal prices – 2020-2023 from Big Rivers forecasted delivery then 2024 and beyond are escalated by JD Energy long term coal forecast (September 2019);
5) Non-fuel Variable O&M Cost – from Big Rivers, with escalation;
6) Emission prices – from ACES July prices, escalated at 2% annually;
7) Unit performance – from Big Rivers historical data;
8) Full department expenses (including capital and ECP cost) – from Big Rivers internal data and other information specified in ECP Application.

The Net Present Value ("NPV") analysis considers the cost and revenue data from the model for each case on an annual basis. The net cost is the difference between the sum of all costs and the sum of all revenues. The NPV is calculated at a discount rate of 5.00%.

Sensitivity analyses were performed around key pricing variables, including power prices and coal prices. In the sensitivities, single variable analysis is performed to isolate the impact of future uncertainty of each pricing element. Sensitivity studies were also performed for unit forced outage rates and for project capital build cost variations. The total set of sensitivity scenarios includes the following (all relative to Base Case values):

- Coal Prices: +50%, +40%, +30%, +20%, +10%, -10%, -20%, -30%, -40%, -50%
- LMP Prices: +50%, +40%, +30%, +20%, +10%, -10%, -20%, -30%, -40%, -50%
- Forced Outage Rates: +5%, -5%
- Project Capital Build Costs: +10%, -10%

V. Results

The NPV of net costs for all three options were calculated over three time periods:

1) 2023 to 2035 (to reflect all of the years explicitly modeled)
2) 2023 to 2043 (to reflect a 20-year study period and also reflect the end of the all service requirement date with Member-Owners)
3) 2023 In Perpetuity (to reflect the operation of facilities beyond a 20-year life)

The analysis clearly shows moving the Coleman scrubber to Wilson being the least-cost option. See Table 1 and Table 2 which follow.

Table 1. Case NPVs

Case	Description	2023 to 2035	2023 to 2043	2023 In Perpetuity
A	Wilson Coleman Scrubber	[redacted]		
B	Wilson Existing			
C	Wilson New Scrubber			
	Least Cost Value	[redacted]		
	Least Cost Case	A	A	A

Table 2. Case Rankings

Case	Description	2023 to 2035	2023 to 2043	2023 In Perpetuity	AVG
A	Wilson Coleman Scrubber	1	1	1	1.00
B	Wilson Existing	3	3	3	3.00
C	Wilson New Scrubber	2	2	2	2.00
	Least Cost Value	1	1	1	1.00
	Least Cost Case	A	A	A	A

Other supporting data is provided in the Appendix.

For the sensitivity studies, the results show that relocating the Coleman scrubber to Wilson is the least-cost option for all scenarios in the 'in perpetuity' cases and for almost all scenarios in the 2023-2035 cases. These cases are summarized as follows.

1) Lower coal prices favor moving the Coleman scrubber to Wilson; higher coal prices favor retaining and operating the existing scrubber at Wilson.
2) Higher LMP prices favor moving the Coleman scrubber to Wilson; lower LMP prices favor retaining and operating the existing scrubber at Wilson.
3) Higher forced outage rates and lower forced outage rates both favor moving the Coleman scrubber to Wilson.
4) Higher capital build costs and lower capital build cost favor relocating the Coleman scrubber to Wilson.

See Appendix for details.

VI. Conclusion

Based on the analyses described herein, Big Rivers will be able to meet the applicable environmental requirements, and to reduce the total net cost at the Wilson Station by the replacement and upgrade of the existing FGD system with the FGD system presently in place at Coleman Station. This option provides the lowest net present value of net costs for the base case and in almost all of the sensitivity scenarios evaluated herein.

VII. Appendix

Supporting data attached.

Big Rivers Electric Corporation
Summary of Wilson FGD Analysis

Line Number	Case	Description	2023 to 2035	2023 to 2043	2023 In Perpetuity
1					
2	A	Wilson Coleman Scrubber	[redacted]		
3	B	Wilson Existing			
4	C	Wilson New Scrubber			
5					
6		Least Cost Value	[redacted]		
7		Least Cost Case	A	A	A
8					
9					

10	Case	Description	2023 to 2035	2023 to 2043	2023 In Perpetuity	AVG
11						
12	A	Wilson Coleman Scrubber	1	1	1	1.00
13	B	Wilson Existing	3	3	3	3.00
14	C	Wilson New Scrubber	2	2	2	2.00
15						
16		Least Cost Value	1	1	1	1.00
17		Least Cost Case	A	A	A	A

Big Rivers Electric Corporation
Wilson FGD Analysis

Line Number	Unit	Property	2023	2024	2025	2026	2027	2028	2029
1	Wilson Coleman Scrubber	Generation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2	Wilson Coleman Scrubber	Capacity Factor	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	Wilson Coleman Scrubber	Build Cost (2023$)	[redacted]						
4	**Wilson Coleman Scrubber**	**Net Profit (Loss)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	**Wilson Coleman Scrubber (to 2035)**	**Net Present Value (2023$)**	[redacted]						
6	**Wilson Coleman Scrubber (to 2043)**	**Net Present Value (2023$)**	[redacted]						
7	**Wilson Coleman Scrubber (Perpetuity)**	**Net Present Value (2023$)**	[redacted]						
8									
9	Wilson Existing	Generation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
10	Wilson Existing	Capacity Factor	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
11	Wilson Existing	Build Cost (2023$)	[redacted]						
12	**Wilson Existing**	**Net Profit (Loss)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
13	**Wilson Existing (to 2035)**	**Net Present Value (2023$)**	[redacted]						
14	**Wilson Existing (to 2043)**	**Net Present Value (2023$)**	[redacted]						
15	**Wilson Existing (Perpetuity)**	**Net Present Value (2023$)**	[redacted]						
16									
17	Wilson New Scrubber	Generation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
18	Wilson New Scrubber	Capacity Factor	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
19	Wilson New Scrubber	Build Cost (2023$)	[redacted]						
20	**Wilson New Scrubber**	**Net Profit (Loss)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
21	**Wilson New Scrubber (to 2035)**	**Net Present Value (2023$)**	[redacted]						
22	**Wilson New Scrubber (to 2043)**	**Net Present Value (2023$)**	[redacted]						
23	**Wilson New Scrubber (Perpetuity)**	**Net Present Value (2023$)**	[redacted]						

Big Rivers Electric Corporation
Wilson FGD Analysis

Line Number	Unit	Property	2030	2031	2032	2033	2034	2035
1	Wilson Coleman Scrubber	Generation	[redacted]					
2	Wilson Coleman Scrubber	Capacity Factor	[redacted]					
3	Wilson Coleman Scrubber	Build Cost (2023$)						
4	**Wilson Coleman Scrubber**	**Net Profit (Loss)**	[redacted]					
5	**Wilson Coleman Scrubber (to 2035)**	**Net Present Value (2023$)**						
6	**Wilson Coleman Scrubber (to 2043)**	**Net Present Value (2023$)**						
7	**Wilson Coleman Scrubber (Perpetuity)**	**Net Present Value (2023$)**						
8								
9	Wilson Existing	Generation	[redacted]					
10	Wilson Existing	Capacity Factor	[redacted]					
11	Wilson Existing	Build Cost (2023$)						
12	**Wilson Existing**	**Net Profit (Loss)**	[redacted]					
13	**Wilson Existing (to 2035)**	**Net Present Value (2023$)**						
14	**Wilson Existing (to 2043)**	**Net Present Value (2023$)**						
15	**Wilson Existing (Perpetuity)**	**Net Present Value (2023$)**						
16								
17	Wilson New Scrubber	Generation	[redacted]					
18	Wilson New Scrubber	Capacity Factor	[redacted]					
19	Wilson New Scrubber	Build Cost (2023$)						
20	**Wilson New Scrubber**	**Net Profit (Loss)**	[redacted]					
21	**Wilson New Scrubber (to 2035)**	**Net Present Value (2023$)**						
22	**Wilson New Scrubber (to 2043)**	**Net Present Value (2023$)**						
23	**Wilson New Scrubber (Perpetuity)**	**Net Present Value (2023$)**						

Big Rivers Electric Corporation
Wilson FGD Analysis

Line Number	Wilson Fixed O&M Costs - Coal-Fired, Existing Scrubber ($M)													
1		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
2	Non-Labor Routine	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	Non-Labor Outage	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	Labor Plant Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	Labor Support Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
6	Plant Capital Costs	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
7	**ECP Capital Costs (No Pond Closure)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	**Total Fixed O&M Cost (Includes Plant Capital and ECP Capital)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	**Total Fixed O&M Costs, $/kW-yr**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
10	**Wilson Fixed O&M Costs - Coal-Fired, Coleman Scrubber ($M)**													
11		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
12	Non-Labor Routine	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
13	Non-Labor Outage	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
14	Labor Plant Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
15	Labor Support Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
16	Plant Capital Costs	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
17	**Total Fixed O&M Cost (Includes Plant Capital and No ECP Capital)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
18	**Total Fixed O&M Costs, $/kW-yr**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
19	ECP Capital Costs (Build Cost), 2023$	[redacted]												
20	**Build Cost, $/kW (2023$)**	[redacted]												
21	**Wilson Fixed O&M Costs - Coal-Fired, New Scrubber ($M)**													
22		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
23	Non-Labor Routine	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
24	Non-Labor Outage	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
25	Labor Plant Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
26	Labor Support Staff	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
27	Plant Capital Costs	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
28	**Total Fixed O&M Cost (Includes Plant Capital and No ECP Capital)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
29	**Total Fixed O&M Costs, $/kW-yr**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
30	ECP Capital Costs (Build Cost), 2023$	[redacted]												
31	**Build Cost, $/kW (2023$)**	[redacted]												

Big Rivers Electric Corporation
Wilson FGD Analysis

Wilson Non-Fuel Variable
Operations and Maintenance Cost ($ / MWh)

Line Number	Year	Existing Scrubber	Coleman Scrubber	New Scrubber
1	2023	[redacted]		
2	2024			
3	2025			
4	2026			
5	2027			
6	2028			
7	2029			
8	2030			
9	2031			
10	2032			
11	2033			
12	2034			
13	2035			

Big Rivers Electric Corporation
Wilson FGD Analysis

Line Number	Wilson Sensitivities			Wilson Sensitivities (No Perpetuity; 2023-2035)		
1	**Sensitivity**	**Least Cost Option**	**Best Bound or PVRR**	**Sensitivity**	**Least Cost Option**	**Best Bound or PVRR**
2	**Base**	**Coleman Scrubber**	[redacted]	**Base**	**Coleman Scrubber**	[redacted]
3	**Base - 2nd**	**New Scrubber**		**Base - 2nd**	**New Scrubber**	
4	**Base - 3rd**	**Existing Scrubber**		**Base - 3rd**	**Existing Scrubber**	
5	**Coal Sensitivities**			**Coal Sensitivities**		
6	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**
7	50% Higher	Coleman Scrubber	[redacted]	50% Higher	Existing Scrubber	[redacted]
8	40% Higher	Coleman Scrubber		40% Higher	Existing Scrubber	
9	30% Higher	Coleman Scrubber		30% Higher	Existing Scrubber	
10	20% Higher	Coleman Scrubber		20% Higher	Coleman Scrubber	
11	10% Higher	Coleman Scrubber		10% Higher	Coleman Scrubber	
12	10% Lower	Coleman Scrubber		10% Lower	Coleman Scrubber	
13	20% Lower	Coleman Scrubber		20% Lower	Coleman Scrubber	
14	30% Lower	Coleman Scrubber		30% Lower	Coleman Scrubber	
15	40% Lower	Coleman Scrubber		40% Lower	Coleman Scrubber	
16	50% Lower	Coleman Scrubber		50% Lower	Coleman Scrubber	
17	**LMP Sensitivities**			**LMP Sensitivities**		
18	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**
19	50% Higher	Coleman Scrubber	[redacted]	50% Higher	Coleman Scrubber	[redacted]
20	40% Higher	Coleman Scrubber		40% Higher	Coleman Scrubber	
21	30% Higher	Coleman Scrubber		30% Higher	Coleman Scrubber	
22	20% Higher	Coleman Scrubber		20% Higher	Coleman Scrubber	
23	10% Higher	Coleman Scrubber		10% Higher	Coleman Scrubber	
24	10% Lower	Coleman Scrubber		10% Lower	Coleman Scrubber	
25	20% Lower	Coleman Scrubber		20% Lower	Existing Scrubber	
26	30% Lower	Coleman Scrubber		30% Lower	Existing Scrubber	
27	40% Lower	Coleman Scrubber		40% Lower	Existing Scrubber	
28	50% Lower	Coleman Scrubber		50% Lower	Existing Scrubber	
29	**Forced Outage Rate Sensitivities**			**Forced Outage Rate Sensitivities**		
30	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**
31	+5% Higher EUOR	Coleman Scrubber	[redacted]	+5% Higher EUOR	Coleman Scrubber	[redacted]
32	-5% Lower EUOR	Coleman Scrubber		-5% Lower EUOR	Coleman Scrubber	
33	**Build Cost Sensitivities**			**Build Cost Sensitivities**		
34	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**	**Sensitivity**	**Least Cost Option**	**Best Bound or NPV**
35	+10% Higher Build Cost	Coleman Scrubber	[redacted]	+10% Higher Build Cost	Coleman Scrubber	[redacted]
36	-10% Lower Build Cost	Coleman Scrubber		-10% Lower Build Cost	Coleman Scrubber	

ORIGINAL

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)))))))))	**Case No. 2019-00435**

DIRECT TESTIMONY

OF

MICHAEL T. HOYDICK
DIRECTOR
AMEC FOSTER WHEELER INDUSTRIAL POWER COMPANY, INC.

ON BEHALF OF

BIG RIVERS ELECTRIC CORPORATION

FILED: **February 7, 2020**

Application Exhibit G

DIRECT TESTIMONY
OF
MICHAEL T. HOYDICK

I. INTRODUCTION

Q. Please state your name, business address and occupation.

A. Michael T. Hoydick, Director of Technology & Sales for Amec Foster Wheeler Industrial Power Company, Inc. ("AFWIPC"). AFWIPC is headquartered at the Frick Building in Pittsburgh (437 Grant Street, Suite 908, Pittsburgh, Pennsylvania, 15219).

Q. Please summarize your education and professional experience.

A. I earned my Bachelor of Science degree from the University of Pittsburgh in 1990 and joined the AFWIPC organization shortly thereafter. I have extensive experience with flue gas desulfurization ("FGD," or "scrubber") systems, including with FGD design, commissioning, cost, and operation. Before assuming my current role as Director of Technology and Sales, I served as Senior Technology Manager for AFWIPC's Wet/Dry FGD product lines, with responsibilities including new project development, technical publications, overall system process design, equipment sizing, sub-system equipment evaluation, operation and maintenance manuals, and performance guarantees.

I regularly work with utilities and other generators to achieve cost-effective, compliant solutions using FGD technologies.

Q. Please generally describe AFWIPC.

A. Amec Foster Wheeler Industrial Power Company is an original equipment manufacturer ("OEM") for thermal and environmental products. AFWIPC was formed in 2017 after the Purchase of Amec by the former John Wood Group. AFWIPC's thermal product technology is legacy Foster Wheeler with the environmental technology from legacy Wheelabrator Air Pollution Control.

Q. Has AFWIPC previously worked with Kentucky utilities in matters related to their generation assets?

A. Yes, including with Big Rivers Electric Corporation ("Big Rivers"). Our legacy companies (Wheelabrator Air Pollution Control / Siemens Environmental Equipment) supplied wet scrubbers for Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("HMP&L Station Two") in 1995, as well as the wet scrubber for Big Rivers' Kenneth C. Coleman Station ("Coleman Station") in 2006. In addition to these projects, our company was the original equipment supplier for Owensboro Municipal Utilities' Elmer Smith Station wet scrubbers (1995) and also for Louisville Gas & Electric Company's Trimble County Unit 2 FGD (2010).

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to describe AFWIPC's role in the development and pursuit by Big Rivers of a "new" Wet FGD system at its D.B. Wilson Station ("Wilson Station"). The proposed project, which is further detailed in the *D.B. Wilson Station Flue Gas Desulfurization System with Dewatering and Water Treatment Cost Study* ("Cost Study") appended to my testimony, involves the retrofit and upgrade of the Wilson Station's existing FGD and associated dewatering and wastewater treatment facilities utilizing selective equipment from Big Rivers' Coleman Station and new equipment.

Q. Are you sponsoring any exhibits?

A. Yes, as set forth below. These documents were prepared by me or by individuals working directly under my supervision.

- Exhibit Hoydick–1: Career Summary;
- Exhibit Hoydick–2: D.B. Wilson Station Flue Gas Desulfurization System with Dewatering and Water Treatment Cost Study (January 2020); and
- Exhibit Hoydick–3 : Coleman Station Equipment Reuse List.

II. BACKGROUND

Q. Please describe the Wilson Station's existing FGD system.

A. The Wilson Station's existing FGD system was supplied by Pullman Kellogg and first commercialized in 1986. The system is comprised of four (4) horizontal flow wet scrubbers that treat flue gas from the Wilson Station's boiler with an alkaline reagent (crushed limestone) to "scrub" acid gasses from the gas stream prior to release to the atmosphere. The current FGD system is limestone based and unoxidized and produces a calcium sulfite waste product.

Q. Does the Wilson Station's existing FGD system reflect current technology for emissions control?

A. No—in fact, I am unaware of any horizontal FGD systems (like at the Wilson Station) installed in utility applications after 1990 in the United States due to the performance and maintenance issues encountered with this style of FGD. The scrubbers at the Wilson Station are of the first generation of Wet FGDs installed on utility boilers for sulfur dioxide (SO_2) emission control. The flue gas passes through the FGD modules in a horizontal flow configuration with limestone reagent added from spray nozzles at the top of the vessel(s). While this horizontal flow configuration achieved the desired level of emission performance for the era, this configuration is considered obsolete due, in part, to performance limitations (92% capture maximum).

Q. Do horizontal FGD systems typically experience operational problems, in addition to performance limitations?

A. Yes. Horizontal FGD systems are susceptible to a number of issues, most notably including gypsum scaling and gas flow maldistribution, which results in pluggage issues for the mist eliminators. This can result in high pressure losses throughout the system, excessive maintenance, and subsequent outage requirements.

Q. Please describe the Coleman Station's existing FGD system.

A. The Coleman Station's existing FGD system was supplied by Wheelabrator Air Pollution Control / Siemens Environmental Equipment and first commercialized in 2006. The system is comprised of a single, vertical flow wet scrubber, with two Dual Flow Trays in series that treats flue gas from the Coleman Station's three boilers with an alkaline reagent (crushed limestone) to "scrub" acid gasses from the gas stream prior to release to the atmosphere. The Coleman FGD system process is limestone based and forced oxidation, which produces a calcium sulfate waste product known as gypsum. After careful review of the design conditions, it was determined that the Coleman absorber size and design could adequately satisfy the flue gas conditions for the Wilson Unit 1 boiler.

Q. How does the Coleman Station's FGD compare to the existing Wilson FGD?

A. The main difference between the two FGD systems is that the existing system at the Wilson Station utilizes horizontal flue gas flow while the Coleman FGD is a modern upflow design. Historical data provided by Big Rivers reflects the fact that the Coleman FGD achieved significantly better emission performance (97+% SO2 removal, 99+% HCl removal, 99+% HF removal, and 70% dust capture) compared to the existing Wilson scrubber modules. The Coleman design from 2006 remains the FGD that AFWIPC is offering today for utility applications. It should also be noted that the Pullman Kellogg horizontal style FGD technology was acquired by AFWIPC and we have not offered this style of FGD since I began my working career in 1991.

Q. Does the condition of the existing FGD warrant and necessitate its retrofit or replacement?

A. As a general rule, FGD systems for utility applications are designed for a 30-year lifetime; the FGD at the Wilson Station has been operating for approximately thirty-seven (37) years. The condition and capabilities of the existing FGD, as described herein and in the testimony of Big Rivers' Vice

President of Production, Mr. Michael T. Pullen, underscore that the FGD is at the end of its design life and appropriate for replacement.

III. <u>THE WILSON FGD/WWT PROJECT</u>

Q. Please summarize the Wilson Station FGD project.

A. Fundamentally, this project consists of disassembling the absorber at the Coleman Station, moving it to the Wilson Station, and rebuilding it utilizing a combination of existing parts and infrastructure and new equipment. In addition to moving the absorber, other equipment from the retired Coleman Station WFGD will be utilized for the Wilson project to minimize the cost of the Wilson Station WFGD. In simplistic form, if the cost to relocate the equipment to Wilson was less than new purchased equipment, the equipment will be reused at Wilson. Exhibit Hoydick–3 summarizes the equipment from Coleman that will be reused for the Wilson project.

As reflected in the attached exhibits, the examination conducted by AFWIPC assumed the repurposed FGD at Wilson will use the existing dewatering equipment from the Coleman site and will produce a commercial quality gypsum. This type of equipment gives Big Rivers the ability to market gypsum while significantly reducing the volume of waste that must be landfilled.

One additional fundamental difference between the two projects is the addition of a new Wastewater Treatment System for Wilson that was not required for Coleman. There are new federal guidelines for water discharges from Utility Power Plants that were not in effect during the installation of the Coleman project in 2005. ELG rules, or Effluent Limitation Guidelines rules limit the discharge water concentrations of various regulated pollutants from power plant. In anticipation of meeting these water discharge requirements, a new wastewater treatment plant has been included for the Wilson Project that was not necessary for Coleman.

Q. Will the project utilize existing systems and infrastructure at the Wilson Station to the extent feasible?

A. Yes. As described in the Cost Study, existing equipment at the Wilson Station was evaluated for possible reuse in order to minimize project costs. It was determined that the existing booster fans and limestone grinding systems, among many other components, can be reused at the Wilson Station with minimal modification.

Q. What significant components from the Coleman Station will be reused at the Wilson Station?

A. A primary goal of the Cost Study was to optimize the overall cost for the project by effectively reusing major pieces of equipment from the Coleman Station, consistent with the direction of Big Rivers. For purposes of the Cost Study, this equipment included: the absorber module including most absorber internals, absorber recycle pumps/motors, absorber 48" fiberglass-reinforced-plastic recycle suction and discharge pipes, oxidation air blowers/motors, gypsum dewatering equipment systems, relevant electrical switchgear, motor control centers and distributed controls system cabinets. Smaller items, such as piping 10 inches in diameter or less, limited instrumentation, instrument tubing, valves, electrical/controls tray/wiring, lighting, and certain communications systems, were not considered reasonably cost-effective to reuse and therefore were included as a part of new equipment purchases. Exhibit Hoydick–3 hereto provides detailed information about all the equipment that AFWIPC and Big Rivers anticipate can be reused.

Q. What cost savings can Big Rivers expect to realize as a result of repurposing certain Coleman Station equipment?

A. As discussed in the Cost Study, it is estimated that Big Rivers will save approximately [redacted] by utilizing existing equipment as part of the Wilson FGD retrofit and upgrade project as compared to installing a new FGD and associated equipment.

Q. How will the components repurposed from the Coleman Station be transported to the Wilson Station?

A. The components will be transported by truck from Coleman to Wilson. As detailed in the Cost Study, AFWIPC reviewed the potential to utilize river barges in lieu of conventional truck transportation, but the potential benefits of transport by barge appeared to be outweighed by practical concerns and the significant site and route preparation that would be required. Although an exhaustive examination, including engineering, geotechnical, and detailed logistical studies was not undertaken, AFWIPC's practical assessment concluded that conventional trucking will provide the most economical overall dismantled and reinstalled cost to Big Rivers for the FGD upgrade project.

Q. Please describe the project schedule.

A. The full project, including obtaining necessary approvals, detailed engineering and design, procurement of materials and services, and construction is expected to be completed in roughly twenty four (24) months. Dismantling of the absorber at the Coleman Station is expected to take approximately fourteen (14) weeks, with erection of the absorber at the Wilson Station encompassing approximately twenty-two (22) weeks. The absorber is planned to be reconstructed in reverse order of how it was deconstructed, which allows for piling and foundation work at the Wilson Station to be undertaken simultaneously with deconstruction of the Coleman FGD.

Q. Are you confident that the resulting FGD, comprised of Coleman, Wilson and new components, will perform as Big Rivers requires?

A. Yes. The design conditions for the existing Wilson Station are very similar to the design conditions at the Coleman Station such that an identical FGD can be offered and similar performance can be expected. The Coleman Station's FGD is a proven commodity, with nearly ten (10) years of emissions and operating data verifying performance. Maintenance records from the Coleman Station also reflect that its FGD enjoyed high reliability and could operate two (2) years between major FGD maintenance outages. As further detailed in the Cost Study, AFWIPC is confident that Big Rivers will be satisfied with the results of this project.

Q. Do you believe the estimated cost of the project reflected in the Cost Study is a fair and reasonable estimate?

A. Based on the scope of the study and the information provided by Big Rivers during execution of the Cost Study, AFWIPC is confident that its estimate is a proper indicative cost in 2020 dollars for the Wilson project as outlined in Exhibit Hoydick–2 .

Q. Did AFWIPC also provide an estimate of the impact the project will have on the operations and maintenance costs incurred by Big Rivers at its Wilson Station?

A. No, the project impact on the operations and maintenance costs were to be determined by Big Rivers and are detailed in the testimony of Mr. Pullen.

IV. CONCLUSION

Q. Please summarize your testimony.

A. The existing MW Kellogg FGD at Wilson is an obsolete horizontal flow design that is not offered for utility service in today's marketplace due to poor performance, low reliability, and high maintenance costs. Modern FGD technology, as was supplied for the Coleman Station, remains AFWIPC's current technology for utility applications.

The design conditions for the Wilson Station FGD allow Big Rivers to relocate and repurpose the Coleman Station's existing absorber module to achieve ongoing compliance. This approach allows Big Rivers to reuse significant equipment from the Coleman Site which reduces the costs associated with a new FGD at Wilson. Schedule and engineering cost savings are also realized with this project approach. This is the basis for the Cost Study attached to this testimony.

Q. Do you adopt and authenticate the Cost Study attached to your testimony?

A. Yes.

Q. Does this conclude your testimony?

A. Yes.

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

VERIFICATION

I, Michael T. ("Mike") Hoydick, verify, state, and affirm that I prepared or supervised the preparation of the Direct Testimony filed with this Verification, and that Direct Testimony is true and accurate to the best of my knowledge, information, and belief formed after a reasonable inquiry

Michael T Hoydick
____
Michael T. ("Mike") Hoydick

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by Michael T. ("Mike") Hoydick on this the 4th day of February, 2020.

____
Notary Public, Kentucky State at Large

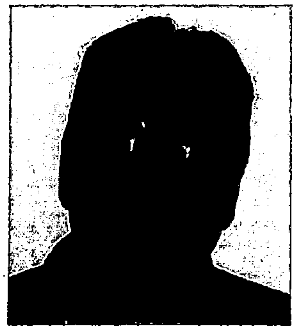
My Commission Expires October 31, 2020

Case No. 2019-00435

Exhibit Hoydick-1

Career Summary

wood.



Career Summary

Michael T. Hoydick

Director, Technology & Sales
Amec Foster Wheeler Industrial Power Company, Inc.

Michael joined the organization in 1991 as an Application Engineer supporting our Wet and Dry FGD product lines. He has over 28 years of experience in design, marketing, commissioning, and operation of Wet/Dry FGD systems. His current position is Director of Sales and Technology with main focus of generating new business opportunities. He also remains lead technical designer for our Wet and Dry scrubber product lines. His previous position was senior technology manager for our Wet / Dry FGD product lines. His responsibilities included sales, marketing, new project development, technical publications, technical presentations, overall system process design, equipment sizing, material balances, process flow diagrams, piping and instrumentation diagrams/logics, sub-system equipment evaluation, operation and maintenance manuals, and performance guarantees. His experience also includes significant field work at many of the WFGD Projects listed below. Field responsibilities include commissioning and final checkout of all FGD sub-systems, initial startup and operation, operator training, and troubleshooting.

Education: University of Pittsburgh, BS Chemical Engineering (1990)

Project Experience:

- ***Freeport-McMoRan, Inc. – Miami Smelter Aisle Scrubber***
  Sodium Based WFGD, Process Design Lead FGD
- ***Longview Power 1 x 700 MW – Wet FGD Upgrade Project***
  Limestone Based WFGD performance upgrade, Process Design Lead FGD, Start-up Team

- ***Fortum, Silesia - 1 x 80 MW CFB***
  CFB Scrubber, Process Design Lead, Design Phase

- ***Prairie State Energy Campus – 2 x 800 MW Wet FGD System***
  Limestone Based WFGD, Process Design Lead FGD, Start-up Team

- ***City, Water, Light, and Power, Dallman Unit 33 – Wet FGD Upgrade Project***
  Dual Loop Limestone Based WFGD performance upgrade, Process Design Lead FGD, Start-up Team

- ***Public Service of New Hampshire, Merrimack Station – 1 x 457 MW Wet FGD System***
  Limestone Based WFGD for Mercury and SO2 Control, Process Design Lead FGD, Start-up Team

- ***We Energies, Pleasant Prairie & South Oak Creek Stations – 4 x 600 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***Dominion, Chesterfield Station – 2 x 620 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***Louisville Gas & Electric, Trimble County Unit 2 – 1 x 750 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***City, Water, Light and Power, Dallman Unit 4 – 1 x 200 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***NRG Energy, Cheswick Station – 2 x 600 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***Longview Power – 1 x 700 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***Raven Power, Brandon Shores Station – 2 x 620 MW***
  Limestone Based WFGD, Process Design Lead, Start-up Team

- ***MHI, OMON Thermal Power Station, Vietnam – 1 x 300 MW***
  Limestone Based WFGD, Process Design Lead

- ***Proposal Engineer / Process Engineer / Startup Team***
  PPL Montour Station – 2 x 775 MW
  PPL Brunner Island – 2 x 775 MW
  NRG Keystone Station – 2 x 850 MW
  WKE Coleman Station – 1 x 485 MW
  Tri States Generation, Craig Station - 2 x 500 MW Upgrade
  Allegheny Energy, Pleasants Station - 2 x 500 MW Upgrade
  First Energy, Bruce Mansfield Station – Wet FGD Upgrade
  Tampa Electric, Big Bend Station, U1 and U2 – 1 x 890 MW
  Tampa Electric, Big Bend Station, U3 and U4 – WFGD Upgrade
  AES, Lal Pir Unit 2, Pakistan – 1 x 300MW
  Henderson Municipal Power & Light, U1 and U2 – 2 x 172 MW
  Owensboro Municipal Utilities – 2 x 267 MW

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

CONFIDENTIAL DOCUMENT

Exhibit Hoydick-2
Direct Testimony of Michael T. Hoydick
FILED: February 7, 2020

<u>INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT</u>

Case No. 2019-00435

Exhibit Hoydick–3

Coleman Station Equipment Reuse List

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC	)	
CORPORATION FOR APPROVAL OF ITS 2020	)	
ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY	)	
TO RECOVER COSTS THROUGH A REVISED	)	
ENVIRONMENTAL SURCHARGE AND TARIFF,	)	Case No. 2019-00435
THE ISSUANCE OF A CERTIFICATE OF PUBLIC	)	
CONVENIENCE AND NECESSITY FOR CERTAIN	)	
PROJECTS, AND APPROPRIATE ACCOUNTING	)	
AND OTHER RELIEF	)	

CONFIDENTIAL DOCUMENT

Exhibit Hoydick-3
Direct Testimony of Michael T. Hoydick
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT

ORIGINAL

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

DIRECT TESTIMONY

OF

SAMUEL E. YODER
PROJECT MANAGER
BURNS & McDONNELL ENGINEERING COMPANY, INC.

ON BEHALF OF

BIG RIVERS ELECTRIC CORPORATION

FILED: February 7, 2020

Application Exhibit H

DIRECT TESTIMONY

OF

SAMUEL E. YODER

I. INTRODUCTION

Q. Please state your name, business address and occupation.

A. My name is Samuel E. Yoder and my business address is 9400 Ward Parkway, Kansas City, MO 64114. I am a Project Manager for Burns & McDonnell Engineering Company, Inc. ("Burns & McDonnell").

Q. Please summarize your education and professional experience.

A. I have a B.S. in Chemical Engineering and B.S. in Mathematics from the University of Missouri, Columbia, 2007. I have worked for Burns & McDonnell for 12 years and I am a Professional Engineer in the Commonwealth of Kentucky.

Q. Please generally describe Burns & McDonnell.

A. Burns & McDonnell is a full-service engineering, architecture, construction, environmental and consulting solutions firm, based in Kansas City, Missouri. Our staff of 7,000 includes engineers, architects, construction professionals, planners, estimators, economists, technicians and scientists, representing virtually all design disciplines. We plan, design, permit, construct and manage facilities all over the world.

Q. Please summarize the primary responsibilities of your role as a Project Manager for Burns & McDonnell.

A. As a Project Manager in Burns & McDonnell's Energy Division, I am responsible for supervising and coordinating engineering staff, design, project schedule and cost, project planning, multi-contract coordination and management, and serve as the primary liaison with clients.

Q. Has Burns & McDonnell previously worked with Kentucky utilities in matters related to their generation assets?

A. Yes, on a number of occasions. Burns & McDonnell has worked with most of the power generating utilities in Kentucky, including in conjunction with applications to this Commission. I have personally provided testimony in cases involving generation facilities and environmental compliance, including in Case No. 2017-00376[1] and Case No. 2018-00270.[2]

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[1] *Application of East Kentucky Power Cooperative, Inc. for Approval to Amend its Environmental Compliance Plan and Recover Costs pursuant to its Environmental Surcharge, Settlement of Certain Asset Retirement Obligations and Issuance of a Certificate of Public Convenience and Necessity and Other Relief* (Ky. P.S.C. May 18, 2018).

[2] *Application of East Kentucky Power Cooperative, Inc. for Approval to Amend its Environmental Compliance Plan and Recover Costs Pursuant to its Environmental Surcharge, and for the Issuance of a Certificate of Public Convenience and Necessity* (Ky. P.S.C. April 1, 2019).

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to describe the role of Burns & McDonnell in assisting Big Rivers Electric Corporation ("Big Rivers") to develop and pursue certain projects proposed for inclusion in Big Rivers' 2020 Environmental Compliance Plan ("2020 Plan"). These projects are detailed in the reports I provide with my testimony. The projects include closure of on-site coal ash ponds at Big Rivers' Kenneth C. Coleman Station ("Coleman Station") and Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("HMP&L Station Two"), as well as the closure of the on-site coal ash pond and various mechanical system conversions and additions at Big Rivers' Robert D. Green Station ("Green Station"). Each of these projects is pursued by Big Rivers for compliance with applicable environmental law, including the Disposal of Coal Combustion Residuals ("CCR") from Electric Utilities Rule ("CCR Rule"), the Steam Electric Power Generating Effluent Guidelines and Standards ("ELG Rule"), and relevant limitations imposed by the relevant Kentucky Pollutant Discharge Elimination System ("KPDES") permit.

Q. Are you sponsoring any exhibits?

A. Yes, as set forth below. These documents were prepared by me or by individuals working directly under my supervision.

- Exhibit Yoder-1: Professional Resume;
- Exhibit Yoder-2: Green Station – CCR/ELG Compliance Project Definition Report;
- Exhibit Yoder-3: Coleman Station – CCR Pond Closure Evaluation; and
- Exhibit Yoder-4: Reid/HMP&L Station Two – CCR Pond Closure Evaluation.

II. CCR/ELG COMPLIANCE AT THE GREEN STATION

Q. Please describe the Green Station.

A. Big Rivers' Robert D. Green Generating Station consists of two wall-fired units (combined capacity of 492 MW (gross)) originally installed in 1976. Each unit includes balanced draft natural circulation, two air preheaters and two electrostatic precipitators ("ESP") downstream of the economizers, and one wet flue gas desulfurization ("FGD") scrubbers. The Green Station burns bituminous coal (pulverized) and, at times, a blend of coal and petcoke, and its on-site ash pond contains approximately 1,000,000 cubic yards of CCR material.

Q. Explain how Burns & McDonnell became involved with CCR/ELG environmental compliance efforts at Big Rivers' Green Station.

A. In 2016, Burns & McDonnell was retained by Big Rivers to assess the options available for meeting CCR and ELG compliance at the Green Station. This initial effort was to assist Big Rivers in making a technology selection for mechanical equipment conversions and to evaluate approaches associated with pond closure. Following in-depth review and discussions with Big Rivers, Burns & McDonnell prepared and issued a Project Definition Report in 2017 detailing the scope, design, schedule, and cost estimates associated with the Green Station projects. Attached hereto as Exhibit Yoder-3 is the final version of the CCR/ELG Compliance Project Definition Report (the "Green Project Definition Report"), which was updated in November of 2019 to reflect developments in market conditions with respect to CCR/ELG compliance projects since the prior version of the report was issued.

Q. Please describe the Green Project Definition Report.

A. The Green Project Definition Report summarizes the scope of the projects proposed for the Green Station and presents engineering information for use by Big Rivers in evaluating feasibility, budgeting, and related planning issues. Among other information, the Green Project Definition Report discusses the assumptions, conceptual design, contracting approach, schedule, and cost estimates for the proposed undertakings at the Green Station, and each of these areas is examined in detail within its own section of the Report. Additionally, numerous appendices are provided that reflect technical drawings, design basis, permitting and assumption matrices, and cash flow considerations.

Q. What environmental compliance projects are discussed within Burns & McDonnell's Green Project Definition Report?

A. The Green Project Definition Report evaluates a number of possible undertakings to promote current and future environmental compliance at Big Rivers' Green Station. These projects include options for the closure of the station's on-site ash pond, construction of a new Water Mass Balance ("WMB") pond, and modifications to the flue gas desulfurization ("FGD") wastewater treatment ("WWT") system. The Green Project Definition Report also examines the conversion of the Green Station's existing bottom ash handling system to a new underboiler drag chain conveyor and the elimination of the station's economizer ash sluicing system.

Q. Please further describe Big River's proposal with respect to the closure and repurposing of the Green Station's existing ash pond.

A. The Green Station's existing ash pond will be closed by using a hybrid approach of capping in place approximately 450,000 cubic yards of the total 1,000,000 cubic yards of CCR material estimated to be in the ash pond footprint by consolidating and covering it along existing berms within the pond. The remaining 550,000 cubic yards will be removed and relocated to the existing on-site permitted special waste landfill. In place of the CCR material removed from the ash pond, Big Rivers proposes to install a new, 17-acre WMB Pond with a liner system consisting of 60-mil high-density polyethylene (HDPE) geomembrane and 12-inches of protective cover. The WMB Pond will include a chemical treatment system to address total suspended solids (TSS), heavy metals levels, and pH to levels that meet federal and state regulations.

Q. Did Burns and McDonnell examine an option that included the complete removal of the Green Station ash pond's CCR material, rather than a hybrid approach?

A. Yes. As detailed in the Green Project Definition Report, Burns and McDonnell also evaluated an option that included complete removal of the ash pond's CCR material and the installation of a new, 26-acre WMB pond in its place. Because this option would provide a larger WMB pond than necessary, as well as significantly increase the cost of the project, Big Rivers has chosen to pursue the hybrid approach I discussed above.

Q. Please further describe the WWT modifications proposed for the Green Station.

A. The Green Station currently processes its FGD wastewater in a solidifying treatment process referred to as the Illinois University Conversion System ("IU") which creates a Poz-O-Tec product or returns it to the system for reuse. There are, however, modifications required to the system to meet CCR and ELG regulation compliance. Those include modifications to the FGD WWT thickener area to capture maintenance activities, modifications to the FGD reaction tanks, and modifications to the FGD surge tanks. In addition, an existing coal pile runoff pond will be re-purposed as a new thickener overflow pond that can store approximately 930,000 gallons of thickener wastewater during maintenance.

Q. What primary risks has Burns & McDonnell identified with respect to the environmental compliance efforts at the Green Station described in its report?

A. As with all large capital projects, there are certain project risks that exist. The following are a few of the project risks identified that could have an impact on the project schedule or budget: long lead equipment manufacturing capacity, quantity of CCR material in the existing Ash Pond, availability of qualified labor, and changes in law. While the above is not an exhaustive list of all potential risks associated with the project, these are the primary risks of concern.

Q. Do you adopt and authenticate the discussions and conclusions contained in Green Project Definition Report attached to your testimony?

A. Yes.

III. THE COLEMAN STATION ASH PONDS

Q. Please briefly describe Big Rivers' Coleman Station.

A. Big Rivers' Coleman Station consists of three (3) pulverized coal units near Hawesville, Kentucky. While these units are presently idled, there are three (3) existing ash ponds containing CCR material. The existing CCR ponds at the Coleman Station are designated as the South Pond, Sluice Pond, and North Pond. The North Pond, which received CCR material generated at the Coleman Station, is approximately sixty (60) acres in size, with an overflow pond located off of the north perimeter berm. The Sluice Pond covers approximately forty-nine (49) acres of the Coleman Station and was primarily utilized as the sluice discharge location for bottom ash and fly ash. The main portion of the South Pond is approximately ninety-four (94) acres in size and located to the south and west of the main powerblock area; an additional area, which has been beneficially used for parking, laydown, and by-product stack out, consists of approximately thirteen (13) acres located north/across of the main Station entrance road from the South Pond main area.

Q. **Please describe the Coleman Station CCR Pond Closure Evaluation conducted by Burns and McDonnell on behalf Big Rivers.**

A. The Coleman Station – CCR Pond Closure Evaluation summarizes the scope and cost of the ash pond closure project at Coleman Station and presents engineering information for use by Big Rivers in evaluating feasibility, budgeting, and related planning issues. Among other information, the Coleman Station – CCR Pond Closure Evaluation discusses the assumptions, conceptual design, contracting approach, schedule, and cost estimates for the defined ash pond closure project.

Q. **Do you adopt and authenticate the discussions and conclusions contained in the Coleman Station's CCR Pond Closure Evaluation attached to your testimony?**

A. Yes.

IV. THE REID/HMP&L STATION TWO ASH POND

Q. Please briefly describe the ash pond located at the Reid Station/HMP&L Station Two.

A. The ash pond jointly utilized by Big Rivers' Reid Station and HMP&L Station Two was in operation for approximately forty (40) years, during which it received predominately sluiced bottom ash generated by the Reid/HMP&L units. The ash pond is approximately 24 acres in surface area, and is partially incised with a berm above grade on the south, east and west sides.

Q. Please describe the Reid/HMP&L CCR Pond Closure Evaluation conducted by Burns and McDonnell on behalf Big Rivers.

A. The Reid/HMP&L – CCR Pond Closure Evaluation summarizes the scope and cost of the ash pond closure project at the Station and presents engineering information for use by Big Rivers in evaluating feasibility, budgeting, and related planning issues. Among other information, the Reid/HMP&L – CCR Pond Closure Evaluation discusses the assumptions, conceptual design, contracting approach, schedule, and cost estimates for the defined ash pond closure project.

Q. Do you adopt and authenticate the discussions and conclusions contained in the Reid/HMP&L Ash Pond Closure Evaluation attached to your testimony?

A. Yes.

V. CONCLUSION

Q. Please summarize your testimony.

A. Burns & McDonnell assisted Big Rivers in developing technology assessments and cost estimates for several projects proposed for inclusion in Big Rivers' 2020 Environmental Compliance Plan. These projects are detailed in the reports I provide with my testimony.

Q. Do you believe the cost estimates reflected in your exhibits are fair and reasonable?

A. Yes. While there are assumptions that were made in the process of preparing the reports and certain limitations that exist when any engineer develops a project before beginning the project, the estimates we developed in preparing the reports are of budgetary planning quality for similar projects of this complexity and size.

Q. Does this conclude your testimony?

A. Yes.

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

VERIFICATION

I, Samuel E. ("Sam") Yoder, verify, state, and affirm that I prepared or supervised the preparation of the Direct Testimony filed with this Verification, and that Direct Testimony is true and accurate to the best of my knowledge, information, and belief formed after a reasonable inquiry

Sam Yoder

Samuel E. ("Sam") Yoder

STATE OF MISSOURI)
COUNTY OF JACKSON)

SUBSCRIBED AND SWORN TO before me by Samuel E. ("Sam") Yoder on this the 3RD day of February, 2020.

SARA BETH ACTON
Notary Public - Notary Seal
STATE OF MISSOURI
Jackson County
My Commission Expires April 20, 2023
Commission # 15634903

Sara Beth Acton

Notary Public, Missouri State at Large

My Commission Expires 20 April 2023

Case No. 2019-00435

Exhibit Yoder-1

Professional Summary

SAMUEL YODER, P.E.

Project Manager

Mr. Yoder is a Project Manager with Burns & McDonnell's Energy Division. Mr. Yoder has been involved in more than $1.75 Billion in coal-fired power plant pollution control retrofit projects. Mr. Yoder's experience includes all major phases of large capital projects, including project planning studies and evaluations, detailed engineering design, multi-contract coordination and management, construction and commissioning at coal-fired power plants.

EDUCATION

- BS. Chemical Engineering
- BS. Mathematics

REGISTRATIONS

- Professional Engineer (MO. KY)

12 YEARS WITH BURNS & MCDONNELL

12 YEARS OF EXPERIENCE

Green Station Coal Combustion Residuals and Effluent Limitations Guidelines Scoping Study | Big Rivers Electric Corporation 2019-Current

Project manager for the Green Station coal combustion residuals (CCR) and effluent limitations guidelines (ELG) project scoping study. The study involves preliminary engineering design to determine the project costs and schedule to comply with CCR and ELG regulations on Green Units 1 and 2.

Coleman Station Coal Combustion Residuals Pond Closure Study | Big Rivers Electric Corporation
2019-Current

Project manager for the Coleman Station coal combustion residuals (CCR) pond closure study. The study involves preliminary engineering design to determine the project costs and schedule to close the ponds at Coleman Station.

Reid / HMP&L Station Coal Combustion Residuals Pond Closure Study | Big Rivers Electric Corporation
2019-Current

Project manager for the Reid / HMP&L Station coal combustion residuals (CCR) pond closure study. The study involves preliminary engineering design to determine the project costs and schedule to close the ponds at Reid / HMP&L Station.

Spurlock Station Coal Combustion Residuals and Effluent Limitations Guidelines Compliance Project | East Kentucky Power Cooperative
2017-Current

Project manager for the Spurlock Station coal combustion residuals (CCR) and effluent limitations guidelines (ELG) compliance project. The project involves several components for Units 1 and 2 including an FGD wastewater treatment system, a fly ash transfer station and silo, and a bottom ash conversion to dry handling which includes a new silo. In addition to the conversion on Units 1 and 2, the project includes the closure of a 67-acre ash pond and the establishment of a new water mass balance pond.

Bluegrass Generating Station Dual Fuel Implementation Project | East Kentucky Power Cooperative
2018-Current

Project manager for the Bluegrass Generating Station Dual Fuel Implementation project. The project involves converting three simple cycle units to allow for fuel oil as a back-up to natural gas. In addition to the simple cycle conversion, the project includes new fuel oil storage tanks and pumps and a demineralized water storage and pumps for operating on fuel oil.

Bluegrass Generating Station Dual Fuel Implementation Project Scoping Study | East Kentucky Power Cooperative 2017-2018

Project manager for the Bluegrass Generating Station Dual Fuel Implementation project scoping study. The study involves preliminary engineering design to determine the project costs and schedule to convert three simple cycle units to allow for fuel oil as a back-up to natural gas.

Spurlock Station Coal Combustion Residuals and Effluent Limitations Guidelines Scoping Study | East Kentucky Power Cooperative

2016-2017

Project manager for the Spurlock Station coal combustion residuals (CCR) and effluent limitations guidelines (ELG) project scoping study. The study involves preliminary engineering design to determine the project costs and schedule to comply with CCR and ELG regulations on Spurlock Units 1 and 2.

Coal Combustion Residuals and Effluent Limitations Guidelines Scoping Study | Confidential Client

2016-2017

Project manager for a coal combustion residuals (CCR) and effluent limitations guidelines (ELG) project scoping study. The study involves preliminary engineering design to determine the project costs and schedule to comply with CCR and ELG regulations at a coal-fired power plant.

Coal Combustion Residual Documents Implementation Program | East Kentucky Power Cooperative

2015-2016

Project manager for the EKPC CCR Implementation Program that included the documents required to meet the new EPA CCR Rule. Documents included inspection lists, groundwater monitoring studies, quality assurance program, fugitive dust program, and website/data management development. Roles included reviewing and developing documentation for EKPC CCR implementation, client coordination and internal engineering coordination.

Spurlock Station Site Drainage Improvement Project | East Kentucky Power Cooperative

2015-2016

Project manager for a diverse and fast paced project at Spurlock Station. The project consists of design and specification development, as well as construction management for rerouting the wet FGD blowdown from the coal pile runoff pond to the ash pond almost 8,000 feet away in less than 6 months. Once the reroute was completed, design and specifications were developed for deepening and lining the existing coal pile runoff pond. Lastly, site pavement design drawings and specifications were developed to pave nearly 15 acres at Spurlock Station.

Wilson Station Dry Sorbent Injection Project | Big Rivers Electric Corporation

2014-2016

Project manager for the Wilson Station Dry Sorbent Injection project. The project consists of dry sorbent injection silo, pipe rack and injection grid on Wilson Unit 1. The project consisted of developing design and specifications for the equipment supply contract as well as the installation contract.

Dale Station Ash Pond Closure and Site Restoration | East Kentucky Power Cooperative
2013-Present

Project manager for closure by removal of ash ponds at East Kentucky Power Cooperative's Dale Station near Ford, Kentucky. The project consists of removal of approximately 500,000 cubic yards of coal combustion residuals (CCR) from multiple ponds along the Kentucky River and hauling the CCR material to a landfill being developed at East Kentucky Power Cooperative's J.K. Smith Station.

Cooper Station Unit 1 – Duct Reroute Project | East Kentucky Power Cooperative
2013-2016

Project manager for the Cooper Unit 1 duct reroute project. The project consists of re-routing the Cooper Unit 1 flue gas into the previously constructed Cooper Unit 2 circulating dry scrubber system for MATS compliance. This unique project consisted of several equipment and material supply contracts as well as two installation contracts.

Green Station Units 1 & 2 MATS Compliance Project | Big Rivers Electric Corporation
2013-2015

Project manager for the Green Station Unit 1 & 2 MATS compliance project. The project consists of dry sorbent injection and powdered activated carbon injection on Green Units 1 & 2 for MATS compliance. The project consisted of detailed design and specification development for equipment supply, pilings, foundations, and mechanical construction. In addition, the project had multiple installation contracts that required coordination.

Spurlock Station Mercury Control Project | East Kentucky Power Cooperative
2013-2015

Project manager for the Spurlock Station mercury control project. The project involves the addition of a wet flue gas desulfurization (FGD) mercury reemission additive and a fuel additive to Spurlock Units 1 and 2.

MATS Compliance Study | Indianapolis Power and Light
2014

Project manager for the Indianapolis Power and Light MATS compliance study that evaluated the potential application of calcium bromide fuel additive for Harding Street Unit 7. The purpose of the study was to determine whether the application of fuel additive alone could bring Harding Street Unit 7 into MATS compliance. In addition to the feasibility evaluation, Mr. Yoder helped develop a testing plan that could be utilized by IP&L for testing the fuel additive application.

Cooper Station Unit 2, East Kentucky Power Cooperative
2009-2013

Process engineer for the Cooper Unit 2 environmental project. The project involved the addition of a circulating dry flue gas desulfurization (FGD) system, baghouse, and selective catalytic reduction (SCR) systems to Cooper Station Unit 2, which is 225 MW.

Field engineer for the Cooper Unit 2 environmental project. In this role, Mr. Yoder answered both technical and contractual questions from the installing contractors, assisted in coordinating the onsite work activities between multiple installation contractors, and coordinated and managed the equipment manufacturer's field representative services.

Process commissioning engineer for the Cooper Unit 2 environmental project. In this role, Mr. Yoder assisted in commissioning the SCR, the circulating dry scrubbing FGD, primary air fan, forced draft fan, induced draft fan, and air heater. In addition, Mr. Yoder assisted in commissioning the balance of plant equipment for the Cooper Unit 2 environmental project.

Cholla Power Station Unit 3, Arizona Public Service

2007-2010

Process engineer for the Cholla Unit 3 and Unit 4 scrubber and baghouse retrofit project for Arizona Public Service. The project involved the addition of wet FGD systems on each Unit, a new baghouse on Unit 4, and the replacement of the existing hot side electrostatic precipitators (ESP) with a baghouse on Unit 3. The Unit 4 ESP, which was abandoned on the Unit 4 retrofit, was converted into the Unit 3 baghouse.

Seminole Generating Stations Units 1 & 2, Seminole Electric

2007-2009

Detailed engineering and design for modifications to existing air pollution control equipment and installation of new air pollution control equipment for the existing Units 1 and 2. Work included new SCRs, urea injection, sorbent injection testing, sorbent injection equipment for SO_3 control, and FGD modifications including new mist eliminator wash, installation of perforated trays, and new gypsum dewatering equipment.

Merom Station, Hoosier Energy Rural Electric Cooperative, Inc.

2007

Development of specifications and drawings for procurement of sulfuric acid mist (SAM) control system. System was designed for reagent injection upstream of the existing particulate collection device

In the Matter of:

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Case No. 2019-00435

CONFIDENTIAL DOCUMENT

Exhibit Yoder-2
Direct Testimony of Samuel E. Yoder
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

CONFIDENTIAL DOCUMENT

Exhibit Yoder-3
Direct Testimony of Samuel E. Yoder
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION PETITION FOR CONFIDENTIAL TREATMENT

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	**Case No. 2019-00435**

CONFIDENTIAL DOCUMENT

Exhibit Yoder-4
Direct Testimony of Samuel E. Yoder
FILED: February 7, 2020

INFORMATION SUBMITTED WITH MOTION
PETITION FOR CONFIDENTIAL TREATMENT

ORIGINAL

Big Rivers ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN, AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL SURCHARGE AND TARIFF, THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR CERTAIN PROJECTS, AND APPROPRIATE ACCOUNTING AND OTHER RELIEF	)	Case No. 2019-00435

DIRECT TESTIMONY

OF

JOHN WOLFRAM
PRINCIPAL, CATALYST CONSULTING LLC

ON BEHALF OF

BIG RIVERS ELECTRIC CORPORATION

FILED: February 7, 2020

Application Exhibit I

DIRECT TESTIMONY

OF

JOHN WOLFRAM

I. INTRODUCTION

Q. Please state your name, business address, and position.

A. My name is John Wolfram. I am the Principal of Catalyst Consulting LLC. My business address is 3308 Haddon Road, Louisville, Kentucky, 40241.

Q. On whose behalf are your testifying?

A. I am testifying on behalf of Big Rivers Electric Corporation ("Big Rivers").

Q. Briefly describe your education and work experience.

A. I received a Bachelor of Science degree in Electrical Engineering from the University of Notre Dame in 1990 and a Master of Science degree in Electrical Engineering from Drexel University in 1997. I founded Catalyst Consulting LLC in June 2012. From March 2010 through May 2012, I was a Senior Consultant with The Prime Group, LLC. I have developed cost of service studies and designed rates for numerous electric and gas utilities, including electric distribution cooperatives, generation and transmission cooperatives, municipal utilities and investor-owned utilities. I have performed economic analyses, rate mechanism reviews, ISO/RTO membership evaluations, and wholesale formula rate reviews. I have also been employed by the parent companies of Louisville Gas and Electric Company and Kentucky Utilities Company, by the PJM Interconnection, and by the Cincinnati Gas & Electric Company. A more detailed description of my qualifications is included in Exhibit Wolfram-1.

Q. Have you testified before the Kentucky Public Service Commission ("Commission")?

A. Yes. I have testified in numerous regulatory proceedings before this Commission. A listing of my testimony in other proceedings is included in Exhibit Wolfram-1.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the mechanics and components of the Big Rivers environmental surcharge ("ES") tariff rider and explain how the surcharge will be calculated and charged to Big Rivers' members. I will also (i) summarize how the ES tariff rider operates; (ii) identify the specific cost components of environmental compliance to be included in the surcharge; (iii) describe Big Rivers' reporting procedures and monthly report for the environmental surcharge; and (iv) provide an estimate of the impact of the costs incurred in connection with the new projects in Big Rivers' 2020 Environmental Compliance Plan ("2020 Plan").

Q. Are you sponsoring any exhibits?

A. Yes. I have prepared the following exhibits to support my testimony:

- Exhibit Wolfram-1 – Qualifications of John Wolfram;
- Exhibit Wolfram-2 – Existing Big Rivers ES Tariff;
- Exhibit Wolfram-3 – Existing Big Rivers ES Monthly Report;
- Exhibit Wolfram-4 – Proposed Big Rivers ES Monthly Report; and
- Exhibit Wolfram-5 – Estimated Member Billing Impact

II. ENVIRONMENTAL SURCHARGE TARIFF

Q. Please describe the ES tariff.

A. The ES tariff includes the costs associated with the projects approved by the Commission in Case No. 2007-00460 (the "2007 Plan") and Case No. 2012-00063 (the "2012 Plan"). In the 2007 case, the compliance plan proposed by Big Rivers consisted of programs and the associated operation and maintenance ("O&M") costs dealing with the control of sulfur dioxide ("SO_2"), nitrogen oxides ("NO_X"), and sulfur trioxide ("SO_3"). The costs proposed to be recovered for each of the programs consisted entirely of variable costs that were associated with reagents, disposal of coal-combustion by-products, and allowance purchases as needed (and offset by revenues associated with the sale of allowances and gypsum). Big Rivers' 2012 Plan, which ultimately included four projects, consisted of the installation of activated carbon injection and dry sorbent injection systems at Big Rivers' D.B. Wilson Station ("Wilson Station"), Kenneth C. Coleman Station ("Coleman Station"), Robert D. Green Station ("Green Station"), and Henderson Municipal Power and Light's ("HMP&L") William L. Newman Station Two facility ("Station Two"). The ES tariff operates in conjunction with base rates, allowing Big Rivers to recover certain costs related to environmental compliance that are not recovered in base rates, consistent with and pursuant to KRS 278.183.

Q. **Does the ES tariff allow Big Rivers to recover its expenses for the approved projects as well as allow Big Rivers to earn a reasonable return on its investment in the approved projects?**

A. Yes. The ES tariff allows Big Rivers to recover the variable costs for the 2007 Plan. (The 2007 Plan did not consist of any capital projects.) The ES tariff also allows Big Rivers to recover expenses and earn a reasonable return on the capital projects for the 2012 Plan.

Q. **What is the formula utilized in the existing ES tariff?**

A. The Current Environmental Surcharge Factor ("CESF") is defined as

CESF = Net Jurisdictional E(m) / Jurisdictional R(m)

where E(m) is the total of each approved environmental compliance plan revenue requirement of environmental costs for the current expense month, and R(m) is the average monthly revenue, including base revenues and automatic adjustment clause charges or credits less Environmental Surcharge revenues, for Big Rivers for the twelve months ending with the current expense month. Thus, the current CESF is a percentage-of-revenue charge, not a per-kWh charge.

Q. Is Big Rivers proposing any changes to the methodology currently used for calculating the monthly environmental surcharge in the ES tariff?

A. No. Big Rivers is not proposing to change the methodology. Big Rivers is simply proposing to add projects to the approved Environmental Compliance Plan ("ECP") and apply the existing methodology to all projects in the ECP on the same basis.

Q. Is Big Rivers proposing any changes to its ES tariff?

A. No. Big Rivers is not proposing changes to its ES tariff. The ES tariff addresses the rate treatment of "environmental compliance plan projects approved by the Commission" and "each approved environmental compliance plan" but does not specify the projects or plans themselves to any greater specificity. Since Big Rivers is seeking Commission approval of additional projects in the 2020 Plan and no changes to the actual cost recovery formulas, no revisions to the ES Tariff to accommodate the 2020 Plan are necessary. The ES tariff is attached as Exhibit Wolfram-2. All of the changes necessary to include the 2020 Plan in the ES can be addressed through revisions to the ES Monthly Report, which I discuss later in my testimony.

Q. Does the Big Rivers ES tariff continue to comply with all statutory and regulatory requirements, as well as all applicable previous Commission Orders?

A. Yes.

III. <u>ES TREATMENT OF 2020 PLAN</u>

Q. What cost components are included in the proposed ES tariff rider?

A. The proposed ES tariff rider will include the following costs related to the pollution control capital expenditures in the 2020 Plan:

1. a return on pollution control rate base for approved 2020 Plan facilities and equipment,
2. incremental O&M expenses,

3. depreciation over the expected useful life of the relevant pollution control facilities and equipment,
4. property taxes on pollution control equipment,
5. insurance related to pollution control equipment, and
6. emission allowance expense.

Additionally, the ES tariff rider will continue to include the variable costs associated with the Big Rivers' projects for SO_2, NO_X, and SO_3, respectively that were approved in the 2007 Plan as well as the expenses and return on investment for the Big Rivers' projects that were approved in the 2012 Plan, as previously described.

Q. Please list the 2020 Plan projects to be reflected in Big Rivers' Environmental Surcharge.

A. The 2020 Plan includes four main projects. One of the projects has three sub-projects. The projects include:

- Project 12 –Wilson FGD/Wastewater Treatment ("WWT") System;
- Project 13 – Ash Pond Closures –
  - Project 13-1 – Green Station Ash Pond Closure/Water Mass Balance ("WMB") Pond/WWT,
  - Project 13-2 – Coleman Station Ash Pond Closure, and
  - Project 13-3 – Station Two Ash Pond Closure;

- Project 14 – Wilson Phase 1 Landfill Cover;
- Project 15 – Green Landfill Drainage System; and
- Project 16 – CCR Environmental Compliance.

These projects are described in detail in the Direct Testimony of Michael T. Pullen.

Q. Did Big Rivers establish any regulatory assets pertaining to the 2020 ECP?

A. Yes. As described in the Direct Testimony of Paul G. Smith, Big Rivers sought and was granted authority, in Case No. 2015-00333, to establish a regulatory asset for the income statement impacts (including gains, losses, depreciation and accretion expense) resulting from AROs related to its Green and Reid/Station Two ash ponds for 2015 and subsequent years (the "ARO Regulatory Asset"). Additionally, Big Rivers was authorized to defer as regulatory assets the actual CCR-compliance costs it incurred for Green, Wilson, Reid/Station Two, and Coleman beginning in 2015 and thereafter (the "CCR Regulatory Assets"). These regulatory assets fit into the requested ES cost recovery as described below.

Q. Please describe the specific cost recovery that Big Rivers seeks to be reflected in Big Rivers' ES.

A. With respect to cost recovery, Big Rivers seeks the following.

1. Authority to recover the costs of the 2020 Plan through the existing Environmental Surcharge tariff.
2. Authority to begin recovering through its ES the aforementioned ARO and CCR Regulatory Assets, and the corresponding settlement of the Green and Reid/Station Two ash pond AROs, as discussed in the Direct Testimony of Paul G. Smith.
3. With respect to Project 12: authority to add to its environmental rate base the capital costs of the project, the undepreciated net book value of the plant being moved from Coleman Station, and capitalized interest; authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and recover that depreciation expense through the ES; and continued recovery of the on-going variable O&M expense associated with the FGD through the ES.
4. With respect to Project 13-1: authority to include in the ES as an expense the amortization of the Green ARO Regulatory Asset over a rolling 10-year period; authority to add to its environmental rate base the non-ARO costs that are reflected in Project 13-1, authority to depreciate that plant utilizing the approved Green Station depreciation rates and

recover that depreciation expense through the ES; and recovery of ongoing O&M as an expense through the ES.

5. With respect to Project 13-2: authority, upon the revision of the CCR Rule to include legacy ash ponds and the recognition by Big Rivers of the Coleman Station ARO, to establish a regulatory asset for the income statement impacts (including gains, losses, accretion and depreciation expenses) associated with the ARO-related liabilities arising from the Coleman Stations ash ponds; authority to include in the ES as an expense the amortization of the Coleman ARO Regulatory Asset over a rolling 10-year period; and authority to recover the on-going O&M expense associated with the project through the ES.
6. With respect to Project 13-3: authority to include in the ES as an expense the amortization of the ARO Regulatory Asset over a rolling 10-year period, as well as authority to recover the on-going O&M expense associated with the project through the ES.
7. With respect to Project 14: authority to add to its environmental rate base the capital costs of the project and capitalized interest; authority to depreciate that plant utilizing the approved Wilson Station depreciation rates and recover that depreciation expense through the ES; and authority to recover the on-going O&M expense associated with the project through the ES. (Note that Project 14, as well as Project 15, have

a small impact on the ES due to the lower overall cost of these undertakings relative to the other projects listed in the ECP 2020 Plan Summary attached to this Application as Exhibit C.)

8. With respect to Project 15: authority to add to its environmental rate base the capital costs of the project and capitalized interest; authority to depreciate that plant utilizing the approved Green Station depreciation rates and recover that depreciation expense through the ES; and authority to recover the on-going O&M expense associated with the project through the ES.

9. With respect to Project 16: authority to include in the ES as an expense the amortization of the CCR Regulatory Asset over a fixed 10-year period.

10. Authority to establish a regulatory asset for the expenses incurred in developing and pursuing the relief requested, and to include in the ES as an expense the amortization of the regulatory asset over a fixed three-year period.

All of these items are discussed in detail in the Direct Testimony of Paul G. Smith. Also, each of these items is reflected not as a revision to the ES tariff, but as a revision to the ES Monthly Report, which I discuss in the next section of my testimony.

IV. ES MONTHLY REPORT

Q. Is Big Rivers proposing any changes to the monthly report used for calculating the monthly environmental surcharge?

A. Yes. Big Rivers is proposing changes to the forms in the monthly report that Big Rivers files with the Commission. The revisions are needed to accommodate the inclusion of projects in the 2020 Plan proposed by Big Rivers. The current ES Monthly Report is attached as Exhibit Wolfram-3, and the proposed ES Monthly Report is attached as Exhibit Wolfram-4. The forms in Exhibit Wolfram-4 reflect the addition of the projects in the 2020 Plan without any other substantive changes to the approach used in the existing forms.

Q. Please describe the detailed support forms that Big Rivers will file each month, as attached in Exhibit Wolfram-4

A. Exhibit Wolfram-4 shows the detailed support forms that Big Rivers will file each month for reporting purposes.

1. ES Form 1.00 shows the calculation of the monthly billed Environmental Surcharge Factor ("MESF") for the expense month, where MESF equals the CESF less the Base Environmental Surcharge Factor ("BESF") (which is currently zero for Big Rivers).
2. ES Form 1.10 shows the calculation of the Total E(m) and Jurisdictional Surcharge Billing Factor for the expense month.

3. ES Form 2.00 shows the determination of Environmental Compliance Rate Base and Determination of the Pollution Control Operating Expenses, Gross Proceeds from By-Product and Emission Allowance Sales, and the amortization of the Over/Under Recovery due to timing effects.
4. ES Form 2.10 shows the determination of Eligible Plant in Service, CWIP, Depreciation Expense, Taxes and Insurance Expense.
5. ES Form 2.20 shows the determination of Inventories of Spare Parts, reagents, etc.
6. ES Form 2.30 shows the inventory of Emission Allowances and how the monthly Allowance expense is calculated.
7. ES Form 2.31 shows the inventory of SO_2 Emission Allowances for the current vintage year.
8. ES Form 2.32 shows the inventory of NO_X Emission Allowances for the ozone season allowance allocation.
9. ES Form 2.33 shows the inventory of NO_X Emission Allowances for the annual allowance allocation.
10. ES Form 2.40 shows the incremental O&M expenses and the Determination of Cash Working Capital.
11. ES Form 2.50 shows the calculation of monthly O&M expenses associated with the pollution control equipment.

12. ES Form 3.00 shows the derivation of R(m), the average adjusted monthly revenue and the determination of the Jurisdictional Allocation Ratio for the current month.

13. ES Form 3.10 shows additional detail of the calculation of revenues used in the derivation of R(m) for the current month.

Q. To which of the aforementioned forms does Big Rivers propose revisions in order to incorporate the 2020 Plan?

A. Big Rivers proposes changes to the forms as follows:

1. <u>ES Form 2.10 – Plant, CWIP, Depreciation, & Taxes and Insurance Expenses.</u> This form is revised to add the 2020 Plan projects to the list of projects included in the calculation of plant balances, CWIP, depreciation, taxes and insurance for the ES.
2. <u>ES Form 2.50 – Pollution Control - Operations & Maintenance Expenses</u>. This form is revised to add the 2020 Plan projects to the list of projects included in the calculation of monthly O&M expenses for the ES.

The remaining forms need not be revised, because they (a) reference data on these two forms, or (b) do not apply to the projects in the 2020 Plan.

V. IMPACT ON MEMBER BILLS

Q. Did Big Rivers estimate the rate impact of the new projects in the 2020 Plan?

A. Yes. The estimated annual impact on member bills associated with the projects included in the 2020 Plan are provided for each rate class in Exhibit Wolfram-5. This is based on the projected 2020 Plan costs and other data that affects the way costs are jurisdictionalized pursuant to the ES Tariff. In particular, the exhibit shows (i) the amount of the average usage of each customer class, (ii) the effect upon the average bill in dollars for each customer by class, and (iii) the estimated percent increase for each customer class, both annually and monthly.

Q. What is the approximate percentage increase in Big Rivers' overall member bills associated with the 2020 Plan?

A. Based on preliminary 2019 member billing totals, the application of the 2020 Plan on the ES tariff charges (using the estimated $/MWH incremental charges for 2023, the year following the projected completion of the Wilson FGD in Project 12) would result in average increases to annual member bills of approximately 2.4 percent overall.

VI. RECOMMENDATION AND CONCLUSION

Q. What is your recommendation to the Commission?

A. Based on my testimony, I recommend that the Commission approve Big Rivers' 2020 Plan and grant all of the relief requested by Big Rivers in this proceeding as filed.

Q. Does this conclude your testimony?

A. Yes.

BIG RIVERS ELECTRIC CORPORATION

APPLICATION OF BIG RIVERS ELECTRIC CORPORATION
FOR APPROVAL OF ITS 2020 ENVIRONMENTAL COMPLIANCE PLAN,
AUTHORITY TO RECOVER COSTS THROUGH A REVISED ENVIRONMENTAL
SURCHARGE AND TARIFF,
THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND
NECESSITY FOR CERTAIN PROJECTS,
AND APPROPRIATE ACCOUNTING AND OTHER RELIEF
CASE NO. 2019-00435

VERIFICATION

I, John Wolfram, verify, state, and affirm that I prepared or supervised the preparation of the Direct Testimony filed with this Verification, and that Direct Testimony is true and accurate to the best of my knowledge, information, and belief formed after a reasonable inquiry

John Wolfram

COMMONWEALTH OF KENTUCKY)
COUNTY OF HENDERSON)

SUBSCRIBED AND SWORN TO before me by John Wolfram on this the 6th day of February, 2020.

Notary Public, Kentucky State at Large

My Commission Expires October 31, 2020

Case No. 2019-00435

Exhibit Wolfram-1

Qualifications of John Wolfram

JOHN WOLFRAM

Summary of Qualifications

Provides consulting services to investor-owned utilities, rural electric cooperatives, and municipal utilities regarding utility rate and regulatory filings, cost of service studies, wholesale and retail rate designs, tariffs and special contracts, formula rates, and other analyses.

Employment

CATALYST CONSULTING LLC — June 2012 – Present
Principal

Provide consulting services in the areas of tariff development, regulatory analysis, economic development, revenue requirements, cost of service, rate design, and other utility regulatory areas.

Provide utility clients assistance regarding regulatory policy and strategy; project management support for utilities involved in complex regulatory proceedings; process audits; state and federal regulatory filing development; cost of service development and support; the development of special rates, including economic development rates, to achieve strategic objectives; the development of rate alternatives for use with customers; and energy efficiency program development.

Prepare retail and wholesale rate schedules and/or filings submitted to the Federal Energy Regulatory Commission ("FERC"), state regulators, and/or Boards of Directors for electric and gas utilities.

THE PRIME GROUP, LLC — March 2010 – May 2012
Senior Consultant

E.ON U.S., LLC, Louisville, KY — 1997 - 2010
(Louisville Gas & Electric Company and Kentucky Utilities Company)
Director, Customer Service & Marketing (2006 - 2010)
Manager, Regulatory Affairs (2001 - 2006)
Lead Planning Engineer, Generation Planning (1998 - 2001)
Power Trader, LG&E Energy Marketing (1997 - 1998)

PJM INTERCONNECTION, LLC, Norristown, PA — 1990 - 1993; 1994 - 1997
Project Lead – PJM OASIS Project
Chair, Data Management Working Group

CINCINNATI GAS & ELECTRIC COMPANY, Cincinnati, OH — 1993 - 1994
Electrical Engineer - Energy Management System

Education

Bachelor of Science Degree in Electrical Engineering, University of Notre Dame, 1990
Master of Science Degree in Electrical Engineering, Drexel University, 1997
Leadership Louisville, 2006

Associations

Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
IEEE Power Engineering Society

Expert Witness Testimony & Proceedings

FERC:

Submitted direct testimony for Tucson Electric Power Company in FERC Docket No. ER19-2019 regarding a proposed Transmission Formula Rate.

Submitted direct testimony for Cheyenne Light, Fuel & Power Company in FERC Docket No. ER19-697 regarding a proposed Transmission Formula Rate.

Supported Westar Energy and Kansas Gas & Electric Company in FERC Docket No. ER19-269-000 regarding revisions to fixed depreciation rates in the Westar Transmission Formula Rate.

Submitted direct testimony for Midwest Power Transmission Arkansas, LLC in FERC Docket No. ER15-2236 regarding a proposed Transmission Formula Rate.

Submitted direct testimony for Kanstar Transmission, LLC in FERC Docket No. ER15-2237 regarding a proposed Transmission Formula Rate.

Supported Westar Energy and Kansas Gas & Electric Company in FERC Docket Nos. FA15-9-000 and FA15-15-000 regarding an Audit of Compliance with Rates, Terms and Conditions of Westar's Open Access Transmission Tariff and Formula Rates, Accounting Requirements of the Uniform System of Accounts, and Reporting Requirements of the FERC Form No. 1.

Submitted direct testimony for Westar Energy in FERC Docket Nos. ER14-804 and ER14-805 regarding proposed revisions to a Generation Formula Rate.

Supported Intermountain Rural Electric Association and Tri-State G&T in FERC Docket No. ER12-1589 regarding revisions to Public Service of Colorado's Transmission Formula Rate.

Supported Intermountain Rural Electric Association in FERC Docket No. ER11-2853 regarding revisions to Public Service of Colorado's Production Formula Rate.

Expert Witness Testimony & Proceedings (*continued*)

FERC (*continued*):

Supported Kansas Gas & Electric Company in FERC Docket No. FA14-3-000 regarding an Audit of Compliance with Nuclear Plant Decommissioning Trust Fund Regulations and Accounting Practices.

Supported LG&E Energy LLC in FERC Docket No. PA05-9-000 regarding an Audit of Code of Conduct, Standards of Conduct, Market-Based Rate Tariff, and MISO's Open Access Transmission Tariff at LG&E Energy LLC.

Submitted remarks and served on expert panel in FERC Docket No. RM01-10-000 on May 21, 2002 in Standards of Conduct for Transmission Providers staff conference, regarding proposed rulemaking on the functional separation of wholesale transmission and bundled sales functions for electric and gas utilities.

Kansas: Submitted direct and rebuttal testimony for Westar Energy, Inc. in Docket No. 18-WSEE-328-RTS regarding overall rate design, prior rate case settlement commitments, lighting tariffs, an Electric Transit rate schedule, Electric Vehicle charging tariffs, and tariff general terms and conditions.

Submitted direct and rebuttal testimony for Westar Energy, Inc. in Docket No. 18-KG&E-303-CON regarding the Evaluation, Measurement and Verification ("EM&V") of an energy efficiency demand response program offered pursuant to a large industrial customer special contract.

Submitted report for Westar Energy, Inc. in Docket No. 18-WCNE-107-GIE regarding plans and options for funding the decommissioning trust fund, depreciation expenses, and overall cost recovery in the event of premature closing of the Wolf Creek nuclear plant.

Submitted direct and rebuttal testimony for Westar Energy, Inc. in Docket No. 15-WSEE-115-RTS regarding rate designs for large customer classes, establishment of a balancing account related to new rate options, establishment of a tracking mechanism for costs related to compliance with mandated cyber and physical security standards, other rate design issues, and revenue allocation.

Kentucky: Submitted direct testimony and responses to data requests on behalf of Jackson Energy Cooperative in Case No. 2019-00066 regarding revenue requirements, cost of service and rate design in a streamlined rate case.

Submitted direct testimony and responses to data requests on behalf of Jackson Purchase Energy Corporation in Case No. 2019-00053 regarding revenue requirements, pro forma adjustments, cost of service and rate design in a streamlined rate case.

Expert Witness Testimony & Proceedings (*continued*)

Kentucky (*continued*):

Submitted direct testimony and data request responses on behalf of Big Rivers Electric Corporation in Case No. 2018-00146 regarding ratemaking issues associated with the anticipated termination of contracts regarding the operation of an electric generating plant owned by the City of Henderson, Kentucky.

Submitted direct testimony on behalf of fifteen distribution cooperative owner-members of East Kentucky Power Cooperative in Case No. 2018-00050 regarding the economic evaluation of and potential cost shift resulting from a purchased power agreement proposed by South Kentucky R.E.C.C.

Submitted direct testimony on behalf of Big Sandy R.E.C.C. in Case No. 2017-00374 regarding revenue requirements, pro forma adjustments, cost of service and rate design in a base rate case.

Submitted direct testimony on behalf of Progress Metal Reclamation Company in Kentucky Power Company Case No. 2017-00179 regarding the potential implementation of a Load Retention Rate or revisions to an Economic Development Rate.

Submitted direct testimony on behalf of Kenergy Corp. and Big Rivers Electric Corporation in Case No. 2016-00117 regarding a marginal cost of service study in support of an economic development rate for a special contracts customer.

Submitted rebuttal testimony on behalf of Big Rivers Electric Corporation in Case No. 2014-00134 regarding ratemaking treatment of revenues associated with proposed wholesale market-based-rate purchased power agreements with entities in Nebraska.

Submitted direct and rebuttal testimony on behalf of Big Rivers Electric Corporation in Case No. 2013-00199 regarding revenue requirements, pro forma adjustments, cost of service and rate design in a base rate case.

Submitted direct and rebuttal testimony on behalf of Big Rivers Electric Corporation in Case No. 2012-00535 regarding revenue requirements, pro forma adjustments, cost of service and rate design in a base rate case.

Submitted direct and rebuttal testimony on behalf of Big Rivers Electric Corporation in Case No. 2012-00063 regarding an Environmental Compliance Plan and Environmental Surcharge rate mechanism.

Submitted direct, rebuttal, and rehearing direct testimony on behalf of Big Rivers Electric Corporation in Case No. 2011-00036 regarding revenue requirements and pro forma adjustments in a base rate case.

Expert Witness Testimony & Proceedings (*continued*)

Kentucky (*continued*):

Submitted direct testimony for Louisville Gas & Electric Company in Case No. 2009-00549 and for Kentucky Utilities Company in Case No. 2009-00548 for adjustment of electric and gas base rates, in support of a new service offering for Low Emission Vehicles, revised special charges, and company offerings aimed at assisting customers.

Submitted discovery responses for Kentucky Utilities and/or Louisville Gas & Electric Company in various customer inquiry matters, including Case Nos. 2009-00421, 2009-00312, and 2009-00364.

Submitted discovery responses for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2008-00148 regarding the 2008 Joint Integrated Resource Plan.

Submitted discovery responses for Louisville Gas & Electric Company and Kentucky Utilities Company in Administrative Case No. 2007-00477 regarding an investigation of the energy and regulatory issues in Kentucky's 2007 Energy Act.

Submitted direct testimony for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2007-00319 for the review, modification, and continuation of Energy Efficiency Programs and DSM Cost Recovery Mechanisms.

Submitted direct testimony for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2007-00067 for approval of a proposed Green Energy program and associated tariff riders.

Submitted direct testimony for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2005-00467 and 2005-00472 regarding a Certificate of Public Convenience and Necessity for the construction of transmission facilities.

Submitted discovery responses for Kentucky Utilities in Case No. 2005-00405 regarding the transfer of a utility hydroelectric power plant to a private developer. Submitted discovery responses for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2005-00162 for the 2005 Joint Integrated Resource Plan.

Presented company position for Louisville Gas & Electric Company and Kentucky Utilities Company at public meetings held in Case Nos. 2005-00142 and 2005-00154 regarding routes for proposed transmission lines.

Supported Louisville Gas & Electric Company and Kentucky Utilities Company in an Investigation into their Membership in the Midwest Independent Transmission System Operator, Inc. ("MISO") in Case No. 2003-00266.

Expert Witness Testimony & Proceedings *(continued)*

Kentucky (*continued*):

Supported Louisville Gas & Electric Company and Kentucky Utilities Company in a Focused Management Audit of Fuel Procurement practices by Liberty Consulting in 2004.

Supported Louisville Gas & Electric Company and Kentucky Utilities Company in a Focused Management Audit of its Earning Sharing Mechanism by Barrington-Wellesley Group in 2002-2003.

Submitted direct testimony for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2002-00381 regarding a Certificate of Public Convenience and Necessity for the acquisition of four combustion turbines.

Submitted direct testimony for Louisville Gas & Electric Company and Kentucky Utilities Company in Case No. 2002-00029 regarding a Certificate of Public Convenience and Necessity for the acquisition of two combustion turbines.

Virginia: Submitted direct testimony for Kentucky Utilities Company d/b/a Old Dominion Power in Case No. PUE-2002-00570 regarding a Certificate of Public Convenience and Necessity for the acquisition of four combustion turbines.

Presentations

"Revisiting Rate Design Strategies" presented to APPA Public Power Forward Summit, November 2019.

"Utility Rates at the Crossroads" presented to APPA Business & Financial Conference, September 2019.

"New Developments in Kentucky Rate Filings" presented to Kentucky Electric Cooperatives Accountants' Association Summer Meeting, June 2019.

"Electric Rates: New Approaches to Ratemaking" presented to CFC Statewide Workshop for Directors, January 2019.

"The Great Rate Debate: Residential Demand Rates" presented to CFC Forum, June 2018.

"Benefits of Cost of Service Studies" presented to Tri-State Electric Cooperatives Accountants' Association Spring Meeting, April 2017.

"Proper Design of Utility Rate Incentives" presented to APPA/Area Development's Public Power Consultants Forum, March 2017.

"Utility Hot Topics and Economic Development" presented to APPA/Area Development's Public Power Consultants Forum, March 2017.

Presentations (*continued*)

"Emerging Rate Designs" presented to CFC Independent Borrowers Executive Summit, November 2016.

"Optimizing Economic Development" presented to Grand River Dam Authority Municipal Customer Annual Meeting, September 2016.

"Tomorrow's Electric Rate Designs, Today" presented to CFC Forum, June 2016.

"Reviewing Rate Class Composition to Support Sound Rate Design" presented to EEI Rate and Regulatory Analysts Group Meeting, May 2016.

"Taking Public Power Economic Development to the Next Level" presented to APPA/Area Development's Public Power Consultants Forum, March 2016.

"Ratemaking for Environmental Compliance Plans" presented to NARUC Staff Subcommittee on Accounting and Finance Fall Conference, September 2015.

"Top Utility Strategies for Successful Attraction, Retention & Expansion" presented to APPA/Area Development's Public Power Consultants Forum, March 2015.

"Economic Development and Load Retention Rates" presented to NARUC Staff Subcommittee on Accounting and Finance Fall Conference, September 2013.

"The Case for Economic Development Rates: Theory and Regulatory Considerations" presented to 2011 Electric Cooperative Rate Conference, October 2011.

"Rates for Distributed Generation" presented to 2010 Electric Cooperative Rate Conference, October 2010.

"What Utilities Can Do to Advance Energy Efficiency in Kentucky" panel session of Second Annual Kentucky Energy Efficiency Conference, October 2007.

Articles

"Economic Development Rates: Public Service or Piracy?" *IAEE Energy Forum*, International Association for Energy Economics, 2016 Q1 (January 2016), 17-20.

Case No. 2019-00435

Exhibit Wolfram-2

Existing Big Rivers ES Tariff

ES - Environmental Surcharge:

Applicability:

To all Big Rivers' Members.

Availability:

The Environmental Surcharge ("ES") is mandatory to Standard Rate Schedule RDS, Standard Rate Schedule LIC, and to the FAC and the Non-FAC PPA adjustment clauses, including service to the Smelters under the Smelter Agreements.

Rate:

The ES shall provide for monthly adjustments based on a percent of revenues equal to the difference between the environmental compliance costs in the base period and in the current period based on the following formula:

CESF = Net Jurisdictional E(m)/Jurisdictional R(m)

MESF = CESF – BESF

MESF = Monthly Environmental Surcharge Factor
CESF = Current Environmental Surcharge Factor
BESF = Base Environmental Surcharge Factor (presently equal to zero)

Where E(m) is the total of each approved environmental compliance plan revenue requirement of environmental costs for the current expense month and R(m) is the revenue for the current expense month as set forth below.

Definitions:

Please see Section 4 for definitions common to all tariffs.

(1) E(m) = [(RB/12)(RORORB)] + OE – BAS

Where:

(a) RB is the Environmental Compliance Rate Base, defined as electric plant in service for applicable environmental projects adjusted for accumulated depreciation, cash working capital, spare parts inventory, and limestone inventory, and emission allowance inventory;

ES - Environmental Surcharge – (*continued*)

Definitions (*continued*):

(b) RORORB is the Rate of Return on the Environmental Compliance Rate Base, designated as the average cost of debt for environmental compliance plan projects approved by the Commission plus application of a Times Interest Earned Ratio of 1.24;

(c) OE represents the Monthly Pollution Control Operating Expenses, defined as the operating and maintenance expense and emission allowance expense of approved environmental compliance plans; and

(d) BAS is the net proceeds from By-Products and Emission Allowance Sales.

(2) Total E(m) is multiplied by the Jurisdictional System Allocation Ratio to arrive at Jurisdictional E(m). The Jurisdictional Allocation Ratio is the ratio of the 12-month total revenue from sales to Members to which the ES will be applied ending with the current expense month, divided by the 12-month total revenue from sales to Members and off-system sales for the current expense month.

(3) The revenue R(m) is the average monthly revenue, including base revenues and automatic adjustment clause charges or credits less Environmental Surcharge revenues, for Big Rivers for the twelve months ending with the current expense month.

(4) Jurisdictional E(m) is adjusted for Over/(Under) Recovery and, if ordered by the Commission, a Prior Period Adjustment to arrive at Net Jurisdictional E(m).

(5) The current expense month (m) shall be the second month preceding the month in which the ES is billed.

Case No. 2019-00435

Exhibit Wolfram-3

Existing Big Rivers ES Monthly Report

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT

Calculation of Monthly Billed Environmental Surcharge Factor - MESF
For the Expense Month Ending: MONTH DD,YYYY

MESF = CESF - BESF

Where:

CESF	=	Current Environmental Surcharge Factor
BESF	=	Base Environmental Surcharge Factor

Calculation of MESF:

CESF, from ES Form 1.10	=	0.000000%
BESF	=	0.000000%
MESF	=	0.000000%

Effective Date for Billing: Month DD, 2020

Submitted by: ______________________

Title: Manager of Finance

Date Submitted: ______________________

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Calculation of Total E(m) and Jurisdictional Surcharge Billing Factor

For the Expense Month Ending: MONTH DD,YYYY

Calculation of Total E(m)

E(m) =OE - BAS + RORB, where			$ -
OE	=	Pollution Control Operating Expenses	$ -
BAS	=	Total Proceeds from By-Product and Allowance Sales	$ -
RORB	=	[(RB/12) x (RORORB)]	$ -

(1)	Rate Base (RB) (Form 2.00)		=	$ -
(2)	Rate Base / 12		=	$ -
(3)	Rate of Return on Environmental Compliance Rate Base (RORORB)		=	0.00%
(4)	Return on Rate Base (RORB)	(2) x (3)	=	$ -
(5)	Operating Expenses (Form 2.00)		=	$ -
(6)	By-Product and Emission Allowance Sales (BAS) (Form 2.00)		=	$ -
(7)	Sub-Total E(m)	(4) + (5) - (6)	=	$ -

Calculation of Jurisdictional Environmental Surcharge Billing Factor

(8)	Member System Allocation Ratio for the Month (Form 3.00)		=	0.000000%
(9)	Subtotal E(m) = Subtotal E(m) x Member System Allocation Ratio	(7) x (8)	=	$ -
(10)	Adjustment for (Over)/Under Recovery, as applicable (Form 2.00)		=	$ -
	(10a) Prior Period Adjustment		=	$ -
(11)	E(m) = Subtotal E(m) plus (Over)/Under Recovery plus Prior Period Adjustment	(9) + (10) + (10a)	=	$ -
(12)	R(m) = Average Monthly Member System Revenue for the 12 Months Ending with the Current Expense Month (Form 3.00)		=	$ -
(13)	CESF: E(m) / R(m); as a % of Revenue	(11) ÷ (12)	=	0.000000%

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Revenue Requirements of Environmental Compliance Costs

For the Expense Month Ending: MONTH DD,YYYY

RB
Determination of Environmental Compliance Rate Base

Eligible Pollution Control Plant (Gross Plant) (Form 2.10)	$	-
Eligible Pollution Control CWIP (Form 2.10)	$	-
Subtotal	$	-
Additions:		
Inventory - Spare Parts (Form 2.20)	$	-
Inventory - Limestone (Form 2.20)	$	-
Inventory - Emission Allowances (Forms 2.31, 2.32, 2.33, and 2.34)	$	-
Cash Working Capital Allowance (Form 2.40)	$	-
Subtotal	$	-
Deductions:		
Accumulated Depreciation on Eligible Pollution Control Plant (Form 2.10)	$	-
Subtotal	$	-
Environmental Compliance Rate Base	$	-

OE
Determination of Pollution Control Operating Expenses:

Monthly Operation & Maintenance Expense (Form 2.50)	$	-
Monthly Depreciation and Amortization Expense (Form 2.10)	$	-
Monthly Taxes Other Than Income Taxes (Form 2.10)	$	-
Monthly Insurance Expense (1)	$	-
Monthly Emission Allowance Expense (Forms 2.31, 2.32, 2.33, and 2.34)	$	-
Amortization of Regulatory Asset	$	-
Total Pollution Control Operation Expense	$	-

BAS
Proceeds From By-Product and Allowance Sales:

Allowance Sales	$	-
Scrubber By-Products Sales	$	-
Total Proceeds from Sales	$	-

True-up Adjustment: Over/(Under) Recovery of Monthly Surcharge

B. Net Jurisdictional E(m) for MONTH Expense Month	$	-
D. E(m) recovered from MONTH Sales (Billed in MONTH)	$	-
E. Over/(Under) Recovery	$	-
Over recovery will be deducted from Jurisdictional E(m); (Under) recovery will be added to Jurisdictional E(m)		

(1) Monthly Insurance Expense is included with the Monthly Taxes Other Than Income Taxes amount above.

Form 2.10

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Plant, CWIP, Depreciation, & Taxes and Insurance Expenses

For the Expense Month Ending: MONTH DD,YYYY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Project No.	Description	Eligible Gross Plant in Service	Eligible Accumulated Depreciation	CWIP Amount	Eligible Net Plant	Monthly Depreciation Expense	Monthly Taxes and Insurance Expense
					(2) - (3) + (4)		
2012 Plan:							
Project 9	Wilson-Dry Sorbent Injection	$ -	$ -	$ -	$ -	$ -	$ -
Project 10	Green-Dry Sorbent Injection	$ -	$ -	$ -	$ -	$ -	$ -
	Total	$ -	$ -	$ -	$ -	$ -	$ -

Case No. 2019-00435
Exhibit Wolfram-3
Direct Testimony of John Wolfram

Form 2.20

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventories of Spare Parts and Limestone

For the Expense Month Ending: MONTH DD,YYYY

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Description	Beginning Inventory	Purchases	Other Adjustments	Utilized	Ending Inventory	Reason(s) for Adjustment
					(2)+(3)+(4)-(5)	
Spare Parts:						
Wilson - 2012 Plan Project 9 Spare Parts	$ -	$ -	$ -	$ -	$ -	
Green - 2012 Plan Project 10 Spare Parts	$ -	$ -	$ -	$ -	$ -	
Sub-total (Spare Parts)	$ -	$ -	$ -	$ -	$ -	
Limestone:						
Wilson - Limestone Inventory	$ -	$ -	$ -	$ -	$ -	
Sub-total (Limestone)	$ -	$ -	$ -	$ -	$ -	
Total	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory and Expense of Emission Allowances

Vintage Year	Number of Allowances				Total Dollar Value Of Vintage Year				Comments and Explanations
	SO_2 ARP	NOx Ozone Season CSAPR	NOx Annual CSAPR	SO_2 CSAPR	SO_2 ARP	NOx Ozone Season CSAPR	NOx Annual CSAPR	SO_2 CSAPR	
2014		-	-	-	$ -	$ -	$ -	$ -	The emission allowances reported on this form represent Big Rivers' remaining
2015		-	-	-	$ -	$ -	$ -	$ -	emission allowances under the Environmental Protection Agency's (EPA)
2016		-	-	-	$ -	$ -	$ -	$ -	Cross State Air Pollution Rule (CSAPR) and Acid Rain Program (ARP).
2017		-	-	-	$ -	$ -	$ -	$ -	
2018		-	-	-	$ -	$ -	$ -	$ -	
2019		-	-	-	$ -	$ -	$ -	$ -	
2020		-	-	-	$ -				
2021			-	-					
2022			-	-					
2023									
2024									
2025									
2026									
2027									
2028									
2029									
2030									
2031									
2032									
2033									
2034									
2035									
2036									
2037									
2038									
2039									
2040									

Other than the assignment of allowances by EPA, inventory adjustments include, but are not limited to, purchases, allowances acquired as part of other purchases, and the sale of allowances.

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of Acid Rain Program - Title IV. - SO_2 Emission Allowances - Current Vintage Year

For the Expense Month Ending: MONTH DD,YYYY

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
							The Acid Rain Program (ARP) was not affected by CSAPR, and Title IV. SO_2 emission
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							allowances will continue to be used for compliance with ARP.
Quantity	-	-	-	-	-	-	Separate SO_2 emission allowances are used for compliance with CSAPR and those
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	allowances may not be used for compliance with ARP.
	$ -						See Form 2.34 for detail of Big Rivers' CSAPR SO_2 emission allowances.
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - NOx Ozone Season Emission Allowances - Current Vintage Year

For the Expense Month Ending: MONTH DD,YYYY

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - NOx Annual Emission Allowances - Current Vintage Year

For the Expense Month Ending: MONTH DD,YYYY

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

ES FORM 2.34

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - SO_2 Emission Allowances - Current Vintage Year

For the Expense Month Ending: MONTH DD,YYYY

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
							The Acid Rain Program (ARP) was not affected by CSAPR, and separate (Title IV.) SO_2
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							emission allowances are still used for compliance with ARP.
Quantity	-	-	-	-	-	-	See Form 2.31 for detail of Big Rivers' Title IV. SO_2 emission allowances under the ARP.
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
O&M Expenses and Determination of Cash Working Capital Allowance

For the Expense Month Ending: MONTH DD,YYYY

Eligible O&M Expenses	
Jan	$ -
Feb	$ -
Mar	$ -
Apr	$ -
May	$ -
Jun	$ -
Jul	$ -
Aug	$ -
Sep	$ -
Oct	$ -
Nov	$ -
Dec	$ -
Total 12 Month O&M	$ -
Average Monthly O&M	$ -

Determination of Working Capital Allowance	
12 Months O&M Expense	$ -
One-Eighth (1/8) of 12 Month O&M Expenses	$ -

ES FORM 2.50

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Pollution Control - Operations & Maintenance Expenses

For the Expense Month Ending: MONTH DD,YYYY

O&M Expense Account	COLEMAN Station	GREEN Station	HMPL SII Station	WILSON Station	REID Station	TOTAL All Stations
2007 Plan:						
NOx Plan						
Anhydrous Ammonia	$ -	$ -	$ -	$ -	$ -	$ -
Emulsified Sulphur for NOx	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Total NOx Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
SO2 Plan						
Disposal-Bottom Ash	$ -	$ -	$ -	$ -	$ -	$ -
Disposal-Fly Ash	$ -	$ -	$ -	$ -	$ -	$ -
Off Spec Gypsum	$ -	$ -	$ -	$ -	$ -	$ -
Fixation Lime	$ -	$ -	$ -	$ -	$ -	$ -
Disposal-Flyash/Bottom Ash/Sludge	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Calcium Oxide (landfill stab.)	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Limestone	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Lime	$ -	$ -	$ -	$ -	$ -	$ -
Emulsified Sulphur for SO2	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-DiBasic Acid	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Sodium BiSulfite for SO2	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Hydroxy Basic Acid	$ -	$ -	$ -	$ -	$ -	$ -
Total SO2 Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
SO3 Plan						
Hydrated Lime for SO3	$ -	$ -	$ -	$ -	$ -	$ -
Activated Carbon	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Total SO3 Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -

Case No. 2019-00435
Exhibit Wolfram-3
Direct Testimony of John Wolfram
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BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Pollution Control - Operations & Maintenance Expenses

For the Expense Month Ending: MONTH DD,YYYY

O&M Expense Account	COLEMAN Station	GREEN Station	HMPL SII Station	WILSON Station	REID Station	TOTAL All Stations
2012 Plan:						
Project 9 - Wilson Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 9 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 10 - Green Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 10 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 11 - HMPL SII Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 11 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Current Month O&M Expense for All Plans	$ -	$ -	$ -	$ -	$ -	$ -

Form 3.00

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Monthly Average Revenue Computation of R(m)

For the Expense Month Ending: MONTH DD,YYYY

Revenues from Member Systems								Total Company Revenues	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Month	Base Rate Revenues	Fuel Clause Revenues	Non-FAC PPA Revenues	Environmental Surcharge Revenues	Total (2)+(3)+(4)+(5)	Total Excluding Environmental Surcharge (6)-(5)	Off-System Sales	Total (6)+(8)	Total Excluding Environmental Surcharge (9)-(5)
Jan	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Feb	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Mar	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Apr	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
May	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Jun	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Jul	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Aug	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sep	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Oct	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Nov	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Dec	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Average Monthly Member System Revenues, Excluding Environmental Surcharge, for 12 Months Ending Current Expense Month.						$ -			
Member System Allocation Percentage for Current Month (Environmental Surcharge excluded from Calculations): Column (7) / Column (10) =									0.000000%

Form 3.10

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Monthly Revenue Detail for Average Revenue Computation of R(m)

For the Expense Month Ending: MONTH DD,YYYY

	Revenue						
Class	**Demand**	**Energy**	**Base Rates**	**FAC**	**Non-FAC PPA**	**ES**	**Total**
Rural	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Large Industrial	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -

		Revenue						
Smelter	**Base Monthly Energy (KWH)**	**Premium ($0.00025 / kWh)**	**Base Monthly Energy**	**Base Monthly Energy Less Premium**	**FAC**	**Non-FAC PPA**	**ES**	**Total**
Alcan	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Century	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total				$ -	$ -	$ -	$ -	$ -

Case No. 2019-00435

Exhibit Wolfram-4

Proposed Big Rivers ES Monthly Report

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT

Calculation of Monthly Billed Environmental Surcharge Factor - MESF
For the Expense Month Ending: March 31, 2020

MESF = CESF - BESF

Where:

CESF	=	Current Environmental Surcharge Factor
BESF	=	Base Environmental Surcharge Factor

Calculation of MESF:

CESF, from ES Form 1.10	=	0.000000%
BESF	=	0.000000%
MESF	=	0.000000%

Effective Date for Billing: May 1, 2020

Submitted by: ____________________

Title: Manager of Finance

Date Submitted: ____________________

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Calculation of Total E(m) and
Jurisdictional Surcharge Billing Factor

For the Expense Month Ending: March 31, 2020

Calculation of Total E(m)

E(m) =OE - BAS + RORB, where			$ -
OE	=	Pollution Control Operating Expenses	$ -
BAS	=	Total Proceeds from By-Product and Allowance Sales	$ -
RORB	=	[(RB/12) x (RORORB)]	$ -

(1)	Rate Base (RB) (Form 2.00)		=	$ -
(2)	Rate Base / 12		=	$ -
(3)	Rate of Return on Environmental Compliance Rate Base (RORORB)		=	0.00%
(4)	Return on Rate Base (RORB)	(2) x (3)	=	$ -
(5)	Operating Expenses (Form 2.00)		=	$ -
(6)	By-Product and Emission Allowance Sales (BAS) (Form 2.00)		=	$ -
(7)	Sub-Total E(m)	(4) + (5) - (6)	=	$ -

Calculation of Jurisdictional Environmental Surcharge Billing Factor

(8)	Member System Allocation Ratio for the Month (Form 3.00)		=	0.000000%
(9)	Subtotal E(m) = Subtotal E(m) x Member System Allocation Ratio	(7) x (8)	=	$ -
(10)	Adjustment for (Over)/Under Recovery, as applicable (Form 2.00)		=	$ -
	(10a) Prior Period Adjustment		=	$ -
(11)	E(m) = Subtotal E(m) plus (Over)/Under Recovery plus Prior Period Adjustment	(9) + (10) + (10a)	=	$ -
(12)	R(m) = Average Monthly Member System Revenue for the 12 Months Ending with the Current Expense Month (Form 3.00)		=	$ -
(13)	CESF: E(m) / R(m); as a % of Revenue	(11) ÷ (12)	=	0.000000%

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Revenue Requirements of Environmental Compliance Costs
For the Expense Month Ending: March 31, 2020

RB
Determination of Environmental Compliance Rate Base

Eligible Pollution Control Plant (Gross Plant) (Form 2.10)	$	-
Eligible Pollution Control CWIP (Form 2.10)	$	-
Subtotal	$	-
Additions:		
Inventory - Spare Parts (Form 2.20)	$	-
Inventory - Limestone (Form 2.20)	$	-
Inventory - Emission Allowances (Forms 2.31, 2.32, 2.33, and 2.34)	$	-
Cash Working Capital Allowance (Form 2.40)	$	-
Subtotal	$	-
Deductions:		
Accumulated Depreciation on Eligible Pollution Control Plant (Form 2.10)	$	-
Subtotal	$	-
Environmental Compliance Rate Base	$	-

OE
Determination of Pollution Control Operating Expenses:

Monthly Operation & Maintenance Expense (Form 2.50)	$	-
Monthly Depreciation and Amortization Expense (Form 2.10)	$	-
Monthly Taxes Other Than Income Taxes (Form 2.10)	$	-
Monthly Insurance Expense [(1)]	$	-
Monthly Emission Allowance Expense (Forms 2.31, 2.32, 2.33, and 2.34)	$	-
Amortization of Regulatory Asset	$	-
Total Pollution Control Operation Expense	$	-

BAS
Proceeds From By-Product and Allowance Sales:

Allowance Sales	$	-
Scrubber By-Products Sales	$	-
Total Proceeds from Sales	$	-

True-up Adjustment: Over/(Under) Recovery of Monthly Surcharge

B. Net Jurisdictional E(m) for January 2020 Expense Month	$	-
D. E(m) recovered from February 2020 Sales (Billed in March 2020)	$	-
E. Over/(Under) Recovery	$	-
Over recovery will be deducted from Jurisdictional E(m); (Under) recovery will be added to Jurisdictional E(m)		

[(1)] Monthly Insurance Expense is included with the Monthly Taxes Other Than Income Taxes amount above.

Form 2.10

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Plant, CWIP, Depreciation, & Taxes and Insurance Expenses

For the Expense Month Ending: March 31, 2020

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Project No.	Description	Eligible Gross Plant in Service	Eligible Accumulated Depreciation	CWIP Amount	Eligible Net Plant	Monthly Depreciation Expense	Monthly Taxes and Insurance Expense
					(2) - (3) + (4)		
2012 Plan:							
Project 9	Wilson-Dry Sorbent Injection	$ -	$ -	$ -	$ -	$ -	$ -
Project 10	Green-Dry Sorbent Injection	$ -	$ -	$ -	$ -	$ -	$ -
2020 Plan:					$ -		
Project 12	Wilson-FGD / WWT	$ -	$ -	$ -	$ -	$ -	$ -
Project 13-1	Green-Ash Pond / WMB Pond / WWT	$ -	$ -	$ -	$ -	$ -	$ -
Project 14	Wilson-Phase 1 Landfill Cover	$ -	$ -	$ -	$ -	$ -	$ -
Project 15	Green-Landfill Drainage	$ -	$ -	$ -	$ -	$ -	$ -
					$ -		
	Total	$ -	$ -	$ -	$ -	$ -	$ -

Form 2.20

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventories of Spare Parts and Limestone

For the Expense Month Ending: March 31, 2020

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Description	Beginning Inventory	Purchases	Other Adjustments	Utilized	Ending Inventory	Reason(s) for Adjustment
					(2)+(3)+(4)-(5)	
Spare Parts:						
Wilson - 2012 Plan Project 9 Spare Parts	$ -	$ -	$ -	$ -	$ -	
Green - 2012 Plan Project 10 Spare Parts	$ -	$ -	$ -	$ -	$ -	
Sub-total (Spare Parts)	$ -	$ -	$ -	$ -	$ -	
Limestone:						
Wilson - Limestone Inventory	$ -	$ -	$ -	$ -	$ -	
Sub-total (Limestone)	$ -	$ -	$ -	$ -	$ -	
Total	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory and Expense of Emission Allowances

For the Expense Month Ending: March 31, 2020

Vintage Year	Number of Allowances				Total Dollar Value Of Vintage Year				Comments and Explanations
	SO_2 ARP	NOx Ozone Season CSAPR	NOx Annual CSAPR	SO_2 CSAPR	SO_2 ARP	NOx Ozone Season CSAPR	NOx Annual CSAPR	SO_2 CSAPR	
2014									The emission allowances reported on this form represent Big Rivers' remaining
2015									emission allowances under the Environmental Protection Agency's (EPA)
2016									Cross State Air Pollution Rule (CSAPR) and Acid Rain Program (ARP).
2017									
2018									
2019									
2020									
2021									
2022									
2023									
2024									
2025									
2026									
2027									
2028									
2029									
2030									
2031									
2032									
2033									
2034									
2035									
2036									
2037									
2038									
2039									
2040									

Other than the assignment of allowances by EPA, inventory adjustments include, but are not limited to, purchases, allowances acquired as part of other purchases, and the sale of allowances.

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT

Inventory of Acid Rain Program - Title IV. - SO_2 Emission Allowances - Current Vintage Year

For the Expense Month Ending: March 31, 2020

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
							The Acid Rain Program (ARP) was not affected by CSAPR, and Title IV. SO_2 emission
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							allowances will continue to be used for compliance with ARP.
Quantity	-	-	-	-	-	-	Separate SO_2 emission allowances are used for compliance with CSAPR and those
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	allowances may not be used for compliance with ARP.
							See Form 2.34 for detail of Big Rivers' CSAPR SO_2 emission allowances.
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

ES FORM 2.32

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - NOx Ozone Season Emission Allowances - Current Vintage Year

For the Expense Month Ending: March 31, 2020

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

ES FORM 2.33

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - NOx Annual Emission Allowances - Current Vintage Year

For the Expense Month Ending: March 31, 2020

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

ES FORM 2.34

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Inventory of CSAPR - SO_2 Emission Allowances - Current Vintage Year

For the Expense Month Ending: March 31, 2020

	Beginning Inventory	Allocations/ Purchases	Utilized (Coal Fuel)	Utilized (Other Fuels)	Sold	Ending Inventory	Allocation, Purchase, or Sale Date & Vintage Years
TOTAL EMISSION ALLOWANCES IN INVENTORY, ALL CLASSIFICATIONS							
Quantity	-	-	-	-	-	-	The EPA's Cross State Air Pollution Rule (CSAPR) became effective January 1, 2015
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	and replaced the EPA's previous Clean Air Interstate Rule (CAIR).
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
							The Acid Rain Program (ARP) was not affected by CSAPR, and separate (Title IV.) SO_2
ALLOCATED ALLOWANCES FROM EPA: COAL FUEL							emission allowances are still used for compliance with ARP.
Quantity	-	-	-	-	-	-	See Form 2.31 for detail of Big Rivers' Title IV. SO_2 emission allowances under the ARP.
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOCATED ALLOWANCES FROM EPA: OTHER FUELS							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
ALLOWANCES FROM PURCHASES:							
From Market:							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	
From Big Rivers							
Quantity	-	-	-	-	-	-	
Dollars	$ -	$ -	$ -	$ -	$ -	$ -	
$/Allowance	$ -	$ -	$ -	$ -	$ -	$ -	

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
O&M Expenses and Determination of Cash Working Capital Allowance

For the Expense Month Ending: March 31, 2020

Eligible O&M Expenses	
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
	$ -
Total 12 Month O&M	$ -
Average Monthly O&M	$ -

Determination of Working Capital Allowance	
12 Months O&M Expense	$ -
One-Eighth (1/8) of 12 Month O&M Expenses	$ -

ES FORM 2.50

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Pollution Control - Operations & Maintenance Expenses

For the Expense Month Ending: March 31, 2020

O&M Expense Account	COLEMAN Station	GREEN Station	HMPL SII Station	WILSON Station	REID Station	TOTAL All Stations
2007 Plan:						
NOx Plan						
Anhydrous Ammonia	$ -	$ -	$ -	$ -	$ -	$ -
Emulsified Sulphur for NOx	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Total NOx Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
SO2 Plan						
Disposal-Bottom Ash	$ -	$ -	$ -	$ -	$ -	$ -
Disposal-Fly Ash	$ -	$ -	$ -	$ -	$ -	$ -
Off Spec Gypsum	$ -	$ -	$ -	$ -	$ -	$ -
Fixation Lime	$ -	$ -	$ -	$ -	$ -	$ -
Disposal-Flyash/Bottom Ash/Sludge	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Calcium Oxide (landfill stab.)	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Limestone	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Lime	$ -	$ -	$ -	$ -	$ -	$ -
Emulsified Sulphur for SO2	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-DiBasic Acid	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Sodium BiSulfite for SO2	$ -	$ -	$ -	$ -	$ -	$ -
Reagent-Hydroxy Basic Acid	$ -	$ -	$ -	$ -	$ -	$ -
Total SO2 Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
SO3 Plan						
Hydrated Lime for SO3	$ -	$ -	$ -	$ -	$ -	$ -
Activated Carbon	$ -	$ -	$ -	$ -	$ -	$ -
Individual Expense Account Items	$ -	$ -	$ -	$ -	$ -	$ -
Total SO3 Plan O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -

Case No. 2019-00435
Exhibit Wolfram-4
Direct Testimony of John Wolfram
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BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Pollution Control - Operations & Maintenance Expenses

For the Expense Month Ending: March 31, 2020

O&M Expense Account	COLEMAN Station	GREEN Station	HMPL SII Station	WILSON Station	REID Station	TOTAL All Stations
2012 Plan:						
Project 9 - Wilson Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 9 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 10 - Green Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 10 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 11 - HMPL SII Hg						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 11 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
2020 Plan:						
Project 12 - Wilson FGD / WWT						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 12 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 13 - Ash Pond Closures						
13-1 Green Ash Pond Closure - Reg Asset Amort	$ -	$ -	$ -	$ -	$ -	$ -
13-1 Green Ash Pond Closure - O&M	$ -	$ -	$ -	$ -	$ -	$ -
13-1 Green Ash Pond Closure - WMB / WWT	$ -	$ -	$ -	$ -	$ -	$ -
13-2 Coleman Ash Pond Closure - Reg Asset Amort	$ -	$ -	$ -	$ -	$ -	$ -
13-2 Coleman Ash Pond Closure - O&M	$ -	$ -	$ -	$ -	$ -	$ -
13-3 Station Two Ash Pond Closure - Reg Asset Amort	$ -	$ -	$ -	$ -	$ -	$ -
13-3 Station Two Ash Pond Closure - O&M	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 13 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 14 - Wilson Phase 1 Landfill Cover						
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 14 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -

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ES FORM 2.50

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Pollution Control - Operations & Maintenance Expenses

For the Expense Month Ending: March 31, 2020

O&M Expense Account	COLEMAN Station	GREEN Station	HMPL SII Station	WILSON Station	REID Station	TOTAL All Stations
Project 15 - Green Landfill Drainage						
Green Allocation	$ -	$ -	$ -	$ -	$ -	$ -
Station Two Allocation	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 14 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Project 16 - CCR Environmental Compliance						
Green CCR Regulatory Asset Amortization	$ -	$ -	$ -	$ -	$ -	$ -
Station Two CCR Regulatory Asset Amortization	$ -	$ -	$ -	$ -	$ -	$ -
Wilson CCR Regulatory Asset Amortization	$ -	$ -	$ -	$ -	$ -	$ -
Reid CCR Regulatory Asset Amortization	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -
Total Project 14 O&M Expenses	$ -	$ -	$ -	$ -	$ -	$ -
Current Month O&M Expense for All Plans	$ -	$ -	$ -	$ -	$ -	$ -

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Form 3.00

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Monthly Average Revenue Computation of R(m)

For the Expense Month Ending: March 31, 2020

	Revenues from Member Systems							Total Company Revenues	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Month	Base Rate Revenues	Fuel Clause Revenues	Non-FAC PPA Revenues	Environmental Surcharge Revenues	Total (2)+(3)+(4)+(5)	Total Excluding Environmental Surcharge (6)-(5)	Off-System Sales	Total (6)+(8)	Total Excluding Environmental Surcharge (9)-(5)
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Average Monthly Member System Revenues, Excluding Environmental Surcharge, for 12 Months Ending Current Expense Month.						$ -			
Member System Allocation Percentage for Current Month (Environmental Surcharge excluded from Calculations): Column (7) / Column (10) =									0.000000%

Form 3.10

BIG RIVERS ELECTRIC CORPORATION
ENVIRONMENTAL SURCHARGE REPORT
Monthly Revenue Detail for Average Revenue Computation of R(m)

For the Expense Month Ending: March 31, 2020

	Revenue						
Class	Demand	Energy	Base Rates	FAC	Non-FAC PPA	ES	Total
Rural	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Large Industrial	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -

		Revenue						
Smelter	Base Monthly Energy (KWH)	Premium ($0.00025 / kWh)	Base Monthly Energy	Base Monthly Energy Less Premium	FAC	Non-FAC PPA	ES	Total
Alcan	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Century	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total				$ -	$ -	$ -	$ -	$ -

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Exhibit Wolfram–5

Estimated Member Billing Impact

Big Rivers Electric Corporation
2020 Environmental Compliance Plan
Estimated Member Billing Impact

Rate Class	2019 Annual Usage MWH	2019 Annual Billings $	2019 Annual Rate $/MWH	2023 Incr Rate $/MWH	New Rate $/MWH	New Billings $	Annual Increase $	Annual Increase %	Monthly Usage MWH	Monthly Increase $	Monthly Increase %
Rurals RDS	2,261,069	$195,139,886	86.30	2.09	88.40	$199,868,449	$4,728,562	2.42%	188,422	$394,047	2.42%
Large Industrials LIC	946,070	$61,139,947	64.63	1.58	66.20	$62,631,580	$1,491,633	2.44%	78,839	$124,303	2.44%