

**EXHIBIT NO. ___(RJR-24)
DOCKETS UE-17___/UG-17___
2017 PSE GENERAL RATE CASE
WITNESS: RONALD J. ROBERTS**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

Docket UE-17___

Docket UG-17___

**TWENTY-THIRD EXHIBIT (NONCONFIDENTIAL) TO THE
PREFILED DIRECT TESTIMONY OF**

RONALD J. ROBERTS

ON BEHALF OF PUGET SOUND ENERGY

JANUARY 13, 2017



Prepared for

Talen Montana, LLC
580 Willow Avenue
Colstrip, Montana 59323

Master Plan Summary Report Update

Colstrip Steam Electric Station

Prepared by

Geosyntec 
consultants

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Project Number ME1199

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Revision 1: 2 July 2015

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1. INTRODUCTION

This report, entitled “*Master Plan Update for Coal Combustion Residual Waste Management Systems, Effluent Holding Pond Areas and Plant Area, Colstrip Steam Electric Station, Colstrip Montana*”, has been prepared for Talen Montana, LLC (Talen) to present a Master Plan Summary for the development, operation, and closure of the water and waste management features at the Colstrip Steam Electric Station (CSES or the Station). The need for this Master Plan arose from new requirements for management of the coal combustion residuals (CCRs) that are generated at the site, which are codified in the United States Environmental Protection Agency’s (EPA’s) Final Rule for regulation of CCRs under Subtitle D of the Resource Conservation and Recovery Act (RCRA) – hereafter referred to as the CCR Rule.

This report was prepared by Geosyntec Consultants with support from DOWL of Billings Montana. The plan was developed throughout early 2015, and most recently updated in 2016, with input from Talen staff at the CSES including Mr. Gordon Criswell, Mr. Richard Borsheim, and Ms. Ashley Marcelli, as well as internal counsel (Ms. Heather McDowell of Talen) and external counsel (Mr. Douglas Green of Venable LLP). This report was prepared by Ms. Carrie H. Pendleton, P.E., and staff at Geosyntec, and it was reviewed by Mr. Michael F. Houlihan, P.E., of Geosyntec, in accordance with the firm’s peer review policy.

2. PROJECT BACKGROUND AND PURPOSE

On 17 April 2015, the United States Environmental Protection Agency (EPA) published the final CCR Rule. In anticipation of the promulgation of the CCR Rule, Talen Montana, LLC (Talen) contracted Geosyntec Consultants (Geosyntec) in December 2014 to develop a Master Plan for CSES to guide its efforts to bring the Station into compliance with the CCR Rule. The purpose of the master planning effort has been to describe the means and methods for managing water and waste at the Station in a manner that complies with the CCR Rule and other applicable regulations, and that most economically maintains the continuity and efficiency of the Station’s overall operation. The purpose of this updated document is to present an executive summary of the Master Plan. A comprehensive presentation of the original version of the Master Plan, including all calculations, analyses, and backup documentation, was presented in a report entitled, “*Master Plan – Colstrip Steam Electric Station*” prepared by Geosyntec Consultants and issued to Talen’s attorneys in November 2015. That document was prepared at the direction of Talen’s attorneys and is privileged. This document has been edited such that it does not include privileged information.

3. SITE BACKGROUND

CSES is located in Colstrip, Rosebud County, Montana. The location of the CSES is shown on Figure 1. Electric power is generated at two distinct facilities. Units 1 and 2 generate 614

megawatts (MW) of power and began commercial operation in 1975 and 1976; Units 3 and 4 generate 1,480 MW of power and began commercial operation in 1984 and 1986. The three primary areas of the Station are shown on Figures 2 through 4 and include the plant area, the Stage-Two Evaporation Pond (STEP) area, and the Effluent Holding Pond (EHP) area, respectively. Electricity generation operations at the Station produce two CCRs: (i) *scrubber slurry*, which includes the fly ash and flue gas desulfurization solids from the air pollution control system; and (ii) *bottom ash*, which is collected at the bottom of the boilers. The scrubber slurry is transferred as a slurry through pipes to either the STEP (for CCR generated at Units 1/2) or to EHP (for CCR generated at Units 3/4), where it is treated and dewatered (this resulting material is referred to as paste throughout this report) and then disposed. Bottom ash that is generated at the units is dewatered in bottom ash ponds at the plant area, and then transported via truck to EHP for disposal. The ponds at the Station also store and treat water that is used in plant operations. Because the Station is a “zero discharge” operation, the storage and evaporation functions of the ponds are critical to operations at the facility.

CCRs are managed at many different areas of the CSES. The status and current use of the impoundments are as follows:

CCR Unit ID	Status and Current Use of Unit
Plant Area Units	
Units 1&2 Fly A Pond	Full with CCRs prior to the effective date of the CCR Rule and no longer receives CCRs nor impounds water.
Units 1&2 B Pond	Contains a significant amount of CCRs and is currently in use for CCR disposal, as needed.
Units 1 & 2 Bottom Ash Pond	Contain a significant amount of bottom ash and water and is currently in use for bottom ash dewatering.
Units 3 & 4 Wash Tray Pond	CCRs removed prior to effective date of CCR Rule, contains no CCRs.
Units 3 & 4 Scrubber Drain Collection Pond (DC Pond)	CCRs removed prior to effective date of CCR Rule, contains no CCRs.
Units 3 & 4 Bottom Ash Pond	Contain a significant amount of bottom ash and water and is currently in use for bottom ash dewatering.
Units 1 & 2 Stage II Evaporation Pond	
A Cell	Full with CCRs prior to effective date of the CCR Rule and no longer receives CCRs nor impounds water.
B Cell (Clearwater Cell)	Used for water storage and is the current location of return water to the plant.
C Cell	Not yet constructed.
Old Clearwell	Contains CCRs and water and is currently in use.
D Cell	Currently used for water storage.

E Cell	Contains significant amounts of both paste/water and is currently in use..
Units 3 & 4 Evaporation Holding Pond	
A Cell	Contains a significant amount of bottom ash and other dry CCRs and is currently used for bottom ash disposal.
B Cell	Used for water storage and is the current location of return water to the plant.
C Cell	Contains significant amounts of paste and minimal water and is currently used for paste and bottom ash disposal.
D/E Cell	Contain significant amounts of dry CCRs and currently used for bottom ash disposal.
F Cell	Currently used for water storage.
G Cell	Contains significant amounts of paste and used for paste and bottom ash disposal.
H Cell	Currently used for water storage.
J Cell	Contains significant amounts of paste and used for paste disposal.

4. MASTER PLAN DEVELOPMENT: APPROACH

The Master Plan was developed by: (i) identifying relevant compliance parameters; (ii) identifying relevant site operating parameters; (iii) collecting data needed to perform the planning analyses and performing water balance analyses; (iv) analyzing current and future disposal capacities for water and waste under several potential future site development scenarios; and (v) estimating the cost for various candidate master plan approaches. Then, after incorporating input from Talen, an overall approach for future development of the CCR units at the Station was developed. The elements the Master Plan development process are summarized below, and the resulting Master Plan is described in the following section.

(i) Compliance Parameters. As described earlier, the need for this Master Plan arose from the need to achieve compliance with the CCR Rule. The primary sections of the CCR Rule that affect the schedule and cost components of the Master Plan are the Design Criteria (§257.70 through §257.74) and Closure (§257.100 through §257.102) sections of the CCR Rule. In addition, compliance with §257.82 of the CCR Rule (Hydrologic and hydraulic capacity requirements for CCR surface impoundments) is a key compliance parameter because non-compliance with these criteria could have required major modifications to the dams at the CSES. The applicability and impact of remaining components of the CCR Rule (i.e., Location Restrictions; Operating Criteria other than §257.82; Groundwater Monitoring and Corrective Action; Post-Closure Care; and Recordkeeping, Notification, and Posting of Information to the Internet) have been reviewed to the extent necessary to verify that no fatal flaws exist with any of the components of the Master Plan; however, further work on these components of CCR Rule compliance will be performed under a separate scope to Talen and is not part of the scope of this Master Plan.

(ii) Site Operating Parameters. In addition to complying with the CCR Rule, the Master Plan is intended to provide an approach that allows the site to operate while also having sufficient CCR disposal and water storage capacity that is compliant with the CCR Rule. This requires that disposal locations be selected and construction be scheduled such that capacity is available when needed without interrupting Station operations. For the Master Plan Summary, the Year 2022 was selected as the final year of operation for Units 1&2 and the Year 2040 was selected as the final year of operation for Units 3&4. For Units 3&4, this was selected so as to be sufficiently distant in the future (i.e., approximately 25 years) such that making decisions beyond that date is not particularly meaningful because the exact execution of the Master Plan may change within the 25-year timeframe.

(iii) Data Collection and Analysis. The data needed for development of the Master Plan was obtained from existing site records, discussion with site operations personnel, and studies performed during this project. The data collection efforts are summarized below.

- **Existing Data.** Geosyntec used information provided by Talen personnel over the past year to develop an understanding of the design of the CCR units, their intended operation, the characteristics of earth materials at the site, ambient environmental conditions, and the availability and cost of materials that could be used to construct closure systems or new waste or water management areas. In general, the information contained most of the data that Geosyntec needed to develop the master plan except for certain topographic information and water balance information, which are described below.
- **Topographic and Bathymetric Surveys.** An aerial survey was performed in December 2014 by Aerial Data Design to provide current surface elevations in the existing impoundments, which are either the surface of water or paste depending on the impoundment. In addition, a bathymetric survey of STEP A and E Cells was performed in April 2015 by DOWL. Bathymetric surveys were needed only for these cells because these are the only two cells where CCRs have been disposed that also have a significant volume of water present. The information from the two surveys, as well as base grade information where available, provided the information needed to calculate existing volumes of paste and water for use in the Master Plan. In some cases, the existing volume of paste could not be calculated due to a lack of information on the base grades of the impoundment; however, in those locations, there is no plan to remove paste and, therefore, existing paste volumes are not needed.
- **Water Balance Analysis.** In order to evaluate the disposal capacity needed for the CSSES, it was important for Geosyntec to understand the water generation and usage at the facility. AECOM performed a water balance analysis for the station entitled, “*Colstrip Steam Electric Station Water Balance & Pond Water*

Reduction Study” dated 18 February 2015, which was provided to Geosyntec. Based on the report and for the purposes of the Master Plan, Geosyntec assumed that the site has a “net zero” water balance each year (i.e., the amount of water generated from plant operations is equal to the combined amount of water evaporated in plant operations, at the ponds, and through forced evaporation). In addition, Geosyntec understands that Talen is in the process of designing and constructing a water treatment system that will allow the plant to re-use much of the water that is currently stored in impoundments at the facility. Worley Parsons evaluated water management needs for current plant operations and following shutdown of Units 1 and 2 and presented their evaluation in two reports entitled, “*Integrated Water Management Study Report*” and “*Shutdown Water Management Options Analysis.*” Information presented in this Master Plan Summary regarding water treatment and forced evaporation is based on these two reports.

- *Stormwater Analysis.* An analysis of stormwater runoff for existing and future conditions was performed for the CSES by DOWL of Billings, Montana. The purpose of the analysis was to estimate the amount of stormwater storage capacity that will need to be provided for the site. DOWL’s full computation package, including model outputs, is included as an appendix to the full Master Plan report. The analysis addresses two primary needs: (i) evaluating the site’s ability to remain a no-discharge facility throughout the time period covered by the Master Plan; and (ii) addressing the requirements of §257.82 of the CCR Rule (Hydrologic and hydraulic capacity requirements for CCR surface impoundments). The critical timeframe for both of these needs is the final year of the Master Plan, because this is when the cumulative volume of CCRs disposed is at a maximum and the volume available for water storage in surface impoundments is at a minimum. In addition, DOWL evaluated current conditions for compliance with §257.82 of the CCR Rule because the Station will need to document compliance with this in the near future. DOWL’s analysis indicates that, using the development approach described in the Master Plan, the Station will be able to satisfy both of the needs described herein.
- *Structural Integrity and Liner System Compliance Evaluation.* Geosyntec evaluated the ability of the liner systems at the CSES to meet the CCR Rule provisions in §257.71 (i.e., Liner Systems for Existing Surface Impoundments) and the ability of the embankments to meet the requirements of §257.73 (i.e., Structural Integrity Criteria for Existing CCR Surface Impoundments). The purpose of these evaluations was to identify any fatal flaws in the ability of the CCR units to meet these requirements. The analyses showed that: (i) many of the current liners at CSES do not meet the specific requirements of the CCR Rule, and so those types of liner systems will not be relied on in the Master Plan; and

(ii) the embankments at the CSES appear to meet the structural integrity requirements of the CCR rule and should not require upgrades to fill their function under the Master Plan.

(iv) **Disposal Capacity and Water Storage Needs.** Based on information provided to Geosyntec by Talen, Geosyntec was able to calculate the approximate annual quantities of paste and bottom ash disposed for each set of units. The calculated quantities in cubic yards per year are:

Units	Paste (cy/yr)	Bottom Ash (cy/yr)
U12	174,000	96,000
U34	651,000	262,000

In addition to the need for disposal capacity, the site will need to maintain ongoing water storage capacity for use in Station operations. The volumes needed for water storage capacity were provided to Geosyntec by Talen. The table below provides the ongoing water capacity needs and the location where the capacity will be provided.

Location	Water Storage Capacity (millions of gallons)	Water Storage Location
Plant	50	1&2 B Pond
Plant	1	1&2 Bottom Ash Clearwell
STEP	90	B Cell
EHP	100	New Clearwell

(v) **Costs of Future Development.** Costs of future development were estimated for each scenario considered. The basis for cost estimates was recent experience at CSES with similar construction work and Geosyntec’s experience with similar projects. In order to estimate costs for future development activities, a cost for typical construction activities anticipated to be performed at the Station was developed (e.g., capping, liner system) and this cost was then normalized on a per acre basis. This per acre cost was then be used to estimate construction costs for each of the anticipated impoundment construction activities based on the size of the existing or proposed impoundment. All costs presented are in 2016 dollars and have not been discounted to future costs.

5. MASTER PLAN: DESCRIPTION

The Master Plan that was developed using the approach described above is presented in Tables 1 through 4. Table 1 presents (in graphical form) the plan for Units 1 and 2 describing, for a given year, where return water to the plant will be stored, where CCRs will be disposed, and what construction and design activities will occur. The same information is presented in text format in Table 2, with the addition of design and construction costs as well as an estimate of Operation and Maintenance (O&M) activities and costs. Tables 3 and 4 present the same information as for Units 3 and 4. The information presented in Tables 1 through 4 is based on the following key assumptions.

- ***Determination of Which Units Must Comply.*** As of the effective date of the CCR Rule, surface impoundments that do not contain CCRs and water – and will not impound water – and that cease to accept CCRs for disposal are not required to comply with the CCR Rule. For the purposes of the Master Plan, several CSES impoundments will be unregulated; these include A Pond, Wash Tray Pond, and Scrubber Drain Pond at the plant area, A and B Cells at STEP, and F and H Cells at EHP. This Master Plan was developed under the assumption that these units will not be required to comply with the CCR Rule.
- ***Construction of Surface Impoundment over Closed Surface Impoundment.*** The Master Plan for EHP calls for constructing a CCR surface impoundment over an existing CCR surface impoundment that is properly closed under the CCR Rule. This is an important consideration at the EHP where there are existing CCRs in place in locations where new surface impoundments will be built. The CCR Rule does not specifically prohibit the construction of a new CCR surface impoundment over a closed CCR surface impoundment so long as all requirements of the Rule are met (i.e., the underlying unit is properly closed and the new unit meets all criteria for a new surface impoundment). Based on this, the Master Plan takes this approach for EHP and has followed the CCR Rule criteria regarding the proper closure of an existing surface impoundment and the criteria for the construction of a new surface impoundment.
- ***Conversion from Wet to Dry Disposal.*** Units 3&4 will continue to operate in the current manner for fly ash disposal (i.e., using the pasting process) until July 1, 2022. At that time, Units 3&4 will install a system to sufficiently dry the paste such that it can be disposed above grade in the impoundments which historically have been used for the disposal of paste. Nothing in the Rule prohibits the disposal of dry CCR in a CCR surface impoundment, provided the unit continues to meet the definition of a CCR surface impoundment and continues to meet all the criteria applicable to a surface impoundment. Therefore, CSES intends to continue disposing of CCR waste in the impoundment after CSES has converted to dry waste handling. This will require that

CSES continue to meet the CCR Rule requirements for operating impoundments (primarily related to §257.82).

- ***Use Cap as Portion of Liner System.*** Under the Master Plan, the cap of a properly closed unit will be used as a portion of the liner system for any new unit constructed over the closed unit so long as the CCR Rule's technical requirements for closing and constructing new units are met.
- ***Continued Use of Existing Impoundments.*** The CCR Rule allows the continued use of existing unlined surface impoundments (or surface impoundments whose liners do not meet the design requirements of the CCR Rule) as long as those surface impoundments are not contributing to a violation of a groundwater protection standard. Geosyntec assumes that it will be possible to demonstrate (through the groundwater monitoring network) that B Cell and D Cell at STEP have not contributed to a violation of a groundwater protection standard and, therefore, can continue to operate without installation of new liner systems. This Master Plan was developed assuming that this demonstration will be successful.
- ***Alternative Closure.*** Units 1 and 2 have a date certain for permanent cessation of the coal-fired boilers of July 1, 2022. Talen plans to comply with §257.103(b)(1) of the CCR Rule.
- ***Water Treatment.*** Finally, implementation of the Master Plan depends on being able to reduce water inventory prior to when existing cells are scheduled to be capped or used for CCR disposal. Talen has indicated that the new water treatment system will be operational by 2019. If operation of the water treatment system is delayed, implementation of the Master Plan may be impacted.

6. LIMITATIONS

The Master Plan described in this memorandum was developed based on Geosyntec's review of information provided by Talen and numerous interpretations of the new CCR Rule. Many of these interpretations are preliminary, and there is the possibility that future EPA guidance and/or litigation surrounding the rule will further clarify and/or cause amendments to these preliminary interpretations. Geosyntec applied our best interpretation of the CCR Rule at this time. If further controlling interpretations are developed, the preliminary interpretations developed by Geosyntec and the Master Plan elements that rely on them may need to be reevaluated. Finally, it is noted that there are a number of assumptions (as discussed in Section 5 of this report) that affect the recommendations of this Master Plan, which are subject to further verification.

TABLE 1
UNITS 1/2 CONSTRUCTION ACTIVITIES

Colstrip Steam Electric Station
Talen Montana, LLC - Colstrip, Montana

Impoundment Location	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
STEP																									
A Cell																									
B Cell																									
C Cell																									
D Cell																									
E Cell																									
Old Clearwell																									
Plant																									
Existing Bottom Ash Pond and Clearwell																									
A Pond																									
B Pond																									

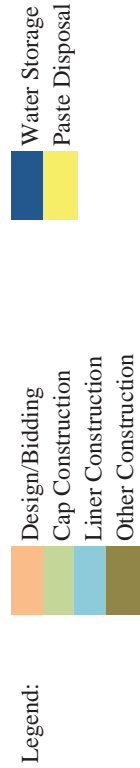


TABLE 2
UNITS 1/2 COSTS

Colstrip Steam Electric Station
Talen Montana, LLC - Colstrip, Montana

Year	Scrubber Slurry Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule					Total
					Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal	
2016	E	Design/Begin Construction Bottom Ash Dewatering System & new Scrubber Makeup Water Pond, Design/Construct Water Management System.	\$ 4,400,000	CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 200,000	\$ 260,000				\$ 460,000
2017	E			CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 200,000	\$ 520,000				\$ 720,000
2018	E&D	Design A Pond Closure	\$ 150,000	CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 200,000	\$ 520,000				\$ 720,000
2019	D	Design Capture Well Treatment System	\$ 200,000	CCR Rule-Specific O&M ¹ ; Pond Treatment System O&M	\$ 200,000					\$ 1,200,000
		Close A Pond	\$ 2,500,000							
		Design STEP A Cell closure	\$ 300,000							
2020	D	Close STEP A Cell	\$ 8,600,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Treatment System O&M	\$ 200,000					\$ 1,228,000
		Design Capture Well Storage Pond	\$ 150,000							
		Design/Construct Capture Well Treatment System	\$ 6,460,000							
2021	D	Construct Capture Well Storage Pond	\$ 1,710,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Treatment System O&M	\$ 200,000					\$ 1,312,800
		Construct Capture Well Treatment System	\$ 10,336,000							
		Design STEP Old Clearwell closure	\$ 300,000							
		Design STEP E Cell closure	\$ 300,000							
		Design Bottom Ash Pond closure	\$ 300,000							
		Close STEP Old Clearwell	\$ 2,300,000							
2022	D	Close STEP E Cell.	\$ 9,500,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Treatment System O&M	\$ 200,000					\$ 812,800
		Complete construction of Capture Well Treatment System	\$ 9,044,000							
		Close bottom ash ponds and clearwell.	\$ 1,700,000							
		Design STEP D Cell closure	\$ 300,000							
		Design B Pond Closure at plant area.	\$ 150,000							
		Close STEP D Cell	\$ 5,300,000							
2023		Close B Pond	\$ 2,800,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 200,000					\$ 4,192,492
		Prepare STEP B Cell for use as post-closure stormwater management pond	\$ 500,000							
2024				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000					\$ 4,218,292
2025				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000					\$ 4,218,292
2026				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000					\$ 4,218,292

Year	Scrubber Slurry Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule					Total
					Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal	
2027				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,759,380	\$ 320,600		\$ 3,229,980
2028				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,759,380	\$ 320,600		\$ 3,229,980
2029				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2030				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2031				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2032				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2033				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2034				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2035				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2036	N/A			CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2037				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2038				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 2,232,570	\$ 320,600		\$ 2,703,170
2039				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2040				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2041				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2042				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2043				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2044				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2045				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2046				CCR Rule-Specific O&M; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348

Year	Scrubber Slurry Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule					Total
					Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal	
2047				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2048				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ 1,967,748	\$ 320,600		\$ 2,438,348
2049				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ -	\$ 320,600		\$ 470,600
2050				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ -	\$ 320,600		\$ 470,600
2051				CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 150,000		\$ -	\$ 320,600		\$ 470,600

Note 1: "CCR Rule-Specific O&M¹" includes the additional cost of monitoring, maintenance, and operations resulting from the CCR Rule, and includes: (i) dust

and groundwater monitoring that is not already being performed; (ii) data and website management; and (iii) inspections and periodic technical

Note 2: Post Closure Care is assumed to be \$2,000 per acre of closed impoundment and includes maintenance of final cover as needed to maintain integrity & effectiveness and address settlement & erosion; O&M of leachate collection &

Note 3: Forced evaporation and wastewater treatment costs are from evaluations performed by Worley Parsons.

TABLE 3
UNITS 3/4 CONSTRUCTION ACTIVITIES

Colstrip Steam Electric Station
Talen Montana, LLC - Colstrip, Montana

Impoundment Location	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
EHP																									
A Cell	Design/Bidding	Cap Construction																							
B Cell			Other Construction																						
C Cell	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
D/E Cells	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
G Cell	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
J/J-1 Cell	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
New Clearwell	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
Paste Plant Bypass	Design/Bidding	Cap Construction	Other Construction				Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage	Water Storage
Plant																									
Bottom Ash Dewatering System	Design/Bidding	Cap Construction	Other Construction																						
Existing Bottom Ash Pond and Clearwell																									

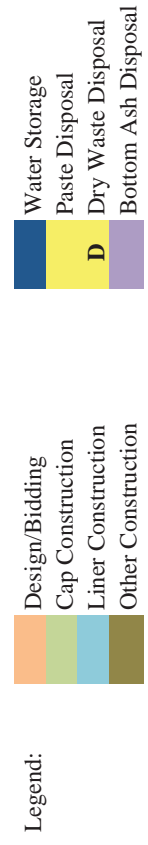


TABLE 4
UNITS 3/4 COSTS

Colstrip Steam Electric Station - Units 3&4
Tahen Montana - Colstrip, Montana

Year	Scrubber Slurry Disposal Location	Bottom Ash Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule					Total
						Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal	
2016	C paste	A/C/D/E	Construct compliant closure and liner system in EHP J Cell, begin construction of bottom ash dewatering system, design EHP New Clearwell and A Cell closure, construct forced evaporation system, design pond chemistry water treatment system.	\$ 21,600,000	CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 350,000	\$ 260,000				\$ 610,000
2017	C/J paste	C/D/E	Construct EHP New Clearwell and close A Cell.	\$ 13,400,000	CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 350,000	\$ 520,000				\$ 870,000
2018	C/J paste	C/D/E	Design EHP G Cell Closure & Liner System Begin construction of pond chemistry water treatment system.	\$ 400,000 \$ 10,000,000	CCR Rule-Specific O&M ¹ ; Forced Evaporation O&M	\$ 350,000	\$ 520,000		\$ 46,200		\$ 916,200
2019	J paste	G	Construct closure and liner system in EHP G Cell. Finish construction of pond chemistry water treatment system. Design closure for plant area bottom ash pond. Conduct Pilot Test for dry waste disposal system Close EHP B Cell	\$ 300,000 \$ 500,000 \$ 5,300,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M	\$ 350,000		\$ 2,000,000	\$ 46,200		\$ 2,396,200
2020	J paste	G	Design dry waste disposal system. Close plant area bottom ash pond. Design paste plant bypass.	\$ 500,000 \$ 3,100,000 \$ 400,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M	\$ 350,000		\$ 2,000,000	\$ 124,200		\$ 2,474,200
2021	J paste	G	Construct dry waste disposal system. Construct paste plant bypass in EHP C Cell.	\$ 10,000,000 \$ 4,000,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M	\$ 350,000		\$ 2,000,000	\$ 154,200		\$ 2,504,200
2022	G dry	G	Design closure for EHP D/E Cells. Close EHP D/E Cells.	\$ 500,000 \$ 7,900,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 154,200	\$ 1,750,000	\$ 4,254,200
2023	G/C dry	G/C	Construct closure and partial liner system in EHP C Cell Design closure for EHP J-1 Cell.	\$ 13,900,000 \$ 400,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 232,600	\$ 3,500,000	\$ 6,082,600
2024	G/C dry	G/C	Close EHP J-1 Cell	\$ 11,600,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 304,400	\$ 3,500,000	\$ 6,154,400
2025	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2026	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2027	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2028	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2029	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2030	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2031	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2032	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2033	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600

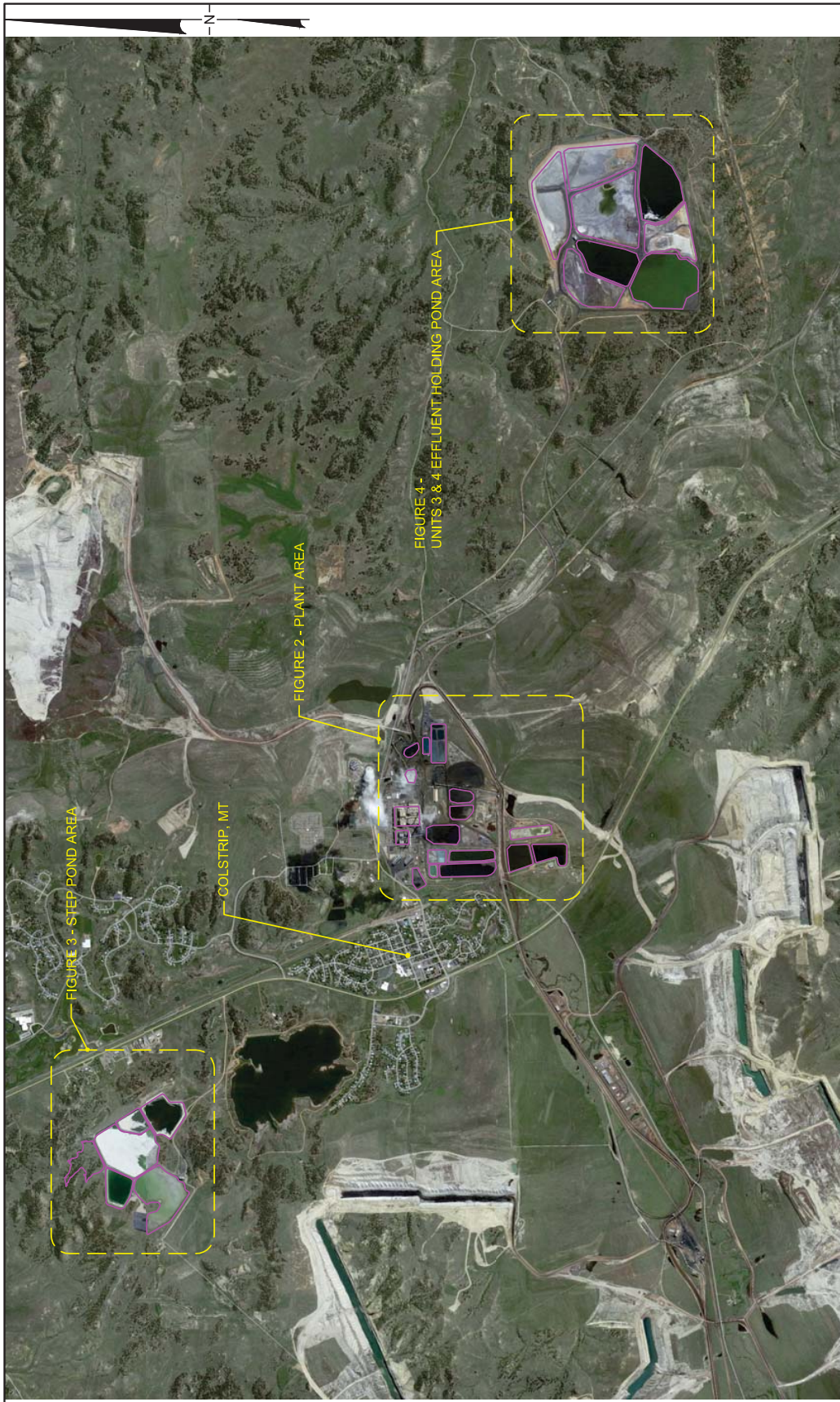
Year	Scrubber Slurry Disposal Location	Bottom Ash Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule					Total
						Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal	
2034	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2035	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2036	G/C dry	G/C			CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2037	G/C dry	G/C	Design Capture Well Treatment System	\$ 200,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2038	G/C dry	G/C	Construct Capture Well Treatment System.	\$ 12,500,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2039	G/C dry	G/C	Design closure for CIG; Design closure for EHP New Clearwell Construct Capture Well Treatment System.	\$ 400,000 \$ 400,000 \$ 12,500,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Pond Chemistry Treatment System O&M; Dry Disposal O&M	\$ 350,000		\$ 2,000,000	\$ 418,600	\$ 3,500,000	\$ 6,268,600
2040	--	--	Close EHP C/G Cells. Close EHP New Clearwell	\$ 18,300,000 \$ 3,100,000	CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 418,600		\$ 1,718,600
2041					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2042					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2043					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2044					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2045					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2046					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2047					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2048					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2049					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 1,000,000	\$ 682,000		\$ 1,982,000
2050					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2051					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2052					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2053					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2054					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2055					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2056					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2057					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000
2058					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000

Year	Scrubber Slurry Disposal Location	Bottom Ash Disposal Location	Construction and Design Activities	Design and Construction Costs	O&M Activities	Estimated O&M Costs Resulting from CCR Rule						Total
						Monitoring	Forced Evaporation	Wastewater Treatment	Post Closure Care	Landfill Dry Disposal		
2059					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 700,000	\$ 682,000		\$ 1,682,000	
2060					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2061					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2062					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2063					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2064					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2065					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2066					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2067					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2068					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	
2069					CCR Rule-Specific O&M ¹ ; Post Closure Care; Capture Well Treatment System O&M	\$ 300,000		\$ 400,000	\$ 682,000		\$ 1,382,000	

Note 1: "CCR Rule-Specific O&M" includes the additional cost of monitoring, maintenance, and operations resulting from the CCR Rule, and includes: (i) dust and groundwater monitoring that is not already being performed; (ii) data and website management; (iii) inspections and periodic technical demonstrations; and (iv) dry waste disposal operations beginning in 2022.

Note 2: Post Closure Care costs of approximately \$2,000 per acre of capped area include maintenance of final cover as needed to maintain integrity & effectiveness and address settlement & erosion; O&M of leachate collection & removal system; O&M of groundwater monitor

Note 3: Forced evaporation and wastewater treatment costs are from evaluations performed by Worley Parsons.

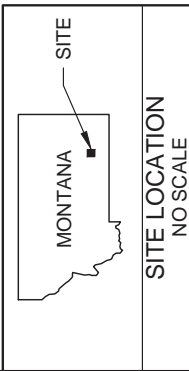


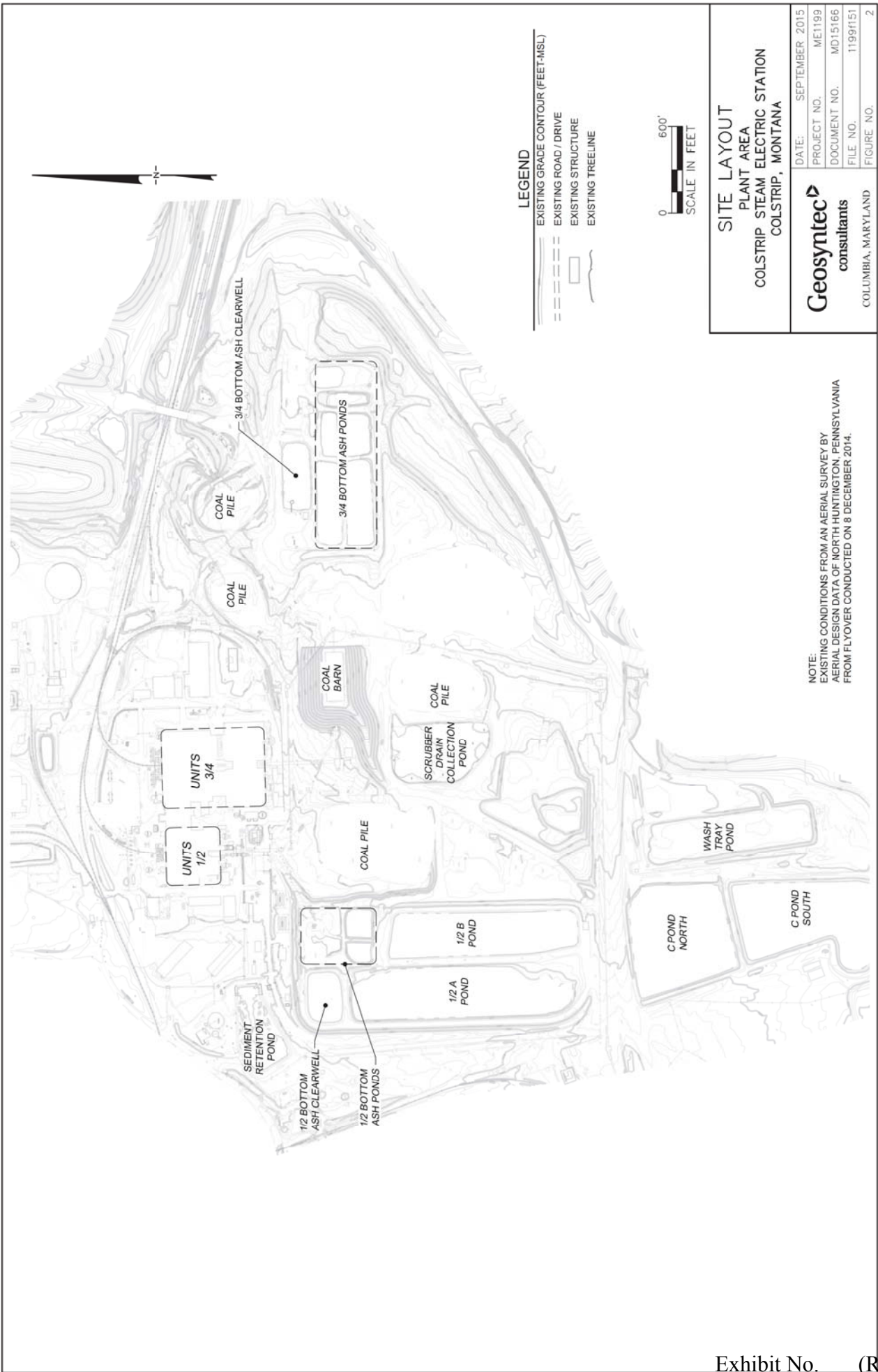
PROJECT LOCATION MAP
COLSTRIP STEAM ELECTRIC STATION
COLSTRIP, MONTANA

DATE:	SEPTEMBER 2015
PROJECT NO.	ME1199
DOCUMENT NO.	MD15166
FILE NO.	1199f154
FIGURE NO.	1

Geosyntec
consultants
 COLUMBIA, MARYLAND

BACKGROUND © GOOGLEMAPS (2015)







LEGEND

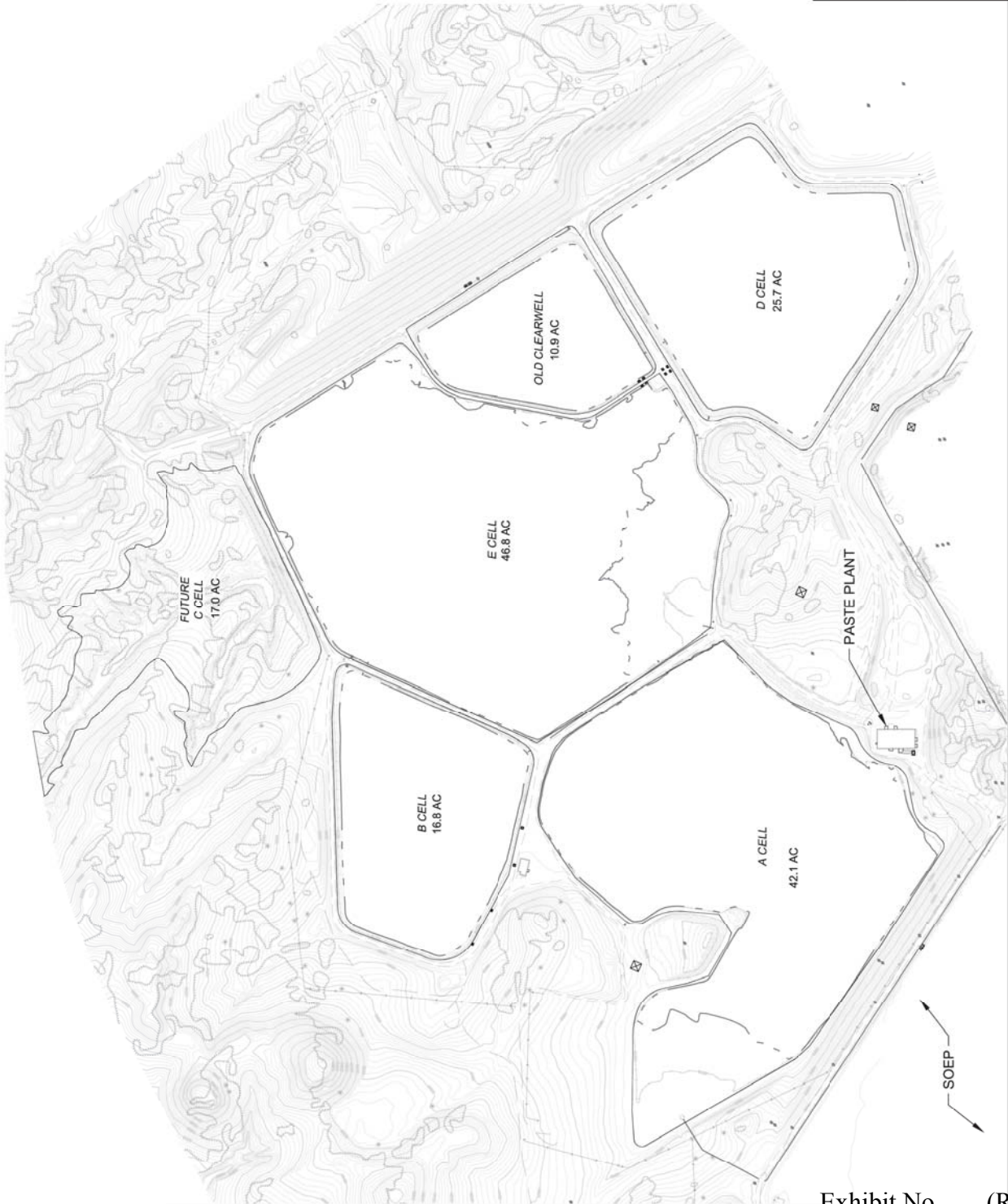
- EXISTING GRADE CONTOUR (FEET-MSL)
- EXISTING ROAD / DRIVE
- EXISTING STRUCTURE
- EXISTING TREELINE
- EXISTING WATERLINE

NOTE:
EXISTING CONDITIONS FROM AN AERIAL SURVEY BY
AERIAL DESIGN DATA OF NORTH HUNTINGTON, PENNSYLVANIA
FROM FLYOVER CONDUCTED ON 8 DECEMBER 2014.



SITE LAYOUT
STEP POND AREA
COLSTRIP STEAM ELECTRIC STATION
COLSTRIP, MONTANA

Geosyntec consultants	DATE: SEPTEMBER 2015
COLUMBIA, MARYLAND	PROJECT NO. ME1199
	DOCUMENT NO. MD15166
	FILE NO. 1199ft152
	FIGURE NO. 3





LEGEND

- EXISTING GRADE CONTOUR (FEET-MSL)
- - - EXISTING ROAD / DRIVE
- EXISTING STRUCTURE
- ~ EXISTING TREELINE
- - - - EXISTING WATERLINE

NOTE:
 EXISTING CONDITIONS FROM AN AERIAL SURVEY BY
 AERIAL DESIGN DATA OF NORTH HUNTINGTON, PENNSYLVANIA
 FROM FLYOVER CONDUCTED ON 8 DECEMBER 2014.



SITE LAYOUT
UNITS 3 & 4 EFFLUENT HOLDING POND AREA
COLSTRIP STEAM ELECTRIC STATION
COLSTRIP, MONTANA

Geosyntec consultants	DATE: SEPTEMBER 2015
COLUMBIA, MARYLAND	PROJECT NO. ME1210
	DOCUMENT NO. MD15166
	FILE NO. 1199f153
	FIGURE NO. 4