

## 2020 ECR Plan Status Update Report Quarterly Report – Update #14 April 30, 2024

### Executive Summary:

#### General

This report covers LG&E and KU’s (“Companies”) progress on the 2020 Environmental Cost Recovery (“ECR”) Plan through the first quarter of 2024. The Companies filed applications requesting approval of their 2020 ECR Plan on March 31, 2020<sup>1</sup> and received approval on September 29, 2020.

The 2020 ECR Plan safety performance through the first quarter of 2024 remains excellent with a Year-to-Date OSHA Recordable Incident Rate of 0.0 and an Inception-to-Date OSHA Recordable Incident Rate of 0.0, compared to the industry average of 2.4.

Work to date continues to focus on construction and startup activities at all three stations: Trimble County (“TC”), Ghent (“GH”), and Mill Creek (“MC”). At all three sites, work has included installation of above ground piping and electrical conduit/cable; ongoing loop checks for the control wiring which will continue into next quarter, start-up activities for Bottom Ash at GH as well as performance testing of the TC Effluent Limitation Guidelines (“ELG”) system.

Compared to the total 2020 ECR Plan projected cost of \$405.2 million (net)<sup>2</sup>, as provided in Case Nos. 2020-00060 (KU) and 2020-00061 (LG&E), the projected spend, as of the first quarter of 2024, remains at the \$272.6 million (net)<sup>2</sup> reported last quarter. This projected spend continues to represent a \$132.6 million (net) reduction from the original filing. The total spend to date increased to \$234.5 million (net)<sup>2</sup> through March 31, 2024.

#### Background

The Environmental Protection Agency’s (“EPA”) 2015 ELG Rule and amendments precipitated the need to construct ELG water treatment systems at TC, MC and GH, as well as a Bottom Ash Transport Water (“BATW”) recirculation system at GH. The EPA’s proposed amendments to the 2015 ELG Rule were finalized in the Fall of 2020. The current ELG Rule includes daily maximum and monthly average limits for the concentration of mercury, nitrates/nitrites, selenium and arsenic allowed in Flue-Gas Desulfurization (“FGD”) wastewater effluent.

To meet the revised limits for these constituents, the Companies are required to install ELG water treatment systems to treat the effluent from the physical/chemical FGD process water treatment systems recently placed into service as described in the 2016 ECR Plan quarterly reports. Without the proposed 2020 ECR Plan projects at TC, MC, and GH stations, the Companies would not be able to continue steam generating operations at these generating stations and simultaneously comply with the ELG Rule, as enforced by

<sup>1</sup> Case No. 2020-00060 and Case No. 2020-00061

<sup>2</sup> Co-Owners of the Trimble County plant: Illinois Municipal Electric Agency (IMEA) and Indiana Municipal Power Agency (IMPA) are responsible for 25%. IMEA owns 12.12% and IMPA owns 12.88%. Co-owner shares are not included in the costs provided in this report.

Kentucky Pollutant Discharge Elimination System (“KPDES”) permits at each generating station. This would significantly impair the Companies’ ability to fulfill their mandate to provide adequate, efficient, and reasonable service to their ratepayers, as these generating stations are the three largest generating stations within the Companies’ generating fleet. The ELG Rule requires compliance for the FGD wastewater as soon as possible on or after November 1, 2020, but no later than December 31, 2025<sup>3</sup>.

The final ELG Rule also includes up to 10 percent volumetric discharge limit (on a 30-day rolling average) for BATW, which also must be complied with “as soon as possible” but in no event later than December 31, 2025. This proposed discharge limit requires KU to construct a BATW recirculation system on the existing bottom ash transport system at GH. The recirculation system will collect the transport water currently discharged from the remote bottom ash dewatering facility and reroute it through tanks and piping systems back to the four generating units for reuse. TC and MC do not require a BATW recirculation system due to their bottom ash transport systems being previously converted to a dry transport instead of a wet sluicing system like GH’s.

On April 25, 2024, the EPA released a pre-publication of the final ELG Rule requiring membrane filtration followed by solidification, or thermal evaporation for zero discharge of FGD Wastewater; zero discharge of Bottom Ash Transport Water; zero discharge of combustion residual leachate waters, and did not establish specific limitations for Legacy Waste Water as the permitting authority will be responsible to establish site-specific technology-based limits. The pre-publication stipulates compliance as soon as possible, but no later than December 31, 2029. The Companies are currently reviewing the pre-publication copy of the final ELG rule to determine impacts to ongoing projects and to establish future compliance strategy.

**Schedules**

**FGD Process Water Treatment Facilities and Diffusers**

<b><u>Project</u></b>	<b><u>Project #</u></b>	<b><u>Awarded Contractor</u></b>	<b><u>Status</u></b> <sup>4</sup>	<b><u>Planned / Actual In-Service Date</u></b> <sup>5</sup>
Trimble County Effluent Limitations Guidelines Water Treatment System <sup>6</sup>	KU Project 44 LG&E Project 32	OKEP	Awarded March 15, 2021	September 2024
Mill Creek Effluent Limitations Guidelines Water Treatment System <sup>6</sup>	LG&E Project 31	OKEP	Awarded March 15, 2021	November 2024
Mill Creek Outfall 025 Diffuser	LG&E Project 31	Tetra Tech	Awarded May 12, 2021	Placed in service December 2021
Ghent Effluent Limitations Guidelines Water Treatment System <sup>6</sup>	KU Project 43	OKEP	Awarded March 15, 2021	December 2024

<sup>3</sup> 84 Fed. Reg. 64664.

<sup>4</sup> Project Engineering Department or Engineering, Procurement, and Construction (“EPC”) Contract work status.

<sup>5</sup> The Planned In-Service Dates are per the 2020 ECR Plan filing (Straight Testimony, page 4-5) or the current, active construction schedule. Actual in-service dates are signified with red font.

<sup>6</sup> ELG Equipment OEM: Frontier

Ghent Bottom Ash Transport Water Recirculation System <sup>7</sup>	KU Project 43	OKEP	Awarded March 15, 2021	April 2024
Ghent Outfall 001 Diffuser	KU Project 43	MAC Construction & Excavating	Awarded March 22, 2021	Placed in service December 2021

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<sup>7</sup> BATW Equipment OEM: United Conveyor Corporation

## **Quarterly Status Update:**

### **General**

The engineering, procurement, and construction, (“EPC”) contracts for TC, MC, and GH were awarded on March 15, 2021 to Old Kentucky Energy Partners (“OKEP”), which is a joint venture between Bowen Engineering (a local company) and United E&C. At TC, GH and MC, work has included continued installation of above ground piping and electrical conduit/cable; installation of process equipment and electrical gear; installation of fiberglass tanks; heat tracing; initiation of commissioning activities at MC; and performance testing on TC’s ELG and GH BATW systems. Electrical work completed consisted of setting of switchgears, motor control center’s, installing cable tray, and conduit.

Burns & McDonnell (“B&McD”) is the ELG Owner’s Engineer and is assisting the Companies with reviewing engineering, design and construction support related to submittals and fieldwork from the EPC (OKEP) and ELG technology providers (Frontier – ELG) or United Conveyor Corporation (Ghent BATW).

### **KU Project 44 and LG&E Project 32 – Trimble County (TC) Station Effluent Limitations Guidelines (ELG) Water Treatment System**

#### **General**

Project 44 (KU) and Project 32 (LG&E) are for construction of an ELG water treatment system at the TC generating station. The current forecasted capital cost to implement these facilities remains \$51.6 million (net)<sup>8</sup>, allocated between KU and LG&E, with Mechanical Completion achieved in October 2023 and planned in-service by September 2024. The planned in-service date has been adjusted to address impacts associated with late delivery of critical electrical components and failure of the initial performance test due to biomass shed as further described below.

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<sup>8</sup> KU’s 48 percent ownership allocation equals \$24.8 million (Project 44) and LG&E’s 52 percent ownership allocation equals \$26.8 million (Project 32) – both costs are net.

## ELG

The ELG system is being constructed in close proximity to the recently completed process water treatment system (“PWS”). All facilities are being installed on land currently owned by KU and LG&E at the generating station. The system is designed to handle water flow capacity up to 750 gallons per minute. Engineering was completed in the first-quarter of 2024. The remaining home-office focus is the completion of as-built drawings. Field work continued with piping and electrical installation associated with the Maintenance Tank and pump house, and continuation of the ELG system Performance Testing.

As previously reported, the first Performance Test in late 2023 did not pass due to the noted biomass shed from the bioreactors. In line with how system testing often identifies process issues requiring tuning and optimization, OKEP and the OEM, Frontier, evaluated the conditions of the failed test and requested plant modifications upstream of the ELG system prior to the second Performance Test. After chemical modifications the flue gas de-sulfurization unit (FGD) of TC1, the second Performance Test was successfully completed during the first quarter of 2024. Achievement of Commercial Operation and Final Completion are anticipated to be completed during the second quarter of 2024.

Although the second Performance Test was successful, long-term system reliability and economic considerations led to the execution of a contract with B&McD to review possible FGD system chemical, mechanical, or operational (or a combination thereof) modifications to TC1. Until this engineering is vetted and a solution determined, the generating station will utilize the same chemicals which facilitated the successful Performance Test; this chemical change results in increased costs.

Reliable operations and maintenance of the new ELG facility, requires on site spare parts and materials. A new warehouse is necessary for this purpose and will be constructed adjacent to the ELG facility. This construction contract was awarded to East & Westbrook Construction, Inc.



*Trimble County – ELG Water Treatment Location – December 2023*



*Trimble County – ELG Water Treatment Location – March 2024*

## **LG&E Project 31 – Mill Creek (MC) Station Effluent Limitations Guidelines (ELG) Water Treatment System and Diffuser**

### **General**

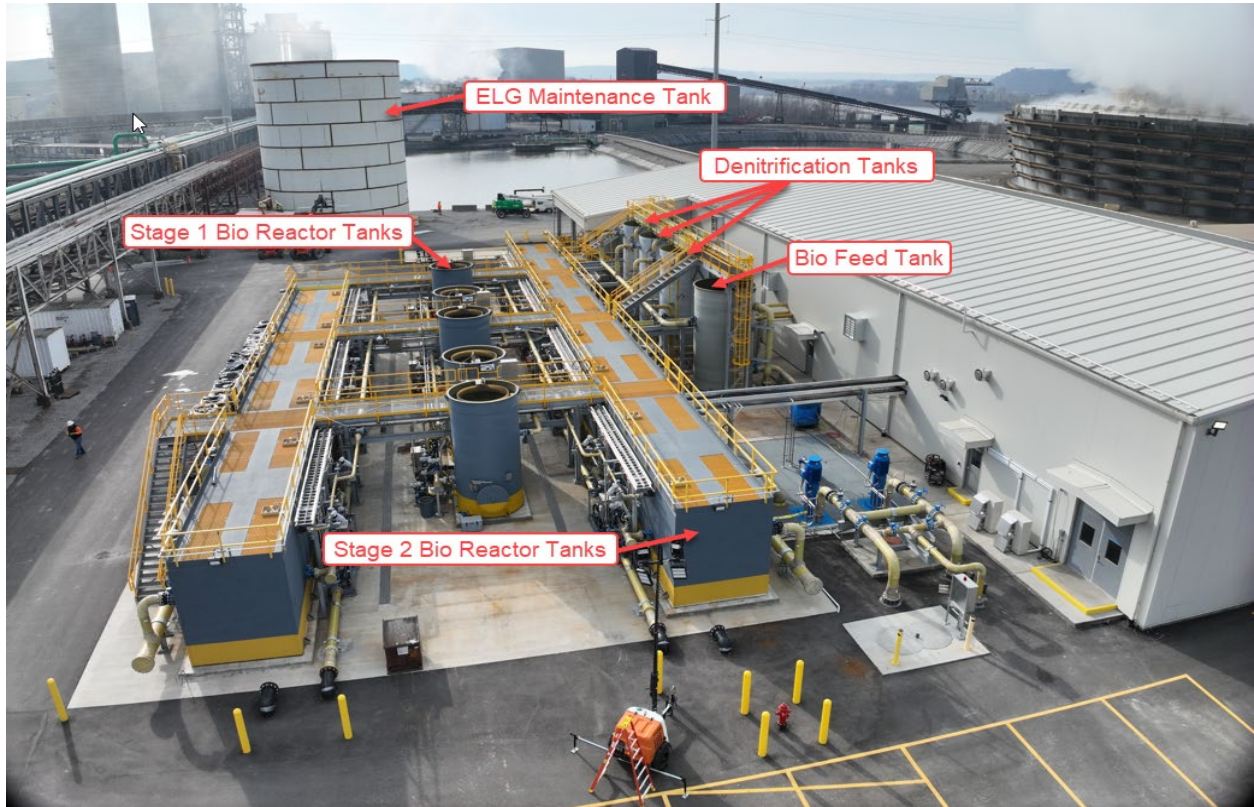
Project 31 is for construction of an ELG water treatment system and wastewater diffuser at the MC generating station. The current forecasted capital costs to implement this project remains \$72.0 million. The MC project team has engaged the TC and GH project teams during all major reviews to apply lessons learned from the other projects. This collaborative effort was implemented to ensure lessons learned are applied across all the projects to promote a common fleet approach to the ELG program.

### **ELG**

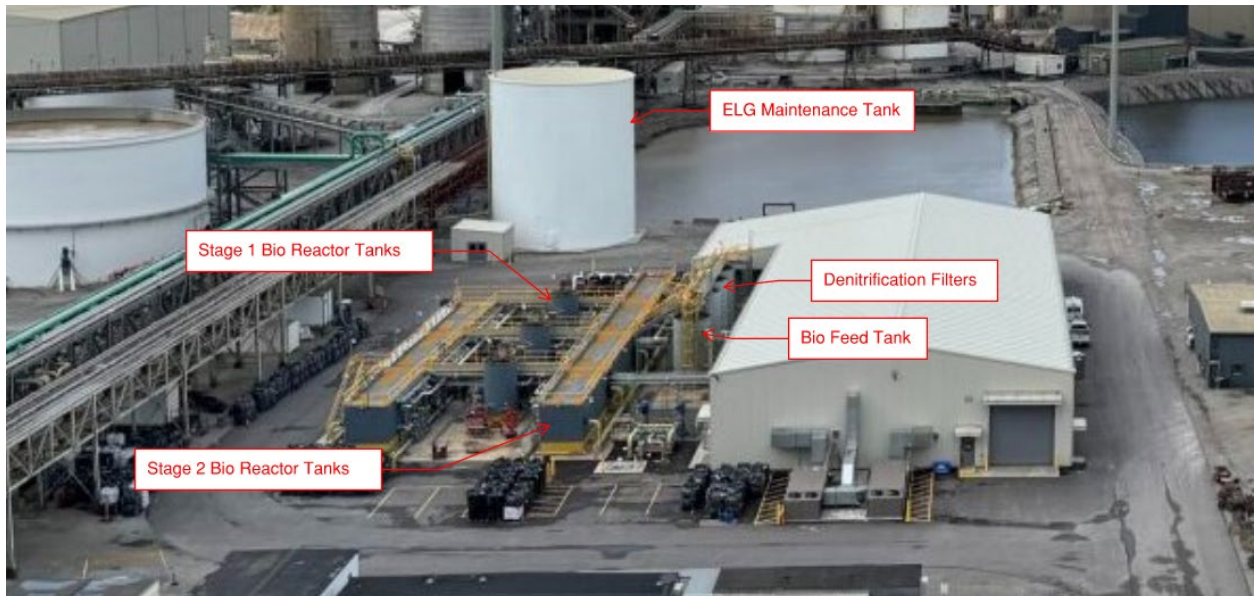
In the first quarter of 2024, OKEP completed most critical electrical construction tasks and commenced start-up. OKEP installed DCS wiring was installed, completed loop checks, and installed the temporary control network. With the functional DCS, OKEP energized their 4kV “B” side feed and began testing motors, operating valves, and general checkout of equipment. OKEP began and completed the coating of the Maintenance Tank as well as electrical construction efforts. They tied mechanical piping for the Maintenance Tank into the PWS system as well and began filling the tanks to test the pumps, piping and system flow prior to introducing media and biomass next quarter. OKEP continued to address punch list items and began preparing construction turnover books.

### **Diffuser**

The diffuser was installed and placed into service in 2021.



*Mill Creek – ELG Water Treatment – December 2023*



*Mill Creek – ELG Water Treatment – April 2024*



## **KU Project 43 – Ghent (GH) Station Effluent Limitations Guidelines (ELG) Water Treatment System, Bottom Ash Transport Water (BATW) Recirculation System, and Diffuser**

### **General**

Project 43 is for construction of an ELG water treatment system, a BATW recirculation system, and a wastewater outfall diffuser at the GH generating station. These facilities are designed to process and lawfully discharge wastewater from GH in accordance with the EPA’s existing and proposed amendments to the ELG Rule and the existing Kentucky Pollutant Discharge Elimination System (“KPDES”) Permit for GH. The current forecasted capital costs to implement these facilities remains \$149.8 million, with construction completion anticipated for April 2024 for the BATW recirculation system and December 2024 for the ELG water treatment system.

The ELG Rule requires that BATW be recirculated, instead of used once, to transport bottom ash and then discharged. The BATW recirculation system at GH consists of transfer tanks, low pressure pumps, high pressure pumps, piping, foundations, controls, and related equipment. This system will collect the bottom ash sluice water, after being dewatered from the bottom ash solids in the remote bottom ash dewatering facility and pump the water to collection tanks where the water will then be pumped back to the bottom ash removal systems underneath the four generating unit boilers to be used again for sluicing bottom ash to the remote dewatering facility. The water will be recirculated as necessary, with fresh water being added to replace evaporated water. A purge system, up to 10 percent of the volumetric discharge limit (on a 30-day rolling average) for BATW per the ELG Rule, will be included to control pH and other constituent buildup in the recirculation system.

The GH project team has engaged the TC and MC project teams during all major reviews, to apply lessons learned from the other projects. This collaborative effort was implemented to ensure lessons learned are applied across all the projects to promote a common fleet approach to the ELG program.

### **ELG**

In the first quarter of 2024, onsite construction activities included installation of electrical conduits, cable trays, and equipment skids within the ELG Building and Tank Farm area. Electricians finalized power cable terminations in the ELG electrical room, as well as conduit and support installation for the ELG Well Water pump and the Fire Detection system. Testing of 480V power cables and installation of process and chemical piping continues, including completion of the ELG system backup Service Water tie-in from PWT and the ELG Sump Pump piping. The ELG Lab installation has progressed and is near completion. OKEP continues to address punch list items and to collaborate with Triangle on maintenance access for HVAC units. In preparation for ELG performance testing, GH2 flue gas de-sulfurization system (“FGD”) began dosing NALCO Mercontrol and to assess resulting ORP and Persulfate levels. This has yielded favorable results, similar to TC1.

## **Bottom Ash Transport Water (“BATW”)**

During the first quarter of 2024, OKEP made significant progress on the BATW and associated subprojects. OKEP previously achieved Commercial Operation for the Unit 1 Ash Subproject and proceeded to do so this quarter for the Common, Unit 2, and Unit 4 Ash Subprojects. Performance testing for these units has concluded with preliminary and final test reports received. The Unit 3 Ash Subproject continues, with a focus on various pump performance. Throughout the quarter, the teams continued to monitor and complete mechanical and electrical punch list items.

### **Diffuser**

The diffuser was installed and placed into service in 2021.



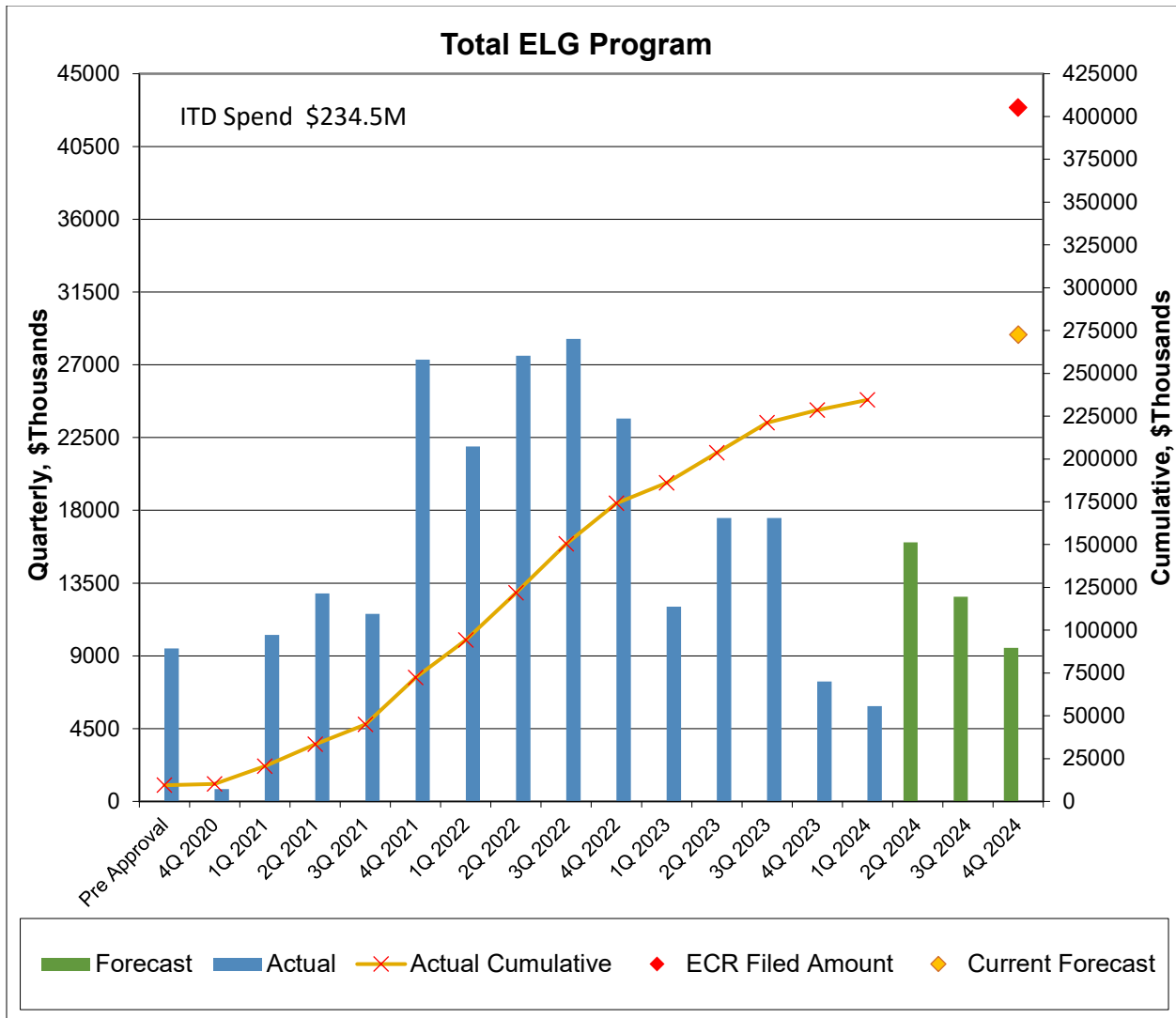
*Ghent – ELG Water Treatment – December 2023*



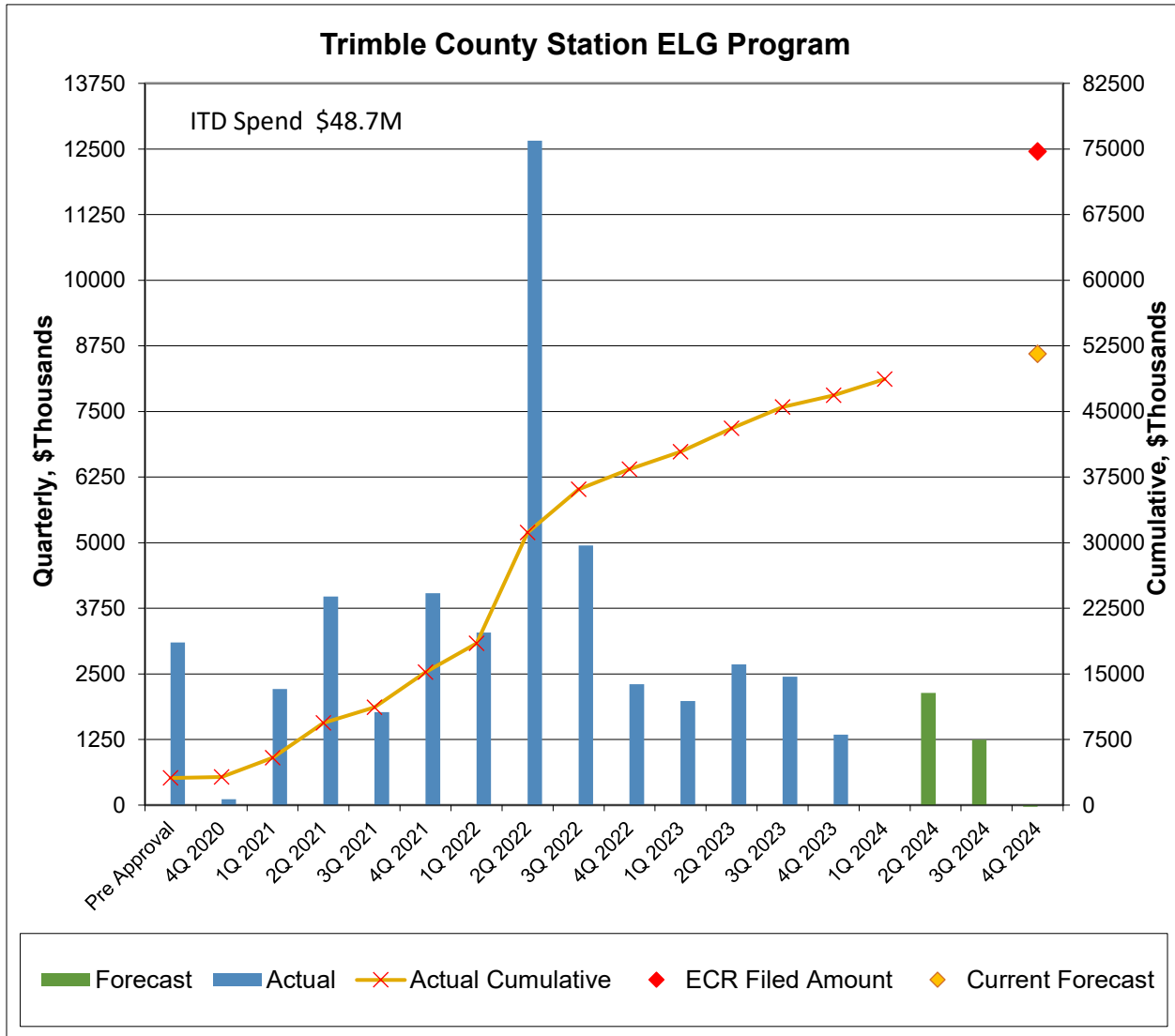
*Ghent – ELG Water Treatment – March 2024*

**Financials:**

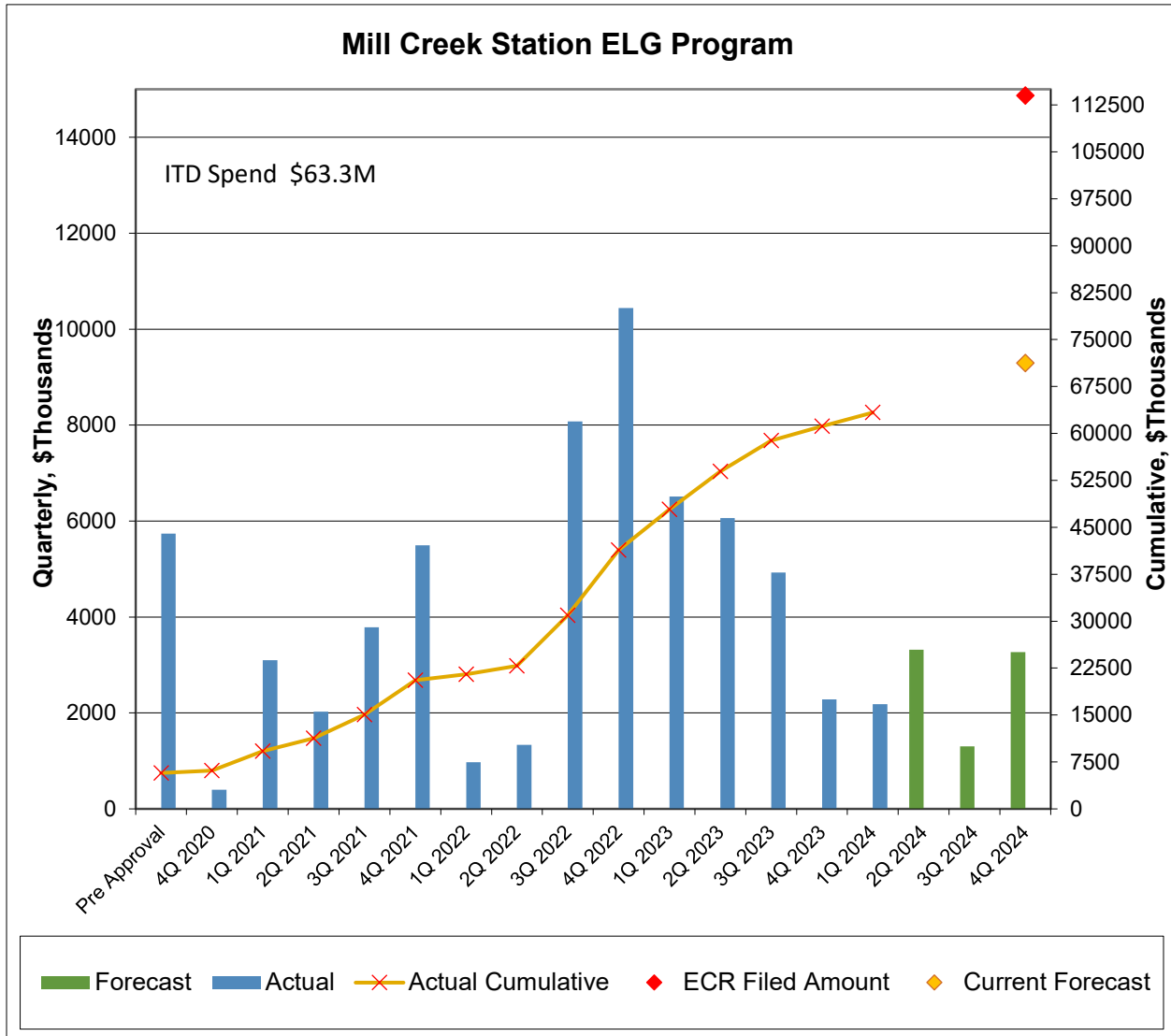
As previously reported, the total 2020 ELG Program forecasted cost was reduced from \$405.2 million (net), as filed, to \$272.6 million (net). The projected spend, as of the first quarter of 2024, remains \$272.6 million (net). Total spend increased to \$234.5million (net)<sup>2</sup> through March 31, 2023. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



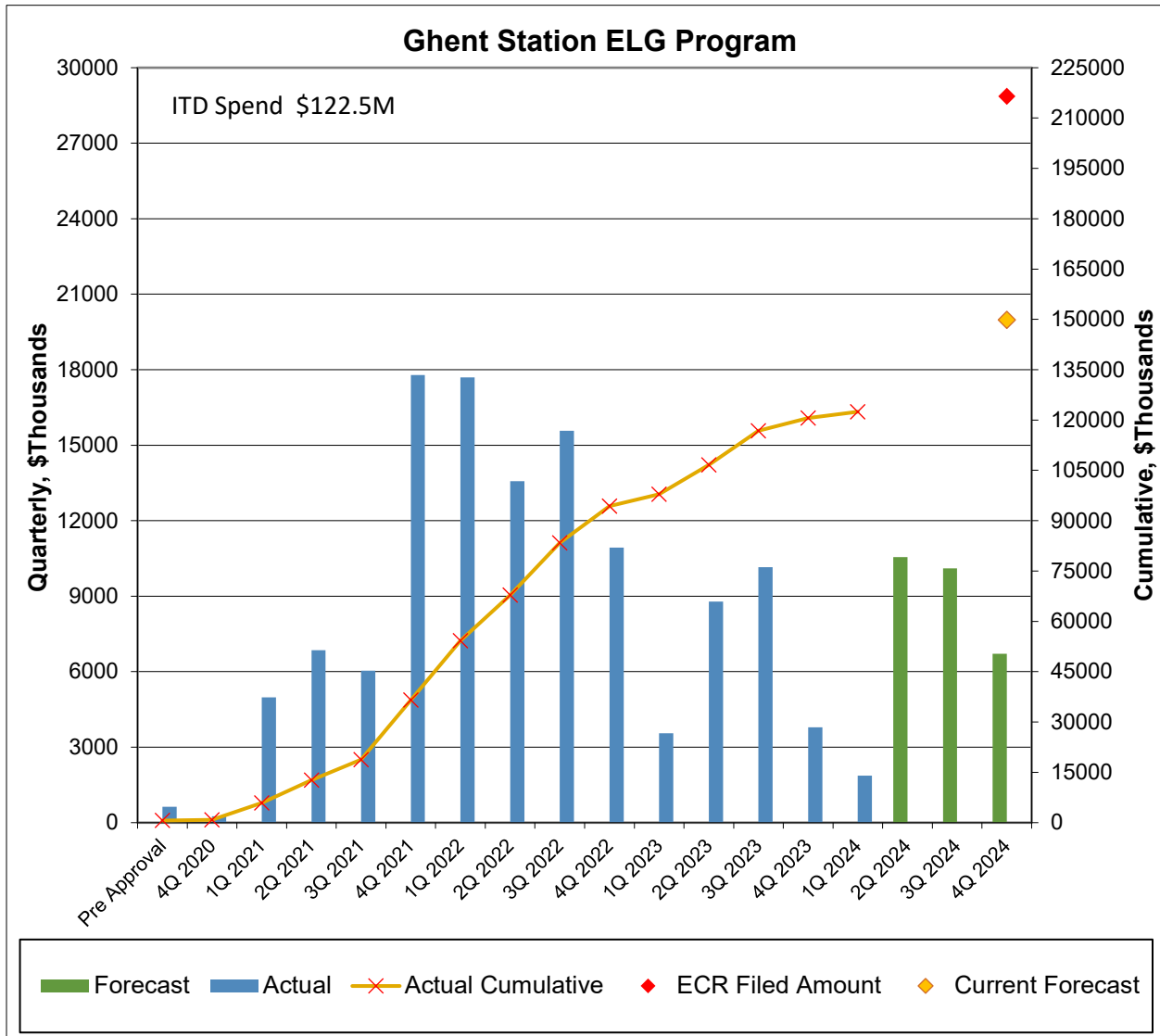
The total Trimble County Station ELG Program forecasted cost remains \$51.6 million (net)<sup>2</sup>. Total spend increased to \$48.7 (net)<sup>2</sup> through March 31, 2024. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



The total Mill Creek Station ELG Program and Diffuser forecasted cost remains \$72.0 million. Total spend was \$63.3 million through March 31, 2024. The graph below includes: 1) a symbol(♦) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



The total Ghent Station ELG Program, BATW, and Diffuser forecasted remains \$149.8 million. Total spend increased to \$122.5 million through March 31, 2024. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



## **Planned Activities for Next Quarter:**

### **KU Project 44 and LG&E Project 32 – Trimble County (TC) Station Effluent Limitations Guidelines (ELG) Water Treatment System**

ELG – OKEP should complete perform commissioning of the maintenance tank and achieve Commercial Operations, at which time LG&E will take care, custody, and control of the ELG system. OKEP will complete the update of remaining as-built drawings for record. B&McD will continue evaluating potential mechanical, chemical, and process modifications to the TC1 FGD. East & Westbrook will continue detailed engineering of the new warehouse and begin the submittal process.

### **LG&E Project 31 – Mill Creek (MC) Station Effluent Limitations Guidelines (ELG) Water Treatment System and Diffuser**

ELG – OKEP will focus on completing electrical construction and ensuring delivery of nutrient and treatment chemicals to site. OKEP will complete maintenance tank piping and electrical work and continue commissioning and startup activities with clean water testing, media loading, and system optimization. The performance test is planned to begin at the beginning of the 3<sup>rd</sup> quarter of 2024.

Diffuser – No further work expected.

### **KU Project 43 – Ghent (GH) Station Effluent Limitations Guidelines (ELG) Water Treatment System, Bottom Ash Transport Water (BATW) Recirculation System, and Diffuser**

ELG – KU will maintain regular meetings with OKEP to monitor progress of the construction project. Construction activities will focus on installation of electrical conduits and cable tray, pulling electrical and control cables, terminations, as well as preliminary system checkout. It is anticipated that Mechanical Completion will occur at the end of the 2<sup>nd</sup> quarter or early in the 3<sup>rd</sup> quarter. Hot commissioning and performance testing will occur in the 3<sup>rd</sup> quarter.

BATW –The SFC Sump Pump A and the 3A HP Pump will achieve Mechanical Completion, and system commissioning will continue. Upon Mechanical Completion OKEP will commence performance testing and should achieve Commercial Operation upon successful completion of the performance test. .

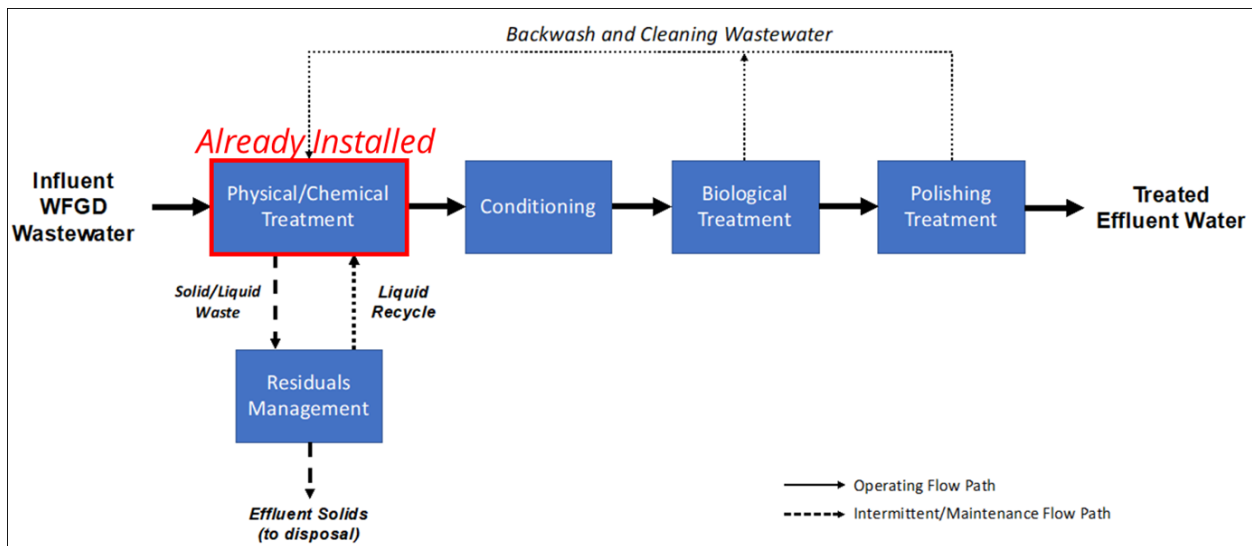


## APPENDIX

### ELG Water Treatment System Description – TC, MC, and GH

The ELG Rule requires the Companies to use the Best Available Technology Economically Achievable (“BAT”)<sup>9</sup> to control particulate, metals, arsenic, mercury, selenium, and nitrates/nitrites. Current BAT technology is physical/chemical treatment plus biological treatment. The process water systems are physical/chemical systems designed to capture particulate and most metals; however, they are not designed to capture nitrates/nitrites and selenium. The levels of nitrate/nitrite and selenium capture required by the ELG Rule requires biological treatment of the process water treatment system’s effluent.

The first step in the biological treatment process is denitrification, which is the reduction in concentration of nitrates/nitrites through a biological process utilizing denitrification equipment. Effluent from the denitrification equipment is discharged to the first stage reactor, which is comprised of fiberglass vessels and internal reactor surfaces. The reactor contains living microorganisms, which are fed nutrients and convert the nitrates/nitrites and selenium molecules in an aerobic atmosphere, to an elemental form. Effluent from the first stage reactor flows into a second stage reactor, where additional biological processes reduce remaining selenium. The elemental form of selenium is transferred, via a backwash phase of the process, to the equalization tanks at the beginning of the process water treatment system for particulate removal. The second stage reactor feeds to an ultrafiltration (“UF”) system where remaining particulate metals are filtered out. The UF tank is then discharged to a series of clean water tanks, which can be used to backwash the biological and UF systems or be discharged. A “typical” flow diagram is shown below.



The majority of the mechanical and electrical systems will be constructed in a building for weather protection, whereas most of the biological process tanks will be located outside. The building houses the denitrification equipment, UF systems, effluent tanks, various pumps and support subsystems. The system also requires cleaning and chemical feed equipment, pumps, piping, valves, and electrical equipment.

<sup>9</sup> 84 Fed. Reg. 64624.

Separate rooms must be constructed inside the treatment building to house battery systems and electrical equipment. A control room is also required, along with restrooms. The reactor area, including the vessels housing the microorganisms, will be constructed outside the building under a weather canopy. All of the tanks and reactors in the system must be large enough to handle the immense volume of water flowing through the effluent treatment process. In other words, the system must be sized commensurate with the process water treatment systems recently commissioned to enable treatment of the effluent of flow from the process water treatment systems.

### Diffusers Description – GH and MC

The diffusers planned to be installed at GH and MC are large multi-port pipes that connect to the stations’ wastewater outfall pipe and are placed into the bottom of the Ohio River with the discharge ports above the riverbed and facing downstream. The pictures shown below provide a general concept of the GH diffuser, which will be similar to the proposed MC diffuser. As this graphic representatively shows, the diffuser is a single large discharge pipe that is installed in the riverbed. The diffuser ports face downstream to disperse the water out of multiple discharge ports instead of a single, larger point of discharge.

### Ghent Outfall 001 Diffuser Concept

