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November 2, 2020

VIA ELECTRONIC FILING

Ms. Kimberley A. Campbell, Chief Clerk
North Carolina Utilities Commission
Dobbs Building
430 North Salisbury Street
Raleigh, North Carolina 27603

Re: DEP Late-Filed Exhibit Nos. 17, 19, and 21
Docket No. E-2, Sub 1219

Dear Ms. Campbell:

Per the request of the North Carolina Utilities Commission during the Duke Energy Progress, LLC ("DEP") evidentiary hearing, enclosed for filing on behalf of DEP in the above-referenced proceeding are *Late-Filed Exhibit Nos. 17, 19, and 21*, including supporting workpapers.

Please do not hesitate to contact me should you have any questions. Thank you for your assistance with this matter.

Very truly yours,

/s/Mary Lynne Grigg

MLG:sjg

Enclosures

Duke Energy Progress, LLC
Late-Filed Exhibit No. 17

Duke Energy Progress
Docket E-2, Sub 1219
Late Filed Exhibit #17
October 23, 2020

Request: Provide any document for documents comparable in purpose and use to DEC's May 29, 2007 Duke Energy Environmental Management Program for Coal Combustion Products (AGO Kerin Direct Cross-Exam Exhibit 3, Docket No. E-7, Sub 1146), however titled or denominated and whenever dated.

Response: Please see the attached document comparable in purpose and use to DEC's May 29, 2007 Duke Energy Environmental Management Program for Coal Combustion Products. This document was prepared after the July 2012 merger with Progress Energy. The Company has not located comparable documents for Duke Energy Progress prepared prior to the merger.

- Regulated Utility Operations Env Regulatory Issues Document – Spring 2013 Final

Duke Energy

Regulated Utility Operations

Environmental Regulatory Issues

April 2013

Table of Contents

Acronym Listing

AFUDC	Allowance for Funds Used During Construction
ANPR	Advanced Notice of Proposed Rulemaking
BACT	Best Available Control Technology
BMP	Best Management Practices
CAAA	Clean Air Act Amendments
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CCB	Coal Combustion Byproducts
CCR	Coal Combustion Residuals
CCW	Condenser Cooling Water
CEM	Continuous Emission Monitor
CMP	Carbon Mitigation Plan
CSAPR	Cross-State Air Pollution Rule
DAQ	Division of Air Quality
DBA	Dibasic Acid
ESP	Electrostatic Precipitator
FDEP	Florida Department of Environmental Protection
FGD	Flue Gas Desulfurization
GHG	Greenhouse Gases
HAPs	Hazardous Air Pollutants
IDEM	Indiana Department of Environmental Management
ICR	Information Collection Request
LAER	Lowest Achievable Emissions Rate
LNB	Low NO_X Burners
MACT	Maximum Achievable Control Technology
MATS	Mercury and Air Toxic Standards
MSA	Metropolitan Statistical Area
MTR	Mountain Top Removal
NAAQS	National Ambient Air Quality Standards
NCCSA	North Carolina Clean Smokestack Act

Acronym Listing (cont'd)

NCDENR	North Carolina Department of Environment and Natural Resources
NODA	Notice of Data Availability
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NSR	New Source Review
PM	Particulate Matter
OFA	Over-fired Air
ORSANCO	Ohio River Valley Sanitation Commission
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
RACT	Reasonably Achievable Control Technology
SBS	Sodium Bi-Sulfate
SCDHEC	South Carolina Department of Health and Environmental Control
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SNCR	Selective Non-Catalytic Reduction
SOFA	Separated Over-fired Air
TR	Transport Rule
USWAG	Utilities Solid Waste Activities Group
316(a)	Clean Water Act Thermal Discharge Regulation
316(b)	Clean Water Act Cooling Water Intake Regulation

Executive Summary

The primary purpose of the Environmental Regulatory Issues document is to support Regulated Generation's and other utility operation's overall environmental issues management, business planning and budgeting needs. The goal is to help fulfill their significant current and future environmental regulatory requirements (e.g., air, water, waste and climate) both cost effectively and at the appropriate time, while considering the variety of business impacts. In addition, the document is intended to assist other corporate strategic planning and financial planning functions in their evaluation of regulated assets due to projected environmental implications.

The various issues described in this document are designed to represent potential environmental requirements that may result from rulemaking or legislative initiatives. Many uncertainties exist regarding future environmental regulations, including the scope and timing of compliance obligations. The issues described in this document are highly dependent on the assumptions made, and are to be used as an internal planning tool to allow Duke Energy to develop diversified, long-term and cost-effective environmental compliance options intended to satisfy reliably the electricity demands of customers located within a service territory. The pollution equipment installations described herein are not meant to represent Best Available Control Technology ("BACT") or Lowest Achievable Emissions Rates ("LAER"), etc. Furthermore, the pollution equipment installations described are based on high-level engineering and cost estimating. Any decision to install specific pollution controls at an existing facility will require more extensive engineering and cost estimating. Finally, due to the uncertainties regarding the timing of future environmental regulations, the possibility of unit retirements must be considered; however, specific decisions regarding unit retirements would need to be made based on multiple factors in a separate engineering study.

New environmental regulations now final or expected to be finalized over the next few years will have a significant effect on the planning and operations of Duke Energy's regulated generation fleet. While the specific regulatory requirements and timing of many of the regulations are still uncertain, the current expectation is that several new regulatory requirements will likely significantly impact coal-fired generation in the 2013 to 2020 timeframe. New requirements will target SO_2, NO_X, HAPs, PM, and CO_2 emissions, station cooling water intakes and surface and groundwater impacts as well as the handling, use and storage of coal combustion residuals. Until there are final rules in place, the uncertainty surrounding the details of these expected new requirements will require thoughtful planning to most effectively comply with these requirements, given the array of scenarios that may occur. Decisions around installation of new controls, retirement of units, NSR considerations, deployment of renewable energy sources and other replacement generation sources are all likely to be involved in addressing these requirements. The environmental issues that are expected to create the greatest impact to Duke Energy's operations over the next several years are:

1. Mercury and Air Toxics Standard (also Utility Boiler MACT) - The final rule was published in the Federal Register on February 16, 2012. The rule establishes emission limits for mercury, acid gases, and non-mercury metals from coal-fired power plants. It allows for the control of SO_2 emissions as a surrogate for acid gases and filterable particulate matter as a surrogate for non-mercury metals. The rule requires compliance within 3 years of the effective date of the rule (April 16, 2012). The rule allows (but does not guarantee) permitting authorities to grant up to a one-year extension of the compliance period on a case-by-case basis if more time is needed to install controls, where replacement generation is being installed at the same site as the source being retired, or for addressing transmission reliability associated with retirement of a unit. These standards will require significant new or modified air emission controls and systems (e.g., SCR, activated carbon, sorbent injection) to be added to certain existing units. Requirements to install new controls to meet the various standards will potentially cause some units to be retired, in lieu of making the investment to add controls.

2. Clean Water Act 316 (b) – EPA is developing new regulations for cooling water intake structures for existing facilities to address fish impingement and entrainment concerns. The final rule is expected to be published in June 2013. If the rule is finalized as proposed, initial submittals, station details, study plans, etc. for some facilities would be due in the March/April 2014 timeframe. If required, modifications to the intakes to comply with the impingement requirements could be required as early as mid to late 2016. Under the proposed rule, all nuclear, coal and possibly some combined cycle combustion turbine stations are at risk for some type of modification requirements. EPA's proposed regulation was published on April 20, 2011 and does not mandate closed-cycle cooling but requires closed-cycle cooling to be evaluated as best technology available for entrainment reduction.

3. Coal combustion residuals (CCR) rules – New CCR regulations, when finalized, are expected to significantly impact operations relative to handling, disposal and re-use of CCR. There remains risk that CCR may be regulated as a hazardous waste. If so, the historic means of disposing of and re-using CCR, including both coal ash and synthetic gypsum, would be significantly altered and would be much more costly. Even if CCR remain non-hazardous, it is anticipated that new regulations will likely affect the way CCR are handled and disposed of on-site (dry handling of flyash and bottom ash), will require additional groundwater monitoring and closure of ash ponds, and will increase the need for additional landfills and alternative wastewater treatment systems. When the rule is finalized, expected to occur in 2014, compliance requirements could begin 5 years or less from when the rule is promulgated. The likelihood is low of federal legislation blocking EPA from finalizing its hazardous proposal and instead directing states to regulate CCR as non-hazardous.

4. NAAQS - The 75 ppb ozone standard will remain in place until it is revised under the next 5-year review, which is expected to be completed in 2014. EPA finalized area designations in May 2012 under the current ozone standard. With regard to the $PM_{2.5}$ standards, EPA finalized a revision in December 2012. The annual standard was changed from 15 micrograms per cubic meter (ug/m^3) to 12 ug/m^3, and EPA retained the current 24-hour standard of 35 ug/m^3. The 1-hour SO_2 standard is also in place. EPA plans to make final area designations with this standard in June 2013.

In addition to the new and major issues already described, some of the other regulatory risks addressed in this document that are likely to impact operations include:

- Steam Electric Effluent Limitation Guidelines - EPA plans to revise the Steam Electric Effluent Limitation Guidelines which are federally established technology-based effluent limits for NPDES discharges in the steam electric industrial category. The guidelines are expected to target primarily ash handling, landfill leachate, and FGD wastewater treatment system operations. New regulations from these guidelines are expected to be proposed in April 2013 and to become final, under consent decree by April 28, 2014 with compliance beginning as early as mid-2017 for some facilities.

- Climate Change - Federal climate change cap-and-trade or carbon tax legislation is not likely to be enacted through 2013. However, on the regulatory front, EPA finalized a number of rules including the Tailoring Rule which subjects any GHG emitting generating unit that undergoes a modification that will result in a net increase of 75,000 tons/year of GHG to NSR/PSD permitting requirements. Challenges to the Tailoring and other rules were dismissed in June 2012 but have been appealed to the Supreme Court. EPA proposed New Source Performance Standards (NSPS) for GHGs for new electric generating units in March 2012. It is possible that EPA will re-propose the rule in 2013, delaying a final rule until 2014. The schedule for EPA to propose GHG emission guidelines for existing (and potentially modified) EGUs will be influenced by EPA's schedule for the new source NSPS rule.

- Lower NPDES permit limits and groundwater standards - EPA is evaluating establishing surface water quality criteria for selenium. Various states are also targeting stricter limits for nitrates, mercury, boron, bromides and other constituents. Potential strategies to address new, stricter limits on these constituents are likely to focus on converting wet-sluiced ash handling systems to dry ash handling and on requirements for enhancement of FGD wastewater treatment systems. Lower groundwater standards and increased focus on the threat of groundwater impacts from ash basin operations will require the monitoring of groundwater around Duke Energy's ash basins. This requirement creates additional risk for corrective actions, including conversion to dry ash handling systems and landfill development, due to groundwater impacts.

- PCB Phase-out - A proposed rule from EPA is expected in 2013 or 2014, focused on registration requirements for PCB transformers and Large Capacitors (≥ 500 ppm) and marking requirements for regulated PCB-containing (≥ 50 ppm PCB) equipment that has been removed from service. EPA had also been considering the phase-out of PCB use by 2025.

- CCR Storage Area Closures –Active and inactive CCR storage areas (ash basins) will be impacted by final federal and state CCR rules. Storage areas are likely to require a state or federally approved plan for addressing closure/post closure care along with a financial mechanism to address any remediation and groundwater monitoring following their closure. Closure will have to consider continued management of other low volume wastewater streams and limitations (loss of Bevill exemption) once units cease producing CCR. Consideration is being given to how these plants are operated and prepared for closure (waste volumes and disposal) before retirement.

1.0 Introduction

Environmental obligations have significantly impacted planning and operations for Duke Energy's regulated utility operations. The expectation is that Duke Energy's operations will continue to provide reliable and affordable electricity while meeting or exceeding all environmental regulatory requirements. Also, some of Duke Energy's greatest sustainability risks and opportunities are in the environmental focus area. One element of Duke Energy's systematic approach to managing environmental challenges, opportunities and impacts is to anticipate, identify, prevent and mitigate risks and impacts to protect people, the environment, the business and customers. A significant component of environmental risk and opportunity has been Duke Energy's strategy to comply with laws, regulations and permits. A related component has been Duke Energy's process to assure our day-to-day compliance obligations are met. Strategic plans and responses have included a variety of approaches:

- pollution control equipment (e.g., SCRs, scrubbers, baghouses);
- emissions allowance management;
- fuel specification changes;
- unit dispatch changes;
- unit retirements;
- cooling towers and wastewater treatment (e.g., Flue Gas Desulfurization (FGD)); and
- Coal Combustion Residual (CCR) handling changes and reuse and disposal of byproducts.

Responding effectively to environmental regulatory requirements has demanded a coordinated and systematic approach. Examples of past major requirements include the NC Clean Smokestacks Act and EPA's Clean Air Interstate Rule (CAIR). To comply with these and other environmental regulatory challenges, Duke Energy's coal-fired generation businesses, primarily, have spent approximately $7.5 billion since 1999. Similar challenges are expected from the current wave of environmental regulations under development. For planning purposes, it has been estimated that Duke Energy could potentially spend an additional $5 to $6 billion, excluding allowance for funds used during construction (AFUDC) over the next 10 years to address the environmental issues that will be discussed in greater detail in this document.

The complexity of challenges facing Duke Energy continues to increase as new federal environmental laws and regulations become more stringent, as state environmental agencies address concerns over the interactions between air pollution controls, wastewater streams and waste management, and as requirements related to greenhouse gas emissions, coal mining techniques, renewable energy demands and energy efficiency continue to evolve. Recent lower natural gas prices have also added to the complexity. Upcoming challenges for Duke Energy and the industry both in the near-term and long-term are likely to include:

- current and potentially more stringent National Ambient Air Quality Standards (NAAQS) for ozone, SO_2 and fine particles ($PM_{2.5}$)and potentially revised CSAPR that takes into account lower ozone and $PM_{2.5}$ NAAQS;
- potentially revised CSAPR to address interstate emissions transport;

- compliance with the Mercury and Air Toxics Standards (MATS) rule for mercury, acid gases, metals and organics;
- new or more stringent groundwater standards (e.g., arsenic);
- 316(b) cooling water intake structures and systems;
- new regulations for CCR handling, re-use and disposal practices;
- fuel procurement and operating concerns due to potential limitations imposed on mountain top removal mining restrictions and other regulatory requirements;
- revised steam electric effluent limitation guidelines that may require stricter technology-based wastewater treatment systems to meet effluent requirements;
- actual and potential generation unit retirements; and
- further regulation of greenhouse gas (GHG) emissions.

The primary purpose of the Environmental Regulatory Issues document is to support regulated utility operations' overall issues management, business planning and budgeting needs to help fulfill their significant current and future environmental regulatory requirements (e.g., air, water, waste and climate) cost effectively and at the appropriate time, while considering the variety of business impacts.

A flow chart depicting the general process of providing the environmental challenge input into Duke Energy's overall corporate planning efforts is shown in the Appendix of this document. Prior to the Appendix, Tables summarize the current environmental controls in place at each of the coal-fired stations, EPA's current regulatory schedule and the potential impact that the various regulations may ultimately have on Duke Energy's regulated generating facilities.

This is a summary level document and may reference other documents for detail as needed. Individual strategies to address specific environmental issues are generally divided between the Carolinas, Florida and the Midwest regulated operating regions for ease of analysis, understanding, and application to both compliance and resource planning, and to assist with making general business decisions.

This document was developed through input from the Environmental Regulatory Working Group. The group is identified in Section 7.0 of this document and was established to support the development of Duke Energy's environmental strategy to address the legislative and regulatory risks facing the corporation, both near term and over the next ten years. This Working Group is focused on regulated utility operations and provides guidance and direction by identifying and quantifying specific environmental issues and assumptions.

2.0 Air Quality Strategic Issues

Over the next several years, the major regulatory drivers related to air emissions that will most influence environmental strategy include the MATS rule, state implementation plans (SIP) related to current and potentially more stringent SO_2, Ozone and Fine Particles ($PM_{2.5}$) NAAQS, and sulfuric acid mist impacts. Requirements related to controlling or otherwise reducing GHG emissions (principally CO_2) resulting from expected future EPA regulation will be another potential challenge. A brief description of each program and how they have or could impact Duke Energy's regulated operations is presented below. Table 1 at the end of Section 2.0 summarizes likely air quality impact challenges.

2.1 North Carolina Clean Smokestack Act (NC CSA)

North Carolina passed legislation in 2002 to place a firm annual cap on NO_X and SO_2 emissions. These caps will remain separate and specific for the two operating utilities: Duke Energy Carolinas and Duke Energy Progress. The specific requirements for Duke Energy Carolinas and Duke Energy Progress units in NC are:

Duke Energy Carolinas
SO_2 – Phase II: 80,000 tons (began in 2013).
NO_X – Phase II: 31,000 tons (began in 2009).

Duke Energy Progress
SO_2 – Phase II: 50,000 tons (began in 2013).
NO_X – Phase I: 25,000 tons (began in 2007).

Duke Energy Carolinas Strategy - NC CSA establishes firm system-wide NO_X and SO_2 emissions caps.

All controls to meet the SO_2 and NO_X requirements have been completed.

Unit environmentally-affected dispatch is based on total production cost ($/MWh), which includes the market allowance value of NO_X and SO_2.

Duke Energy Carolinas Strategy Challenges

The major compliance challenges include higher customer demand than forecast and forced outages on nuclear or other lower- or non-emitting units. Based upon emissions projections, there appears to be minimal concern with being able to meet the caps.

SO_2 – The lower cap in 2013 should be readily met with Cliffside Unit 6 in commercial operation, combined cycle operation, plans for increased renewable generation and conservation, and continued retirement of non-scrubbed units.

NO_X –The emission cap of 31,000 tons per year is slightly more restrictive than the Duke Energy Carolinas portion of the 2013 and 2014 CAIR Phase I requirements but less restrictive than the CAIR Phase II annual NO_X allocations.

<u>Duke Energy Progress Strategy</u> - NC CSA establishes firm system-wide NO_X and SO_2 emissions caps.
All controls to meet the SO_2 and NO_X requirements have been completed.

Unit environmentally-affected dispatch is based on total production cost ($/MWh), which includes the market allowance value of NO_X and SO_2.

<u>Duke Energy Progress Strategy Challenges</u>

The major compliance challenges include higher customer demand than forecast and forced outages on nuclear or other lower- or non-emitting units. Based upon emissions projections, there appears to be minimal concern with being able to meet the caps.

SO_2 - The lower cap in 2013 should be readily met with the Wayne County Combined Cycle Units at the H.F. Lee Energy Complex entering service along with existing combined cycle operation, plans for increased renewable generation and conservation, and retirement of non-scrubbed units.

NO_X –The NC CSA NO_X emission cap of 25,000 tons per year is slightly more restrictive than the Phase 1 CAIR requirements.

2.2 Clean Air Interstate Rule (CAIR) and the Cross-State Air Pollution Rule (CSAPR)

Barring an unlikely reversal by the Supreme Court, the D.C. Circuit’s vacatur and subsequent denial of EPA’s request for rehearing leaves the CAIR in place until the EPA completes a CSAPR replacement rulemaking. It is unknown how long it will take EPA to complete and implement a replacement rule, but it’s likely to take beyond 2015 which means that Phase II of CAIR would take effect on January 1, 2015. Until that time, CAIR Phase I is in place. Little to no risk for compliance with CAIR Phase I or Phase II exists, especially with controls added for the MATS rule.

2.3 Mercury and Air Toxics Standard (MATS)

EPA's final MATS rule was published in the Federal Register on February 16, 2012. The rule regulates Hazardous Air Pollutants (HAP) by establishing unit-level emission limits for mercury, acid gases, and non-mercury metals, and work practice standards for organics from coal and oil-fired electric generating units. Compliance with the rule will be required by April 16, 2015. Permitting authorities have the discretion to grant up to a one-year compliance extension, on a case-by-case basis, to sources that are unable to install emission controls before the compliance deadline. The one-year extension to meet compliance is not to be granted for units set to retire unless a retirement would cause grid reliability problems.

On November 30, 2012, EPA published a notice of reconsideration of a limited number of MATS related issues. The main issues addressed in the reconsideration proposal were the emission limits applicable to new units (addressed March 29, 2013) and the definition of startup and shutdown. EPA is expected to finalize its startup and shutdown proposal by mid- 2013.

Numerous petitions for review of the final MATS rule have been filed with the United States Court of Appeals for the District of Columbia. The court established a schedule for the litigation that has final briefs being filed on April 8, 2013. Oral arguments have not been scheduled. A court decision in the case is likely in late 2013 or early 2014. Duke Energy cannot predict the outcome of the litigation or how it might affect the MATS requirements as they apply to regulated operations.

Because of the emission limits and other requirements, the MATS rule may potentially drive the accelerated retirement of up to 1,776 MWs of coal-fired generation by April of 2015. By April 2013, Duke Energy (including Duke Energy Progress) will have retired 2,789 MWs of regulated coal-fired generation. A significant portion of this is in anticipation of new regulations.

The 1,776 MWs that are at risk for accelerated retirement in response to the MATS rule include:

- 370 MWs at Duke Energy Carolinas' Lee;
- 575 MWs at Duke Energy Progress' Sutton;
- 668 MWs at Wabash River 2 – 6; and
- 163 MWs at Miami Fort 6.

Some of the requirements that the rule will impose on the remaining, operating regulated generating fleet include:

- a filterable PM emission rate limit of 0.03#/mmBTU which may be used as a surrogate for the non-mercury metals limit;
- a 30-day rolling average emission rate limit for mercury (Hg) of 1.2 #/TBTU or a 1.0#/TBTU limit if using facility averaging; and
- an HCl emission limit of 0.002#/mmBTU or 0.2#/mmBTU SO_2

In addition to specific emissions standards, the rule includes work practice standards to mitigate emissions of organics, dioxins, and furans. Work practices also include performance testing for optimal combustion.

In February 2012, EPA also finalized revisions to the New Source Performance Standards (NSPS) for SO_2, NO_X and PM that would affect new units, reconstructed units, and units modified such that they emit more on an hourly basis.

Regulated Generation has continued to conduct characterization and control studies to help understand the mercury, acid gas and other co-benefits from existing SO_2 and NO_X emission control equipment. One positive is that filterable particulate emissions have decreased notably since the installation of scrubbers, which will be critical in complying with MATS. In the Carolinas, average particulate levels have decreased between 60% and 92% for the units where FGDs have been installed.

Some mercury CEMs in the Midwest have not been commissioned. This needs to be done so there is confidence in the data. Mercury CEMs need to be kept in good working order so mercury emissions along with operating data can be analyzed to anticipate compliance issues. Corrective action can then be taken prior to 2015 to ensure compliance.

Burning higher sulfur coals that generate additional SO_3 will have a negative effect on native loss of ignition (LOI or unburned carbon) to capture mercury and can lead to increased mercury emissions. Additional mercury controls may be required when burning these coals to meet emission limits established by the MATS rule.

2.4 MACT Standards - Other

On January 30, 2013, EPA published revisions to the standards for industrial boilers and process heaters at major sources of hazardous air pollutants (IB MACT). There are requirements for new, reconstructed and existing boilers based on size, fuel type and type of operation (i.e., limited use). Some of the requirements must be complete within 6 months (i.e., July 30). Gas-fired boilers require a periodic tune-up and reporting every 1 to 5 years starting by 2016. “Limited use” (<10% capacity) and small liquid-fueled boilers require tune-ups every 5 years, but have no specific emission limits. Larger liquid-fueled boilers have emission limits which must be met in 2016. Compliance is based on stack testing and/or fuel sampling. The rule also requires a one-time energy assessment for all of the affected boilers except for “limited use” boilers. Environmental Services will finalize the list of affected boilers, communicate specific requirements and develop an implementation plan.

On January 30, 2013, EPA also published revisions to the standards for reciprocating internal combustion engines (RICE MACT). The rule takes effect on May 3, 2013 for diesel engines and October 19, 2013 for spark ignition engines. Operating limits and testing requirements are based on unit size, location, designation and type. Additions to the final rule include the use of ultra low sulfur diesel fuel beginning in 2015 and the 50-hour peak-shaving exemption will expire in May 2014. Demand-response is only allowed within a 100 hour limit that also accommodates NERC Alert Level 2 emergency use, testing and maintenance. Operation during a weather emergency will continue to be unregulated and engines that operate less than 15 hours per year are exempt from most requirements. Beginning in 2015, sources including Duke Energy will be required to report on customers' emergency generators.

In addition to these MACT standards, EPA is considering the development of a revised Combustion Turbine MACT to target certain HAPs emitted from those facilities. At this time a schedule for when EPA may issue these standards is not known.

2.5 National Ambient Air Quality Standards (NAAQS): 8-hour ozone standard

On May 21, 2012 EPA finalized area designations for the 2008 standard. Both the Charlotte and Cincinnati areas were classified as marginal nonattainment areas. Marginal areas have until December 31, 2015 to attain the standard. Marginal areas need only have "clean" air during the 2015 ozone season to qualify for the first of two possible one-year extensions of the attainment date. States are not required to develop SIPs for marginal nonattainment areas. If a marginal area doesn't either attain the standard by the 2015 attainment date or at least qualify for a one-year extension based on having clean air in 2015, the area would get bumped up to the moderate nonattainment classification and would have six years from that time to attain the standard.

EPA is targeting June 2013 to issue a proposed implementation rule for the 75 ppb standard that will address various implementation issues, including policies on required control measures and guidance to the states regarding Reasonably Available Control Technology (RACT). That proposal should provide important information that will help assess if implementation of the 75 ppb standard could potentially pose risk to any Duke Energy facilities in the Charlotte or Cincinnati areas.

The EPA is working on a review of the 75 ppb standard and could propose a new standard in late 2013 and finalize a revision toward the end of 2014. Attainment dates associated with a revised standard would depend on an area's nonattainment classification. For a standard finalized in 2014, 2019 would be a potential attainment year for marginal nonattainment areas and 2021 or 2022 for moderate nonattainment areas. The extent of nonattainment areas and their classifications will be highly dependent upon the level of the standard EPA finalizes (EPA is considering a range from 60 ppb to 70 ppb).

The Florida service area is attaining the current standard; therefore, it is not expected to have a material effect on Florida operations.

2.6 NAAQS Fine Particle ($PM_{2.5}$) Standard

On December 14, 2012 the EPA issued a revised NAAQS lowering the previous 15 ug/m^3 $PM_{2.5}$ annual standard to a level of 12 ug/m^3. EPA retained the 24-hour standard at 35 $ug/m^3$and set the secondary $PM_{2.5}$ standard equal to the primary standard. It is expected that EPA will finalize area designations in early 2015. States with nonattainment areas will be required to submit SIPs to EPA in mid-2016, with an attainment date of 2021. Based on 2009 –2011 air quality data, a handful of monitors in Duke's service territories (Southern and Central Indiana and Cincinnati area) had values higher than 12 ug/m^3. The EPA will likely use the most current air quality data to make final designations, which could show improved air quality.

To date the annual and daily $PM_{2.5}$ standards have not driven emission reductions through the state SIP process. Instead, the reductions in SO_2 and NO_X emissions to address the $PM_{2.5}$ standards are currently being addressed through CAIR, and could be addressed through a potential CSAPR replacement rule. SO_2 and/or NO_X emission reductions to address the 12 ug/m^3 $PM_{2.5}$ standards could also be required as part of the state SIP development process

Carolinas and Midwest Strategy
At this time, it is too early to determine how future $PM_{2.5}$ non-attainment designations might impact regulated operations. However, any potential impact will be mitigated by the SO_2 and NO_X controls already being installed and by additional controls installed in response to the MATS rule that reduce SO_2 and NO_X emissions. Any additional SO_2 and/or NO_X reductions that may be required in response to lower $PM_{2.5}$ standards could be required in 2020.

Carolinas and Midwest Strategy Challenges
The risk of additional controls will be greater for plants located near non-attainment areas, possibly including those near Cincinnati, Indianapolis and Louisville.

Florida Strategy
All of Florida is currently attaining the revised standard; therefore, the revision is not expected to have a material effect on Florida operations.

2.7 NAAQS SO_2 Standard

On June 22, 2010 EPA established a 75 ppb 1-hour SO_2 NAAQS and revoked the annual and 24-hour SO_2 standards. EPA plans to make final area designations for the 75 ppb standard in June 2013. Based on EPA's preliminary final designations, the only area across Duke Energy's regulated service territory that will be designated nonattainment is a small area around Wabash River. Assuming Wabash River is retired or repowered in response to MATS, the nonattainment designation will have no impact on the facility. If this does not occur, Indiana is required to develop a SIP by the end of 2015 that will have to address the SO_2 emissions from Wabash River to bring the area into attainment by 2018.

On February 6, 2013 the EPA released a document that updates its strategy for addressing all areas that it will not be designating as nonattainment areas in June 2013. The document indicated that EPA will allow states to use modeling or monitoring to evaluate the impact of large SO_2 emitting sources relative to the 75 ppb standard. The document also laid out a schedule for implementing the standard. Key dates in that schedule are as follows.

- 2015: States identify sources that will deploy new air quality monitors and those that will instead be subject to modeling
- 1/2017: States have new monitors deployed and operational. States submit modeling analyses for selected sources and nonattainment area boundary recommendations as appropriate.
- 12/2017: EPA finalizes area designations for modeled areas
- 8/2019: State SIPs due for modeled areas designated nonattainment in 2017
- 5/2020: States submit designation recommendations for areas relying on monitoring
- 12/2020: EPA makes final area designations for monitored areas
- 8/2022: State SIPs due for areas designated in 12/2020 based on monitoring

The EPA plans on undertaking notice and comment rulemaking to codify the implementation requirements for the 75 ppb standard. The outcome of that rulemaking, which EPA currently intends to complete in late 2014 could be different from what EPA put forth in its February 6, 2013 document.

Carolinas and Midwest Strategy

Scrubber installations at Allen, Cliffside 5 and Cayuga, Gibson Units 1 – 3, and the implementation of the Gallagher consent decree should positively impact 2009 – 2011 data. Reductions made by neighboring utilities for CAIR and other reasons should also make contributions to lower ambient SO_2 concentrations. Data from the Indiana ambient SO_2 monitoring network have already shown positive trends near the Gibson and Gallagher stations. Potential SO_2 impacts from Wabash River and Miami Fort 6 may be identified in future nonattainment designations, but retirements for these units would avert 2018 control requirements.

Carolinas and Midwest Strategy Challenges

It is possible that regulatory agencies will increase their focus on short-term power plant emission rates including those from scrubbed units. Stations with shorter stacks, such as Marshall, may have increased modeling risks. The potential for increased use of higher sulfur coal may also pose additional risk to Carolinas generation.

Gibson Unit 5 operates an older design scrubber unit with a comparatively high emission rate, and as a result emits a relatively high amount of SO_2. Longer term, new and relocated ambient SO_2 monitors could pose new challenges.

In addition, maintaining efficient scrubber operations, even though not potentially required in order to comply with NC CSA and CAIR SO_2 requirements, is important to avoid triggering monitored SO_2 exceedances near the scrubbed stations.

Duke Energy has begun to perform its own dispersion modeling to see what plants might be at risk and might be helpful with decisions about future coal purchases and compliance planning strategies.

Florida Strategy

The fuel used in the Anclote plant is being converted from a mixture of residual oil and natural gas to 100 percent natural gas. Installation of scrubbers on Crystal River Units 4 and 5 was completed in 2010. Crystal River Units 1 and 2 will be potentially retired in the 2015 to 2020 time frame.

2.8 Sulfuric Acid Mist or "Blue Plume" Impacts

When coal is combusted, a portion of the SO_2 that is created will ultimately convert to sulfuric acid mist (SAM). A visible "blue plume" can be more acute with units that operate SCRs, particularly when using higher sulfur coal, and at units operating wet FGD systems because of the cold, wet stack conditions.

The main concern is that the plume opacity once it exits the stack could be in excess of applicable opacity standards. In addition, there is the possibility of "touchdown" of a plume in the area surrounding the facility. Projects of potential concern can include the installation of a new SCR, installing additional SCR catalyst layers, or projects that change the catalyst SO_2 to SO_3 conversion rate. Such projects could require increased operation of plume mitigation systems.

The selection of sorbents for new systems or the increased use of sorbents on existing units with plume mitigation should be studied to provide a clear understanding of the impacts of the FGD system wastewater discharge and the effects on the leaching of pollutants from CCR solids. Soluble sorbents such as sodium are problematic in various disposal scenarios by affecting both discharges to surface water from leachate storm water and ground water.

Carolinas and Midwest Strategy and Challenges

Any unit with a wet scrubber has some type of SO_3 mitigation system installed or has the capability to readily install some type of SO_3 mitigation system. Historical use of lower sulfur coal in the Carolinas has significantly reduced the potential for visible emissions associated with sulfuric acid mist, but new fuel blending and use of higher sulfur fuels may increase the risk of sulfuric acid mist formation. Scrubbed units that may require future SCR or additional catalyst layers may also have to be evaluated for SO_3 mitigation. Use of SO_3 mitigation technology necessitates balance-of-plant evaluations to determine operational impacts.

Table 1 – Air Quality Issues/Challenges Summary

Carolinas	Existing Controls	CAIR Phase I Existing/(Planned Yr)		MATS (Potential Impacts)	CAIR (Potential Impacts)		NAAQS (Potential Impacts)
		NO_X	SO_2	HAPs	NO_X	SO_2	
Allen	SOFA, SNCR, FGD			$CaBr_2$ Add. and/or ACI . Add'l control risk/uncertainty if loss of CAPP fuel. Dry Sorbent injection for SO3 control if higher sulfur fuel use.			Ozone – NOx control using SCR or NOx Oxidation Technology (hydrogen peroxide injection)
Belews Creek	OFA/SCR, FGD						
Cliffside 5 & 6	SOFA/SCR 5, FGD 5 OFA/SCR 6, FGD 6			U5 - $CaBr_2$ Add. and/or ACI. Dry Sorbent injection for SO3 control if higher sulfur fuel use. Possible ESP enlargement depending on required injection levels of ACI and dry sorbent			
Lee	SOFA			Retire/gas conversion	Potential operational reductions in 2013 - 2014	Potential operational reductions in 2013 - 2014	Retire or convert to gas
Marshall	SOFA, SNCR 1, 2 & 4, SCR 3, FGD 1- 4			U1&2 - Br Add. and/or ACI; possibly ESP enlargement, depending on injection levels of ACI and sorbent; U4 – $CaBr_2$			Ozone – NO_X control using SCR or NO_X Oxidation Technology (hydrogen peroxide injection)
Asheville	SCR, FGD						Take lower SO2 permit limit
Mayo	SCR, FGD			Possible ACI or re-emission chemical.			
Roxboro	SCR, FGD						

Carolinas	Existing Controls	CAIR Phase I Existing/(Planned Yr)		MATS (Potential Impacts)	CAIR (Potential Impacts)		NAAQS/Other (Potential Impacts)
		NO_X	SO_2	HAPs	NO_X	SO_2	
Sutton	SNCR – U3			Retire coal units			Retire coal units by 12/31/13
Florida							
Crystal River	SCR, FGD – U4&5	U1&2 BART – Options either control by 2018 or retire by 2020	U1&2 BART – Options either control by 2018 or retire by 2020	U1&2 – Investigating options including coal switch and de-rate. Possible ACI or re-emission chemical.			U1&2 Ozone – Options either control by 2018 or retire by 2020. Timing should take care of SO2

Midwest Reg	Existing Controls	CAIR Phase I Existing/(Planned Yr)		MATS (Potential Impacts)	CSAPR (Potential Impacts)		NAAQS/Other (Potential Impacts)
		NO_X	SO_2	HAPs	NO_X	SO_2	
Cayuga	LNB/OFA, FGD			Re –emissions Additive, $CaBr_2$ Add. and/or ACI. Dry sorbent injection: SCR			
East Bend 2	OFA/SCR, FGD		FGD upgraded in 2005	$CaBr_2$ Add. and/or ACI. Dry sorbent injection; Re –emissions Additive			FGD Upgrade; Upgrades to SO_3 mitigation
Gallagher	LNB/OFA		Baghouses & Low Sulfur coal	Alkali inj. – 2 units are operational, Converting to Hydrated Lime injection		Potential load reduction beginning in 2014	Ozone – NO_X control for Units 2, 4
Gibson	FGD 1-5 OFA/SCR 1-5		FGD 1-5	Re –emissions Additive; possibly ACI. Quarterly stack testing for HCl.	New LNB with OFA, new flue gas mixing, fan upgrades and ductwork mods	FGD Upgrade 1-4, New FGD 5 or derate unit or retire unit	FGD Upgrade 1-4, New FGD5 for SO_2 or derate unit or retire unit
Miami Fort 6	LNB			Potential Retirement, Site-wide averaging provision			Likely Retire
Wabash River 2-6	LNB/OFA 2-6			Potential Retirement		Potential load reduction beginning in 2013, significant operating risk in ‘14	Likely Retire

3.0 Water Quality Strategic Issues

Over the next several years, the major drivers related to water quality that will influence environmental strategy are 316(b) Cooling Water Intake Structures (fish impingement/entrainment), 316(a) thermal discharge variance renewals, steam electric effluent limitation guidelines, groundwater monitoring requirements with more stringent groundwater standards, and water availability concerns in the Carolinas. Table 2 at the end of this Section summarizes likely station-specific water quality impact challenges.

3.1 316(b) Cooling Water Intake Structures

EPA published its proposed cooling water intake structures rule on April 20, 2011. The proposed rule establishes mortality reduction requirements due to both fish impingement and entrainment and advances one preferred approach and three alternatives. The EPA's preferred approach establishes aquatic protection requirements for existing facilities and new on-site generation that are defined as existing facilities with a design intake flow of 2 million gallons per day (MGD) or more from rivers, streams, lakes, reservoirs, estuaries, oceans, or other U.S. waters and utilizing at least 25% of the water withdrawn for cooling purposes. Based on the preferred approach, most, if not all of the coal- and nuclear-fueled regulated facilities are likely affected sources. Additional sources, including some combined-cycle combustion turbine facilities, may also be impacted, at least for impingement intake modifications, due to the 2-MGD design intake flow threshold.

To comply with impingement requirements, modified traveling intake screens with fish handling and return systems are a likely retrofit. EPA proposed a strict definition of closed-cycle cooling and closed-cycle cooling systems that if units met the definition were deemed to have met the entrainment requirements, although the proposed rule does not mandate closed-cycle cooling at all sites. Site specific evaluations to determine the best technology available to address entrainment are, however, required to be conducted and closed-cycle cooling and fine mesh screens must be evaluated. EPA published a Notice of Data Availability (NODA) in mid-2012 to solicit comments on "preapproved technologies" to address impingement and other compliance alternatives along with addressing new "benefits" information from a previous survey.

The current EPA settlement agreement calls for the EPA to finalize the 316(b) rule in June 2013. If the rule is finalized as proposed, initial submittals, station details, study plans, etc, for some facilities would be due in the March/April 2014 timeframe. If required, modifications to the intakes to comply with the impingement requirements could be required as early as mid to late 2016. Within the proposed rule, EPA did not provide a compliance deadline for meeting the entrainment requirements.

Strategy

Work with the Utility Water Act Group (UWAG) to effect a positive outcome with EPA on the final rule. Also review EPRI research results of various technologies as those are available. Impingement Mortality and Entrainment (IM&E) studies and reports will be completed for applicable facilities and tentative plans will be made for intake screen/fish return modifications. Once the rule is finalized, compliance and technology evaluations will be conducted. If intake screen modifications are required, preliminarily, affected stations could spend approximately $5 to $30 million on average to complete these types of retrofits. The costs are primarily dependant on the number of intake bays/screens at the facility. If required, the costs and impacts of installing cooling towers will obviously be significantly greater to impacted stations. Based on the expected compliance schedule, several of the more severely affected coal-fired stations in the Carolinas and Midwest will be retired and thus should not be impacted. However, those coal sites that may be converted to gas and will continue to use the station intakes to support new combined cycle generation are likely to be impacted to comply with intake impingement requirements and installation of 316(b) compliant screens.

The Gibson Station has an NPDES permit for stormwater. Gibson may need to consider re-routing its stormwater in order to eliminate the need for the stormwater permit. The existence of the stormwater permit for Gibson could require compliance with 316(b) requirements.

3.2 NPDES and Wastewater Treatment Discharges

Every regulated coal-fired facility in the Carolinas and Midwest has an ash basin/pond which receives some combination of bottom ash, slag, fly ash, and other plant wastewater streams for treatment. Ash basin effluents (except Gibson) are regulated by a state National Pollutant Discharge Elimination System (NPDES) permit.

The NPDES permit limits vary by station, based on different state requirements and a projected reasonable potential of exceeding toxicity thresholds or other levels of concern for metals or other constituents relating to a specific discharge. Bottom ash and slag are relatively stable and pose very little impact to ash basin water quality. Fly ash can have a much larger impact on ash basin chemistry, in part due to the comparatively large combined surface area, which leads to much more leaching of various water-soluble constituents, including metals, from the particles. Fly ash is also a collector of ammonia slip from NO_X control systems, reagents for SO_3 control such as sodium, calcium bromide and magnesium, and the potential sorbents for mercury control. Ash basin chemistry is also influenced by changes in fuel source. All of these have the potential to impact metal concentrations and levels of other constituents of concern (e.g., nutrients, ionic constituents) at the NPDES discharge.

Steam Electric Effluent Limitation Guidelines: In September 2009, EPA announced plans to revise the steam electric effluent limitation guidelines, which are federally established, technology-based effluent limits based on the capability of the best technology available. The primary focus of the revised regulation is coal-fired generation, thus the major areas likely to be impacted are FGD wastewater treatment systems and ash handling systems. Any focus on nuclear facilities is likely to be on chemical cleaning operations. The EPA may set limits based on the performance of certain FGD wastewater treatment technologies for the industry and may require dry ash handling systems for both fly ash and bottom ash to be installed. EPA may also set limits on landfill leachate, possibly requiring leachate to be routed to a treatment system prior to it discharging to an ash basin or through an outfall.

The current EPA settlement agreement calls for the EPA to propose the revised steam electric effluent limitation guidelines by April 2013, and finalize the guidelines by May 2014.

After the final rulemaking, effluent guideline requirements will be included in a station's NPDES permit renewals. Thus requirements to comply with NPDES permit conditions may begin as early as mid-2017 for some facilities.

Selenium Water Quality Criteria: EPA establishes recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants. These criteria are published pursuant to CWA Section 304(a) and provide guidance for states to use in adopting surface water quality standards. EPA could issue draft revised water quality criterion (chronic) on selenium in 2013. The new criterion will incorporate water quality action levels of approximately 2 ppb selenium for lentic (non-flowing) and a slightly higher level for lotic (flowing) waters. If the action level is exceeded, a fish tissue (ovary) criterion must be met. It is uncertain when a draft implementation guidance document will be issued. This guidance will inform state regulators on how to restrict selenium in NPDES permits. Over the next several years the new chronic criteria will require fish tissue to be measured for selenium content, particularly in waterbodies where the water concentration of selenium exceeds action levels. If the tissue criteria is also exceeded, then the water body will be considered impaired and NPDES permitted facilities will have selenium limits imposed to reduce the selenium loading to the water body. Currently, an acute selenium criterion is not envisioned.

SO_2 Scrubber Wastewater Treatment (WWT): A wastewater stream is created from the scrubber blow down and dewatering of the scrubber by-product (gypsum). Many of the semi-volatile metals and nitrates that are not captured in the Electrostatic Precipitators (ESP) are captured in the scrubbers. Based on NPDES permitting requirements, the constituents of most concern are mercury, selenium, arsenic and nitrates. Although water quality standards for boron, chloride and bromide do not currently exist, EPA and various states are contemplating their inclusion in future rulemakings.

The regulatory limits differ from station to station, depending upon the impact on the receiving waters. Various FGD wastewater treatment systems are now in place at Allen, Belews Creek, Cliffside 5, Cayuga, Gibson, Asheville, Roxboro, Mayo and Marshall. Various stations treat FGD wastewater system effluents in the ash basins. A change in CCR rules could affect this option and thus the treatment process used at many sites.

For Cliffside 6, an FGD with a spray dryer and baghouse combination is used. The spray dryer may, however, be supplemented with an upgrade of the wastewater treatment system via a modular reactor to manage the selenium because the spray dryer cannot manage the total wastewater output from both units. A decision regarding the type of wastewater treatment system will be deferred until there is more certainty concerning the Effluent Guidelines and the upcoming NPDES permit renewal. The FGD effluent is used in the lime slurry that is injected in the spray dryer ahead of the baghouse.

Stormwater Permitting: In 2010, NCDENR Division of Water Quality (DWQ) initiated the removal of storm water discharges associated with industrial activity coverage within the NPDES Wastewater Permit at North Carolina coal-fired stations and began requiring an application and issuance for coverage under a separate NPDES Storm Water Permit. This change to an individual permit would occur during the normal renewal process for NPDES wastewater permits. Comments were submitted to DWQ in May 2012 from both Duke Energy Carolinas and Duke Energy Progress that included the request that DWQ adopt a general permit for storm water discharges associated with industrial activity that would cover steam electric plants, similar to the general permits used in other states. There has been no response to date.

If adopted, the compliance requirements of the DWQ NPDES Storm Water Permit are onerous with a number of parameters to analyze and compare to a host of benchmark values.

For Florida, Ohio, Indiana, and Kentucky storm water discharges associated with industrial activity is currently covered within the station’s NPDES Wastewater Permit (i.e., as applied for in a submitted Form 2F). For states with an adopted general permit, the requirements for storm water in the NPDES Wastewater Permit are patterned after the conditions and requirements of the general permit.

Stations in Florida have decided to apply for coverage under the state’s NPDES Industrial Storm Water General Permit (Sector O) and remove the storm water requirements from the NPDES Wastewater Permit. This voluntary change will occur during station NPDES Wastewater Permit renewal. Coverage for industrial storm water at stations in South Carolina are currently covered under the South Carolina NPDES General Permit for Storm Water Discharges Associated with Industrial Activity and not a component of the wastewater permit.

Other NPDES Limit Initiatives: There are various state initiatives to implement water quality standards changes which could directly impact the NPDES discharge limits. The impacts to the company are difficult to assess at this time. Initiatives of note are shown below:

- Lower nitrate limits will be proposed in the Midwest within the next few years. Treatment technologies are limited to expensive biological options. A water quality trading project has been initiated in the Ohio River Basin in which Duke Energy is participating with EPRI.
- The Ohio River Valley Sanitation Commission (ORSANCO) is leading an initiative to place a limit of 12 ppt for Hg on any permitted discharge with compliance required in 2013.
- Indiana finalized an Antidegradation Rule on June 28, 2012. This rule applies to a proposed new or increased loading of a regulated pollutant to a surface water of the state that results from a deliberate activity subject to the CWA including a change in process or operation that will result in a significant lowering of water quality.
- Several states have begun to look at setting water quality-based NPDES limits on boron. Currently the technology for treatment of boron is very limited and expensive.
- Some States are considering regulating the discharge of bromide and chlorides into receiving waters. Belews Creek has detected increased levels of bromide downstream of its discharge in the Dan River. These increased bromide concentrations can create disinfectant byproduct problems for drinking water systems. The municipalities of Eden and Madison, North Carolina have experienced difficulties meeting their total trihalomethane (TTHM) drinking water limits. The Belews Creek NPDES contains language that commits Duke to provide semi-annual reports to DWQ with updates on efforts to manage bromide at the source (a potentially viable treatment technology has been identified and is being pilot tested at Belews Creek.) Cliffside and other stations using wet FGD systems with discharge to relatively low flow receiving waters have the potential to impact downstream water treatment plants as well. In addition, there is a risk that EPA and/or NC could institute a water quality standard for bromide because wastewaters with high bromide concentrations are typical with shale fracking operations for natural gas.
- Florida Mercury TMDL: In accordance with a court settlement, the Florida DEP is completing a mercury Total Maximum Daily Loading (TMDL) determination for the state's waters. Florida must complete this TMDL to avoid the EPA developing and imposing one on the state. The DEP concluded that no additional mercury reductions will be required from the state's electric utilities to achieve the TMDL. EPA proposed approval on November 30, 2012. The Florida legislature is expected to ratify the TMDL in the 2013 session, and then the EPA will take final action.
- Florida Numeric Nutrient Criteria (NNC): The Florida DEP has developed alternate criteria for total nitrogen and total phosphorus in most of the state's waters that will replace more stringent criteria developed by EPA in 2011.

The EPA proposed approval of Florida's criteria on November 30, 2012. Final action is expected in 2013.

Strategy

The most comprehensive solution to ash basin compliance for effluent guidelines, water quality criteria and other initiatives is to convert facilities to dry ash handling and either sell the ash or dispose of it in a lined landfill.

Additional wastewater treatment systems may be required in the coming years as the use of ash basins for wastewater treatment is phased out due to effluent guidelines and CCR regulations or as additional constituents of NPDES permitted discharges become more stringently regulated.

The United States Supreme Court's January 2013 decision in *Los Angeles Flood Control District v. Natural Resources Defense Council, Inc.,* No. 11-460 unanimously held that the flow of water from an improved portion of a navigable waterway into an unimproved portion of the same waterway does not qualify as the "discharge of a pollutant" under the Clean Water Act (CWA). The Supreme Court's decision is important to the hydroelectric industry in that it preserves the long-standing precedent that discharges from reservoirs through hydropower dams are not subject to NPDES permitting.

3.3 Groundwater Standards and Monitoring

Unlined landfills and ash basins can potentially impact groundwater. Many of these waste management units, primarily in the Midwest, are constructed over significant aquifers. Duke Energy implemented a voluntary plan to monitor groundwater, and by the end of 2010 had monitoring wells around all active landfills and ash basins. North Carolina active ash basin wells were replaced in 2010-2011 with wells at the compliance boundary. Compliance sampling data is provided to NCDENR three times per year and to SCDHEC on a semi-annual basis. If an exceedance of groundwater standards is found attributable to the CCR units, Duke Energy would consult with the state regulatory agency in N.C. to decide on a plan of action. In Indiana, impacts to groundwater have been observed at all of the stations except Wabash River Station. The ash ponds at Gibson and Cayuga are a source of contaminants and have impacted off site receptors, however, no-off site MCLs have been exceeded. These ponds are in the process of being closed, evaluated, and/or retrofitted with liners.

Regulatory Status and Monitoring Results to Date

Carolinas – Elevated levels of boron and other non-carcinogenic substances have been detected at some on-site sampling wells in excess of State groundwater standards. Naturally occurring iron and manganese are frequently detected.

Relatively higher concentrations of boron, total dissolved solids (TDS) and chlorides in FGD wastewaters being discharged to ash basins also increase the risk of boron and chloride impacts to groundwater. If groundwater standard exceedances are reported, the agencies could require a Site Investigation and Corrective Action Plan. The extent of the additional requirements would vary depending on site conditions and regulatory requirements. NC DWQ has initiated regional ash basin groundwater assessments at the seven legacy Duke fossil facilities. For Sutton plant, Phase I and Phase II groundwater investigations were completed between 2010 and 2012 to better identify the extent of the boron plume at or beyond the compliance boundary. These investigations were completed per the Wilmington Regional Office. For the Asheville plant, on March 22, 2013 the North Carolina Attorney General's office filed a Civil Enforcement Action in the Wake County Superior Court on behalf of DWQ. That action alleges that the Asheville Plant violated the groundwater standard for thallium and has seepage from the ash ponds and other locations at the plant that is not allowed by facility's NPDES permit. The company has 30 days to answer the DWQ Action. The Southern Environmental Law Center on March 26, 2013 issued a Notice of Intent of impending legal action against Duke Energy Carolinas related to ash basin seepage and groundwater exceedances at the Riverbend Steam Station. . No other Duke Energy Progress ash basin is involved in investigation mandated per a state agency (e.g., the investigations completed at Weatherspoon plant were initiated internally).

Midwest – Many of the contaminants observed in the ground water monitoring networks have not exceeded health based standards. Data from groundwater monitoring networks, however, continue to be evaluated to determine potential exceedances of health-based standards. Gibson Station has received approval from the IDEM to close its East Ash Pond System under a schedule that provides reasonable time to construct and close. The station is also currently studying the performance of the only ash pond that will remain active to manage bottom ash once all flyash systems are converted to dry handling. Cayuga Station has submitted an ash pond closure plan that is pending approval from IDEM. At Cayuga Station, all ash sluice and wastewaters will eventually be managed through lined ponds and ditches until discharge via the NPDES outfall. Duke Energy has proactively facilitated provision of municipal drinking water to residents in close proximity to the Gibson and Cayuga stations. All other stations are continuing to monitor ground water and at this time no further action is necessary.

The following water-related issues and problems are expected to present challenges to regulated generation and should be evaluated and planned for over the next several years.

1. Further studies are necessary to better understand the impacts of the surface water from the Gibson cooling pond on ground water. For example, future studies may focus on the sediments in the cooling pond and how they affect surface water

leaching into ground water. Duke Energy will need to continue to demonstrate to the IDEM the effectiveness regarding the closure work of the East Ash Pond and the performance of the existing landfill. The Gibson cooling pond may be identified as the source of groundwater impacts at certain downgradient wells. This may trigger regulatory or enforcement issues that will need to be addressed.

2. Evaluate means to reduce or eliminate the wastewater stream (high chlorides discharge) from the reverse osmosis (RO) water system at Gibson. Evaluate deep injection wells as possible disposal means for RO water and other non-hazardous waste streams.
3. The new CCR rules will likely not allow ash ponds to remain active as a means for waste water treatment without retrofitting with liners. Alternatives to ash ponds for wastewater treatment will be required for stations that continue to operate and currently have no other waste water treatment capability.
4. With station retirements, managing leachates and other wastewaters during and after plant closure will be a challenge.
5. Studies should continue to look at using FGD Wastewater (high chlorides, and trace elements) in the fixation process to be sure it is a viable option to manage waste water that can no longer go to ponds. Past studies have been short-term, additional studies should be conducted under variable conditions and longer periods of time.

3.4 Water Availability Concerns

Climate change has the potential to affect water availability. While highly speculative, some predict that climate change will alter weather events and patterns such that they become more extreme, featuring more severe droughts and higher floods. Strategies designed to help cope with potential climate change could include measures to prepare for the potential for more extreme weather conditions coupled with increased population demand for water.

As part of a review of water availability issues in the Carolinas which began in 2009, specific issues were identified at Oconee, McGuire and Catawba Nuclear Stations. At Oconee, system requirements limit how far Lake Keowee can be drawn down, which exacerbates water availability issues during a drought or when the downstream U.S. Army Corps of Engineers (USACE) Projects require a Lake Keowee release of water in accordance with Duke Energy's1968 Operating Agreement. Oconee is preparing a modification to allow greater lake-level flexibility. At McGuire, potential thermal issues have been identified if Lake Norman is required to be drawn down in accordance with the Low Inflow Protocol (LIP) developed as part of the Catawba-Wateree Hydro Project Comprehensive Relicensing Agreement (CRA). At Catawba, an instrumentation issue on the Nuclear Service Water system limits draw-down of Lake Wylie during drought conditions to keep Catawba operational. Catawba is preparing a modification to address this instrumentation issue.

Currently there is no law in NC regulating withdrawals of surface water (unless returned to a different basin, also known as inter-basin transfer). South Carolina, however, passed into law the Surface Water Withdrawal Permitting, Use and Reporting Act and it became effective January 1, 2011. The General Assembly in June 2012 passed S. 1220 which removes the surface water withdrawal permitting fees sunset date provision and establishes the surface water withdrawal permitting fees via legislation. The regulations were published in the June 2012 S.C. State Register. Environmental Services submitted surface water withdrawal permit applications for all existing Duke Energy S.C. generating facilities that require a permit (i.e. Lee Steam, Oconee, Catawba, and Robinson). SCDHEC communicated that they will begin issuing surface water withdrawal permits in 2013. Hydroelectric generation is exempt from the surface water withdrawal permit requirement.

Table 2 – Water Issues/Challenges Summary

	Current Systems		Water Issue Challenges			
	Ash Handling Existing	FGD WWT Type/year	NPDES Limit Potential	316(b)	Dry Ash Conversion	FGD Wastewater Treatment Limits
Carolinas						
Allen	Dry	Solid Removal/Bio Reactor (09)	Se, As, B, pH	Modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation	Convert bottom ash to dry	Se, As, B, Cl, Hg, TDS
Belews Creek	Dry	Solid Removal/Bio Reactor	Se, As, B	Installation of modified traveling screens/ impingement monitoring-- CT and fine mesh screen evaluation	Convert bottom ash to dry	Se, As, B, Cl, Hg, Br, TDS; separate discharge risk concern
Cliffside 5&6	Dry	CS5 Solid Removal /Gravity Filter (10)	Se, B, pH	Modified traveling screens	U5 - Convert bottom ash to dry	Se, As, B, Cl, Hg, Br, TDS
Lee	Sluice	N/A	As, pH	Modified traveling screens/ impingement monitoring Utilize existing towers to be defined as closed-cycle cooling.	Not likely due to retirement	N/A

	Current Systems		Water Quality Challenges			
	Ash Handling Existing	FGD WWT Type/year	NPDES Limit Potential	316(b)	Dry Ash Conversion	FGD Wastewater Treatment Limits
Marshall	Dry	Solid Removal /Wetland	Se, As, B, pH	Installation of modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation	Convert bottom ash to dry	Se, As, B, Cl, Hg, TDS
McGuire	N/A	N/A	N/A	Modified traveling screens / impingement monitoring-- CT and fine mesh screen evaluation	N/A	N/A
Oconee	N/A	N/A	N/A	Installation of modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation	N/A	N/A
Catawba	N/A	N/A	N/A	Modified traveling screens / impingement monitoring; CT in service	N/A	N/A
Asheville	Sluice	Solid Removal/Wetland (05)	Se, B, Cl, Hg,, As, Ba, Be, Br, Cd, Co, Cr, Mn, Mo, Pb, Sb, Tl, V, Cl, F, TSS	Modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation		

	Current Systems		Water Quality Challenges			
	Ash Handling Existing	FGD WWT Type/year	NPDES Limit Potential	316(b)	Dry Ash Conversion	FGD Wastewater Treatment Limits
Lee / Wayne NGCC	N/A	N/A		Modified traveling screens / impingement monitoring	N/A	N/A
Mayo	Dry flyash, converting to dry bottom ash in 2013	Settling Pond/Bioreactor (09), Partial ZLD complete by end 0f 2013	As	Modified traveling screens/fine mesh screen evaluation	Convert bottom ash to dry in 2013	Se, B, Cl, Hg,, Ba, Be, Cd, Co, Cr, Mn, Mo, Pb, Sb, Tl, V, Cl, F, TSS
Roxboro	Dry flyash, converting to dry bottom ash 2014	Settling Pond/Bioreactor (07)	Se, B, Cl, Hg,, As, Ba, Be, Br, Cd, Co, Cr, Mn, Mo, Pb, Sb, Tl, V, Cl, F, TSS	U1-3; Modified traveling screens / impingement monitoring-- CT and fine mesh screen evaluation U4; Modified traveling screens	Convert bottom ash to dry in 2014	
Sutton NGCC	N/A	N/A		Modified traveling screens / impingement monitoring	N/A	N/A
Shearon Harris	N/A	N/A	N/A	Installation of modified traveling screens; CT in service	N/A	N/A

	Current Systems		Water Quality Challenges			
	Ash Handling Existing	FGD WWT Type/year	Ash Handling Existing	FGD WWT Type/year	Ash Handling Existing	FGD WWT Type/year
Brunswick	N/A	N/A	N/A	Several technologies in place, incl. fine mesh screens & diversion structure. Possibility of modified traveling screens/impingement monitoring/ barrier nets / CT evaluation	N/A	N/A
Robinson	N/A	N/A	N/A	Installation of modified traveling screens / impingement monitoring - CT and fine mesh screen evaluation	N/A	N/A
Florida						
Crystal River	Dry	Percolation Pond (09)		Once Thru – U1&2; Modified traveling screens / impingement monitoring / barrier net -- CT and fine mesh screen evaluation Closed cycle cooling – U4&5; Fine Mesh Screen evaluation		

	Current Systems		Water Quality Challenges			
	Ash Handling Existing	FGD WWT Type/year	NPDES Limit Potential	316 (b)	Dry Ash Conversion	FGD Wastewater Treatment Limits
Anclote	N/A	N/A		Modified traveling screens / impingement monitoring / barrier net -- CT and fine mesh screen evaluation	N/A	N/A
Bartow	N/A	N/A		Modified traveling screens / impingement monitoring / barrier net -- CT and fine mesh screen evaluation	N/A	N/A
Suwannee	N/A	N/A		Modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation	N/A	N/A
Midwest Reg						
Cayuga	Sluice to new pond	Solids removal & dilution	Hg, pH	Modified traveling screens / impingement monitoring -- CT and fine mesh screen evaluation Helper towers in place	~ $35M to convert; Convert bottom ash to dry	TSS, O & G, As, Cd, Cr, Cu, Pb, Mn, Hg

	Current Systems		Water Quality Challenges			
	Ash Handling Existing	FGD WWT Type/year	Ash Handling Existing	FGD WWT Type/year	Ash Handling Existing	FGD WWT Type/year
East Bend 2	Dry	Closed cycle design, FGD wastewater recycled or incorporated into solid waste and landfilled	Cu, Hg	Modified traveling screens	Convert bottom ash to dry	Min. Risk
Edwardsport IGCC	Slag-beneficial reuse			NA, Groundwater Collection Wells		
Gallagher	Dry		Nitrates, pH, Hg	Modified traveling screens -- CT and fine mesh screen evaluation / impingement monitoring	Convert bottom ash to dry or retire	
Gibson	1-3 Sluice (converting to dry in 2012-2013) 4&5 Dry	Solids removal, then to North Ash pond	N/A	Installation of modified traveling screens / impingement monitoring	Flyash - $126M for U 1-3; Convert bottom ash to dry	Se, As, B, Cl, Hg, TDS
Miami Fort 6	Sluice		Hg, Nitrates, pH	Likely Retire	Likely Retire	
Wabash River 2-6	Sluice, U6 can also handle dry		pH, hex chrome, Hg	Likely Retire	Likely Retire	

4.0 **Waste Management Strategic Issues**

Various waste related issues may have very large implications in the coming years, depending upon the outcome of regulations that EPA is considering. New regulations targeting CCRs have been proposed by EPA. CCRs include fly ash, bottom ash, boiler slag, mill rejects, FGD byproducts and many of the fossil fuel emission control additives/byproducts (i.e. activated carbon, spent sorbents).

EPA in 2010 also took advanced comment on possible mandatory phase-out of all uses of polychlorinated biphenyls (PCB) in the next decade.

Table 3 at the end of this Section summarizes likely waste issue challenges.

4.1 PCB Phase-Out

On April 7, 2010 EPA issued an Advanced Notice of Proposed Rulemaking (ANPR) to reassess authorizations for PCB use and distribution in commerce. EPA is considering the possibility of following a 2008 Canadian regulation that would require phase-out of PCBs by 2025. Following the Canadian approach would result in phasing-out all electrical equipment containing PCBs at 50 ppm or greater, as well as eliminating the authorization to use PCBs at those concentrations in gas pipeline systems. A preliminary inventory of Duke Energy Carolina's electrical equipment has been completed. Current PCB regulations do not require testing of equipment and allow companies to assume that non-tested equipment contains 50 ppm or more PCB. Thus, there is no accurate inventory of the distribution electrical equipment in the regulated business that contains PCBs at or above 50 ppm and that would be affected by such a new phase-out rule. Electrical equipment manufactured prior to 1980 has the highest risk of containing PCBs. Costs of complying with such a final regulation would primarily impact the Power Delivery function, although the generating facilities and Gas Operations will also likely incur costs.

EPA has established a new target date of the fall of 2013 for a proposed rule. EPA will likely move forward with drafting a proposed rule focused on liquid PCBs, as well as for issuing a data information collection request (ICR) later in 2013 for certain targeted gas pipeline companies. The PCB liquids rulemaking will likely focus on transformers; it is not clear at this time whether the proposal would also apply generally to all PCB liquid-containing equipment.

4.2 Coal Combustion Residuals

The EPA issued proposed regulations relative to CCR management on June 21, 2010 and then followed up in 2011 with a NODA to gain comments on all new data from the proposed rule comment period. Final regulations are not expected to be issued by EPA until 2014 or later. EPA's final regulatory classification of CCRs as hazardous or non-hazardous will be critical in developing plans for handling CCRs in the future. The new rule will likely require the development of applications to permit all ash basins under the solid waste regulatory structure for groundwater protection. Permit applications will likely include groundwater monitoring plans, dam/dike safety requirements with inspections, composite liners for all new units and expansions, closure/post closure plans, and a financial assurance mechanism to receive a permit. Compliance monitoring is expected to begin one year after the rule is finalized and compliance with most other portions of the rule would likely begin around 2019.

There are three major CCR sub-types generated during Duke Energy's operations.

1. Bottom ash – Disposal is generally into an ash basin and poses low environmental risk due to stability. Bottom ash is also sold for various reuses.
2. Fly ash – Disposal either to a landfill or via sluicing to an ash basin. Dry ash is also sold for reuse.
3. FGD solids – Forced oxidation scrubbers generate calcium sulfate (gypsum) and inhibited oxidation scrubbers generate calcium sulfite. The gypsum is generally reused in the wall board and agricultural use markets and the calcium sulfite is generally mixed with fly ash and fixated with lime prior to disposal. If the gypsum cannot be reused, it will be disposed in a lined landfill. In addition, the filtercake from the FGD wastewater treatment plants associated with forced oxidation scrubbers must be disposed of in a landfill. The use of gypsum in agricultural markets occurs in the Midwest and is being evaluated in the Carolinas.

<u>Carolinas and Midwest Strategy</u>

Escalating CCR disposal costs, increasing uncertainty and risk associated with CCR disposal, changing and inconsistent regulations and diminishing land availability for disposal require multi-faceted strategic planning for future needs. In the Midwest, there are currently adequate long-term disposal options for CCR for each station. In the Carolinas, Duke Energy is implementing an improved long-term position for the scrubbed stations. Except for Lee Steam Station in South Carolina, all Carolinas non-scrubbed stations are expected to retire by the end of 2013 and will not require landfills for remaining ash disposal. The S.C. Lee station is expected to retire its coal operations in 2015. The use of landfills at the various stations is summarized in Table 3.

<u>Bottom Ash and Fly Ash Disposal</u>

Landfills - New landfills will be required to install a prescriptive cap/liner system to help prevent impacts to groundwater. Siting of landfills is currently one of the greatest challenges, due to the large space requirements and the diminishing availability of land around many of our sites. NC law provides a good option for constructing double-lined landfills over previous on-site ash disposal/use areas. This option allows for reuse of onsite land that would otherwise not be available, and it effectively caps the past ash disposal area. Construction of composite liners with leachate collection landfills over past ash disposal areas is also an option in Indiana, where two of its existing landfills have been permitted and built. Landfills are prohibited on portions of the Marshall site due to this site being partially located within the State's Critical Watershed Areas. For preliminary budgeting purposes, the capital cost of a prescriptive (composite lined) landfill can be $500k/acre.

Ash Basins and Surface Impoundments – Under current regulations, existing ash basins will likely be required to meet a performance-based standard for groundwater protection, which may force corrective action, with the worst case being a phase-out and closure of ponds. Phasing out of surface impoundments will result in conversion to dry fly ash and bottom ash collection. Any phase-out would result in managing CCR in landfills, closure activities of the basins and significant changes to wastewater treatment. Ash basins are used not only for ash management but also for treatment of various low volume wastewater streams.

FGD Byproducts Disposal

Currently, there are 30 coal-fired units with operating scrubbers on the regulated Duke Energy system. In the Midwest, all newer FGDs were designed to produce wallboard-grade gypsum. The Gibson Unit 5 FGD upgrade (forced oxidized) produces disposable grade gypsum that is pug-milled with ash and quicklime for fixation. The byproducts from the Gibson Unit 4 scrubber and the scrubber at East Bend are pug-milled with fly ash and quicklime but need water for stabilization. Gibson Units 1-3 are in the process of converting to dry fly ash handling and the gypsum will be used for fly ash stabilization. The FGD wastewater will be used as water for hydration eliminating one of the major sources of contaminant loading in the surface water systems.

Gallagher Station is currently the only station using a dry sorbent injection system to control SO_2. Units 2 and 4 control sulfur dioxide using hydrated lime to avoid landfill leachate issues from sodium use.

In the Carolinas, all the FGD systems produce a wallboard-grade gypsum product. Gypsum residuals from the FGD wastewater treatment system are disposed of in a landfill. With the construction and operation of lined landfills at Allen and Cliffside, the lined FGD landfill at Marshall no longer receives off-site FGD wastes. Belews Creek also has on-site landfills for these FGD fines and any gypsum that is not immediately reused. At both Mayo and Roxboro, the FGD systems produce a wallboard-grade gypsum product that is sent to a wallboard plant adjacent to Roxboro. FGD materials produced at Asheville are re-used to the extent possible but unused materials are sent to an off-site landfill for disposal.

In Florida, Crystal River Units 4 and 5 are equipped with FGDs and the gypsum produced is primarily sold. Unsold gypsum is disposed in an on-site landfill.

CCR Reuse

In both the Midwest and Carolinas, Duke Energy currently sells its fly ash into the concrete market and its gypsum into the wallboard market. With the addition of scrubbers and possible ash beneficiation projects, saleable volumes of both fly ash and gypsum could increase. However, future CCR sales will depend not only upon the market demand but also upon the final regulatory classification of CCRs.

In the Carolinas, the contract with National Gypsum will generally be met with the gypsum produced from Marshall, Allen and Cliffside 5, with Allen being the first supply option due to its proximity. With Cliffside Unit 6 operational, an additional 250,000 to 400,000 ton/yr will be produced. An initiative is needed to find use for the additional gypsum that will be produced at Cliffside.

Going forward and in general, ash reuse as structural fill material is not a viable option.

Proposed Regulations

New federal regulations were proposed on June 21, 2010 and will dictate how regulatory programs will address both dam safety and CCR management in the future.

Both current and past ash handling practices and disposal areas are expected to be impacted by the proposed CCR regulation and will likely require significant attention in the future. The proposed CCR regulations include options to regulate CCRs as hazardous waste (RCRA Subtitle C) or as non-hazardous (RCRA Subtitle D). Except where noted, deadlines to comply with a final regulation are generally expected to fall in the 2018 to 2022 timeframe. EPA may not issue a final CCR rule until 2014 or later.

The general requirements under the proposed options for handling CCRs are summarized below:

Subtitle D

- To remain operable, existing surface impoundments would have to meet location and liner requirements within 5 years or they must close via clean closure or more likely close in place.
- A “D-prime” option (preferred by Duke Energy) allows ponds to remain in operation for their remaining useful life if they meet certain performance criteria.
- New and existing surface impoundments must meet new dam safety requirements, would require groundwater monitoring and corrective actions as needed, must meet siting restrictions, would require weekly inspections and have requirements for closure and post-closure care.
- New landfills require composite liner and leachate control.
- Landfills would have to meet stringent groundwater monitoring requirements and be subject to corrective actions for groundwater exceedances.

- There are no proposed restrictions to "encapsulated" uses of CCRs.
- EPA reserves the right to establish controls on "unencapsulated uses" of CCRs. Large scale fill projects would be considered as landfills.
- The Subtitle D proposed rule discusses the possibility for beginning closure activities of any inactive ash basin, landfill or structural fill as early as seven months after promulgation of a Subtitle D rule (or 30 days following the effective date of the rule) with closure completed six months later.

Subtitle C

- Existing surface impoundments must cease operation within 5 years and close via clean closure within 2 years thereafter. These closure requirements would extend to all impoundments that have not been properly closed.
- New and existing surface impoundments must meet new dam safety requirements, would require groundwater monitoring and corrective actions as needed, must meet siting restrictions, would require weekly inspections, and have requirements for closure and post-closure care.
- New landfills require composite liner and leachate control.
- Existing landfills will have to be re-permitted. All landfills would have to meet stringent groundwater monitoring requirements and be subject to corrective actions for groundwater exceedances.
- CCR destined for reuse is proposed to be exempt from hazardous waste regulation.
- Exemption would not apply to CCR used in large scale fill projects.
- EPA reserves the right to establish controls on "unencapsulated uses".
- Questionable ability to re-use CCR if labeled "hazardous waste."
- Concerns with compliance with hazardous waste regulations – spill reporting threshold (1 lb), employee training requirements, transporter requirements, re-engineering of plant systems, land disposal restrictions, etc.

New CCR regulations or the various States' implementation of the regulations may also address environmental justice concerns relative to CCR disposal, which are a priority for the current Administration. Environmental justice issues would include the potential impacts of offsite landfills on low income and minority populations. Environmental justice issues could be a factor in siting of new CCR handling and disposal facilities and could create additional challenges as dry handling and landfilling of CCRs become required and/or as hazardous waste classification of CCRs occurs.

CCR Regulation Challenges

A new rule will very likely require much more stringent maintenance and inspection requirements of CCR impoundments. Over time, wet fly ash and bottom ash handling systems are expected to be replaced with dry handling systems. Ash ponds are expected to be closed. Ash ponds and other ash fill operations will be replaced exclusively with lined landfills. New wastewater treatment systems will be required to replace treatment offered by wet ash basin systems. Closure of various wet and dry CCR disposal areas will be required in accordance with applicable regulatory requirements. Costs and challenges will vary by station depending upon the magnitude, complexity and type of CCR handling operations already in place and the outcome of the final regulation.

Table 3 – Waste Management Issues/Challenges Summary

Station	**Ash Handling**		**FGD Handling**	**Disposal Means**	**Risks**
Carolinas	Fly	Bottom			
Allen	Dry	Wet	Yes	Bottom Ash to Pond; Fly Ash, FGD to Lined Landfill	Future pond cleanouts will likely be landfilled. Long term landfill capacity needs for ash/gypsum – beyond 2022 – may be off-site. Convert bottom ash handling to dry system. Significant ash pond closure needs
Belews Creek	Dry	Wet	Yes	Bottom Ash to Pond; Fly Ash, FGD to Lined Landfills	Significant landfill needs. Little to no current market for gypsum. Convert bottom ash handling to dry system. Significant ash pond closure needs.
Cliffside 5&6	U5 – Wet/Dry U6 - Dry	U5- Wet U6 - Dry	Yes	Bottom/Fly Ash to Pond-U5; U5&6 Fly & U6 Bottom Ash, FGD to Lined Landfill	Convert U5 bottom ash handling to dry system. Significant ash pond closure needs.
Lee	Wet	Wet	No	Bottom/Fly Ash to Pond	Significant past and present ash pond closure needs when retired.
Marshall	Dry	Wet	Yes	Bottom Ash to Pond; Fly Ash, FGD to Lined Landfills	Convert bottom ash handling to dry system. Significant ash pond closure needs.
Asheville	Wet	Wet	Yes	Bottom Ash and Fly Ash to Pond; FGD Filter Cake to Lined Landfills; FGD Reused	Difficulty anticipated siting a landfill. Convert dry and bottom ash handling to dry systems. Significant ash pond closure needs.

Station	**Ash Handling**		**FGD Handling**	**Disposal Means**	**Risks**
	Fly	Bottom			
Mayo	Dry	Wet (Dry in 2013)	Yes	Bottom Ash and Fly Ash to Roxboro Landfill, Mayo Landfill Under Construction with September 2013 In-Service Date; FGD to Roxboro Storage Pad for Re-use in Adjacent Wallboard Plant	Convert bottom ash handling to dry system. Significant ash pond closure needs.
Roxboro	Dry	Wet (Dry in 2014)	Yes	Fly Ash to On-site Landfill, Bottom Ash to Pond, FGD to On-site Storage Pad for Re-use in Adjacent Wallboard Plant	Convert bottom ash handling to dry system. Contractual commitments to supply gypsum. Significant ash pond closure needs.
Sutton Coal	Wet	N/A	N/A	Bottom/Fly Ash to Pond	Significant ash pond closure needs.
<u>Florida</u>					
Crystal River	Dry	Dry	U4&5 - Yes	Bottom and Fly Ash, FGD to Lined Landfill, sales	
<u>Midwest</u>					
Cayuga	Wet	Wet	Yes	Bottom/Fly Ash to Pond; Landfill for final ash and FGD disposal	Convert all ash handling to dry systems. Significant ash pond closure needs.
East Bend 2	Dry	Wet	Yes	Bottom Ash to Pond; Fly Ash, FGD to Lined Landfill	Convert bottom ash handling to dry system. Significant ash pond closure needs.
Gallagher	Dry	Wet	No	Bottom Ash to Pond; Fly Ash to Lined Landfill	Convert bottom ash handling to dry system. Significant ash pond closure needs.

Station	Ash Handling		FGD Handling	Disposal Means	Risks
Gibson	Wet 1-3; convert to dry in 2012-2013 Dry (4-5)	Wet	Yes	Bottom Ash to Pond; Fly Ash, FGD to Lined Landfill; U1-3 conversion in ’12 and ’13.	Convert bottom ash handling to dry system. Significant ash pond closure needs.
Miami Fort 6	Wet	Wet	No	Bottom/Fly Ash to Pond; Landfill for final ash disposal	Ash pond closure considerations with other unit actions.
Wabash River 2-6	U2-5 – Wet U6 - Dry	Wet	No	Bottom/Fly Ash to Pond; Dry Ash to off-site.	Significant past and present ash pond closure needs when retired.

5.0 Decommissioned Sites and New Combined Cycle Generation Regulatory Issues

As a result of the EPA regulations discussed in Sections 2.0 – 4.0, a general decrease in the demand for electricity, and the reduction in natural gas prices, numerous coal-fired stations have been and will continue to retire over the next few years. Most of the retiring coal-fired generation is being replaced with natural gas-fired combined cycle units. Several new combined cycle stations have become operational within the last couple of years – Buck, Dan River and the Lee Energy Complex in North Carolina with others possible in South Carolina, Florida and the Midwest.

Combined cycle generation faces significantly fewer environmental challenges than the coal-fired units they are replacing. The combined cycle units face no challenges from SO_2 emissions and coal ash and only minimal concerns with NO_X emissions and 316(b) risks due to their use of SCR and cooling towers, respectively. Though better by about 50% than coal relative to carbon dioxide emissions, this could become their most significant emissions challenge over time.

Power plant decommissioning will be a significant effort and expense over the next decade. Expenditures and plans are now well underway as part of the Plant Retirement Comprehensive Program taking place in the Carolinas. A total of 10 coal-fired facilities (some including oil and gas-fired simple cycle combustion turbines) and 2 additional stand-alone combustion turbine sites (Buzzard Roost and Morehead City) are in various stages of decommissioning.

At some point after plant retirement, remediation of various past plant activities may need to occur. Subsurface investigation, assessment and remediation of plant areas previously used for fuel oil storage and conveyance, switchyards and substations, combustion turbine operations, coal piles and coal handling operations, ash ponds and landfills, etc will be needed. To prepare for this work, planning and discussions with regulators is underway in order to understand closure requirements, especially relative to ash handling and storage where investigation and closure requirements are still being explored.

Final closure requirements are not known but could involve installation of impermeable caps for closure in place, removal of CCRs from the plant sites and disposal in landfills, or other on-site closure measures. Decisions on the proper closing method will likely vary by state and potentially by plant site. The final regulatory classification of CCRs will also impact closure method options. Some NPDES permit renewals (e.g., in NC) are beginning to require ash basin closure plans to be submitted prior to ending use of the basin. CCR removal or capped closure will require significant dollars. If capped in-place, long-term groundwater monitoring, will require significant dollars. If capped in-place, long-term groundwater monitoring (possibly 30 years) will also be required.

Closure in place has occurred at non-Duke Energy sites, and these instances provide some cost data. Closure in-place costs (5-10 years ago) have totaled approximately $200,000 per acre (Ref. “EPRI – Decommissioning Handbook for Coal-Fired Power

Plants," November 2004). CCR storage and disposal areas typically consume significant site acreage. Also, the projected requirements for CCR remedial activities and closure will likely be more stringent than past CCR plant closure requirements. Thus, with costs that may be significantly greater than $200k per acre and the large CCR footprints to be addressed, planning and budgeting for these retirement costs is underway.

The following general waste-related issues are expected to present challenges to regulated generation and should be evaluated and planned for over the next several years.

- The management of soluble sorbents in landfills
- The challenge of managing fugitive dust in landfills
- With station retirements, how landfill leachate and general stormwater will be managed during and after plant closure
- If and when ash ponds are required to be closed by the CCR rule, what the means of treatment for landfill leachate after pond closures will be

The solubility of sodium particles makes it very difficult to contain pollutants when disposed of in landfills. More studies are needed to understand sodium and fixation of the trace elements it reacts with to eliminate the transfer of pollutants to leachate and other wastewaters that must be treated before discharge.

6.0 Climate Change Strategic Issues

In May 2010 the EPA finalized what is commonly referred to as the Tailoring Rule, which increased the emission thresholds significantly above conventional pollutants that determine when a source is potentially subject to PSD permitting for greenhouse gases. The Tailoring Rule sets the GHG significant net emissions increase threshold for modifications at 75,000 tons per year CO2e, meaning that any existing Duke Energy coal-fired or large natural gas-fired generating unit, that undertakes a modification that results in a net increase of at least 75,000 tons/year of CO_2e, is subject to PSD permitting requirements for GHGs. Being subject to PSD permitting requirements for CO_2e will require a Best Available Control Technology (BACT) analysis and the application of BACT for GHGs. BACT will be determined by the state permitting authority. EPA has issued GHG BACT guidance which focuses on unit efficiency improvements as possible BACT. Duke Energy reviews all projects in advance for potential PSD compliance considerations. Currently, there are no known plans for any Duke Energy generating unit to undertake a modification that triggers PSD permitting requirements for GHGs. Thus the potential implications of this regulatory requirement are unknown.

One potential future BACT for GHGs, carbon capture and storage (CCS) has significant potential as a carbon mitigation technology for coal and natural gas based generation. Development of the technology has, however, slowed due to low natural gas prices and regulatory uncertainty regarding the reduction of carbon dioxide emissions. Enhanced oil recovery (EOR) provides a near-term economic driver for CCS, but the sheer magnitude of the carbon dioxide (CO_2) to be captured necessitates the development of saline aquifer storage. Other storage location options, albeit of less magnitude, such as coal seams, basalt formations, enhanced coal bed methane recovery and deep ocean storage are also being tested around the world. Other aspects of CCS including capture and pipeline transportation of the CO_2 are also under investigation.

Aside from the economic and technical issues, there are important regulatory and legal challenges that must be addressed before CCS can be widely used. Many of them are being addressed at the state level while some are being addressed at the federal level. However, all these activities are moving very slowly and CCS on a commercial scale has advanced very little in recent years.

The most notable regulatory development at the federal level in the recent past is the federal requirements for CO_2 injection wells. The U.S. Environmental Protection Agency (EPA) released the requirements under the *Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells* regulation in December of 2010. This rule established requirements for geologic sequestration pursuant EPA's authority under the Safe Drinking Water Act and creates within the EPA's UIC Program a Class VI for geologic sequestration wells. The rule includes the option of primacy for states that allows states to administer the program. The UIC program regulates the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal.

On April 13, 2012, the EPA published its proposed rule to establish New Source Performance Standards (NSPS) for carbon dioxide (CO_2) emissions for pulverized coal, IGCC, and natural gas combined cycle electric generating units that are permitted and constructed in the future. The proposal would not apply to any of Duke Energy's regulated operations' coal (which includes IGCC) and natural gas electric generation plants that are currently under construction or in operation. Any future pulverized coal and IGCC units will have to employ carbon capture and storage (CCS) technology to meet the CO_2 emission standard the EPA has proposed. The proposed standard will not require new natural gas combined cycle facilities to install CCS technology. It is not known when EPA will finalize the proposal. It has been rumored that EPA might re-propose the rule for the purpose of setting separate emission limits for gas-fired and coal-fired units. If EPA does this it will likely push the date for a final rule into 2014.

EPA is expected to propose GHG emission guidelines for existing EGUs that do not undergo a modification at some point. It's unlikely that EPA will issue a proposal until sometime in 2014. Once EPA finalizes emission guidelines for existing sources, the states will be required to develop the regulations that will apply to covered sources, based on the emission performance standards established by EPA in its guidelines.

It is highly unlikely that legislation mandating reductions in GHG emissions or establishing a carbon tax will be passed by the 113th Congress which began on January 3, 2013. Beyond 2014 the prospects for enactment of any federal legislation mandating reductions in GHG emissions or establishing a carbon tax are highly uncertain. Given the high degree of uncertainty surrounding potential future federal GHG legislation, Duke Energy cannot predict if or when such legislation might be enacted, what the requirements of any potential legislation might be, or the potential impact it might have.

7.0 References

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Tables

Table 4 – Station Environmental Controls Summary

Issue	Cayuga 1&2	East Bend 2	Gallagher 2&4	Gibson 1-5
NO_X	LNB/OFA	LNB/OFA/SCR (2002)	LNB/OFA	LNB/OFA/SCR
SO_2	Wet FGD (2008)	Dry FGD (1981)	Low sulfur coal/hydrated lime	Wet FGD U1-3 ('06/'07); U4 '79; U5 '82
Particulate	Cold side ESPs	Hot side ESP	Baghouses (2007-2008)	Cold side ESPs
Cooling Water	Helper Cooling Towers	Cooling Towers	No CTs	Cooling pond
Fly Ash Handling	Wet Sluiced	Dry Handled	Dry Handled	Wet sluiced (U1-3); Dry Handled(U4-5)
Bottom Ash Handling	Wet Sluiced	Wet Sluiced	Wet Sluiced	Wet Sluiced
Waste Water Treatment	Solids removal & dilution; ash basin	Closed cycle design	Ash basin	Solids removal, then to North Ash pond; ash basins
Ash Disposal	Sluiced to pond, final to LF	Bottom ash to pond, fly ash as FSS to LF	Bottom ash to basin, fly ash to lined LF	Bottom ash to basin, fly ash to pond (U1-3) to lined LF (U4-5)
FGD Disposal	CCR LF	As fixated scrubber sludge to LF	N/A	As fixated scrubber sludge to LF
Disposal Units	Ash pond (1 lined and 1 unlined & CCR landfill	Ash pond (1) and special waste LF	1 ash pond, new ash LF	2 active ash ponds and 2 CCR landfills

Table 4 – Station Environmental Controls Summary (cont'd)

	Miami Fort 6	Wabash River 2- 6	Allen 1-5	Belews Creek 1&2
Issue				
NO_X	LNB	LNB/OFA	LNB/SOFA/LOFIR /SNCR (U1, 3, 5); LNB/SOFA/SNCR (U2, 4)	LNB/OFA/SCR (2003-2004)
SO_2	None	None	Wet FGD (2009)	Wet FGD (2008)
Particulate	Cold side ESP	Cold side ESPs	Cold side ESPs	Cold side ESPs
Cooling Water	No CTs	No CTs	No CTs	No CTs
Fly Ash Handling	Wet Sluiced	Wet Sluiced (U2-5) Dry Handled or Wet Sluiced (U6)	Dry Handled	Dry Handled
Bottom Ash Handling	Wet Sluiced	Wet Sluiced	Wet Sluiced	Wet Sluiced
Waste Water Treatment	Ash basins	Ash ponds	Solid removal/bioreactor; ash basins	Solid removal/bioreactor/ wetlands; ash basin
Ash Disposal	To pond A	To ponds and U6 dry ash off-site for re-use	Bottom ash to basin, fly ash to lined LF	Bottom ash to basin, fly ash to lined LF
FGD Disposal	N/A	N/A	CCR landfill	FGD landfill
Disposal Units	2 ash ponds	2 ash ponds, final pond is lined.	CCR landfill and ash pond	Ash basin and 2 lined landfills

Table 4 – Station Environmental Controls Summary (cont'd)

	Cliffside 5 & 6	**Lee 1-3**	**Marshall 1-4**
Issue			
NO_X	LNB/SOFA/LOFIR /SCR (U5- 2002) LNB/OFA/SCR (U6 – 2012)	SOFA	LNB/SOFA/LOFIR /SNCR (U1, 2, 4); LNB/SOFA/LOFIR /SCR (U3 - 2008);
SO_2	Wet FGDs (U5- 2010, U6- 2012)	None	Wet FGD (2007)
Particulate	Cold side ESP (U5); Baghouse (U6)	Hot side ESPs	Cold side ESPs
Cooling Water	Closed cycle Cooling Towers	Helper Cooling Towers	No CTs
Fly Ash Handling	Dry Handled	Wet Sluiced	Dry Handled
Bottom Ash Handling	Wet Sluiced (U5) Dry (U6)	Wet Sluiced	Wet Sluiced
Waste Water Treatment	Solid removal/Gravity filter and ash pond	Ash basins	Solid removal/wetlands; ash basin
Ash Disposal	Bottom ash (U5) to pond; fly ash and bottom ash (U6) to lined LF	To ponds	Bottom ash to ponds; fly ash to lined LFs
FGD Disposal	CCR landfill	N/A	FGD/CCR landfills
Disposal Units	1 ash pond; 1 lined CCR LF	2 ash ponds	Ash pond and 2 lined LFs

Table 4 – Station Environmental Controls Summary (cont'd)

	Asheville 1-2	**Mayo 1**	**Roxboro 1-4**	**Sutton 1-3**	**Crystal River 1-2, 4-5**
Issue	**Existing Environmental Controls**				
NO_X	SCR	SCR	SCR	SNCR (U3)	LNB (U1&2); SCR (U4&5)
SO_2	FGD	FGD	FGD	None	FGD (U4&5)
Particulate	Cold side ESP (U1, U2)	Hot side ESP	Cold side ESP (U1, U2, U3); Hot side ESP (U4)	Hot side ESP (U1, U2); Cold side ESP (U3)	Cold side ESP (U1, U2, U4, U5)
Cooling Water	Once-Thru; No CTs	Cooling Lake	Once Thru (U1-3); Cooling Towers (U4)	Cooling Lake	Once Thru (U1-2); Cooling Towers (U4-5)
Fly Ash Handling	Wet sluiced	Dry	Dry	Wet Sluiced	Dry
Bottom Ash Handling	Wet sluiced	Wet sluiced, converting to dry.	Wet sluiced	Wet Sluiced	Dry
Waste Water Treatment	Solid removal/Wetlands/ Ash pond	Settling Pond /Bioreactor/Ash pond, Partial ZLD complete by end of 2013	Settling ponds/Bioreactor/ Ash pond	2 ash ponds	Percolation pond
Ash Disposal	Fly and bottom ash to pond	Bottom ash to pond; fly ash to lined LF	Bottom ash to pond; fly ash to lined LF	Fly and bottom ash to pond	Fly and bottom ash to sales, lined LF
FGD Disposal	Filter Cake Off-site Landfill; FGD Re-used, But No On-site Disposal if Market Goes Away	Roxboro Storage Pad for Re-use in Adjacent Wallboard Plant	Roxboro Storage Pad for Re-use in Adjacent Wallboard Plant	N/A	Sales; onsite lined LF
Disposal Units	2 ash ponds	1 ash pond; 1 lined CCR LF (2013)	1 ash pond; 1 lined CCR LF on site	2 ash ponds	1 lined CCR LF

Table 5 – Station Environmental Impact Options Summary

		Cayuga	**East Bend 2**	**Edwards-port IGCC**	**Gallagher 2 & 4**	**Gibson**
Issue	Likely Impact Date	**Potential Impact/Option**				
CAIR Ph. II or CSAPR	2015		FGD Upgrade; LNB/OFA Upgrades	Pulverized Coal - Retired	SNCR	FGD Upgrade (U1-4); New FGD (U5); LNB/OFA Upgrades
MATS	2015	Re-emissions additive, $CaBR_2$ or ACI;	Re-emissions additive, $CaBR_2$ inj./ACI		Alkali Inj. for HAPS	Re-emissions additive, FGD upgrades on U5
NAAQS Ozone Std.	2020	SCR (likely 2014/2015)			SNCR	
NAAQS SO_2 Std.	2018		FGD Upgrade			FGD Upgrade (U1-4); New FGD (U5)
316(b)	2016	Screen mods; CT evaluation	Screen mods		Screen mods; CT evaluation	Screen mods; stormwater mod.
Waste Water Treatment	2017	Enhanced treatment – NPDES & FGD				Alternative to final disposal to cooling pond
CCR Handling	2018 or later	Convert to Dry ash; Pond closures	Pond closures; Dry bottom ash conv.		Pond closures	Convert U1-3 to dry ash. Pond closures; Dry bottom ash conv.

Table 5 – Station Environmental Impact Options Summary (cont'd)

		Miami Fort 6	**Wabash River**	**Allen**	**Belews Creek**
Issue	Likely Impact Date	**Potential Impact/Option**			
CAIR Ph II or CSAPR	2015	Reduced operations	Reduced operations		
MATS	2015	Likely retire	Likely retire	CaBr2. or ACI; DSI for SO3	ACI;
NAAQS Ozone Std.	2019	Likely retire	Likely retire	SNCR upgrade/ Hydrogen Peroxide Injection/ SCR	
NAAQS SO_2 Std.	2018	Likely retire	Likely retire		
316(b)	2016	Likely retire	Likely retire	Screen mods; CT eval.	Screen mods; CT eval.
Waste Water Treatment	2017	Likely retire	Likely retire	Enhanced treatment – NPDES	Enhanced treatment – NPDES
CCR Handling	2018 or later	Pond closures; Likely retire	Pond closures; Likely retire	Pond closures; Dry bottom ash conv.	Pond closures; Dry bottom ash conv.

Table 5 – Station Environmental Impact Options Summary (cont'd)

		Cliffside 5 & 6	**Lee**	**Marshall**
Issue	Likely Impact Date	**Potential Impact/Option**		
CAIR Ph. II or CSAPR	2015		Reduced Operations poss.	SNCR Upgrade
MATS	2015	U5 - – $CaBr_2$ or ACI; DSI for SO3 control	Likely retire/gas conversion	U1&2 - CaBr2 Addition or ACI;U4 - $CaBr_2$
NAAQS Ozone Std.	2019		Likely retire/gas conversion	SNCR upgrade / Hydrogen Peroxide Injection / SCR (U1&2)/ SCR (U4)
NAAQS SO_2 Std.	2018		Likely retire/gas conversion	
316(b)	2016	Screen mods.	Screen mods. poss.	Screen mods; CT eval.
Waste Water Treatment	2017			Enhanced treatment – NPDES, FGD
CCR Handling	2018 or later	Pond closures; Dry bottom ash conv. – U5	Pond closures	Pond closures; Dry bottom ash conv.

Table 5 – Station Environmental Impact Options Summary (cont'd)

		Asheville	Mayo	Roxboro	Sutton	Crystal River
Issue	Likely Impact Date	**Potential Impact/Option**				
CAIR Ph. II or CSAPR	2015					
MATS	2015		Possible ACI or re-emission chemical		Retire	Possible ACI or re-emission chemical
NAAQS Ozone Std.	2019				N/A - To Be Retired	
NAAQS SO_2 Std.	2018	Take lower permit limit	Take lower permit limit	Take lower permit limit	N/A – To Be Retired	U1&2 likely retired; Take lower permit limit
316(b)	2016	Screen mods; CT eval.	Screen mods; flow eval.	Barrier net; Screen mods; CT eval.	N/A – To Be Retired	
Waste Water Treatment	2017	Enhanced treatment – NPDES, FGD	Partial ZLD 2013	Enhanced treatment – NPDES, FGD	N/A – To Be Retired	Enhanced treatment – NPDES, FGD
CCR Handling	2018 or later	Convert to dry fly and bottom ash; Pond closures	Convert to dry bottom ash (2013); Pond closures	Convert to dry bottom ash (2014); Pond closures	Pond closures	

Table 6 – Major Regulatory Issues Schedule

***Bold** Dates indicated in the Table are actual dates.

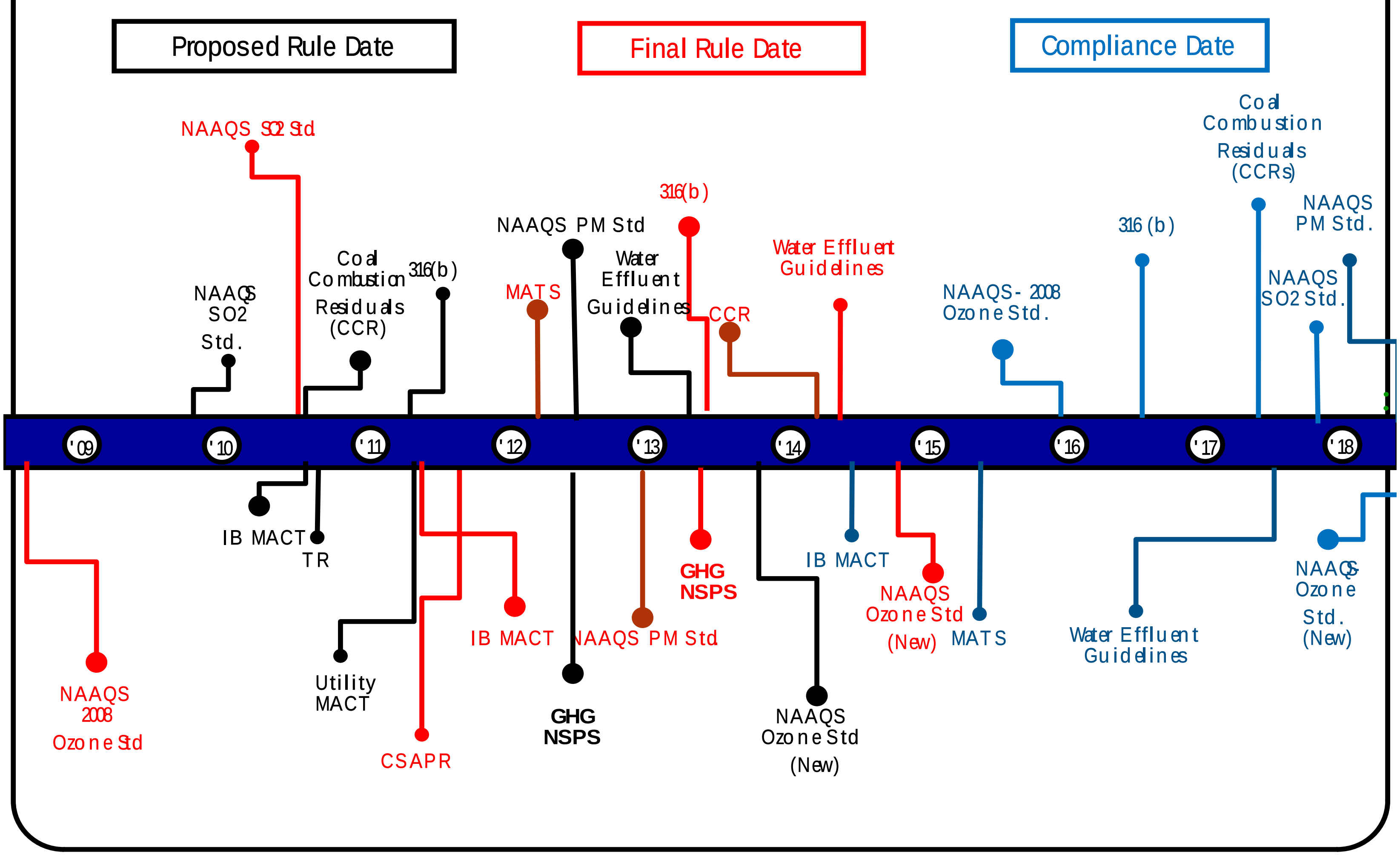
Regulation/Issue	Proposed Rule Date	Final Rule Date	Compliance Date	Notes
Water				
316 (b)	**April 20, 2011**	June, 2013*	Mid-Late 2016	Compliance – 3 yrs (impinge); 6 yrs (entrain) after next NPDES permit
Effluent Guidelines	April 2013**	May, 2014**	Mid-2017	
Air				
CSAPR	**August 2, 2010**	**August 8, 2011**		CSAPR vacated August 2012; CAIR remains in place
MATS	**May 3, 2011**	**February 16, 2012**	April 16, 2015	One year ext. possible for compliance.
Industrial Boiler MACT	**June 8, 2010**	**May 20, 2011**	May 2014	Revised standards in May/June 2012; may reset the compliance period to June 2015
NAAQS - 8 hr. Ozone Std. Implementation (2008 Std – 75 ppb)		**2008**	**December 31, 2015**	NA Areas designated – May 2012
NAAQS - 8 hr. Ozone Std	Late 2013	Late 2014	Starting 2019	Compliance date depends on designation (e.g., marginal)
NAAQS $PM_{2.5}$ Std.	**June 14, 2012**	**December 14, 2012**	2020	NA Areas designated – 2015
NAAQS SO_2 Std.	**November 16, 2009**	**June 22, 2010**	2018	NA Areas designated - June 2013

Table 6 – Major Regulatory Issues Schedule (cont'd)

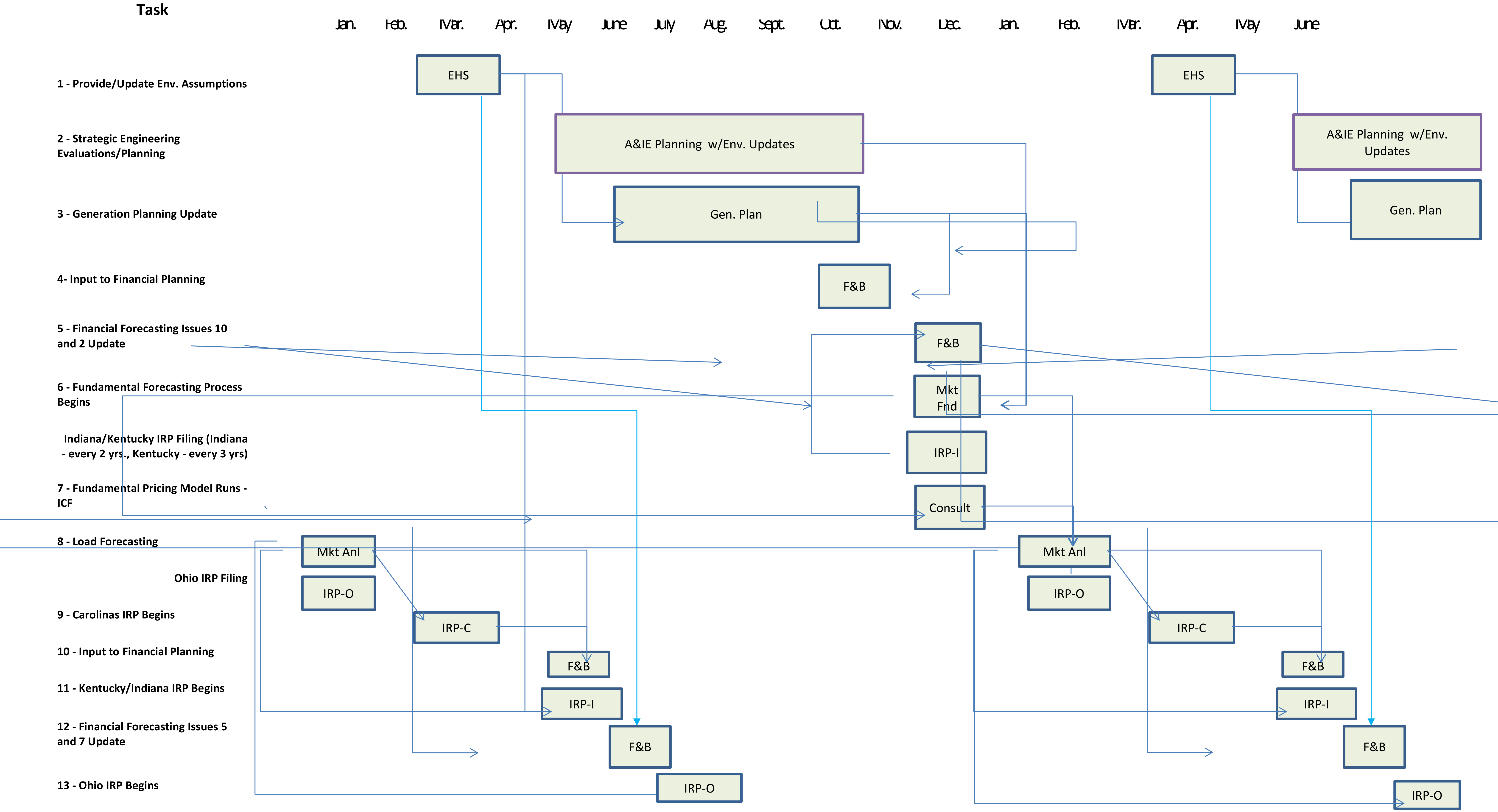
Regulation/Issue	Proposed Rule Date	Final Rule Date	Compliance Date	Notes
Waste				
Coal Combustion Residuals (CCRs)	**June 21, 2010**	2014 or later	2018 or later	
PCB Use Authorization	2013 or later	Unknown		
Climate				
Greenhouse Gas Regulation – New Source Performance Standards for New or Modified Sources	**April 13, 2012****	2013**	Takes effect upon proposal	Applies to new/modified facilities that haven't commenced construction by proposal publication date
Greenhouse Gas Regulation – New Source Performance Standards for Existing Sources	Unknown	Unknown	Unknown	Tailoring Rule in effect **1/2/11** for PSD and Title V.

* Date specified per Settlement Agreement
** Dates specified per consent decree.

Major Regulatory Issues Timeline



Appendix – Environmental Issues Input to Planning Process


Task
Jan.
Feb.
Mar.
Apr.
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June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
1 - Provide/Update Env. Assumptions
2 - Strategic Engineering Evaluations/Planning
3 - Generation Planning Update
4- Input to Financial Planning
5 - Financial Forecasting Issues 10 and 2 Update
6 - Fundamental Forecasting Process Begins
Indiana/Kentucky IRP Filing (Indiana - every 2 yrs., Kentucky - every 3 yrs)
7 - Fundamental Pricing Model Runs - ICF
8 - Load Forecasting
Ohio IRP Filing
9 - Carolinas IRP Begins
10 - Input to Financial Planning
11 - Kentucky/Indiana IRP Begins
12 - Financial Forecasting Issues 5 and 7 Update
13 - Ohio IRP Begins
EHS
A&IE Planning w/Env. Updates
Gen. Plan
F&B
F&B
Mkt Fnd
IRP-I
Consult
Mkt Anl
IRP-O
IRP-C
F&B
IRP-I
F&B
IRP-O
EHS
A&IE Planning w/Env. Updates
Gen. Plan
Mkt Anl
IRP-O
IRP-C
F&B
IRP-I
F&B
IRP-O

Carolinas IRP Filing

IRP-C

Notes:

ES - Env. Strategic Issues Working Group (Dave Mitchell); Str. Eng – Strategic Engineering (Joe Miller); F&B - Forecasting and Budgeting (Dwight Jacobs); Mkt Fnd - Market Fundamentals - Comp. Analysis (Kevin Delehanty);
Mkt Anl - Market Analysis (Dick Stevie); IRPs - Integrated Resource Planning - (Janice Hager);
Gen. Plan - Generation Planning Budget Input.

Duke Energy Progress, LLC
Late-Filed Exhibit No. 19

Duke Energy Progress
Docket E-2, Sub 1219
Late Filed Exhibit #19
October 23, 2020

Request: Provide any document comparable in purpose to Progress Energy's November 1, 2004 L.V. Sutton Long Term Ash Strategy Study Phase Report (AGO Wells Cross-Exam Exhibit 3, Docket No. E-2, Sub 1142), however titled or denominated and whenever produced or issued.

Response: See documents provided with this response, as well as the documents provided in Docket E-2, Sub 1219, Late Filed Exhibit #5.

- Cape Fear Fly Ash Management dated July 12, 2004
- HF Lee Assessment of Fly Ash dated July 12, 2004
- Weatherspoon 1999 Ash Pond Study
- Sutton Report Ash Study dated January 13, 2000
- Weatherspoon Fly Ash Management dated July 12, 2004

In reference to the 2004 L.V. Sutton Long Term Ash Strategy Study Phase Report in the request, please also see the attached response to AGO Data Request 7-1 filed in Docket No. E-2, Sub 1219.

Duke Energy Progress
Response to
Attorney General's Office Data Request
Data Request No. AGO 7

Docket No. E-2, Sub 1219

Date of Request: **March 6, 2020**
Date of Response: **March 18, 2020**

☐ **CONFIDENTIAL**

☒ **NOT CONFIDENTIAL**

Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to AGO Data Request No. 7-1, was provided to me by the following individual(s): Trudy H. Morris, Project Manager II, and was provided to AGO under my supervision.

Camal O. Robinson
Associate General Counsel
Duke Energy Progress

Request:

1. In reference to the attached document identified above, please provide the following:
a. Identify the source(s) of information for this document
b. Identify all of the names of those who participated in the development and/or drafting of this document, as well as those who reviewed the document and the roles of each as related to the document
c. Identify any and all former and later versions of similar “Long Term Ash Strategy” Reports for all DEP facilities
d. On page 1 of the document, in the final paragraph, it states that the alternative plan of an industrial park built adjacent to the plant site be chosen and “that the engineering design, environmental permitting, and pre-construction activities be approved to allow for construction to begin no later than January 2006 to support the 1984 ash pond end of life.”
i. Identify whether this recommendation was implemented
ii. If not implemented, explain and describe why this recommendation was not implemented
iii. If not implemented, explain and describe what, if anything, was done “to support the 1984 ash pond end of life” since November 2004
e. On page 2 of the document, second paragraph, it states that “Additionally, Sutton unit 3 is targeted for FGD installation in 2012, making gypsum disposal another potential problem.”
i. Identify whether and when a FGD was installed at Sutton
ii. Explain and describe why Sutton was targeted for FGD installation in 2012
iii. Explain and describe the “potential problem” gypsum disposal would have or did create(d) at Sutton
iv. If the FGD installation did not occur in 2012, explain and describe why it was not installed at that time
f. On page 2 of the document, under the heading 1983 Pond is Unlined, it states that “the 1983 ash pond was constructed during a period when it was not required to provide a non-permeable liner…”
i. Identify the time period when it was required to provide a non-permeable liner when constructing an ash pond
ii. Identify the law(s) underlying the liner requirement
g. On page 2 of the document, under the heading 1983 Pond is Unlined, it states that the 1983 Pond “is occasionally used when there are issues requiring the 1984 ash pond to be temporarily dry.”
i. Describe the “issues” that required the 1984 ash pond to be temporarily dry and how those issues were resolved
ii. Identify the length of time the 1984 ash pond was “temporarily dry” on each occasion
h. On page 2 of the document, under the heading 1983 Pond is Unlined, it states that “[t]he current environmental atmosphere is that these ponds will eventually have to [be] emptied and placed in a lined containment to eliminate the leaching of the ash products into the ground water system. This is an issue that is not currently being pressed, but it is anticipated that with the tighter environmental conditions it will soon become an emergent issue.”

i. Describe "the current environmental atmosphere" regarding the ponds "eventually having to be emptied and placed in a lined containment to eliminate the leaching of the ash products into the ground water system."
1. Identify and describe the "leaching of the ash products into the ground water system" and the volume of leaching that was occurring
a. Describe the method of determining that there was "leaching of the ash products into the ground water system"
b. If monitoring wells were utilized, identify the number and location of all monitoring wells at each facility in November 2004
c. Describe the process utilized by Progress Energy in informing others internally and externally of this leaching of the ash products into the ground water system
d. Describe all communication with DWQ regarding the issue of leaching of ash products into the ground water
2. Identify and describe the "tighter environmental conditions" anticipated that would require the lining of coal ash basins
i. On page 2 of the document, under the heading 1983 Pond is Unlined, it states that a monitoring well near the 1983 ash pond "has shown high levels of arsenic during the past two quarterly tests." "It could be mitigated by adding monitoring wells to the NPDES permit…"
i. Identify the exact location of the monitoring well referenced above
ii. Identify the numerical value(s) of the "high levels of arsenic" found and the exact dates of those tests.
iii. Describe the results for arsenic for that well from the date of the referenced tests until today
iv. Identify whether monitoring wells were added to the NPDES permit and the first date they became part of the NPDES permit
1. If the monitoring wells were not added to the NPDES permit shortly after this report was provided, explain and describe the basis of the decision for not adding the wells to the permit at that time.
v. Describe all communications with the NC Division of Water Quality ("DWQ") regarding the "high levels of arsenic" or regarding any other ground water contamination concerns at that time
j. On page 2 of the document, under the heading Unlined Ash Disposal Site, it states that during the initial running of the Sutton plant, a pre-ash pond discharge site was located behind an old 5 million gallon heavy oil tank, which "consisted of a discharge pipe that was discharged at the edge of the site, and ran off based on the lay of the land."
i. Identify the time frame when this pre-ash pond discharge site was utilized and describe all of the types of discharge coming from the pipe
ii. Identify the total amount of each discharge that issued from this pipe during the time when it was utilized
iii. Identify whether any groundwater monitoring has been done on this part of the site; when the groundwater monitoring was initiated; and the results of all groundwater sampling

at this location at the Sutton site
k. On page 3 of the document, under the heading “3.1 Alternative 1 – Do Nothing,” it “assumes two other “worst case” scenarios:” 1) the DWQ requiring that the 1983 ash pond be “emptied and lined to comply with current ash pond regulations,” with a 5% chance annually of requiring a liner starting in 2007, and with a 10% chance annually thereafter until 2019; and 2) DWQ requiring that the Pre-ash disposal site being “remediated by 2019.”
i. Identify the “current ash pond regulations” which would have been enforced by the DWQ to require that the 1983 ash pond be emptied and lined
1. Describe all communications with DWQ regarding the “current ash pond regulations” and the subject of emptying and lining coal ash ponds prior to CAMA
ii. Identify if and when DWQ required that the Pre-ash disposal site be remediated
1. Describe all communications with DWQ regarding the Pre-ash disposal site
l. On page 19 of the document, under the heading “9.3 1983 Un-lined Ash Pond,” it states that “[b]y the construction of the new ash pond in 1984, all ash ponds were required to be lined with an impermeable liner to keep the water and contents from seeping into the surrounding soils and water.”
i. Describe the liner that was utilized in the 1984 ash pond and the reason that DEP believed that ash ponds were “required” to be lined at that time
1. Describe all communications with DWQ or any other entity regarding the liner requirement.
m. On page 19 of the document, under the heading “9.3 1983 Un-lined Ash Pond,” it states that “[t]here is currently increased emphasis on ash ponds and their affects on the surrounding environment and ground water.”
i. Describe the source(s) of the “Increased emphasis on ash ponds and their affects on the surrounding environment and ground water.”
ii. Describe all communications internally and externally regarding this statement
n. On page 20 of the document, under the heading “9.5 Pre-ash Pond Disposal Site,” it states that “[e]arlier in the history of the plant, the pre-ash pond disposal site was identified as a Federal Superfund site, and scheduled to be cleaned up. The cleanup never occurred, and little attentions are currently being placed on this site. It is also anticipated that with additional attention to the ash ponds this area might get increased attention.”
i. Describe all communications with DWQ and/or the EPA and/or any other regulatory agency regarding the identification of the pre-ash pond disposal site being identified as a Federal Superfund site and the requirement to clean it up.
ii. Explain and describe the current remediation status of the pre-ash pond disposal site
o. On page 25 of the document, under the heading “19.0 Contingency Plan,” it states that the contingency plan is to direct “$500,000 to O&M in 2005 to stack the ash in order to allow for this study and funding recommendations to be completed. The current budget for 2006 funds the vertical dike extension to allow the plant to continue to generate electricity for the next 5 to 7 years.”
i. Identify whether either or both of the contingency plans were employed
ii. If the contingency plans were employed, describe how those plans were implemented and the costs for each

Response:

Item 1.a. This document was gathered as a requirement to provide input for generation of a budget request for a project to look at alternatives to extend the remining usable life of the ash basin. This data was compiled by looking at the alternative, evaluating the alternatives, and developing cost estimates based on historic cost, discussions with engineers, vendors and internal resources to estimate costs to perform the alternatives mentioned in the report. These estimates were for the budget process only and were ROM (Rough Order of Magnitude Estimates).

Item 1.b. Bill Forster was the author of this document (as noted on the document itself) and recalls that there were several resources utilized to gather this data. The FHO (Fossil Hydro Operations) management team reviewed this document and it was submitted as part of a budget request for funds to perform work. The author does not recall specific names or parties involved with the report issued 15 years ago.

Item 1.c. This study was a specific report issued for a budget request. This report was performed to address a specific issue associated with the 1984 ash pond at L.V. Sutton S.E.P. No other legacy Progress Energy Plants were evaluated unless a specific issue was to be addressed and required funding through the budget process at that time. DEP has not been able to locate any other similar reports at this time.

Item 1.d.i. Response: This recommendation was not implemented.

Item 1.d.ii This recommendation was not implemented due to a corporate decision at that time to manage the ash inside the ash basin.

Item 1.d.iii A rim ditch operation was initiated to allow for the daily excavation, drying, stacking and placement of ash within the confines of the existing ash ponds at L.V. Sutton on an ongoing basis until plant operations ceased.

Item 1.e.i A FGD (Flue Gas De-sulfurization) Unit was never installed at L.V. Sutton.

Item 1.e.ii DEP evaluated the installation of an FGD scrubber at Sutton as part of its plan for compliance with the Clean Smokestacks Act.

Item 1.e.iii The potential “problem” was that the addition of an FGD unit would have produced a gypsum byproduct that possibly could have been added to the ash product going into the existing ash basin, adding to the volume required for future storage and potentially requiring additional means for creating space to maintain station operation. The issue was never realized due to the FGD not being utilized at L.V. Sutton.

Item 1.e.iv DEP elected to comply with the Clean Smokestacks Act by retiring the coal units at HF Lee and constructing a combined cycle natural gas plant, which eliminated the need for a scrubber on Sutton Unit 3.

Item 1.f.i To the knowledge of DEP, there was no generally-applicable legal requirement to provide a non-permeable liner when constructing an ash pond prior to 2015. In North Carolina, before 2011, requirements could have been included as a design requirement in wastewater treatment system Authorization to Construct (ATC). The requirement of a clay liner was included at the request of DEP's predecessor Carolina Power & Light in the ATC for the 1984 ash pond.
Item 1.f.ii Final Rule: Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities, 80 FR 21301 (April 17, 2015) (the CCR Rule); NC Gen. Stat. § 143-215.1(a)(2) (Authorization to Construct)

Item 1.g.i When the 1984 ash pond required maintenance, including excavation in wet areas and inspections of the liner and discharge pipe, the 1983 basin was utilized to allow for the safe operation of these functions without the introduction of sluice water into the pond.

Item 1.g.ii The length of time the temporary sluicing to the 1983 basin varied in duration based on the operation that was being performed that required the diversion of the normal sluicing process.

Item 1.h.i In May 2000, EPA published a Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels (65 FR 32214). The Notice concluded that coal combustion residuals did not warrant regulation as hazardous waste under RCRA Subtitle C but expressed an intent to regulated them under RCRA Subtitle D.

Item 1.h.i.1a Leaching was inferred from the use of a network of groundwater monitoring wells.

Item 1.h.i.1b Please refer to the table provided in response to DEP PSDR 2-11 for all the wells installed through 2004.

Item 1.h.i.1c Results from annual groundwater monitoring sampling events per NPDES permit were reported to DEQ via DMRs (discharge monitoring reports). Assessment work completed at Sutton supervised by the Division of Waste Management was submitted to the Division of Waste Management in various reports.

Item 1.h.i.1d DEP has communicated with DWQ regarding the potential for leaching of ash products into groundwater since 1983, shortly before the construction of the 1984 ash basin. These communications involved the design of groundwater monitoring well networks and, later, submission of the results of groundwater monitoring. In 1989, monitoring wells were included in the NPDES permit, and the site began submitting results in accordance with the permit. In 2004, at the time this report was prepared, DEP was party to a voluntary Administrative Agreement with the Division of Waste Management to address groundwater conditions at the site. Pursuant to the agreement, DEP submitted a report titled "Comprehensive Site Assessment Report for Old Ash Pond (OAP) Area" prepared by the consulting firm Blasland, Bouck & Lee. Subsequently, DEP began monitoring wells as part of the USWAG Action Plan and providing results to the Department.

Item 1.h.i.2 In May 2000, EPA published a Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels (65 FR 32214). The Notice concluded that coal combustion residuals did not warrant regulation as hazardous waste under RCRA Subtitle C but expressed an intent to regulated them under RCRA Subtitle D.

Item 1.i.i and 1.i.ii DEP is only able to review historical groundwater monitoring data at Sutton starting in 1990. In review of this data, values of arsenic greater than the historical 2L standard of arsenic (50 ug/l) were not observed until 1998 in monitoring well MW-02C. The 1998 arsenic value was 55 ug/l. It is shown on the attached "Sutton 1990 NPDES GW Monitoring" document. Results from March 9, 2004 sampling event for MW-02C was 47 ug/l arsenic. The remainder of the wells sampled has less than 5 ug/l arsenic.

Item 1.i.iii The groundwater arsenic sampling results of MW-02C from 1990 start as non-detect (<1 ug/L). The first detection sample was in 1998 at 55 ug/L. MW-02C continued to be sampled through 2014 and ranged from non-detect to 290 ug/L (maximum value March 6, 2007).

Item 1.i.iv Groundwater monitoring wells were first required at Sutton under the Authorization to Construct the 1984 ash basin. Groundwater monitoring was first required in an NPDES permit issued December 7, 1989 (effective January 1, 1990). Additional monitoring wells (MW-17, MW-18, and MW-19) were installed as part of the Comprehensive Site Assessment in 2004. At the request of DE Progress, those wells were added to the NPDES permit issued on December 14, 2006 (effective January 1, 2007).

Item 1.i.v As stated above, at this time, DE Progress was party to a voluntary Administrative Agreement with the Division of Waste Management to address groundwater conditions at the site. Pursuant to the agreement, DE Progress submitted a Comprehensive Site Assessment Report for Old Ash Pond (OAP) Area prepared by the consulting firm Blasland, Bouck & Lee. This report was produced primarily to evaluate arsenic values in MW-2C. The report concludes that arsenic was not exceeding standards at the compliance boundary.

Item 1.j.i The area, now called the Lay of Land Area or LOLA, was used from 1954 to 1972. During this period coal ash was discharged from the pipe to the LOLA.

Item 1.j.ii DEP does not have records of the total amount of each discharge during the time period in which the LOLA was used.

Item 1.j.iii Groundwater monitoring around the LOLA began in 2004. Please refer to DEP PSDR 11 for well installation dates.

Item 1.k.i The current ash pond regulations discussed in this section were regulations dealing with NPDES wastewater discharge permits. DEP anticipated the possibility that DWQ would not issue an NPDES permit authorizing further discharges from the 1983 basin unless the basin was emptied and lined.

Item 1.k.i.1 DEP has not identified any communications with DWQ regarding the "current ash pond regulations" or the subject of emptying and lining coal ash ponds prior to CAMA.

Item 1.k.ii.1 Between October 2003 and September 2007, DE Progress was party to a voluntary Administrative Agreement with the Division of Waste Management to address groundwater conditions at the LOLA. Pursuant to the Administrative Agreement, DE Progress submitted a Phase I Remedial Investigation Report in September 2004, a Phase II Remedial Investigation Report in May 2005, and a Remedial Action Plan in March 2006. The Division of Waste Management did not authorize DE Progress to proceed under the Remedial Action Plan at that time. DE Progress elected to exit the Administrative Agreement in September 2007, but the LOLA remained on the Inactive Hazardous Sites Inventory. In 2016, DEP was directed to address the LOLA in an Order Granting Motion for Partial Summary Judgment from the Wake County Superior Court (case number 13-CVS-4061) (sometimes called the "Four Plant Order"). Following that agreement, DWM and DWR agreed that DWR would take the lead in overseeing remedial action, and the site was removed from the Inventory.

Item 1.l.i The 1984 ash pond was built with a compacted clay liner. Although there was no regulation in place in 1984 specifically requiring the lining of basins, DEP concluded that a liner was appropriate given changes to the North Carolina groundwater rules.

Item 1.l.i.1 Construction of the 1984 basin was authorized by an Authorization to Construct issued by the Department on June 15, 1983. On March 26, 1984, Carolina Power & Light Company requested a modification of the Authorization to Construct to include a liner in the basin design. By letter dated May 8, 1984, the Department approved.

Item 1.m.i In May 2000, EPA published a Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels (65 FR 32214). The Notice concluded that coal combustion residuals did not warrant regulation as hazardous waste under RCRA Subtitle C but expressed an intent to regulated them under RCRA Subtitle D.

Item1.m. ii DEP is not aware of any communications internally or externally regarding this particular statement. In October 2002, EPA staff informally invited USWAG to develop a voluntary plan to address groundwater monitoring. DE Progress participated in the USWAG Action Plan. That participation involved internal communications to inform DE Progress employees about the steps to be taken. It also involved the communication of monitoring results to the Department.

Item 1.n.i Sutton has never been listed on the National Priorities List. In the context of this statement, identification as a Federal Superfund site is a reference to a series of risk evaluations conducted jointly by EPA and the NC agency in the 1980s and 1990s. In the 1980s, Carolina Power & Light submitted a RCRA Part A application for Sutton and other plants, anticipating they might be required to hold RCRA permits to manage fly ash. Although the company did not need RCRA permits, the application resulted in the sites being screened under RCRA and CERCLA. In 1989, NUS Corporation, acting as a contractor for EPA, performed a Screening Site Inspection, Phase I and recommended the site for a Phase II. In 1991, the firm Greenhorne & O'Mara, Inc. completed a Phase II Screening Site Inspection and submitted the results to the Superfund Section of the North Carolina Division of Solid Waste Management. Based on that inspection, the site was assigned in 1992 a medium priority for an Expanded Site Investigation. The Expanded Site Investigation was completed by the Superfund Section and submitted to EPA in 1999. That letter suggested the site be considered for further federal action under CERCLA, but no further action was taken by EPA. Instead, the site was managed under the North Carolina Inactive Hazardous Sites program.

Item 1.n.ii The area identified as "pre-ash disposal site" is currently being excavated, dredged, and placed in a licensed landfill on the L.V. Sutton plant site.

Item 1.o.i Both of the contingency plans were incorporated.

Item 1.o.ii The stacking occurred to allow the plant to continue to sluice into the existing ash pond until both a design and a budget could be established to install an internal vertical dike within a portion of the 1984 ash basin. As the costs were in 2006 and in a predecessor company's accounting system, the costs are not readily available, but DEP is working with our technology department to see if it can be provided.

Sutton 1990 NPDES
GW Monitoring.pdf

FINAL REPORT

STRATEGIC ASSESSMENT OF FLYASH MANAGEMENT AT CAPE FEAR STEAM PLANT

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July 12, 2004

MACTEC Project No. 6468-04-0549

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Appendices

1.0 Executive Summary

A study of ash disposition options and concepts for short-term and long-term storage has been conducted for the Cape Fear, Lee and Weatherspoon plants. The study included:

- Review of previous study reports and ash capacity estimates.
- Review of data on ash content and Loss of Ignition (LOI) material for current coal usage.
- Review of data on projected coal consumption volumes over the next five years.
- Updating estimates of present ash storage capacity and projections of remaining storage life.
- Discussion of ash management practices with environmental coordinators of other electric utility providers and review of industry practices for ash disposal.
- Discussion of current ash handling and management practices with plant personnel.
- Performing a physical profile of the ash ponds through depth soundings.
- Identification of available techniques for ash disposition
- Workshop meetings with Eastern Region engineering personnel and with plant personnel knowledgeable in the ash handling practices.
- Selection of ash handling options feasible for each plant
- Development of strategies for implementing the identified short and long term options identified from the workshop sessions.
- Preparation of conceptual cost estimates and timelines for the options.
- Preparation of separate reports for each plant.

A finding common for all plants was that past projections of storage life used ash production from only contract coal, while current and future plans indicate a large percentage of coal burned may be "opportunity coal' which has a much higher ash content than contract coal. Also, past calculations did not incorporate and adjustment for presence of unburned carbon (LOI material). The projections prepared in this report incorporate provisions for unburned carbon and use of "opportunity coal".

The Cape Fear plant is currently operating its ash pond at elevation 191.3 feet, msl which is as high as it can be operated under the design criteria and present top of dike elevation. Diversion curtains are being installed to assist in management of total suspended solids issues; these curtains are projected to allow operation of the pond for another 2.7 to 5.9 years depending on the coal use rate and mix of contract coal and opportunity coal. For discussion and comparison purposes, MACTEC has chosen to use the average ash use rate from the 5-year projections and a 50-50 mix of contract coal and opportunity coal. With this approach, the Cape Fear Plant ash pond is projected to have 3.9 years of remaining physical storage life at its current level.

The recommended short-term ash management strategy is the excavation/dredging and hauling/transfer of a volume of ash from the 1985 pond into the 1978 pond (currently used only for plant storm water) to provide additional storage space in the 1985 pond. The approximate life extension of the pond achieved by digging and stacking is 6.5 yrs. At that point, the pond is too full to have room to store ash while an area is excavated, even though the stack area in the 1978 pond would handle a bit more.

Additional short-term pond management strategies that were not evaluated as part of this study include construction of a secondary settlement pond and modification of the discharge riser in the

1985 pond to allow for stratified drainage of the pond prior to an anticipated turnover event. A more detailed discussion of these alternatives is provided in Appendix C. These alternatives do not provide additional storage space in the pond and are not viewed as ash management strategies, but rather measures that will improve the ability of the pond to consistently comply with the discharge requirements of the plant's NPDES permit.

The long term alternatives for ash management evaluated during this assessment are:

- Alternate 1: Raise existing dike to allow for more storage;
- Alternate2: Use Geotubes for ash storage and de-watering within the pond;
- Alternate 3: Construct a new ash pond

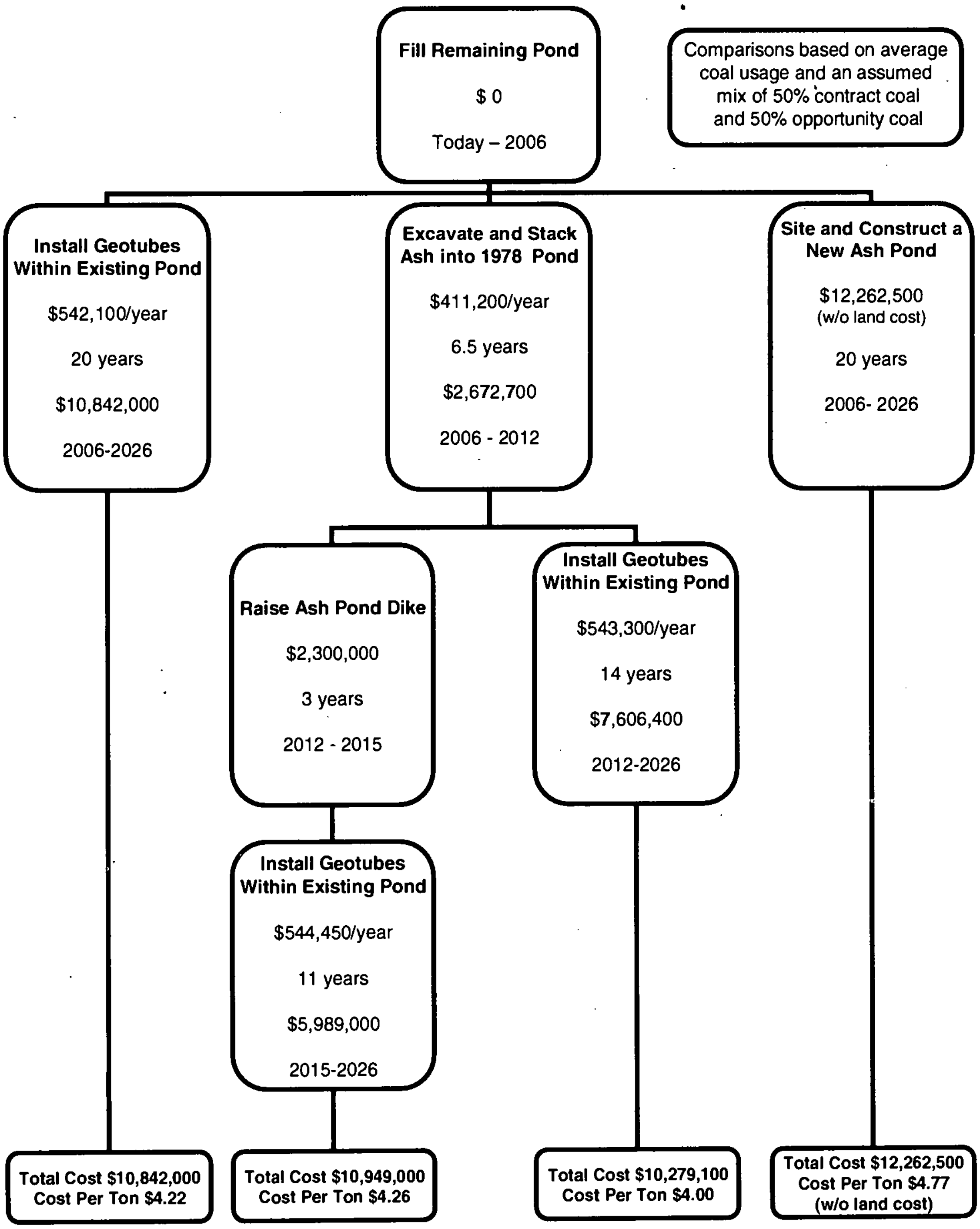
MACTEC recommends installation of Geotubes to store and de-water ash in the 1985 pond as a long-term (20-year) management strategy. Geotubes can be used in conjunction with a dig and stack program, or alone as a 20-year storage strategy. Combining the two alternatives reduces the number and cost of Geotubes required.

A cost comparison of the alternatives evaluated for this study using the average coal use and a 50-50 coal mix (see attached page) shows that a combined strategy of dig and stack/Geotube installation is the most cost-effective long term option.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

This final report incorporates and addresses comments made by Progress Energy on the draft report submitted May 14, 2004

Cape Fear Plant



2.0 Problem Description

Progress Energy's fossil power plants burn coal for electricity generation. The Eastern Region has five plants: Cape Fear, Lee, Robinson, Sutton and Weatherspoon. Ash is produced as a byproduct of the coal combustion process. Depending on the coal burned, from 10 to 20 percent of the weight of coal is ash that is produced after combustion. A fine-grained ash ("fly ash") forms the majority of the material. About 10 percent of the ash total volume is coarse-grained material commonly termed "bottom ash"; however, the term "fly ash" is typically used generically for all the material produced. At some plants, the bottom ash and fly ash are commingled before transport to disposal areas; in others, the two ashes are moved separately.

Progress Energy disposes of ash by mixing the ash with water and pumping it into storage areas on the plant sites. The storage areas ("ash ponds") were generally constructed impoundment areas build above original ground surface and enclosed by earth dikes. No artificial liners or clay liners were incorporated in the pond designs for the Cape Fear, Lee or Weatherspoon plants that are the subject of this study.

Vertical pipes connected to horizontal outflow pipes through the dikes provide for release of water from the ponds. Ponds at some plants incorporate secondary settling ponds to aid in control of suspended solids in the water discharged from then pond. The ponds are permitted as water treatment facilities and are regulated by the Division of Water Quality.

The ash is pumped in a water slurry at about 35 percent solids. The ash settles, gradually filling in the pond volume. Normally, the ash settlement progresses from the pipe discharge location toward the pond's outlet structure. Depending on the shape of a pond and the relative locations of the ash discharge lines and the pond outlet structure, ash can accumulate close to the outlet and create excessive suspended solids in the pond outflow. Most plants have some environmental permit controls for the outflow, either pH or Total Suspended Solids or both.

Over time, Progress Energy has found that the total volume of a pond can not be filled without potential risk of exceeding permit limits on the outflow. Often, the positioning of the ash discharge results in premature filling near an outlet, leaving large areas of usable area inaccessible. Plants have repositioned ash discharge lines and have added chemicals to the ash lines or in the pond itself as techniques to improve settling rates or reduce/raise pH.

Various alternates to increasing the volume in ponds, providing for removal and stacking of ash or treating the ash have been studied along with the pond actual volumes and their projected life spans by Progress Energy, MACTEC and others over the past several years. In general, no land is available at existing plants that could be used to construct new ash ponds. Progress Energy also prefers to avoid new pond construction due to the costs, environmental issues and permitting conditions.

Progress Energy has determined that conducting studies at individual plants may not be providing the best approach to an overall ash management strategy. Progress Energy retained MACTEC to review past studies, conduct interviews across the industry to ascertain current practices, interview plant personnel regarding specific conditions at their plant and assess short and long term strategies for managing ash at the Cape Fear, Lee and Weatherspoon plants. Beneficial reuse of ash, while acknowledged as one option, was excluded from the study due to the volatility and unpredictability of reuse opportunities.

3.0 Root Cause Analysis

3.1 Ash Pond Data

The 1985 pond was designed with an operating surface area of 58 acres, a top of dike elevation of 194 ft msl, and a maximum operating level of 192 ft msl. The initial storage volume of the pond at the surface elevation of 192 feet was approximately 63.8 million cubic feet. Based on a survey conducted in 2002, a low point on the dike was identified at elevation 193.8 ft. The discharge point was raised in 2002 to increase retention time in the pond. The raise was limited by the low point on the dike to elevation 191.3 ft msl, which is the current operating level of the pond. Table 1 summarizes ash pond information.

The pond receives ash sluice from two influent pipelines on the western bank of the pond. These ash sluice lines have been moved to the center of the pond and extended approximately 450 feet to prevent ash backup in the lines and promote more uniform settlement in the pond.

As part of this study, MACTEC conducted an updated physical profile of the ash pond to identify changes in the pond bottom contours since our last survey in November 2003. MACTEC Senior Engineer Andrew Rodak and Staff Technician Calvin Arrington were on-site on February 24, 2004 to conduct the pond survey activities. The survey consisted of profiling and delineation of the ash/water interface as well as pond soundings conducted at 10 distinct locations between the interface and the outfall in the shallower areas of the pond. A combination of bottom sounding and horizontal location using GPS surveying was used. Two rows of approximately 10 points each were collected in an east west direction. The depth was obtained by measuring the depth to the bottom and the location was noted using a GPS surveying instrument.

The sounding locations were recorded using a GPS field tracking device. Soundings were conducted using a weighted measuring tape. In addition, subsurface pond current velocities were measured using a portable stream velocity meter, and the maximum velocities and associated depths recorded at each sounding location

Figure 1 depicts the ash/water interface as delineated by MACTEC during our February 2004 survey, as well as the ash/water interface as delineated during the November 2003 survey. As indicated in the drawing, the ash water interface has moved a considerable distance (approximately 330 feet) over the short (3-month) interval. Subsurface current velocities in the pond are relatively negligible and occur near the surface, most likely influenced by surficial wind patterns. MACTEC compared our survey with the Bathymetrical Survey performed by PGN's Environmental Services Section (ESS) in May 2003. The topography of the pond bottom as interpreted from our survey is fairly consistent with that plotted from the Bathymetrical Survey.

3.2 Coal Usage Factors

MACTEC reviewed existing analyses of ash generated from different coal types burned at the plant under various burn scenarios. According to Progress Energy personnel, the ash content of the contract coal currently burned at the plant is approximately 10% by weight. This is comprised of both bottom ash (10%) and flyash (90%). The bottom ash is a heavier, denser material that settles out immediately upon entering the pond through the sluice influent pipe.

Additional unburned carbon, referred to as "Loss of Ignition" material, also is mixed in with the ash and is sluiced into the pond. According to plant personnel, the LOI content of the contract coal burned in Unit 5 is 5% and the LOI content of the contract coal burned in Unit 6 is 20%. LOI material is also dense, and settles out fairly rapidly. The LOI content of the coal was taken into account when the quantity of ash produced from coal usage was calculated.

The unit weight of sedimented ash also is a variable. Estimates of ash dry unit weights range from 50 pounds per cubic foot for freshly placed ash to 68 pounds per cubic foot for ash that has been in place for many years. For the purposes of evaluating alternates in this study, a dry unit weight of 55 pounds per cubic foot has been used (see Table 3).

The effect of the unburned carbon on the ash/unburned carbon mix unit weight was also considered. A paper published by J.Y. Hwang, X. Sun, and Z. Li of the Institute of Materials Processing, Michigan Technological University entitled *Unburned Carbon from Fly Ash for Mercury Adsorption: I. Separation and Characterization of Unburned Carbon* shows that the unit weight of the unburned carbon component of fly ash separated by an electrostatic precipitator is lower than the unit weight of the fly ash itself. Therefore, in considering the unit weight of the ash/unburned carbon mixture, using the ash unit weight only is conservative.

Table 2 lists the current, average and maximum projected volume of coal usage (in tons) at the Cape Fear plant over the next five years. This data is listed in the "Annual Coal Unit Summary" spreadsheets provided to MACTEC by Progress Energy. As indicated in the summary, the highest projected use of coal is this year (2004), fluctuates over the next three years and drops off for the last two years in the projection period. Based on the ash content in the coal of 10%, the associated annual ash volumes entering the pond are also depicted on the table.

Several of the East Region plants (among them Cape Fear) are beginning to use "Opportunity Coal" in their processes. "Opportunity Coal" is a low-sulfur, cheaper-grade coal than the contract coal, with ash content of approximately 20% by weight. As indicated in Table 3, ash volumes entering the pond double if "Opportunity Coal" is burned in the plant, which reduces the storage capacity of the pond from that determined when considering contract coal usage. A graph following Table 3 depicts the relationship between available pond life and various ratios of coal usage at the plant (ranging from all contract coal to all opportunity coal). As depicted in the graph, available ash storage in the pond ranges from about 3 years to about 6 years based on the ratio of coal burned.

Other coal types or combustion processes that may affect ash settlement ability in the pond include the use of low-NO_x burners, Camp Creek (low sulfur) coal, ammonia addition to reduce NO_x emissions, and sorbent injection (limestone) to reduce SO_x emissions. It has been suspected by plant personnel that these processes may be producing a smaller or less dense fly ash particle which could be contributing to the inability of smaller ash particles to settle out in the ponds prior to flow over the discharge pipe. These factors could account for cloudiness and TSS concerns that have been historically present in the pond, although they were not evaluated by MACTEC during this study.

3.3 Ash Settlement Factors

A settlement analysis of a sample of flyash was performed by MACTEC during the assessment. The test was performed using a hydrometer and distilled water, and revealed that approximately 99% of the flyash settled within 15 minutes. This represents ash settlement characteristics under quiescent conditions and in a static environment. In reality, specific environmental conditions in the pond affect the ability of the fine-grained sediments to settle out in a uniform pattern as simulated in a hydrometer.

In MACTEC's 2002 Study Report of the Cape Fear ash pond, it was concluded that two factors contributing to ash settlement in the pond were hydraulic short circuiting of the influent flow that promoted a scouring of ash particles in shallow areas of the pond and hindered settlement of the particles in these areas through reduced retention time, and high pond pH resulting from the presence of carbonates and other alkaline compounds in the pond that are products of different combustion processes in the plant's boiler units.

An additional factor that may be affecting ash settlement in the pond is the condition of pond turnover. Pond turnover is a condition in which thermal stratification (layering) is created in a pond on a seasonal interval. In the spring, pond water temperatures are nearly equal at all depths. In the summer, the surface water warms at a faster rate than the deeper, cooler water due to surface air temperatures and calm weather patterns, creating three distinct thermal layers of water in the pond- a less dense, warm upper layer (eplimnion) that is exposed to the sun and atmospheric oxygen, a very thin middle layer (metalimnion) where temperature and density changes rapidly, and a cold, lower layer (hypolimnion) that remains unchanged throughout the year due to the absence of sun exposure and lack of mixing with the upper two layers. In the fall, surface waters cool from rain and cooler atmospheric temperatures, and the temperature of the epilimnion layer becomes equal to that of the metalimnion layer. This reaction causes the colder water to sink and displace the warmer water. The "flip-flop" of layers creates currents that, in an ash pond, may disturb the lightweight ash sediments in the deeper areas of the pond, causing them to remain in suspension and be carried over the outfall.

Studies conducted in 2002 by Progress Energy's Environmental Services Section (ESS) concluded that pond turnover is occurring in the 1985 pond and is adversely affecting pond discharge quality through increased levels of turbidity and TSS in the effluent.

3.4 Discharge Permit Issues

Overflow from the ash pond discharges through an outfall structure (Outfall 005) into the plant's discharge canal which flows into the Cape Fear River. No treatment is currently performed on the pond effluent. The pond effluent is permitted under NPDES Permit Number NC0003433, and monthly limits are imposed on oil and grease, total suspended solids (TSS), selenium, and arsenic.

Plant personnel monitor the outfall bi-monthly, and submit the average of the readings in accordance with the permit reporting requirements. The pond discharge has historically been compliant with the NPDES permit limits; however, TSS levels have been steadily rising as the pond nears storage capacity. A review by MACTEC of the last three years of pond discharge monitoring data revealed that seasonal spikes have occurred in the TSS levels observed in the pond discharge. These spikes have occurred in the early spring and fall; this is most likely reflective of pond turnover events. Progress Energy is concerned that the NPDES monthly average limit of 30 mg/l may be exceeded in the near future if concentrations of TSS continue to increase as the pond fills and the ash/water interface nears the outlet riser.

3.5 Ash Pond Volume and Projected Life

The calculated future storage capacity of an ash pond is affected by variable ash unit weights, uncertainties in measured bottom elevations or surveys, unpredictable patterns of ash settlement and unpredictable and erratic behavior of ash related to suspended solids limits at the discharge. In earlier work, MACTEC projected capacities by assuming that the remaining pond area could be filled only to within an average of 1 foot of the riser top before suspended solids issues were likely. These projections, made mainly in 1999 and 2000, have appeared to be too optimistic based on reports from the plants. Generally, suspended solid issues have arisen before the ash level has reached the average 1 foot below the riser. Implementing operational aids such as relocating discharge points or installing baffle curtains has allowed ponds to continue filling available capacity and meet discharge limits.

For the three plants included in this study, application of the previous 1-foot factor would represent 22 to 42 percent reduction of theoretical volume to the top of the riser, based on current pond surface areas. During workshop meetings, no clear method for adjusting theoretical capacity was developed; some suggested using a 50 percent reduction, others less. It was noted that implementation of operational controls would allow more efficient use of the available volume. For purposes of comparing various alternatives, MACTEC elected to apply a uniform reduction factor of 25 percent to the calculated volumes for estimating usable life. That is, the calculated volume was multiplied by 0.75 to obtain a volume to use in projecting life of the ponds and various alternatives.

MACTEC plotted the depths at the February 2004 sounding locations and used those along with the depths measured during our November 2003 survey to create a topographic map of the pond. MACTEC then calculated surface areas enclosed by the isotopic lines and multiplied these by the corresponding average depths within each line to determine the current volume of the pond. This volume is depicted in Table 4. Based on the survey, MACTEC calculated a current volume in the pond of approximately 24.3 million cubic feet.

The Bathymetrical survey conducted in May 2003 by Progress Energy's ESS revealed that the available pond capacity at that time was approximately 25.3 million cubic feet. A comparison of the contour map created by MACTEC from the November 2003 and February 2004 surveys and the contour map created by the Bathymetrical survey indicates that there is some agreement with the contouring of the pond as determined by both survey methods.

The difference in ash pond capacity as calculated from the 2003 Bathymetrical survey and MACTEC's survey is 951,090 ft^3. Using an ash unit weight of 55 pcf, that is 26,155 tons of ash that has theoretically filled the active pond in the interval between the two surveys (nine months). Using the annual ash generation rate for 2004 of 91,875 tons, the theoretical volume of ash that entered the pond during the interval represents approximately 28% of the annual ash generation volume projected for 2004. This assumes, however, that the ash generation rate from the plant was uniform during the interval (it is historically not; peaking in summer and winter) and that all ash entering the pond ended up in the active portion of the pond and did not settle out in the sedimented dry area of the pond.

Conservatively estimating that roughly 75% of the remaining pond volume can be used for ash storage and still maintain discharge within permit limits to the permitted outfall, roughly 18.2 million cubic feet of ash storage space remain in the pond based on the calculated remaining volume from MACTEC's surveys. At an average influent ash unit weight of 55 pcf, this equates to roughly 669,600 tons of remaining ash storage, if all the volume could be filled. If the remaining pond volume calculated from the Bathymetrical survey is used and considering that nine months have elapsed between the Bathymetrical survey in May 2003 and MACTEC's survey in February 2004, approximately 16.5 million cubic feet of ash storage space remain in the pond. At an average influent ash unit weight of 55 pcf, this equates to roughly 454,000 tons of remaining ash storage, if all the volume could be filled, less than computed using the MACTEC survey results.

Table 3 compares the current pond volume with the current, average, and maximum ash generation at the plant over the next five years. Since it is not known what percentage of the coal burned at the plant will be Opportunity Coal, MACTEC calculated ash generation rates using different ratios of contract and opportunity coal to evaluate various operating scenarios. As depicted in Table 3 and its accompanying graph, based on current pond volume determination and projecting that 75% of that volume can be filled with ash, as well as the projected ash generation rates, remaining pond life ranges from about 3 years (using all opportunity coal) to about 6 years (using all contract coal). Because the volumes of contract coal and opportunity coal are not known, we have based further evaluations of ash capacity improvements on an average coal use rate and a 50-50 blend of contract coal and opportunity coal. For the Cape Fear plant, this results in an annual ash generation rate of 128,400 tons. The remaining life calculations assumed uniform ash distribution in the pond, a unit weight of 55 pcf, and the current operating level. For comparison purposes, the remaining pond life as calculated using the available pond volume determined by the Bathymetrical survey and adjusting this volume to 2004 pond conditions as surveyed by MACTEC results in reduction of pond life by approximately 2-2.5 months under the same loading scenarios.

3.6 Conclusions

The Cape Fear plant ash pond has been filled to approximately 65% of its original, theoretical capacity for ash storage available at the current operating level, and has a projected usable life of about 3 to 6 years remaining assuming proper functioning of the diversion baffle system presently being installed. The pond life assessments that were performed in 1999 and 2000 assumed uniform distribution of ash in the pond and projected that pond capacity would be reached in 14 years. Previous life assessments did not take into account the potential use of "Opportunity Coal" in the plant, which produces twice as much ash as Contract Coal. The effect of environmental factors in the pond that affect the quality of the discharge and the ability of the plant to maintain compliance with its NPDES permit were also underestimated.

MACTEC believes that the potential increase in ash volume entering the pond through the use of "Opportunity Coal" poses a detrimental influence on the pond's ability to operate effectively as a wastewater treatment system. The problems currently being encountered with TSS and turbidity levels in the outfall will only be magnified by an increase in ash volume entering the pond.

In addition, there is evidence to suggest that the current environmental conditions in the pond are contributing to sporadic instances of increased turbidity and elevated levels of suspended solids in the pond effluent. Environmental conditions such as pond turnover are potentially a factor in the ability of suspended material produced in deeper areas of the pond to settle out of suspension prior to reaching the discharge riser. Disturbance of ash sediments in the pond during turnover events, influenced by wave patterns in the pond and the shallow depths, is a contributing factor to the pond's historical non-compliance with discharge limits during these events.

If pond turnover is allowed to continue without provisions made for compliance with discharge permit limits (such as drainage of the eplimnion layer or a secondary settlement pond), there is evidence to suggest that it will consistently occur seasonally in the spring and fall, and may have adverse impacts on permit compliance as more ash enters the pond and can be disturbed during turnover events.

Based on the pond survey results and observations made during the pond profiling event, our knowledge of the Cape Fear plant ash properties, present and future projected coal combustion volumes and types, and historical pond behavior, MACTEC concludes that the root cause of the increased levels of turbidity in suspended solids in the ash pond is a combination of; 1) decreased retention time in the pond due to the increase in ash volume; and 2) pond turnover.

The effective operating life span of the pond is now less than previously predicted based on factors such as the burning of "Opportunity Coal", an increase in the volume of projected coal burn, and location of the ash sluice line.

4.0 Evaluation of Alternatives for Ash Management

MACTEC developed and evaluated a list of ash pond management strategies for both short term compliance and long-term ash handling. The list was developed based on MACTEC's research into ash management practices currently underway in other electric utility providers, at other Progress Energy plants, and into innovative technologies approved and being conducted by other industries for solid and hazardous waste management. Based on our research, we identified the following strategies for short and long-term ash pond management:

- Use of diversion baffles to increase sediment retention time;
- Excavation/dredging and stacking of ash into another existing permitted pond or landfill;
- Use of Geotubes for ash storage and dewatering within a pond;
- Use of wetlands (existing or engineered) for treatment of pond discharge;
- Chemical treatment (coagulants, flocculants) of pond discharge;

- Physical treatment of pond discharge (settling basins);
- Extension of the dike to increase the volume of the ash pond;
- Raising the discharge riser in the pond to increase operating level;
- Modification of the discharge riser to allow partial drainage of the pond prior to a projected turnover event;
- Mycorrhizal Technology of land-applied flyash;
- Recirculation of pond discharge back to plant to supplement sluice makeup and create a closed-loop system; and
- Construction of a new ash pond

These strategies were presented to Progress Energy during Strategic Ash Management Team meetings on March 18, 2004 and April 27, 2004 for discussion. General comments received from Progress Energy indicated that wetlands, Mycorrhizal Technology, chemical treatment, and recirculation of pond discharge would not be feasible strategies for further consideration due to permitting constraints and practicality.

Construction of a secondary settlement basin and modification of the discharge riser were not considered as ash management strategies as defined in this study in that these measures would not provide additional storage space in the pond for ash. These measures are interpreted as short term compliance strategies to enhance maintenance of compliance with pollutant limits in the pond's discharge. For discussion purposes, a more detailed evaluation of these strategies is provided in Appendix C.

It was learned during the team meetings that a mixing box was constructed near the outfall of the pond at the time of original pond construction to provide for future distribution of chemicals into the discharge for treatment. This box has never been used. Its current condition and how chemicals would be supplied and solids removed are not known. Chemical treatment either using the box or other methods was not evaluated as a short-term strategy because it does not address ash physical capacity concerns.

The remaining strategies are presented in the study report for analysis, and are categorized as either "short term" or "long term" strategies.

Short term management strategies address immediate concerns in the ash ponds: (1) ability to maintain compliance with permit discharge limits; (2) prevent pond turnover; and (3) optimize ash flow in the pond to promote uniform settlement and maintain the projected fill schedule that was used in determining remaining pond life.

Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules by creating additional space in the ponds through excavation, use of Geotubes, or construction of a new ash pond to meet future ash projections. Long-term management strategies consider operation of the plant over a 20-year planning window.

4.1 Short Term Ash Management Alternatives

4.1.1 Description of Alternatives

MACTEC evaluated three alternatives for short-term management of current pond conditions and available capacity. Short-term alternatives address compliance issues in the pond through consideration/management of current pond conditions and ash settlement factors. The short term alternatives that were evaluated by MACTEC were:

- Installation of diversion baffles to lengthen sediment flow paths in the pond and increase retention time; and

- Excavation or dredging a certain volume of ash from the pond and dry-stacking it in the 1978 pond.

Since baffle installation was a recommendation in the 2002 Ash Pond Study Report and is in the process of implementation, it will not be discussed further in this report. Projected life spans for alternates assume proper installation and functioning of the baffles.

4.1.1.1 Alternative 1: Excavation/Dredge, Haul and Stack

4.1.1.1.1 Technical Analysis of Alternative

For the excavation alternative, ash would be excavated from a designated area in the pond using trackhoes and transported via truck to a stacking area in the 1978 pond. Entrained water in the ash would be allowed to drain from the stacked ash through rim ditches or bleed channels constructed around the perimeter of the stacking area into the active pond. For a dredging operation, a floating dredge would be used to pump ash/water slurry through piping into cells constructed in the dry portion of the 1978 pond. The dredge will need to have a pumping capacity to move an ash water slurry of about 15 to 20 percent solids at least 3,500 feet with a head differential of about 25 feet.

Ash storage for a dredging operation would use cells constructed by digging out ash to form basins. The dredged material would be allowed to settle in a basin with excess water decanted into the water area of the 1978 pond. After a cell dries sufficiently for handling, the ash would be used to create a raise of the cell dike to allow for more storage. A similar operation has been implemented at the Asheville Plant successfully. The cell dikes may need reinforcing with geogrids for stability, and adequate buffers need to be allowed between the cell dikes and the pond dike as well.

With either excavation or dredging, ash could be stacked as high as practical in the stacking areas of the pond, considering slope stability and erosion potential. Stacked ash will need to be capped with 6 inches of soil and seeded after final grading activities are conducted. Provisions for haul routes into the stacked area and dredge line placement must consider the narrow plant entry through the flood gates and the need to cross the railroad spur and the discharge canal.

Excavation of ash from the Cape Fear active pond would involve the area in the northwest portion of the pond, where ash has filled in the available space (dredging of ash would occur in the shallow areas of the active pond for sedimented ash beneath the water surface). Ash excavation from the active pond allows for additional space in the active pond for ash storage (the amount of additional storage depends on the surface area of the pond that can be excavated). Water is pumped out of the excavation area to lower the surface water level, maintain a workable excavation base and allow for additional excavation of ash. Previous excavation projects at the Weatherspoon plant have shown that a maximum excavation depth of 6 feet will maintain stability and dryness of the excavation floor for equipment traffic without additional drainage measures. Drainage can also be accomplished through installation of additional rim ditches and bleed channels to provide conduits for entrained water. Excavation to depths greater than 6 feet can be accomplished through construction of impervious separator sections and additional dewatering devices. Depth of ash removal by dredging would not be limited by wet conditions.

To optimize available capacity of the pond and prevent water intrusion into the excavation area, the area for proposed excavation should be isolated from the main pond by a separator dike. The proposed excavation area is depicted on Figure 2. The separator dike would be constructed of geogrids, borrow material and ash and would be constructed to an elevation of approximately 194 ft msl (to maintain a minimum of two feet of freeboard in the active pond). The proposed excavation cell area provides approximately 15 total acres of surface area for excavation. Prior to excavation activities, the ash sluice line must be re-routed/extended around the cell area to provide a flow path for ash from the plant to the main pond during the excavation activities. The conceptual approach to a digging and stacking strategy is that the constructed cell can be used for future storage of ash sluiced from the plant after excavation, and the remaining active pond would be available for emergency use only. The proposed cell configuration is conceptual; different cell configurations are certainly possible, and ash can also be excavated/dredged out of a portion of the active pond area if necessary.

At a maximum excavation depth of six feet, excavation slopes of 10:1 and average density of excavated ash of 60 pcf, a total volume of 113,322 tons of ash can be excavated from the pond per dig event, adding approximately 1 year of additional storage per dig cycle at the current ash generation rate. Given that each excavation/stacking cycle can occur as soon as possible after the dig area is full (see Timeline in Appendix A), the amount of time that it takes per dig (approximately six months), and the time it takes to fill in the dig area after excavation (based on dig area volume and average annual ash generation rate from the plant), it is estimated that four digging/stacking cycles can be conducted during the remaining usable life of the pond. Therefore, the approximate life extension to the pond achieved through digging and stacking is 6.5 yrs.

Excavated/dredged material from the 1985 pond could be hauled/pumped to the 1978 pond for stacking. The 1978 pond is still considered an "active" pond in the facility's NPDES permit, although sluice lines from the plant have been removed and it is no longer capable of receiving ash from the plant. Currently, the pond is permitted to receive stormwater runoff and discharge from the low-level wastewater basin. Progress Energy environmental personnel have advised that movement or placement of ash within an active permitted pond is allowed under the Water Quality permit. Solid Waste regulations do not apply. Should that situation change, and regulations for industrial landfills issued by the Division of Solid Waste become applicable, liners and other measures would be required, considerably impacting planning time and cost.

The 1978 pond has approximately 17 acres of previously sedimented ash that is above the current water level and can be used for stacking. After allowing for buffer space and accounting for unusable space, the footprint of the stack area is about 15 acres. The stacking area has been divided into three cell areas (designated as "Area A", "Area B", and "Area C", see Figure 3). The maximum height of stacking in each cell area would be dependent upon slope stability and ease of equipment mobility for grading, and would affect the surface area footprint occupied by the transplanted ash (the higher you can effectively stack the ash, the smaller the footprint). Theoretically, the cycles of digging in the 1985 pond and stacking in the 1978 pond can continue until the available stacking area in the 1978 pond is filled. However, since part of the available capacity of the 1985 pond is used up during each digging episode, the 1985 pond will be too full to have room to store ash while area is excavated for a 5th dig, even though stack area would handle a bit more. Therefore, maximum stacking heights of 20 feet in Cell A, 30 feet in Cell B and 75 feet in Cell C could be achieved in the 1978 pond.

4.1.1.1.2 Safety Analysis of Alternative

Generally, the primary safety concern of excavation and dry-stacking of ash is the stability of the excavation floor and surrounding dike and ingress/egress to/from the excavation area. Since the ash to be removed has a certain percentage of entrained water, the excavation area is likely to be unstable and potential for entrapment of equipment and personnel exists. For this reason, spread mats constructed of wooden material are suggested for use in equipment/personnel transport through the ingress/egress areas. Additionally, a minimum 30-foot buffer must be constructed and maintained around the perimeter of the excavation area to prevent stability of the dikes from being compromised during the excavation activities.

Disturbance of ash sediments also poses the risk of liberating flyash particles into the air, where they can be inhaled and present a respiratory hazard. For this reason, breathing filtration equipment should be used in the work zones where appropriate.

The primary safety concern associated with dredging of ash is the potential damage to the dike through the operation of the dredging equipment or pumping into a storage area. A previous dredging project in the Weatherspoon pond resulted in a partial breach of the ash containment dike, releasing a large volume of ash into the pond and outside the pond.

Another safety concern related to dredging is the height of stacked ash from dredging that could be achieved inside the cells within the pond. If adequate buffer space is available (as was the case in the Asheville plant's dredge/stacking area), the concern for cell dike breach is minimized, as provisions are in place to contain the dredged materials within the pond. As the height of the stacked ash begins to increase and becomes greater than the cell dike height, and adequate buffer space is not available, a potential breach of the cell dike could cause ash to overflow the pond dikes or cause a failure of the pond dikes as well.

Transport of the ash across the railroad tracks presents safety issues that can be addressed through proper planning. For truck transport, there is a risk of accidents between trucks and other plant vehicular traffic.

4.1.1.1.3 Reliability Analysis of Alternative

Excavation/dredging of ash has proven to be an effective method of creating additional storage space in active ash ponds in other Progress Energy and electric utility steam plants. The volume of additional storage space created in the pond is dependant on the available stacking area to which the ash is transported, the ash influent rate into the pond, and the maximum depth of stacking that can be achieved. The benefits of cell development for stacking lie in the ability to use portions of the pond for filling while others are being excavated, while the main pond does not receive ash under normal operations.

4.1.1.1.4 Economic Analysis of Alternative

MACTEC estimates the total cost for digging and stacking for 4 cycles (6.5 years of additional storage) as approximately $2,672,700 in today's dollars. This cost is broken down in Appendix A and is discussed below.

The unit cost for excavation and hauling of ash is taken as $4.50 per ton due to the haul distance from the pond to the stack area. For four excavation and stack cycles, MACTEC estimates the cost for the excavation, hauling and stacking at approximately $2,311,200. The estimated cost does not include placing a liner in the 1978 pond. We understand that Progress Energy has verified through discussions with the DWQ that a liner is not required for stacking in the 1978 pond.

The cost of construction for a separation dike for the excavation and stacking areas is based on a cost of $4.00 per square yard for the geogrids (as applied) and $3.00 per c.y. for borrow fill. Assuming that the dikes will be 12 feet in width, average four feet in height, and total 2,000 feet in total length (as depicted on Figures 2 and 3), estimated cost for construction of the dikes is approximately $30,000.

The cost for placing a soil cap and hydroseeding the stacked ash is estimated based on a unit rate of $15.00 per cu. yd. for fill. Assuming a six-inch soil cap to be placed over the stacked areas in the 1978 pond, the cost for a soil cap is estimated at $181,500 for a surface area of 15-acres.

The cost of excavation and dry stacking must be spread out over the life gained because only a limited area can be excavated at any one time. For dredging, the excavating is limited by the area available and the time required for sedimentation and stacking. It may be possible to capitalize dredging costs with the life extension gained by dredging exceeding the time frame of the dredging work.

4.1.1.1.5 Environmental Analysis of Alternative

Since the ash is being transported into an existing wastewater treatment system, no provisions are needed for water drainage or stormwater runoff from the stacked ash; it can be directed through constructed bleed channels back into the water portion of the 1978 pond for retention and treatment. The 1978 pond is still considered an "active" pond in the plant's NPDES permit, and will not need to be permitted to receive additional ash.

Progress Energy environmental personnel have advised that movement or placement of ash within an active permitted pond is allowed under the Water Quality permit. Solid Waste regulations do not apply. Should that situation change, and regulations for industrial landfills issued by the Division of Solid Waste become applicable, liners and other measures would be required, considerably impacting planning time and cost.

Since the runoff from the stacked ash will contain suspended solids, a potential exists that water quality in the 1978 pond will be adversely affected by the runoff. Concern over rising levels of suspended solids in the 1978 pond effluent was the primary factor for taking the pond off-line and construction of the 1985 pond to receive and treat ash from the plant In previous excavation/stacking projects at other Progress Energy ash ponds, problems with suspended solids were not encountered, primarily because the stacking area was located far enough away from the discharge of the pond that adequate retention time for solids settlement is available. Suspended solids generated from ash excavation in the 1985 can be controlled through the separation dike and the diversion baffles.

If dredging is the method of ash transfer to the 1978 pond, designated cells for dry-stacking will need to be constructed to allow adequate retention time for suspended sediments to settle out before reaching the discharge riser. Construction of a primary settling basin cells in the pond will be required to collect runoff from the dry stacking of dredged ash, with secondary basins, overflow weirs or rip ditches to provide runoff conduits for the stacked ash. A buffer area around the dry stacking can be used for construction of the settling basins. These basins can also be used for treatment of stormwater runoff and discharge from the low-level wastewater basins.

4.1.1.1.6 Risk Assessment of Alternative

Ash excavation and re-stacking has proven to be an effective method of removing ash from active ponds to allow for additional space. Inherent risks lie in the stability of dike walls and the floor of the excavation area, and are based on the entrained moisture content of the ash and rainfall, and the ability to effectively pump this water out of the excavation. If provisions are not made to protect the cell dikes during excavation or dredging activities, breaching may occur.

Protection of water quality in the active pond during dredging or excavation activities is also important, as agitation of sedimented ash during these activities will cause dispersion of sediments throughout the pond and could affect discharge quality. This has not been a problem in previous excavation and stacking projects at other Progress Energy ponds, and is dependent upon the proximity of the excavation/stacking area to the pond discharge riser, buffer size and separation dikes. Construction of settlement basins in the 1978 pond will be necessary for runoff control from dredged ash. Use of the diversion baffles to increase the retention time of particles in suspension in the 1985 pond should also minimize the risk of adverse impacts of water quality in the pond during excavation and dredging activities.

The third risk is the actual life extension provided to the pond through an excavation/stacking strategy. Our estimates are based on a 50/50 contract/opportunity coal ratio, and an average coal production rate calculated over a five-year projection period. If the percentage of opportunity coal increases above a 50/50 ratio and annual coal production exceeds the average by more than 10% (this would exceed the maximum projected volume of coal), the actual pond life extension will be shortened, and projections made in this report will be invalid.

4.2 Long Term Ash Management Alternatives

4.2.1 Description of Alternatives

MACTEC evaluated three alternatives for long-term management of ash and available pond capacity. Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules as determined assuming uniform ash distribution patterns, as well as account for at least 20 years of future coal usage at the plants.

The long term alternatives that were evaluated by MACTEC were:

- Raising the main pond dike 6 feet to an elevation of 199.8 ft msl ;
- Use of Geotubes for storage of ash; and
- Construction of a new ash pond.

During the meetings with Progress Energy, the concept of creating a landfill on top of the abandoned ash storage areas of the 1963 and/or 1970 ponds or even developing an off-site landfill was discussed. Landfills would fall under the permitting requirements of the Solid Waste Division. A similar project was undertaken by the Roxboro Plant for expanding their landfill on a former ash pond. A permitting time frame of about two years was required. Detailed hydrogeologic studies were required. The expansion was required to have a liner, leachate collection system and ground-water monitoring.

In 2002, Jacobs Engineering and Law Engineering prepared a study for CP&L for the Asheville Plant which studied landfilling concepts both on their existing ash pond and off site. Landfilling would require implementing a dry ash handling system as well as the development of the landfill under Solid Waste regulations and permits. The ash quantity used for that study was 120,000 tons per year plus 50,000 tons per year of sludge from planned air cleaning equipment for a total waste amount of 170,000 tons per year. The amount of ash is essentially the same as the average ash at a 50-50 mix of opportunity and contract coal for the Cape Fear plant.

We have used the cost estimates prepared in the Asheville study as a guide for a rough estimate for developing a landfill at Cape Fear on the abandoned 1963/1970 ash pond area or off-site, possibly on Cherokee Brick property adjacent to the plant. For an on-site landfill development operated for 25 years, the total estimated cost at Cape Fear is $76,740,000 (2002 dollars). This includes:

Dry Ash System	$ 2,240,000
Permitting	$ 1,000,000
Development/Construction	$48,000,000
Operation for 25 years	$25,000,000 (contracted operator)
Post Closure Monitoring	$ 500,000
TOTAL	$76,740,000

At an ash amount of 128,400 tons per year (average coal use and 50-50 mix of coal types) and 25 years of life, the above cost translates to $23.91 per ton, significantly greater than other options.

The Roxboro Plant landfill experience suggests costs to develop an on-site landfill may be significantly lower than the above numbers, based on telephone conversations with personnel involved in that work. A rough cost of $1.00 per ton for capital and $2.00 per ton for operation were stated. The Roxboro operation is much larger (~500,000 tons per year), and this would make the per ton costs lower. Review of landfill development and operational costs in more detail is needed if a landfill option is to be considered further.

The potential site for a landfill at the plant is adjacent to the Cape Fear River and significant environmental concerns would be expressed by Solid Waste and possible opponents about risks of leachate reaching the river. The dikes of the old ash ponds along the river are very steep and have stability concerns for creating a landfill, although proper engineering design can address these.

If an off site landfill concept were adopted, a rough estimate based on the Asheville study is $73,240,000 (2002 dollars) for a 25 year operation. This estimate is based on per acre costs from Waste Management, Inc. in the Asheville study and includes land purchase at $10,000 per acre. The size used at Asheville was 200 acres. For Cape Fear we have estimated the landfill size as 50 acres with 125 acres for operations and buffers (175 acres total). The estimate includes:

Dry Ash System	$ 2,240,000
Land Purchase @10,000 per acre	$ 1,750,000
Host Community Fee, estimate	$ 500,000
Permitting	$ 1,500,000
Construction @$275,000 per acre	$13,750.000
Closure @150,000 per acre	$ 7,500,000
Post Closure monitoring and reports	$ 2,000,000
Operation for 25 years (@$1,000,000 per year	$25,000,000
Transport Ash @$6.00/ton	$18,000,000
TOTAL	$73,240,000

At an ash amount of 128,400 tons per year and 25 years of life, the above cost translates to $22.82 per ton, significantly greater than other options. The difference in on-site development and off-site development was due to the different methods of estimating used by Jacobs/Law in the Asheville study for the two options.

In the April 27 meeting, the possibility of using three existing clay pits owned by Tom Darden, the former owner of Cherokee Brick that are located between the 1978 pond and the discharge canal for ash placement was discussed. The pits were created for storage of stumps and waste fill, and have a capacity of approximately 9.1 million cubic feet of storage. This equates to approximately 2 years of ash storage at a 50/50 coal ratio and average coal usage. The pits were discussed as a possible storage area of ash because of their imperviousness. However, any ash stacking that occurs outside the boundaries of the permitted wastewater treatment system would be considered to be land filling, and would require additional permitting and study.

Another concept that was briefly discussed in the April 27 meeting was developing a centralized regional ash landfill to receive ash from at least the three plants studied. For an estimated landfill size of 340 acres and using the per acre estimate approach from the Asheville study, we estimate a cost of about $155,000,000 for a 25-year life.

Experience that municipalities and private waste handling firms have had trying to site new landfill space indicates finding a suitable landfill site and obtaining permits is a daunting task. Public opposition to landfills, regardless of their content, has made it extremely difficult for new projects to be successful. Municipalities have the power of eminent domain as a tool to obtain land; it is not clear if Progress Energy could use that approach. Extended legal actions by opponents delay implementation of landfill construction and operation. Creation of landfills does not appear viable as an alternate. Therefore, landfills were not evaluated further as a long-term strategy in this study.

4.2.1.1. Alternative 1: Raising Main Pond Dike

4.2.1.1.1 Technical Analysis of Alternative

This alternative involves the addition and compaction of fill material along the crest of the main pond dike to raise the dike. The existing dikes were constructed using compacted structural soil from within the Ash Pond and from adjacent borrow areas on top of residual soils. Approximately 7,200 linear feet of earth fill embankments surrounds the pond and makes up the existing dike. Current maximum dike height is about 28 feet, with a crest width of about 12 feet, and side slopes of approximately 2H:1V upstream and ranging from 2H:1V to 4H:1V downstream.

To provide for increased ash storage capacity, the crest of the existing dike can be raised by approximately 6 feet, to elevation 200 feet (msl). With implementation of this strategy, the planned operating level of the pond can be raised to a maximum elevation of 198 feet msl. The maximum height for the modified dam will be 34 feet, and the storage volume will be 2,275 acre-feet for the 65-acre impoundment area. Based on the planned height and storage capacity, the modified dike will be considered of intermediate size under the North Carolina definitions.

The work will include placing earth fill on the crest and downstream side of the existing dam, and extending the existing riser structure to provide for a minimum 2.5-ft freeboard.

Raising of the pond dike will accomplish the following objectives:

1) Provide additional storage of ash and extension of pond life. Additional storage life of about 3 years is projected with the extension and current pond elevation;
2) Provide for more settlement time in the pond to improve discharge water quality.

Modification of the ash sluice line plumbing would be required for implementation of this alternative. A vertical extension to the lines may be required to transfer the sluice into the pond at a higher elevation as a result of the dike raise. Additionally, the available head against which the sluice pumps are pumping would be increased, and the pumps' ability to handle the increase in static lift would need to be evaluated by the plant. Currently, ash and water are removed from the ash sump pit by two hydro seal ash pumps. The pump for Unit 5 is designed to deliver 1,150 gpm of ash and water slurry against a discharge head of 50 ft with 10 ft submergence. The pump for Unit 6 is designed to deliver 1,750 gpm of ash and water slurry against a discharge head of 50 ft with 10 ft submergence. Under this condition, 20 bhp is required from the Unit 5 pump motor and 30 bhp is required from the Unit 6 pump motor, both with efficiencies of 75%. However, the pumps are fairly old, and a pump performance evaluation would be required to determine discharge rate and efficiency against additional head.

4.2.1.1.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to the stability of the dikes after the raise is complete. Design measures to address the stability are available. The detailed design of a dike raise will need to include stability analyses using circular arc failure surfaces based on a random grid pattern. Seismic analyses should also be conducted on the final dike slopes using a horizontal acceleration factor of 0.05g. Soil properties can be determined from laboratory analyses and historical information.

Existing slopes with fair to moderate grass cover have performed well in the current dike and do not show signs of sliding. To limit the surficial erosion, all dike faces will need to be hydro-seeded with drought tolerant grasses to aid in reducing potential surface sloughing.

4.2.1.1.3 Reliability Analysis of Alternative

Dike raises have been conducted at other Progress Energy ash ponds (Robinson) and have been proven reliable in short-term stability.

4.2.1.1.4 Economic Analysis of Alternative

Based on the height of the dike raise, the volume and type of fill material required, and considering design, construction and monitoring costs, the cost for raising the dike six feet is estimated at \$2.32 million. At an operational life of 3 years (considering the extension provided to the pond life with the raise and taking into account ash volume production over that period at a 50/50 contract/opportunity coal ratio), this equates to an annual cost of \$703,030. This cost also does not include any required modifications to the sluice pumps to overcome the additional static and frictional head associated with pumping over the dike. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

4.2.1.1.5 Environmental Analysis of Alternative

Permitting requirements for this alternative are an erosion and sedimentation permit if land-disturbance activities exceed 1 acre in size, and an authorization to construct. Detailed construction plans including erosion and sedimentation control features, and a separate narrative and plan sheets must be prepared for submittal to the Raleigh Regional office of the Land Quality Section. The authorization to construct can be prepared based on the plans and must be submitted to the Raleigh Regional office of the Division of Water Quality. It is not clear at this time if a separate grading or land-disturbing permit will be required by Chatham County.

Modifications to existing dams would normally require a permit from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

4.2.1.1.6 Risk Assessment of Alternative

The inherent risk of raising the dikes lies in the stability of dike walls, and is based on the type of material used for the fill, the interior and exterior slopes, and the erosion control measures employed during construction. If provisions are not made to prevent erosion from dike faces during and after construction, breaching may occur.

Protection of water quality in the active pond during dike construction activities is also important, as sediments created during these activities may enter the pond and could affect discharge quality. This can be prevented through proper sediment control measures employed during and post construction, such as silt fences, turf matting, rip rap or vegetation.

4.2.1.2. Alternative 2: Use of Geotubes for Ash Storage

4.2.1.2.1 Technical Analysis of Alternative

This alternative involves the purchase and installation of Geotubes within the pond dikes to collect and store ash. Geotubes are porous, woven monofilament fabric tubes that can be used to collect, store, and de-water ash either directly from the sluice lines entering the pond, or from a dredge line. Geotubes are traditionally used in sand dredging operations in coastal areas because they allow for both storage of dredged material for possible future use as well as provide future structural opportunities for berm construction. They have also been used in sludge dewatering operations, including coal sludge. Geotubes are an attractive option for storage of ash for the following reasons:

1) They allow the solids to be kept further away from the outfall line;
2) They provide a more structured containment; no dry stacking of ash is needed in the future;

3) The tubes can be stacked on top of each other, thus creating additional years of storage;
4) No erosion control or seeding is needed to prevent ash blowing as with other dry stacking operations; and
5) Ash is kept clean and easily removed once a market develops

Geotubes are supplied in sections; length of each section is specified by the purchaser. Circumferences range from 30 feet up to 90 feet. Geotubes can increase solids content through de-watering by a factor of up to 2.5. Literature on Geotubes is provided in Appendix B.

Modification of the ash sluice line plumbing would be required for implementation of this alternative. An extension to the lines would be required to transfer the sluice to the tubes. Typically, tube sections are pre-formed to specified lengths, laid out in the pond according to the desired configuration, and filled through ports attached to an overhead valve manifold system. A central trunk line is positioned above the length of the tube, and branch lines are connected to the main line at distinct locations above the Geotube fill ports. Filling of the tube sections is accomplished through manual valves installed on each branch line; the proper sequence of filling allows for even distribution of ash in the tubes. Maintenance of the valves is required to maintain uniform filling of the tube sections and prevent backup in the sluice lines. A pressure relief valve is positioned at each end of the tube to prevent structural failure due to blockage in the fabric.

The proposed Geotube layout is depicted in Figure 4. The layout has been devised to maximize the available space in the pond for Geotube placement, as well as minimize the amount of manifold piping needed to fill the tubes. As an alternate layout, the tubes can be used as part of the dike raise. Based on an average annual ash generation from the plant of 128,400 tpy, considering a ratio of 50/50 contract/opportunity coal, a projected storage interval of 20 years, the capacity of a 90-foot circumference (28.5-ft diameter) Geotube, and an available storage area in the pond of 15.2 acres, it is estimated that approximately 192,000 lineal feet of Geotubes will be required in the pond. This can be accomplished through the installation of 240 Geotubes each approximately 800 feet in length arranged according to Figure 4 and stacked in 5 levels.

4.2.1.2.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to installation of the tubes in the pond and operation of the fill valves The tubes weigh approximately 24 pounds per lineal foot empty, so considerable weight is associated with tube lengths of 800 feet. Cranes and other heavy equipment are required for installation of the tubes in the pond. The valves require manual actuation when filling the tubes; this is elevated work under high flow conditions. Risks associated with elevated work and pressurized vessels are inherent to the tube filling process. No additional safety concerns are associated with this alternative.

4.2.1.2.3 Reliability Analysis of Alternative

Geotubes are traditionally used and have been proven effective in sand dredging and sludge dewatering operations because they reduce waste volumes, allow for storage of dredged material for possible future use, and provide future structural opportunities for construction of berms using the Geotubes. They take up less surface area than typical stacking operations, and can be stacked to further minimize space. Geotubes are constructed of strong material resistant to tearing, and are designed to withstand wide width tensile strength up to 4,800 lbs/ft. While they have not been used in flyash ponds, they have been used to dewater coal sludge; the characteristics of which are similar to flyash. Geotubes can also be designed to handle a wide range of water content in the influent stream, which can accommodate the intervals of sluice pumping with low solids content (pump cycling). Further evaluation of the ability of the Geotubes to handle sluice loads of primarily water and little solids as the pumps go through their operational cycles would be required prior to implementation of this strategy.

4.2.1.2.4 Economic Analysis of Alternative

Based on the total volume of Geotubes needed to store 20 years of ash, the material cost for a 90-ft circumference tube, the material cost for 240 Geotubes is estimated at $8.6 million. Costs for the piping manifold system are estimated at $31,300. Installation costs for the Geotubes and piping manifold are estimated at 25% of the material cost and are projected to be approximately $2.2 million. For an implementation interval of 20 years, the cost per year is $ 367,500.

This cost does not include modifications needed for the sluice pumps to overcome the additional static and frictional head associated with pumping into the stacked Geotubes. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

A geotube system would require additional plant manpower for monitoring and operation. The impact of the manpower needs on the total system cost has not been determined.

4.2.1.2.5 Environmental Analysis of Alternative

Environmental impacts of using Geotubes to store ash sluiced from the plant are expected to be minimal, and will actually enhance compliance with the discharge permit requirements by preventing discharge of the pond during while the tubes are filling. No permit revisions are required for implementing this alternative, since Geotubes will be installed within the dike and will not increase the discharge flow of the pond above the permit limit. Since this is a minor modification to the existing permitted wastewater treatment system, authorization to construct will be required from the Raleigh Regional Office of the Division of Water Quality. This can be obtained through a submittal of the design plans for the Geotube system to the DWQ.

4.2.1.2.6 Risk Assessment of Alternative

The inherent risk of installing Geotubes is in the utilization of available area in the pond and ability of existing equipment to pump solids into the Geotubes for storage. An evaluation of the existing sluice pumps' ability to pump at the design rate and overcome the additional head imposed by the installation of Geotubes would be required to verify that current operation of the pumps will not be adversely affected. The available head against which the sluice pumps are pumping would be increased, as the Geotubes provide additional static head due to their fill ports.

4.2.1.3 Alternative 3: Construction of New Ash Pond

4.2.1.3.1 Technical Analysis of Alternative

For this alternative, a new ash pond would be constructed on property purchased by Progress Energy at a selected location. A siting study would need to be conducted to determine the optimal location for the pond, taking into consideration fill and drainage requirements, dike construction, permeability of subsurface soils, etc. Design considerations for the new pond would include average annual ash generation rates using both contract and opportunity coal, a usable life of 20 years, a freeboard of 2 feet, excess capacity of 25% to account for non-uniform ash distribution, and a maximum height of 20 feet above existing grade.

Design considerations must also be made for pumps and piping to sluice ash from the plant to the location of the new pond, connection of the outfall structure to a receiving water body, and permit requirements.

For the Cape Fear plant, based on an annual ash generation rate of 128,400 tons (using a 50/50 coal mix), a design height of 20 feet, design freeboard of 2 feet, 25% excess capacity provision, and a usable life of 20 years, the required land area to accommodate a new pond is approximately 170 acres. Rough dimensions of the pond are a length of 3,650 feet and a width of 1,800 feet. This pond would have a storage capacity of approximately 3,000,000 tons of ash.

4.2.1.3.2 Safety Analysis of Alternative

The primary safety concern associated with construction of an ash pond lies in the design of the retaining dike and construction activities relating to excavation and grading. Proper design of the dike to minimize erosion and maintain stability is design considerations integral to the design of the pond. Proper design of the discharge weir is also required to maintain flow balance in the pond and provide adequate support to prevent overturning of the riser under high wind and wave impacts.

4.2.1.3.3 Reliability Analysis of Alternative

Construction of a new ash pond will be an effective method of creating additional storage space for future ash generation, and has been utilized as a long-term storage method in several of the other electric utility steam plants with whom we contacted The volume of additional storage space created with a new pond is dependant on the available area in which the pond can be constructed, existing site conditions that affect excavation and development, and the maximum depth of the pond that can be constructed.

4.2.1.3.4 Economic Analysis of Alternative

The construction costs for a new ash pond are presented in Appendix A. Costs are based on permitting and design of the new pond, construction testing and monitoring, equipment mobilization, drainage and erosion control, a discharge structure and outfall piping, extension of the sluice piping, soil and subgrade placement and compaction, a 60 mil HDPE liner, Geotextile and Geosynthetic material, Rip Rap and roadway construction.

Based on the size of a pond needed for 20-year storage of ash from an average use and 50/50 mix of opportunity coal, estimated design and construction costs total approximately $12.3 million. These costs are present-day, and are exclusive of the cost to purchase additional land for construction, if necessary. Approximately 205 acres of land would be needed.

4.2.1.3.5 Environmental Analysis of Alternative

Construction and operation of a new ash pond would require obtaining a National Pollutant Discharge Elimination System (NPDES) Wastewater permit from the North Carolina Division of Water Quality. The permit application would require sealed engineering drawings, construction plans and specifications on the pond, pollutant loadings and possible flow modeling to demonstrate compliance with surface water standards. The permit would provide authorization to construct the pond and assess limits on pollutant levels in the runoff from the pond upstream of the receiving water body.

MACTEC anticipates that a liner would be required for the pond to protect groundwater quality in the surrounding area. The liner should have a minimum thickness of 60 mil and be constructed of HDPE.

New dam construction normally requires approval from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

A Stormwater General Permit would also be required for construction of the pond under the NCDWQ Phase II Stormwater program. The permit would cover protection of stormwater quality from construction site runoff, and would require development, submittal, and implementation of an Erosion and Sediment Control plan for runoff from the site.

4.2.1.3.6 Risk Assessment of Alternative

Construction of a new ash pond is an effective long-term ash management strategy; however, available land would be required considering appropriate buffers for protection of existing surface water quality. There is also an inherent risk in the design and construction of any new containment structure when considering dike stability and erosion. As with the introduction of any new ash management program, proper maintenance is required to ensure long-term goals are met and the pond filling schedule is consistent with the projected fill pattern.

5.0 Recommended Ash Management Strategic Approach

5.1 Short Term Approach

To achive short term goals of pond discharge complaince and maximizing remaining usable life, MACTEC recommends of a combination of the following:

1) Implementation of the diversion baffle system already in progress; and
2) Implementation of a cyclic ash excavation or dredging and stacking program to move ash from the 1985 pond to the 1978 pond

The dig and stack cycles in the pond provide an additional 6.5 years of storage. Planning of the excavation/stacking program should be started in 2005; after the performance of the baffles is evaluated. The excavation/stacking plan can be based on the plan used for the Weatherspoon ash pond in 2002, as well as the basis for cost development. The 1978 pond has sufficient room to allow multiple digging and stacking cycles; the volume of material removed from the 1985 pond will be limited to the maximum excavation depth that can be achieved accounting for dewatering needs; previous excavation work has shown this depth to be six feet. Additional excavation depth may be achieved through installation of rim ditches and bleed channels in the 1985 pond for conveyance of entrained surface and storm water.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

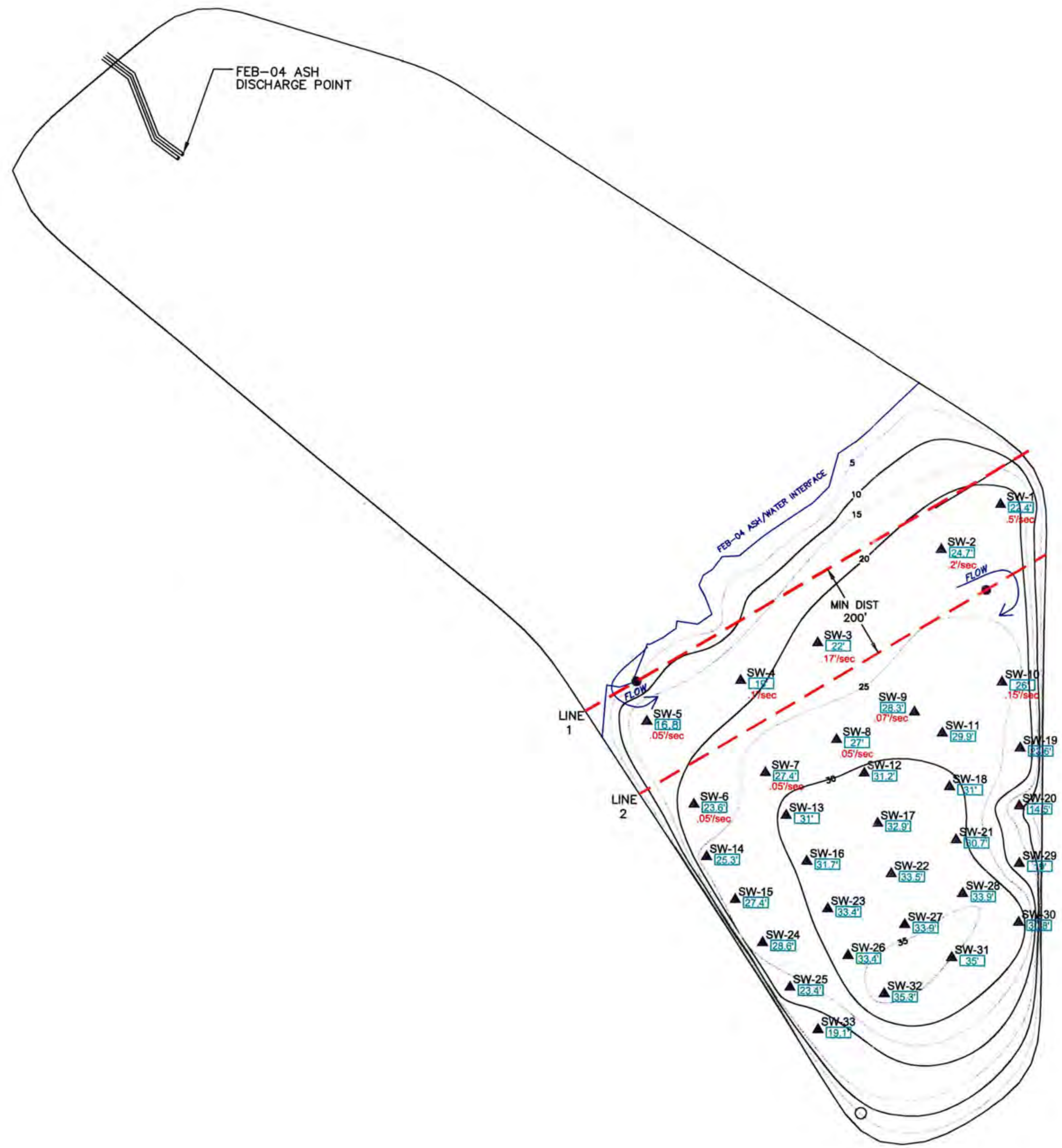
5.2 Long Term Approach

A long term ash management strategy would employ the combination of the ash excavation and stacking program with the use of Geotubes to extend the storage life to 20 years. The proposed Geotube configuration is provided in Figure 3; other configurations are possible depending on available space and the cell configuration. Geotubes can be used exclusively to achieve 20 years of ash storage or in conjunction with the dig and stack program. By combining the two alternatives, the number and cost of Geotubes required to store ash over the 20-year planning interval is reduced, thus requiring less space in the pond for Geotube placement. Geotubes provide an option to store and de-water ash for future beneficial re-use or us as structural components in future dike construction.

A long-term concept that could also be considered is the construction of a regional ash landfill and conversion of the plant ash handling to a dry system. The costs of implementing a dry ash system are relatively high. Previous studies at the Asheville plant indicate costs on the order of $1.2 million for the ash handling system and $155 million for construction of a regional landfill. We understand such capital expenditures are very unlikely for the Cape Fear plant due to cost and availability of suitable land.

A cost comparative analysis of the alternatives evaluated for this study is provided in the Executive Summary. As illustrated in the cost comparison chart, the combined strategy of dig and stack/Geotube installation is the most cost-effective long term option.

FIGURES



LEGEND

SW-2 — SOUNDING NUMBER
24.7' — SOUNDING DEPTH
.2'/sec — VELOCITY READING
● — BAFFLE ANCHOR CONNECTION POINT
— — BAFFLE ANCHOR CONNECTION LINES

NOTES

LINE 1: 900' LONG, 10' DEEP
LINE 2: 900' LONG, 15' DEEP

GRAPHIC SCALE – IN FEET

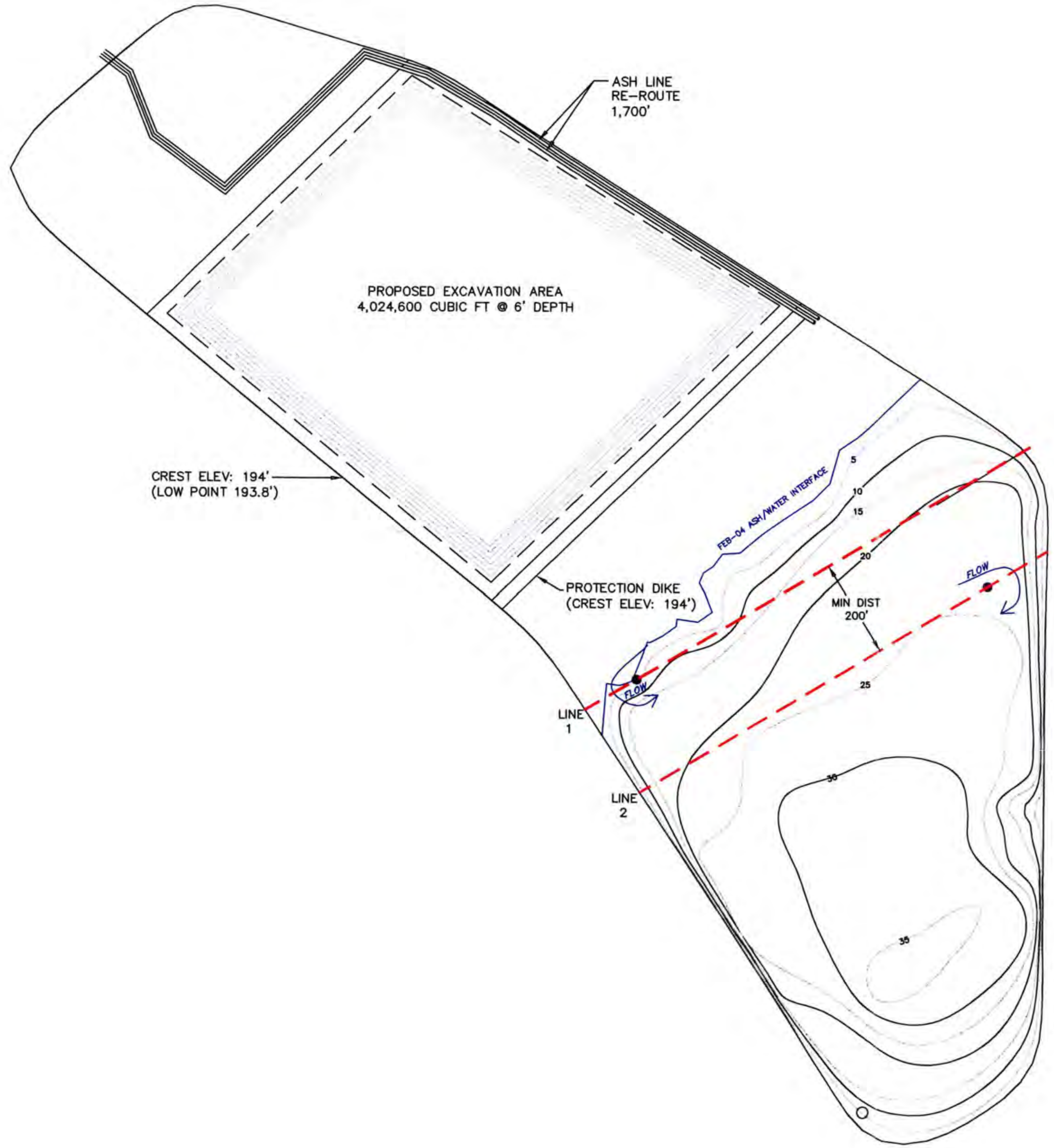
300' 150' 0 300' 600'

EXISTING POND CONDITIONS
WITH BAFFLES INSTALLED
PROGRESS ENERGY
CAPE FEAR PLANT
MONCURE, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK: AMR	SCALE: 1"=300'	1
APPROVAL: JAT	JOB: 6468-04-0549	



LEGEND

● BAFFLE ANCHOR CONNECTION POINT

— — — BAFFLE ANCHOR CONNECTION LINES

NOTES

LINE 1: 900' LONG, 10' DEEP

LINE 2: 900' LONG, 15' DEEP

GRAPHIC SCALE – IN FEET

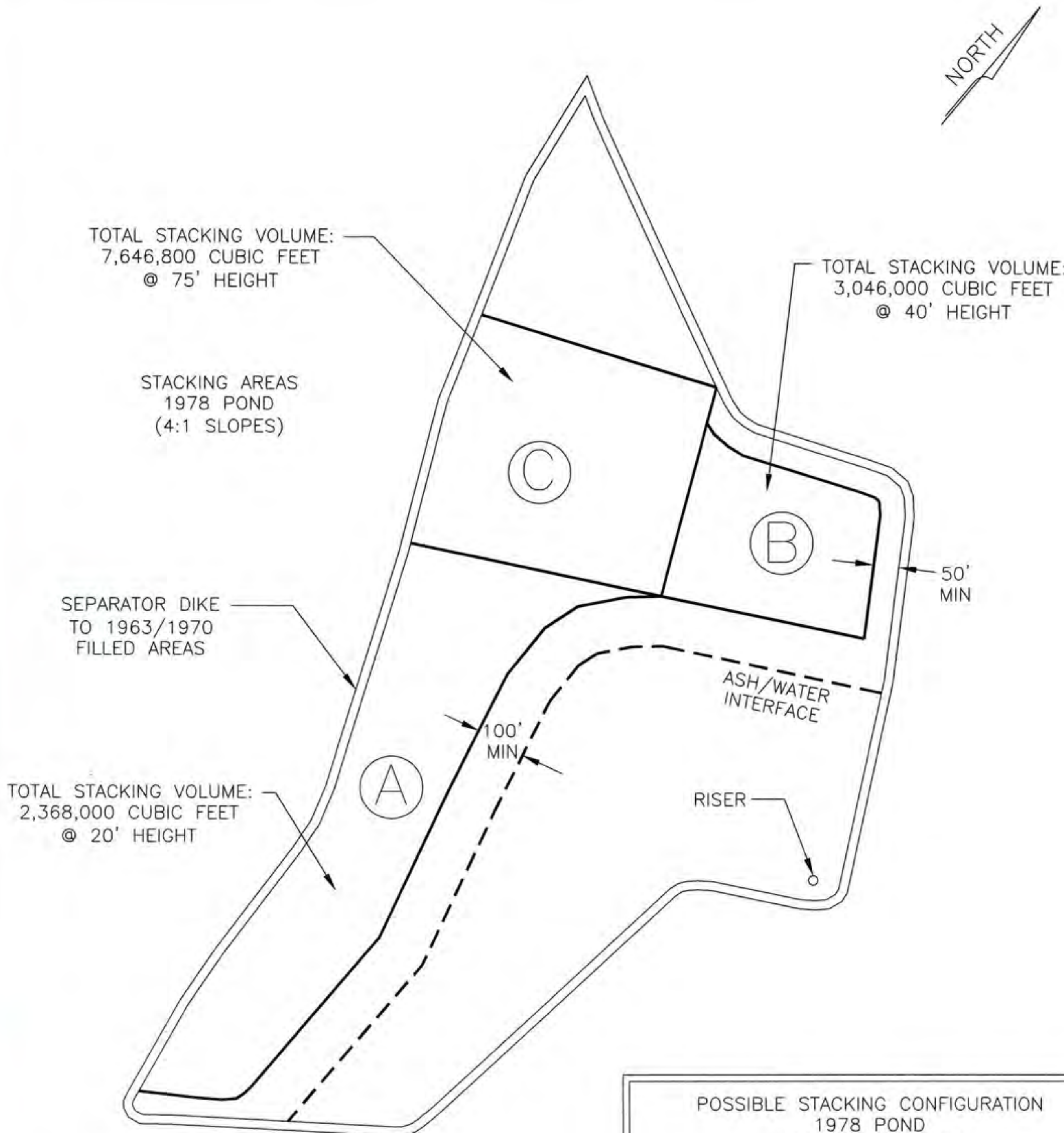
300' 150' 0 300' 600'

PROPOSED EXCAVATION AREA
PROGRESS ENERGY
CAPE FEAR PLANT
MONCURE, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY–2004	FIGURE
DFT CHECK: AMR	SCALE: 1"=300'	2
APPROVAL: JAT	JOB: 6468–04–0549	



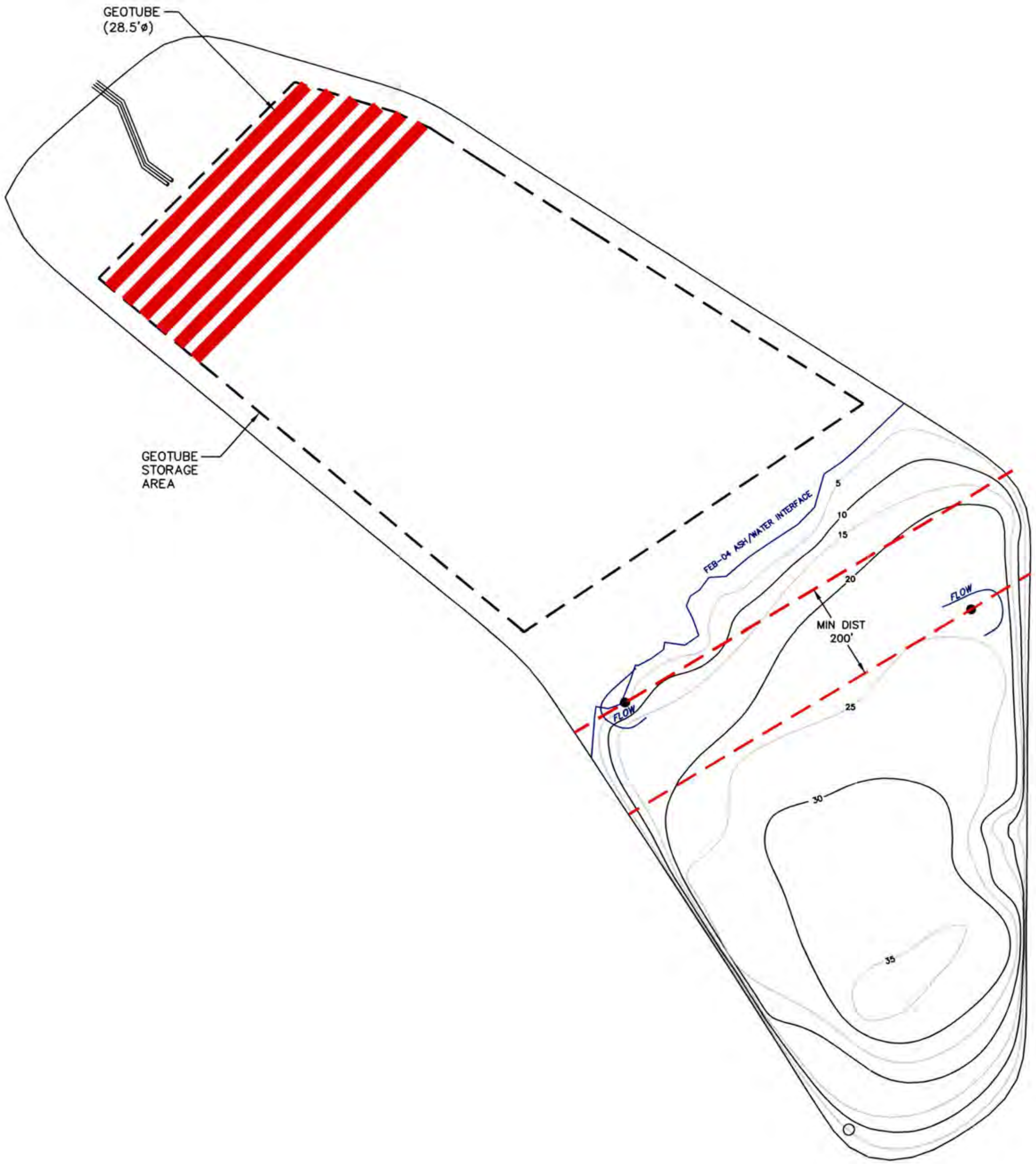
POSSIBLE STACKING CONFIGURATION
1978 POND
PROGRESS ENERGY
CAPE FEAR PLANT
MONCURE, NORTH CAROLINA

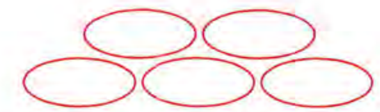
MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: APRIL–2004	FIGURE
DFT CHECK:	SCALE: 1"=300'	3
APPROVAL:	JOB: 6468-04-0549	

REFERENCE: AERIAL PHOTO





STACKED GEOTUBES

* UPON COVERING THE STORAGE AREA, ADDITIONAL LAYERS OF GEOTUBES WILL BE ADDED TO ACCOMODATE 20 YEARS OF ASH STORAGE

NOTES

1. GEOTUBE STORAGE AREA BASED ON CURRENT AVAILABLE AREA. STORAGE AREA MAY BE INCREASED AS ASH POND IS FILLED
2. MODIFICATIONS TO CURRENT ASH SLUICE PUMPS MAY BE REQUIRED TO ACCOMODATE THE PROPOSED GEOTUBE STACKING. EVALUATION OF THE ASH SLUICE PUMPS HAS NOT BEEN PERFORMED AS PART OF THIS PROJECT.
3. GEOTUBES SHOWN IN LAYOUT ARE A PORTION OF THE TOTAL NUMBER PROPOSED FOR STORAGE AND ARE SHOWN FOR ORIENTATION PURPOSES.

LEGEND

● ← BAFFLE ANCHOR CONNECTION POINT

— — — BAFFLE ANCHOR CONNECTION LINES

GRAPHIC SCALE – IN FEET

300' 150' 0 300' 600'

PROPOSED GEOTUBE INSTALLATION
PROGRESS ENERGY
CAPE FEAR PLANT
MONCURE, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY–2004	FIGURE
DFT CHECK: AMR	SCALE: 1"=300'	4
APPROVAL: JAT	JOB: 6468-04-0549	

TABLES

TABLE 1.

CAPE FEAR ASH POND STATISTICS

Plant Coal Usage	Current- 798k tons; maximum projected -798k tons- 2004
1985 Pond Size and Capacity	Design- 58 acres Design- 1,764 acre-ft (maximum) at 27 feet depth
Design Pond Max Elevation, ft	192
Present Pond Operating Elevation, ft	191.3 (max due to dike survey)
Age and Construction	18 years, 1985
Ash Production as % of Coal Usage	10%(contract coal); 20% (opportunity coal)
Annual Ash Production (contract coal), adjusted for LOI and different unit usage	Current -91,875 tons; maximum projected – 91,875 tons (2004); 5-yr projected average – 85,600 tons
Annual Ash Production (opportunity coal) adjusted for LOI and different unit usage	Current- 183,750 tons; maximum projected – 183,750 tons (2004); 5-yr projected average – 171,200 tons
Ash Volume in Pond	1,042 acre-ft
Available Pond Capacity (theoretical)	24,348,140 cubic feet (669,600 tons @ 55 pcf)
Projected Life for 50/50 coal mix and average use*	3.9 yrs
Ash Interface Line to Pond Outfall (distance)	960 ft
Daily Average Ash Sluice Discharge Rate	Approx 0.6 MGD
Daily Average Pond Discharge Rate	Approx. 0.5 MGD
Average Water Velocity	0.15 fps
Average Ash Settleability Rate	99% in 15 minutes (1)
Ash Settling Distance	135 ft
Pond NPDES Requirements	TSS- 30 mg/l (monthly ave); 100 mg/l (daily max)
	Oil & Grease-15 mg/l (monthly ave); 100 mg/l (daily max)
	Selenium- no listed limit
	Arsenic- no listed limit

(1) Ash settleability rate based on hydrometer testing of ash samples collected from Cape Fear ash pond. Settleability rates may vary between ponds and are dependent upon the coal sources.

2) Based on top of dike elevation at 193.8 ft from Smith and Smith survey.

*Assuming fill up to 75% of remaining theoretical volume. A graph attached with Table 3 illustrates change in projected life for varying percentages of opportunity coal.

Table 2.
Coal Use Projected Breakdown- 2004-2009
Progress Energy Carolinas
Weatherspoon Steam Plant

Year	Projected Annual Coal Usage, Tons
2004	184,600
2005	257,000
2006	275,100
2007	283,200
2008	279,200
2009	253,500
Average	255,433
Maximum	283,200

Source: Annual Coal Unit Summary, Carolinas

Table 3.
Summary of Coal Usage (2004-2009) and Resultant Pond Life
Progress Energy Carolinas
Cape Fear Steam Plant
Moncure, NC
MACTEC Project No. 6468-04-0549

	Maximum (2004)	Current	Average
Contract Coal Usage			
Coal Usage 5 yr Projection (tons)	798,000	798,000	743,500
Coal % as Ash	10	10	10
Coal % as LOI (Unit 5)	5	5	5
Coal % as LOI (Unit 6)	20	20	20
Annual Ash/LOI Productions (tons)	91,875	91,875	85,600
Opportunity Coal Usage			
Coal Usage 5 yr Projection (tons)	798,000	798,000	743,500
Coal % as Ash	20	20	20
Coal % as LOI (Unit 5)	5	5	5
Coal % as LOI (Unit 6)	20	20	20
Annual Ash/LOI Productions (tons)	183,750	183,750	171,201
Theoretical pond vol at el 191.3 msl (ft^3)	24,348,140		
Theoretical pond vol at el 191.3 msl (tons)	669,574	(@ 55 pcf)	

Estimated Pond Life Blending Contract Coal and Opportunity Coal- Current Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Life, Yrs at 191.3 msl
100	0	91,875	5.5
90	10	101,063	5.0
80	20	110,250	4.6
70	30	119,438	4.2
60	40	128,625	3.9
50	50	137,813	3.6
40	60	147,000	3.4
30	70	156,188	3.2
20	80	165,375	3.0
10	90	174,563	2.9
0	100	183,750	2.7

Estimated Pond Life Blending Contract Coal and Opportunity Coal- Ave 5 yr Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Life, Yrs at 191.3 msl	at 191.3 msl
100	0	85,600	5.9	
90	10	94,160	5.3	
80	20	102,720	4.9	
70	30	111,280	4.5	
60	40	119,840	4.2	
50	50	128,401	3.9	
40	60	136,961	3.7	
30	70	145,521	3.5	
20	80	154,081	3.3	
10	90	162,641	3.1	
0	100	171,201	2.9	

Based on 75% of theoretical capacity being filled and ash average unit weight of 55 pcf

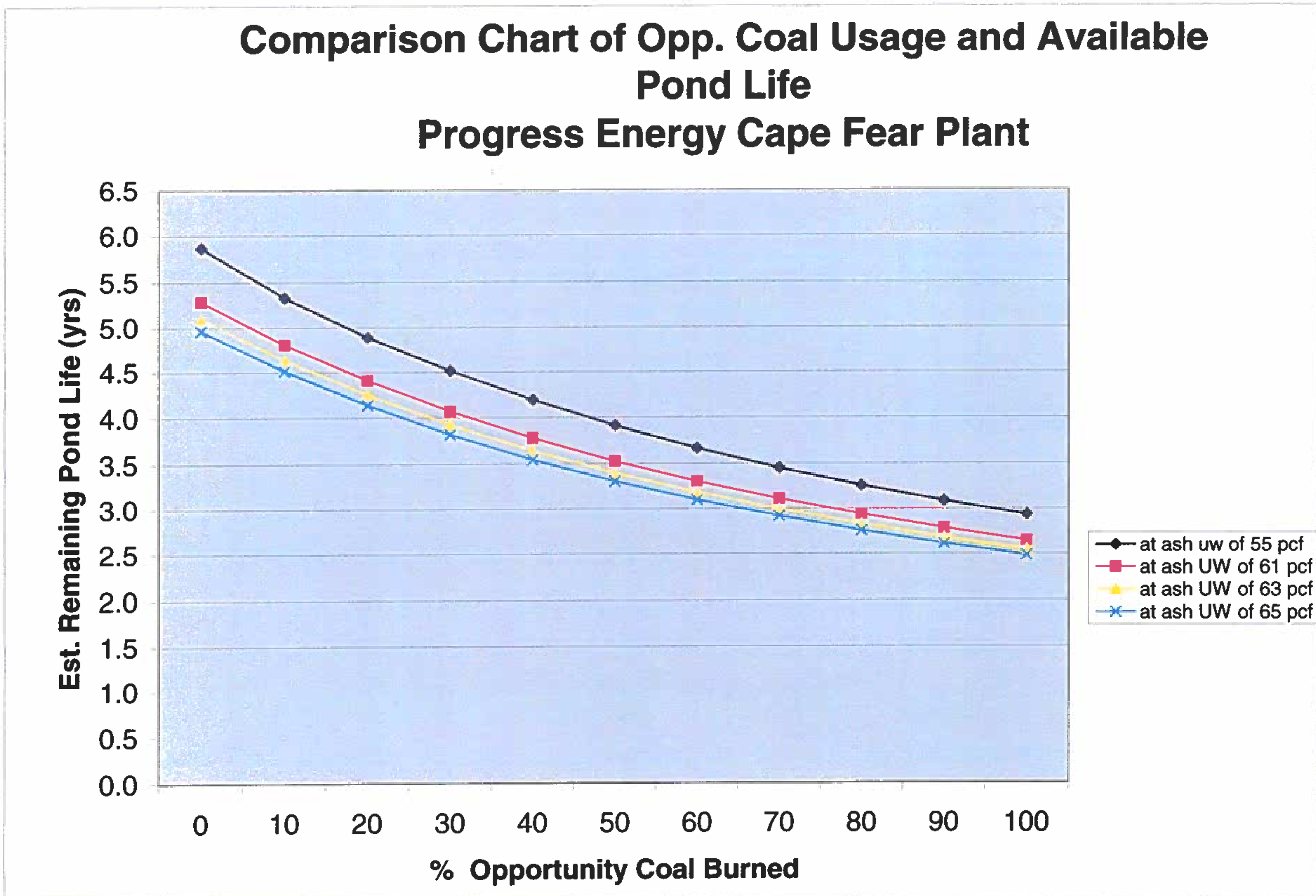

Comparison Chart of Opp. Coal Usage and Available Pond Life
Progress Energy Cape Fear Plant
Est. Remaining Pond Life (yrs)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
70
80
90
100
% Opportunity Coal Burned
at ash uw of 55 pcf
at ash UW of 61 pcf
at ash UW of 63 pcf
at ash UW of 65 pcf

Table 4.
Ash Pond Present Volume Determination (@191.3 msl)
Progress Energy Carolinas
Cape Fear Steam Plant
MACTEC Project No.: 6468-04-0549

Depth Contour	Available Ash Storage - Main Ash Pond						
	Surface Area (ft^2)	Average Area (ft^2)	Thickness (ft)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (yd^3)	Cumulative Volume (tons @55 pcf)
0	1,111,118						
		1,077,092	5	5,385,460	5,385,460	199,461	148,100
5	1,043,066						
		1,000,210	5	5,001,048	10,386,508	384,685	285,629
10	957,353						
		917,093	5	4,585,463	14,971,970	554,517	411,729
15	876,832						
		792,883	5	3,964,415	18,936,385	701,348	520,751
20	708,934						
		586,900	5	2,934,498	21,870,883	810,033	601,449
25	464,865						
		343,809	5	1,719,045	23,589,928	873,701	648,723
30	222,753						
		124,799	5	623,993	24,213,920	896,812	665,883
35	26,844						
		26,844	5	134,220	24,348,140	901,783	669,574

APPENDIX A
COST ESTIMATES

ENGINEERING COST ESTIMATES
ASH HANDLING OPTIONS
CAPE FEAR PLANT

The workshop meetings on March 18, 2004 and April 27, 2004 resulted in identifying excavation and stacking in the 1978 Pond Area as the best short-term approach after installing the baffles that are in this year's budget. Planning for this work should be started in 2005.

Longer term approaches are to raise the 1985 pond dikes, construct a new ash pond (for an estimated 20 year storage capacity) or use geotubes.

The preliminary estimated costs in today's dollars for the dig and stack option are as follows:

- Excavate and Stack in 1978 Pond Area for ~6.5 years (4 episodes of digging, see following page) (without inflation). After 6.5 years, there is no more ash storage capacity, and one of the long-term options must be implemented. The stacking will have altered how the long-term options can be implemented. $2,672,700

o Engineering	$ 40,000	Cost per year (50/50 and avg)	$411,200
o Construction	$2,311,200	Cost per ton/yr	$ 3.20
o Separator Dike Construction	$ 30,000		
o Soil Cap	$ 181,500		
o Drainage/Erosion Control	$ 30,000		
o Discharge Pipe Mods	$ 50,000		

For longer term projects, three options exist:

- Raise Dikes 6 feet (previous study, adds 3 yrs with 50/50 and avg coal use at present pond elev) $2,320,000.

o Engineering and Permitting	$ 150,000	Cost per yr (50/50 and avg)	$773,300
o Construction Monitoring	$ 70,000	Cost per ton/yr	$ 6.82
o Construction	$2,100,000		

- Construct New 20-yr Pond (50/50 and avg coal use) $12,262,500 w/o land cost

o Design and Permitting	$ 211,000	Cost per yr	$613,125
o Construction Monitoring	$ 351,500	Cost per ton/yr	$ 4.77
o Construction	$11,700,000		
o Land needed ~ 205 acres $??			

- Install Geotubes

As a Stand-Alone Strategy for 20-year storage: $10,841,743

o Engineering and Design	$ 20,000	Cost per year	$ 542,087
o Geotubes and Installation	$ 8,626,051	Cost per ton/yr	$ 4.22
o Ash Line Manifold	$ 31,344		
o Construction	$ 2,164,349		

In Conjunction with a Dig-and-Stack Program (14-year storage): $7,606,421

o Engineering and Design	$ 20,000	Cost per year	$ 543,315
o Geotubes	$ 6,038,236	Cost per ton/yr	$ 2.96
o Ash Line Manifold	$ 30,901		
o Construction	$ 1,517,284		

In Conjunction with a Dig-and-Stack Program and Dike Raise (11-year storage): $5,989,000

o Engineering and Design	$ 20,000	Cost per year	$ 544,454
o Geotubes	$ 4,74,000	Cost per ton/yr	$ 2.33
o Ash Line Manifold	$ 30,901		
o Construction	$ 1,193,800		

POSSIBLE TIME LINE FOR CAPE FEAR EXCAVATE AND STACK APPROACH ASSUMING 50/50 MIX OF COALS AND AVERAGE COAL USAGE

Duration of Activity (Yrs)	Elapsed Time (yrs)	Activity	Main Pond Capacity Left (yrs)	Capacity Added by Activity (yrs)	Total Time Left in Pond (yrs)
Now	0		3	0	3
0.25	0.25	Plan and Permit	2.7	0	2.7
0.75	1.0	Bid and first dig	2.0	1.0	3.0
1.0	2.0	Fill in first dig	2.0	0	2.0
0.5	2.5	Execute 2nd dig	1.5	1.0	2.5
1.0	3.5	Fill in 2nd dig	1.5	0	1.5
0.5	4.0	Execute 3rd dig	1.0	1.0	2.0
1.0	5.0	Fill in 3rd dig	1.0	0	1.0
0.5	5.5	Execute 4th dig	0.5	1.0	1.5
1.0	6.5	Fill in 4th dig	0.5	0	0.5

At this point, pond is too full to have room to store ash while area is excavated for a 5th dig, even though stack area in 1978 pond would handle a bit more. So, approximate life extension to 1985 pond achieved by digging and stacking is 6.5 yrs.

If take dig and stack costs as $4.50 per ton stacked, assume one year of ash at 50/50 and average use is 128,400 tons, and ignore inflation, the total cost for 4 dig and stacks is 4(128,400)($4.50) = ~$2,311,200.

GEOTUBE DESIGN
PROGRESS ENERGY CAROLINAS
CAPE FEAR PLANT

Design Criteria and Specifications	
Average Annual Ash Production[1] (tons/yr)	128,401
Ash Production (yd^3/yr)	158,520
Geotube Life (yrs)	20
Necessary Storage Volume (yd^3)	3,170,395
Storage Area (ft^2)	1,156,270
Storage Area - Average Length (ft)	1,250
Storage Area - Average Width (ft)	800
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	800
Geotube Area (ft^2)	22,800
Geotube Volume - Total (ft^3)	510,352
Geotube Volume - Ash (ft^3)	357,246
Geotube Volume (yd^3)	13,231
Number of Geotubes	240
Total Geotube Area (ft^2)	5,463,166
Geotube Levels	5.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	$20,000	$20,000
Geotube	191,690	ft	$45	$8,626,051
Ash Line Manifold (12" diameter)	2,125	ft	$14.75	$31,344
Geotube and Line Installation	25%	construction cost	$8,657,395	$2,164,349
			Total Cost	$10,841,743

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
CAPE FEAR PLANT

Design Criteria and Specifications	
Average Annual Ash Production[1] (tons/yr)	128,401
Ash Production (yd^3/yr)	158,520
Geotube Life[2] (yrs)	14
Necessary Storage Volume (yd^3)	2,219,277
Storage Area (ft^2)	1,156,270
Storage Area - Average Length (ft)	1,250
Storage Area - Average Width (ft)	800
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	800
Geotube Area (ft^2)	22,800
Geotube Volume - Total (ft^3)	510,352
Geotube Volume - Ash (ft^3)	357,246
Geotube Volume (yd^3)	13,231
Number of Geotubes	168
Total Geotube Area (ft^2)	3,824,216
Geotube Levels	3.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	$20,000	$20,000
Geotube	134,183	ft	$45	$6,038,236
Ash Line Manifold (12" diameter)	2,095	ft	$14.75	$30,901
Geotube and Line Installation	25%	construction cost	$6,069,137	$1,517,284
			Total Cost	$7,606,421

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
CAPE FEAR PLANT

Design Criteria and Specifications

Average Annual Ash Production[1] (tons/yr)	128,401
Ash Production (yd^3/yr)	158,520
Geotube Life[2] (yrs)	3
Necessary Storage Volume (yd^3)	475,559
Storage Area (ft^2)	1,156,270
Storage Area - Average Length (ft)	1,250
Storage Area - Average Width (ft)	800
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	800
Geotube Area (ft^2)	22,800
Geotube Volume - Total (ft^3)	510,352
Geotube Volume - Ash (ft^3)	357,246
Geotube Volume (yd^3)	13,231
Number of Geotubes	36
Total Geotube Area (ft^2)	819,475
Geotube Levels	1.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	$20,000	$20,000
Geotube	28,754	ft	$45	$1,293,908
Ash Line Manifold (12" diameter)	2,065	ft	$14.75	$30,459
Geotube and Line Installation	25%	construction cost	$1,324,366	$331,092
			Total Cost	$1,675,458

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

<u>Pond Design Cape Fear</u>

Ash Production (tons/yr)	128,400
Pond Life (yrs)	20
Pond Height (ft)	20
Pond Freeboard (ft)	2
Necessary Pond Excess (%)	25
Necessary Volume (ft^3)	107,000,000
Pond Length (ft)	3,650
Pond Width (ft)	1,800
Pond Surface Area (top)	6,570,000
Pond Surface Area (bottom)	5,993,064
Dike Slope Area	689,377
Pond Volume (ft^3)	107,770,176
Pond Outside Footprint (acres)	170.11
Land Area to purchase (acres)	204.13

<u>Pond Construction</u>

Excavation Depth (ft)	1.9
Excavation Volume (ft^3)	12,417,509
Dike Perimeter (ft)	10,900
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20
Dike Volume (ft^3)	14,658,647

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	2%	construction cost	$11,718,690	$210,936
Construction Testing/Monitoring	3%	construction cost	$11,718,690	$351,561
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	6,570,000	ft^2	$0	$262,800
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	459,908	yd^3	$3.00	$1,379,723
Soil Placement	542,913	yd^3	$5.00	$2,714,564
Sand Subgrade	247,498	yd^3	$13.00	$3,217,471
60 mil HDPE Liner	7,231,852	ft^2	$0.47	$3,398,971
Geosynthetic (Geogrid)	25,532	yd^2	$2.75	$70,214
Geotextile (wave protection)	4,037	yd^2	$1.80	$7,267
Rip Rap	17,440	tons	$22	$383,680
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$12,281,188
Construction Only (total less design and cmt				$11,718,690

APPENDIX B
GEOTUBE INFORMATION

Dewatering & Containment Technologies, Inc.

Geotube Volume Spreadsheet

Known Flow Rates

Input

Project Name:	Progress Energy
Date:	30-Mar-04
Materials Information:	
Type of Material to be Dewatered	Fly Ash
Specific Gravity of Solids Within The Sludge	1.40
Percent Solids of the Insitu Sludge	35.0
Bulking Factor of The Sludge While Pumping or Dredging	1
Target Percent of Solids After Dewatering With Geotubes	70
Percent of Solids Estimated In Effluent Water	0.000
Percent of Course Grain Solids in The Insitu Sludge	3%
Production Rates:	
Dredge / Pumping Operation Rate (GPM)	1750
Dredge / Pumping Operation (Hours Per Day)	16.00
Dredge / Pumping Operation (Days Per Year)	1.00
Geotube Costs ($ Lin. Ft.):	
30 Ft. Circumference	
45 Ft. Circumference	
60 Ft. Circumference	
90 Ft. Circumference	

Output

Production Rates:			
Production Volume Wet (gal/day)		1,680,000	
Production Volume Wet (cy/day)		8,317	
Production Volume Wet (tons/day)		7,785	
Production Volume Wet (cy/yr)		8,317	
Production Volume Wet (tons/yr)		7,785	
Bone Dry (tons/year)		2,725	
Bone Dry (tons/day)		2,724.59	
Reduction Due To Dewatering:			
Reduction Factor		2.25	
Dewatered Volume (cy/yr)		3,585	
Dewatered Volume (tons/yr)		4,038	
Geotube Cost:		**Length (ft.)**	**Total $**
30 Ft. Circumference	9.5 ø	2,131	$ 30,573.34
45 Ft. Circumference	14.3 ø	1,096	$ 23,557.76
60 Ft. Circumference	19.1 ø	710	$ 20,595.28
90 Ft. Circumference	28.6 ø	412	$ 18,556.37

Click on one of the industries below to view case studies

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste & Contaminates	Marine

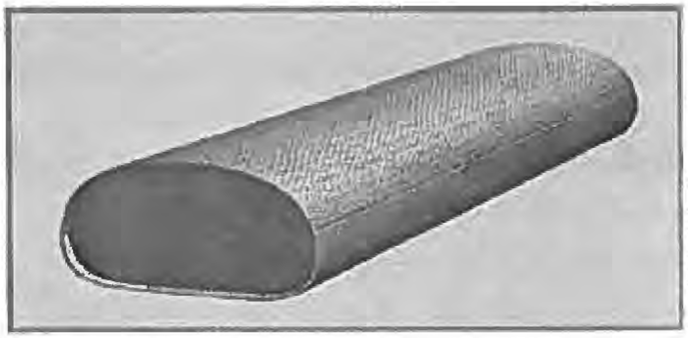
Home

What is a Geotube®?

How it all works

Miratech

Dewatering & Containment Technologies, Inc.



What is a Geotube®?

Geotubes® are constructed out of high strength woven geotextile fabric manufactured by Ten Cate Nicolon. The Geotube® is then fabricated by Miratech, a division c Ten Cate Nicolon.

Designed with appropriate sized openings, the Geotube® retains fill material to do one of two things: if you are using the GT500 it will allow water to permeate through the tube wall, if you use the GT100 for marine applications it will contain all the material for a vei long time.

Geotubes® are custom fabricated with seaming techniques that resist pressures during pumping operations.

e-mail us at:
geotubes@dewatercontain.com

U.S. Postal Address:
P.O. Box 740
Cedar Springs, Michigan 49319
616-784-3681 - Phone
616-784-3685 - Fax

Click on one of the industries below to view case studies

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste & Contaminates	Marine

Home

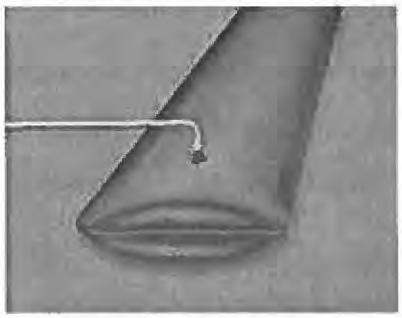
What is a Geotube®?

How it all works

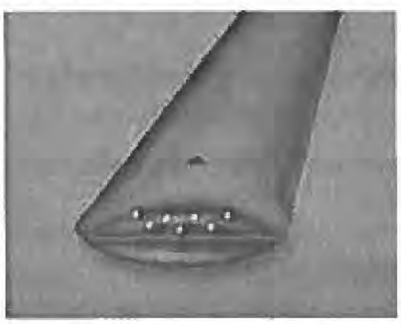
Miratech

Dewatering & Containment Technologies, Inc.

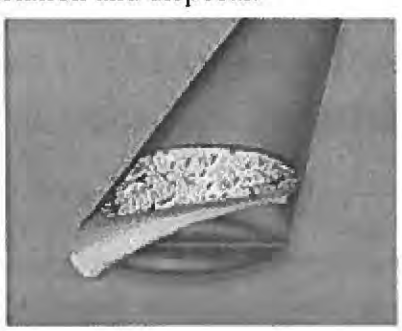
1) The Geotextile tube is pumped with sludge material.



2) As the liquid escapes from the tube, solid particles are trapped inside. The process is repeated until the tube is full.



3) Eventually the solids can be handled as dry material increasing options for transportation and disposal.



e-mail us at:
geotubes@dewatercontain.com

e-r
geotubes@dewatercont:

Dewatering & Containment Technologies, Inc.

See the case studies in each industry below:

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste	Marine

Home

Dredging a Bay

Wastewater Treatment Plant

Dredging a 25-acre bay

The 25 acre bay was dredged to remove contaminated sediment.

120 Geotubes were installed to dewater over 87,000 cubic meters (95,000 cubic yards) of contaminated sediments

www.dewatercontain.com
e-mail us at:
geotubes@dewatercontain.com

e-m
geotubes@dewaterconta

Dewatering & Containment Technologies, Inc.

See the case studies in each industry below:

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste	Marine

Home

Mineral Processing Plant

Mineral Processing Plant

Challenge: All titanium dioxide waste lagoons at this plant had reached capacity. To continue operations, lagoons must be emptied.

Solution: Geotube® containers are an excellent method to dewater industrial by-products. This plant was able to recycle the minerals during the process.

18 m (60') circumference X 61 m (200') long Geotube® containers were used to dewater 68,580 cubic meters (75,000 cubic yards) of sludge.

Pictured to the right is a partially filled Geotube® containing dewatered sludge at 60% solids.

APPENDIX C
SHORT-TERM COMPLIANCE STRATGIES

1. Alternative 1: Modification of the Discharge Riser

1.1 Technical Analysis of Alternative

This alternative involves the modification of the discharge riser in the pond to allow for controlled pond drainage prior to an anticipated turnover event. The pond outlet structure consists of a four-foot diameter pipe weir located approximately 2,500 feet southeast of the influent piping. The current top of riser elevation in the pond is 191.3 feet msl. The pipe is constructed of sections joined together with grout. The pond drains through the top of the riser; it acts as a weir. The objective of modifying the riser would be to allow personnel to drain the pond from various depths below the original weir elevation to remove selective thermal layers of water prior to a pond turnover event. The benefit of draining off a thermal layer in the pond is twofold:

1) It removes the metalimnion layer and creates distinct stratification in the pond that reduces thermal currents in the pond;
2) It prevents a discharge to the outfall during a pond turnover event, reducing the risk of a permit excursion

The valve structure would consist of a metal "collar" or sleeve that is placed over the riser. Valves installed at selective depths on opposite sides of the sleeve would control the flow of water over the riser, and could be opened to allow the pond to drain at different levels. Personnel would open the valves from above the water surface using a "tee" device. Access to the valves would be provided through a bridge or walkway constructed out to the riser from the dike.

1.2. Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to personnel operation of the valves on the structure and the integrity of the grout used to seal the valve sections to the existing riser. If the grout or sealant used is not suitable for the conditions or is not applied correctly, the seal will leak and possible damage to the riser may result.

Protective equipment such as flotation devices should be worn when adjusting valves on the weir, as the work will be conducted over water. No additional safety concerns are associated with this alternative.

1.3 Reliability Analysis of Alternative

Stratified risers have been used in fish ponds to prevent algae growth related to pond turnover, but MACTEC did not identify use of this alternative in ash ponds during our study. The concept of pond stratification is widely recognized as a phenomenon common in all small, moderately deep surface water bodies where atmospheric conditions vary throughout the year.

1.4. Economic Analysis of Alternative

Engineer Opinion-of Cost for the design and construction of a modified riser structure is $50,000. This cost includes labor for design and installation of the structure and access bridge or walkway, and materials for the structure, valve adjustment, and accessway.

1.5 Environmental Analysis of Alternative

Environmental impacts of modifying the discharge of the pond are expected to be minimal, and will enhance compliance with the discharge permit requirements by preventing discharge of the pond during a turnover event when sedimented ash is in suspension. No permit revisions are required for modifying the discharge structure, since it will not increase the discharge flow of the pond above the permit limit. However, an Authorization to Construct from the North Carolina Division of Water Quality will be required for this modification. The authorization to construct can be prepared based on the design plans prepared for the riser structure and must be submitted to the Raleigh Regional Office of the Division of Water Quality.

1.6 Risk Assessment of Alternative

The inherent risk of modifying the discharge riser lies in knowing when a pond turnover is about to occur so that provisions can be made to drain the pond before an upset condition. The best way to predict when a pond turnover will occur is to place thermal monitors in different levels at selected locations around the pond, and monitor temperature readings over a period of time. When the temperatures of the upper and middle layers of the pond are almost identical, that is a sign that pond turnover is imminent or occurring. The benefit to knowing when pond turnover will occur is that plant personnel could drop the level of the pond prior to a turnover to drain off the middle layer and maintain distinct thermal stratification.

The other risk lies in the design of the discharge structure and placement of valves. The discharge structure must be designed with consideration given to type and thickness of the grout used to seal the valve sections to the existing riser. If the grout or sealant used is not suitable for the conditions or is not applied correctly, the seal will leak and possible damage to the riser may result. Valve placement too close to the bottom of the pond can allow disturbed sediments to pass through the valve and over the weir, resulting in permit non-compliance. Valves placed too close to the surface can create a vortex that may pull in suspended solids near the pond surface or cenospheres. Proper design of the valve heights is a critical design element that can be determined during the thermal profiling of the pond.

2. Alternative 2: Construction of Secondary Settlement Basin

2.1 Technical Analysis of Alternative

For this alternative, a new secondary settlement pond would be constructed at a selected location between the discharge riser of the 1985 pond and the outfall canal. The secondary pond could also be constructed in the 1985 pond through dike construction in the pond; however, this would decrease the available ash storage capacity of the 1985 pond and would involve considerable cost for dike construction. A siting study would need to be conducted to determine the optimal location for the pond, taking into consideration fill and drainage requirements, potential wetlands locations, dike construction, permeability of subsurface soils, etc. Design considerations for the new pond would include average and peak pond discharge rates, an assumed life of 20 years, a freeboard of 2 feet, excess capacity of 25% to account for a 100-year design storm, and a maximum height of 10 feet above existing grade.

Design considerations must also be made for modifications to the discharge riser in the 1985 pond to allow drainage into the secondary settlement pond, installation of a discharge riser in the secondary settlement pond and connection of the new riser to the outfall structure, and permit requirements.

For the Cape Fear plant, based on a daily average discharge rate of 0.5 MGD and peak discharge rate of 1.3 MGD (using a peak factor of 2.5), a design height of 10 feet, design freeboard of 2 feet, 25% excess capacity provision, and a design surface loading rate of 1,000 gal/day/ft^2 for sediment removal, the required land area to accommodate a new pond is approximately 2 acres. Rough dimensions of the pond are a length of 175 feet and a width of 100 feet. This pond would have a storage capacity of approximately 1.7 million gallons; providing up to 2 days of retention time.

2.2 Safety Analysis of Alternative

The primary safety concern associated with construction of a secondary settling pond lies in the design of the retaining dike and construction activities relating to excavation and grading. Proper design of the dike to minimize erosion and maintain stability is a design considerations integral to the design of the pond. Proper design of the discharge weir is also required to maintain flow balance in the pond and provide adequate support to prevent overturning of the riser under high wind and wave impacts, although with a smaller surface area these risks are reduced significantly.

2.3 Reliability Analysis of Alternative

Construction of a secondary settling pond will be an effective method of providing additional retention time for settlement of fine ash sediments prior to reaching the outfall. The pond will not, however, creating additional storage space for future ash generation in the main pond as it will only provide settlement space for very fine material that discharges from the main pond. Secondary settlement ponds are currently installed as short-term compliance methods at Progress Energy's

Lee and Weatherspoon plants, and have proven effective in maintaining compliance with discharge limits.

2.4 Economic Analysis of Alternative

The construction costs for a secondary settlement pond are presented in Appendix A. Costs are based on permitting and design of the new pond, construction testing and monitoring, equipment mobilization, drainage and erosion control, a discharge structure and outfall piping, modification of the current discharge piping, soil and subgrade placement and compaction, a 60 mil HDPE liner, Geotextile and Geosynthetic material, Rip Rap and roadway construction.

Based on the size of a pond needed for the peak daily discharge rate from the 1985 pond, estimated design and construction costs total approximately $600,000. These costs are present-day. Approximately 2 acres of land would be needed for pond construction; we assume that suitable pond locations would be on property presently owned by Progress Energy.

2.5 Environmental Analysis of Alternative

The construction of a secondary settlement pond would have to be done within the limits of the existing permitted wastewater treatment system as defined by the plant's NPDES permit. If construction of the pond falls outside of the wastewater system boundaries, an additional wastewater permit would be required for this treatment system. Additional permitting requirements for this alternative are an erosion and sedimentation permit if land-disturbance activities exceed 1 acre in size, and an authorization to construct. Detailed construction plans including erosion and sedimentation control features, and a separate narrative and plan sheets must be prepared for submittal to the Raleigh Regional office of the Land Quality Section. The authorization to construct can be prepared based on the plans and must be submitted to the Raleigh Regional office of the Division of Water Quality. It is not clear at this time if a separate grading or land-disturbing permit will be required by Chatham County.

MACTEC anticipates that a liner would be required for the pond to protect groundwater quality in the surrounding area. The liner should have a minimum thickness of 60 mil and be constructed of HDPE.

New dam construction normally requires approval from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

2.6 Risk Assessment of Alternative

Construction of a secondary settlement pond is an effective compliance strategy for removal of suspended sediments in the 1985 pond discharge; however, additional land would be required considering appropriate buffers for protection of existing surface water quality. There is also an inherent risk in the design and construction of any new containment structure when considering dike stability and erosion. As with the introduction of any new structure in the wastewater treatment process, proper maintenance and monitoring is required to ensure long-term goals are met and the pond performance is consistent with the projected throughput pattern.

Cape Fear Secondary Ash Settlement Pond Design

Daily Flow (MGD)	0.5
Daily Peak Flow (MGD)	1.3
Design Surface Loading Rate (gal/day/ft^2)	1,000.0
Solids Loading (ppm)	100
Max. solids loading (lb/day)	417.0
Max solids loading (@ 16 hr/day operating schedule)	26.1
Design Surface Loading Rate (lb/ft^2-hr)	2.0
Pond Life (yrs)	20.0
Pond Height (ft)	10.0
Pond Freeboard (ft)	2.0
Necessary Volume (ft^3)	12,500.0
Pond length (ft)	175.0
Pond Width (ft)	100.0
Pond Surface Area (top)	17,500.00
Pond Surface Area (bottom)	6,604.0
Dike Slope Area	17,392.5
Pond Volume (ft^3)	230,136
Pond Outside Footprint (acres)	1.87

Pond Construction

Excavation Depth (ft)	1.5
Excavation Volume (ft^3)	23,641
Dike Perimeter (ft)	550
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	3%	construction cost	$568,564	$14,214
Construction Testing/Monitoring	3%	construction cost	$568,564	$17,057
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	12,500	ft^2	$0.04	$500
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	876	yd^3	$3.00	$2,627
Soil Placement	46,876	yd^3	$5.00	$234,381
Sand Subgrade	889	yd^3	$13.00	$11,554
60 mil HDPE Liner	29,796	ft^2	$0.47	$14,004
Geosynthetic (Geogrid)	644	yd^2	$2.75	$1,771
Geotextile (wave protection)	204	yd^2	$1.80	$367
Rip Rap	880	tons	$22	$19,360
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$599,835
Construction Only (total less design and cmt)				$568,564

FINAL REPORT

STRATEGIC ASSESSMENT OF FLYASH MANAGEMENT AT H.F. LEE STEAM PLANT

Prepared For:

Progress Energy Carolinas
1420 WalPat Road
Smithfield, NC 27577

Prepared By:

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, North Carolina 27604

July 12, 2004

MACTEC Project No. 6468-04-0549

MACTEC

Table of Contents

Figures

Tables

Appendices

1.0 Executive Summary

A study of ash disposition options and concepts for short-term and long-term storage has been conducted for the Cape Fear, Lee and Weatherspoon plants. The study included:

- Review of previous study reports and ash capacity estimates.
- Review of data on ash content and Loss of Ignition (LOI) material for current coal usage.
- Review of data on projected coal consumption volumes over the next five years.
- Updating estimates of present ash storage capacity and projections of remaining storage life.
- Discussion of ash management practices with environmental coordinators of other electric utility providers and review of industry practices for ash disposal.
- Discussion of current ash handling and management practices with plant personnel.
- Performing a physical profile of the ash ponds through depth soundings.
- Identification of available techniques for ash disposition
- Workshop meetings with Eastern Region engineering personnel and with plant personnel knowledgeable in the ash handling practices.
- Selection of ash handling options feasible for each plant
- Development of strategies for implementing the identified short and long term options identified from the workshop sessions.
- Preparation of conceptual cost estimates and timelines for the options.
- Preparation of separate reports for each plant.

A finding common for all plants was that past projections of storage life used ash production from only contract coal, while current and future plans indicate a large percentage of coal burned may be "opportunity coal' which has a much higher ash content than contract coal. Also, past calculations did not incorporate and adjustment for presence of unburned carbon (LOI material). The projections prepared in this report incorporate provisions for unburned carbon and use of "opportunity coal".

The Lee plant is currently operating its ash pond at elevation 84 feet, msl, a level about three feet lower than the design maximum. Projections of available life at the current level range from 2.4 to 6.0 years depending on the coal use rate and mix of contract coal and opportunity coal. For discussion and comparison purposes, MACTEC has chosen to use the average ash use rate from the 5-year projections and a 50-50 mix of contract coal and opportunity coal. With this approach, the Lee Plant ash pond is projected to have 3.7 years of remaining physical storage life.

In order to reduce potential for suspended solids issues, the Unit 3 discharge line should be relocated as planned by the plant as soon as possible. In addition to this relocation, the short term alternatives for ash management evaluated during this assessment are:

- Alternate 1: Installation of Diversion Baffles;
- Alternate 2:Excavation or dredging of ash from main pond and stacking into western area of pond; and
- Alternate 3: Raising pond operating level two feet through extension of the discharge riser pipe

The recommended short-term ash management strategy is to relocate the Unit 3 ash discharge line to the northern side of the pond as soon as possible, then implement a sequence of baffle installation, conducting four cycles of excavating ash and stacking in the western end of the pond, and raising the pond operating level two feet after the last dig and haul cycle. The approximate life extension of the pond achieved by these approaches is 13 years.

The long term alternatives for ash management evaluated during this assessment are:

- Alternate 1:Raise existing dike to allow for more storage;
- Alternate 2: Use Geotubes for ash storage and de-watering within the pond, and;
- Alternate 3:Construct a new ash pond

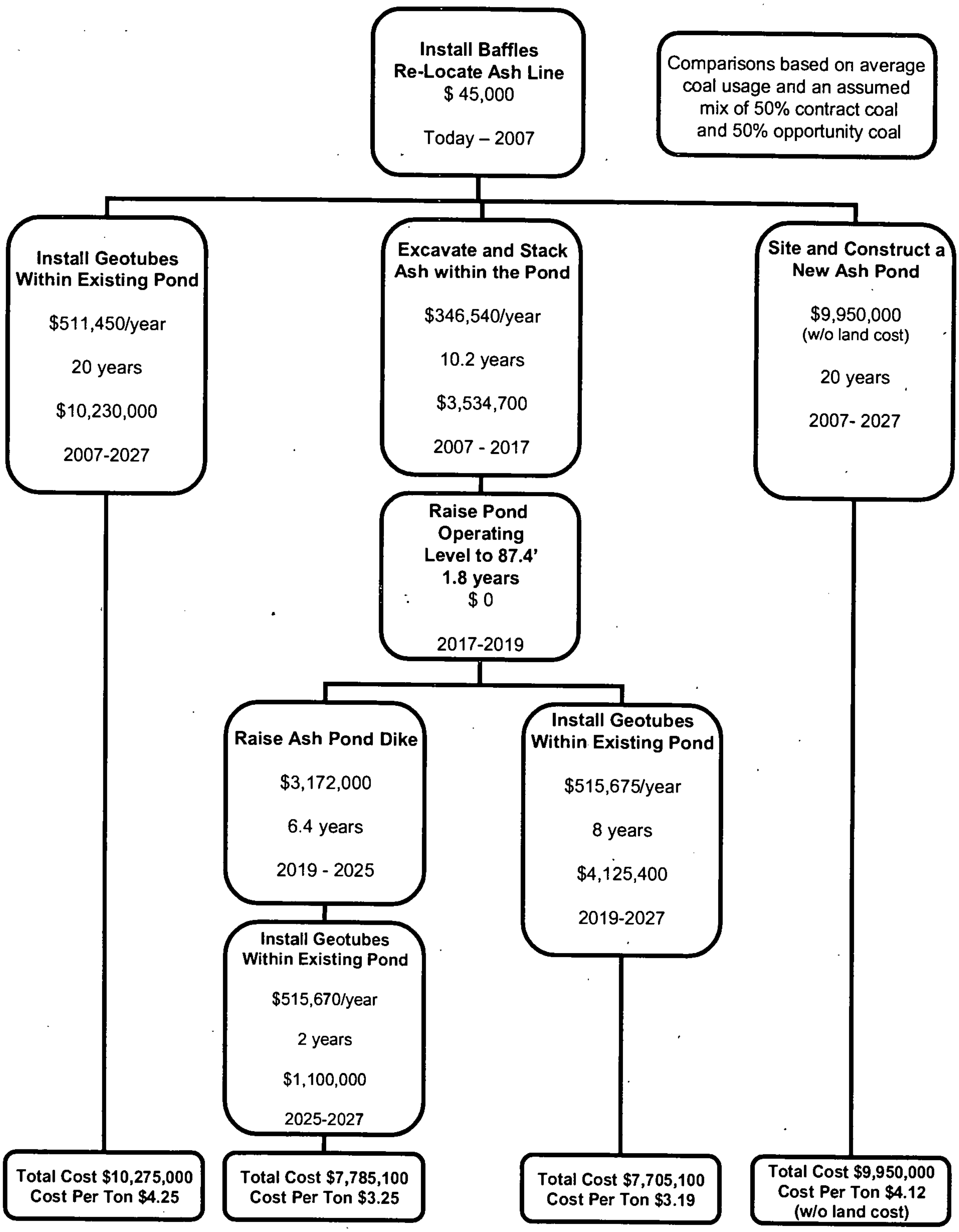
A cost comparison of the alternatives evaluated for this study shows that for a 20-year period, a combined strategy of dig and stack/Geotube installation is the most cost-effective long term option.

The figure on the following page illustrates the results of the study in a timeline, again using the average coal use and a 50/50 mix of coal types.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

This final report incorporates and addresses comments made by Progress Energy on the draft report submitted May 14, 2004

Lee Plant


Install Baffles
Re-Locate Ash Line
$ 45,000
Today – 2007
Comparisons based on average coal usage and an assumed mix of 50% contract coal and 50% opportunity coal
Install Geotubes Within Existing Pond
$511,450/year
20 years
$10,230,000
2007-2027
Excavate and Stack Ash within the Pond
$346,540/year
10.2 years
$3,534,700
2007 - 2017
Site and Construct a New Ash Pond
$9,950,000
(w/o land cost)
20 years
2007- 2027
Raise Pond Operating Level to 87.4'
1.8 years
$ 0
2017-2019
Raise Ash Pond Dike
$3,172,000
6.4 years
2019 - 2025
Install Geotubes Within Existing Pond
$515,675/year
8 years
$4,125,400
2019-2027
Install Geotubes Within Existing Pond
$515,670/year
2 years
$1,100,000
2025-2027
Total Cost $10,275,000
Cost Per Ton $4.25
Total Cost $7,785,100
Cost Per Ton $3.25
Total Cost $7,705,100
Cost Per Ton $3.19
Total Cost $9,950,000
Cost Per Ton $4.12
(w/o land cost)

2.0 Problem Description

Progress Energy's fossil power plants burn coal for electricity generation. The Eastern Region has five plants: Cape Fear, Lee, Robinson, Sutton and Weatherspoon. Ash is produced as a byproduct of the coal combustion process. Depending on the coal burned, from 10 to 20 percent of the weight of coal becomes ash. A fine-grained ash ("fly ash") forms the majority of the material. About 10 percent of the ash total volume is coarse-grained material commonly termed "bottom ash"; however, the term "fly ash" is typically used generically for all the material produced. At some plants, the bottom ash and fly ash are commingled before transport to disposal areas; in others, the two ashes are moved separately.

Progress Energy disposes of ash by mixing the ash with water and pumping it into storage areas on the plant sites. The storage areas ("ash ponds") were generally constructed impoundment areas build above original ground surface and enclosed by earth dikes. No artificial liners or clay liners were incorporated in the pond designs for the Cape Fear, Lee or Weatherspoon plants that are the subject of this study.

Vertical pipes connected to horizontal outflow pipes through the dikes provide for release of water from the ponds. Ponds at some plants incorporate secondary settling ponds to aid in control of suspended solids in the water discharged from then pond. The ponds are permitted as water treatment facilities and are regulated by the Division of Water Quality.

The ash is pumped in a water slurry at about 35 percent solids. The ash settles, gradually filling in the pond volume. Normally, the ash settlement progresses from the pipe discharge location toward the pond's outlet structure. Depending on the shape of a pond and the relative locations of the ash discharge lines and the pond outlet structure, ash can accumulate close to the outlet and create excessive suspended solids in the pond outflow. Most plants have some environmental permit controls for the outflow, either pH or Total Suspended Solids or both.

Over time, Progress Energy has found that the total volume of a pond can not be filled without potential risk of exceeding permit limits on the outflow. Often, the positioning of the ash discharge results in premature filling near an outlet, leaving large areas of usable area inaccessible. Plants have repositioned ash discharge lines and have added chemicals to the ash lines or in the pond itself as techniques to improve settling rates or reduce/raise pH.

Various alternates to increasing the volume in ponds, providing for removal and stacking of ash or treating the ash have been studied along with the pond actual volumes and their projected life spans by Progress Energy, MACTEC and others over the past several years. In general, no land is available at existing plants that could be used to construct new ash ponds. Progress Energy also prefers to avoid new pond construction due to the costs, environmental issues and permitting conditions.

Progress Energy has determined that conducting studies at individual plants may not be providing the best approach to an overall ash management strategy. Progress Energy retained MACTEC to review past studies, conduct interviews across the industry to ascertain current practices, interview plant personnel regarding specific conditions at their plant and assess short and long term strategies for managing ash at the Cape Fear, Lee and Weatherspoon plants. Beneficial reuse of ash, while acknowledged as one option, was excluded from the study due to the volatility and unpredictability of reuse opportunities.

3.0 Root Cause Analysis

3.1 Ash Pond Data

The 1980 pond was designed with an operating surface area of 143 acres, a maximum surface water level elevation of 90 ft msl (crest of dike), and a maximum operating level of 88 ft msl. The operating level is limited, however, to 87.4 ft msl due to several low spots in the dike crest. The initial storage volume of the pond at the operating level was approximately 87.2 million cubic feet, or 2.4 million tons of ash. The pond was raised to an operating level of 84 ft msl in 2001; however, the discharge riser collapsed in March 2004 due to high winds. The riser was replaced to the same elevation (84 ft msl) and the pond has since re-filled to that level. A summary of pond statistics is presented in Table 1.

The pond receives ash from two influent pipes located on the northern and southern banks of the pond. According to Ricky Miller, the plant plans to move the ash sluice line from Unit 3 to the northern bank, which would maximize the settling distance for all ash generated from the plant.

As part of this study, MACTEC conducted an updated physical profile of the ash pond to identify changes in the pond bottom contours since the last survey in 1999. MACTEC Senior Engineer Andrew Rodak and Staff Technician Calvin Arrington were on-site on February 13, 24, and 27, 2004 to conduct the pond survey activities. The surveys consisted of profiling and delineation of the ash/water interface as well as pond soundings conducted at 165 distinct locations between the interface and the outfall. A combination of bottom sounding and horizontal location using GPS surveying was used. Thirty-three rows of approximately 5 points each were collected in an east west direction. The depth was obtained by measuring the depth to the bottom and the location was noted using a GPS surveying instrument.

The sounding locations were recorded using a GPS field tracking device. Soundings were conducted using a weighted measuring tape. In addition, subsurface pond current velocities were measured using a portable stream velocity meter, and the maximum velocities and associated depths recorded at each sounding location

Figure 1 depicts the ash/water interface as delineated by MACTEC during our February 2004 survey. As indicated in the drawing, the ash water interface ranges from approximately 610 feet up to 750 feet from the outfall in the southern portion of the pond. Subsurface current velocities in the pond are relatively negligible and occur near the surface, most likely influenced by surficial wind patterns.

3.2 Coal Usage Factors

MACTEC reviewed existing analyses of ash generated from different coal types burned at the plant under various burn scenarios. According to Progress Energy personnel, the ash content of the contract coal currently burned at the plant is approximately 10% by weight. This is comprised of both bottom ash (10%) and flyash (90%). The bottom ash is a heavier, denser material that settles out immediately upon entering the pond through the sluice influent pipe. Additional unburned carbon, referred to as "Loss of Ignition" material, also is mixed in with the ash and is sluiced into the pond. According to plant personnel, the LOI content of the contract coal burned in Units 1, 2 and 3 is 20%. LOI material is also dense, and settles out fairly rapidly. The LOI content of the coal was taken into account when the quantity of ash produced from coal usage was calculated.

The unit weight of sedimented ash also is a variable. Estimates of ash dry unit weights range from 50 pounds per cubic foot for freshly placed ash to 68 pounds per cubic foot for ash that has been in place for many years. For the purposes of evaluating alternates in this study, a dry unit weight of 55 pounds per cubic foot has been used (see Table 3).

The effect of the unburned carbon on the ash/unburned carbon mix unit weight was also considered. A paper published by J.Y. Hwang, X.Sun, and Z. Li of the Institute of Materials Processing, Michigan Technological University entitled *Unburned Carbon from Fly Ash for Mercury Adsorption: I. Separation and Characterization of Unburned Carbon* shows that the unit weight of the unburned carbon component of fly ash separated by an electrostatic precipitator is lower than the unit weight of the fly ash itself. Therefore, in considering the unit weight of the ash/unburned carbon mixture, using the ash unit weight only is conservative.

Table 2 lists the current, average and maximum projected volume of coal usage (in tons) at the Lee plant over the next five years. This data is listed in the "Annual Coal Unit Summary" spreadsheets provided to MACTEC by Progress Energy. As indicated in the summary, coal usage will increase in the plant over the next three years, peak in 2007, and drop off for the last two years in the projection period. Based on the ash content of the contract coal of 10%, the associated annual ash volumes entering the pond are also depicted on the table.

Several of the East Region plants (among them Lee) are beginning to use "Opportunity Coal" in their processes. "Opportunity Coal" is a low-sulfur, cheaper-grade coal than the contract coal, with ash content of approximately 20% by weight. As indicated in Table 3, ash volumes entering the pond double if "Opportunity Coal" is burned in the plant, which reduces the storage capacity of the pond from that determined when considering contract coal usage. Table 3 also presents the relationship between available pond life and various ratios of coal usage at the plant (ranging from all contract coal to all opportunity coal). A graph following Table 3 depicts the relationship between available pond life and various ratios of coal usage at the plant (ranging from all contract coal to all opportunity coal). As depicted in the graph, available ash storage in the pond ranges from 3 years to 5.5 years based on the ratio of coal burned.

Other coal types or combustion processes that may affect ash settlement ability in the pond include the use of low-NO_x burners and Camp Creek (low sulfur) coal. It has been suspected by plant personnel that these processes may be producing a smaller or less dense fly ash particle which could be contributing to the inability of smaller ash particles to settle out in the ponds prior to flow over the discharge pipe. These factors could account for the cloudiness and TSS concerns, although they were not evaluated by MACTEC during this study.

3.3 Ash Settlement Factors

A settlement analysis of a sample of flyash obtained from the Cape Fear plant was performed by MACTEC during the assessment. The test was performed using a hydrometer and distilled water, and revealed that approximately 99% of the flyash settled within 15 minutes. This represents ash settlement characteristics under quiescent conditions and in a static environment. In reality, specific environmental conditions in the pond affect the ability of the fine-grained sediments to settle out in a uniform pattern as simulated in a hydrometer.

In MACTEC's 2002 Study Report of Progress Energy's Cape Fear ash pond, it was concluded that two factors contributing to ash settlement in that pond were hydraulic short circuiting of the influent flow that promoted a scouring of ash particles in shallow areas of the pond and hindered settlement of the particles in these areas through reduced retention time, and high pond pH resulting from the presence of carbonates and other alkaline compounds in the pond that are products of different combustion processes in the plant's boiler units. These factors may also be affecting the Lee pond, although the Lee pond has historically recorded low pH readings in the pond, requiring Caustic addition as an adjustment measure.

An additional factor that may be affecting ash settlement in the pond is the condition of pond turnover. Pond turnover is a condition in which thermal stratification (layering) is created in a pond on a seasonal interval. In the spring, pond water temperatures are nearly equal at all depths. In the summer, the surface water warms at a faster rate than the deeper, cooler water due to surface air temperatures and calm weather patterns, creating three distinct thermal layers of water in the pond- a less dense, warm upper layer (eplimnion) that is exposed to the sun and atmospheric oxygen, a very thin middle layer (metalimnion) where temperature and density changes rapidly, and a cold, lower layer (hypolimnion) that remains unchanged throughout the year due to the absence of sun exposure and lack of mixing with the upper two layers. In the fall, surface waters cool from rain and cooler atmospheric temperatures, and the temperature of the epilimnion layer becomes equal to that of the metalimnion layer. This reaction causes the colder water to sink and displace the warmer water. The "flip-flop" of layers creates currents that, in an ash pond, may disturb the lightweight ash sediments in the deeper areas of the pond, causing them to remain in suspension and be carried over the outfall.

3.4 Discharge Permit Issues

The pond discharges into a secondary settlement basin approximately one acre in surface area. The basin acts as secondary treatment for the ash wastewater by providing additional retention time for settlement of finer sediments. The settlement basin discharges directly into the Neuse River. The pond effluent is permitted under a NPDES Permit, and monthly limits are imposed on pH, total suspended solids (TSS), nitrogen and phosphorus. Quarterly limits are imposed on selenium and arsenic as well as toxicity. Plant personnel monitor the outfall bi-monthly, and submit the average of the readings in accordance with the permit reporting requirements. The pond discharge has historically been compliant with the NPDES permit limits; however, TSS levels have slowly risen as the pond nears storage capacity. A review by MACTEC of the last three years of pond discharge monitoring data revealed that seasonal spikes have occurred in the TSS levels observed in the pond discharge. These spikes have occurred in the early spring and fall; this is most likely reflective of pond turnover events. Progress Energy is concerned that the NPDES monthly average limit of 30 mg/l may be exceeded in the near future if concentrations of TSS continue to increase as the pond fills and the ash/water interface nears the outlet riser.

3.5 Ash Pond Volume and Projected Life

The calculated future storage capacity of an ash pond is affected by variable ash unit weights, uncertainties in measured bottom elevations or surveys, unpredictable patterns of ash settlement and unpredictable and erratic behavior of ash related to suspended solids limits at the discharge. In earlier work, MACTEC projected capacities by assuming that the remaining pond area could be filled only to within an average of 1 foot of the riser top before suspended solids issues were likely. These projections, made mainly in 1999 and 2000, have appeared to be too optimistic based on reports from the plants. Generally, suspended solid issues have arisen before the ash level has reached the average 1 foot below the riser. Implementing operational aids such as relocating discharge points or installing baffle curtains has allowed ponds to continue filling available capacity and meet discharge limits.

For the three plants included in this study, application of the previous 1-foot factor would represent 22 to 42 percent reduction of theoretical volume to the top of the riser, based on current pond surface areas. During workshop meetings, no clear method for adjusting theoretical capacity was developed; some suggested using a 50 percent reduction, others less. It was noted that implementation of operational controls would allow more efficient use of the available volume. For purposes of comparing various alternatives, MACTEC elected to apply a uniform reduction factor of 25 percent to the calculated volumes for estimating usable life. That is, the calculated volume was multiplied by 0.75 to obtain a volume to use in projecting life of the ponds and various alternatives.

Based on the results of the survey, MACTEC plotted the depths at the 165 sounding locations to create a bottom contour map of the pond. MACTEC then calculated surface areas enclosed by the isotopic lines and multiplied these by the corresponding average depths within each line to determine the current volume of the pond. This volume is depicted in Table 4. Based on the survey, MACTEC calculated a current volume in the pond of approximately 21.6 million cubic feet. Assuming that roughly 75% of the pond volume can be used for ash storage and still discharge to the permitted outfall, roughly 16.2 million cubic feet of ash storage space remains in the pond. At an average influent ash unit weight of 55 pcf, this equates to roughly 445,500 tons of remaining ash storage.

Table 3 compares the current pond volume with the current, average, and maximum ash generation at the plant over the next five years. Since it is not known what percentage of the coal burned at the plant will be Opportunity Coal, MACTEC calculated ash generation rates using different ratios of contract and opportunity coal to evaluate various operating scenarios. As depicted in Table 3 and the accompanying graph, based on current pond volume determination and projecting that 75% of that volume can be filled with ash, as well as the projected ash generation rates, remaining pond life ranges from approximately 3 years (using all opportunity coal) to 5.5 years (using all contract coal). Because the volumes of contract coal and opportunity coal are not known, we have based further evaluations of ash capacity improvements on an average coal use rate and a 50-50 blend of contract coal and opportunity coal. For the Lee plant, this results in an annual ash generation rate of 120,800 tons. The remaining life calculations assumed uniform ash distribution in the pond, a unit weight of 55 pcf, and the current operating level.

3.6 Conclusions

The Lee plant ash pond has been filled to approximately 75% of its theoretical capacity for ash storage at the current operating level and has a projected usable life of 3 to 5.5 years remaining. The pond life assessments that were performed in 1999 and 2000 assumed uniform distribution of ash in the pond and projected that pond capacity would be reached in 14 years. Previous life assessments did not take into account the potential use of "Opportunity Coal" in the plant, which produces twice as much ash as Contract Coal, or environmental factors in the pond that affected the quality of the discharge and the ability of the plant to maintain compliance with its NPDES permit. Because of the factors contributing to ash settlement in the pond, complete deposition of ash is not occurring prior to reaching the outfall, and non-uniform accumulation of ash is occurring in areas of the pond. This inability of ash to completely settle in the pond prior to discharge is affected by wave patterns in the pond, the location of the ash sluice line, the type of ash being deposited in the pond, pond turnover, and the pond chemistry.

MACTEC believes that the potential increase in ash volume entering the pond through the use of "Opportunity Coal" poses a detrimental influence on the pond's ability to operate effectively as a wastewater treatment system. The problems currently being encountered with TSS and turbidity levels in the outfall will only be magnified by the increase in ash volume entering the pond.

In addition, there is evidence to suggest that the current environmental conditions in the pond are contributing to sporadic instances of increased turbidity and elevated levels of suspended solids in the pond effluent. Environmental conditions such as pond turnover are potentially a factor in the ability of suspended material produced in deeper areas of the pond to settle out of suspension prior to reaching the discharge riser. If pond turnover is allowed to continue without provisions made for compliance with discharge permit limits, there is evidence to suggest that it will consistently occur seasonally in the spring and fall, and may have adverse impacts on permit compliance as more ash enters the pond and can be disturbed during turnover events.

Based on the pond survey results and observations made during the pond profiling event, our knowledge of the Lee plant ash properties, present and future projected coal combustion volumes and types, and historical pond behavior, MACTEC concludes that the root cause of the increased levels of suspended solids in the ash pond and short projected remaining life span are a combination of; 1) decreased retention time in the pond due to the increase in ash volume; 2) pond turnover; and 3) short circuiting of flow through the pond due to the Unit 3 sluice line location which can affect the settling time available for the influent suspended solids. The effective operating life span of the pond has also been calculated to be less than originally predicted, based on factors such as the burning of "Opportunity Coal", LOI content, an increase in the volume of projected coal burn, and location of the ash sluice line.

4.0 Evaluation of Alternatives for Ash Management

MACTEC developed and evaluated a list of ash pond management strategies for both short term and long term ash pond management. The list was developed based on MACTEC's research into ash management practices currently underway in other electric utility providers, at other Progress Energy plants, and into innovative technologies approved and being conducted by other industries for solid and hazardous waste management. Based on our research, we identified the following strategies for short and long-term ash pond management:

- Excavation/dredging and stacking of ash into another existing permitted pond;
- Use of Geotubes for ash storage and dewatering within a pond;
- Use of diversion baffles to increase sediment retention time;
- Use of wetlands (existing or engineered) for treatment of pond discharge;
- Chemical treatment (coagulants, flocculants) of pond discharge;

- Extension of the riser pipe to increase the volume of the ash pond;
- Raising the dike to increase storage volume in the pond;
- Modification of the discharge riser to allow partial drainage of the pond prior to a projected turnover event;
- Mycorrhizal Technology of land-applied flyash;
- Recirculation of pond discharge back to plant to supplement sluice makeup and create a closed-loop system; and
- Construction of a new ash pond

These strategies were presented to Progress Energy during Strategic Ash Management Team meetings on March 18, 2004 and April 27, 2004 for discussion. General comments received from Progress Energy indicated that wetlands, Mycorrhizal Technology, chemical treatment, and recirculation of pond discharge would not be feasible strategies for further consideration due to permitting constraints, projected costs and practicality. The remaining strategies are presented in the study report for analysis, and are categorized as either "short term" or "long term" strategies.

Short term management strategies address immediate concerns in the ash pond:

- The ability to maintain current ash fill schedules through creation of additional storage space in the pond; and
- The optimization of ash flow in the pond to promote uniform settlement and maintain the projected fill schedule that was used in determining remaining pond life.

Short term management strategies are intended to address immediate operational issues of the pond.

Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules by creating additional space in the ponds through excavation, use of Geotubes, or construction of a new ash pond to meet future ash projections. Long-term management strategies consider operation of the plant over a 20-year planning window.

4.1 Short Term Ash Management Alternatives

4.1.1 Description of Alternatives

MACTEC evaluated four alternatives for short-term management of current pond conditions and available capacity. Short-term alternatives address compliance issues in the pond through consideration/management of current pond conditions and ash settlement factors. The short term alternatives that were evaluated by MACTEC were:

- Relocation of the Unit 3 ash line to the north, to the discharge point of the Units 1 and 2 ash line;
- Installation of diversion baffles to lengthen sediment flow paths in the pond and increase retention time;

- Raising the operating level of the pond three feet by extending the discharge riser; and
- Excavation or dredging a certain volume of ash from the pond and stacking it in an area of the pond previously filled in.

Relocation of the ash line is currently being planned by Progress Energy, and the alternative analyses in this report are presented assuming the relocation is undertaken within the next six months. Raising the pond level can be done before or after the excavation and stacking program, as discussed during the April meeting. Ricky Miller stated that the plant may prefer to raise the pond level after the digging and stacking program is completed.

4.1.1.1 Alternative 1: Diversion Baffles

4.1.1.1.1 Technical Analysis of Alternative

A submerged baffle system consists of floating fabric baffles constructed of 22 oz/sq yd vinyl coated Dacron and installed across the pond. The baffles are lowered into the pond to a depth above the bottom, and supported in the pond with vinyl coated steel cables anchored to the banks of the pond. Flotation pockets are attached to the top of the baffles to provide additional support and maintain a vertical position in the pond. The baffles would be installed in a maze-like pattern to direct ash and water flow in the pond from the influent pipe to the deeper areas of the pond along the northern shoreline. The meandering flow pattern increases the flow-length and subsequent retention time of solids in the influent flow stream, and promotes more thorough settlement of solids in the deeper sections of the pond. This will help to regulate the capacity of the pond and retard premature breaching of the capacity that is currently occurring with non-uniform settlement of the ash particles.

The objective of the baffles is to create a meandering pathway for ash to travel across the pond, which will prevent short circuiting form the pond influent to the pond effluent. The pathway increases the distance that the ash particles travel across the pond, which decrease flow velocity, increases retention time and promotes more complete settlement of the finer ash particles. Installation of the baffles will improve the pond's ability to fill more uniformly and in conformance with the projected remaining life schedule.

Based on MACTEC's conversation with Don Williams of Aer-Flo, a series of two or three baffles spaced approximately 300 to 400 feet would be required for the ash pond. This would provide a flow distance of approximately 1,600 feet that would extend approximately 500 feet into the deeper sections of the pond. The baffles would be installed at depths of nine to thirteen feet below the surface of the water, and be installed across the northern and southern sections of the pond, as shown on Figure 2. The total baffle length is estimated to be around 2,000 feet.

4.1.1.1.2 Safety Analysis of Alternative

Safety issues associated with installation and maintenance of the baffle system are based on the nature of the work over water. Protective equipment such as flotation devices should be worn when installing, adjusting, or repairing the baffles, as the work will be conducted over water via boat access. Maintenance requirements of the baffles are minimal, and are primarily associated with repair of the baffle walls if damage occurs. Removal of the baffles can be accomplished by disconnecting the baffle sections by hand via boat access, or by disconnecting the anchor cables on the banks of the pond and pulling the baffle curtains to shore.

4.1.1.1.3 Reliability Analysis of Alternative

From a conceptual standpoint, a submerged baffle system would be the most reliable method of promoting more settlement in the pond. A submerged baffle system provides additional retention time in the pond by eliminating short circuiting and directing ash particles to the deeper areas in the center of the pond for settlement. This method of solids separation has been performed at Progress Energy's Sutton plant using diversion curtains (which are similar to baffles), and has proven successful in improving the quality of the pond effluent. The baffles are also planned for use in the Cape Fear ash pond. When used in the conjunction with the transfer of the Unit 3 ash sluice pipe to the northern shoreline, baffles will assist in maximizing the flow path and subsequent settling time for ash particles in the pond.

4.1.1.1.4 Economic Analysis of Alternative

Based on information provided by Aer-Flo and ACF Environmental, a designer and distributor of diversion curtains and baffles, respectively, a budgetary cost estimate for the capital cost of a submerged baffle system is $6.00 per lineal foot of baffle material for an installation depth of one foot, with $1.00 per lineal foot added for every one foot of additional depth. MACTEC provided Aer-flow with the pond bottom contours that were developed from the pond profiling, and they provided us with a preliminary design for the baffles. Assuming that a total of three baffles would be installed in the northern and central sections of the pond where the deeper contours are present, and from shoreline to shoreline in one or two directions, requires approximately 2,500 lineal feet of baffle material are required.

MACTEC estimates the total cost for the baffle system as approximately $44,000 in today's dollars. This cost is broken down in Appendix A and is discussed below.

The estimated capital cost for the baffle material and supporting cables and connection hardware is $15,000. Installation costs, which would involve the installation of concrete footings on the pond banks from which to install anchors for the steel cable that supports the curtains, and attaching the baffles to the steel cable in sections, are based on those used for the Cape Fear baffle system, and are estimated at $20,000. Engineering design of the baffle system is estimated at $9,000.

Operation and maintenance costs for the baffles are expected to be minimal, as they would consist of occasional baffle section replacement (at $6.00 per foot for one-foot depth) and repair to the steel cable or flotation pockets. Re-positioning of the baffles would involve installation of additional concrete footings for anchors in the desired locations, and moving the baffle sections by hand via boat access. These activities can be accomplished in-house to minimize outside costs. Annual maintenance costs are estimated at $5,000.

4.1.1.1.5 Environmental Analysis of Alternative

Environmental impacts associated with operation of a baffle system are expected to be minimal. Solids remain in the pond, and are directed through a modified flow path to the deeper areas of the pond for increased retention and settlement time. Installation of a baffle system is not expected to adversely affect the pond's existing ash capacity; it will re-distribute the ash more uniformly across the pond and prevent mounding of ash in shallow areas. No permitting revisions are necessary, because the baffle system is installed within the existing permitted wastewater treatment system extents.

4.1.1.1.6 Risk Assessment of Alternative

Inherent risks associated with implementation of this technology are minimal. The potential for overturning of the baffles due to lateral water force is reduced because the forces acting on the baffles are in equilibrium and act parallel to the baffles in the direction of the flow. Ash settlement occurs along the bottom of the baffles and does not contribute to overturning forces acting on the top of the baffles. The sole risk to be considered in the implementation of this alternative is the possibility of ash mounding in areas of low flow velocity. This risk can be minimized by re-routing the baffles periodically to promote steady-state flow to deeper areas of the pond. This can be accomplished by breaking one anchor connection and swinging the baffle to another anchor point.

4.1.1.2 Alternative 2: Raising the Pond Level

4.1.1.2.1 Technical Analysis of Alternative

This alternative involves raising the pond operating level approximately three feet to the maximum operating elevation of 87 ft msl. This would be accomplished by raising the discharge riser pipe in the pond three feet. The recent pipe repair in April 2004 involved replacement of the pipe with a stainless steel section equipped with a flange. This allows for addition of new sections easily.

The riser would be raised by joining a three-foot section of pipe to the flange on top of the new pipe and sealing with grout. The benefits of raising the water level in the pond are:

1) It provides additional depth and capacity in the pond for ash settlement.
2) It moves the ash/water interface farther away from the outfall.

The projected location of the ash-water interface in the pond after raising the water level is shown on Figure 3.

4.1.1.2.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to riser extension and the integrity of the grout used to seal the riser extension to the existing riser. If the grout or sealant used is not suitable for the conditions or is not applied correctly, the seal will leak and possible damage to the riser may result.

An additional potential safety concern is the condition of the existing earth dikes and their ability to support the raised water level. The effects on the existing dikes from raising the water level two feet are considered to be negligible, since the top of dike is still at least two feet above the new operating pond level and the design freeboard is maintained. In 1999, LAW conducted a study of the stability of the south dike (the dike parallel to the Neuse River) considering a potential raise of the pond to the design operating level. The south dike is has the steepest slopes of all the ash pond dikes. The analyses found that the dike would be stable with the raised water level. Recommendations for addressing interior slope erosion potential and for continued checks of the dike for indications of local slumps or other signs of instability were made. The interior slopes have since been improved due to the repairs following Hurricane Floyd.

Protective equipment such as flotation devices should be worn when added the additional section to the riser, as the work will be conducted over water.

No additional safety concerns are associated with this alternative.

4.1.1.2.3 Reliability Analysis of Alternative

Riser extensions have been conducted in other Eastern Region Progress Energy ponds, including Cape Fear and Sutton. They have proven to be effective in maintaining discharge permit compliance. Riser extensions are constrained by the maximum operating level in the pond and design freeboard.

4.1.1.2.4 Economic Analysis of Alternative

Engineer Opinion-of Cost for the riser extension is $2,500. The cost includes labor for design of a stainless steel riser extension, materials for the structure and joint, and installation by crane. Riser extensions can be placed by plant personnel. The estimate is based on costs for riser extensions on similar-sized pipes at Progress Energy's Cape Fear, Lee and Sutton Plants.

4.1.1.2.5 Environmental Analysis of Alternative

Environmental impacts of modifying the discharge riser are expected to be minimal. Since the work would be conducted within the limits of the treatment system, a permit revision is not required for the work. However, an Authorization to Construct would be required from the Washington Regional Office of the Division of Water Quality (DWQ), as this is modification work that will be performed on a permitted treatment system. Detailed construction plans on the riser extension, along with a separate narrative and plan sheets must be prepared for submittal to the DWQ. The authorization to construct will be granted based on approval of the plans by the DWQ.

4.1.1.2.6 Risk Assessment of Alternative

The inherent risk of modifying the discharge riser lies in the preservation of integrity of the joint seal during placement of the extension. If the grout or other joint sealant does not sufficiently set, leakage can occur, possibly resulting in damage to the riser through structural failure. Since structural failure has already occurred on the riser in March of 2004, careful consideration must be made in the design of the extension to account for stability of the longer pipe.

If the discharge riser is extended prior to implementing a dig and stack program, it would provide longer life than if done after or during digging and stacking. However, raising the riser prior to creating another storage area leaves the plant with no options should permit limits be reached on the discharge. Leaving the riser at its present elevation while digging and stacking allows some room for handling short term discharge limit upsets should they occur.

4.1.1.1.7 Other Issues

Extension of the discharge riser, if done before implementing a dig and stack program, will provide an additional 5 years of storage capacity in the pond, assuming an average coal usage of 644,233 tons and a ratio of 50/50 contract/opportunity coal. Due to the continued filling in the pond during a dig and stack program, raising the discharge riser after the dig and stack program will only add about 1.8 years of additional life. This option should be considered in conjunction with other short-term strategies, as it will not provide long-term benefits to ash management. It is, however, a practical and cost-effective strategy to extend the short-term capacity of the pond.

4.1.1.3 Alternative 3: Excavation/Dredge, Haul and Stack

4.1.1.3.1 Technical Analysis of Alternative

For this alternative, ash would be excavated or dredged from a designated area in the pond and transported via truck or through pumping to a stacking area in the pond. Entrained water in the ash would be allowed to drain from the stacked ash through rim ditches or bleed channels constructed around the perimeter of the stacking area into the active pond. For a dredging operation, a floating dredge would be used to pump ash/water slurry through piping into cells constructed in the western, dry, portion of the current pond. The dredge will need to have a pumping capacity to move an ash water slurry of about 15 to 20 percent solids at least 2,500 feet with a maximum head differential of about 40 feet.

Ash storage for a dredging operation would use cells constructed by digging out ash to form basins. The dredged material would be allowed to settle in a basin with excess water decanted into the water area of the 1978 pond. After a cell dries sufficiently for handling, the ash would be used to create a raise of the cell dike to allow for more storage. A similar operation has been implemented at the Asheville Plant successfully. The cell dikes may need reinforcing with geogrids for stability, and adequate buffers need to be allowed between the cell dikes and the pond dike as well.

With either excavation or dredging, ash could be stacked as high as practical in the stacking areas of the pond, considering slope stability and erosion potential. Stacked ash will need to be capped with 6 inches of soil and seeded after final grading activities are conducted. Provisions for haul routes into the stacked area and dredge line placement must be considered. Figure 4 illustrates a possible configuration for a dig and stack program.

Ash excavation from the active pond allows for additional space in the active pond for ash storage (the amount of additional storage depends on the surface area of the pond that can be excavated). Water is pumped out of the excavation area to lower the surface water level, allow for additional excavation of ash, and return any rain water from the stacked area to the active ash pond. Previous excavation projects at Progress Energy's Weatherspoon plant have shown that a maximum excavation depth of 6 feet with pumping from sump ditches will maintain stability and dryness of the excavation floor for equipment traffic without additional drainage measures. Drainage can also be accomplished through installation of additional rim ditches and bleed channels to provide conduits for entrained water. Excavation to depths greater than 6 feet can be accomplished through construction of impervious separator dikes and additional dewatering devices. Depth of ash removal by dredging would not be limited by wet conditions.

Excavation of ash from the Lee active pond would involve the area in the center portion of the pond, where ash has sedimented and has filled in the available space (dredging of ash would occur in the shallow areas of the active pond for sedimented ash beneath the water surface). Excavation of ash would be performed by mass excavating equipment (large-bucket trackhoes) and articulating dump trucks. Dredging of ash would be performed by a dredging barge that would be floated out into the pond and controlled on the shoreline.

To optimize available capacity of the pond and prevent water intrusion into the excavation area, the area for proposed excavation should be isolated from the active pond by a separator dike. The proposed excavation area is depicted on Figure 3. The separator dike would be constructed of geogrids, borrow material, and ash and would be constructed to an elevation of approximately 90 ft msl (to maintain a minimum of two feet of freeboard in the active pond). The proposed excavation cell area provides approximately 23 total acres of surface area for excavation. Prior to excavation activities, the ash sluice line must be re-routed/extended around the cell area to provide a flow path for ash from the plant to the active pond during the excavation activities. The conceptual approach to a digging and stacking strategy is that the constructed cell can be used for future storage of ash sluiced from the plant after excavation, and the remaining active pond would be available for emergency use only. The proposed cell configuration is conceptual; different cell configurations are certainly possible, and ash can also be excavated/dredged out of a portion of the active pond area if necessary.

At a maximum excavation depth of six feet, excavation slopes of 10:1 and average density of excavated ash of 60 pcf, a total volume of 181,000 tons of ash can be excavated from the pond per dig event, adding approximately 1.5 years of additional storage per dig cycle at a 50/50 ash generation rate. Assuming that each excavation/stacking cycle would occur 1 year after planning and permitting (see Timeline, Appendix B), the amount of time that it takes per dig (approximately 10 months), and the time it takes to fill in the dig area after excavation (based on dig area volume and average annual ash generation rate from the plant), we estimate that four digging/stacking cycles can be conducted during the remaining usable life of the pond. Therefore, the approximate life extension to the pond achieved through digging and stacking is

10.2 yrs. At that time, the option to raise the operating level of the pond is available (as it is throughout the dig and stack program), but as discussed previously, it will achieve only an additional 1.8 years of storage after the dig and stack program is complete.

Excavated/dredged material from the main pond could be hauled/pumped to the western portion of the pond for stacking. This area has sedimented ash and is fairly dry and established with vegetative cover. The proposed stack area has approximately 20 acres of ash storage capacity and can be divided into two stacking areas (designated as "Area A" and "Area B"). The maximum height of stacking in each area would be dependant upon slope stability and ease of equipment mobility for grading, and would affect the surface area footprint occupied by the transplanted ash (the higher you can effectively stack the ash, the smaller the footprint).

Based on the number of dig and stack cycles that can be conducted within the usable life span of the pond and the available stacking area, , maximum stacking heights of 40 feet in Area A and 30 feet in Area B could be achieved.

4.1.1.2.2 Safety Analysis of Alternative

Generally, the primary safety concern of excavation and dry-stacking of ash is the stability of the excavation floor and surrounding dike and ingress/egress to/from the excavation area. Since the ash to be removed has a certain percentage of entrained water, the excavation area is likely to be unstable and potential for entrapment of equipment and personnel exists. For this reason, spread mats constructed of wooden material are suggested for use in equipment/personnel transport through the ingress/egress areas. Additionally, a minimum 30-foot buffer must be constructed and maintained around the perimeter of the excavation area to prevent stability of the dikes from being compromised during the excavation activities.

Disturbance of ash sediments also poses the risk of liberating flyash particles into the air, where they can be inhaled and present a respiratory hazard. For this reason, breathing filtration equipment should be used in the work zones where appropriate. Excavation slopes of 10:1 and a minimum buffer of 30 feet around the excavation area are recommended design parameters to maintain dike wall stability and allow vehicle ingress/egress to the excavation area.

The primary safety concern associated with dredging of ash is the potential damage to the dike through the operation of the dredging equipment. Some previous dredging projects in other ash ponds have encountered problems such as partial breaching of ash dikes used for retaining the dredge material. For this reason, Progress Energy personnel are reluctant to consider dredging as an option. However, favorable results with dredging have been reported at the Asheville Plant.

Another safety concern is the height of stacked ash from dredging that could be achieved inside the cells within the pond. If adequate buffer space is available (as is the case in the Asheville plant's stacking area), the concern for cell dike breach is minimized, as provisions are in place to contain the dredged materials within the pond. As the height of the stacked ash begins to increase and becomes greater than the cell dike height, and adequate buffer space is not available, a potential breach of the cell dike could cause ash to overflow the pond dikes or cause a failure of the pond dikes as well.

4.1.1.2.3 Reliability Analysis of Alternative

Excavation/dredging of ash has proven to be an effective method of creating additional storage space in active ash ponds in other Progress Energy and electric utility steam plants. The volume of additional storage space created in the pond is dependant on the available stacking area to which the ash is transported, the ash influent rate into the pond, and the maximum depth of stacking that can be achieved. The benefits of cell development for stacking lie in the ability to use portions of the pond for filling while others are being excavated, while the main pond does not receive ash under normal operations.

4.1.1.2.4 Economic Analysis of Alternative

MACTEC estimates the total cost for digging and stacking for 4 cycles (10 years of additional storage) as approximately $3,534,700 in today's dollars. This cost is broken down in Appendix A and is discussed below.
The unit cost for excavation and hauling of ash is roughly $4.00 per ton. The unit cost for dredging of ash is approximately $3.00 per ton, excluding the cost of containment cell construction. MACTEC estimates the cost for four excavation/stack cycles using at approximately $2.94 million.

The cost of construction for a separation dike for the cells is based on a cost of $4.00 per square yard for the geogrids (as applied) and $3.00 per c.y. for borrow fill. Assuming that the dikes will be 12 feet in width, average four feet in height, and total 10,000 feet in total length (as depicted on Figure 3), estimated cost for construction of the dikes is approximately $266,700.

The cost for soil cap and hydroseeding on the stacked ash is estimated based on a unit rate of $15.00 per cu. yd. for fill and seeding. Assuming a six-inch soil cap to be placed over the entire stack area, the cost for a soil cap is estimated at $242,000 for the 20-acre area.

The cost of excavation and dry stacking must be spread out over the life gained because only a limited area can be excavated at any one time. For dredging, the excavating is limited by the area available and the time required for sedimentation and stacking. It may be possible to capitalize dredging costs with the life extension gained by dredging exceeding the time frame of the dredging work.

4.1.1.2.5 Environmental Analysis of Alternative

Since the ash is being transported within the existing wastewater treatment system no provisions are needed for water drainage or stormwater runoff from the stacked ash; it can be directed through constructed bleed channels back into the active pond for retention and treatment.

Since the runoff from the stacked ash will contain suspended solids, a potential exists that water quality in the main pond will be adversely affected by the runoff. In previous excavation/stacking projects at other Progress Energy ash ponds, problems with suspended solids were not encountered, primarily because the stacking area was located far enough away from the discharge of the pond that adequate retention time for solids settlement is available. Suspended solids generated from ash excavation in the main pond can be controlled through the separation dike and the diversion baffles.

4.1.1.2.6 Risk Assessment of Alternative

Ash excavation and re-stacking has proven to be an effective method of removing ash from active ponds to create additional space. Inherent risks lie in the stability of dike walls and the floor of the excavation area, and are based on the entrained moisture content of the ash and rainfall, and the ability to effectively pump this water out of the excavation. If provisions are not made to protect the cell dikes during excavation or dredging activities, breaching may occur.

Protection of water quality in the active pond during dredging or excavation activities is also important, as agitation of sedimented ash during these activities will cause dispersion of sediments throughout the pond and could affect discharge quality. This has not been a problem in previous excavation and stacking projects at other Progress Energy ponds, and is dependent upon the proximity of the excavation/stacking area to the pond discharge riser, and separation dikes. Use of the diversion baffles to increase the retention time of particles in suspension in the main pond should also minimize the risk of adverse impacts of water quality in the pond during excavation and dredging activities.

The third risk is the actual life extension provided to the pond through an excavation/stacking strategy. Our estimates are based on a 50/50 contract/opportunity coal ratio, and an average coal production rate calculated over a five-year projection period. If the percentage of opportunity coal increases above a 50/50 ratio and annual coal production exceeds the average by more than 10% (this would exceed the maximum projected volume of coal), the actual pond life extension will be shortened, and projections made in this report will be invalid.

4.2 Long Term Ash Management Alternatives

4.2.1 Description of Alternatives

MACTEC evaluated three alternatives for long-term management of ash and available pond capacity. Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules as determined assuming uniform ash distribution patterns, as well as account for future coal usage at the plants by addressing long-term storage needs.

The long term alternatives that were evaluated by MACTEC were:

- Raising the main pond dike 6 feet to an elevation of 96 ft msl ;
- Use of Geotubes for storage of ash; and
- Construction of a new ash pond.

During the meetings with Progress Energy, the concept of creating a landfill on top of the abandoned ash storage area west of the plant or even developing an off-site landfill was discussed. Landfills would fall under the permitting requirements of the Solid Waste Division. A similar project was undertaken by the Roxboro Plant for expanding their landfill on a former ash pond. A permitting time frame of about two years was required. Detailed hydrogeologic studies were required. The expansion was required to have a liner, leachate collection system and ground-water monitoring.

In 2002, Jacobs Engineering and Law Engineering prepared a study for CP&L for the Asheville Plant which studied landfilling concepts both on their existing ash pond and off site. Landfilling would require implementing a dry ash handling system as well as the development of the landfill under Solid Waste regulations and permits. The ash quantity used for that study was 120,000 tons per year plus 50,000 tons per year of sludge from planned air cleaning equipment for a total waste amount of 170,000 tons per year. The amount of ash is essentially the same as the average ash at a 50-50 mix of opportunity and contract coal for the Lee plant.

We have used the cost estimates prepared in the Asheville study as a guide for a rough estimate for developing a landfill at Lee on the abandoned ash pond area west of the plant. For an on-site landfill development operated for 25 years, the total estimated cost at Lee is $76,740,000 (2002 dollars). This includes:

• Dry Ash System	$ 2,240,000
▪ Permitting	$ 1,000,000
▪ Development/Construction	$48,000,000
▪ Operation for 25 years	$25,000,000
▪ Post Closure Monitoring	$ 500,000
TOTAL	$76,740,000

At an ash amount of 120,000 tons per year and 25 years of life, the above cost translates to $25.58 per ton, significantly greater than other options.

The Roxboro Plant landfill experience suggests costs to develop an on-site landfill may be significantly lower than the above numbers, based on telephone conversations with personnel involved in that work. A rough cost of $1.00 per ton for capital and $2.00 per ton for operation were stated. The Roxboro operation is much larger (~500,000 tons per year), and this may make the per ton costs lower. Review of landfill development and operational costs in more detail is needed if a landfill option is to be considered further.

If an off site landfill concept were adopted, a rough estimate based on the Asheville study is $73,240,000 (2002 dollars) for a 25 year operation. This estimate was based on per acre costs from Waste Management, Inc. in the Asheville study and included land purchase at $10,000 per acre. The size used at Asheville was 200 acres. For Lee we have estimated the landfill size as 50 acres with 125 acres for operations and buffers (175 acres total). The estimate includes:

• Dry Ash System	$ 2,240,000
• Land Purchase @10,000 per acre	$ 1,750,000
• Host Community Fee, estimate	$ 500,000

- Permitting $ 1,500,000
- Construction @$275,000 per acre $13,750,000
- Closure @150,000 per acre $ 7,500,000
- Post Closure monitoring and reports $ 3,000,000
- Operation for 25 years (@$1,000,000 per year) $25,000,000
- Transport Ash @$6.00/ton <u>$18,000,000</u>

TOTAL $73,240,000

At an ash amount of 120,000 tons per year and 25 years of life, the above cost translates to $24.42 per ton, significantly greater than other options. The difference in on-site development and off-site development was due to the different methods of estimating used by Jacobs/Law in the Asheville study for the two options.

Another concept that was briefly discussed in the April 18, 2004 meeting was developing a centralized regional ash landfill to receive ash from at least the three plants studied. For an estimated landfill size of 340 acres and using the per acre estimate approach from the Asheville study, we estimate a cost of about $155,000,000 for a 25-year life.

Experience that municipalities and private waste handling firms have had trying to site new landfill space indicates finding a suitable landfill site and obtaining permits is a daunting task. Public opposition to landfills, regardless of their content, has made it extremely difficult for new projects to be successful. Municipalities have the power of eminent domain as a tool to obtain land; it is not clear if Progress Energy could use that approach. Extended legal actions by opponents delay implementation of landfill construction and operation. Creation of landfills does not appear viable as an alternate. Therefore, it has not been evaluated further as a long-term strategy in this study.

4.2.1.1. Alternative 1: Raising Main Pond Dike

4.2.1.1.1 Technical Analysis of Alternative

This alternative was evaluated during a previous ash study, and remains a valid alternate. However, depending on what short-term alternates are implemented, raising the dikes may not be feasible or may not provide the estimated storage increase. Raising the dikes involves the addition and compaction of fill material along the crest of the main pond dike. The total length of the ash pond dike is 2.0 miles. The dike crest is 12 feet wide at elevation 90.0 feet msl. Design side slopes are 2(H):1(V). The height of the dike ranges from 13 feet on the north and east end of the pond to 20 feet on the south and west ends.

The previous study concluded the existing dam can be raised by approximately 6 feet, to elevation 96 feet (msl). With implementation of this strategy, the planned operating level of the pond can be raised to a maximum elevation of 94 feet to allow for 2 feet of freeboard. The maximum height for the modified dam will be 26 feet, and the maximum storage volume will be 2,838 acre-feet for the 143-acre impoundment area. Based on the planned height and storage capacity, the modified dam will be considered an intermediate size dam under the North Carolina definitions.

The work will include placing earth fill on the crest and downstream side of the existing dam, and extending the existing riser structure. On the south side, adjacent to the Neuse River, no fill can be placed within 100 feet of the river due to the Neuse River buffer zone. This requirement may dictate fill placement on the interior dike side here. Interior placement is more costly, but is technically feasible.

Raising of the pond dike will accomplish the following objectives:

1) Provide additional storage of ash and extension of pond life. Based on a previous study conducted by MACTEC, additional storage life of about 6 years is projected with the extension and an operating pond elevation of 94 ft msl;
2) In conjunction with the diversion baffle system, provide for more settlement time in the pond to improve discharge water quality; and
3) Provide for the option to raise the pond operating level incrementally through riser adjustment;

Modification of the ash sluice line plumbing would be required for implementation of this alternative. A vertical extension to the lines may be required to transfer the sluice into the pond at a higher elevation as a result of the dike raise. Additionally, the available head against which the sluice pumps are pumping would be increased, and the pumps' ability to handle the increase in static lift would need to be evaluated by the plant. Currently, ash and water are removed from the ash sump pits by three hydro seal ash pumps. Each pump is designed to deliver 1,750 gpm of ash and water slurry against a discharge head of 100 ft with 10 ft submergence. Under this condition, 55 bhp is required from each pump motor, and the efficiency is 60%. However, the pumps are old, and a pump performance evaluation would be required to determine discharge rate and efficiency against additional head imposed by a dike raise.

4.2.1.1.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to the stability of the dikes after the raise is complete. Previous local, surficial slumps in the dike exterior slope and erosion on interior slopes after hurricanes in the 1990's have presented concern about long-term stability, although the last dike inspection conducted by MACTEC in 2003 concluded that the dike is currently in satisfactory condition. The stability of the proposed modifications should be evaluated using circular arc failure surfaces based on a random grid pattern. Seismic analyses should also be conducted on the final dike slopes using a horizontal acceleration factor of 0.05g. Soil properties can be determined from laboratory analyses and historical information.

Based on analyses conducted on dike raises at other Progress Energy steam plants, slopes of 3:1 (H:V) on interior dike faces provide satisfactory factor of safety under static and seismic loadings; however, due to space constraints created by the secondary settlement basin and the ash pond interior riser structure, exterior slopes of 2:1 can be used for the final design. Existing slopes with fair to moderate grass cover have performed well for the majority of time in the current dike and do not show signs of sliding. To limit the surficial erosion, all dike faces will need to be hydro-seeded with drought tolerant grasses to aid in reducing potential surface sloughing.

4.2.1.2.3 Reliability Analysis of Alternative

Dike raises have been conducted at other Progress Energy ash ponds (Robinson) and have been proven reliable in short-term stability.

4.21.1.4 Economic Analysis of Alternative

Based on a previous ash impoundment study conducted by MACTEC for the Lee pond in 2000, constructing the conventional vertical extension would require a fill of approximately 198,400 cubic yards. The approximate cost, including design, permitting and construction testing and monitoring (CMT), for implementing this alternative is $3.2 million for the conventional method. At an operational life of 6.4 years (considering the extension provided to the pond life with the raise and taking into account ash volume production over that period at a 50/50 contract/opportunity coal ratio), this equates to an annual cost of $495,625. This cost also does not include any required modifications to the sluice pumps to overcome the additional static and frictional head associated with pumping over the dike. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

4.2.1.1.5 Environmental Analysis of Alternative

Since the majority of work for this alternative would be confined to within the existing ash impoundment, there are no current additional environmental considerations beyond those associated with the past or present operation of the impoundment. However, the Neuse River Buffer rules that were promulgated in 2001 require 100-foot buffers around all construction work on land within the river basin. These buffer rules could potentially affect the conventional construction of a dike on the south and southwest portions of the impoundment, and construction would have to remain outside the buffer zones. Failure of a pipeline would release ash into the environment that could potentially impact the Neuse River.

Permitting requirements for this alternative are an erosion and sedimentation permit if land-disturbance activities exceed 1 acre in size, and an authorization to construct. Detailed construction plans including erosion and sedimentation control features, and a separate narrative and plan sheets must be prepared for submittal to the Washington Regional office of the Land Quality Section. The authorization to construct can be prepared based on the plans and must be submitted to the Washington Regional office of the Division of Water Quality It is not clear at this time if a separate grading or land-disturbing permit will be required by Wayne County.

Modifications to existing dams would normally require a permit from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

4.2.1.1.6 Risk Assessment of Alternative

The inherent risk of raising the dikes lies in the stability of dike walls and seepage potential, and is based on the type of material used for the fill, the interior and exterior slopes, and the erosion control measures employed during construction. If provisions are not made to prevent erosion from dike faces during and after construction, breaching may occur.

Protection of water quality in the active pond during dike construction activities is also important, as sediments created during these activities may enter the pond could affect discharge quality. This can be prevented through proper sediment control measures employed during and post construction, such as silt fences, turf matting, rip rap or vegetation.

4.2.1.2. Alternative 2: Use of Geotubes for Ash Storage

4.2.1.2.1 Technical Analysis of Alternative

This alternative involves the purchase and installation of Geotubes within the pond dike to collect and store ash. Geotubes are porous, woven monofilament fabric tubes that can be used to collect, store, and de-water ash either directly from the sluice lines entering the pond, or from a dredge line. Geotubes are traditionally used in sand dredging operations in coastal areas because they allow for both storage of dredged material for possible future use as well as provide future structural opportunities for berm construction. They have also been used in sludge dewatering operations, including coal sludge. Geotubes are an attractive option for storage of ash for the following reasons:

1) They allow the solids to be kept further away from the outfall line;
2) They provide a more structured containment; no dry stacking of ash is needed in the future;
3) The tubes can be stacked on top of each other, thus creating additional years of storage;
4) No erosion control or seeding is needed to prevent ash blowing as with other dry stacking operations; and
5) Ash is kept clean and easily removed should a market develop

Geotubes are supplied in sections; length of each section is specified by the purchaser. Circumferences range from 30 feet up to 90 feet. Geotubes can increase solids content through de-watering by a factor of up to 2.5. Literature on Geotubes is provided in Appendix B.

Modification of the ash sluice line plumbing would be required for implementation of this alternative. An extension to the lines would be required to transfer the sluice to the tubes. Typically, tube sections are pre-formed to specified lengths, laid out in the pond according to the desired configuration, and filled through ports attached to an overhead valve manifold system. A central trunk line is positioned above the length of the tube, and branch lines are connected to the main line at distinct locations above the Geotube fill ports. Filling of the tube sections is accomplished through manual valves installed on each branch line; the proper sequence of filling allows for even distribution of ash in the tubes. Maintenance of the valves is required to maintain uniform filling of the tube sections and prevent backup in the sluice lines.

A pressure relief valve is positioned at each end of the tube to prevent structural failure due to blockage in the fabric.

The proposed Geotube layout is depicted in Figure 5. The layout has been devised to maximize the available space in the pond for Geotube placement, as well as minimize the amount of manifold piping needed to fill the tubes. As an alternate layout, the tubes can be used as part of the dike raise. Based on an average annual ash generation from the plant of 120,800 tpy, considering a ratio of 50/50 contract/opportunity coal, a projected storage interval of 20 years, the capacity of a 90-foot circumference (28.5-ft diameter) Geotube, and an available storage area in the pond of 25 acres, it is estimated that approximately 180,000 lineal feet of Geotubes will be required in the pond. This can be accomplished through the installation of 120 Geotubes each approximately 1,500 feet in length arranged according to Figure 5 and stacked in 2 levels.

4.2.1.2.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to installation of the tubes in the pond and operation of the fill valves The tubes weigh approximately 24 pounds per lineal foot empty, so considerable weight is associated with tube lengths of 1,500 feet. Cranes and other heavy equipment are required for installation of the tubes in the pond. The valves require manual actuation when filling the tubes; this is elevated work under high flow conditions. Risks associated with elevated work and pressurized vessels are inherent to the tube filling process. No additional safety concerns are associated with this alternative.

4.2.1.2.3 Reliability Analysis of Alternative

Geotubes are traditionally used and have been proven effective in sand dredging and sludge dewatering operations because they reduce waste volumes, allow for storage of dredged material for possible future use, and provide future structural opportunities for construction of berms using the Geotubes. They take up less surface area than typical stacking operations, and can be stacked to further minimize space. Geotubes are constructed of strong material resistant to tearing, and are designed to withstand wide width tensile strength up to 4,800 lbs/ft. While they have not been used in flyash ponds, they have been used to dewater coal sludge; the characteristics of which are similar to flyash. Geotubes can also be designed to handle a wide range of water content in the influent stream, which can accommodate the intervals of sluice pumping with low solids content (pump cycling). Further evaluation of the ability of the Geotubes to handle sluice loads of primarily water and little solids as the pumps go through their operational cycles would be required prior to implementation of this strategy.

4.21.1.4 Economic Analysis of Alternative

MACTEC estimates the total cost for using Geotubes for a 20-year period as approximately $10.2 million in today's dollars. This cost is broken down in Appendix A and is discussed below.

Based on the total volume of Geotubes needed to store 20 years of ash and the material cost for a 90-ft circumference tube, the material cost for 120 Geotubes is estimated at $8.12 million. Costs for the piping manifold system are estimated at $52,000. Installation costs for the Geotubes and piping manifold are estimated at 25% of the material cost and are projected to be approximately $2.04 million. The total capital cost is therefore approximately $10.2 million. For an implementation interval of 20 years, the average cost per year is $ 511,445.

Geotubes can be combined with digging and stacking, being implemented after the stacking has been completed. Assuming use of Geotubes for eight years after digging and stacking, the Geotube total cost is estimated as $4,125,400. See Appendix A for a breakdown.

The above total costs do not include modifications needed for the sluice pumps to overcome the additional static and frictional head associated with pumping into the stacked Geotubes. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

A geotube system would require additional plant manpower for monitoring and operation. The impact of the manpower needs on the total system cost has not been determined.

4.2.1.1.5 Environmental Analysis of Alternative

Environmental impacts of using Geotubes to store ash sluiced from the plant are expected to be minimal. An improvement of water quality in the pond will be made by reducing solids loadings to the pond while the tubes are being filled. No permit revisions are required for implementing this alternative, since Geotubes will be installed within the dike and will not increase the discharge flow of the pond above the permit limit. Since this is a minor modification to the existing permitted wastewater treatment system, authorization to construct will be required from the Washington Regional Office of the Division of Water Quality. This can be obtained through a submittal of the design plans for the Geotube system to the DWQ.

4.2.1.2.4 Risk Assessment of Alternative

The inherent risk of installing Geotubes is in the utilization of available area in the pond and ability of existing equipment to pump solids into the Geotubes for storage. An evaluation of the existing sluice pumps' ability to pump at the design rate and overcome the additional head imposed by the installation of Geotubes would be required to verify that current operation of the pumps will not be adversely affected. The available head against which the sluice pumps are pumping would be increased, as the Geotubes provide additional static head due to their fill ports.

4.2.1.3 Alternative 3: Construction of New Ash Pond

4.2.1.3.1 Technical Analysis of Alternative

For this alternative, a new ash pond would be constructed on property purchased by Progress Energy at a selected location. A siting study would need to be conducted to determine the optimal location for the pond, taking into consideration fill and drainage requirements, dike construction, permeability of subsurface soils, etc. Design considerations for the new pond would include average annual ash generation rates using both contract and opportunity coal, a usable life of 20 years, a freeboard of 2 feet, excess capacity of 25% to account for non-uniform ash distribution, and a maximum height of 20 feet above existing grade.

Design considerations must also be made for pumps and piping to sluice ash from the plant to the location of the new pond, connection of the outfall structure to a receiving water body, and permit requirements.

For the Lee plant, based on an annual ash generation rate of 120,800 tons (from a 50/50 mix of coal), a design height of 20 feet, design freeboard of 2 feet, 25% excess capacity provision, and a usable life of 20 years, the required land to accommodate a new pond is approximately 192 acres. Rough dimensions of the pond are a length of 3,525 feet and a width of 1,750 feet. This pond would have a storage volume of approximately 100,900,000 ft^3, or roughly 2.77 million tons of ash at a unit weight of 55 pcf.

4.1.1.2.2 Safety Analysis of Alternative

The primary safety concern associated with construction of an ash pond lies in the design of the retaining dike and construction activities relating to excavation and grading. Proper design of the dike to minimize erosion and maintain stability is design considerations integral to the design of the pond. Proper design of the discharge weir is also required to maintain flow balance in the pond and provide adequate support to prevent overturning of the riser under high wind and wave impacts.

4.1.1.2.3 Reliability Analysis of Alternative

Construction of a new ash pond will be an effective method of creating additional storage space for future ash generation, and has been utilized as a long-term storage method in several of the other electric utility steam plants with whom we contacted The volume of additional storage space created with a new pond is dependant on the available area in which the pond can be constructed, existing site conditions that affect excavation and development, and the maximum depth of the pond that can be constructed.

4.1.1.2.4 Economic Analysis of Alternative

The construction costs for a new ash pond are presented in Appendix A. Costs are based on permitting and design of the new pond, construction testing and monitoring, equipment mobilization, drainage and erosion control, a discharge structure and outfall piping, extension of the sluice piping, soil and subgrade placement and compaction, a 60 mil HDPE liner, Geotextile and Geosynthetic material, Rip Rap and roadway construction.

Based on the size of a pond needed for 20-year storage of ash from 50/50 coal usage, estimated design and construction costs total approximately $9.8 million. Appendix A provides a breakdown. These costs are present-day, and are exclusive of the cost to purchase additional land for construction, if necessary.

4.1.1.2.5 Environmental Analysis of Alternative

Construction and operation of a new ash pond would require obtaining a National Pollutant Discharge Elimination System (NPDES) Wastewater permit from the North Carolina Division of Water Quality. The permit application would require sealed engineering drawings, construction plans and specifications on the pond, pollutant loadings and possible flow modeling to demonstrate compliance with surface water standards. The permit would provide authorization to construct the pond and assess limits on pollutant levels in the runoff from the pond upstream of the receiving water body.

MACTEC anticipates that a liner would be required for the pond to protect groundwater quality in the surrounding area. The liner should have a minimum thickness of 60 mil and be constructed of HDPE.

New dam construction normally require approval from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

A Stormwater General Permit would also be required for construction of the pond under the NCDWQ Phase II Stormwater program. The permit would cover protection of stormwater quality from construction site runoff, and would require development, submittal, and implementation of an Erosion and Sediment Control plan for runoff from the site.

4.1.1.2.6 Risk Assessment of Alternative

Construction of a new ash pond is an effective long-term ash management strategy; however, available land would be required considering appropriate buffers for protection of existing surface water quality. There is also an inherent risk in the design and construction of any new containment structure when considering dike stability and erosion. As with the introduction of any new ash management program, proper maintenance is required to ensure long-term goals are met and the pond filling schedule is consistent with the projected fill pattern. Proper pond freeboard must be maintained to account for design storms and safety factors, and erosion prevention measures must be continually conducted over the life of the pond.

5 Recommended Ash Management Strategic Approach

5.1 Short Term Approach

To achive short term goals of pond discharge complaince and maximizing remaining usable life, MACTEC recommends a sequence of the following activities:

1) Movement of ash line from Unit 3 to northern end of pond;
2) Implementation of the diversion baffle system;
3) Implementation of a cyclic ash excavation or dredging and stacking program from the main pond to the filled area in the western section of the pond; and
4) Raising the pond level through a riser extension (only if no other option can be implemented due to increased risk of reaching limits on discharge with the pond full).

The baffles should be installed at depths of approxiately nine and thirteen feet, and extend from the northern and eastern shoreline to the southern and western shoreline to promote flow of ash to the deeper sections in the center of the pond. The baffles should be anchored to the banks of the pond using stainless steel cables, and be equipped with flotation pockets to mainatin a vertical position in the pond and maintain stability. When the ash accumulation along the baffles reaches a level where solids concentrations in the effluent begin to indicate that retention time has been reduced, the baffles can be re-positioned in the pond to direct ash flow into deeper areas.

The baffles could be used in conjunction with a dig-and stack program or riser extension, as an effective short term pond management strategy. The attractiveness of using the baffles as an initial short term strategy is their versatility for use in a variety of conditions in the pond. The curtains can be shortened and lengthened in sections whenever necessary, and the baffle length can be modified by doing so. This modification can be performed whenever the available volume of the pond changes to take full advantage of the pond's volume. As ash buildup occurs in various locations within the pond, the baffles can even be moved to promote additional settlement away from those areas and into deeper areas of the pond. Current volume estimates based on soundings indicate that, assuming the baffles operate as expected, the existing pond may have as much as 6 years of life at the present operating level with present coal LOI and ash percents. If opportunity coal is used exclusively, the life of the pond is cut in half. After baffles are placed, there is room to conduct several cycles of excavating and stacking to increase pond life.

The dig and stack cycles in the pond provide an additional 10.2 years of storage. Planning of the excavation/stacking program should be started within the next three years; after the performance of the baffles is evaluated. The excavation/stacking plan can be based on the plan used for the Weatherspoon ash pond in 2002, as well as the basis for cost development. The western portion of the 1980 pond has sufficient room to allow multiple digging and stacking cycles; the volume of material removed from the eastern areas of the pond will be limited to the maximum excavation depth that can be achieved accounting for dewatering needs; previous excavation work has shown this depth to be six feet. Additional excavation depth may be achieved through installation of rim ditches and bleed channels in the dig area for conveyance of entrained surface and storm water.

Through a branched sluice pipe network, pond filling can be coordinated with the excavation cycles to create a balanced system of filling and digging. The main area of the pond can be regulated to backup status; ash influent to the pond can be directed into the dig area as additional space is created.

At the conclusion of the fourth dig and haul cycles, the pond level can then be raised two feet through riser extension to achieve an additional 1.8 years of storage. This can be done within one year after the last dig, since each dig cycle provides 1.5 years of ash storage in the pond.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

5.2 Long Term Approach

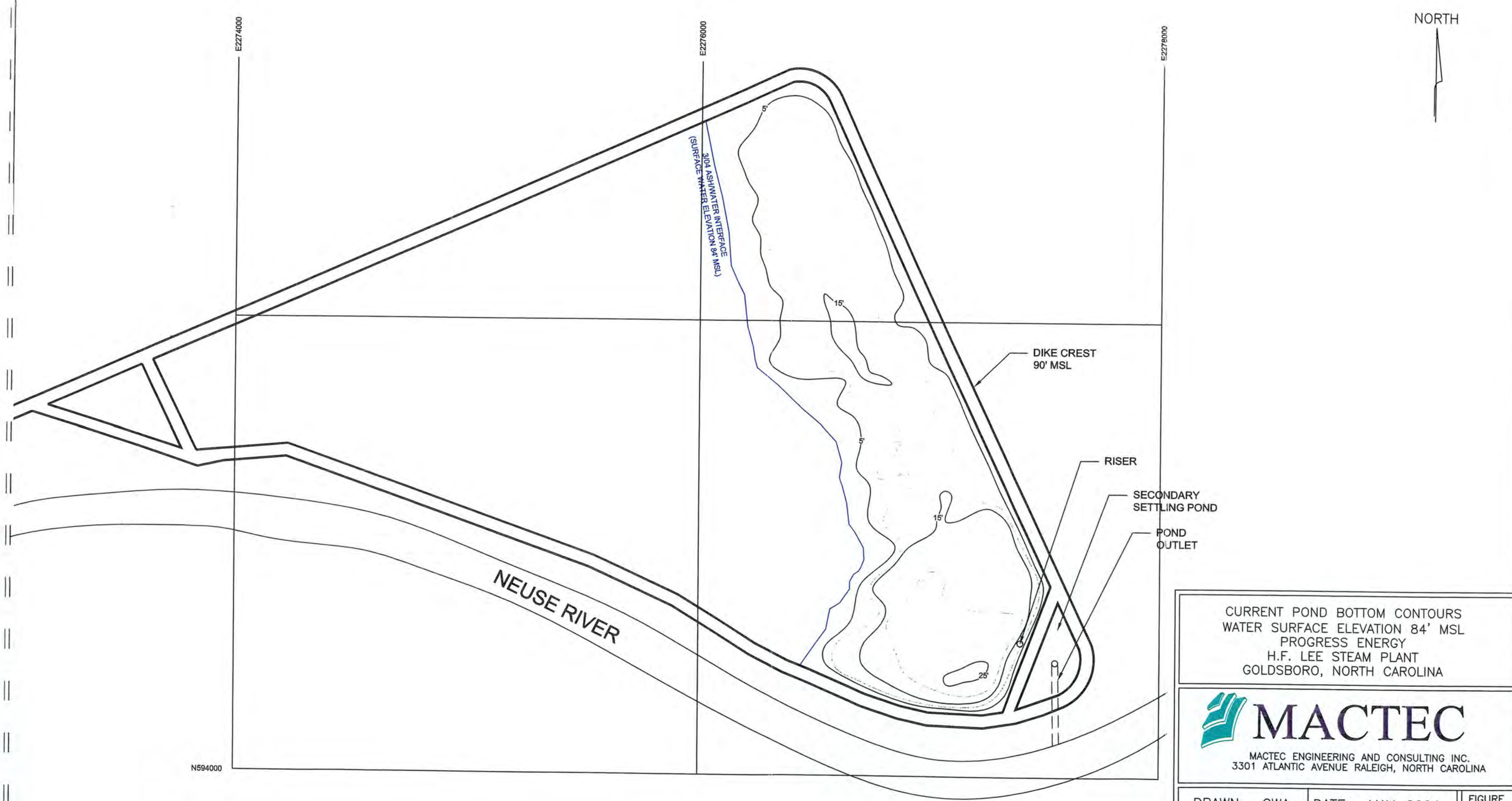
A long term ash management strategy would employ the combination of the ash excavation and stacking program with the use of Geotubes to extend the storage life to 20 years. The proposed Geotube configuration is provided in Figure 5; other configurations are possible depending on available space and the cell configuration. Geotubes can be used exclusively to achieve 20 years of ash storage, or in conjunction with the dig and stack program. Combining the two alternatives reduces the number and cost of Geotubes required to store ash over the 20-year planning interval, thus requiring less space in the pond for Geotube placement. Geotubes provide an option to store and de-water ash for future beneficial re-use or us as structural components in future dike construction.

A long-term concept that could also be considered is the construction of a regional ash landfill and conversion of the plant ash handling to a dry system. The costs of implementing a dry ash system are relatively high. Previous studies at the Asheville plant indicate costs on the order of $2 million for the ash handling system and $155 million for construction of a regional landfill. Based on conversations with Progress Energy personnel in previous studies, offsite transport is not economically feasible and represents a liability in terms of transportation mishaps that could potentially release ash into the environment.

A cost comparative analysis of the alternatives evaluated for this study is provided in the Executive Summary. As illustrated in the cost comparison chart, the combined strategy of dig and stack/Geotube installation is the most cost-effective option for a 20-year life.

FIGURES

FIGURES



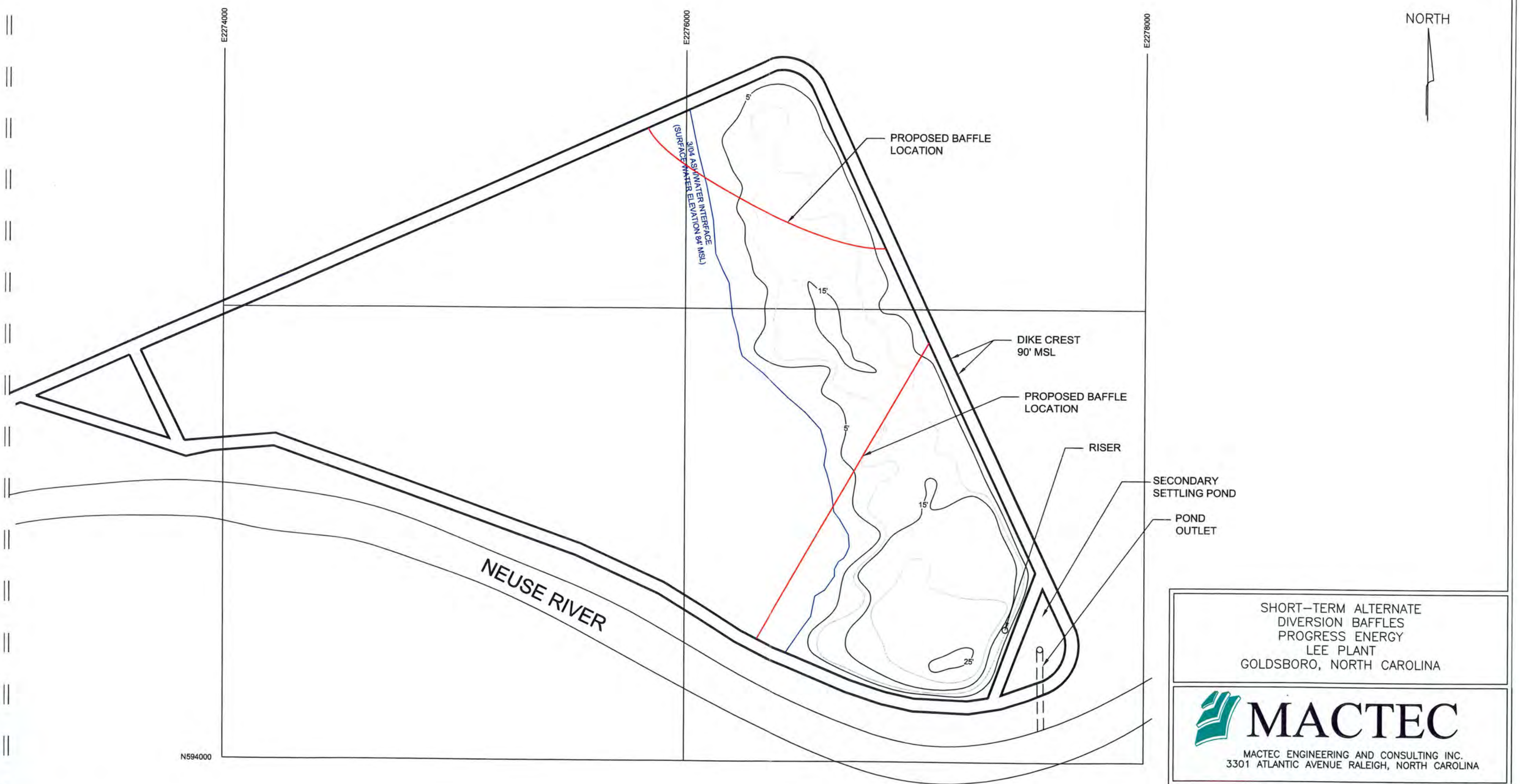
CURRENT POND BOTTOM CONTOURS
WATER SURFACE ELEVATION 84' MSL
PROGRESS ENERGY
H.F. LEE STEAM PLANT
GOLDSBORO, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK:AMR	SCALE: 1"=400'	1
APPROVAL:JAT	JOB: 6468-04-0549	

REFERENCE: POND DESIGN DRAWINGS AND 2/04 MACTEC SOUNDINGS



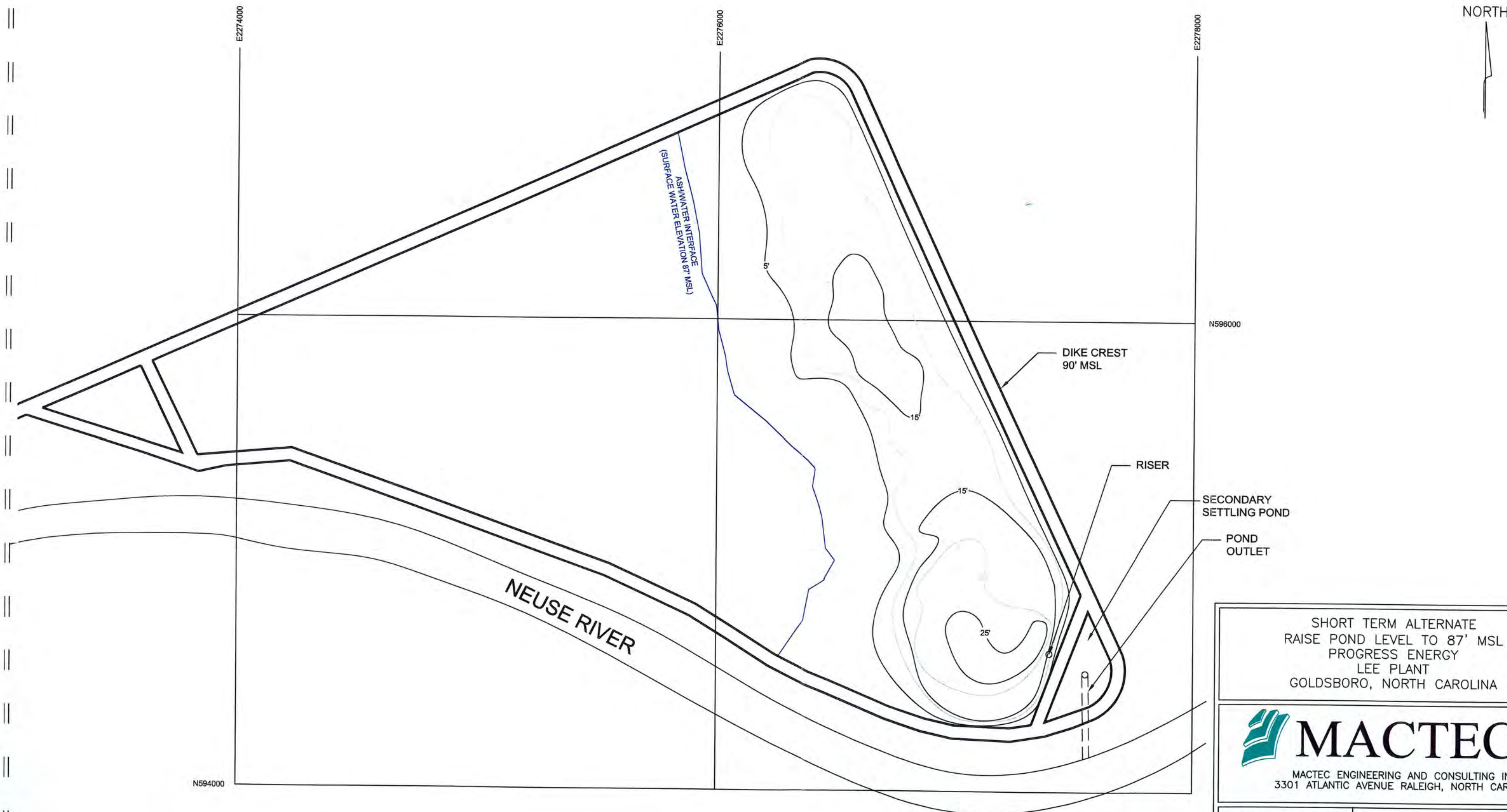
REFERENCE: POND DESIGN DRAWINGS AND 2/04 MACTEC SOUNDINGS

SHORT–TERM ALTERNATE DIVERSION BAFFLES
PROGRESS ENERGY
LEE PLANT
GOLDSBORO, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY–2004	FIGURE
DFT CHECK:AMR	SCALE: 1"=400'	2
APPROVAL:JAT	JOB: 6468-04-0549	



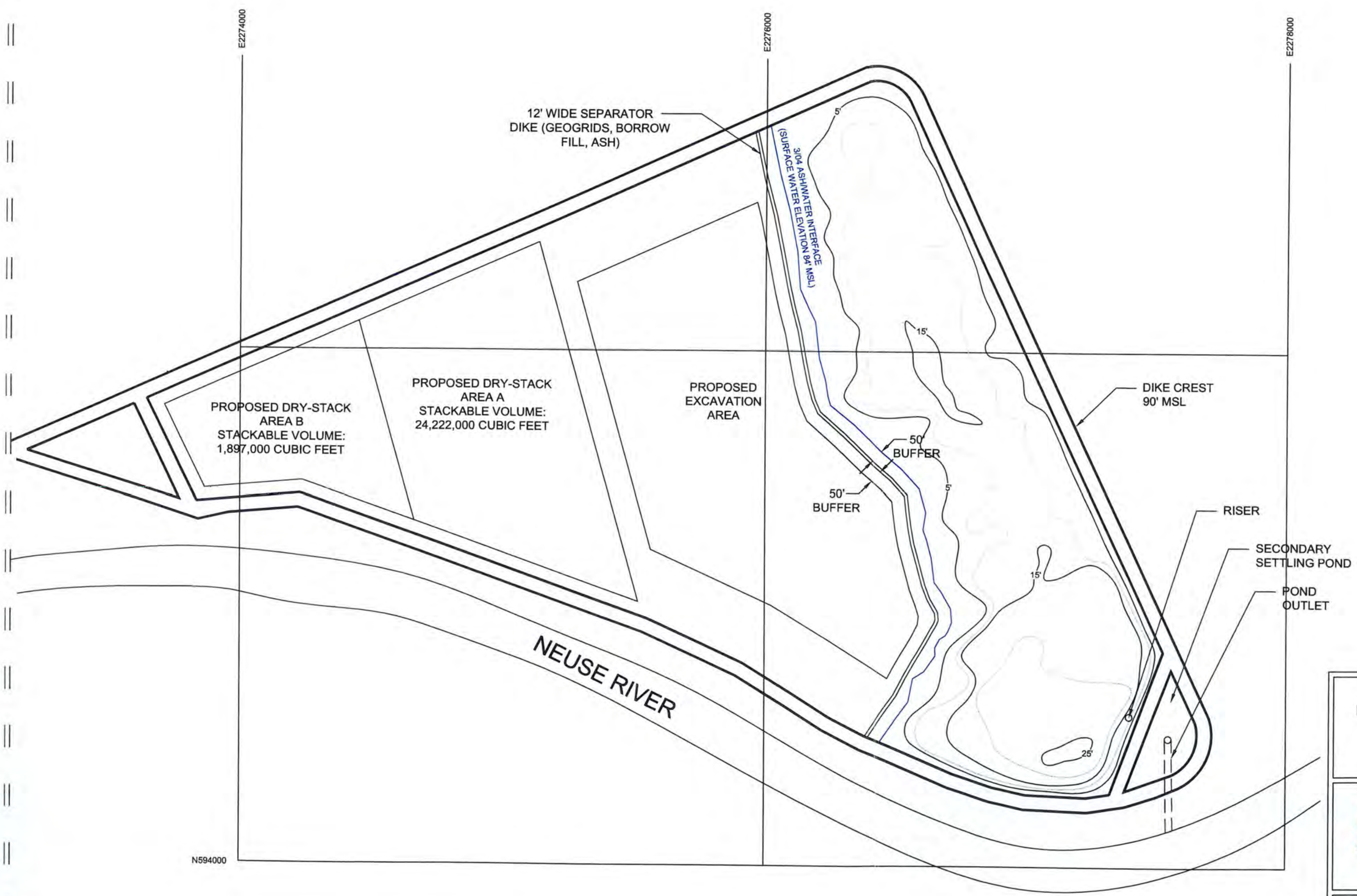
SHORT TERM ALTERNATE
RAISE POND LEVEL TO 87' MSL
PROGRESS ENERGY
LEE PLANT
GOLDSBORO, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

REFERENCE: POND DESIGN DRAWINGS AND 2/04 MACTEC SOUNDINGS

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK:AMR	SCALE: 1"=400'	3
APPROVAL:JAT	JOB: 6468-04-0549	



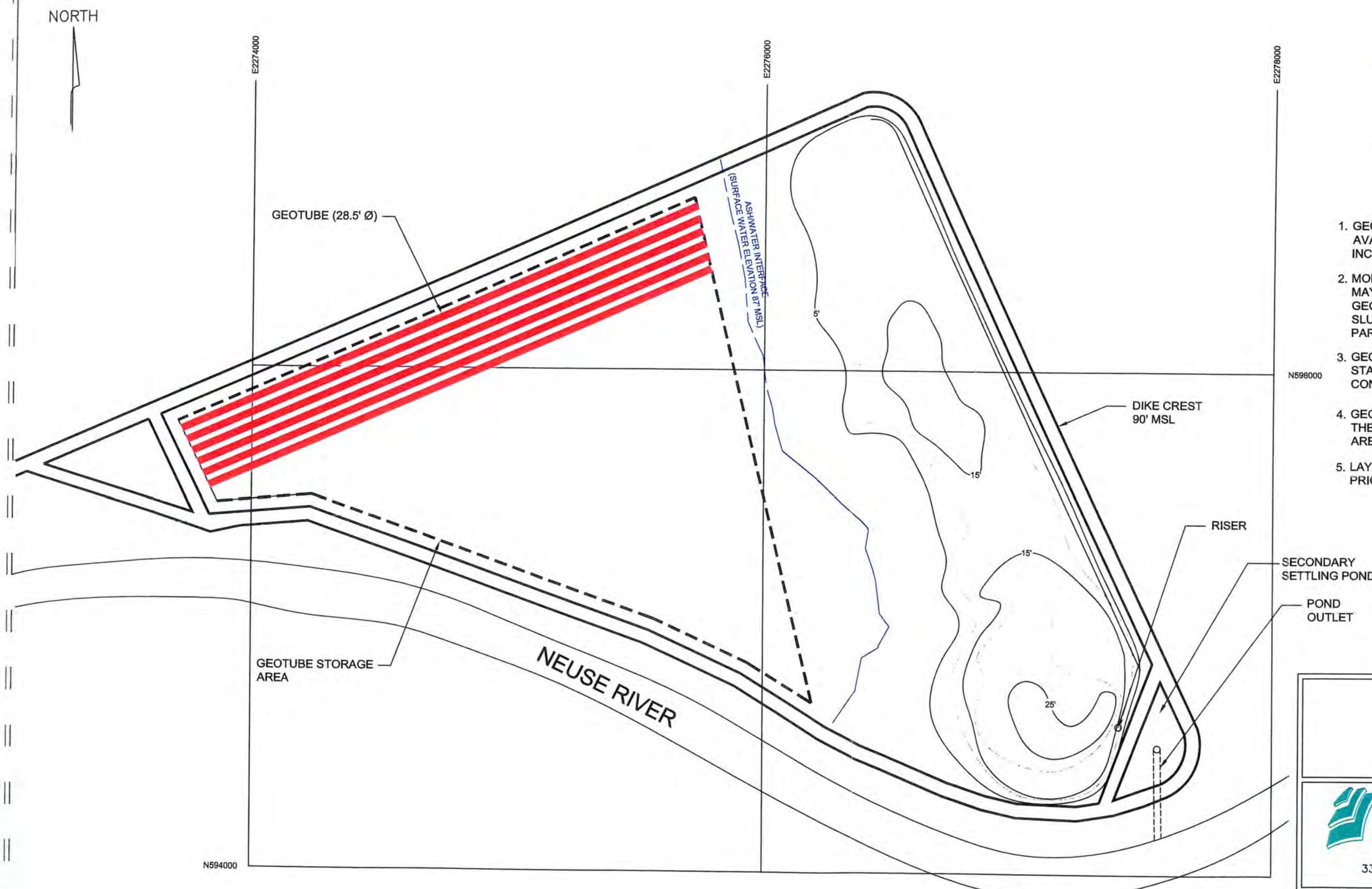
SHORT TERM ALTERNATE
EXCAVATE, HAUL AND DRY-STACK (84' MSL)
PROGRESS ENERGY
LEE PLANT
GOLDSBORO, NORTH CAROLINA

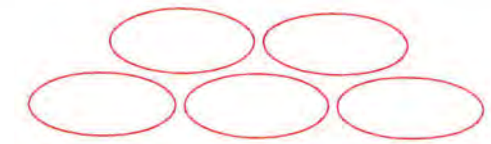
MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK:AMR	SCALE: 1"=400'	4
APPROVAL:JAT	JOB: 6468-04-0549	

REFERENCE: POND DESIGN DRAWINGS AND 2/04 MACTEC SOUNDINGS





STACKED GEOTUBES

* UPON COVERING THE STORAGE AREA, ADDITIONAL LAYERS OF GEOTUBES WILL BE ADDED TO ACCOMODATE 20 YEARS OF ASH STORAGE

NOTES

1. GEOTUBE STORAGE AREA BASED ON CURRENT AVAILABLE AREA. STORAGE AREA MAY BE INCREASED AS ASH POND IS FILLED.
2. MODIFICATIONS TO CURRENT ASH SLUICE PUMPS MAY BE REQUIRED TO ACCOMODATE THE PROPOSED GEOTUBE STACKING. EVALUATION OF THE ASH SLUICE PUMPS HAS NOT BEEN PERFORMED AS PART OF THIS PROJECT.
3. GEOTUBES CAN BE USED AS A LONG-TERM STAND-ALONE ASH MANAGEMENT STRATEGY OR IN CONJUNCTION WITH A DIG AND STACK PROGRAM.
4. GEOTUBES SHOWN IN LAYOUT ARE A PORTION OF THE TOTAL NUMBER PROPOSED FOR STORAGE AND ARE SHOWN FOR ORIENTATION PURPOSES.
5. LAYOUT SHOWN ASSUMES POND LEVEL RAISED PRIOR TO BEGINNING GEOTUBE USE.

LONG–TERM ALTERNATE
GEOTUBE LAYOUT
PROGRESS ENERGY
LEE PLANT
GOLDSBORO, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY–2004	FIGURE 5
DFT CHECK:AMR	SCALE: 1"=400'	
APPROVAL:JAT	JOB: 6468–04–0549	

REFERENCE: POND DESIGN DRAWINGS AND 2/04 MACTEC SOUNDINGS

TABLES

TABLES

TABLE 1.

LEE ASH POND STATISTICS

Plant Coal Usage	Current- 592K tons; max projected-729K tons (2007)
Pond Size and Capacity	143 acres; 1,980 acre-ft
Design Pond Max Elevation, ft	88 (limited to 87.4 by dike crest low spots)
Present Pond Operating Elevation, ft	? (Riser fell over) was approx. 84
Age and Construction	24 years, 1980
Ash Production as % of Coal Usage	10%(contract coal); 20% (opportunity coal)
Annual Ash Production (contract coal), adjusted for LOI and different unit usage	Current -74,025 tons; maximum projected – 91,125 tons (2007); 5-yr projected average – 80,529 tons
Annual Ash Production (opportunity coal) adjusted for LOI and different unit usage	Current- 148,050 tons; maximum projected – 182,250 tons (2007); 5-yr projected average – 161,058 tons
Ash Volume in Pond	1,268 acre-ft
Theoretical Pond Capacity at elevation 84 feet	21,546,243 cubic feet (592,522 tons)
Projected Life for 50/50 coal mix and average use at elevation 84 feet*	3.7 yrs
Theoretical Pond Capacity at elevation 87.4 feet	28,878,960 cubic feet (794,170 tons)
Projected Life for 50/50 coal mix and average use at elevation 87.4 feet*	4.9 yrs
Ash Interface Line to Pond Outfall (distance)	610 ft (min)
Daily Average Ash Sluice Discharge Rate	1.0 MGD
Daily Average Pond Discharge Rate	0.9 MGD
Average Water Velocity	0.15 fps
Average Ash Settleability Rate	99% in 15 minutes (1)
Ash Settling Distance	135 ft.
Pond NPDES Requirements	TSS-Monthly Ave- 30 mg/l, Daily Max- 100 mg/l
	Chronic Toxicity (1.41%)
	pH- 6 to 9

(1) Ash settleability rate based on hydrometer testing of ash samples collected from Cape Fear ash pond. Settleability rates may vary between ponds and are dependent upon the coal sources.

2) Based on top of dike elevation at 90 ft from Progress Energy survey.

*Assuming fill up to 75% of remaining theoretical volume. See graph following Table 3 for illustration of change in projected life for varying percentages of opportunity coal.

Table 2.
Coal Use Projected Breakdown- 2004-2009
Progress Energy Carolinas
H.F. Lee Steam Plant

Year	Projected Annual Coal Usage, Tons
2004	592,200
2005	546,200
2006	677,900
2007	729,100
2008	692,200
2009	627,800
Average	644,233
Maximum	729,100

Source: Annual Coal Unit Summary, Carolinas

Table 3.
Summary of Coal Usage (2004-2009) and Resultant Pond Life
Progress Energy Carolinas
Lee Steam Plant
Goldsboro, NC
MACTEC Project No. 6468-04-0549

	Maximum (2007)	Current	Average
Contract Coal Usage			
Coal Usage 5-yr Projection (tons)	729,000	592,200	644,233
Coal % as Ash	10	10	10
Ash Production (tons)	72,900	59,220	64,423
Coal % as LOI	20	20	20
Annual Ash/LOI Productions (tons)	91,125	74,025	80,529
Opportunity Coal Usage			
Coal Usage 5-yr Projection (tons)	729,000	592,200	644,233
Coal % as Ash	20	20	20
Ash Production (tons)	145,800	118,440	128,847
Coal % as LOI	20	20	20
Annual Ash/LOI Productions (tons)	182,250	148,050	161,058

Theoretical Pond vol at el 84 ft msl (ft^3)	21,605,668			
Theoretical Pond vol at el 87.5 msl (ft^3)	28,938,385	Net add'l		7,332,717
Theoretical Pond vol at el 84 ft msl (tons @ 55pcf)	594,156	Area at 139		2,095,062.0
Theoretical Pond vol at el 87.5 msl (tons at 55 pcf))	795,806			
Added Pond Volume if raise dike 6' (ft^3)	37,374,480		1,027,798 tons	
Added pond volume with 6' dike raise and stack area out (ft^3)	24,540,000		674,850 tons	

Estimated Remaining Pond Life Blending Contract Coal and Opportunity Coal- Current Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Pond life, years	
			elev 84	elev 87.4
100	0	74,025	6.0	8.1
90	10	81,428	5.5	7.3
80	20	88,830	5.0	6.7
70	30	96,233	4.6	6.2
60	40	103,635	4.3	5.8
50	50	111,038	4.0	5.4
40	60	118,440	3.8	5.0
30	70	125,843	3.5	4.7
20	80	133,245	3.3	4.5
10	90	140,648	3.2	4.2
0	100	148,050	3.0	4.0

Estimated Remaining Pond Life Blending Contract Coal and Opportunity Coal- Ave 5-yr Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Pond life, years			
			elev 84	elev 87.4	6' Dike Raise*	6' Dike Raise**
100	0	80,529	5.5	7.4	9.6	6.3
90	10	88,582	5.0	6.7	8.7	5.7
80	20	96,635	4.6	6.2	8.0	5.2
70	30	104,688	4.3	5.7	7.4	4.8
60	40	112,741	4.0	5.3	6.8	4.5
50	50	120,794	3.7	4.9	6.4	4.2
40	60	128,846	3.5	4.6	6.0	3.9
30	70	136,899	3.3	4.4	5.6	3.7
20	80	144,952	3.1	4.1	5.3	3.5
10	90	153,005	2.9	3.9	5.0	3.3
0	100	161,058	2.8	3.7	4.8	3.1

Estimated life taken as 75% theroetical volume and ash unit weight of 55 pounds per cubic foot
*around whole pond
** around unstacked area of pond

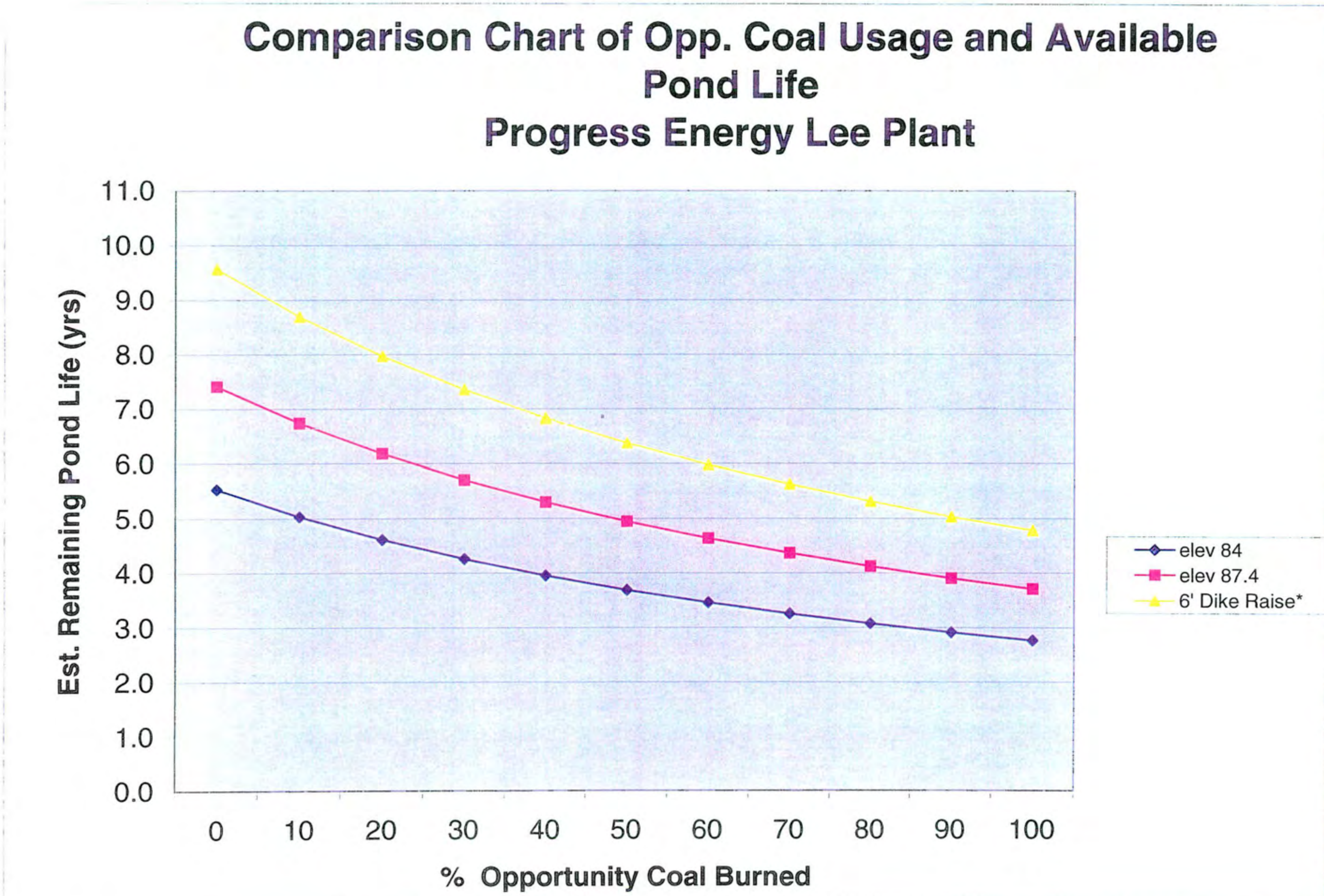

Comparison Chart of Opp. Coal Usage and Available Pond Life
Progress Energy Lee Plant
Est. Remaining Pond Life (yrs)
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
10
20
30
40
50
60
70
80
90
100
% Opportunity Coal Burned
elev 84
elev 87.4
6' Dike Raise*

Table 4.
Ash Pond Present Volume Determination
Progress Energy Carolinas
Lee Steam Plant
MACTEC Project No.: 6468-04-0549

	Available Ash Storage - Main Ash Pond						
Depth Contour	Surface Area (ft^2)	Average Area (ft^2)	Thickness (ft)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (yd^3)	Cumulative Volume (tons)
0	11,885						
		102,458	5	512,290	512,290	18,974	14,088
5	193,031						
		339,922	5	1,699,610	2,211,900	81,922	60,827
10	486,813						
		773,279	5	3,866,395	6,078,295	225,122	167,153
15	1,059,745						
		1,310,307	5	6,551,533	12,629,828	467,771	347,320
20	1,560,868						
		1,783,283	5	8,916,415	21,546,243	798,009	592,522
25	2,005,698						
Theoretical Vol.				-	21,546,243	798,009	592,522
75% Theoretical					16,159,682	598,507	444,391
From Elev 84 to elev 87.5 adds theoretical volume				7,332,717	28,878,960		794,171
75% of total					21,659,220		595,629

APPENDIX A

APPENDIX A
COST ESTIMATES

ENGINEERING COST ESTIMATES
ASH HANDLING OPTIONS
LEE PLANT

The workshop meetings on March 18, 2004 and April 27, 2004 resulted in identifying installation of baffles as the initial ash pond management approach to allow more efficient use of the pond. After baffles are placed, there is room to conduct several cycles of excavating and stacking. The attached sheet shows a possible timeline for four episodes of excavating and stacking.

Longer term approaches are to raise the dikes, construct a new ash pond (20-yr capacity) or use geotubes.

The preliminary estimated costs in today's dollars for the options are as follows:

- Baffles — $ 45,000
  - Engineering $ 9,000
  - Construction $ 35,000

- Excavate and Stack four cycles of approximately 1.5 years of ash each over 10.2 years. See attached Time Line for more information. After 10.2 years, there is no more ash storage capacity, and another short-term option (raising the pond operating level)can be implemented. The stacking will have altered how the long-term options can be implemented. — $3,534,700

o Engineering	$ 40,000	Cost per year (50/50 and avg)	$346,540
o Construction	$ 2,896,000	Cost per ton/yr	$ 1.91
o Separator Dike Construction	$ 266,700		
o Soil Cap	$ 242,000		
o Drainage/Erosion Control	$ 30,000		
o Discharge Pipe Mods	$ 50,000		
o Additional Riser Construction (1)	$ 10,000		

For longer term projects, three options exist:

- Raise Dikes 6 feet (previous study, adds 6.4 yrs at 50/50 and avg coal use and pond at present elev) $3,172,000

o Engineering and Permitting	$ 80,000	Cost per year (50/50 and avg)	$495,625
o Construction Monitoring	$ 92,000	Cost per ton/yr	$ 4.09
o Construction	$3,000,000		

- Construct New 20-yr Pond (50/50 and avg coal use) — $9,950,000, w/o land cost

o Design and Permitting	$ 170,000	Cost per year	$497,500
o Construction Monitoring	$ 280,000	Cost per ton/yr	$ 4.12
o Construction	$9,500,000		
o Land needed ~192 acres	$???		

- Install Geotubes:

As a Stand-Alone Strategy for 20-year storage: — $10,228,900

o Engineering Design and Permitting	$ 20,000	Cost per year	$511,445
o Geotubes	$ 8,115,008	Cost per ton/yr	$ 4.23
o Ash Line Manifold	$ 52,000		
o Construction	$ 2,041,769		

In conjunction with a Dig-and-Stack Strategy (8-year storage): — $4,125,400

o Engineering Design and Permitting	$ 20,000	Cost per year	$515,675
o Geotubes	$ 3,246,000	Cost per ton/yr	$ 4.27
o Ash Line Manifold	$ 52,000		
o Construction	$ 824,500		

In conjunction with a Dig-and-Stack Strategy plus raising dike (2-year storage): — $1,100,000

o Engineering Design and Permitting	$ 20,000	Cost per year	$550,000
o Geotubes	$ 811,500	Cost per ton/yr	$ 4.55
o Ash Line Manifold	$ 52,000		
o Construction	$ 215,800		

POSSIBLE TIME LINE FOR LEE EXCAVATE AND STACK APPROACH ASSUMING 50/50 MIX OF COALS AND AVERAGE COAL USAGE

Duration of Activity (yrs)	Elapsed Time (yrs)	Activity	Main Pond Capacity Left (yrs)	Capacity Added by Activity	Total Time Left in Pond (yrs)
Now	0		3.7	0	3.7
1.0	1.0	Plan and Permit	2.7	0	2.7
0.8	1.8	Bid and first dig	1.9	1.5	3.4
1.5	3.3	Fill in first dig	1.9	0	1.9
0.8	4.1	Execute 2nd dig	1.0	1.5	2.5
1.5	5.6	Fill in 2nd dig	1.0	0	1.0
0.8	6.4	Execute 3rd dig	1.0	1.5	2.5
1.5	7.9	Fill in 3rd dig	1.0	0	1.0
0.8	8.7	Execute 4th dig	0.2	1.5	1.7
1.5	10.2	Fill in 4th dig	0.2	0	0.2
0.2	10.5	Raise pond level to 87.4 msl	0.0	1.8	1.8

After 4th dig, available pond area is too full to have room to store additional ash for a 5th dig, So, approximate life extension by digging and stacking is 10.2 yrs. After that, option to raise operating level of pond is available, and can achieve 1.8 additional years of storage.

At the request of Ricky Miller, one year of elapsed time was added to the beginning of the time line.

If take dig and stack costs as $4.00 per ton stacked, assume 1.5 years of ash at 50/50 and average use is 181,000 tons, and ignore inflation, the total cost for 4 dig and stacks is 4(181,000)($4.00) = ~$2,896,000.

LEE
50-50 AVE ASH

Pond Design Lee

Ash Production (tons/yr)	120,794
Pond Life (yrs)	20
Pond Height (ft)	20
Pond Freeboard (ft)	2
Necessary Pond Excess (%)	25
Necessary Volume (ft^3)	100,661,667
Pond Length (ft)	3,525
Pond Width (ft)	1,750
Pond Surface Area (top)	6,168,750
Pond Surface Area (bottom)	5,610,714
Dike Slope Area	667,241
Pond Volume (ft^3)	100,887,876
Pond Outside Footprint (acres)	160.30
Land Area to purchase (acres)	192.36

Pond Construction

Excavation Depth (ft)	2.1
Excavation Volume (ft^3)	12,884,315
Dike Perimeter (ft)	10,550
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20
Dike Volume (ft^3)	13,917,877

LEE
50-50 AVE ASH

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	2%	construction cost	$9,342,985	$168,174
Construction Testing/Monitoring	3%	construction cost	$9,342,985	$280,290
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	6,168,750	ft^2	$0	$246,750
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	477,197	yd^3	$3.00	$1,431,591
Soil Placement	515,477	yd^3	$5.00	$2,577,385
Sand Subgrade	232,517	yd^3	$5.00	$1,162,584
60 mil HDPE Liner	6,796,431	ft^2	$0.47	$3,194,323
Geosynthetic (Geogrid)	24,713	yd^2	$2.75	$67,960
Geotextile (wave protection)	3,907	yd^2	$1.80	$7,033
Rip Rap	16,880	tons	$22	$371,360
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$9,791,448
Construction Only (total less design and cmt				$9,342,985

GEOTUBE DESIGN
PROGRESS ENERGY CAROLINAS
LEE PLANT

Design Criteria and Specifications	
Avearge Annual Ash Production[1] (tons/yr)	120,794
Ash Production (yd^3/yr)	149,128
Geotube Life (yrs)[2]	20
Necessary Storage Volume (yd^3)	2,982,568
Storage Area (ft^2)	2,852,560
Storage Area - Average Length (ft)	2,000
Storage Area - Average Width (ft)	1,500
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	1,500
Geotube Area (ft^2)	42,750
Geotube Volume - Total (ft^3)	956,909
Geotube Volume - Ash (ft^3)	669,837
Geotube Volume (yd^3)	24,809
Number of Geotubes	120
Total Geotube Area (ft^2)	5,139,505
Geotube Levels	2.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	20,000	$20,000
Geotube	180,334	ft	$45	$8,115,008
Ash Line Manifold (12" diameter)	3,530	ft	$14.75	$52,068
Geotube and Line Installation	25%	construction cost	$8,167,076	$2,041,769
			Total Cost	$10,228,845

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
LEE PLANT

Design Criteria and Specifications	
Avearge Annual Ash Production[1] (tons/yr)	120,794
Ash Production (yd^3/yr)	149,128
Geotube Life (yrs)[2]	8
Necessary Storage Volume (yd^3)	1,193,027
Storage Area (ft^2)	2,852,560
Storage Area - Average Length (ft)	2,000
Storage Area - Average Width (ft)	1,500
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	1,500
Geotube Area (ft^2)	42,750
Geotube Volume - Total (ft^3)	956,909
Geotube Volume - Ash (ft^3)	669,837
Geotube Volume (yd^3)	24,809
Number of Geotubes	48
Total Geotube Area (ft^2)	2,055,802
Geotube Levels	1.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	$20,000	$20,000
Geotube	72,133	ft	$45	$3,246,003
Ash Line Manifold (12" diameter)	3,515	ft	$14.75	$51,846
Geotube and Line Installation	25%	construction cost	$3,297,850	$824,462
			Total Cost	$4,142,312

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
LEE PLANT

Design Criteria and Specifications	
Avearge Annual Ash Production[1] (tons/yr)	120,794
Ash Production (yd^3/yr)	149,128
Geotube Life (yrs)[2]	2
Necessary Storage Volume (yd^3)	298,257
Storage Area (ft^2)	2,852,560
Storage Area - Average Length (ft)	2,000
Storage Area - Average Width (ft)	1,500
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	1,500
Geotube Area (ft^2)	42,750
Geotube Volume - Total (ft^3)	956,909
Geotube Volume - Ash (ft^3)	669,837
Geotube Volume (yd^3)	24,809
Number of Geotubes	12
Total Geotube Area (ft^2)	513,951
Geotube Levels	0.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	$20,000	$20,000
Geotube	18,033	ft	$45	$811,501
Ash Line Manifold (12" diameter)	3,500	ft	$14.75	$51,625
Geotube and Line Installation	25%	construction cost	$863,126	$215,781
			Total Cost	$1,098,907

APPENDIX B

APPENDIX B
GEOTUBE INFORMATION

Dewatering & Containment Technologies, Inc.

Geotube Volume Spreadsheet

Known Flow Rates

Input

Project Name:	Progress Energy
Date:	30-Mar-04
Materials Information:	
Type of Material to be Dewatered	Fly Ash
Specific Gravity of Solids Within The Sludge	1.40
Percent Solids of the Insitu Sludge	35.0
Bulking Factor of The Sludge While Pumping or Dredging	1[illegible]
Target Percent of Solids After Dewatering With Geotubes	70
Percent of Solids Estimated In Effluent Water	0.000
Percent of Course Grain Solids in The Insitu Sludge	3%
Production Rates:	
Dredge / Pumping Operation Rate (GPM)	1750
Dredge / Pumping Operation (Hours Per Day)	16.00
Dredge / Pumping Operation (Days Per Year)	1.00
Geotube Costs ($ Lin. Ft.):	
30 Ft. Circumference	
45 Ft. Circumference	
60 Ft. Circumference	
90 Ft. Circumference	

Output

Production Rates:			
Production Volume Wet (gal/day)		1,680,000	
Production Volume Wet (cy/day)		8,317	
Production Volume Wet (tons/day)		7,785	
Production Volume Wet (cy/yr)		8,317	
Production Volume Wet (tons/yr)		7,785	
Bone Dry (tons/year)		2,725	
Bone Dry (tons/day)		2,724.59	
Reduction Due To Dewatering:			
Reduction Factor		2.25	
Dewatered Volume (cy/yr)		3,585	
Dewatered Volume (tons/yr)		4,035	
Geotube Cost:		**Length (ft.)**	**Total $**
30 Ft. Circumference	9.5 ø	2,131	$ 30,673.34
45 Ft. Circumference	14.3 ø	1,096	$ 23,567.76
60 Ft. Circumference	19.1 ø	710	$ 20,595.28
90 Ft. Circumference	28.6 ø	412	$ 18,556.37

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

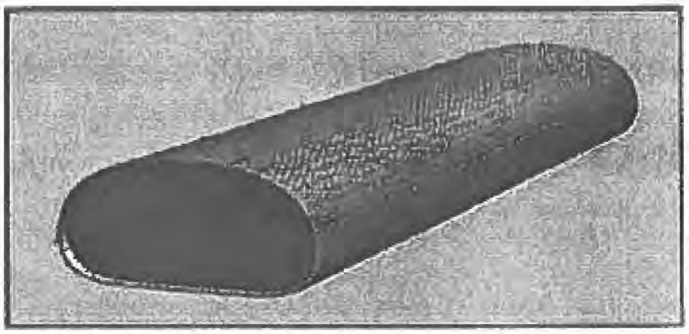
Pond Design Cape Fear	
Ash Production (tons/yr)	128,400
Pond Life (yrs)	20
Pond Height (ft)	20
Pond Freeboard (ft)	2
Necessary Pond Excess (%)	25
Necessary Volume (ft^3)	107,000,000
Pond Length (ft)	3,650
Pond Width (ft)	1,800
Pond Surface Area (top)	6,570,000
Pond Surface Area (bottom)	5,993,064
Dike Slope Area	689,377
Pond Volume (ft^3)	107,770,176
Pond Outside Footprint (acres)	170.11
Land Area to purchase (acres)	204.13
Pond Construction	
Excavation Depth (ft)	1.9
Excavation Volume (ft^3)	12,417,509
Dike Perimeter (ft)	10,900
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20
Dike Volume (ft^3)	14,658,647

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	2%	construction cost	$11,718,690	$210,936
Construction Testing/Monitoring	3%	construction cost	$11,718,690	$351,561
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	6,570,000	ft^2	$0	$262,800
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	459,908	yd^3	$3.00	$1,379,723
Soil Placement	542,913	yd^3	$5.00	$2,714,564
Sand Subgrade	247,498	yd^3	$13.00	$3,217,471
60 mil HDPE Liner	7,231,852	ft^2	$0.47	$3,398,971
Geosynthetic (Geogrid)	25,532	yd^2	$2.75	$70,214
Geotextile (wave protection)	4,037	yd^2	$1.80	$7,267
Rip Rap	17,440	tons	$22	$383,680
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$12,281,188
Construction Only (total less design and cmt				$11,718,690

Dewatering & Containment Technologies, Inc.



What is a Geotube®?

Geotubes® are constructed out of high strength woven geotextile fabric manufactured by Ten Cate Nicolon. The Geotube® is then fabricated by Miratech, a division c Ten Cate Nicolon.

Designed with appropriate sized openings, the Geotube® retains fill material to do one of two things: if you are using the GT500 it will allow water to permeate through the tube wall, if you use the GT100 for marine applications it will contain all the material for a ver long time.

Geotubes® are custom fabricated with seaming techniques that resist pressures during pumping operations.

e-mail us at:
geotubes@dewatercontain.com

U.S. Postal Address:
P.O. Box 740
Cedar Springs, Michigan 49319
616-784-3681 - Phone
616-784-3685 - Fax

Click on one of the industries below to view case studies

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste & Contaminates	Marine

Home

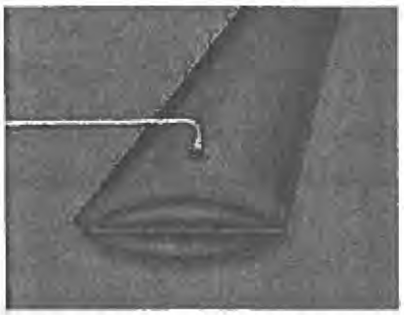
What is a Geotube®?

How it all works

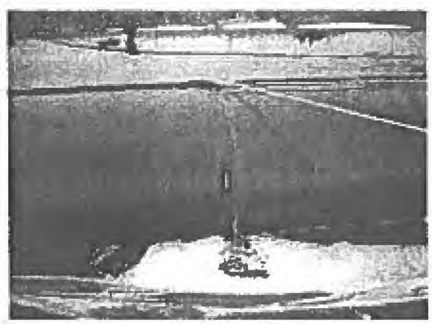
Miratech

Dewatering & Containment Technologies, Inc.

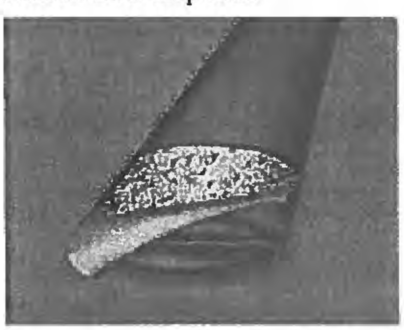
1) The Geotextile tube is pumped with sludge material.




2) As the liquid escapes from the tube, solid particles are trapped inside. The process is repeated until the tube is full.

3) Eventually the solids can be handled as dry material increasing options for transportation and disposal.




e-mail us at:
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Dewatering & Containment Technologies, Inc.

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Dredging a Bay

Wastewater Treatment Plant

Dredging a 25-acre bay

The 25 acre bay was dredged to remove contaminated sediment.

120 Geotubes were installed to dewater over 87,000 cubic meters (95,000 cubic yards) of contaminated sediments

www.dewatercontain.com
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Dewatering & Containment Technologies, Inc.

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Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste	Marine

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Mineral Processing Plant

Mineral Processing Plant

Challenge: All titanium dioxide waste lagoons at this plant had reached capacity. To continue operations, lagoons must be emptied.

Solution: Geotube® containers are an excellent method to dewater industrial by-products. This plant was able to recycle the minerals during the process.

18 m (60') circumference X 61 m (200') long Geotube® containers were used to dewater 68,580 cubic meters (75,000 cubic yards) of sludge.

Pictured to the right is a partially filled Geotube® containing dewatered sludge at 60% solids.

www.dewatercontain.com
e-mail us at:
geotubes@dewatercontain.com

LAW
LAWGIBB Group Member

REPORT OF ASH POND STUDY
CAROLINA POWER & LIGHT COMPANY
WEATHERSPOON STEAM ELECTRIC PLANT
LUMBERTON, NORTH CAROLINA
LAW PROJECT NO. 30720-9-3428

Prepared by:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

August 20, 1999

LAW
LAWGIBB Group Member

August 20, 1999

CP&L
P. O. Box 1551
Raleigh, North Carolina 27602

Attention: Mr. Keith Gettle

SUBJECT: REPORT OF ASH POND CAPACITY EVALUATION
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA
LAW PROJECT NO. 30720-9-3428

Dear Mr. Gettle:

As authorized by CP&L work release 99-05 under Work Authorization XSA 4031042, Law Engineering and Environmental Services, Inc. (Law) has conducted a study of the ash pond capacity and options for ash disposal at the Weatherspoon Plant. Our report is attached.

We appreciate the opportunity of having worked with CP&L on this project. Please contact us if you have questions or comments.

Respectfully submitted,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Timothy L. LaBounty, P.E.
Senior Engineer
Registered, North Carolina 20681

NORTH CAROLINA PROFESSIONAL 8-20-99 SEAL 20681 ENGINEER TIMOTHY L. LABOUNTY

J. Allan Tice, P.E.
Corporate Geotechnical Consultant
Assistant Vice President
Registered, North Carolina 6428

TLL/JAT/tll

Attachments

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

The Weatherspoon Steam Electric Plant consumes an average of approximately 200,000 tons of coal per year. The maximum amount of coal consumed per year from 1992 to 1998 was 300,513 tons of coal in 1998. The plant produces approximately 10 percent of ash by-products from burning coal. This results in an average and maximum amount of ash produced of approximately 20,000 and 30,000 tons per year, respectively. The ash by-product is approximately 10 percent bottom ash and 90 percent flyash. The ash is mixed with water and pumped via an aboveground pipeline into the ash storage impoundment located to the east of the plant. The ash storage impoundment is formed by earthen embankments that include an access road on top.

A review of available ash storage capacity made in 1997 projected there was less than five years of useful storage remaining in the ash storage impoundment. This current report estimates that less than two years of useful storage remains and addresses alternatives available for handling the ash in the future.

The following feasible alternatives for handling ash in the future were evaluated:

- Dike vertical extension with conversion to dry ash system and future vertical expansion;
- Vertical expansion with excavation of active cell and future conversion to dry ash system;
- Vertical expansion without excavation of active cell and future conversion to dry ash system;
- Market ash for beneficial reuse;

The following alternate concepts for handling ash in the future were not evaluated based on discussions with CP&L personnel regarding their feasibility at the Weatherspoon site:

- Construct new ash storage pond;
- Construct dedicated CP&L ash landfill site(s)
- Plant power output load leveling.

The results of the study indicate that finding markets for beneficial re-use coupled with vertical expansion and conversion to a dry ash process represents the only feasible solution for long-term (>20 years) ash management. Beneficial use of ash offsite should be evaluated by CP&L on a case by case basis regarding potential immediate and long-term liability to CP&L. Three alternatives have been provided regarding vertical expansion of the existing ash impoundment area that will require internal evaluation by CP&L in terms of information provided in this and other evaluations, the availability of resources, and projected use of fossil fuel power generation in the future.

2.0 PROBLEM DESCRIPTION

2.1 Historical Background

General information about the plant operation, coal use and ash pond history has been obtained from review of dam safety inspection reports, discussions with CP&L personnel at the Weatherspoon Plant and from site visits.

Ash by-products from coal combustion have been mixed with water to create an ash-water slurry that is pumped through a pipeline to a storage area impoundment located east of the plant (attached CP&L Drawing L-D-6966). The impoundment is constructed of compacted soil earthen embankments (dikes) on top of residual soils at the site. In general, residual soils consist of sand and clayey sand to approximately elevation 100 feet mean sea level (msl). These are underlain by sandy clay and clay that extend from 100 feet msl to at least 80 feet msl.

The ash-water slurry is retained in the impoundment so the ash can settle. The water is discharged through piping systems to a secondary settling basin and ultimately released to the Lumber River. Water quality limits are in effect for the pH and suspended solids of the water released.

The original impoundment, Area B shown on Drawing 4.3.1, was used to store ash until 1979 when the active impoundment was placed in service. Area B was also used to store semi-dry material excavated from the active impoundment in the early 1990's. The active impoundment has a crest elevation of 145 feet (msl) and a design operating level of 143 feet msl. According to the 1995 dam safety inspection, the active impoundment does not have conditions that would present concerns for continued use to its design capacity.

2.2 Active Impoundment Design Information

The active ash impoundment was designed with compacted structural soil fill embankments that were extended to elevation 145 feet msl. Interior and exterior slopes were constructed to 2.5(H):1(V) and 2(H):1(V) angles, respectively.

The CP&L tract is primarily bordered by single-family tracts that are mostly undeveloped. The cooling pond is located adjacent to and south of the active impoundment. The CP&L plant is located adjacent to and west of the active impoundment. Further to the west is the Lumber River. Single-family tracts are located east and north of the active impoundment.

The impoundment design was by CP&L staff. Area B consumes an area of approximately 19 acres and the active impoundment consumes approximately 32 acres. According to CP&L personnel, the design operating level (143 feet msl) provides two feet of freeboard to allow for periodic pH or turbidity adjustments by temporarily raising the water level.

2.3 Storage Capacity Available

In 1997, Trigon Engineering Consultants, Inc. provided a survey of the active impoundment to determine the available and projected storage capacity (Trigon Drawing 1). Their report (reference 1) used contours obtained by conventional land surveying and bottom depth soundings in the spring of 1997. Their report concluded the active impoundment had about 5 years of available storage remaining, assuming a pond operating level of elevation 143 and average ash discharge rates based on data through 1996.

As part of the current ash pond evaluation, Law was requested to review and update the Trigon information regarding available capacity. Based on field survey data collected using conventional and Global Positioning System (GPS) methods and consideration of filling to the design level (143 feet msl) at the maximum annual ash discharge volume rate (300513 Tons/year), we conclude that the existing active impoundment will serve approximately 1.5 years from the present date (Appendix A). The updated survey is provided as Drawing 2.3. Using an average annual discharge volume (200,889 Tons/Year), we conclude that the existing active impoundment will last approximately 2 years from the date of this report. Studies were recommended to determine long-term options for ash disposal.

Based on our review of the Trigon report and consideration of the information we obtained during our evaluation, the estimates of remaining capacity provided by Trigon in 1997 appear consistent with our findings.

2.4 Statement of the Problem

Regardless of variability in capacity estimates due to different ash unit weights, average or maximum discharge rates, ash/coal ratios or coal tonnage burned, the active impoundment is expected to reach its design capacity within 2 years from the present date. Provision for disposition of ash must be available by the time active impoundment design capacity is reached.

3.0 ROOT CAUSE ANALYSIS FOR PROBLEM

The root cause of the problem is the generation of ash from production of power by burning coal combined with the limited available capacity for storage of slurried ash.

4.0 EVALUATION OF ALTERNATIVES

4.1 Technical Factors for Ash

4.1.1 Ash Composition

The ash consists of fine (fly ash) and coarse (bottom ash) portions with the great majority being fly ash. Other than the typical metals found in fly ash, Toxic Characteristic Leaching Procedure (TCLP) constituents such as regulated pesticides, PCBs, herbicides, base/neutral/acid extractables or volatile organics are typically not associated with ash generated at these facilities. No testing of the fly ash for sulfate or resistivity values has been done. These parameters are often of interest when evaluating fly ash for use as fill that would be in contact with buried metal piping.

4.1.2 Ash Unit Weight

Ash properties reported in the ash evaluation study performed for the Asheville facility (reference 2) were utilized for this study.

For freshly-deposited ash, a unit weight of 50 pounds per cubic foot (the lower value used by Trigon in their study) appears reasonable. For ash that has been in place for several years, a unit weight of 68 pounds per cubic foot (the higher number suggested by CP&L as reported by Trigon) appears reasonable. Projecting available storage capacity should account for the variable unit weights related to the time the ash has been in the pond. In our Asheville report, we assigned unit weights as follows:

YEARS SINCE DEPOSITION	DRY UNIT WEIGHT, pcf
0	50
1	53
2	58
3	63
4	68

In summary, for freshly deposited ash, a unit weight of 50 pounds per cubic foot (the lower value used by Trigon in their study) appears reasonable. For ash that has been in place for several years, a unit weight of 68 pounds per cubic foot (the higher number suggested by CP&L as reported by Trigon) appears reasonable.

4.1.3 Ash Production

Historical coal usage at the Weatherspoon Plant , as provided by CP&L, is summarized below.

YEAR	COAL BURNED, tons
1992	256,529
1993	198,169
1994	96,572
1995	116,458
1996	223,079
1997	274,680
1998	300,513
1999	80,950*

* Data through 5/99

The ratio of ash produced to coal burned is reported by Mr. Mark Shilling of CP&L as 10 percent for the Weatherspoon Plant. According to CP&L personnel, about 10 percent of the ash is bottom ash. Using the average and maximum coal usage quantities and the above percentages, 20,088 and 30,051 tons of ash, respectively, is produced per year, requiring placement into the active impoundment or some other form of storage/disposal. CP&L plant personnel expect no significant changes to the trend of coal usage in the foreseeable future.

4.2 Description of Non-Feasible Alternatives

The following conceptual alternatives were not considered feasible solutions for reasons described in the following sections:

- Constructing an additional on-site ash impoundment;
- Constructing a dedicated CP&L ash landfill;
- Load leveling of plant power outputs;

4.2.1 Additional On-site Ash Impoundment

This alternative consists of constructing an additional ash storage impoundment on site. Based on discussions with CP&L personnel at the Weatherspoon facility, review of site plan drawings and field observations, there does not appear to be room available for construction of a new impoundment for long-term usage. An area was identified across the Lumber River that is owned by CP&L that contains enough acreage for constructing an ash impoundment for long-term usage. However, according to CP&L personnel, the majority of the area is considered wetlands and construction would present significant regulatory constraints. A smaller strip adjacent to the west side of the ash impoundment, approximately 80 to 100 feet wide, was identified but this would only provide about 1 year of ash storage capacity. Based on these items, this alternative was not considered feasible at this site.

4.2.2 Dedicated CP&L Landfill(s)

This alternative consists of identifying at least one existing CP&L ash disposal facility on CP&L property as a dedicated facility for the remaining facilities. Ash generated from the remaining facilities would be transported via rail or truck to the dedicated facility. Advantages would be to limit construction, design and permitting costs to the dedicated facility or facilities and the remaining facilities would incur costs related to storing, loading and transporting the ash to a dedicated facility. Based on conversations with CP&L personnel, it appears that offsite transport is not economically feasible. According to Mr. Mark Shilling, CP&L previously evaluated offsite disposal of ash into excavated mines that revealed excessive storage, loading and transportation costs. In addition, offsite transport and disposal of ash represents a liability in terms of transportation mishaps that could potentially release ash into the environment and potential liability should the disposal area present an environmental impact. Based on these items, this alternative was not considered feasible for the Weatherspoon plant.

4.2.3 Plant Load Leveling

This alternative consists of transferring power production requirements from facilities near their ash impoundment capacities to other facilities with more capacity available to decrease the amount of ash generated at the near-capacity facilities. Based on conversations with CP&L personnel, this alternative does not appear feasible in terms of current operating and existing power generation transfer capabilities at the plants.

4.3 Description of Feasible Alternatives

The following conceptual alternatives have been identified as feasible solutions based on our understanding of the site requirements, review of the existing operations and discussions with CP&L personnel. Each is discussed briefly in this section. Section 4.3 contains the technical, safety, reliability, economic, environmental, risk and other issue analyses as appropriate for each alternate.

4.3.1 Dike Vertical Extension/Fill Remaining Capacity/Convert to Dry System/Vertical Expansion

This alternative consists of wet filling the remaining volume of the active impoundment to the design level of 143 feet msl and simultaneously raising the height of the active impoundment dike six feet to elevation 151 feet msl (Drawings 4.3.1, 4.3.1.1 and 4.3.1.2). More recently filled wetter portions of the impoundment (approximately one-fourth of the perimeter) filled to capacity will likely require the use of conventional methods to raise the dike. Following the construction of the dike extension, the new active portion will be lined with a 60 mil high density polyethylene (HDPE) flexible liner based on regulatory and design requirements. Upon completion of the dike vertical extension, wet filling of ash will continue to the new design elevation of 149 feet msl. The existing skimmers and settling basin dikes and the ash discharge pipes will be raised to accommodate the new operating levels. While the dike vertical extension is being filled with wet ash, the plant will be converting the wet ash disposal system to a dry system. After the wet ash vertical extension volume is filled, the plant will dispose of future dry ash by vertically expanding the existing active area and Area B (former ash impoundment/dry stack area). Area B will be lined with 60 mil HDPE liner prior to receiving ash. Following completion of the vertical expansion, the disposal area must be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a 6-inch soil erosion layer that will promote vegetative growth.

4.3.2 Fill Remaining Volume/Construct Berm/Excavation-Dry Stack/Vertical Expansion

This alternative consists of wet filling the remaining volume in the active impoundment during the construction of a divider berm along the existing ash-water interface (Drawing 4.3.2). Ash on the dry side (west side) of the berm will be excavated to a depth of approximately 11 feet below land surface (bls) and transported and stockpiled in a semi-dry state to Area B. Area B will be lined with a 60 mil HDPE liner prior to placement of excavated material. Following the completion of excavation activities, a 60 mil liner, skimmers and discharge pipes will be installed in the newly excavated ash impoundment area. Wet filling operations will continue until the design operation level of 143 feet msl has been reached. Prior to reaching the design operation level of the active impoundment, the plant will have converted the wet ash disposal system to a dry system. Future dry ash will be disposed by vertically expanding the existing active area and Area B (former ash impoundment/dry stack area). The portion of the active impoundment on the east side of the divider berm that was not lined previously will be lined with a 60-mil HDPE liner prior to vertically expanding. Following completion of the vertical expansion, the disposal area will be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a 6-inch soil erosion layer that will promote vegetative growth.

4.3.3 Fill Remaining Volume/Vertical Expansion

This alternative consists of wet filling the remaining volume in the active impoundment to the design operation level of 143 feet msl (Drawing 4.3.3). During this period, the plant will be in the process of converting to a dry ash disposal system and lining Area B and portions of the active impoundment area currently above water with a 60 mil HDPE liner. Once the design operating level in the active impoundment has been reached with wet filling, the remainder of the active impoundment area will be lined. Once the remaining volume in the active impoundment has been filled with wet ash, dry ash disposal will be initiated. Future dry ash will be disposed by vertical expansion in Area B and the newly lined active impoundment. Following completion of the vertical expansion, the disposal area will be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a six-inch soil erosion layer that will promote vegetative growth.

4.3.4 Improve Markets for Beneficial Reuse of Ash

Various markets for use of fly ash exist. Some companies have expressed an interest in obtaining ash, and bottom ash is presently being consumed at other CP&L facilities for beneficial use. Mr. Mark Shilling has indicated during previous studies that CP&L has pursued various markets. In addition, the Robeson County Landfill was contacted regarding potential opportunities for using the flyash as daily cover in their landfill operations. We also reviewed the NCDOT Transportation Improvement Program for upcoming projects in Robeson County through the year 2006.

4.4 Analysis of Alternatives

The following analysis of alternatives assumes use of high-density polyethylene (HDPE) liners based on discussions with representatives of the North Carolina Solid Waste Section and CP&L.

According to Mr. Bill Sessoms with the North Carolina Solid Waste Section, existing unlined landfills will be closed upon reaching their permitted design capacity unless a facility can prove that leachate will not migrate outside of the ash impoundment. According to Mr. Sessoms, this will be extremely difficult in an earthen lined impoundment. In general, a facility that has historically reported elevated ash constituents above the regulatory limit in groundwater will likely be closed and will not be permitted to vertically expand. However, consideration would be provided by NCDENR on a case-by-case basis regarding alternative strategies. According to Mr. Sessoms, other methods to expand capacity such as vertical expansions, vertical dike extensions, dry-stacking or constructing additional impoundments would require conformance with the new North Carolina Solid Waste Management Rules (15A NCAC 13B).

According to conversations with Mssrs. Mick Greeson and Cary McPherson with CP&L, ash slurry discharge operations are covered by a National Pollutant Discharge Elimination System (NPDES) permit. Removal of wet ash from the wastewater treatment system and subsequent manipulation of the ash within the existing ash impoundment is covered by a wastewater non-discharge permit. Disposal of ash (dry) from dry processes on top of the existing ash is covered by the Solid Waste Section of NCDENR.

Based on this information, we have incorporated applicable components of the new solid waste facility requirements into our evaluation. These include a bottom liner system and a cap as discussed in the following sections.

The estimated remaining times in the following alternative analyses are based on the maximum ash discharge rate from 1992 to May 1999 provided by CP&L. We have chosen to use the maximum ash discharge rate because it is more representative of the recent (1995 to 1998) increasing trend in annual coal consumption than the average discharge rate. Using the maximum instead of the average ash discharge rate will result in a more conservative estimate for alternative lifetimes. A factor of 1.5 times the estimated times outlined in the following sections may be applied for comparison with the average ash discharge rate from 1992 to May 1999.

Our cost estimates for the following alternatives were based on standard published unit rates, our experience with similar activities, and extrapolation of data from other studies. Costs associated with the conversion to a dry ash disposal system were based on a study by CRS Sirrine (reference 3 prepared for the CP&L Asheville Steam Electric Plant. According to Mr. Mark Shilling, the cost estimates in the CRS Sirrine study should be reduced by a factor of 2 to compensate for the relative size and power output of the Weatherspoon facility when compared to the Asheville facility. In addition, we converted the 1985 cost estimates to 2002 dollars using a 4% inflation rate.

4.4.1 Dike Vertical Extension/Fill Remaining Capacity/Convert to Dry System/Vertical Expansion

4.4.1.1 Technical Analysis

Filling of the remaining volume of approximately 1.8 million cubic feet would continue to the design elevation of 143 feet msl for approximately 1.5 years. Dike construction would be concurrent with the continued wet disposal of ash to fill the remaining volume. The dike vertical extension height was limited to 6 feet to maintain the existing dam size classification as small. According to the North Carolina Dam Safety regulations, a dam that equals or exceeds 35 feet is classified as a medium size dam and would require additional hydrologic and hydraulic analyses related to the provided storage volumes and discharge capacities.

By conventional methods (Drawing 4.3.1.1), the construction of the six foot dike vertical extension around the active impoundment would consist of approximately 222,000 cubic yards of compacted soil fill placed on the outside slope face to create approximately 8.8 million cubic feet of additional capacity. Approximately 48,000 square yards of geosynthetic would be placed to stabilize the surficial layer of the newly constructed 2(H):1(V) soil slope.

Alternatively, innovative technologies (Drawing 4.3.1.2) regarding embankment construction over poor subgrades have successfully utilized geosynthetics to reduce costs, materials and time when compared to conventional methods. The majority (approximately 65 percent) of the active impoundment dike would be extended using approximately 7,000 cubic yards of ash and 21,000 cubic yards of select soil fill with geogrids (about 1/10 of the fill volume required for conventional methods). The soil fill would be utilized in exterior portions of the dike and the ash would be utilized on the interior portions. Approximately 48,000 square yards of geosynthetic would be placed within the newly constructed dike extension that would bear, in part, on the ash surface of the active impoundment. Portions of the impoundment dike adjacent to recently filled unconsolidated areas would likely require the installation of vibro-concrete piers extended (approximately 10 to 15 feet below the ash surface elevation) to adequate bearing materials for additional foundation support or the use of conventional methods.

Following construction of the dike extension, the new 6-foot high active impoundment area would be lined with a 60 mil HDPE liner to protect against migration of leachate (ash-laden water) out of the impoundment. (Note: The necessity of lining the raised active impoundment area will depend on actual regulatory interpretations regarding this alternative as well as further technical evaluation during the design phase specifically related to effects of a phreatic surface through the dike.) Wet portions of the active impoundment that will have been recently filled to capacity should be allowed to consolidate for as long as possible prior to the placement of a liner and fill material. Wet ash disposal processes would continue in the newly constructed lined impoundment for approximately seven years.

Upon reaching the new design operation level of 149 feet msl in the newly lined impoundment, the plant will have converted the existing wet ash disposal process to a dry system as described in Case 2 in the CRS Sirrine study mentioned previously and proceed with vertically expanding Area B and the active impoundment. Area B must be lined with a 60 mil HDPE liner prior to vertically expanding with dry ash. The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The approximate maximum height of the vertical expansion is 120 feet above the top of dike elevation. The final cap will consist of a 30 mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). The bar chart in Appendix B illustrates the general sequence of activities to implement this alternative. Dry ash disposal operations would last approximately 64 years resulting in a total lifetime estimate of 72.5

years (Appendix B) for this alternative at costs of $16.9 and $19.6 million for the innovative and conventional dike construction technologies, respectively (Appendix C).

Raising the existing dike and vertical expansion level requires consideration of the effects on embankment stability and seepage that are discussed in the sections below.

4.4.1.1.1 DAM STABILITY EFFECTS

We analyzed built-out conditions (innovative and conventional) when the vertical expansion was completely filled for the dike vertical extension alternative. These conditions were considered worst-case scenarios regarding slope stability analyses for the vertical expansion alternatives provided. Our analyses included circular slip failure analyses with and without a phreatic surface. Analyses without the phreatic surface revealed safety factors that exceeded 1.5. Analyses that included a phreatic surface through the embankment above elevation 135 msl on the upstream side and terminating at the toe generally revealed factors of safety less than 1.5.

In general, a minimum factor of safety of 1.5 is recommended against sliding which our analyses without the effects of the phreatic surface revealed. Analyses that included a phreatic surface above elevation 135 msl in the dike revealed unstable slope conditions. However, once the HDPE liners are installed and infiltration of water into the subsurface is minimized, effects from an elevated phreatic surface should not represent a concern regarding the long-term stability of the slope. During construction of the dike vertical extension, the liner should be installed as soon as possible over finished portions of the newly constructed dike and impoundment bottom to reduce infiltration of water into the subsurface.

The construction of the dike using the conventional method (external dike) will facilitate the construction of measures (i.e. toe or blanket drains) to control the elevation of the phreatic surface within the dike as an alternative or as a supplementary measure to the proposed liner system. The innovative method (internal dike) will primarily rely on the newly installed liner system to control the phreatic surface within the dike because of difficulties anticipated with retrofitting the existing impoundment dike with effective control measures.

Monitoring of the phreatic surface would be done under the normal CP&L dam safety-monitoring program. During construction, the frequency of checking the piezometers in the crest and downstream slope should be increased to every two weeks. During the first two years of filling the newly lined dike extension impoundment, the frequency of checking the piezometers in the crest and downstream slope should be increased to monthly. During the first year of vertical expansion, the frequency of checking the piezometers in the crest and downstream slope should be increased to monthly.

4.4.1.1.2 SEEPAGE CONSIDERATIONS

Seepage at the Weatherspoon facility has occurred previously along the south dike. The seepage appears to have been controlled by the installation of toe drains. The addition of the dike vertical extension and vertical expansion with liners and caps as proposed should reduce the amount of leachate (ash-laden water) generated as the facility progresses. As a result, this should in time reduce the potential of seepage from the ash impoundment. HDPE liners can develop leaks but would have a low likelihood of causing significant seepage, as the quantity of leachate leaking would likely be very small.

4.4.1.2 Safety Analysis

The technical analysis above shows that the existing embankment can be raised and a vertical expansion constructed without compromising safety, provided that the height of the phreatic surface in the impoundments is controlled by the use of measures to prevent water migration through the embankments and into the subsurface. Because of the on site location of the proposed vertical expansion, the likelihood of significant offsite impacts or damage resulting from an unstable slope condition of the ash impoundment at the Weatherspoon facility is remote. If further analysis during the design phase shows concerns related to seepage or seepage related stability, use of the conventional method with incorporation of internal drainage would represent a feasible solution.

4.4.1.3 Reliability Analysis

A dike vertical extension and vertical expansion could be constructed to perform in a reliable fashion. Vertical expansions are widely used methods to increase capacities of landfills. HDPE liners can develop leaks but would have a low likelihood of causing significant changes in the foundation seepage, as the quantity of water leaking would likely be very small. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable liner and cap system.

4.4.1.4 Economic Analysis

Constructing the innovative dike vertical extension would require a fill of approximately 28,000 cubic yards. To reduce the amount of soil fill needed we have proposed to construct the interior portion of the dike with select ash fill located in the active impoundment. This will reduce the necessary soil volume needed for the dike by approximately 25 percent.

Constructing the conventional vertical extension would require a fill of approximately 220,000 cubic yards. We have conservatively budgeted the use of offsite fill material to construct the dike. However, further investigation during the design phase with NCDENR on a case-by-case basis regarding use of ash from the impoundment to construct portions of the dike vertical extension may further reduce costs by reducing the quantity of offsite material needed.

In addition, the ash discharge pipe will need to be raised and the settling basin discharge structures and dikes will need to be vertically extended.

The approximate cost for implementing this alternative is estimated to be $16.5 and $19.6 million for the innovative and conventional methods, respectively (Appendix C).

4.4.1.5 Environmental Analysis

Since the work for this alternate would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Lumber River. Provisions for dust control may become necessary during the work to prevent ash dust from migrating offsite.

4.4.1.6 Risk Assessment

With respect to the concept of providing additional capacity for the ash, there is very little risk that the storage volume would not provide long-term storage. Other risks are related to potential impacts on the surrounding area should ash migrate offsite via an embankment failure or erosive forces as discussed above.

4.4.1.7 Other Issues

The aesthetics of having a large mound of ash (approximately 120 feet high) may represent a concern. In addition, modifications to an existing dam would normally require a permit from the North Carolina Dam Safety Section. CP&L is exempt from the North Carolina Dam Safety Law, but has an agreement with the North Carolina Utilities Commission to furnish plans for dam construction to the Dam Safety Section for comment. We understand that CP&L encountered some regulatory-driven delay to creating an ash landfill on top of an abandoned pond at the Roxboro plant in the late 1980's, although the issues were successfully addressed. The potential for similar regulatory delays involved with solid waste and non-discharge permitting may still exist.

4.4.2 Fill Remaining Volume/Construct Berm/Excavation-Dry Stack/Vertical Expansion

4.4.2.1 Technical Analysis

Excavation of approximately 371,000 cubic yards from the existing active impoundment to a depth of 11 feet below the existing ash surface would require the construction of a divider berm located along the existing ash/water interface. The excavated ash would be placed into Area B as was done previously in the early 1990's. Prior to placement of ash in Area B a 60 mil HDPE liner would be installed on top of the existing land surface of Area B. Filling of the remaining volume of the active impoundment on the east side of the berm (approximately 900,000 cubic feet) would continue to the design operation elevation of 143 feet msl for approximately 1 year by extending the existing ash discharge line through or around the berm into the remaining fill area in the active impoundment. The excavation in the active impoundment would be lined with 60 mil HDPE on the bottom and side slopes and would require rerouting of the newly installed discharge structures to the existing settling basin. (Note: The necessity of lining the newly excavated impoundment will depend on actual regulatory interpretation of this alternative.) Upon reaching the design operation elevation in the original remaining discharge area on the east side of the divider berm, the ash discharge line would be relocated to begin discharging into the newly lined active impoundment. Wet ash disposal into the newly lined impoundment would last approximately 8.5 years.

Prior to reaching the design operation level of 143 feet msl in the newly lined impoundment, the facility will convert the existing wet ash disposal process to a dry system as described in Case 2 in the CRS Sirrine study mentioned previously and proceed with vertically expanding Area B and the active impoundment. The east side of the berm must be lined with 60 mil HDPE prior to receiving dry ash. Wet portions of the active impoundment that will have been recently filled to capacity should be allowed to consolidate for as long as possible prior to the placement of a liner and fill material. The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The approximate maximum height of the vertical expansion is 120 feet above the top of dike elevation. The final cap will consist of a 30 mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). The bar chart in Appendix B illustrates the general sequence of activities to implement this alternative. Dry ash disposal operations would last approximately 39 years resulting in a total lifetime estimate of 48.5 years (Appendix B) at a cost of 17.3 million dollars for this alternative (Appendix C).

4.4.2.2. Safety Analysis

Based on several historical CP&L excavation projects it appears that removal of ash from the active impoundment can be performed without compromising safety. Reference Section 4.4.1.2 regarding safety issues for the vertical expansion.

4.4.2.3 Reliability Analysis

A vertical expansion could be constructed to perform in a reliable fashion. The excavation and construction of a berm within an active impoundment has been done previously with favorable results. HDPE liners can develop leaks but would have a low likelihood of causing significant changes in the foundation seepage, as the quantity of water leaking would likely be very small. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable seal.

4.4.2.4 Economic Analysis

Constructing the lined impoundment would require excavation of approximately 371,000 cubic yards of ash of which 24,000 cubic yards would be used to construct the divider berm. In addition, the ash discharge pipe will need to be extended and relocated and the new impoundment discharge structures will need to be routed to the existing settling basin. The approximate cost for implementing this alternative including design, permitting and conversion to a dry ash system is estimated to be $17.3 million (Appendix C).

4.4.2.5 Environmental Analysis

Since the work for this alternative would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now. Excavating the ash and transporting it across the divider road to Area B does not impact the environment outside of the ash impoundments themselves. During the construction of the divider berm, the amount of suspended solids in the water near the discharge structure may increase, potentially causing violations of the discharge limits.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Lumber River. Provisions for dust control may become necessary during the work to prevent ash dust from migrating offsite.

4.4.2.6 Risk Assessment

Reference Section 4.4.1.6.

4.4.2.7 Other Issues

The aesthetics of having a large mound of ash may represent a concern. We understand that CP&L encountered some regulatory-driven delay to creating an ash landfill on top of an abandoned pond at the Roxboro plant in the late 1980's, although the issues were successfully addressed. The potential for similar regulatory delays involved with solid waste and non-discharge permitting may still exist.

4.4.3 Fill Remaining Volume/Vertical Expansion

4.4.3.1 Technical Analysis

Filling of the remaining volume of the active impoundment (approximately 1.8 million cubic feet) would continue to the design operation elevation of 143 feet msl for approximately 1.5 years. Prior to reaching the design operation elevation in the original remaining discharge area, the facility will convert the existing wet ash disposal process to a dry system as described in Case 2 in the CRS Sirrine study mentioned previously and proceed with vertically expanding Area B and the active impoundment. All ash disposal areas must be lined with 60 mil HDPE prior to receiving dry ash. Wet portions of the active impoundment that will have been recently filled to capacity should be allowed to consolidate for as long as possible prior to the placement of a liner and fill material. The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The approximate maximum height of the vertical expansion is 120 feet above the top of dike elevation. The final cap will consist of a 30 mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). The bar chart in Appendix B illustrates the general sequence of activities to implement this alternative. Dry ash disposal operations would last approximately 39 years resulting in a total lifetime estimate of 40.5 years (Appendix B) at a cost of 16 million dollars (Appendix C) for this alternative.

4.4.3.2. Safety Analysis

Reference Section 4.4.1.2 regarding safety issues for the vertical expansion.

4.4.3.3 Reliability Analysis

A vertical expansion could be constructed in a reliable fashion. HDPE liners can develop leaks. Leaks would have a low likelihood of causing significant changes in the foundation seepage, as the quantity of water leaking would likely be very small. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable seal.

4.4.3.4 Economic Analysis

The approximate cost for implementing this alternative including design, permitting and conversion to a dry ash system is estimated to be $16 million (Appendix C).

4.4.3.5 Environmental Analysis

Since the work for this alternate would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Lumber River. Provisions for dust control may become necessary during the work to prevent ash dust from affecting surrounding home owners.

4.4.3.6 Risk Assessment

Reference Section 4.4.2.6.

4.4.3.7 Other Issues

Reference Section 4.4.2.7.

4.4.4 Improve Markets for Beneficial Reuse of Ash

CP&L has previously addressed this alternative during previous evaluations of other facilities. The market for use of fly ash is growing and includes uses such as daily cover in landfills, structural fill and various applications in the concrete industry.

We contacted representatives of Robeson County landfill regarding use of flyash as daily cover. The landfill is conveniently located approximately 20 miles from the Weatherspoon facility. The landfill currently uses flyash for this purpose that was obtained from a local source that no longer burns coal. According to landfill personnel, they have an adequate supply of flyash for approximately 4 to 5 years but may be interested in preparing for future daily cover needs. Based on rough estimates of their existing ash supply (app. 2,000,000 cubic feet) provided by them, we have calculated an average annual flyash utilization of between 400,000 and 500,000 cubic feet of ash.

We reviewed the NCDOT Transportation Improvement Program for upcoming projects in Robeson County through the year 2006. The list includes several roadway improvement projects in Robeson County that may represent potential uses for ash. We understand that CP&L has reached agreements with ash reuse companies in the past at other facilities and is continuing to pursue other opportunities at the present time. The previous agreements have been with companies that manufacture concrete products.

While offsite disposal represents an attractive means of handling future ash in terms of cost, there are opportunity costs in terms of offsite liability associated with these uses that include:

- Accidental discharges of ash during transport;
- impacts to the environment where the ash is placed;
- future landfill litigation that could identify CP&L as a Potential Responsible Party (PRP);
- usage unpredictability;
- Utilization of select ash only.

5.0 RECOMMENDED SOLUTION

From our evaluation, we have concluded that a combination of continuing to pursue options for beneficial use of ash coupled with one of the three proposed methods for vertical expansion, that includes conversion to a dry disposal process, represents the only feasible alternative for long-term management of ash disposal at the Weatherspoon facility. Beneficial use of ash offsite should be evaluated by CP&L on a case by case basis regarding potential immediate and long-term liability to CP&L which may exclude beneficial use as an alternative. Decisions regarding which vertical expansion alternative to implement will require internal evaluation made by CP&L based on information provided in this and other evaluations, the availability of resources and projected use of fossil fuel power generation in the future. To assist CP&L in making this evaluation, we have provided a bar chart (Appendix B) for each vertical expansion alternative that projects the necessary resource allocations over time and includes approximate costs for implementing each task.

From our evaluation, the following alternatives were <u>not</u> considered feasible solutions:

- Construct new ash pond;

  This potential alternative was not evaluated further because on-site land was not available to provide long-term ash disposal.

- Plant power output load leveling;

Based on conversations with CP&L personnel, this alternative does not appear feasible in terms of current operating and existing power generation transfer capabilities at the plants.

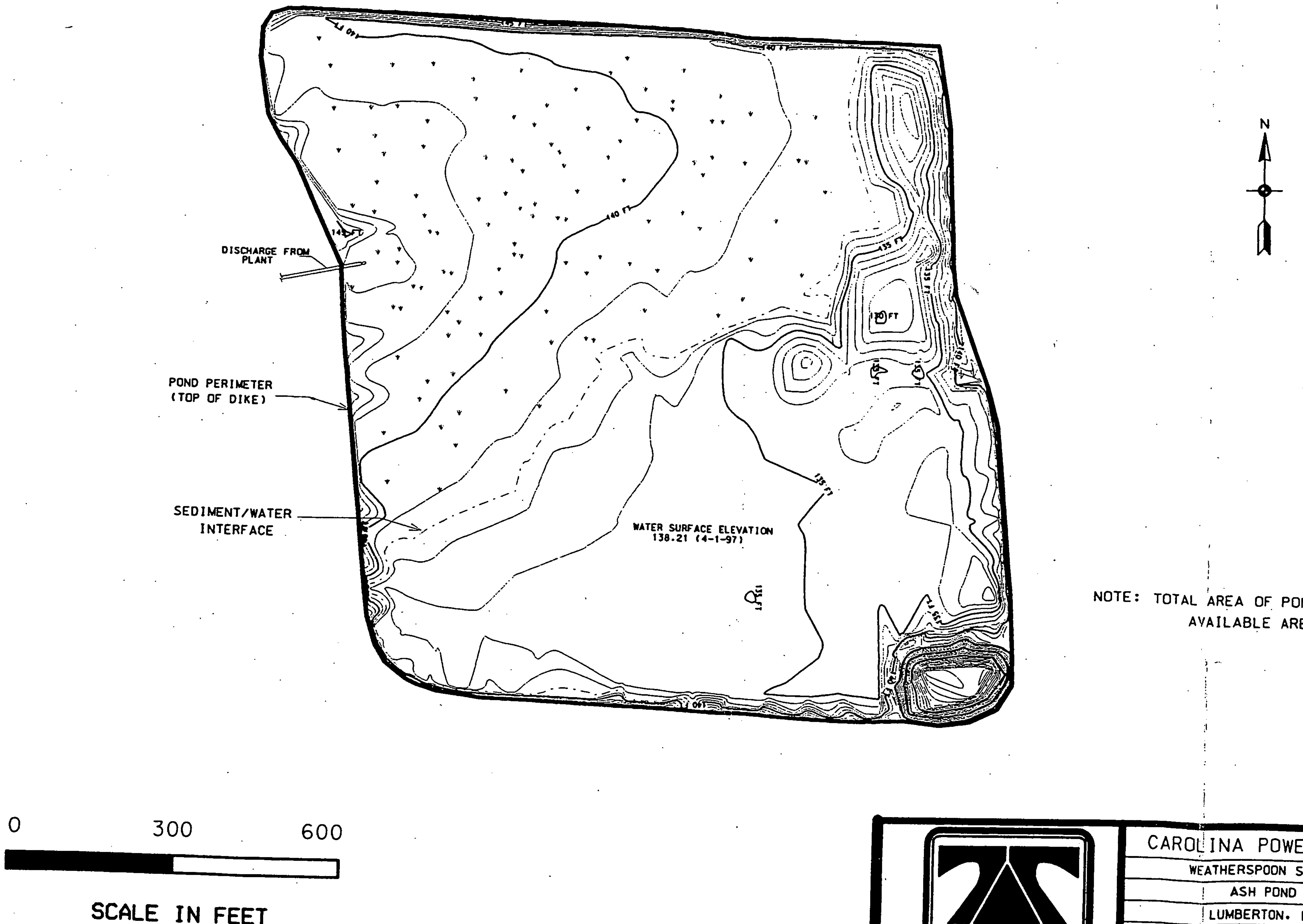
- Dedicated CP&L ash landfill.

Based on conversations with CP&L personnel, it appears that offsite transport is not economically feasible. CP&L previously evaluated offsite disposal of ash into excavated mines that revealed excessive storage, loading and transportation costs. In addition, offsite transport of ash represents a liability in terms of transportation mishaps that could potentially release ash into the environment. Based on these items, this alternative was not considered feasible at this site.

REFERENCE LIST

1. Trigon Engineering Consultants, Inc., 1997. Report entitled "Carolina Power and Light, Active Ash Pond Capacity Evaluation, Weatherspoon, Sutton , and Asheville Plants", May 29, 1997.
2. Law Engineering and Environmental Services, Inc., 1998. Report entitled "Report of Ash Pond Capacity Evaluation", Asheville Plant, January 19, 1999.
3. CRS Sirrine, 1985. Report entitled "CP&L, Budget Cost Estimate, Dry Flyash Disposal, Asheville Steam Electric Plant", May 30, 1985.
4. R. S. Means, 1998. "Building Construction Cost Data 56th Annual Edition".
5. Law Engineering, Reports entitled "Five Year Independent Consultant Inspection as Required by North Carolina Utilities Commission", 1990 and 1995.
6. NCDOT, Transportation Improvement Program through 2000-2006.

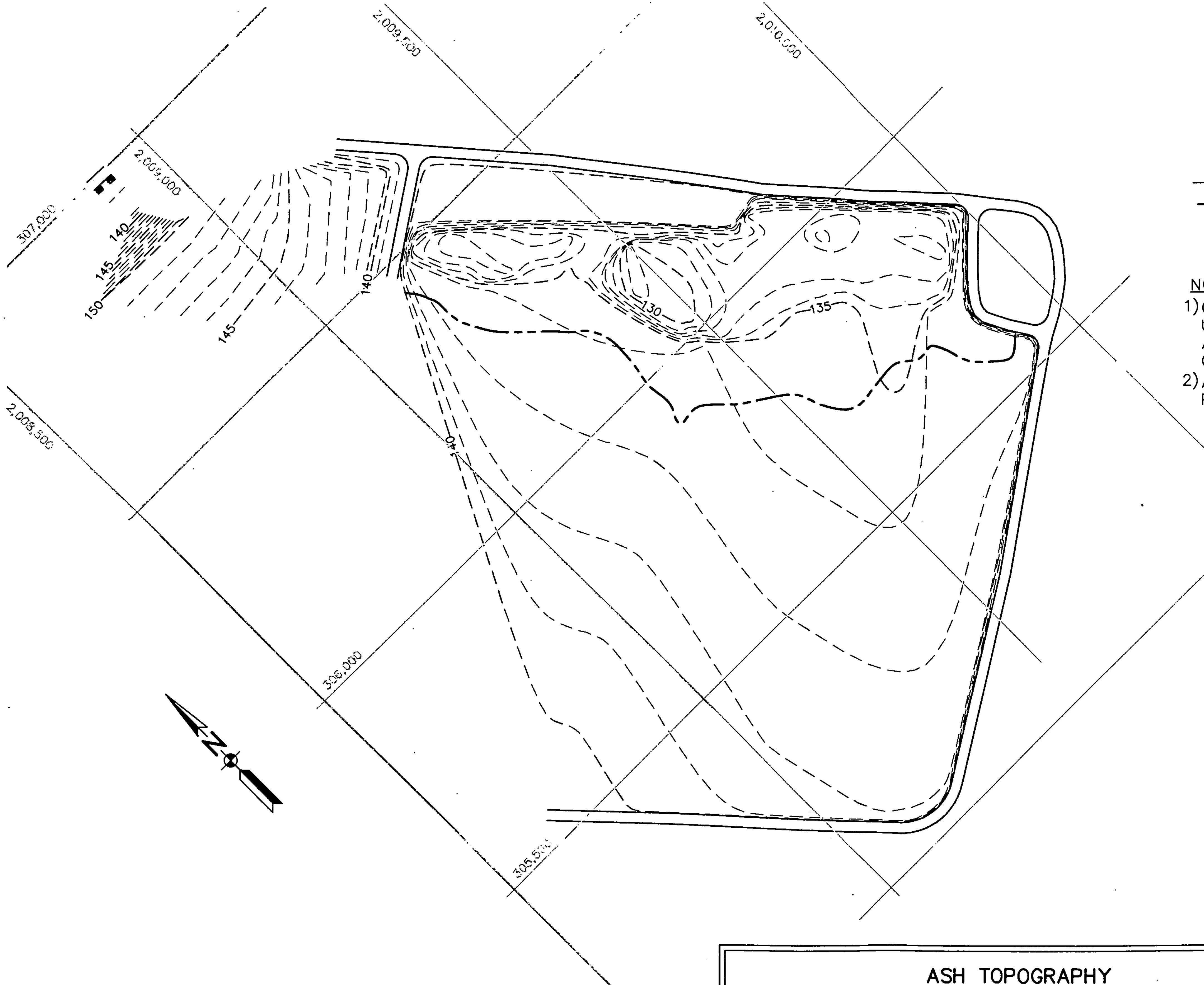
DRAWINGS



NOTE: TOTAL AREA OF POND ≈ 33.3 acres
AVAILABLE AREA ≈ 16.2 acres

TRIGON ENGINEERING CONSULTANTS, INC.

CAROLINA POWER & LIGHT COMPANY			
WEATHERSPOON STEAM ELETRIC PLANT			
ASH POND CONTOUR MAP			
LUMBERTON, NORTH CAROLINA			
FILE NO.	311-97-010	VERT. SCALE	AS SHOWN
DATE	4/97	HORIZ. SCALE	AS SHOWN
DRAWN BY	G. AUTRY	DRAWING NO.	1



— — — 130 — — — ASH ELEVATION CONTOUR (MSL)

— - — - — ASH/WATER INTERFACE ON MAY 11, 1999

NOTES:

1) CONTOURS BASED ON SURVEY PERFORMED 6/4/99, USING MAPPING-GRADE GPS METHOD. COORDINATES ARE REFERENCED TO NORTH CAROLINA STATE PLANE GRID AND MEAN SEA LEVEL.

2) ASH/WATER INTERFACE BASED ON DIGITIZED AERIAL PHOTOGRAPH TAKEN ON MAY 11, 1999.

weatherspoon 3.dwg

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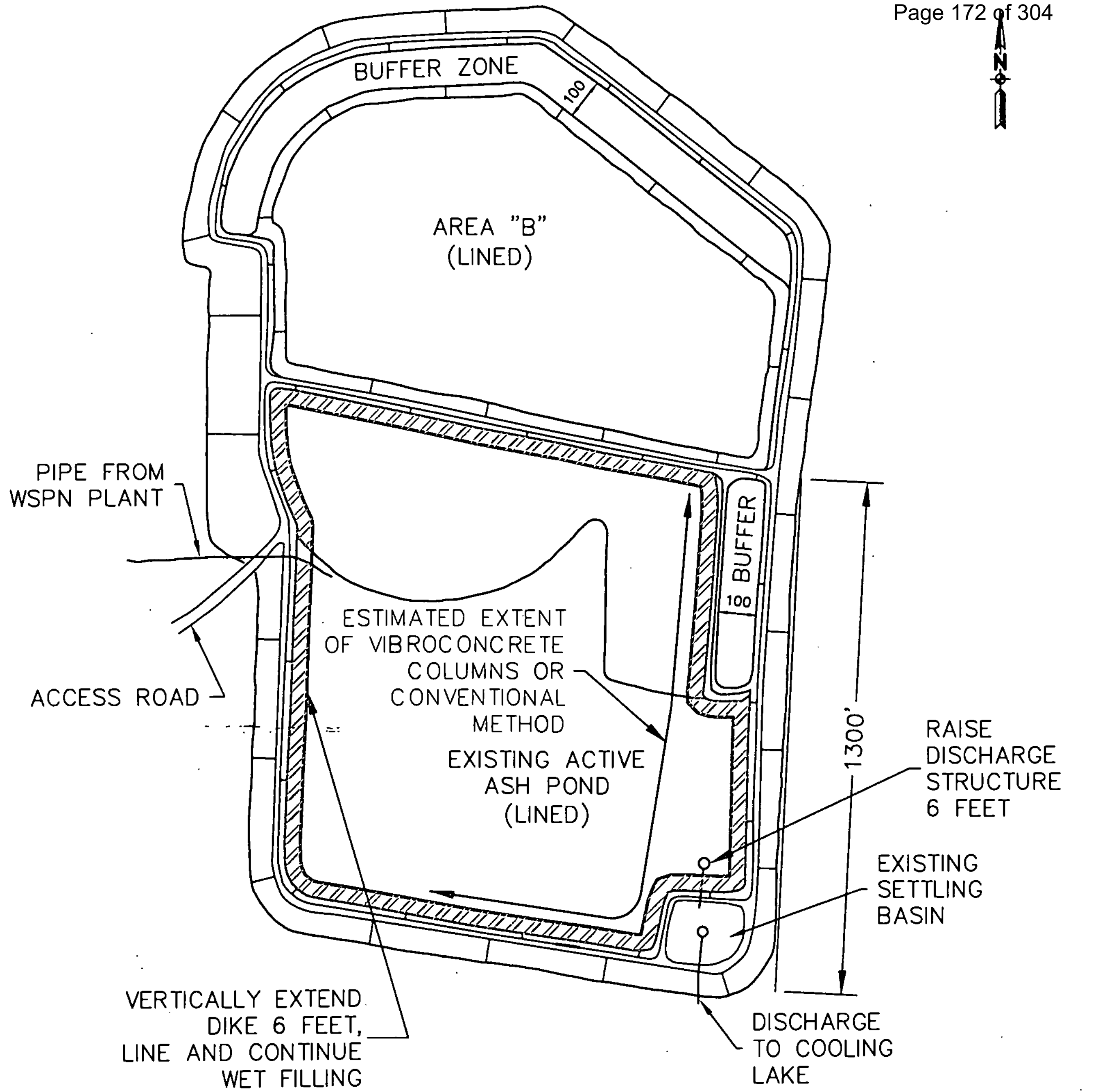
RALEIGH, NC

ASH TOPOGRAPHY
CAROLINA POWER & LIGHT
WEATHERSPOON ASH POND
LUMBERTON, NORTH CAROLINA

DRAWN: SST	DATE: 8/20/99
DFT CHECK: KRT	SCALE: AS SHOWN
ENG CHECK: TLC	JOB: 30720-9-3428/05
APPROVAL: JR	DWG: 2.3

REFERENCE:



NOTE:
VERTICAL EXPANSION WILL CONSIST OF PLACING DRY ASH ON A 5(H):1(V) SLOPE TO THE DESIGN SUBGRADE AND CAPPED. APPROXIMATE MAXIMUM HEIGHT OF VERTICAL EXPANSION IS 120'.

93428S5.DWG

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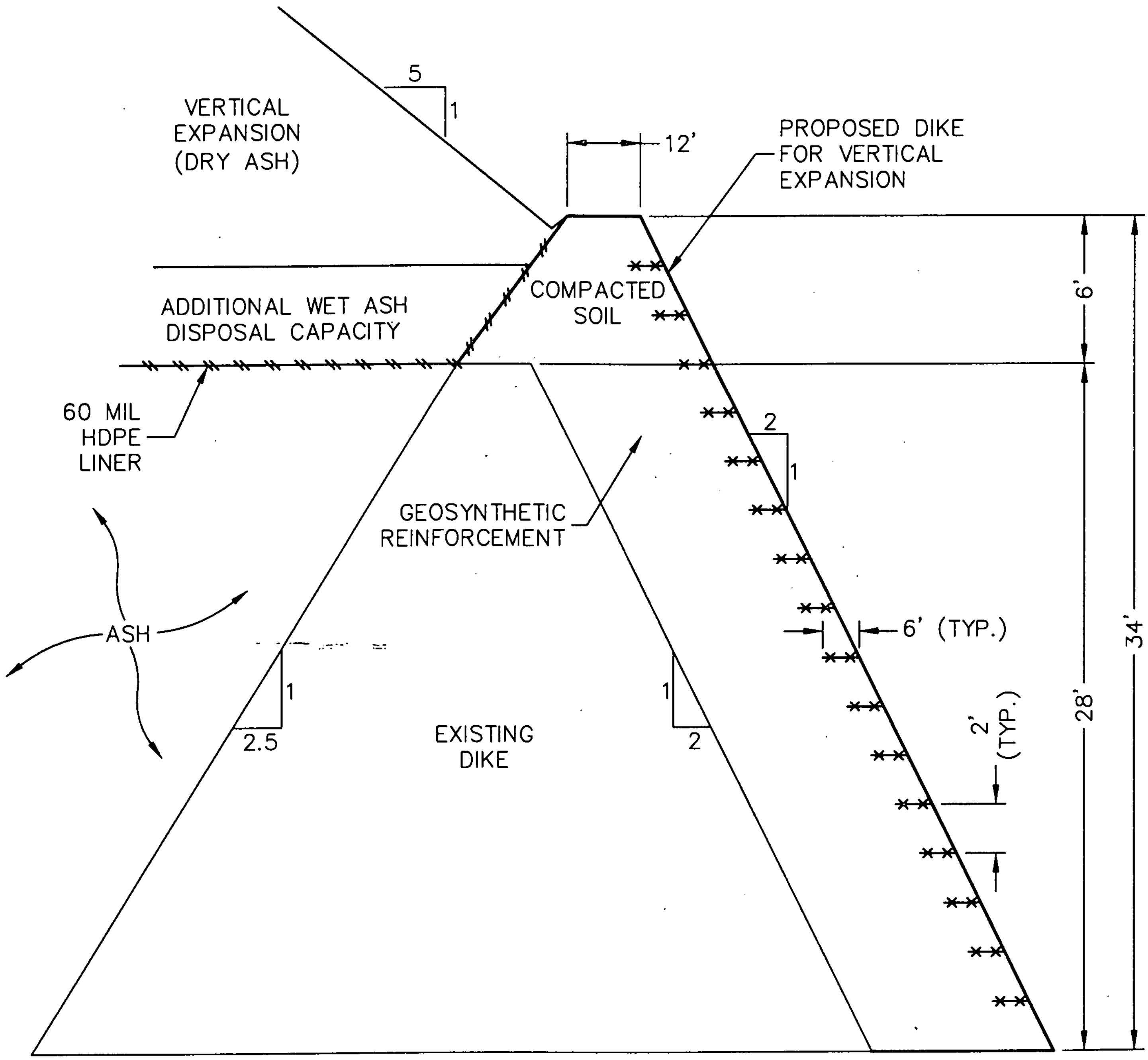
DIKE VERTICAL EXTENSION/
VERTICAL EXPANSION
CP&L – WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

DRAWN: SST	DATE: 8/20/99
DFT CHECK: KRT	SCALE: AS SHOWN
ENG CHECK: TLC	JOB: 30720-9-3428
APPROVAL: R	DWG: 4.3.1

REFERENCE: BASE DRAWING PROVIDED BY CP&L



93428S2.dwg

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SERVICES, INC.
RALEIGH, NC

DIKE SECTION
(CONVENTIONAL)
CP&L – WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

DRAWN: SST	DATE: 8/20/99
DFT CHECK: KRT	SCALE: NOT TO SCALE
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APPROVAL: JC	DWG: 4.3.1.1

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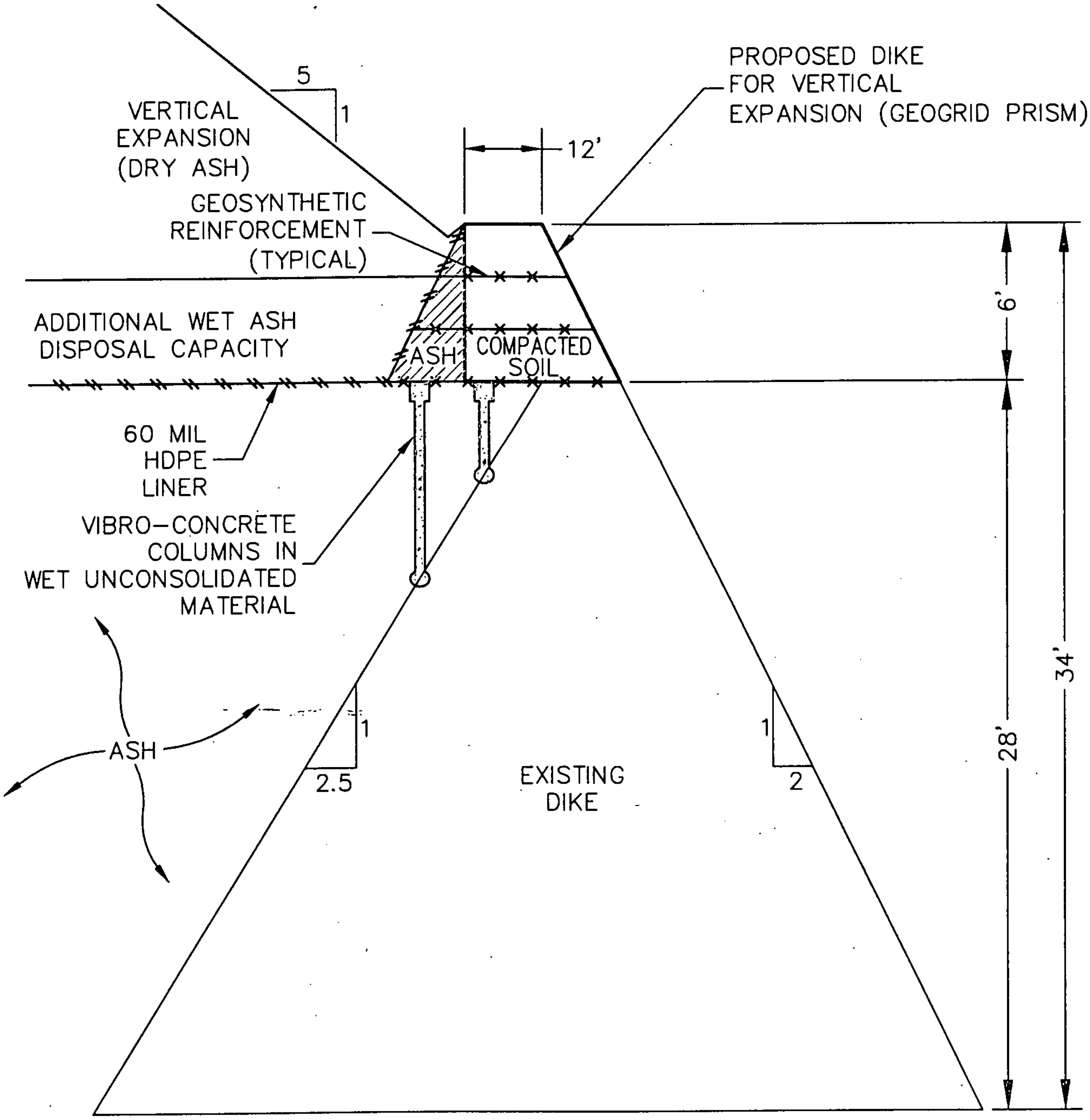

93428S2.DWG

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RALEIGH, NC

DIKE SECTION
(INNOVATIVE)
CP&L – WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

DRAWN: SST	DATE: 8/20/99
DFT CHECK: KRT	SCALE: NOT TO SCALE
ENG CHECK: TLL	JOB: 30720-9-3428
APPROVAL: TLC	DWG: 4.3.1.2

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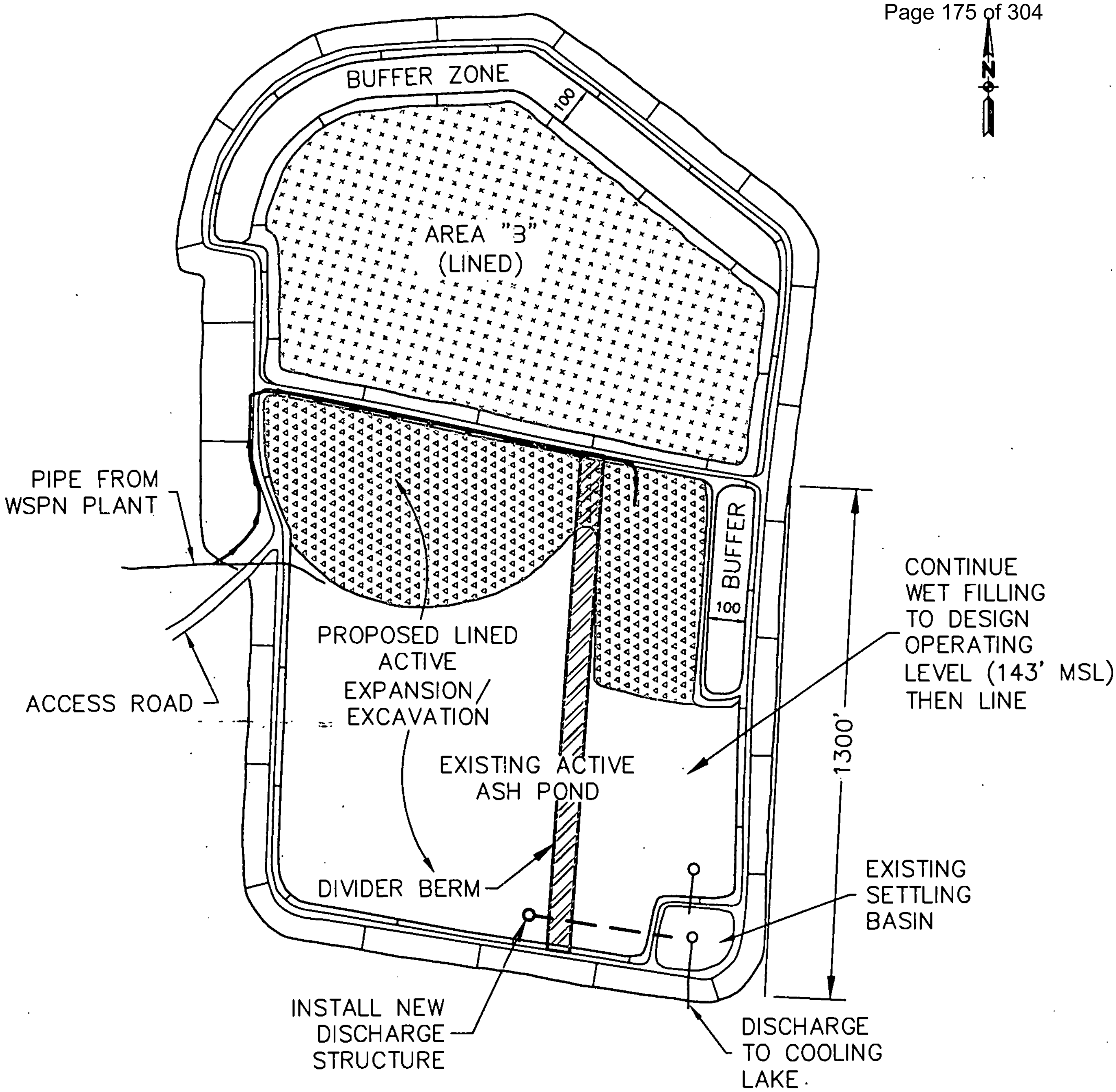

NOTE:
VERTICAL EXPANSION WILL CONSIST OF PLACING DRY ASH ON A 5(H):1(V) SLOPE TO THE DESIGN SUBGRADE AND CAPPED. APPROXIMATE MAXIMUM HEIGHT OF VERTICAL EXPANSION IS 120'.

93428S3.DWG

1"=400' 0' 400' 800' 1200'

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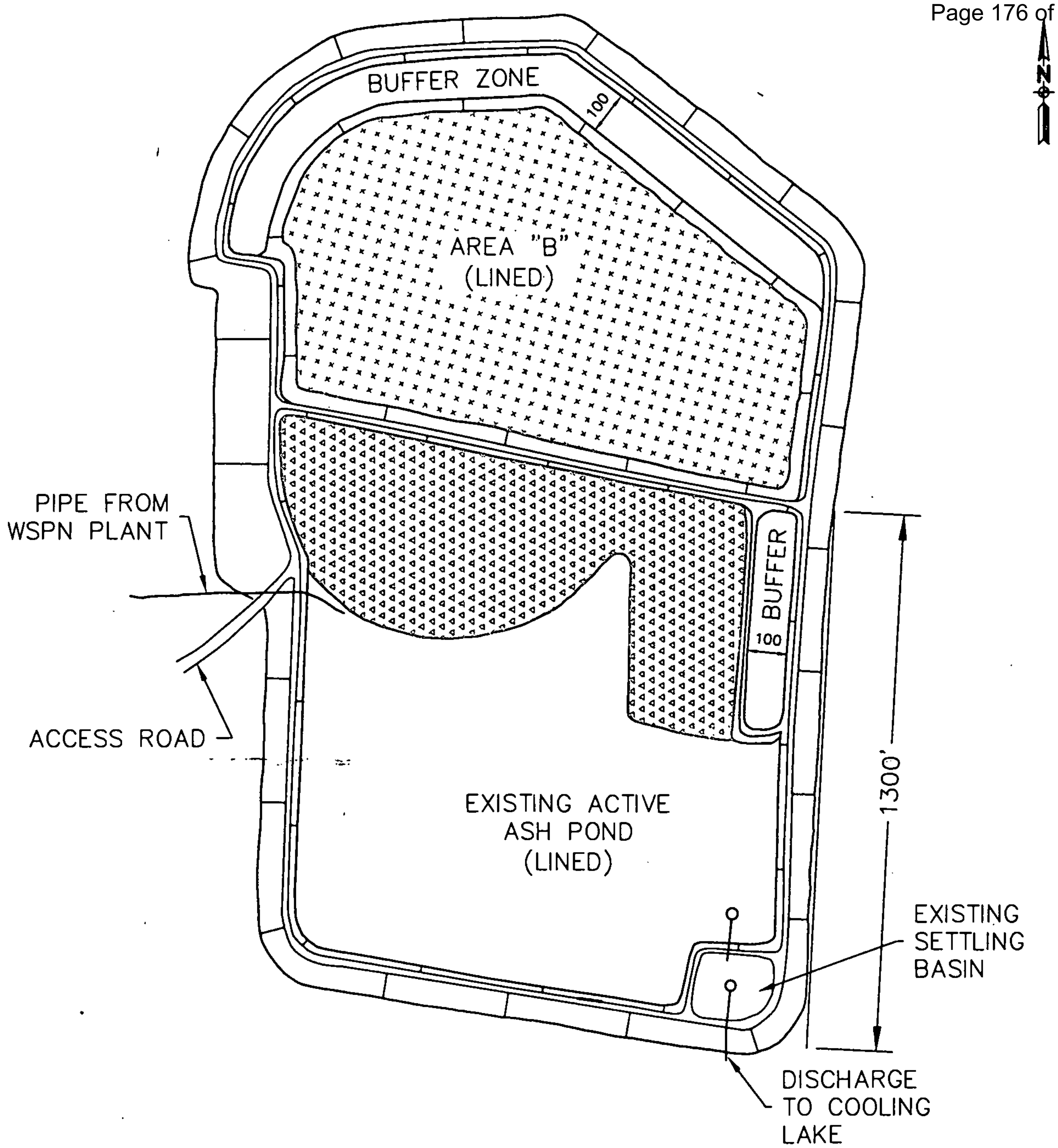
VERTICAL EXPANSION/
ACTIVE AREA EXCAVATION
CP&L – WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

DRAWN: SST	DATE: 8/20/99
DFT CHECK: KLT	SCALE: AS SHOWN
ENG CHECK: TLL	JOB: 30720-9-3428
APPROVAL: TLL	DWG: 4.3.2

REFERENCE: BASE DRAWING PROVIDED BY CP&L



NOTE:
VERTICAL EXPANSION WILL CONSIST OF PLACING DRY ASH ON A 5(H):1(V) SLOPE TO THE DESIGN SUBGRADE AND CAPPED. APPROXIMATE MAXIMUM HEIGHT OF VERTICAL EXPANSION IS 120'.

9342BS4.DWG

1"=400' 0' 400' 800' 1200'

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RALEIGH, NC

VERTICAL EXPANSION CP&L – WEATHERSPOON PLANT LUMBERTON, NORTH CAROLINA	DRAWN: SST	DATE: 8/20/99
	DFT CHECK: KRT	SCALE: AS SHOWN
	ENG CHECK: TLC	JOB: 30720-9-3428
	APPROVAL:	DWG: 4.3.3

REFERENCE: BASE DRAWING PROVIDED BY CP&L

APPENDICES

APPENDIX A-ASH POND CAPACITY ESTIMATES

Weatherspoon Historical Annual Coal Consumption (Tons)								
1992	1993	1994	1995	1996	1997	1998	1999*	Average
256529	198169	96572	116458	223079	274680	300513	80950	200889.83

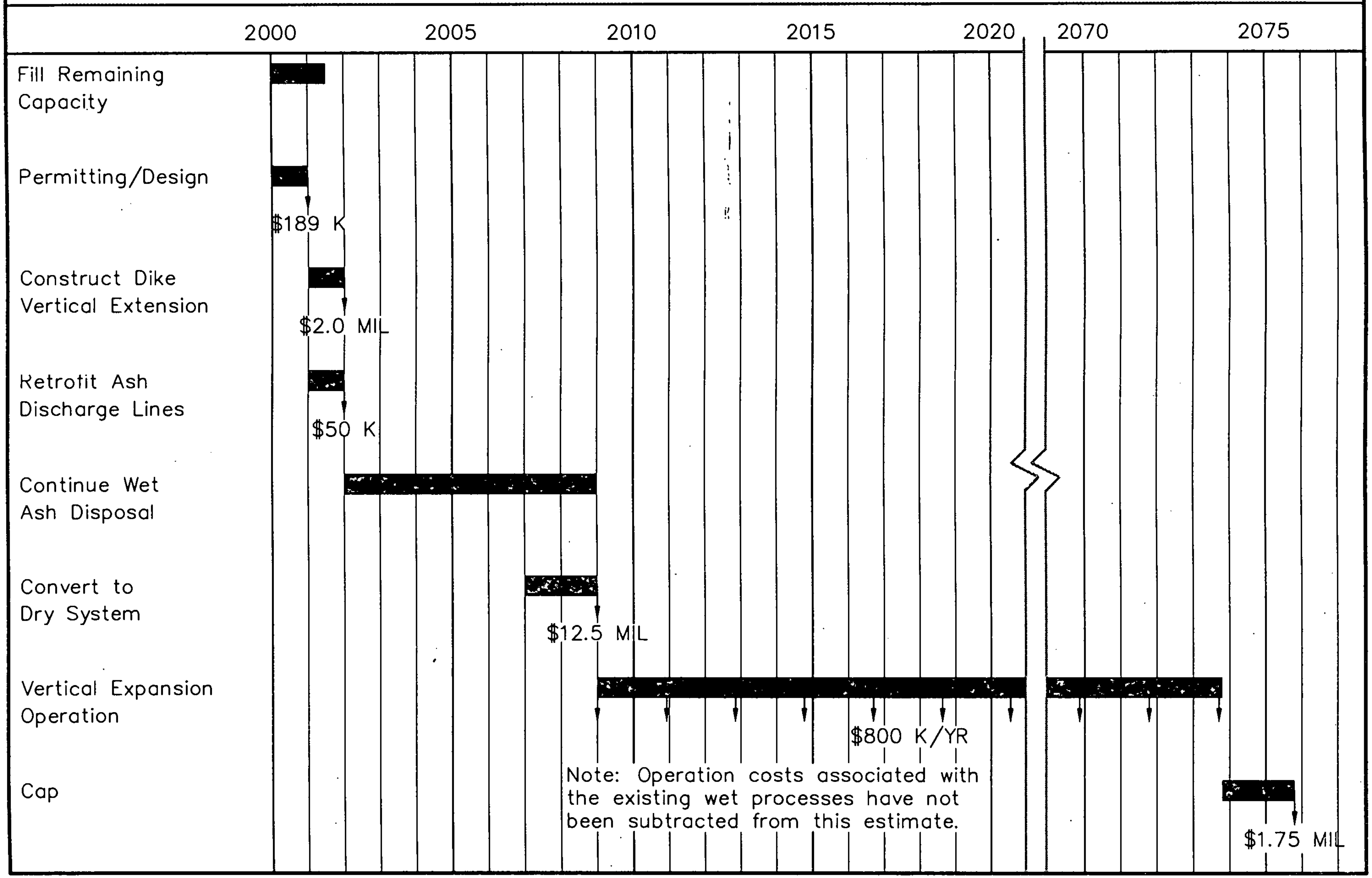
* *Data through 5/99 provided by CP&L*

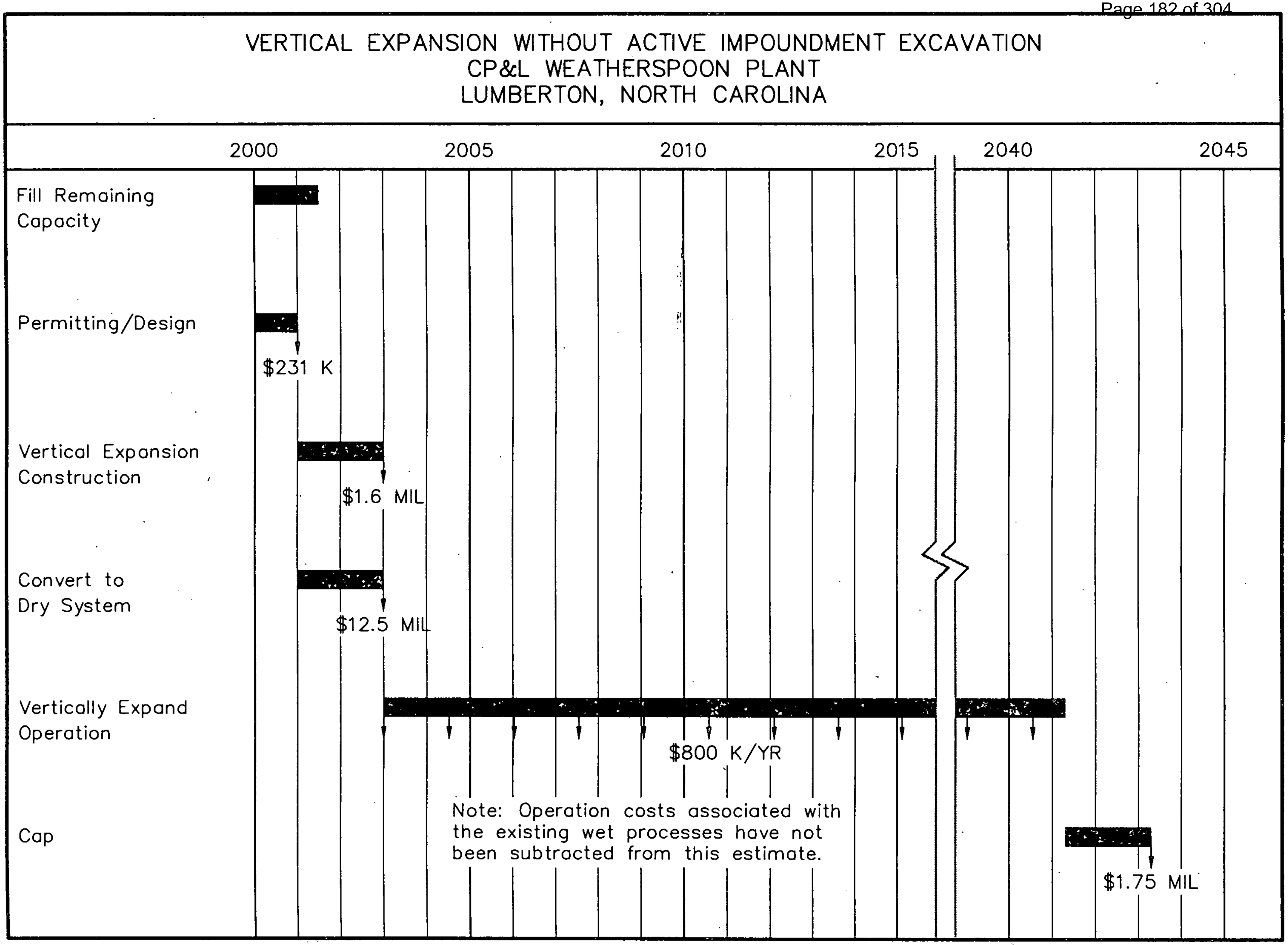
Average Ash Pond Capacity Estimates						
Average Annual Coal Consumption (Tons)*	% Ash	Average Annual Ash Quantity (Tons)	Ash Density (lb/cu.ft.)	Annual Ash Volume (cu.ft.)	Existing Capacity (cu. Ft.)	Estimated Years Remaining
200889.83	10.00	20088.98	50.00	803559.31	1829041.00	2.28

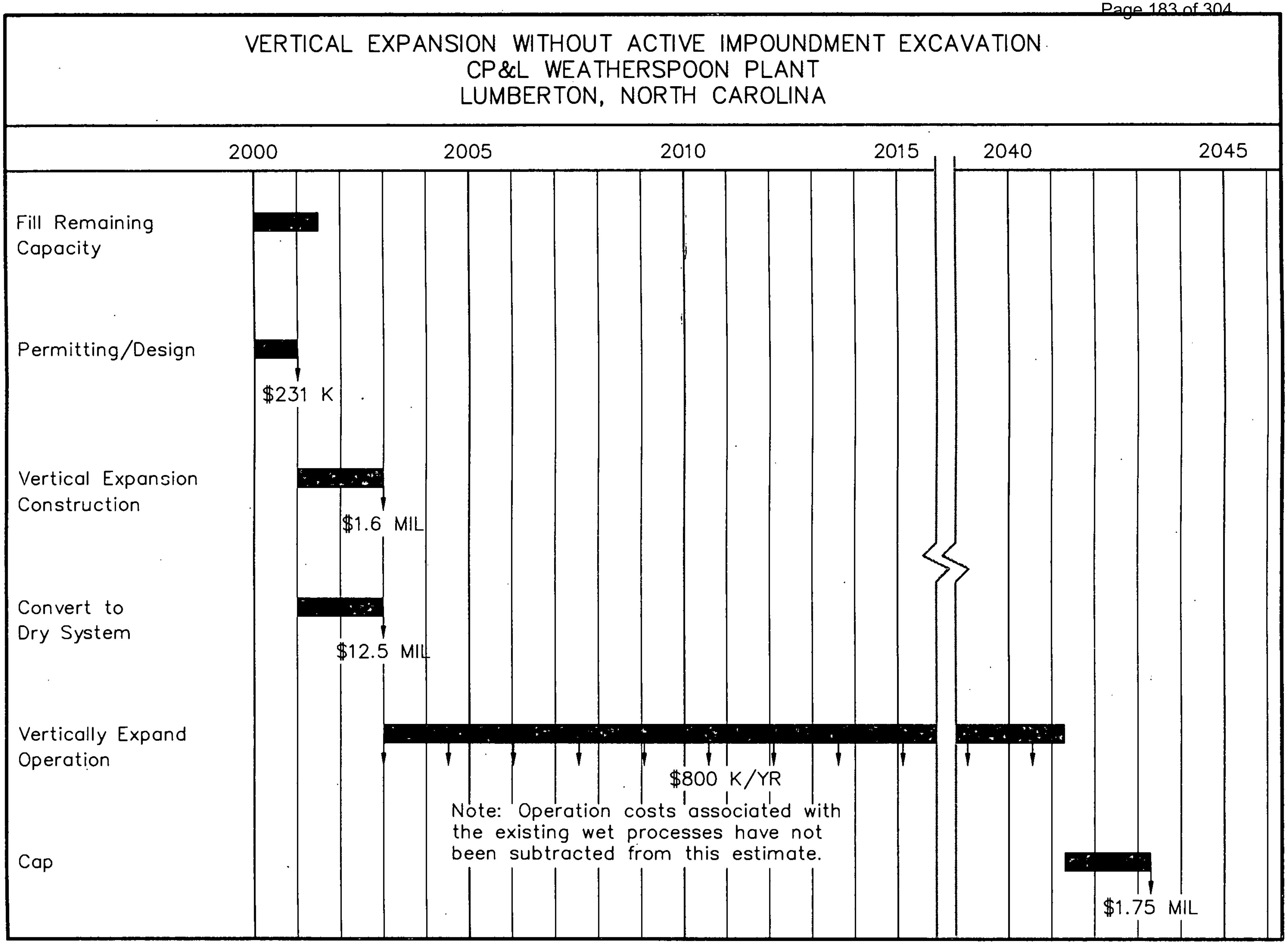
Maximum Ash Pond Capacity Estimates						
Maximum Annual Coal Consumption (Tons)	% Ash	Maximum Annual Ash Quantity (Tons)	Ash Density (lb/cu.ft.)	Annual Ash Volume (cu.ft.)	Existing Capacity (cu. Ft.)	Estimated Years Remaining
300513.00	10.00	30051.30	50.00	1202052.00	1829041.00	1.52

APPENDIX B-ALTERNATIVE LIFETIME BAR CHARTS

DIKE VERTICAL EXTENSION/VERTICAL EXPANSION
CP&L WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA




VERTICAL EXPANSION WITHOUT ACTIVE IMPOUNDMENT EXCAVATION
CP&L WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA
2000
2005
2010
2015
2040
2045
Fill Remaining Capacity
Permitting/Design
$231 K
Vertical Expansion Construction
$1.6 MIL
Convert to Dry System
$12.5 MIL
Vertically Expand Operation
$800 K/YR
Note: Operation costs associated with the existing wet processes have not been subtracted from this estimate.
Cap
$1.75 MIL


VERTICAL EXPANSION WITHOUT ACTIVE IMPOUNDMENT EXCAVATION
CP&L WEATHERSPOON PLANT
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Vertical Expansion Construction
$1.6 MIL
Convert to Dry System
$12.5 MIL
Vertically Expand Operation
$800 K/YR
Note: Operation costs associated with the existing wet processes have not been subtracted from this estimate.
Cap
$1.75 MIL

APPENDIX C-COST ESTIMATES

ASH DISPOSAL ALTERNATIVES
ROUGH COST ESTIMATE
PROJECT NAME: WEATHERSPOON
PROJECT NUMBER: 30720-9-3428/05/800
ALTERNATIVE: DIKE VERTICAL EXTENSION/VERTICAL EXPANSION
LIFETIME: 72.5 YEARS

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL	TOTAL
Mobilization	1	each	$ 50,000.00	$ 50,000	
Clear and Grub	33	acres	$ 1,500.00	$ 49,500	
Soil fill (Dike Exterior)	21,000	cu. yd.	$ 14.23	$ 298,830	
Ash fill (Dike Interior)	7,000	cu. yd.	$ 3.00	$ 21,000	
Geosynthetic (Geogrid)	14,000	sq.yd.	$ 1.70	$ 23,800	
Drainage and Erosion Control	2,160,000	s.f.	$ 0.04	$ 86,400	
Settling Basin	1	each	$ 75,000.00	$ 75,000	
Raise Discharge Pipe(s)	1	event	$ 50,000.00	$ 50,000	
Liner (30 MIL HDPE)-Active	1,500,000	s.f.	$ 0.35	$ 525,000	
Liner (60 MIL HDPE)-Active	1,600,000	s.f.	$ 0.60	$ 960,000	
Soil fill (6-inch cap)	41,300	cu.yd.	$ 14.23	$ 587,699	
Soil fill (18-inch cap)	124,000	cu.yd.	$ 3.00	$ 372,000	
Liner (30 MIL HDPE)-Area B	730,000	s.f.	$ 0.35	$ 255,500	
Liner (60 MIL HDPE)-Area B	720,000	s.f.	$ 0.60	$ 432,000	
SUBTOTAL				**$ 3,786,729**	
Permitting/Design	1	each	0.05	$ 189,336	
Construction Testing and Monitoring	1	each	0.02	$ 75,735	
SUBTOTAL				**$ 265,071**	
Convert to Dry Ash Disposal*	1	event	12500000	$ 12,500,000	
SUBTOTAL				$ 12,500,000	
GRAND TOTAL					**$ 16,551,800**

* - Operation and Maintenance for dry disposal is estimated at $800,000 beginning in 2002 based on CRS Sirrine initial estimate of 400,000 (1/2 of CRS Sirrine estimate for Asheville plant due to relative plant size per Mark Shilling) per year in 1985.

ASH DISPOSAL ALTERNATIVES
ROUGH COST ESTIMATE
PROJECT NAME: WEATHERSPOON
PROJECT NUMBER: 30720-9-3428/05/800
ALTERNATIVE: DIKE VERTICAL EXTENSION/VERTICAL EXPANSION (CONV.)
LIFETIME: 72.5 YEARS

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL	TOTAL
Mobilization	1	each	$ 50,000.00	$ 50,000	
Clear and Grub	33	acres	$ 1,500.00	$ 49,500	
Soil fill (Dike Exterior)	222,000	cu. yd.	$ 14.23	$ 3,159,060	
Geosynthetic (Geogrid)	48,000	sq.yd.	$ 1.70	$ 81,600	
Drainage and Erosion Control	2,160,000	s.f.	$ 0.04	$ 86,400	
Settling Basin	1	each	$ 75,000.00	$ 75,000	
Raise Discharge Pipe(s)	1	event	$ 50,000.00	$ 50,000	
Liner (30 MIL HDPE)-Active	1,500,000	s.f.	$ 0.35	$ 525,000	
Liner (60 MIL HDPE)-Active	1,600,000	s.f.	$ 0.60	$ 960,000	
Soil fill (6-inch cap)	41,300	cu.yd.	$ 14.23	$ 587,699	
Soil fill (18-inch cap)	124,000	cu.yd.	$ 3.00	$ 372,000	
Liner (30 MIL HDPE)-Area B	730,000	s.f.	$ 0.35	$ 255,500	
Liner (60 MIL HDPE)-Area B	720,000	s.f.	$ 0.60	$ 432,000	
SUBTOTAL				**$ 6,683,759**	
Permitting/Design	1	each	0.05	$ 334,188	
Construction Testing and Monitoring	1	each	0.02	$ 133,675	
SUBTOTAL				**$ 467,863**	
Convert to Dry Ash Disposal*	1	event	12500000	$ 12,500,000	
SUBTOTAL				$ 12,500,000	
GRAND TOTAL					**$ 19,651,622**

* - Operation and Maintenance for dry disposal is estimated at $800,000 beginning in 2002 based on CRS Sirrine initial estimate of 400,000 (1/2 of CRS Sirrine estimate for Asheville plant due to relative plant size per Mark Shilling) per year in 1985.

ASH DISPOSAL ALTERNATIVES
ROUGH COST ESTIMATE
PROJECT NAME: WEATHERSPOON
PROJECT NUMBER: 30720-9-3428/05/800
ALTERNATIVE: VERTICAL EXPANSION WITH EXCAVATION
LIFETIME: 48.5 YEARS

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL	TOTAL
EXCAVATE AND LINE NEW CELL					
Mobilization	1	each	$ 50,000.00	$ 50,000	
Clear and Grub	55	acres	$ 1,500.00	$ 82,500	
Excavate and haul to Area B	346,577	cu.yd.	$ 3.00	$ 1,039,731	
Liner (60 MIL HDPE) Area B/Exc	1,840,000	s.f.	$ 0.60	$ 1,104,000	
Divider Dike	24,000	cu.yd.	$ 3.00	$ 72,000	
Drainage and Erosion Control	2,160,000	s.f.	$ 0.04	$ 86,400	
Settling Basin (reroute discharge pipes)	1	each	$ 25,000.00	$ 25,000	
Extend Discharge Pipe(s)	1	event	$ 50,000.00	$ 50,000	
Liner (30 MIL HDPE)-Total	2,230,000	s.f.	$ 0.35	$ 780,500	
Liner (60 MIL HDPE)	470,000	s.f.	$ 0.60	$ 282,000	
Soil fill (6-inch cap)	41,300	cu.yd.	$ 14.23	$ 587,699	
Ash fill (18-inch cap)	124,000	cu.yd.	$ 3.00	$ 372,000	
SUBTOTAL				**$ 4,531,830**	
Permitting/Design (5%)	1	each	0.05	$ 226,592	
Construction Testing and Monitoring (2%	1	each	0.02	$ 90,637	
SUBTOTAL				**$ 317,228**	
Convert to Dry Ash Disposal*	1	event	12500000	$ 12,500,000	
SUBTOTAL				$ 12,500,000	
GRAND TOTAL					**$ 17,349,058**

* - Operation and Maintenance for dry disposal is estimated at $800,000 beginning in 2002 based on CRS Sirrine initial estimate of 400,000 (1/2 of CRS Sirrine estimate for Asheville plant due to relative plant size per Mark Shilling) per year in 1985.

ASH DISPOSAL ALTERNATIVES
ROUGH COST ESTIMATE
PROJECT NAME: WEATHERSPOON
PROJECT NUMBER: 30720-9-3428/05/800
ALTERNATIVE: VERTICAL EXPANSION WITHOUT EXCAVATION
LIFETIME: 40.5 YEARS

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL	TOTAL
Mobilization	1	each	$ 50,000.00	$ 50,000	
Clear and Grub	55	acres	$ 1,500.00	$ 82,500	
Drainage and Erosion Control	2,160,000	s.f.	$ 0.04	$ 86,400	
Settling Basin	1	each	$ 50,000.00	$ 50,000	
Liner (30 MIL HDPE)	2,230,000	s.f.	$ 0.35	$ 780,500	
Liner (60 MIL HDPE)	2,160,000	s.f.	$ 0.60	$ 1,296,000	
Soil fill (6-inch cap)	41,300	cu.yd.	$ 14.23	$ 587,699	
Soil fill (18-inch cap)	124,000	cu.yd.	$ 3.00	$ 372,000	
SUBTOTAL				**$ 3,305,099**	
Permitting/Design	1	each	0.05	$ 165,255	
Construction Testing and Monitoring	1	each	0.02	$ 66,102	
SUBTOTAL				**$ 231,357**	
Convert to Dry Ash Disposal*	1	event	12500000	$ 12,500,000	
SUBTOTAL				$ 12,500,000	
GRAND TOTAL					**$ 16,036,456**

* - Operation and Maintenance for dry disposal is estimated at $800,000 beginning in 2002 based on CRS Sirrine initial estimate of 400,000 (1/2 of CRS Sirrine estimate for Asheville plant due to relative plant size per Mark Shilling) per year in 1985.

LAW
LAWGIBB Group Member

REPORT OF ASH POND STUDY
CAROLINA POWER & LIGHT COMPANY
SUTTON STEAM ELECTRIC PLANT

WILMINGTON, NORTH CAROLINA
LAW PROJECT NO. 30720-9-3428

Prepared by:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

January 13, 2000

LAW
LAWGIBB Group Member

January 13, 2000

CP&L
P.O. Box 1551
Raleigh, North Carolina 27602

Attention: Mr. Keith Gettle

**Subject: REPORT OF ASH POND CAPACITY EVALUATION
SUTTON PLANT
LUMBERTON, NORTH CAROLINA
LAW PROJECT NO. 30720-8-2983**

Dear Mr. Gettle:

On December 16, 1999, a meeting was held to discuss the draft ash evaluation report prepared by LAW for the Sutton steam electric plant in Wilmington, North Carolina. During the meeting, CP&L representatives requested the following modifications and/or information be provided:

- The ash to coal burned ratio be modified from 10 percent to 11 percent;

We modified our capacity estimates to reflect a 1 percent increase in the ash to coal burned ratio. The revised estimates have been incorporated into the final report.

- Capacity of the active impoundment at the current operating level be included;

The remaining lifetimes of the active impoundment at the current operating level (26 feet msl) for the maximum and average discharge values are 3 and 4 years, respectively (Section 2.3 and Appendix A).

- Provide an estimate of the available capacity in the 1983 (inactive) pond if it were reactivated for wet discharge;

The 1983 ash pond does not contain water and obtaining its bottom topography was not within the scope of the field work. We contacted Mr. Mike Norton regarding the current estimated depths from the perimeter dike to the existing land surface in the 1983 ash pond. Based on this information we used an average depth of 10 feet to represent the depth across the pond. Based on these considerations, the available capacity in the 1983 impoundment (inactive) is approximately 20,908,800 cubic feet when completely filled to the brim. If the available volume is filled with dry or semi-dry ash compacted to an average of 70 pounds per cubic foot, approximately 5.6 years or 8 years of ash production can be accommodated at the maximum and average ash production rates, respectively.

LAW Engineering and Environmental Services, Inc.
3301 Atlantic Avenue • Raleigh, NC 27604
919-876-0416 • Fax: 919-831-8136

- Evaluate the feasibility of dredging.

Our evaluation of dredging the ash from within the active impoundment concluded that this method was not as feasible as excavation and compaction based on the following findings:

- Excessive water would be required to dredge the ash from the active impoundment into the inactive impoundment which would consume an excessive amount of the available capacity until the water was drained or seeped out of the inactive impoundment.

- The ash would not be compacted but would rather settle and deposit in a loose state which would not make efficient use of the remaining capacity when compared to compacting the ash in place.

- Provide an order of magnitude estimate for the ash sediment rate;

The sedimentation rate for ash released through a slurry discharge is affected by the discharge velocity, proportion of light to heavy ash, particle size, depth of water and type of discharge (direct into water or along a channel), among others. Coarser particles settle out close to the discharge point and finer particles go further out from the discharge. There is not a single rate that applies to a pond as a whole, and the rates will vary over time.

We appreciate the opportunity of having worked with CP&L on this project. Please contact us if you have questions or comments regarding this report.

Respectfully submitted,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

by ZCC with permission
Steven S. Trimberger, P.E.
Senior Engineer
Registered, North Carolina 20243

J. Allan Tice, P.E.
Corporate Geotechnical Consultant
Assistant Vice President
Registered, North Carolina 6428

NORTH CAROLINA
PROFESSIONAL
SEAL
6428
ENGINEER
J. ALLAN TICE

SST/JAT/sst

Attachments

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DRAWINGS

DRAWING

APPENDICES

APPENDIX	
Appendix A	**Ash Pond Capacity Estimates**
Appendix B	**Alternative Lifetime Bar Charts**
Appendix C	**Cost Estimates**

1.0 EXECUTIVE SUMMARY

The Sutton Steam Electric Plant consumed an average of approximately 822,578 tons of coal per year from 1993 to 1998. The maximum amount of coal consumed per year during that period was 1,178,410 tons in 1998. The plant produces approximately 11 percent of ash by-products from burning coal. Based on an average and maximum of the historical data, ash is produced at a rate of 90,484 and 129,625 tons per year, respectively. The ash by-product is approximately 10 percent bottom ash and 90 percent flyash. The ash is mixed with water and pumped via an aboveground pipeline into the ash storage impoundment located to the northwest of the plant. The ash storage impoundment is formed by earthen embankments that include an access road on top.

Estimates of available ash storage capacity made in 1997 by Trigon projected there was less than nine years of useful storage remaining in the ash storage impoundment. This current report estimates that less than six years of useful storage remains based on the maximum ash discharge rate and addresses alternatives available for handling the ash in the future.

The following feasible alternatives for handling ash in the future were evaluated:

- Alternative 1
  - Short Term: Dike vertical extension to increase pond capacity
  - Long Term: Conversion to dry ash system and future vertical expansion
- Alternative 2
  - Short Term: Excavation of sedimented ash from active cell and dry stack into 1983 Pond
  - Long Term: Conversion to dry ash system and future vertical expansion
- Alternative 3
  - Short Term: Vertical expansion without excavation from active cell
  - Long Term: Conversion to dry ash system and future vertical expansion
- Market ash for beneficial reuse;

The following alternate concepts for handling ash in the future were not evaluated based on discussions with CP&L personnel regarding their feasibility at the Sutton site:

- Construct new ash storage pond;
- Construct dedicated CP&L ash landfill site(s)
- Plant power output load leveling.

The results of the study indicate that short-term solutions include a combination of continuing to pursue beneficial use of ash coupled with providing additional capacity by vertically extending the existing dike or by excavation within the active area and continuing wet disposal operations. The only feasible solutions for long-term (>20 years) ash management are finding markets for beneficial re-use coupled with vertical expansion and conversion to a dry ash process. CP&L should evaluate beneficial use of ash offsite on a case by case basis regarding potential immediate and long-term liability to CP&L. Three alternatives have been provided regarding vertical expansion of the existing ash impoundment area that will require internal evaluation by CP&L in terms of information provided in this and other evaluations, the availability of resources and projected use of fossil fuel power generation in the future.

2.0 PROBLEM DESCRIPTION

2.1 HISTORICAL BACKGROUND

General information about the plant operation, coal use and ash pond history has been obtained from review of dam safety inspection reports, discussions with CP&L personnel at the Sutton Plant and from site visits.

Ash by-products from coal combustion are mixed with water to create an ash-water slurry that is pumped through a pipeline to a storage area impoundment located northwest of the plant (CP&L Drawing D-3235-1). The impoundment is constructed of compacted soil earthen embankments (dikes) on top of coastal plain sediments. In general, the natural soils consist of fine to coarse sand with some layers of silty material to a depth of 50 feet below land surface.

The ash-water slurry is retained in the impoundment so the ash can settle. Until summer 1999, the water was discharged into the adjacent cooling lake. A new piping system was installed in 1999 that routes the discharge through pipes to the Cape Fear River. Water quality limits are in effect for the pH and suspended solids of the water released.

There are two ash ponds at the site - one active and one inactive. The inactive ash pond was originally constructed in 1971 on the north side of the cooling lake. It was modified in 1983 by raising the dikes. This pond is referred to as the 1983 Ash Pond. In 1984, a new ash pond was constructed directly north of the 1983 Ash Pond. A common dike separates the south end of the 1984 Ash Pond from the north end of the 1983 Ash Pond. See Drawing 2.1 for location of the ponds.

The active impoundment has a crest elevation of 34.0 feet (msl) and a maximum operating level of 32.0 feet (msl). Currently the pond is operated at approximately elevation 26 feet (msl). According to the 1997 dam safety inspection, the active impoundment does not have conditions that would present concerns for continued use to its design capacity.

2.2 ACTIVE IMPOUNDMENT DESIGN INFORMATION

The active ash impoundment was designed with compacted structural soil fill embankments that were extended to elevation 34.0 feet mean sea level (msl). Interior and exterior slopes were constructed to 3(H):1(V). The dike fill is a sand. A clay liner blanket was included on the interior slope for seepage retardation.

The CP&L tract is primarily bordered by industrial and commercial properties. The cooling pond is located adjacent to and south of the active impoundment. The CP&L plant is located adjacent to and southeast of the active impoundment. To the west is the Cape Fear River.

The impoundment design was by CP&L staff. The 1983 Ash Pond covers an area of approximately 47 acres and the 1984 Ash Pond covers approximately 82 acres. According to CP&L personnel, the design operating level (32.0 feet msl) provides two feet of freeboard for stormwater rise.

2.3 STORAGE CAPACITY AVAILABLE

In 1997, Trigon Engineering Consultants, Inc provided a survey of the active impoundment to determine the available and projected storage capacity. Their report (reference 1) used contours obtained by conventional land surveying and bottom depth soundings in the spring of 1997. Their report concluded the active impoundment had about 8.9 years of available storage remaining, assuming a pond operating level of elevation 32 feet msl and average ash discharge rates based on data through 1996.

As part of the current ash pond evaluation, Law was requested to review and update the Trigon information regarding available capacity. The life expectancy of the ash pond was estimated based on field survey data collected using conventional and Global Positioning System (GPS) methods and consideration of filling to the design level. The updated survey is provided as Drawing 2.2.

According to the Ash Pond Expansion Drawings, dated January 1983, the pond was designed for a maximum operating level of 32 feet (msl). Based on our interpretation of the Trigon report, they calculated the ash volume to a level of 32 feet (msl). However, ash can not be filled entirely to this level because some water must be available to transport the ash and to allow the water quality to stabilize before it is discharged. Therefore, for capacity estimation purposes, we assumed that ash would fill only to elevation 31 feet (msl). At the maximum annual ash discharge volume rate (129,625 tons/year), we conclude that the existing active impoundment will last approximately 6 years from the present date (Appendix A). Using an average annual discharge volume (90,484 tons/year), we conclude that the existing active impoundment will last approximately 9 years from the date of this report.

The remaining lifetimes of the impoundment at the current operating level for the maximum and average discharge values are 3 and 4 years, respectively.

2.4 STATEMENT OF THE PROBLEM

Regardless of variability in capacity estimates due to average or maximum discharge rates, the active impoundment is expected to reach its design capacity within 9 years from the present date. Provision for disposition of ash must be available by the time active impoundment design capacity is reached.

3.0 ROOT CAUSE ANALYSIS FOR PROBLEM

The root cause of the problem is the generation of ash from production of power by burning coal combined with the limited available capacity for storage of slurried ash.

4.0 EVALUATION OF ALTERNATIVES

4.1 TECHNICAL FACTORS FOR ASH

4.1.1 Ash Composition

The ash consists of fine (fly ash) and coarse (bottom ash) portions with the great majority being fly ash. Other than the typical metals found in fly ash, Toxic Characteristic Leaching Procedure (TCLP) constituents such as regulated pesticides, PCBs, herbicides, base/neutral/acid extractables or volatile organics are typically not associated with ash generated at these facilities. No testing of the fly ash for sulfate or resistivity values has been done. These parameters are often of interest when evaluating fly ash for use as fill that would be in contact with buried metal piping.

4.1.2 Ash Unit Weight

Ash properties from the ash evaluation study performed for the Asheville facility (reference 2) were utilized for this study.

For freshly deposited ash, a unit weight of 50 pounds per cubic foot (the lower value used by Trigon in their study) appears reasonable. For ash that has been in place for several years, a unit weight of 68 pounds per cubic foot (the higher number suggested by CP&L as reported by Trigon) appears reasonable. Projecting available storage capacity should account for the variable unit weights related to the time the ash has been in the pond. In our Asheville report (reference 2), we assigned unit weights as follows:

YEARS SINCE DEPOSITION	DRY UNIT WEIGHT, pcf
0	50
1	53
2	58
3	63
4	68

In summary, for freshly deposited ash, a unit weight of 50 pounds per cubic foot (the lower value used by Trigon in their study) appears reasonable. For ash that has been in place for several years, a unit weight of 68 pounds per cubic foot (the higher number suggested by CP&L as reported by Trigon) appears reasonable.

4.1.3 Ash Production

Historical coal usage at the Sutton Plant, as provided by CP&L, is summarized below.

YEAR	COAL BURNED, tons
1993	765,837
1994	490,256
1995	700,756
1996	933,904
1997	866,305
1998	1,178,410

The ratio of ash produced to coal burned is reported by CP&L as 11 percent for the Sutton Plant. A value of 11 percent has been used in our study as recommended by CP&L representatives during a meeting held on December 16, 1999 to discuss the draft ash capacity evaluation report. According to CP&L personnel, about 10 percent of the ash is bottom ash. Using the above quantities and percentages, the average ash production is 90,484 tons per year and the maximum ash production is 129,625 tons per year, requiring placement into the active impoundment or some other form of storage/disposal. Historical data indicates a significant increase in coal consumption over the last three years.

4.2 DESCRIPTION OF NON-FEASIBLE ALTERNATIVES

The following conceptual alternatives were not considered feasible solutions as described in the following sections:

- Constructing an additional on-site ash impoundment
- Constructing a dedicated CP&L ash landfill
- Load leveling of plant power outputs

4.2.1 Additional On-site Ash Impoundment

This alternative consists of constructing an additional ash storage impoundment on site. Based on discussions with CP&L personnel at the Sutton facility, review of site plan drawings and field observations, there is potentially space available for expansion to the ~~northwest~~ east/northeast of the existing impoundment for or construction of a new impoundment for long-term usage. However, due to considerable regulatory hurdles and past issues with Cape Industries to the north, this alternative was not considered feasible at this site according to a conversation with Mr. Mike Norton of the Sutton Plant.

4.2.2 Dedicated CP&L Landfill(s)

This alternative consists of identifying at least one existing CP&L ash disposal facility on CP&L property as a dedicated facility for the remaining facilities. Ash generated from the remaining facilities would be transported via rail or truck to the dedicated facility. Advantages would be to limit construction, design and permitting costs to the dedicated facility or facilities and the remaining facilities would incur costs related to storing, loading and transporting the ash to a dedicated facility. Based on conversations with CP&L personnel, it appears that offsite transport is not economically feasible. CP&L previously evaluated offsite disposal of ash into excavated mines that revealed excessive storage, loading and transportation costs. In addition, offsite transport and disposal of ash represents a liability in terms of transportation mishaps that could potentially release ash into the environment and potential liability should the disposal area present an environmental impact. Based on these items, this alternative was not considered feasible at this site.

4.2.3 Plant Load Leveling

This alternative consists of transferring power production requirements from facilities near their ash impoundment capacities to other facilities with more capacity available to decrease the amount of ash generated at the near-capacity facilities. Based on conversations with CP&L personnel, this alternative does not appear feasible in terms of current operating and existing power generation transfer capabilities at the plants.

4.3 DESCRIPTION OF FEASIBLE ALTERNATIVES

The following conceptual alternatives have been identified as feasible solutions based on our understanding of the site requirements, review of the existing operations and discussions with CP&L

personnel. The alternatives are separated into short term and long term solutions. The short term solutions are those that do not involve conversion to a dry storage system and are intended to be implemented within the next several years to provide storage capacity for up to 9.5 years. While the capacity from the short term solution is being utilized, the long term solution can be implemented, which is intended to provide a larger storage capacity. Each is discussed briefly in this section. Section 4.4 contains the technical, safety, reliability, economic, environmental, risk, and other issue analyses as appropriate for each alternate.

4.3.1 Alternative 1: Fill Remaining Volume / Vertical Expansion

4.3.1.1 Short Term (Fill Remaining Volume)

This alternative consists of wet filling the remaining volume in the active impoundment to the design operation level of 32 feet msl (Drawing 4.1).

4.3.1.2 Long Term (Convert to Dry Ash System / Vertical Expansion)

To extend storage capacity beyond the available storage capacity, implementation of a dry ash disposal system could be performed. The conversion could be completed while the remaining pond volume is being filled. Initially, the 1983 Pond could be cleared and lined with a 60 mil HDPE liner and placement of the dry ash would begin in this area. Once the design operating level in the active impoundment has been reached with wet filling, the active impoundment will also be lined. Dry ash disposal will then continue with vertical expansion of both the 1983 Pond and the 1984 Pond. Following completion of the vertical expansion, the disposal area will be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a six-inch soil erosion layer that will promote vegetative growth. As shown on Drawing 4.2, the vertical expansion could extend as high as 100 feet above the existing pond.

4.3.2 Alternative 2: Fill Remaining Volume / Active Area Excavation / Dry Stack / Vertical Expansion

4.3.2.1 Short Term (Fill Remaining Volume / Active Area Excavation)

This alternative consists of wet filling the remaining volume in the active impoundment during the construction of a divider berm along the existing ash-water interface (Drawing 4.3). The ash discharge lines will be extended to reach the wet side of the divider berm. Following completion of the divider berm, ash on the dry side of the berm will be excavated to the original grade, transported, and stockpiled in a semi-dry state in the 1983 Pond.

Wet filling operations will continue until the design operation level of 32 feet msl has been reached in the active pond. The plant discharge lines will then be drawn back to discharge into the area excavated, and it will be filled to capacity.

4.3.2.2 Long Term (Convert to Dry System / Vertical Expansion)

To extend storage capacity beyond the short–term alternative, implementation of a dry ash disposal system could be performed. The conversion could be completed while the excavated area is being filled. A 60-mil HDPE liner will be installed on the 1983 pond. Disposal of future dry ash can then be implemented by vertically expanding the 1983 pond. While the 1983 pond is being dry-filled, the 1984 pond will continue to drain and dry out. Once sufficiently dried, the 1984 pond can also be lined and receive dry ash.

Following completion of the vertical expansion, the disposal area will be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a 6-inch soil erosion layer that will promote vegetative growth. The final configuration would be the same as for Alternative 1, shown on Drawing 4.2.

4.3.3 Alternative 3: Dike Vertical Extension / Fill Remaining Capacity / Convert to Dry System / Vertical Expansion

4.3.3.1 Short Term (Dike Vertical Extension / Fill Remaining Capacity)

This alternative consists of wet filling the remaining volume of the active impoundment to the design level of 32 feet msl and simultaneously raising the height of the active impoundment dike six feet to elevation 40 feet msl (Drawings 4.4, 4.5 and 4.6). Upon completion of the dike vertical extension, wet filling of ash will continue to the new design elevation of 38 feet msl. The existing skimmers and the ash discharge pipes will be raised to accommodate the new operating levels.

4.3.3.2 Long Term (Convert to Dry System / Vertical Expansion)

Prior to reaching the design level of the dike vertical extension, the plant could convert the wet ash disposal system to a dry system and dispose of future dry ash by vertically expanding the 1983 (inactive) Pond. While the wet filling of the 1984 Pond is being completed, the 1983 Pond will be lined with a 60 mil HDPE liner prior to receiving ash. Once the wet filling is completed, disposal of dry ash will commence in the 1983 Pond. While the 1983 pond is being dry-filled, the 1984 pond can be drained and allowed to dry out. Once sufficiently dried, the 1984 pond can also be lined and receive dry ash.

Following completion of the vertical expansion, the disposal area must be capped with an 18-inch infiltration layer (ash with 30 mil HDPE membrane) and a 6-inch soil erosion layer that will promote vegetative growth. The final configuration would be the same as for Alternative 1, shown on Drawing 4.2.

4.3.4 Improve Markets for Ash Reuse

Various markets for use of fly ash exist. Some companies have expressed an interest in obtaining ash, and bottom ash is presently being consumed at other CP&L facilities for beneficial use. Mr. Mark Shilling has indicated during previous studies that CP&L has pursued various markets. A formal report was previously prepared by Law, for NCDOT, addressing the use of ash from the Sutton Plant (reference 7).

4.4 ANALYSIS OF ALTERNATIVES

According to conversations with Mick Greeson and Cary McPherson with CP&L, ash slurry discharge operations are considered a wastewater treatment system and are covered by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Division of Water Quality. Removal of wet ash from the wastewater treatment system and subsequent manipulation of the ash within an existing ash impoundment is covered by a wastewater non-discharge permit. Disposal of ash (dry) from dry processes on top of the existing ash is covered by the Solid Waste Section of NCDENR.

The short-term options do not involve placing dry ash or manipulating ash outside of the original impoundments. Thus, these options would not require placement of liners. Should the ash disposal operation be converted to a dry ash system, it appears that the solid waste regulations will apply with respect to the liners. Based on this understanding, our analysis of the long-term options includes bottom liners and caps in accordance with the solid waste facility requirements, where appropriate.

The short-term wet disposal alternatives discussed below include filling the additional volume with ash to within 3 feet of the top of dike elevation (2 feet freeboard and 1 foot of water). Short-circuiting will likely occur prior to the ash level reaching a uniform design elevation across the pond, as the available settling volume diminishes. Due to variabilities associated with wet filling the pond over several years it is difficult to accurately predict a uniform design elevation that will maximize available storage volume and minimize short-circuiting. Therefore, we recommend that the quality of discharge from the ash pond along with the proposed design maximum ash level be considered to determine when the pond is at capacity (assumed 1 foot below design operating elevation for this report).

The estimated remaining times in the following alternative analyses are based on the maximum ash discharge rate from 1993 to 1998 provided by CP&L. We have chosen to use the maximum ash discharge rate because it is more representative of the recent (1996 to 1998) increasing trend in annual coal consumption than the average discharge rate. Using the maximum instead of the average ash discharge rate will result in a more conservative estimate for alternative lifetimes if coal use declines. A factor of 1.4 times the estimated times outlined in the following sections may be applied for comparison with the average ash discharge rate from 1993 to 1998.

Our cost estimates for the following alternatives were based on standard published unit rates, our experience with similar activities, and extrapolation of data from other studies. Costs associated with the conversion to a dry ash disposal system were based on a study by CRS Sirrine (reference 3) prepared for the CP&L L.V. Sutton Steam Electric Plant. In addition, we converted the 1985 cost estimates to 2003 dollars using a 4% inflation rate.

4.4.1 Alternative 1: Fill Remaining Volume / Vertical Expansion

4.4.1.1 Technical Analysis

4.4.1.1.1 Short Term (Fill Remaining Capacity)

Filling of the remaining volume of the active impoundment (approximately 31,922,003 cubic feet) would continue to the design ash fill elevation of 32 feet (msl) established earlier for approximately 6 years.

4.4.1.1.2 Long Term (Vertical Expansion)

Prior to reaching the design operation elevation in the active impoundment, the facility could convert the existing wet ash disposal process to a dry system as described in Case 4 in the CRS Sirrine study mentioned previously, and proceed with vertically expanding the 1983 Pond. All ash disposal areas must be lined with 60 mil HDPE prior to receiving dry ash.

The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. At this slope, the area could be filled to a level 100 feet above the present dike as shown on Drawing 4.2. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The final cap will consist of a 30 mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). Dry ash disposal operations would last approximately 70 years resulting in a total lifetime estimate of 76 years (Appendix B).

4.4.1.2 Safety Analysis

Because of the on site location of the proposed vertical expansion, the likelihood of significant offsite impacts or damage resulting from an unstable slope condition of the ash impoundment is remote.

4.4.1.3 Reliability Analysis

A vertical expansion could be constructed in a reliable fashion. HDPE liners can develop leaks. Leaks would have a low likelihood of causing significant changes in the foundation seepage, as the quantity of water leaking would likely be very small. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable seal.

4.4.1.4 Economic Analysis

No capital cost would be associated with the short term alternative, since this is the current operation of the system. The approximate cost for implementing the long term part of this alternative including design, permitting and conversion to a dry ash system is estimated to be $20.9 million (Appendix C).

4.4.1.5 Environmental Analysis

Since the work for this alternate would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Cape Fear River. Provisions for dust control may become necessary during the work to prevent ash dust from affecting surrounding property owners.

4.4.1.6 Risk Assessment

With respect to the concept of providing additional capacity for the ash, there is very little risk that the storage volume would not provide long-term storage. Other risks are related to potential impacts on the surrounding area should ash migrate offsite via an embankment failure or erosive forces as discussed above.

4.4.1.7 Other Issues

The aesthetics of having a large mound of ash may represent a concern. We understand that CP&L encountered some regulatory-driven delay to creating an ash landfill on top of an abandoned pond at the Roxboro plant in the late 1980's. Although the issues were successfully addressed, the potential for similar regulatory delays may still exist.

4.4.2 Alternative 2: Fill Remaining Volume / Active Area Excavation / Dry Stack / Vertical Expansion

4.4.2.1 Technical Analysis

4.4.2.1.1 Short Term (Fill Remaining Volume / Active Area Excavation)

Sedimented ash occupies about one-third of the 1984 pond. Removal of the sedimented ash and transporting to the 1983 Pond area will allow longer use of the 1984 Pond. Excavation to approximately 15 feet below the existing ash surface would remove approximately 528,900 cubic yards from the existing active impoundment. Construction of a divider berm located along the existing ash/water interface would be required to reduce water inflow into the excavation area. The existing ash discharge lines would be extended through or around the berm into the remaining fill area in the active impoundment. The excavated ash would be placed into the 1983 Pond and compacted as it is placed to reduce volume. Filling of the remaining volume of the active impoundment north of the dividing berm (approximately 20,994,261 cubic feet) would continue to the design filling elevation of 32 feet msl.

According to Mr. Jeff Thompkins of CP&L's Sutton Plant, the existing Hydrovac Tank systems, located at the units, are near their maximum operating head. The system basically operates by pumping the ash slurry to a tank, which gravity feeds the ponds. The elevation of the tank may need to be increased in order to compensate for the additional frictional losses that would result from a pipe extension. Mr. Thompkins believes that this is feasible and estimated the cost at $25,000 to $30,000 per tank. There are two tanks in the system. One is for Units 1 & 2 and the other tank is for Unit 3.

Upon reaching the design operation elevation in the original remaining discharge area, the ash discharge line would be retracted to begin discharging into the excavated area. Volume estimates indicate a life of 6 years remaining in the active pond following installation of the dividing berm. Wet ash disposal into the new impoundment would last an estimated 2.5 additional years, for a total estimated life of 8.5 years.

4.4.2.2 Long Term (Dry Stack / Vertical Expansion)

Prior to reaching the design ash fill level of 32 feet (msl) in the excavated area, the facility could convert the existing wet ash disposal process to a dry system as described in Case 2 in the CRS Sirrine study. The compacted ash previously placed in the 1983 Pond would then be lined with 60-mil HDPE prior to receiving dry ash. Ash disposal will proceed by vertically expanding on the 1983 Pond first. While the

1983 Pond is being dry-filled, the 1984 pond will be drained and allowed to dry. Once sufficiently dried, the 1984 Pond surface will then also be compacted, lined and prepared to receive dry ash.

The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The final cap will consist of a 30-mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). Dry ash disposal operations would last approximately 70 years resulting in a total lifetime estimate of 78.5 years (Appendix B).

4.4.2.3 Safety Analysis

Based on several historical CP&L excavation projects it appears that removal of ash from the active impoundment can be performed without compromising safety. Reference Section 4.4.1.2 regarding safety issues for the vertical expansion.

4.4.2.4 Reliability Analysis

A vertical expansion could be constructed to perform in a reliable fashion. The excavation and construction of a berm within an active impoundment has been done previously with favorable results. HDPE liners can develop leaks but would have a low likelihood of causing significant changes in the foundation seepage, as the quantity of water leaking would likely be very small. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable seal.

4.4.2.5 Economic Analysis

Constructing the impoundment would require excavation of approximately 528,900 cubic yards of ash of which 23,400 cubic yards would be used to construct the divider berm. In addition, the ash discharge pipe will need to extended to fill the active pond and later retracted to fill the new impoundment. The approximate cost for implementing the short-term portion of this alternative is estimated to be $2.3 million (Appendix C).

The approximate cost for implementing the long-term portion of this alternative including design, permitting, and conversion to a dry ash system is estimated to be an additional $20.7 million (Appendix C).

4.4.2.6 Environmental Analysis

Since the work for this alternate would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now. Excavating the ash and transporting it across the divider road to the 1983 Pond does not impact the environment outside of the ash impoundments themselves. During the construction of the divider berm, the amount of suspended solids in the water near the discharge structure may increase, potentially causing violations of the discharge limits. Floating turbidity screens may be useful in reducing discharge of suspended solids.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Cape Fear River. Provisions for dust control may become necessary during the work to prevent ash dust from affecting surrounding property owners.

4.4.2.7 Risk Assessment

Reference Section 4.4.1.6.

4.4.2.8 Other Issues

The aesthetics of having a large mound of ash may represent a concern. We understand that CP&L encountered some regulatory-driven delay to creating an ash landfill on top of an abandoned pond at the Roxboro plant in the late 1980's, although the issues were successfully addressed. The potential for similar regulatory delays may still exist.

4.4.3 Alternative 3: Dike Vertical Extension / Fill Remaining Capacity / Convert to Dry System / Vertical Expansion

4.4.3.1 Technical Analysis

4.4.3.1.1 Short Term (Dike Vertical Extension / Fill Remaining Capacity)

Filling of the remaining volume of approximately 31,922,003 cubic feet would continue to the design ash filling elevation of 32 feet msl for approximately 6 years. During this time, a vertical extension of the existing dikes would be done. For evaluation purposes, the vertical extension height was limited to 6 feet, to bring the top of the dike to an elevation of 40 feet msl. The proximity of the dam to the cooling lake limits the vertical rise. As the dam is raised higher, the base width of the dam also increases and some sections may potentially extend out into the lake, requiring special concerns during design and construction.

Two variations of this alternative were considered. The first alternative (3A) is a conventional approach that expands the dike on the outside face (drawing 4.5). The construction of the dike vertical extension would consist of approximately 208,000 cubic yards of compacted soil and would create approximately 18,652,000 cubic feet of additional capacity. Approximately 309,000 square yards of geosynthetic would be placed within the extension for foundation support.

The second alternative (3B) uses an innovative approach. The major portion of the dike is constructed conventionally as above, but areas where outside space is restricted, the dike is expanded on the inside face, by constructing on top of the ash (drawing 4.6). For evaluation in this report, we assumed 40% of the dike extension would be conventional and 60% would be innovative. The construction of the conventional portion of the dike vertical extension would consist of approximately 83,200 cubic yards of compacted soil. The innovative portion consists of approximately 26,800 cubic yards of compacted soil and 11,500 cubic yards of select ash. The soil fill would be utilized in exterior portions of the dike and the ash would be utilized on the interior portions. Approximately 68,800 square yards of geosynthetic would be placed within the dike extension for foundation support.

This approach is intended for use only in areas where the conventional approach described above will not work due to space limitations. Although this approach has a lower capital cost based on initial calculations, the design and construction logistics are significantly more difficult and have more risk. If this alternative is to be used, additional study would be required to more accurately define design parameters and anticipate construction logistics.

Both approaches would require the installation of an impermeable barrier, such as an HDPE liner or clay layer, to retard infiltration through the dike wall and placement of erosion-resistant material on the interior slope to protect against beaching erosion.

Wet ash disposal processes would continue for approximately 3.5 years in the newly raised impoundment for a total life of approximately 9.5 years.

The Hydrovac tank system that feeds the ponds would likely require raising to compensate for the additional elevation head created by raising the pond level. Refer to Section 4.4.1.1 for additional details.

4.4.3.1.2 Long Term (Convert to Dry System / Vertical Expansion)

Prior to reaching the design operation level of 38 feet msl in the newly lined impoundment, the facility could convert the existing wet ash disposal process to a dry system as described in Case 2 in the CRS Sirrine study. Ash disposal would then proceed by vertically expanding the 1983 pond and the active impoundment. The 1983 Pond must be lined with a 60 mil HDPE liner prior to vertically expanding with dry ash. While the 1983 Pond is being dry-filled, the 1984 pond will be drained and allowed to dry. Once sufficiently dried, the 1984 Pond surface will then also be compacted, lined and prepared to receive dry ash. The dry ash will be transported to the vertical expansion area via conveyor and/or trucks and manipulated by heavy equipment to a 5(H):1(V) finished slope. As ash disposal areas reach the cap subgrade elevation, the final cap will be installed. The final cap will consist of a 30 mil HDPE membrane, 18-inches of compacted select ash fill (infiltration layer) and a 6-inch soil layer to promote vegetative growth (erosion layer). Dry ash disposal operations would last approximately 70 years resulting in a total lifetime estimate of 79.5 years (Appendix B).

Raising the existing dike and vertical expansion level requires consideration of the effects on embankment stability and seepage that are discussed in the sections below.

4.4.3.1.3 Dam Stability Effects

We analyzed built-out conditions (innovative and conventional) when the vertical expansion was completely filled for the dike vertical extension alternative. These conditions were considered worst-case scenarios regarding slope stability analyses for the vertical expansion alternatives provided. Our analyses included circular slip failure analyses with and without a phreatic surface. Analyses without the phreatic surface revealed safety factors that exceeded 1.5. Analyses that included a phreatic surface above elevation 30.5 msl on the upstream side and extending to the toe revealed factors of safety less than 1.5.

In general, a minimum factor of safety of 1.5 is recommended against sliding which our analyses without the effects of the phreatic surface revealed. Analyses that included the phreatic surface above elevation 30.5 msl revealed unstable slope conditions. However, once the HDPE or clay liners are installed on the slope and infiltration of water into the dike is minimized, effects from an elevated phreatic surface should not represent a concern regarding the long-term stability of the slope. During construction of the dike vertical extension, the liner should be installed as soon as possible within finished portions of the newly constructed dike to reduce seepage through the dike.

Monitoring of the phreatic surface would be done under the normal CP&L dam safety-monitoring program. Prior to the expansion, piezometers will need to be installed. During construction, the frequency of checking the piezometers in the crest and downstream slope should be increased to every two weeks. During the first two years of filling the dike extension impoundment, the frequency of checking the piezometers in the crest and downstream slope should be ~~increased~~ decreased to monthly. During the first year of vertical expansion, the frequency of checking the piezometers in the crest and downstream slope should be ~~increased~~ decreased to monthly.

4.4.3.1.4 Seepage Considerations

Seepage at the Sutton facility has historically not represented a concern. The addition of the dike vertical extension and vertical expansion with liners and caps as proposed should reduce the amount of leachate (ash-laden water) generated as the facility progresses. As a result, this should in time reduce the potential of seepage from the ash impoundment. HDPE liners can develop leaks but would have a low likelihood of causing significant seepage, as the quantity of leachate leaking would likely be very small.

4.4.3.2 Safety Analysis

The technical analysis above shows that the existing embankment can be raised and a vertical expansion constructed without compromising safety, provided that the height of the phreatic surface in the impoundments is controlled by the advent of measures to prevent water migration through the embankments and into the subsurface. The property line with Cape Industries is located approximately 1,300 feet east of the dike. Because of the proximity of Cape Industries, there is a potential of offsite impacts or damage resulting from an unstable slope condition of the ash impoundment at the Sutton facility.

4.4.3.3 Reliability Analysis

A dike vertical extension and vertical expansion could be constructed to perform in a reliable fashion and are widely used methods to increase capacities of landfills. HDPE liners are an accepted method of leachate control for landfills, and when properly constructed, provide a reasonably reliable liner and cap system.

4.4.3.4 Economic Analysis

Constructing the dike vertical extension would require a fill of approximately 208,000 cubic yards of soil material for the conventional approach (Alternative 3A) and approximately 110,000 cubic yards of soil material and 11,500 cubic yards of ash for the innovative approach (Alternative 3B). In addition, the ash discharge pipe will need to be raised and the settling basin discharge structures and dikes will need to be vertically extended. The approximate short term cost for implementing Alternative 3A is estimated to be $4.2 million and for Alternative 3B is estimated to be $2.9 million. The approximate cost is estimated to be $20.8 for long term (Appendix C).

4.4.3.5 Environmental Analysis

Since the work for this alternate would be confined to within the existing ash pond, there are no additional environmental considerations beyond those associated with the operation of the pond now.

The dry ash transportation process could pose regulatory concerns should flyash deposition along the transportation route to the vertical expansion occur exposing the facility to potential offsite migration of ash via wind and rain. In addition, the lighter dry flyash within the vertical expansion may be transported offsite via wind. Future consideration of transportation route containment and/or prevention of flyash deposition during transport may be required and will depend on actual future operating conditions. Failure of a pipeline would release ash into the environment that could potentially impact the Cape Fear

River. Provisions for dust control may become necessary during the work to prevent ash dust from affecting surrounding property owners.

4.4.3.6 Risk Assessment

With respect to the concept of providing additional capacity for the ash, there is very little risk that the storage volume would not provide long-term storage. Other risks are related to potential impacts on the surrounding area should ash migrate offsite via an embankment failure or erosive forces as discussed above. Alternative 3B also has additional risk associated with the logistics of design and construction. Additional study and analysis would be required prior to implementation of this innovative approach.

4.4.3.7 Other Issues

The aesthetics of having a large mound of ash may represent a concern. In addition, modifications to an existing dam would normally require a permit from the North Carolina Dam Safety Section. CP&L is exempt from the North Carolina Dam Safety Law, but has an agreement with the North Carolina Utilities Commission to furnish plans for dam construction to the Dam Safety Section for comment. We understand that CP&L encountered some regulatory-driven delay to creating an ash landfill on top of an abandoned pond at the Roxboro plant in the late 1980's, although the issues were successfully addressed. The potential for similar regulatory delays may still exist.

4.4.4 Improve Markets for Beneficial Reuse

CP&L has previously addressed this alternative during previous evaluations of other facilities. The market for use of fly ash is growing and includes uses such as daily cover in landfills, structural fill and various applications in the concrete industry.

We contacted Mr. Ray Church of New Hanover County landfill regarding use of flyash as daily cover. The landfill is conveniently located on US Highway 421 North outside Wilmington. Mr. Church stated that the landfill may be interested in using the material provided that required analytical results are satisfactory and that proper State approval is obtained.

We reviewed the NCDOT Transportation Improvement Program for upcoming projects in New Hanover County through the year 2006. The list included several roadway improvement projects in New Hanover

County, including the Wilmington Bypass, that may represent potential uses for ash. A formal report was previously prepared by Law, for NCDOT, addressing the use of ash from the Sutton Plant (reference 7).

We understand that CP&L has reached agreements with ash reuse companies in the past at other facilities and is continuing to pursue other opportunities at the present time. The previous agreements have been with companies that manufacture concrete products.

While offsite disposal represents an attractive means of handling future ash in terms of cost, there are opportunity costs in terms of offsite liability associated with these uses that include:

- Accidental discharges of ash during transport;
- impacts to the environment where the ash is placed;
- future landfill litigation that could identify CP&L as a Potential Responsible Party (PRP);
- usage unpredictability;
- Utilization of select ash only.

Excavation of ash from within the existing ponds should be restricted to areas that are a least 100 feet away from the dike edges so the excavation will not have the potential to encounter the dike material. Access ramps should be constructed so that no truck traffic is directly on the dike interior slope. A temporary berm should be constructed between the excavation area and the area where water is currently present to reduce the possibility that surface runoff from the work area will cause added turbidity in the active discharge portion of the pond.

5.0 RECOMMENDED SOLUTION

From our evaluation, we have concluded that a combination of continuing to pursue options for beneficial use of ash coupled with one of the three proposed methods for vertical expansion, that includes conversion to a dry disposal process, represents the only feasible alternative for long-term management of ash disposal at the Sutton facility. Short-term solutions include a combination of continuing to pursue beneficial use of ash coupled with providing additional capacity by vertically extending the existing dike or by excavation within the active area and continuing wet disposal operations. The table below summarizes the estimated life and cost of each alternative.

Alternative	Short Term		Long Term	
	Life (years)	Cost ($millions)	Life (years)	Cost ($millions)
1	6	$0	70	$20.9
2	8.5	$2.3	70	$20.7
3A	9.5	$4.2	70	$20.8
3B	9.5	$2.9	70	$20.8

Beneficial use of ash offsite should be evaluated by CP&L on a case by case basis regarding potential immediate and long-term liability to CP&L which may exclude beneficial use as an alternative. Decisions regarding which vertical expansion alternative to implement will require internal evaluation by CP&L based on information provided in this and other evaluations, the availability of resources and projected use of fossil fuel power generation in the future. To assist CP&L in making this evaluation, we have provided a bar chart (Appendix B) for each vertical expansion alternative that projects the necessary resource allocations over time.

From our evaluation, the following alternatives were not considered feasible solutions:

- Construct new ash pond;
  This potential alternative was not evaluated further because Mr. Mike Norton, of the Sutton Plant, stated that they did not currently wish to pursue this option because of the regulatory issues involved.

- Plant power output load leveling;
  Based on conversations with CP&L personnel, this alternative does not appear feasible in terms of current operating and existing power generation transfer capabilities at the plants.

- Dedicated CP&L ash landfill.
  Based on conversations with CP&L personnel, it appears that offsite transport is not economically feasible. CP&L previously evaluated offsite disposal of ash into excavated mines that revealed excessive storage, loading and transportation costs. In addition, offsite transport of ash represents a liability in terms of transportation mishaps that could potentially release ash into the environment.

REFERENCE LIST

1. Trigon Engineering Consultants, Inc., "*Carolina Power and Light, Active Ash Pond Capacity Evaluation, Weatherspoon, Sutton, and Asheville Plants*", May 29, 1997.

2. Law Engineering and Environmental Services, Inc., "*Report of Ash Pond Capacity Evaluation*", Asheville Plant, January 19, 1999.

3. CRS Sirrine, "*CP&L, Budget Cost Estimate, Dry Flyash Disposal, L.V. Sutton/Asheville Steam Electric Plant*", May 30, 1985.

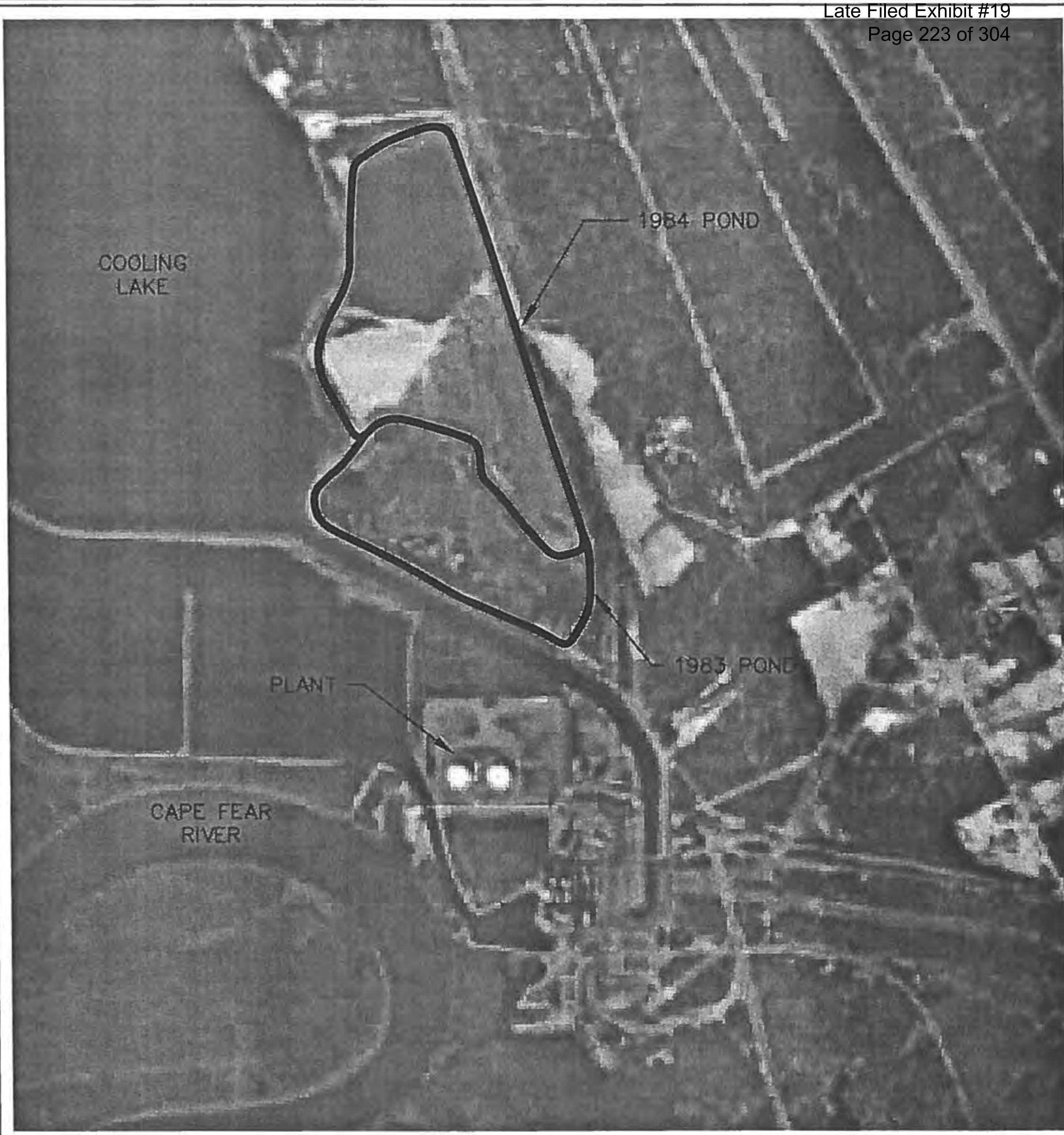
4. R. S. Means, "*1998 Building Construction Cost Data 56th Annual Edition*".

5. Law Engineering and Environmental Services, Inc., "*Independent Consultant Inspection, L.V. Sutton Steam Electric Plant, Ash Pond Dikes*", December 15, 1997.

6. NCDOT, Transportation Improvement Program through 2000-2006.

7. Law Engineering and Environmental Services, Inc., Letter report to North Carolina Department of Transportation, Attention: Mr. W. L. Moore, III, State Project 8.U25902; TIP: R-2633CA, Federal Project NHF-17(25), US17/Wilmington Bypass from US 421 North of Wilmington to US 117.

DRAWINGS



Drawing 2.1.dwg

LAW
LAWGIBB Group Member

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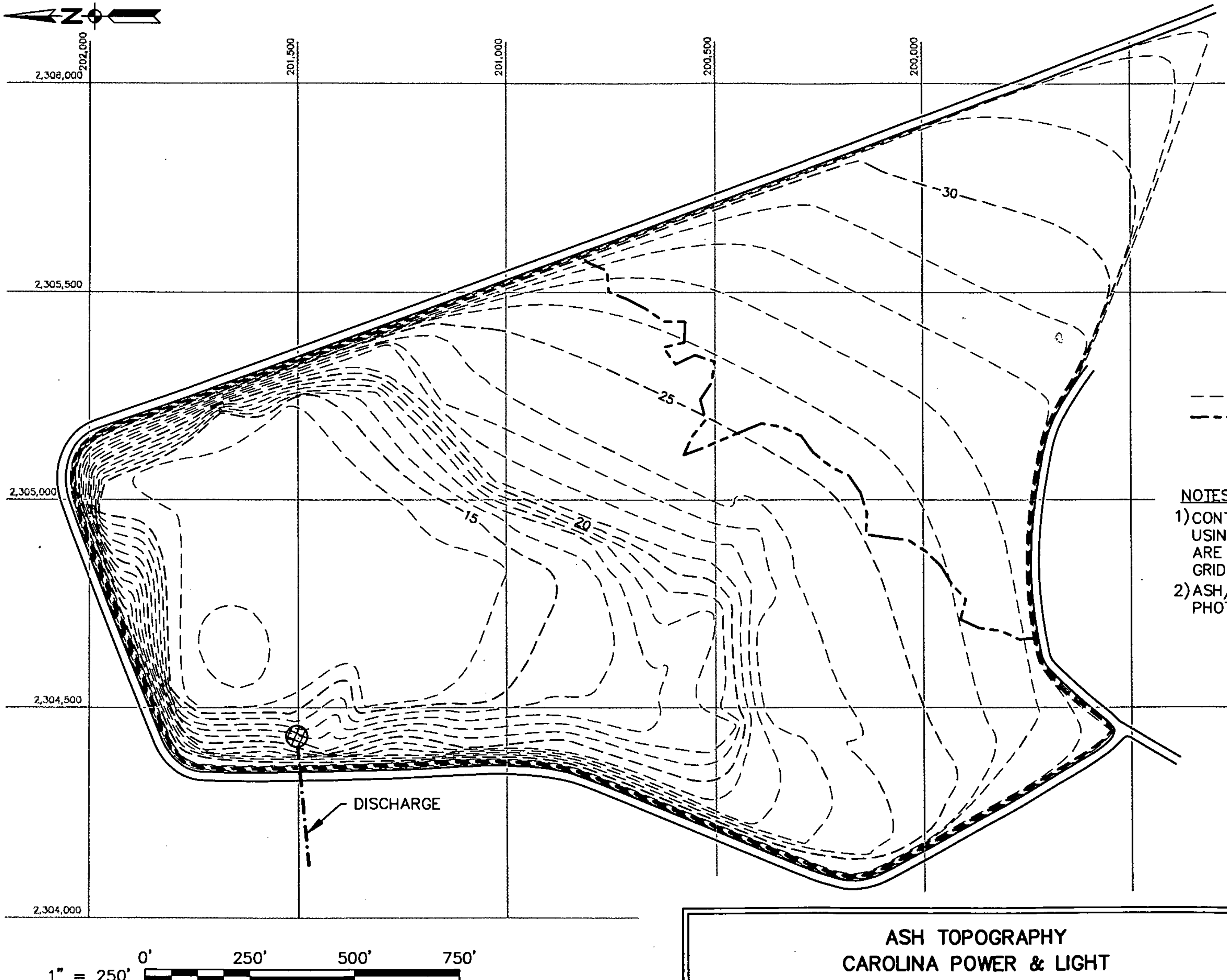
RALEIGH, NC

AERIAL PHOTOGRAPH	DRAWN: SST	DATE: 11/15/99
	DFT CHECK: —	SCALE: NOT TO SCALE
CP&L – SUTTON PLANT WILMINGTON, NORTH CAROLINA	ENG CHECK: SST	JOB: 30720-9-3428/06
	APPROVAL: Jo	DWG: 2.1

REFERENCE: US GEOLOGICAL SOCIETY PHOTOGRAPH TAKEN 10 MAY 1996



NOTES:

1) CONTOURS BASED ON SURVEY PERFORMED 6/7/99, USING MAPPING-GRADE GPS METHOD. COORDINATES ARE REFERENCED TO NORTH CAROLINA STATE PLANE GRID AND MEAN SEA LEVEL.
2) ASH/WATER INTERFACE BASED ON DIGITIZED AERIAL PHOTOGRAPH.

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LAWGIBB Group Member
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RALEIGH, NC

ASH TOPOGRAPHY CAROLINA POWER & LIGHT SUTTON ASH POND WILMINGTON, NORTH CAROLINA	DRAWN: SST	DATE: 11/15/99
	DFT CHECK: —	SCALE: AS SHOWN
	ENG CHECK: SST	JOB: 30720-9-3428/06
	APPROVAL: Ja	DWG: 2.2

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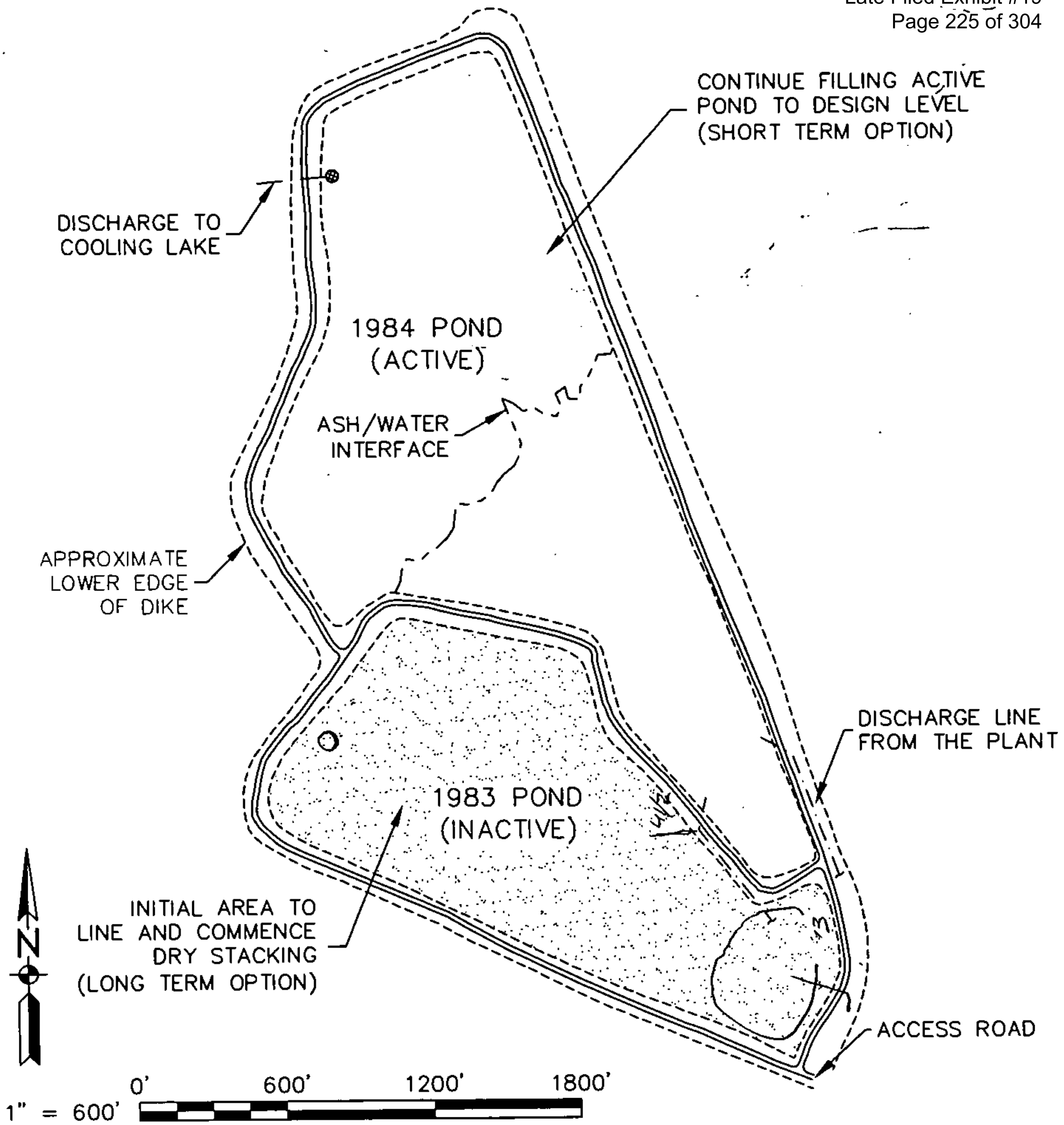

Drawing 4.5.dwg

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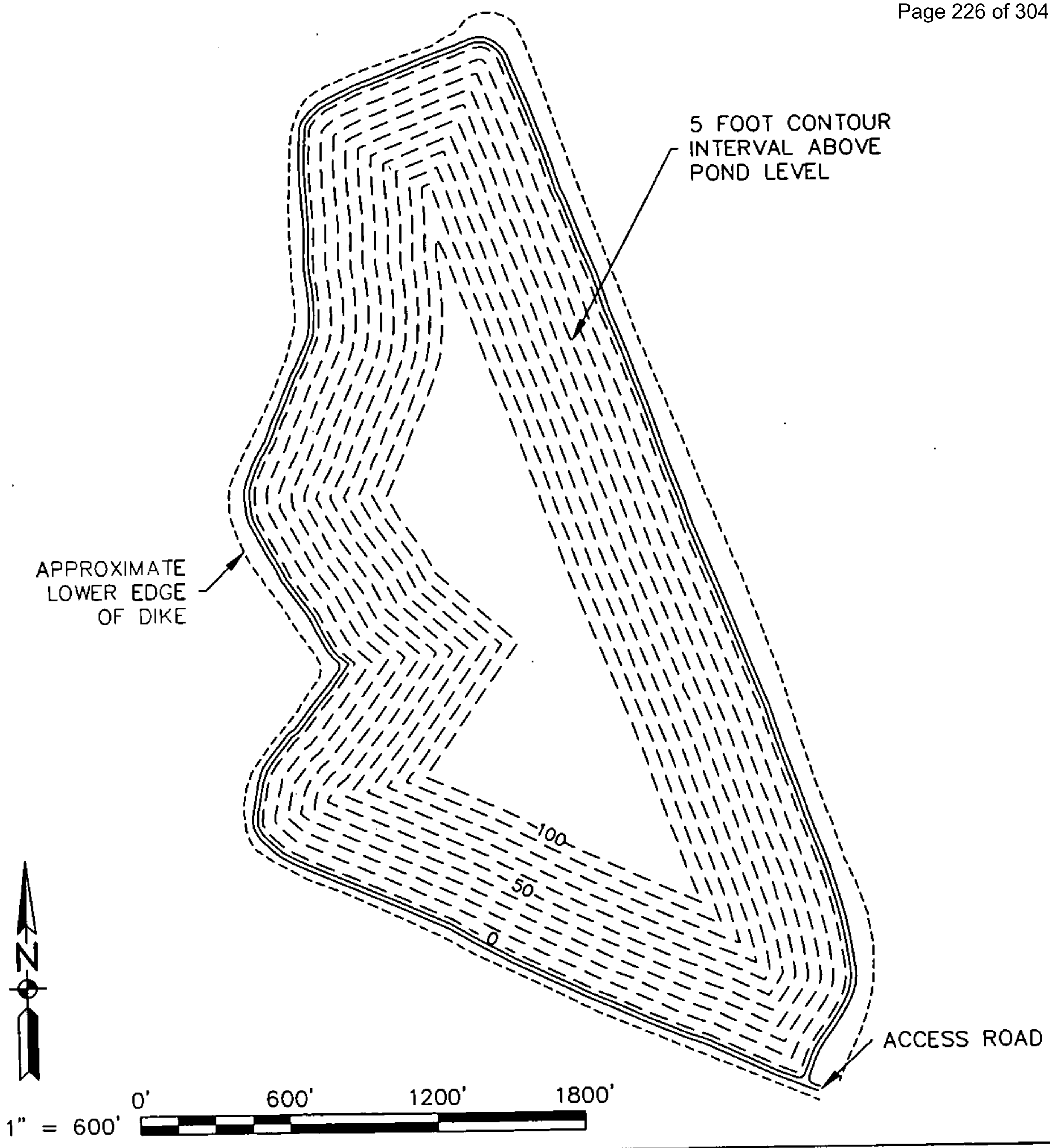
ALTERNATIVE 1 VERTICAL EXPANSION CP&L – SUTTON PLANT WILMINGTON, NORTH CAROLINA	DRAWN: BTS	DATE: 11/22/99
	DFT CHECK: BAM	SCALE: AS SHOWN
	ENG CHECK: TZC	JOB: 30720-9-3428/06
	APPROVAL: JA	DWG: 4.1

REFERENCE: DIGITIZED FROM AERIAL PHOTOGRAPH DATED MAY 10, 1996.



Drawing 4.6.dwg

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LONG TERM VERTICAL EXPANSION
TYPICAL TOPOGRAPHY
CP&L – SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: BTS	DATE: 11/22/99
DFT CHECK: BAM	SCALE: AS SHOWN
ENG CHECK: TZL	JOB: 30720-9-3428/06
APPROVAL: JC	DWG: 4.2

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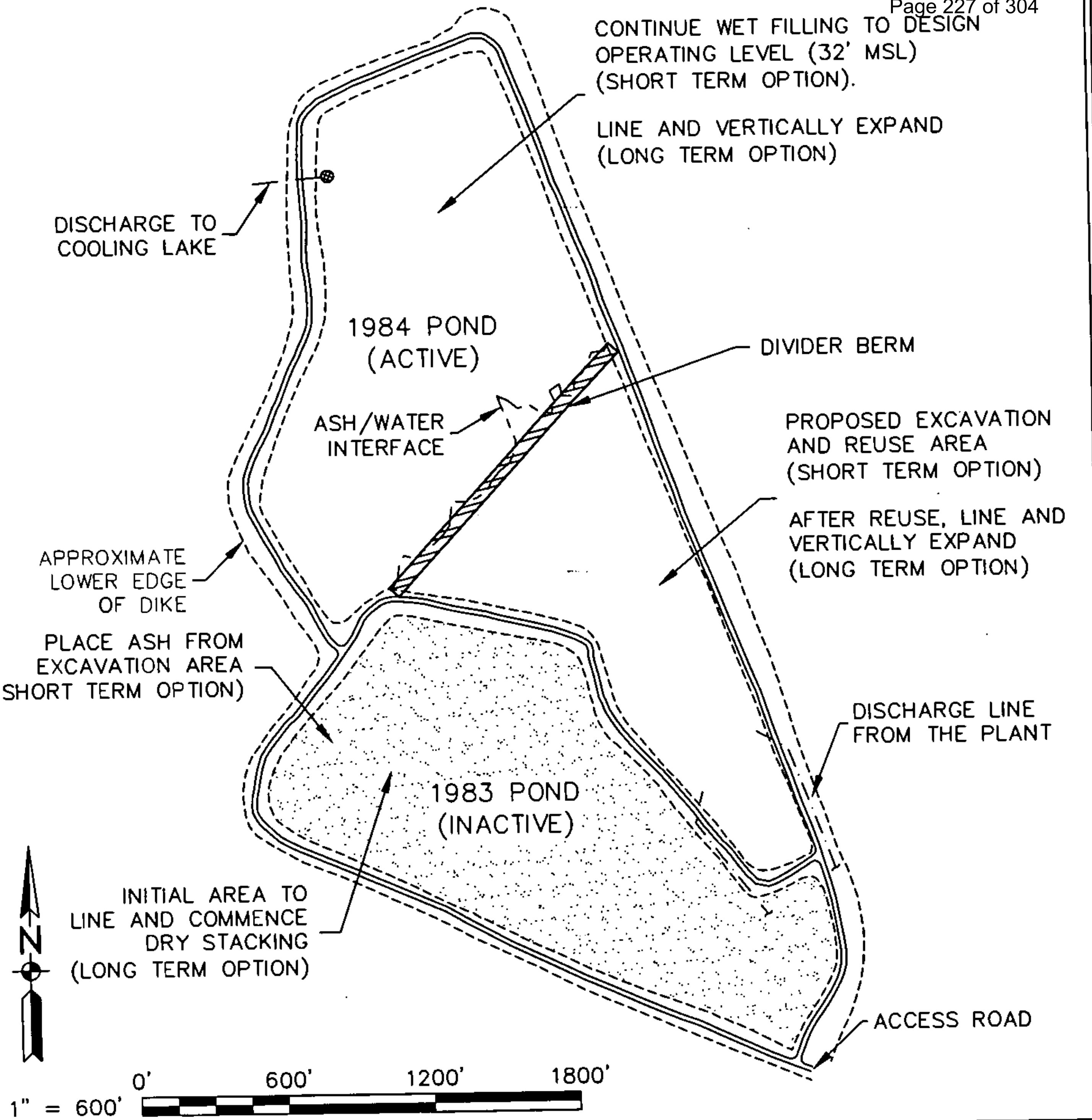


Drawing 4.4.dwg

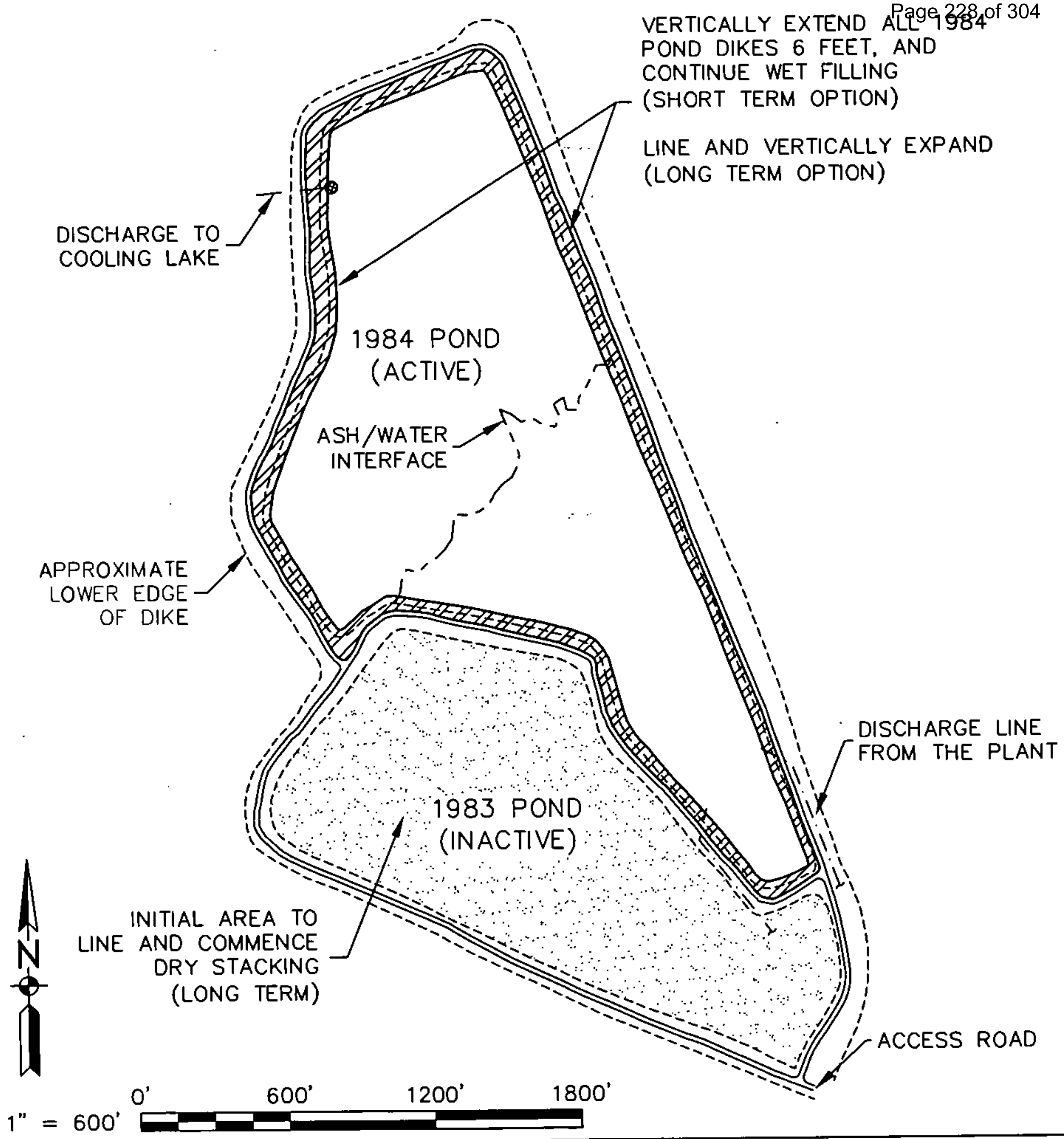
LAW
LAWGIBB Group Member

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.
RALEIGH, NC

ALTERNATIVE 2
BERM/VERTICAL EXPANSION
CP&L – SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: BTJ	DATE: 11/22/99
DFT CHECK: Bom	SCALE: AS SHOWN
ENG CHECK: JLC	JOB: 30720-9-3428/06
APPROVAL:	DWG: 4.3

REFERENCE: DIGITIZED FROM AERIAL PHOTOGRAPH DATED MAY 10, 1996.



Drawing 4.3.dwg

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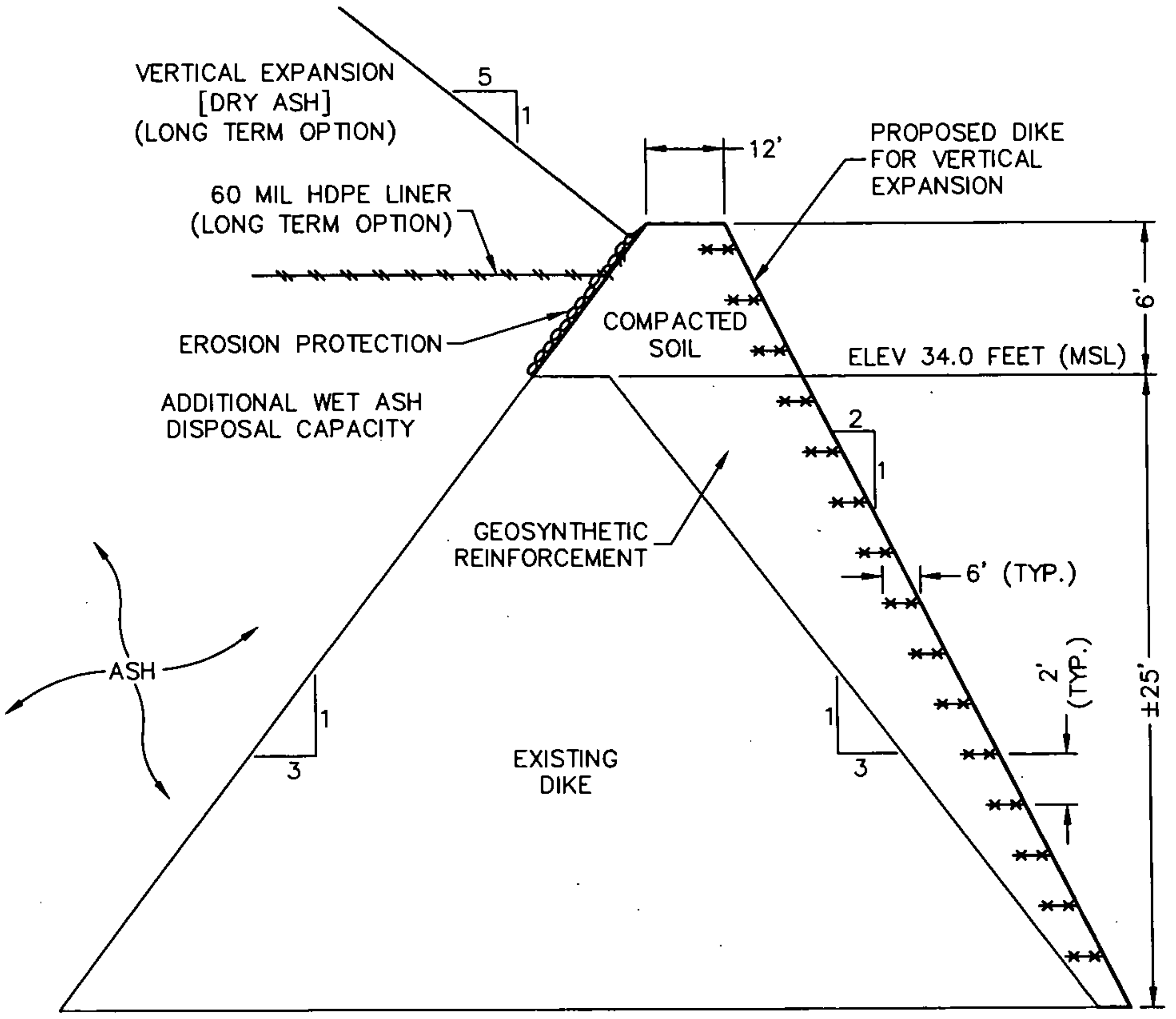
RALEIGH, NC

ALTERNATIVE 3
DIKE VERTICAL EXTENSION
CP&L – SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: BFS	DATE: 11/22/99
DFT CHECK: BAM	SCALE: AS SHOWN
ENG CHECK: TLL	JOB: 30720-9-3428/06
APPROVAL: JA	DWG: 4.4

REFERENCE: DIGITIZED FROM AERIAL PHOTOGRAPH DTAED MAY 10, 1996.



Drawing 4.5.dwg

LAW
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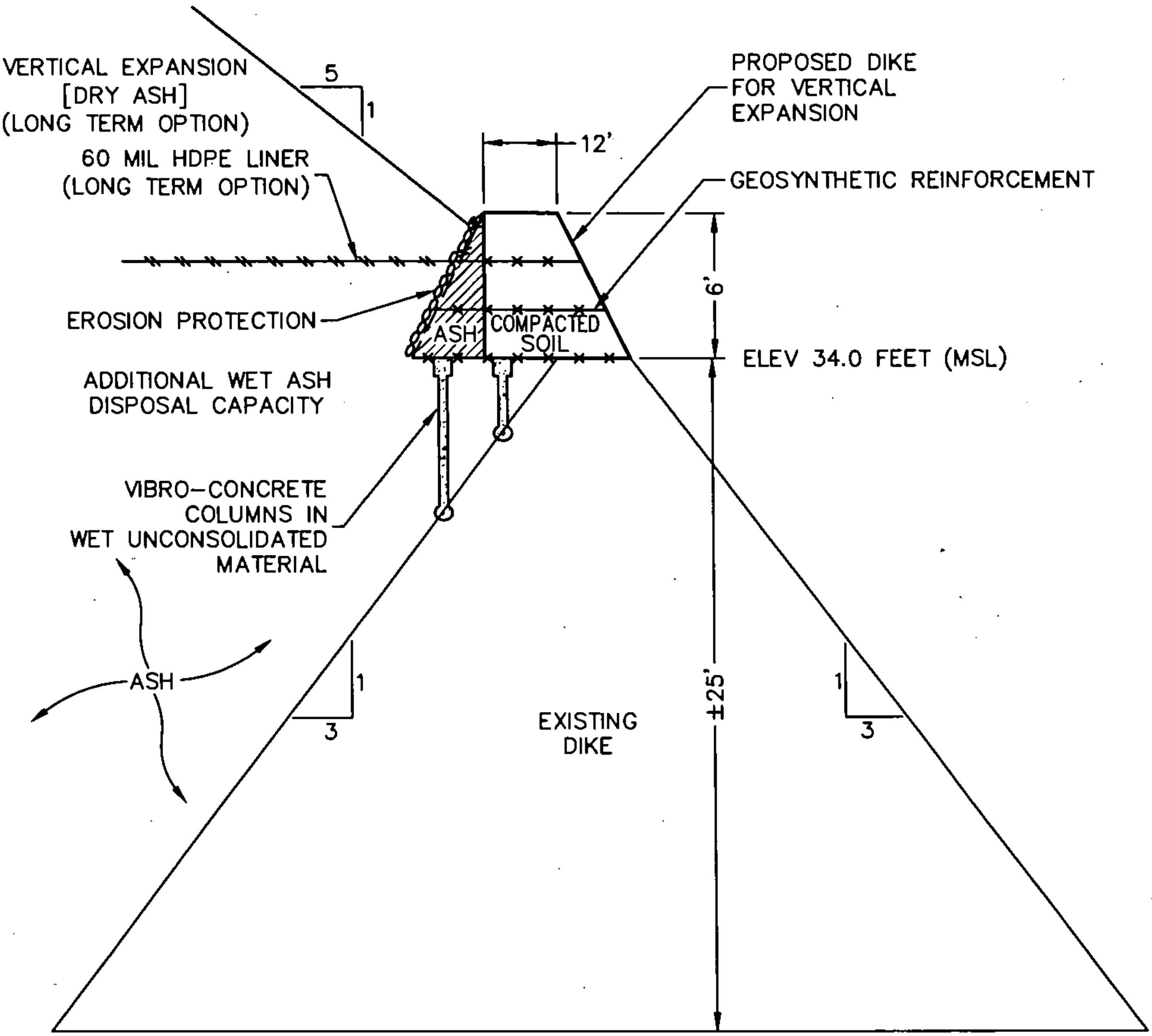
RALEIGH, NC

ALTERNATIVE 3A
DIKE SECTION
CP&L – SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: SST	DATE: 11/22/99
DFT CHECK: —	SCALE: NOT TO SCALE
ENG CHECK: SST	JOB: 30720-9-3428
APPROVAL:	DWG: 4.5

REFERENCE:



Drawing 4.4.dwg

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RALEIGH, NC

ALTERNATIVE 3B
DIKE SECTION
CP&L – SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: [illegible]	DATE: 11/22/99
DFT CHECK: [illegible]	SCALE: NOT TO SCALE
ENG CHECK: [illegible]	JOB: 30720-9-3428
APPROVAL: [illegible]	DWG: 4.6

REFERENCE:

APPENDIX

A

ASH POND CAPACITY ESTIMATES

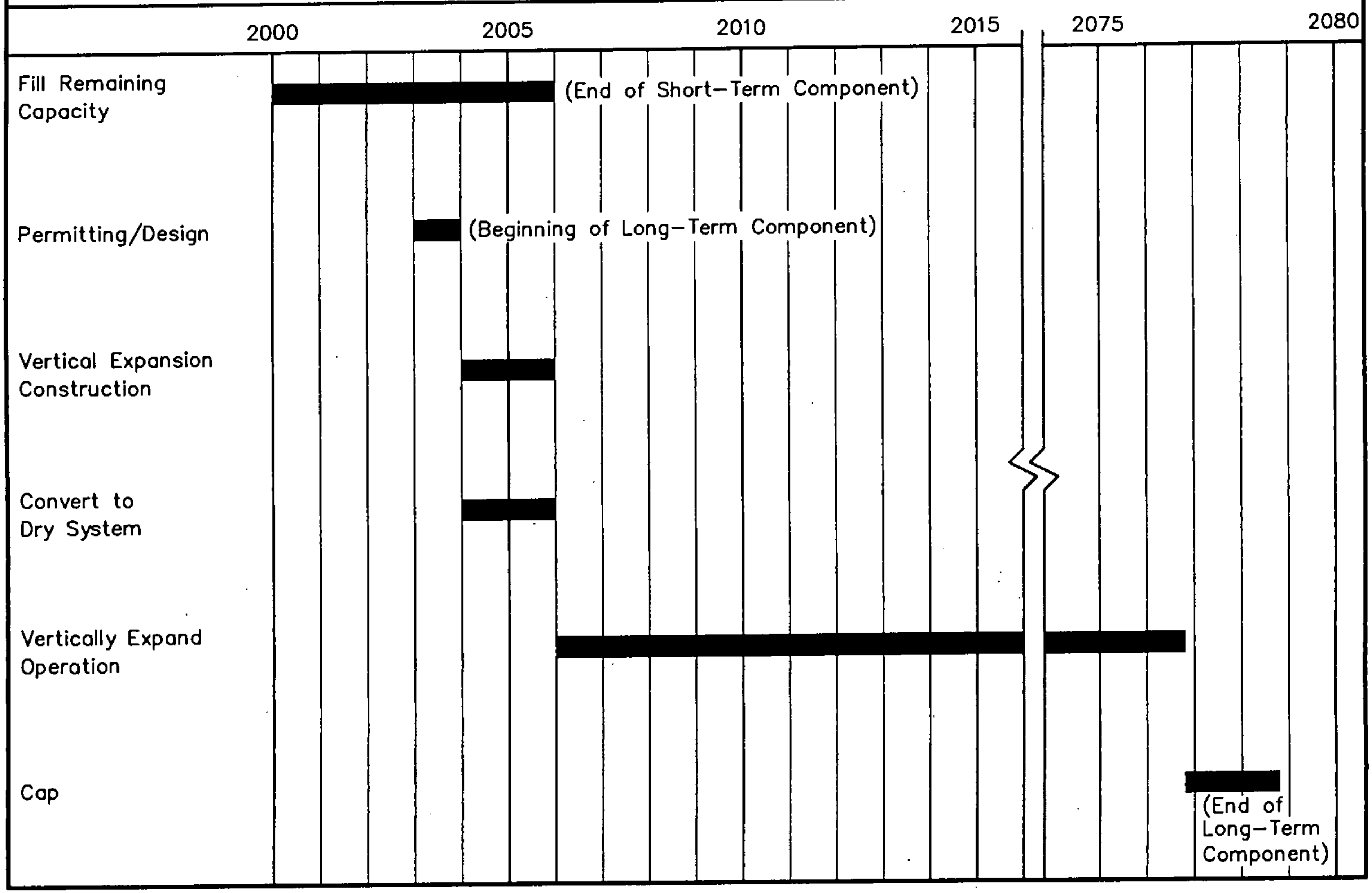
	CP&L SUTTON PLANT ASH POND CAPACITY CALCULATIONS						
	Sutton Historical Annual Coal Consumption (Tons)						
	1993	1994	1995	1996	1997	1998	AVERAGE
	765,837	490,256	700,756	933,904	866,305	1,178,410	822,578
	Ash Impoundment Capacity Estimates (Operating-26 MSL)						
	Coal Consumption (Tons)	% Ash	Ash Quantity (Tons)	Ash Density (lb/cu.ft.)	Annual Ash Volume (cu.ft.)	Existing Capacity (cu. Ft.)	Estimated Years Remaining
Average	822,578	11	90,484	50	3,619,343	14,934,465	4
Maximum	1,178,410	11	129,625	50	5,185,004	14,934,465	3
	Ash Impoundment Capacity Estimates (Maximum-32 MSL)						
	Coal Consumption (Tons)	% Ash	Ash Quantity (Tons)	Ash Density (lb/cu.ft.)	Annual Ash Volume (cu.ft.)	Existing Capacity (cu. Ft.)	Estimated Years Remaining
Average	822,578	11	90,484	50	3,619,343	31,922,003	9
Maximum	1,178,410	11	129,625	50	5,185,004	31,922,003	6

APPENDIX

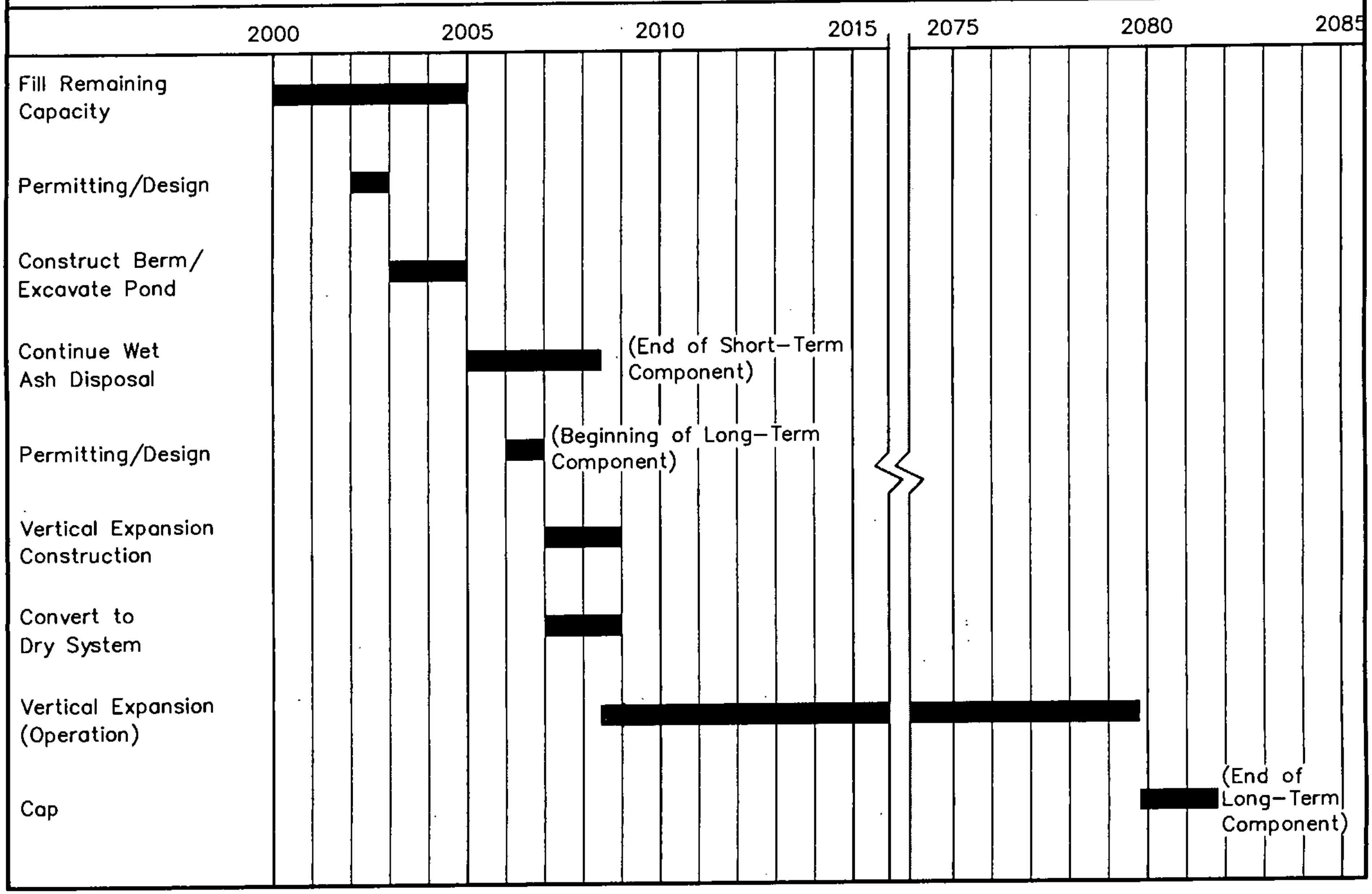
B

ALTERNATIVE LIFETIME BAR CHARTS

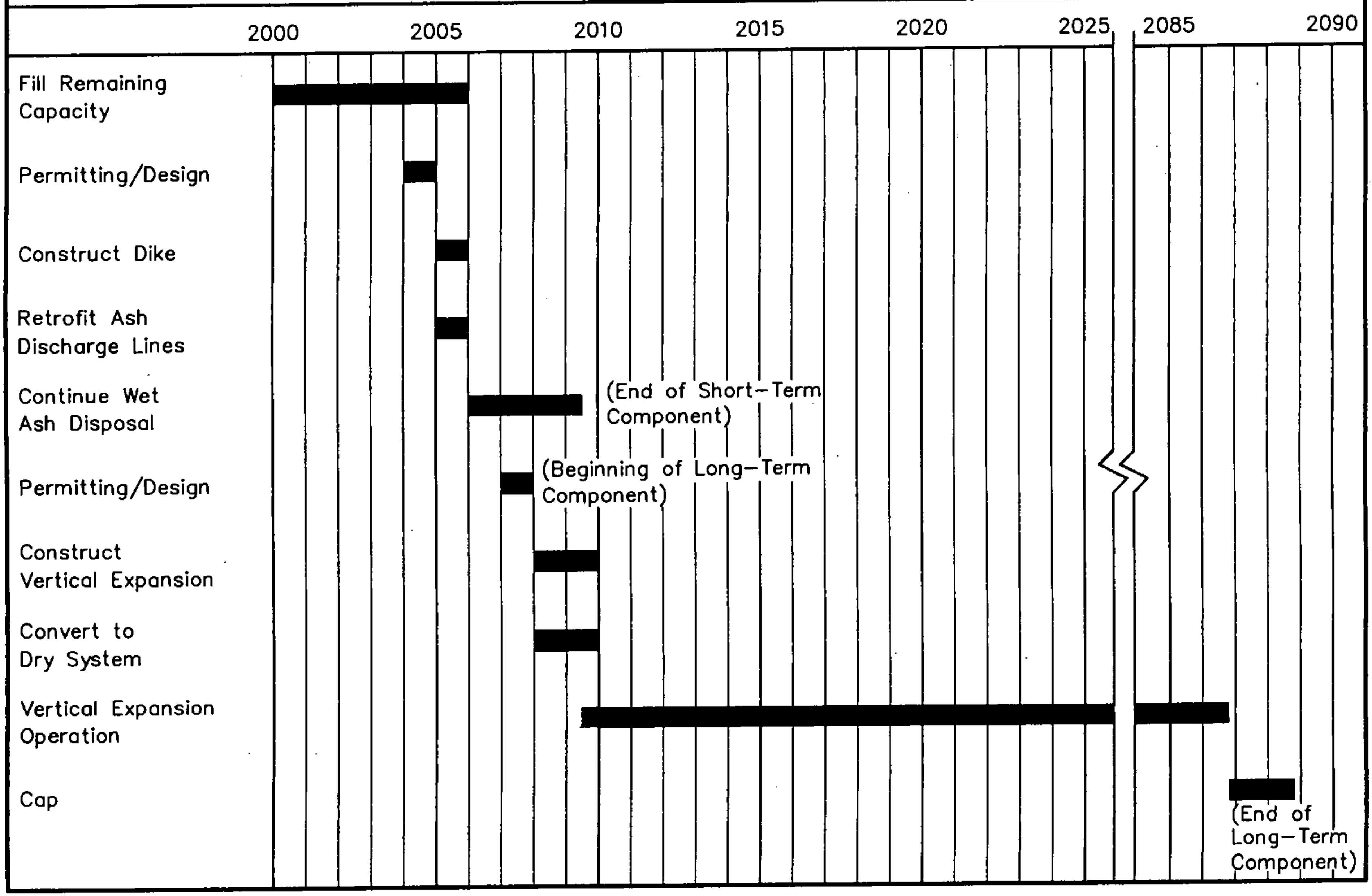
ALTERNATIVE 1: FILL REMAINING CAPACITY / VERTICAL EXPANSION
CP&L SUTTON PLANT
WILMINGTON, NORTH CAROLINA



ALTERNATIVE 2: CONSTRUCT BERM / NEW IMPOUNDMENT / EXCAVATE / VERTICAL EXPANSION
CP&L SUTTON PLANT
WILMINGTON, NORTH CAROLINA



ALTERNATIVE 3: DIKE EXTENSION / VERTICAL EXPANSION
CP&L SUTTON PLANT
WILMINGTON, NORTH CAROLINA



APPENDIX

C

COST ESTIMATES

ASH DISPOSAL ALTERNATIVE 1
SHORT TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Fill Remaining Capacity
Long Term: Vertical Expansion (Dry Stack)
Short Term Lifetime: 5.5 Years

No capital costs are associated with Alternative 1, Short Term

---

ASH DISPOSAL ALTERNATIVE 1
LONG TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Fill Remaining Capacity
Long Term: Vertical Expansion (Dry Stack)
Long Term Lifetime: 76 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTALS
Permitting & Design				
Permitting/Design	3%		$20,062,833	$601,885
Construction Testing and Monitoring	1%		$20,062,833	$200,628
Subtotal				*$802,513*
Vertical Expansion Construction				
Mobilization	1	each	$50,000	$50,000
Clear and Grub	50	acres	$1,500	$75,000
Drainage and Erosion Control	5,871,500	s.f.	$0.04	$234,860
Liner (60 MIL HDPE)	5,871,500	s.f.	$0.60	$3,522,900
Soil fill (6-inch cap)	108,800	cu.yd.	$14.23	$1,548,224
Settling Basin	1	each	$50,000	$50,000
Subtotal				*$5,480,984*
Convert to Dry Ash Disposal				
Convert to Dry Ash Disposal	1	event	$10,000,000	$10,000,000
Subtotal				*$10,000,000*
Cap				
Soil fill (6-inch cap)	108,800	cu.yd.	$14.23	$1,548,224
Liner (30 MIL HDPE)	5,871,500	s.f.	$0.35	$2,055,025
Soil fill (18-inch cap)	326,200	cu.yd.	$3.00	$978,600
Subtotal				*$4,581,849*
GRAND TOTAL				**$20,865,346**

ASH DISPOSAL ALTERNATIVE 2
SHORT TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Fill Remaining Volume / Construct Berm / Excavation (Semi-Dry Stack)
Long Term: Vertical Expansion (Dry Stack)
Short Term Lifetime: 8.5 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL
Permitting & Design				
Permitting/Design	3%		$2,190,874	$65,726
Construction Testing and Monitoring	1%		$2,190,874	$21,909
Subtotal				*$87,635*
Construct Berm/Pond Excavation				
Mobilization	1	each	$50,000	$50,000
Clearing	48	acres	$1,500	$72,000
Drainage and Erosion Control	2,052,300	s.f.	$0.04	$82,092
Divider Dike	29,700	cu.yd.	$3.00	$89,100
Excavate and haul to 1983 Pond	528,900	cu.yd.	$3.00	$1,586,700
Compaction	528,900	cu.yd.	$0.38	$200,982
Extend Discharge Pipe(s)	1	event	$50,000	$50,000
Modifications to Hydrovac Tanks	2	each	$30,000	$60,000
Subtotal				*$2,190,874*
GRAND TOTAL				**$2,278,509**

ASH DISPOSAL ALTERNATIVE 2
LONG TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Fill Remaining Volume / Construct Berm / Excavation (Semi-Dry Stack)
Long Term: Vertical Expansion (Dry Stack)
Long Term Lifetime: 78 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL
Permitting & Design				
Permitting/Design	3%		$19,937,833	$598,135
Construction Testing and Monitoring	1%		$19,937,833	$199,378
Subtotal				*$797,513*
Convert to Dry Ash Disposal				
Convert to Dry Ash Disposal	1	event	$10,000,000	$10,000,000
Subtotal				*$10,000,000*
Vertical Expansion Construction				
Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	5,871,500	s.f.	$0.04	$234,860
Liner (60 MIL HDPE)	5,871,500	s.f.	$0.60	$3,522,900
Soil fill (6-inch protective cover)	108,800	cu.yd.	$14.23	$1,548,224
Subtotal				*$5,355,984*
Cap				
Soil fill (6-inch cap)	108,800	cu.yd.	$14.23	$1,548,224
Liner (30 MIL HDPE)	5,871,500	s.f.	$0.35	$2,055,025
Soil fill (18-inch vegetative cover)	326,200	cu.yd.	$3.00	$978,600
Subtotal				*$4,581,849*
GRAND TOTAL				**$20,735,346**

ASH DISPOSAL ALTERNATIVE 3A
SHORT TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Vertical Extension (Interior Face)
Long Term: Vertical Expansion (Dry Stack)
Short Term Lifetime: 10 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL
Permitting & Design				
Permitting/Design	5%		$3,925,840	$196,292
Construction Testing and Monitoring	3%		$3,925,840	$117,775
Subtotal				*$314,067*
Dike Construction				
General				
Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	5,871,500	s.f.	$0.04	$234,860
Modifications to Hydrovac Tanks	2	each	$30,000	$60,000
Conventional Dike Extension	*9550*	*lf of dike*		
	$370	*per lf of dike*		
Soil fill	208,000	cu. yd.	$14.23	$2,959,840
Geosynthetic (Geogrid)	309,000	sq.yd.	$1.70	$525,300
Geotextile (wave protection)	38,200	sq. ft.	$0.20	$7,640
Rip Rap	1,910	tons	$20.00	$38,200
Subtotal				*$3,875,840*
Retrofit Ash Discharge Lines				
Raise Discharge Pipe(s)	1	event	$50,000	$50,000
Subtotal				*$50,000*
GRAND TOTAL				**$4,239,907**

ASH DISPOSAL ALTERNATIVE 3B
SHORT TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Vertical Extension (Interior Face)
Long Term: Vertical Expansion (Dry Stack)
Short Term Lifetime: 10 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL
Permitting & Design				
Permitting/Design	5%		$2,671,000	$133,550
Construction Testing and Monitoring	3%		$2,671,000	$80,130
Subtotal				*$213,680*
Dike Construction				
General				
Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	5,871,500	s.f.	$0.04	$234,860
Modifications to Hydrovac Tanks	2	each	$30,000	$60,000
40% by Conventional	*3820*	*lf of dike*		
	$370	*per lf of dike*		
Soil fill	83,200	cu. yd.	$14.23	$1,183,936
Geosynthetic (Geogrid)	124,000	sq.yd.	$1.70	$210,800
Geotextile (wave protection)	15,300	sq. ft.	$0.20	$3,060
Rip Rap	764	tons	$20.00	$15,280
60% by Innovative	*5730*	*lf of dike*		
	$151	*per lf of dike*		
Soil fill (Dike Exterior)	26,800	cu. yd.	$14.23	$381,364
Ash fill (Dike Interior)	11,500	cu. yd.	$3.00	$34,500
Liner (seepage control)	45,900	sq.ft.	$0.60	$27,540
Geosynthetic (Geogrid)	68,800	sq.yd.	$1.70	$116,960
Vibro-concrete Columns	9,170	vlf	$30.00	$275,100
Geotextile (wave protection)	23,000	sq. ft	$0.20	$4,600
Rip Rap	1,150	tons	$20.00	$23,000
Subtotal				*$2,621,000*
Retrofit Ash Discharge Lines				
Raise Discharge Pipe(s)	1	event	$50,000	$50,000
Subtotal				*$50,000*
GRAND TOTAL				**$2,884,680**

ASH DISPOSAL ALTERNATIVE 3
LONG TERM
ROUGH COST ESTIMATE

Alternative Description:
Short Term: Vertical Extension (Interior Face)
Long Term: Vertical Expansion (Dry Stack)
Lifetime: 86 Years

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTAL
Permitting & Design				
Permitting/Design	3%		$20,009,833	$600,295
Construction Testing and Monitoring	1%		$20,009,833	$200,098
Subtotal				*$800,393*
Convert to Dry Ash Disposal				
Convert to Dry Ash Disposal	1	event	$10,000,000	$10,000,000
Subtotal				*$10,000,000*
Vertical Expansion Construction				
Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	5,871,500	s.f.	$0.04	$234,860
Clearing	48	acres	$1,500	$72,000
Liner (60 MIL HDPE)	5,871,500	s.f.	$0.60	$3,522,900
Soil fill (6-inch cap)	108,800	cu.yd.	$14.23	$1,548,224
Subtotal				*$5,427,984*
Cap				
Soil fill (6-inch cap)	108,800	cu.yd.	$14.23	$1,548,224
Liner (30 MIL HDPE)	5,871,500	s.f.	$0.35	$2,055,025
Soil fill (18-inch cap)	326,200	cu.yd.	$3.00	$978,600
Subtotal				*$4,581,849*
GRAND TOTAL				**$20,810,226**

FINAL REPORT

STRATEGIC ASSESSMENT OF FLYASH MANAGEMENT AT WEATHERSPOON STEAM PLANT

Prepared For:

Progress Energy Carolinas East Region
1420 WalPat Road
Smithfield, NC 27577

Prepared By:

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3301 Atlantic Avenue
Raleigh, North Carolina 27604

July 12, 2004

MACTEC Project No. 6468-04-0549

MACTEC

Table of Contents

Tables

Figures

Appendices

1.0 Executive Summary

A study of ash disposition options and concepts for short-term and long-term storage has been conducted for the Cape Fear, Lee and Weatherspoon plants. The study included:

- Review of previous study reports and ash capacity estimates.
- Review of data on ash content and Loss of Ignition (LOI) material for current coal usage.
- Review of data on projected coal consumption volumes over the next five years.
- Updating estimates of present ash storage capacity and projections of remaining storage life.
- Discussion of ash management practices with environmental coordinators of other electric utility providers and review of industry practices for ash disposal.
- Discussion of current ash handling and management practices with plant personnel.
- Performing a physical profile of the ash ponds through depth soundings.
- Identification of available techniques for ash disposition
- Workshop meetings with Eastern Region engineering personnel and with plant personnel knowledgeable in the ash handling practices.
- Selection of ash handling options feasible for each plant
- Development of strategies for implementing the identified short and long term options identified from the workshop sessions.
- Preparation of conceptual cost estimates and timelines for the options.
- Preparation of separate reports for each plant.

A finding common for all plants was that past projections of storage life used ash production from only contract coal, while current and future plans indicate a large percentage of coal burned may be "opportunity coal' which has a much higher ash content than contract coal. Also, past calculations did not incorporate and adjustment for presence of unburned carbon (LOI material). The projections prepared in this report incorporate provisions for unburned carbon and use of "opportunity coal".

The Weatherspoon plant is currently operating its ash pond at elevation 140 feet, msl, a level about three feet lower than the design maximum, but only about two feet lower than the surveyed low point of the dike crest. Projections of available life at the current level range from three to seven months depending on the coal use rate and mix of contract coal and opportunity coal. For discussion and comparison purposes, MACTEC has chosen to use the average ash use rate from the 5-year projections and a 50-50 mix of contract coal and opportunity coal. With this approach, the Weatherspoon Plant ash pond is projected to have 4 months of remaining physical storage life at its current level. Raising the elevation to 143 extends the life to 1.7 years.

The short term ash management strategy recommended from our assessment is:

1) Raise the pond operating level two feet to elevation 142 ft msl; and
2) Implement a cyclic ash excavation or dredging and stacking program from the main pond to Area B or to a section in the southwest corner of the main ash pond.

The approximate life extension of the pond achieved by these approaches is approximately 12 years.

The long term alternatives for ash management evaluated during this assessment are:

- Alternate 1: Raise existing dike six feet to allow for more storage;
- Alternate 2: Continue excavation or dredging and stacking of ash in the Area B, if space is available;
- Alternate3: Use Geotubes for ash storage and de-watering within the pond;
- Alternate 4: Construct a new ash pond

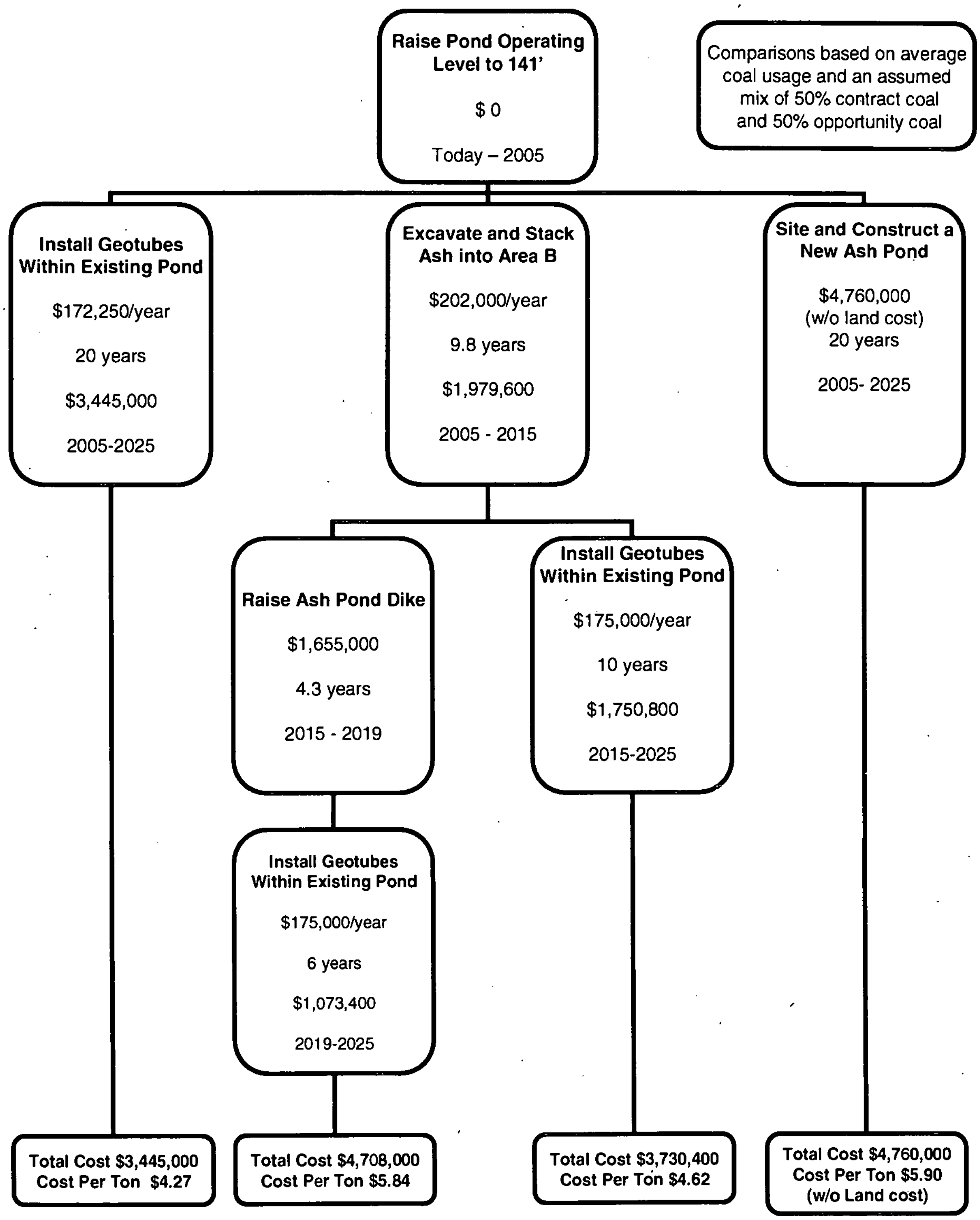
A long term ash management strategy would employ a combination of the ash excavation and stacking program with the use of Geotubes to provide long-term (20 years) ash storage. Geotubes can be used exclusively to achieve 20 years of ash storage or in conjunction with the dig and stack program. Combining the two alternatives reduces the number and cost of Geotubes required.

A cost comparison of the alternatives evaluated for this study using the average coal use and a 50-50 coal mix (see attached page) shows that for a 20-year period, a combined strategy of dig and stack/Geotube installation is the most cost-effective long term option.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

This final report incorporates and addresses comments made by Progress Energy on the draft report submitted May 14, 2004

Weatherspoon Plant



2.0 Problem Description

Progress Energy's fossil power plants burn coal for electricity generation. The Eastern Region has five plants: Cape Fear, Lee, Robinson, Sutton and Weatherspoon. Ash is produced as a byproduct of the coal combustion process. Depending on the coal burned, from 10 to 20 percent of the weight of coal becomes ash. A fine-grained ash ("fly ash") forms the majority of the material. About 10 percent of the ash total volume is coarse-grained material commonly termed "bottom ash"; however, the term "fly ash" is typically used generically for all the material produced. At some plants, the bottom ash and fly ash are commingled before transport to disposal areas; in others, the two ashes are moved separately.

Progress Energy disposes of ash by mixing the ash with water and pumping it into storage areas on the plant sites. The storage areas ("ash ponds") were generally constructed impoundment areas build above original ground surface and enclosed by earth dikes. No artificial liners or clay liners were incorporated in the pond designs for the Cape Fear, Lee or Weatherspoon plants that are the subject of this study.

Vertical pipes connected to horizontal outflow pipes through the dikes provide for release of water from the ponds. Ponds at some plants incorporate secondary settling ponds to aid in control of suspended solids in the water discharged from then pond. The ponds are permitted as water treatment facilities and are regulated by the Division of Water Quality.

The ash is pumped in a water slurry at about 30 percent solids. The ash settles, gradually filling in the pond volume. Normally, the ash settlement progresses from the pipe discharge location toward the pond's outlet structure. Depending on the shape of a pond and the relative locations of the ash discharge lines and the pond outlet structure, ash can accumulate close to the outlet and create excessive suspended solids in the pond outflow. Most plants have some environmental permit controls for the outflow, either pH or Total Suspended Solids or both.

Over time, Progress Energy has found that the total volume of a pond can not be filled without potential risk of exceeding permit limits on the outflow. Often, the positioning of the ash discharge results in premature filling near an outlet, leaving large areas of usable area inaccessible. Plants have repositioned ash discharge lines and have added chemicals to the ash lines or in the pond itself as techniques to improve settling rates or reduce/raise pH.

Various alternates to increasing the volume in ponds, providing for removal and stacking of ash or treating the ash have been studied along with the pond actual volumes and their projected life spans by Progress Energy, MACTEC and others over the past several years. In general, no land is available at existing plants that could be used to construct new ash ponds. Progress Energy also prefers to avoid new pond construction due to the costs, environmental issues and permitting conditions.

Progress Energy has determined that conducting studies at individual plants may not be providing the best approach to an overall ash management strategy. Progress Energy retained MACTEC to review past studies, conduct interviews across the industry to ascertain current practices, interview plant personnel regarding specific conditions at their plant and assess short and long term strategies for managing ash at the Cape Fear, Lee and Weatherspoon plants. Beneficial reuse of ash, while acknowledged as one option to extend life, was excluded from the study due to the volatility and unpredictability of reuse opportunities.

3.0 Root Cause Analysis

3.1 Ash Pond Data

The ash pond was constructed in 1979 as an extension of an older ash pond. The 1979 extension was designed with an operating surface area of 32 acres, a top of dike elevation of 145 ft msl, and a maximum operating level of 143 ft msl (two feet of freeboard). Topographic mapping by Kucera International using aerial methods in 2001 indicated the top of dike elevation is approximately at elevation 141 ft msl; however, a recent survey by Smith & Smith using ground methods confirms the top of dike elevation as approximately 145 feet. The low point of the dike crest is elevation 144.3 feet. Irrespective of the different survey results, the relative ash volumes remain the same. This report uses the elevations from the ground survey by Smith & Smith.

The initial storage volume of the pond at the operating level was approximately 104.5 million cubic feet, or 2.9 million tons of ash. The current operating level of the pond is approximately elevation 140 feet msl. The area of the older ash pond; 19 acres, was used for dry stacking of ash; this is referred to as "Area B". The ash is sluiced into the pond through a 12-inch pipe located in the western side on the pond. Discharge from the pond is through a 15-inch pipe riser located in the southern corner of the pond, approximately 1,250 feet from the ash influent line. Table 1 provides a summary of ash pond information.

As part of this study, MACTEC conducted an updated physical profile of the ash pond to identify the location and orientation of the ash/water interface and map pond bottom contours. MACTEC Senior Engineer Andrew Rodak and Staff Technician Calvin Arrington were on-site on February 18, 2004 to conduct the pond survey activities. The survey consisted of profiling and delineation of the ash/water interface as well as pond soundings conducted at fifty distinct locations between the interface and the outfall. A combination of bottom sounding and horizontal location using GPS surveying was used. Nine rows of approximately five points each were collected in an southwest/northeast direction across the pond.

The sounding locations were recorded using a GPS field tracking device. Soundings were conducted using a weighted measuring tape. In addition, subsurface pond current velocities were measured using a portable stream velocity meter, and the maximum velocities and associated depths recorded at each sounding location.

Figure 1 depicts the ash/water interface as delineated by MACTEC during our February 2004 survey. As indicated in the drawing, the ash water interface is now approximately 340 feet from the discharge riser along its southern edge. The survey also represents conditions in the pond after approximately 120,000 tons of ash were excavated from the pond in late 2002 and stacked in Area B.

MACTEC compared our survey with the Kucera Survey performed in March 2002, and the topographical layout of the pond surface and ash/water interface as plotted by our survey is fairly consistent with that plotted from the Kucera Survey.

3.2 Coal Usage Factors

MACTEC reviewed existing analyses of ash generated from different coal types burned at the plant under various burn scenarios. According to Progress Energy personnel, the ash content of the contract coal currently burned at the plant is approximately 10% by weight. This is comprised of both bottom ash (10%) and flyash (90%). The bottom ash is a heavier, denser material that settles out immediately upon entering the pond through the sluice influent pipe. Additional unburned carbon, referred to as "Loss of Ignition" material, also is mixed in with the ash and is sluiced into the pond. According to plant personnel, the LOI content of the contract coal burned in Unit 1 is 5%. LOI material is also dense, and settles out fairly rapidly. The LOI content of the coal was taken into account when the annual quantity of ash produced from coal usage was calculated.

The unit weight of sedimented ash also is a variable. Estimates of ash dry unit weights range from 50 pounds per cubic foot for freshly placed ash to 68 pounds per cubic foot for ash that has been in place for many years. For the purposes of evaluating alternates in this study, a dry unit weight of 55 pounds per cubic foot has been used (see Table 3).

The effect of the unburned carbon on the ash/unburned carbon mix unit weight was also considered. A paper published by J.Y. Hwang, X.Sun, and Z. Li of the Institute of Materials Processing, Michigan Technological University entitled *Unburned Carbon from Fly Ash for Mercury Adsorption: I. Separation and Characterization of Unburned Carbon* shows that the unit weight of the unburned carbon component of fly ash separated by an electrostatic precipitator is lower than the unit weight of the fly ash itself. Therefore, in considering the unit weight of the ash/unburned carbon mixture, using the ash unit weight only is conservative.

Table 2 lists the current, average and maximum projected volume of coal usage (in tons) at the Weatherspoon plant over the next five years. This data is listed in the "Annual Coal Unit Summary" spreadsheets provided to MACTEC by Progress Energy. As indicated in the summary, the projected use of coal peaks in 2007 and gradually decreases over the last two years in the projection period. Based on the ash content of the contract coal of 10% and LOI content of 5%, the associated annual ash volumes entering the pond are depicted on Table 3.

Several of the East Region plants (among them Weatherspoon) are beginning to use "Opportunity Coal" in their processes. "Opportunity Coal" is a low-sulfur, cheaper-grade coal than the contract coal, with ash content of approximately 20% by weight. As indicated in Table 3, ash volumes entering the pond double if "Opportunity Coal" is burned in the plant, which reduces the storage capacity of the pond from that determined when considering contract coal usage. A graph following Table 3 depicts the relationship between available pond life and various percentages of opportunity coal usage at the plant (ranging from all contract coal to all opportunity coal). As depicted in the graph, available ash storage in the pond for average coal use ranges from about 2.5 months to 7 months based on the ratio of coal burned and the current pond operating level.

Other coal types or combustion processes that may affect ash settlement ability in the pond include the use of low-NO_x burners, Camp Creek (low sulfur) coal, ammonia addition to reduce NO_x emissions, and sorbent injection (limestone) to reduce SO_x emissions. It has been suspected by plant personnel that these processes may be producing a smaller or less dense fly ash particle which could be contributing to the inability of smaller ash particles to settle out in other ash ponds prior to flow over the discharge riser. Since the Weatherspoon ash pond is equipped with a secondary basin, does not discharge directly into a natural surface water body and is not permitted, concerns over pond effluent quality have not historically been an issue.

3.3 Ash Settlement Factors

A settlement analysis of a sample of flyash obtained from the Cape Fear plant was performed by MACTEC during the assessment. The test was performed using a hydrometer and distilled water, and revealed that approximately 99% of the flyash settled within 15 minutes. This represents ash settlement characteristics under quiescent conditions and in a static environment. In reality, specific environmental conditions in the pond affect the ability of the fine-grained sediments to settle out in a uniform pattern as simulated in a hydrometer.

3.4 Discharge Permit Issues

The pond discharges into a secondary settlement basin approximately one acre in surface area. The basin acts as secondary treatment for the ash wastewater by providing additional retention time for settlement of finer sediments. The settlement basin discharges into the plant's cooling lake via a ditch. The cooling lake is a closed, recirculation system, but there are infrequent discharges to the Lumber River.

The ash pond operates under a wastewater permit issued by the North Carolina Division of Water Quality. There are no NPDES permit limits imposed on the cooling lake discharge; therefore there is no additional chemical treatment of the pond for suspended solids. Plant personnel will, however, add sulfuric acid to the cooling pond periodically to lower the pH as a preventative maintenance strategy for the cooling lake discharge.

3.5 Ash Pond Volume and Projected Life

The calculated future storage capacity of an ash pond is affected by variable ash unit weights, uncertainties in measured bottom elevations or surveys, unpredictable patterns of ash settlement and unpredictable and erratic behavior of ash related to suspended solids limits at the discharge. In earlier work, MACTEC projected capacities by assuming that the remaining pond area could be filled only to within an average of 1 foot of the riser top before suspended solids issues were likely. These projections, made mainly in 1999 and 2000, have appeared to be too optimistic based on reports from the plants. Generally, suspended solid issues have arisen before the ash level has reached the average 1 foot below the riser. Implementing operational aids such as relocating discharge points or installing baffle curtains has allowed ponds to continue filling available capacity and meet discharge limits.

For the three plants included in this study, application of the previous 1-foot factor would represent 22 to 42 percent reduction of theoretical volume to the top of the riser, based on current pond surface areas. During workshop meetings, no clear method for adjusting theoretical capacity was developed; some suggested using a 50 percent reduction, others less. It was noted that implementation of operational controls would allow more efficient use of the available volume. For purposes of comparing various alternatives, MACTEC elected to apply a uniform reduction factor of 25 percent to the calculated volumes for estimating usable life. That is, the calculated volume was multiplied by 0.75 to obtain a volume to use in projecting life of the ponds and various alternatives.

Based on the results of our pond survey, MACTEC plotted the depths at the 45 sounding locations and used those along with the contours developed during Kucera's 2002 survey to create a topographic map of the pond (Figure 1). MACTEC then calculated surface areas enclosed by the isotopic lines and multiplied these by the corresponding average depths within each line to determine the current volume of the pond. This volume is depicted in Table 4. Based on the survey, MACTEC calculated a current volume in the pond of approximately 793,600 cubic feet. Assuming that roughly 75% of the pond volume can be used for ash storage and still discharge without adversely impacting the cooling lake, roughly 595,200 cubic feet of ash storage space remains in the pond. At an ash influent unit weight of 55 pcf, that equates to approximately 16,400 tons of ash storage remaining.

Table 3 compares the current pond volume with the current, average, and maximum ash generation at the plant over the next five years. Since it is not known what percentage of the coal burned at the plant will be Opportunity Coal, MACTEC calculated ash generation rates using different ratios of contract and opportunity coal to evaluate various operating scenarios. As depicted in Table 3 and the accompanying graph , based on current pond volume determination, average coal use, and projecting that 75% of that volume can be filled with ash, remaining pond life ranges from 2.5 months (using all opportunity coal) to 7 months (using all contract coal). Because the volumes of contract coal and opportunity coal are not known, we have based further evaluations of ash capacity improvements on an average coal use rate and a 50-50 blend of contract coal and opportunity coal. For the Weatherspoon plant, this results in an annual ash generation rate of 40,300 tons. The remaining life calculations assumed uniform ash distribution in the pond, a unit weight of 55 pcf, and the current operating level.

3.6 Conclusions

The Weatherspoon plant ash pond has been filled to approximately 99% of the theoretical capacity for ash storage available at the current operating level, and has a projected usable life of 2.5 to 7 months remaining at the current operating level. The pond life assessments that were performed in 1999 and 2000 assumed uniform distribution of ash in the pond and projected that pond capacity would be reached in 1 year. Previous life assessments did not take into account the potential use of "Opportunity Coal" in the plant, which produces twice as much ash as Contract Coal, or environmental factors in the pond that affect the ability of the plant to maintain cooling lake water quality.

MACTEC believes that the potential increase in ash volume entering the pond through the use of "Opportunity Coal" poses a detrimental influence on the pond's ability to operate effectively as a wastewater treatment system. The pond will be full of ash in less than 1 year, and will no longer be able to accept ash sluiced from the plant and operate effectively as a wastewater treatment system. Raising the pond level as a short-term measure extends the life by approximately 1.5 years.

Based on the pond survey results and observations made during the pond profiling event, our knowledge of the Weatherspoon plant ash properties, present and future projected coal combustion volumes and types, and historical pond behavior, MACTEC concludes that the root cause of the pond's short projected remaining life span is the decreased volume in the pond due to the increase in ash volume.

The effective operating life span of the pond has been calculated to be less than originally predicted, based on factors such as the burning of "Opportunity Coal", LOI content, an increase in the volume of projected coal burn, and location of the ash sluice line on the same side of the pond as the discharge riser.

4.0 Evaluation of Alternatives for Ash Management

MACTEC developed and evaluated a list of ash pond management strategies for both short term and long term ash pond management. The list was developed based on MACTEC's research into ash management practices currently underway in other electric utility providers, at other Progress Energy plants, and into innovative technologies approved and being conducted by other industries for solid and hazardous waste management. Based on our research, we identified the following strategies for short and long-term ash pond management:

- Excavation/dredging and stacking of ash into another existing permitted pond;
- Use of Geotubes for ash storage and dewatering within a pond;
- Use of diversion baffles to increase sediment retention time;
- Use of wetlands (existing or engineered) for treatment of pond discharge;
- Chemical treatment (coagulants, flocculants) of pond discharge;
- Extension of the riser pipe to increase the volume of the ash pond;
- Raising the dike to increase storage volume in the pond;
- Modification of the discharge riser to allow partial drainage of the pond prior to a projected turnover event;
- Mycorrhizal Technology of land-applied flyash;
- Recirculation of pond discharge back to plant to supplement sluice makeup and create a closed-loop system; and
- Construction of a new ash pond

These strategies were presented to Progress Energy during Strategic Ash Management Team meetings on March 18, 2004 and April 27, 2004 for discussion. General comments received from Progress Energy indicated that wetlands, Mycorrhizal Technology, chemical treatment, and recirculation of pond discharge would not be feasible strategies for further consideration due to permitting constraints, projected costs and practicality. The remaining strategies are presented in the study report for analysis, and are categorized as either "short term" or "long term" strategies.

Short term management strategies address immediate concerns in the ash pond:

- The ability to maintain current ash fill schedules through creation of additional storage space in the pond; and
- The optimization of ash flow in the pond to promote uniform settlement and maintain the projected fill schedule that was used in determining remaining pond life.

Short term management strategies are intended to address immediate operational issues of the pond

Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules by creating additional space in the ponds through excavation, use of Geotubes, or construction of a new ash pond to meet future ash projections. Long-term management strategies consider operation of the plant over a 20-year planning window.

4.1 Short Term Ash Management Alternatives

4.1.1 Description of Alternatives

Due to the limited options available for short-term pond management and the immediacy of the problem identified in the root-cause analysis, MACTEC identified and evaluated two alternatives for short-term management of current pond available capacity. Short-term alternatives address immediate capacity issues in the pond through consideration/management of current pond conditions and ash settlement factors. The short term alternatives that were identified and evaluated by MACTEC for the Weatherspoon pond are:

- Raising the surface water level in the pond two feet; and
- Creation of cells, excavation or dredging a certain volume of ash from the pond and dry-stacking it in Area B or a designated area of the active pond (Area 3)

4.1.1.1 Alternative 1: Raising the Pond Level

4.1.1.1.1 Technical Analysis of Alternative

This alternative involves raising the pond operating level two feet to a surface elevation of 143 ft msl, providing 2 feet of freeboard. This would be accomplished by raising the discharge riser pipe in the pond two feet. The pipe is constructed of sections joined together with grout. The pond drains through the top of the riser; it acts as a weir. The riser would be raised by adding a two-foot section of pipe on top of the pipe and sealing with grout. The benefits of raising the water level in the pond are:

1) It provides additional depth and capacity in the pond for ash settlement; and
2) It moves the ash/water interface farther away from the outfall

The projected location of the ash-water interface in the pond after raising the water level is provided as Figure 2.

4.1.1.1.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to riser extension and the integrity of the grout used to seal the riser extension to the existing riser. If the grout or sealant used is not suitable for the conditions or is not applied correctly, the seal will leak and possible damage to the riser may result. The existing riser has had two previous repairs made to the pipe due to leakage. The existing pipes in both the primary and the secondary ponds should be assessed for long-term reliability and possibly replaced with new pipe prior to raising the pond above its present level.

Protective equipment such as flotation devices should be worn when added the additional section to the riser, as the work will be conducted over water.

The impact to the existing dike is considered to be negligible, since the top of dike is still two feet above the new operating pond level and the design freeboard is maintained. Some minor seepage and wetness has been observed along the south dike and a portion of the east dike during past dam safety inspections. Toe drainage was installed along the south dike in 1994 and is functioning. Prior to raising the pond level, five piezometers should be installed on the crest of the dikes: three along the south dike and two on the east dike. The purpose of installing piezometers would be to monitor existing water levels in the dike and evaluate the impact of raising the pond operating level.

4.1.1.1.3 Reliability Analysis of Alternative

Riser extensions have been conducted in other Eastern Region Progress Energy ponds, including Cape Fear, Lee and Sutton. They have proven to be effective in reducing pond discharge frequencies and in maintaining discharge permit compliance. Riser extensions are constrained by the maximum operating level in the pond and design freeboard.

4.1.1.1.4 Economic Analysis of Alternative

Engineer Opinion-of Cost for the riser extension is $2,500. This cost includes labor for design of a stainless steel riser extension, materials for the structure and joint, and installation by crane. Riser extensions can be placed by plant personnel. The estimate is based on costs for riser extensions on similar-sized pipes at Progress Energy's Cape Fear, Lee and Sutton Plants.

4.1.1.1.5 Environmental Analysis of Alternative

Environmental impacts of modifying the discharge riser are expected to be minimal. Since the pond does not have current permit limits on the discharge and the work would be conducted within the limits of the treatment system, a permit revision is not required for the work. There is no requirement for an Authorization to Construct according to Mr. James Bodiford the plant's environmental coordinator. However, Progress Energy would notify the Fayetteville Regional Office of the Division of Water Quality (DWQ) as a courtesy notification.

4.1.1.1.6 Risk Assessment of Alternative

The inherent risk of modifying the discharge riser lies in the preservation of integrity of the joint seal during placement of the extension. If the grout or other joint sealant does not sufficiently set, leakage can occur, possibly resulting in damage to the riser through structural failure. As previously noted, the condition of the existing riser pipes must be evaluated and the need for repairs or replacement determined prior to raising the pond level or in consideration of long-term usage.

There is a risk that monitoring of water levels within the dikes may indicate a need for additional drainage installation, and associated cost.

4.1.1.1.7 Other Issues

Extension of the discharge riser will provide an additional 1.6 years of storage capacity in the pond, assuming an average coal usage of 255,433 tons per year and a ratio of 50/50 contract/opportunity coal. This option should be considered in conjunction with other short-term strategies, as it will not provide long-term benefits to ash management. It is, however, a practical and cost-effective strategy at this time to address immediate capacity issues in the pond.

4.1.1.2 Alternative 2: Excavation/Dredge, Haul and Stack

4.1.1.2.1 Technical Analysis of Alternative

For this alternative, ash would be excavated or dredged from a designated area in the pond and transported via truck or through pumping to a stacking area in the pond. Entrained water in the ash would be allowed to drain from the stacked ash through rim ditches or bleed channels constructed around the perimeter of the stacking area into the active pond. Ash could be stacked as high as practical, considering slope stability and erosion potential. Stacked ash will need to be capped with soil and seeded after final grading activities are conducted. Provisions for haul routes into the stacked area and dredge line placement must be considered.

Ash excavation from the active pond allows for additional space in the active pond for ash storage (the amount of additional storage depends on the surface area of the pond that can be excavated). Water is pumped out of the excavation area to lower the surface water level, allow for additional excavation of ash, and return any rain water from the stacked area to the main ash pond. Previous excavation projects at the Weatherspoon plant have shown that a maximum excavation depth of 6 feet will maintain stability and dryness of the excavation floor for equipment traffic without additional drainage measures. Drainage can also be accomplished through installation of additional rim ditches and bleed channels to provide conduits for entrained water. Excavation to depths greater than 6 feet can be accomplished through construction of impervious separator dikes and additional dewatering devices.

Dredging is not considered to be a feasible option for the Weatherspoon plant due to a previous project that resulted in a dike breach and loss of ash from the pond. It is therefore not considered for further evaluation in this study.

Excavation of ash from the Weatherspoon active pond would involve the area in the north and southwestern portions of the pond, where ash has sedimented and has filled in the available space Excavation of ash would be performed by mass excavating equipment (large-bucket trackhoes) and articulating dump trucks.

To optimize available capacity of the pond, the area for proposed excavation could be divided into cells separated by separator dikes. The proposed excavation areas are depicted as "Area 1", "Area 2" and "Area 3 in Figures 3A and 3B. Area 3 has also been identified as a potential stacking area. The separator dikes would be constructed of geogrids, borrow material, and ash and would be constructed to an elevation of approximately 145 ft msl (to maintain a minimum of two feet of freeboard in the active pond). The proposed cell areas provide approximately 10 total acres of surface area for excavation. Prior to excavation activities, the ash sluice line must be re-routed/extended into each cell area as well as the active pond area to provide flow paths for ash flow during normal operation of the pond during the excavation activities. The conceptual approach to a digging and stacking strategy is that the constructed cells can be used for storage of ash sluiced from the plant, and the remaining active pond would be available for emergency use only. Different cell configurations are possible, and ash can also be excavated/dredged out of a portion of the active pond area if necessary.

At a maximum excavation depth of six feet, excavation slopes of 10:1 and average density of excavated ash of 60 pcf, a total volume of 78,400 tons of ash can be excavated from the pond per dig event, adding approximately 1.8 years of additional storage per dig cycle at the current ash generation rate. The amount of ash that can be excavated from each cell is limited by the time it takes to fill the other cell with sluiced ash from the plant. Assuming that each excavation/stacking cycle can occur as soon as possible after the dig area is full (see Timeline, Appendix A), the amount of time that it takes per dig (approximately eight months), and the time it takes to fill in the other cell area after excavation (based on dig area volume and average annual ash generation rate from the plant), it is estimated that five digging/stacking cycles can be conducted during the remaining usable life of the pond. Therefore, the approximate life extension to the pond achieved through digging and stacking is 9.8 yrs.

Excavated material from the pond could be hauled to Area "B" or Area 3 for stacking. Area B has been used previously for ash stacking, and has approximately 10.5 acres of surface area for stacking ash. Area 3 could be created by diking off the southwestern corner of the pond to create a cell for stacking. The maximum height of stacking would be dependant upon slope stability and ease of equipment mobility for grading, and would affect the surface area footprint occupied by the transported ash (the higher you can effectively stack the ash, the smaller the footprint). Theoretically, the cycles of digging in Areas 1 and 2 and stacking in Area B or Area 3 can continue until the available stacking areas are filled. However, given the number of digging and stacking episodes that can be conducted in the remaining usable life of the pond and assuming that a maximum excavation depth of six feet is achievable, maximum stacking elevation of approximately 200 feet msl could be achieved in Area B and 160 ft msl could be achieved in Area 3.

4.1.1.2.2 Safety Analysis of Alternative

Generally, the primary safety concern of excavation and dry-stacking of ash is the stability of the excavation floor and surrounding dike and ingress/egress to/from the excavation area. Since the ash to be removed has a certain percentage of entrained water, the excavation area is likely to be unstable and potential for entrapment of equipment and personnel exists. For this reason, spread mats constructed of wooden material are suggested for use in equipment/personnel transport through the ingress/egress areas. Additionally, a minimum 30-foot buffer must be constructed and maintained around the perimeter of each excavation area to prevent stability of the dikes from being compromised during the excavation activities. Excavation slopes of 10:1 are also a recommended design parameter to maintain dike wall stability and allow vehicle ingress/egress to the excavation area.

Disturbance of ash sediments also poses the risk of liberating flyash particles into the air, where they can be inhaled and present a respiratory hazard. For this reason, breathing filtration equipment should be used in the work zones where appropriate.

The primary safety concern associated with dredging of ash is the potential damage to the dike through the operation of the dredging equipment. A previous dredging project in the pond resulted in a partial breach of the northern dike of Area B, releasing a large volume of ash into the pond and affecting water quality in the cooling lake.

4.1.1.2.3 Reliability Analysis of Alternative

Excavation of ash has proven to be an effective method of creating additional storage space in active ash ponds in other Progress Energy and electric utility steam plants. The volume of additional storage space created in the pond is dependant on the available stacking area to which the ash is transported, the ash influent rate into the pond, and the maximum depth of stacking that can be achieved. The benefits of cell development for stacking lie in the ability to use portions of the pond for filling while others are being excavated, and the main pond does not receive ash under normal operations.

4.1.1.2.4 Economic Analysis of Alternative

MACTEC estimates the total cost for digging and stacking for 5 cycles (10 years of additional storage) as approximately $1,979,600 in today's dollars. This does not include supplemental stacking in Area 3. This cost is broken down in Appendix A and is discussed below.

The unit cost for excavation and hauling of ash is roughly $4.00 per ton based on previous work at Weatherspoon. MACTEC estimates that the cost of five excavation/stack cycles is approximately $1,532,600.

The cost of construction for a separation dike for the excavation cells is based on a cost of $4.00 per square yard for the geogrids (as applied) and $3.00 per c.y. for borrow fill. Assuming that the dikes will be 12 feet in width, average four feet in height, and total 2,500 feet in total length (as depicted on Figures 3A and 3B), estimated cost for construction of the dikes is approximately $67,000.

The cost for soil cap on the stacked ash is estimated based on a unit rate of $15.00 per cu. yd. for fill. Assuming a six-inch soil cap to be placed over the entire Area B stacked area, the cost for a soil cap Is estimated at $230,000 for the 19-acre area.

If Area 3 is used as a supplemental stacking area, an initial two dig and stack cycles can be conducted prior to stacking in Area B at a cost of approximately $367,400. Stack heights of 10 feet can be achieved per cycle.

4.1.1.2.5 Environmental Analysis of Alternative

Since the ash is being transported and stacked within the perimeter of an existing permitted wastewater treatment system, no provisions are needed for water drainage or stormwater runoff from the stacked ash; it can be directed through constructed channels back into the active portion of the pond for retention and treatment. Since the runoff from the stacked ash will contain suspended solids, a potential exists that water quality in the active pond will be adversely affected by the runoff. In a previous excavation/stacking project at Weatherspoon, problems with suspended solids were not encountered, primarily because the stacking area is located far enough away from the main pond and secondary settling pond that adequate retention time for solids settlement is available.

Progress Energy environmental personnel have advised that movement of ash within an active permitted pond is allowed under the Water Quality permit. Solid Waste regulations do not apply. Should that situation change, and regulations for industrial landfills issued by the Division of Solid Waste become applicable, liners and other measures would be required, considerably impacting planning time and cost.

4.1.1.2.6 Risk Assessment of Alternative

Ash excavation and re-stacking has proven to be an effective method of removing ash from active ponds to create additional space. Inherent risks lie in the stability of dike walls and the floor of the excavation area, and are based on the entrained moisture content of the ash and rainfall, and the ability to effectively pump this water out of the excavation. If provisions are not made to protect the cell dikes during excavation or dredging activities, breaching may occur.

Protection of water quality in the active pond during dredging or excavation activities is also important, as agitation of sedimented ash during these activities will cause dispersion of sediments throughout the pond and could affect discharge quality. This has not been a problem in previous excavation and stacking projects at Weatherspoon.

The third risk is the actual life extension provided to the pond through an excavation/stacking strategy. Our estimates are based on a 50/50 contract/opportunity coal ratio, and an average coal production rate calculated over a five-year projection period. If the percentage of opportunity coal increases above a 50/50 ratio and annual coal production exceeds the average by more than 10% (this would exceed the maximum projected volume of coal), the actual pond life extension will be shortened, and projections made in this report will be invalid.

4.1.1.2.7 Other Issues

The potential drawback to creating a third cell (Area 3) for stacking is the reduction of available area in the main pond for ash storage from the plant. Although the main pond area would be used primarily as backup storage while Areas 1 and 2 are used as primary, portioning off a section of the main pond area for stacking reduces the available capacity for future ash storage if needed. As an alternative consideration, this area can be used initially for excavation of ash, then later as a potential stacking area

4.2 Long Term Ash Management Alternatives

4.2.1 Description of Alternatives

MACTEC evaluated three alternatives for long-term management of ash and available pond capacity. Long term management strategies combine the goals of the short-term strategies with the concept of beneficial ash re-use and considering future increases in coal usage or ash generation from the plants. Long term goals are to maintain current pond fill schedules as determined assuming uniform ash distribution patterns, as well as account for future coal usage at the plant by addressing long-term storage needs for a 20-year life.

The long term alternatives that were evaluated by MACTEC were:

- Raising the main pond dike 6 feet to an elevation of 150 ft msl;
- Use of Geotubes for storage of ash; and
- Construct a new ash pond.

During the meetings with Progress Energy, the concept of creating a landfill on top of the abandoned ash storage area west of the plant or even developing an off-site landfill was discussed. Landfills would fall under the permitting requirements of the Solid Waste Division. A similar project was undertaken by the Roxboro Plant for expanding their landfill on a former ash pond. A permitting time frame of about two years was required. Detailed hydrogeologic studies were required. The expansion was required to have a liner, leachate collection system and ground-water monitoring.

In 2002, Jacobs Engineering and Law Engineering prepared a study for CP&L for the Asheville Plant which studied landfilling concepts both on their existing ash pond and off site. Landfilling would require implementing a dry ash handling system as well as the development of the landfill under Solid Waste regulations and permits. The ash quantity used for that study was 120,000 tons per year plus 50,000 tons per year of sludge from planned air cleaning equipment for a total waste amount of 170,000 tons per year. The amount of ash is approximately three times the average ash at a 50-50 mix of opportunity and contract coal for the Weatherspoon plant.

We have used the cost estimates prepared in the Asheville study as a guide for a rough estimate for developing a landfill at Weatherspoon. The only apparent location for such a landfill would be the existing pond. Area B is already filled in to a high level, and creating a landfill on top of Area B seems improbable. There is not sufficient room at the plant to develop an on-site landfill while maintaining an active ash pond during the time it would take to plan, design, permit and construct the initial landfill cell.

For an off site landfill concept, a rough estimate based on the Asheville study, is $44,915,000 (2002 dollars) for a 25 year operation. This estimate was based on per acre costs from Waste Management, Inc. in the Asheville study and included land purchase at $10,000 per acre. The size used at Asheville was 70 acres for the landfill with 130 acres of buffer/operational land (200 acres total). For Weatherspoon, we have estimated the landfill size as 20 acres with 50 acres for operations and buffers (70 acres total). The estimate includes:

Dry Ash System	$ 1,215,000
Land Purchase @10,000 per acre	$ 700,000
Host Community Fee, estimate	$ 500,000
Permitting	$ 1,000,000
Construction @$275,000 per acre	$ 5,500,000
Closure @150,000 per acre	$ 3,000,000
Post Closure monitoring and reports	$ 2,000,000
Operation for 25 years (@$1,000,000 per year	$25,000,000
Transport Ash @$6.00/ton	$ 6,000,000
TOTAL	$44,915,000

At an ash amount of 40,000 tons per year and 25 years of life, the above cost translates to $44.92 per ton, significantly greater than other options. The difference in on-site development and off-site development was due to the different methods of estimating used by Jacobs/Law in the Asheville study for the two options.

Another concept that was briefly discussed in the April 18, 2004 meeting was developing a centralized regional ash landfill to receive ash from at least the three plants studied. For an estimated landfill size of 340 acres and using the per acre estimate approach from the Asheville study, we estimate a cost of about $155,000,000 for a 25-year life.

Experience that municipalities and private waste handling firms have had trying to site new landfill space indicates finding a suitable landfill site and obtaining permits is a daunting task. Public opposition to landfills, regardless of their content, has made it extremely difficult for new projects to be successful. Municipalities have the power of eminent domain as a tool to obtain land; it is not clear if Progress Energy could use that approach. Extended legal actions by opponents delay implementation of landfill construction and operation. Creation of landfills off existing Progress Energy property does not appear viable as an alternate.

4.2.1.1. Alternative 1: Raising Main Pond Dike

4.2.1.1.1 Technical Analysis of Alternative

This alternative involves the addition and compaction of fill material along the crest of the main pond dike to raise the dike. This option was evaluated in the 1999 study by Law Engineering and that information is the basis for the present discussion. To provide for increased ash storage capacity, the crest of the existing dam can be raised by approximately 6 feet, to elevation 150 feet (msl). With implementation of this strategy, the planned operating level of the pond can be raised to a maximum elevation of 147 feet msl. The maximum height for the modified dam will be 49 feet, and the storage volume will be 368 acre-feet for the 32-acre impoundment area. Based on the planned height and storage capacity, the modified dam will be considered a small size dam under the North Carolina definitions.

The work will include placing earth fill on the crest and downstream side of the existing dam, and extending the existing riser structure to provide for a minimum 2-ft freeboard. Due to space limitations on the east side, slopes may need to include geogrid reinforcing to allow construction of steeper slopes.

Dike construction over sedimented ash on the interior side of the present dikes can be accomplished through use of geogrid reinforcing or augered pile supports.

Raising of the pond dike will accomplish the following objectives:

1) Provide additional storage of ash and extension of pond life. Additional storage life of about 4.3 years is projected with the extension and current pond elevation;
2) Provide for more settlement time in the pond to improve discharge water quality; and
3) Provide for the option to raise the pond operating level incrementally through riser adjustment

Modification of the ash sluice line plumbing would be required for implementation of this alternative. A vertical extension to the lines may be required to transfer the sluice into the pond at a higher elevation as a result of the dike raise. Additionally, the available head against which the sluice pumps are pumping would be increased, and the pumps' ability to handle the increase in static lift would need to be evaluated by the plant. Currently, ash and water are removed from the ash sump pit by two Allen Sherman Hoff "C" frame hydro seal ash pumps. Each pump is designed to deliver 1,750 gpm of ash and water slurry against a discharge head of 75 ft with 10 ft submergence. Under this condition, 55 bhp is required from each pump motor, and the efficiency is 60%. However, the pumps are old (over 20 years), and a pump performance evaluation would be required to determine discharge rate and efficiency against additional head.

4.2.1.1.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to the stability of the dikes after the raise is complete. The evaluation of dike raising conducted in 1999 found that dike slope stability could become an issue due to the projected elevated phreatic line through the dike. Design measures to address the stability are available. The detailed design of a dike raise will need to include stability analyses using circular arc failure surfaces based on a random grid pattern. Seismic analyses should also be conducted on the final dike slopes using a horizontal acceleration factor of 0.05g. Soil properties can be determined from laboratory analyses and historical information.

Existing slopes with fair to moderate grass cover, have performed well in the current dike and do not show signs of sliding. To limit the surficial erosion, all dike faces will need to be hydro-seeded with drought tolerant grasses to aid in reducing potential surface sloughing.

4.2.1.1.3 Reliability Analysis of Alternative

Dike raises have been conducted at other Progress Energy ash ponds (Robinson) and have proven stable and reliable.

4.21.1.4 Economic Analysis of Alternative

Based on the previous study conducted by LAW Engineering in 1999 for a dike raise, construction of a conventional vertical extension of six feet is estimated at $1.655 million. At an operational life of 4.3 years (considering the extension provided to the pond life with the raise and taking into account ash volume production over that period at a 50/50 contract/opportunity coal ratio), this equates to an annual cost of $384,883. This cost also does not include any required modifications to the sluice pumps to overcome the additional static and frictional head associated with pumping over the dike. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

4.2.1.1.5 Environmental Analysis of Alternative

Permitting requirements for this alternative are an erosion and sedimentation permit if land-disturbance activities exceed 1 acre in size, and an authorization to construct. Detailed construction plans including erosion and sedimentation control features, and a separate narrative and plan sheets must be prepared for submittal to the Fayetteville Regional office of the Land Quality Section. The authorization to construct can be prepared based on the plans and must be submitted to the Fayetteville Regional office of the Division of Water Quality It is not clear at this time if a separate grading or land-disturbing permit will be required by Robeson County.

Modifications to existing dams would normally require a permit from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

4.2.1.1.6 Risk Assessment of Alternative

The inherent risk of raising the dikes lies in the stability of dike walls, and is based on the type of material used for the fill, the interior and exterior slopes, and the erosion control measures employed during construction. If provisions are not made to prevent erosion from dike faces during and after construction, breaching may occur.

Protection of water quality in the active pond during dike construction activities is also important, as sediments created during these activities may enter the pond could affect discharge quality. This can be prevented through proper sediment control measures employed during and post construction, such as silt fences, turf matting, rip rap or vegetation.

4.2.1.2. Alternative 2: Use of Geotubes for Ash Storage

4.2.1.2.1 Technical Analysis of Alternative

This alternative involves the purchase and installation of Geotubes within the pond dike to collect and store ash. Geotubes are porous, woven monofilament fabric tubes that can be used to collect, store, and de-water ash either directly from the sluice lines entering the pond, or from a dredge line. Geotubes are traditionally used in sand dredging operations in coastal areas because they allow for both storage of dredged material for possible future use as well as provide future structural opportunities for berm construction. They have also been used in sludge dewatering operations, including coal sludge. Geotubes are an attractive option for storage of ash for the following reasons:

1) They allow the solids to be kept further away from the outfall line;
2) They provide a more structured containment; no dry stacking of ash is needed in the future;
3) The tubes can be stacked on top of each other, thus creating additional years of storage;
4) No erosion control or seeding is needed to prevent ash blowing as with other dry stacking operations; and
5) Ash is kept clean and easily removed once a market develops

Geotubes are supplied in sections; length of each section is specified by the purchaser. Circumferences range from 30 feet up to 90 feet. Geotubes can increase solids content through de-watering by a factor of up to 2.5. Literature on Geotubes is provided in Appendix B.

Modification of the ash sluice line plumbing would be required for implementation of this alternative. An extension to the lines would be required to transfer the sluice to the tubes. Typically, tube sections are pre-formed to specified lengths, laid out in the pond according to the desired configuration, and filled through ports attached to an overhead valve manifold system. A central trunk line is positioned above the length of the tube, and branch lines are connected to the main line at distinct locations above the Geotube fill ports. Filling of the tube sections is accomplished through manual valves installed on each branch line; the proper sequence of filling allows for even distribution of ash in the tubes. Maintenance of the valves is required to maintain uniform filling of the tube sections and prevent backup in the sluice lines. A pressure relief valve is positioned at each end of the tube to prevent structural failure due to blockage in the fabric.

A proposed Geotube layout is depicted in Figure 4. The layout has been devised to maximize the available space in the pond for Geotube placement, as well as minimize the amount of manifold piping needed to fill the tubes. As an alternate layout, the tubes can be used as part of the dike construction in conjunction with the excavation/stacking alternative. Based on an average annual ash generation from the plant of 40,332 tpy, considering a ratio of 50/50 contract/opportunity coal, a projected storage interval of 20-years, the capacity of a 90-foot circumference (28.5-ft diameter) Geotube, and an available storage area in the pond of 15.2 acres, it is estimated that approximately 60,480 lineal feet of Geotubes will be required in the pond. This can be accomplished through the installation of 108 Geotubes each approximately 560 feet in length arranged according to Figure 4 and stacked in 3 levels.

4.2.1.2.2 Safety Analysis of Alternative

Potential safety concerns associated with this alternative are related to installation of the tubes in the pond and operation of the fill valves. The tubes weigh approximately 24 pounds per lineal foot empty, so considerable weight is associated with tube lengths of 560 feet. Cranes and other heavy equipment are required for installation of the tubes in the pond. The valves require manual actuation when filling the tubes; this is elevated work under high flow conditions. Risks associated with elevated work and pressurized vessels are inherent to the tube filling process. No additional safety concerns are associated with this alternative.

4.2.1.2.3 Reliability Analysis of Alternative

Geotubes are traditionally used and have been proven effective in sand dredging and sludge dewatering operations because they reduce waste volumes, allow for storage of dredged material for possible future use, and provide future structural opportunities for construction of berms using the Geotubes. They take up less surface area than typical stacking operations, and can be stacked to further minimize space. Geotubes are constructed of strong material resistant to tearing, and are designed to withstand wide width tensile strength up to 4,800 lbs/ft. While they have not been used in flyash ponds, they have been used to dewater coal sludge; the characteristics of which are similar to flyash. Geotubes can also be designed to handle a wide range of water content in the influent stream, which can accommodate the intervals of sluice pumping with low solids content (pump cycling). Further evaluation of the ability of the Geotubes to handle sluice loads of primarily water and little solids as the pumps go through their operational cycles would be required prior to implementation of this strategy.

4.21.2.4 Economic Analysis of Alternative

MACTEC estimates the total cost for using Geotubes for a 20-year period as approximately $3.45 million in today's dollars. This cost is broken down in Appendix A and is discussed below.

Based on the total volume of Geotubes needed to store 20 years of ash and the cost for a 90-ft circumference tube, the material cost for 249 Geotubes is estimated at $2,709,526. Costs for the engineering and design are estimated at $20,000, the piping manifold system costs are estimated at $30,000. Installation costs for the Geotubes and piping manifold are estimated at 25% of the material cost and are projected to be approximately $685,000. The total cost is estimated at $3,445,000. This cost also does not include required modifications for the sluice pumps to overcome the additional static and frictional head associated with pumping into the stacked Geotubes. An evaluation of the pumps' ability to handle the additional head would be required prior to implementation of this alternative, and costs associated with required modifications developed at that time.

A geotube system would require additional plant manpower for monitoring and operation. The impact of the manpower needs on the total system cost has not been determined.

4.2.1.2.5 Environmental Analysis of Alternative

Environmental impacts of using Geotubes to store ash sluiced from the plant are expected to be minimal, and will actually improve water quality in the pond by reducing solids loadings to the pond while the tubes are being filled. No permit revisions are required for implementing this alternative, since Geotubes will be installed within the dike and will not increase the discharge flow of the pond above the permit limit. Since this is a minor modification to the existing permitted wastewater treatment system, authorization to construct will be required from the Fayetteville Regional Office of the Division of Water Quality. This can be obtained through a submittal of the design plans for the Geotube system to the DWQ.

4.2.1.2.4 Risk Assessment of Alternative

The inherent risk of installing Geotubes is in the utilization of available area in the pond and ability of existing equipment to pump solids into the Geotubes for storage. An evaluation of the existing sluice pumps' ability to pump at the design rate and overcome the additional head imposed by the installation of Geotubes would be required to verify that current operation of the pumps will not be adversely affected. The available head against which the sluice pumps are pumping would be increased, as the Geotubes provide additional static head due to their fill ports.

4.2.1.3 Alternative 3: Construction of New Ash Pond

4.2.1.3.1 Technical Analysis of Alternative

For this alternative, a new ash pond would be constructed on property to be purchased by Progress Energy at a selected location. A siting study would need to be conducted to determine the optimal location for the pond, taking into consideration fill and drainage requirements, dike construction, permeability of subsurface soils, etc. Design considerations for the new pond would include average annual ash generation rates taking into consideration both contract and opportunity coal, a usable life of 20 years, a freeboard of 2 feet, depth 3 feet, interior and exterior slopes of 3H:1V, excess capacity of 25% to account for non-uniform ash distribution, and a maximum height of 20 feet above existing grade.

Design considerations must also be made for pumps and piping to sluice ash from the plant to the location of the new pond, connection of the outfall structure to a receiving water body, and permit requirements.

For the Weatherspoon plant, based on an annual ash generation rate of 40,332 tons (from a 50/50 coal mix), a design height of 20 feet, design freeboard of 2 feet, 25% excess capacity provision, and a usable life of 20 years, the required land area to accommodate a new pond is approximately 75 acres. Rough dimensions of the pond are a length of 2,225 feet and a width of 1,000 feet. This pond has a storage volume of approximately 33,885,600 ft^3, or roughly 931,900 tons of ash.

4.2.1.3.2 Safety Analysis of Alternative

The primary safety concern associated with construction of an ash pond lies in the design of the retaining dike and construction activities relating to excavation and grading. Proper design of the dike to minimize erosion and maintain stability are design considerations integral to the design of the pond. Proper design of the discharge weir is also required to maintain flow balance in the pond and provide adequate support to prevent overturning of the riser under high wind and wave impacts.

4.2.1.3.3 Reliability Analysis of Alternative

Construction of a new ash pond will be an effective method of creating additional storage space for future ash generation, and has been utilized as a long-term storage method in several of the other electric utility steam plants with whom we contacted The volume of additional storage space created with a new pond is dependant on the available area in which the pond can be constructed, existing site conditions that affect excavation and development, and the maximum depth of the pond that can be constructed.

4.2.1.3.4 Economic Analysis of Alternative

The construction costs for a new ash pond are presented in Appendix A. Costs are based on permitting and design of the new pond, construction testing and monitoring, equipment mobilization, drainage and erosion control, a discharge structure and outfall piping, extension of the sluice piping, soil and subgrade placement and compaction, a 60 mil HDPE liner, Geotextile and Geosynthetic material, Rip Rap and roadway construction.

Based on the size of a pond needed for 20-year storage of ash from a 50/50 coal mix, estimated construction costs total approximately $4.76 million. These costs are present-day, and are exclusive of the cost to purchase additional land for construction, if necessary. Approximately 75 acres of land would be required.

4.2.1.3.5 Environmental Analysis of Alternative

Construction and operation of a new ash pond would require obtaining a National Pollutant Discharge Elimination System (NPDES) Wastewater permit from the North Carolina Division of Water Quality. The permit application would require sealed engineering drawings, construction plans and specifications on the pond, pollutant loadings and possible flow modeling to demonstrate compliance with surface water standards. The permit would provide authorization to construct the pond and assign limits on pollutant levels in the runoff from the pond upstream of the receiving water body.

MACTEC anticipates that a liner would be required for the pond to protect groundwater quality in the surrounding area. The liner should have a minimum thickness of 60 mil and be constructed of HDPE.

New dam construction normally require approval from the North Carolina Dam Safety Section of the Division of Land Resources. Progress Energy, because of its regulation by the North Carolina Utilities Commission, is exempt from the North Carolina Dam Safety Law. However, by agreement with the

Utilities Commission, Progress Energy will submit construction plans for a dam to the State Dam Safety Engineer for review and comment.

A Stormwater General Permit would also be required for construction of the pond under the NCDWQ Phase II Stormwater program. The permit would cover protection of stormwater quality from construction site runoff, and would require development, submittal, and implementation of an Erosion and Sediment Control plan for runoff from the site.

4.2.1.2.6 Risk Assessment of Alternative

Construction of a new ash pond is an effective long-term ash management strategy; however, available land would be required considering appropriate buffers for protection of existing surface water quality. There is also an inherent risk in the design and construction of any new containment structure when considering dike stability and erosion. As with the introduction of any new ash management program, proper maintenance is required to ensure long-term goals are met and the pond filling schedule is consistent with the projected fill pattern.

5.0 Recommended Ash Management Strategic Approach

5.1 Short Term Approach

To achive short term goals of pond discharge complaince and maximizing remaining usable life, MACTEC recommends consideration of a combination of the following:

1) Raising of the pond operating level two feet to 143 ft msl; and
2) Implementation of a cyclic ash excavation or dredging and stacking program from the main pond to Area B or a section in the southwest corner of the main ash pond.

Raising the discharge riser provides a minimum extension of 1 year (opportunity coal) and maximum extension of 2 years (contract coal) of pond life considering average annual ash generation. Riser extension is a relatively inexpensive option that can be done in a short period of time. Although concern exists from the plant regarding the potential for leakage in a riser extension, through proper design and installation of the extension, this potential can be minimized. Implementation of this alternative needs to occur no later than third quarter 2004 to provide enough pond capacity for the remainder of the year.

When combined with the dig and stack cycles in Areas 1, 2, and 3 an additional 11-12 years of storage can be achieved in the pond. Implementation of the excavation/stacking program needs to commence in first quarter 2005, less than one year of storage remains in the ash pond under current conditions and an additional 1 year of storage is provided by raising the discharge riser. The excavation/stacking plan can be based on the plan used in 2002, as well as the basis for cost development. Area B has sufficient room to allow multiple digging and stacking cycles, and a separate diked area in the active pond can be constructed as a supplemental stack or dig area. The volume of material removed from the cells will be limited to the maximum excavation depth that can be achieved accounting for dewatering needs and the fill time for the active cells in the pond; previous excavation work has shown this depth to be six feet.

Additional excavation depth may be achieved through installation of an underdrain collection and conveyance system for entrained water.

Through installation and actuation of a branched sluice pipe network, pond filling can be coordinated with the excavation cycles to create a balanced system of filling and digging. The main area of the pond can be regulated to backup status; ash influent to the pond can be directed into cell Areas 1, 2 (and possibly 3) as additional space is created.

MACTEC recommends that Progress Energy consider implementation of a regional plant excavation/stacking program with an approved contractor. This will allow for better management and planning of dig/stack events at each plant in the Eastern Region, and will be more cost-effective through reduced rates. A uniform dig/haul/stack rate may be negotiated with the contractor during the bid process, or be negotiated depending on a fixed volume of material.

5.2 Long Term Approach

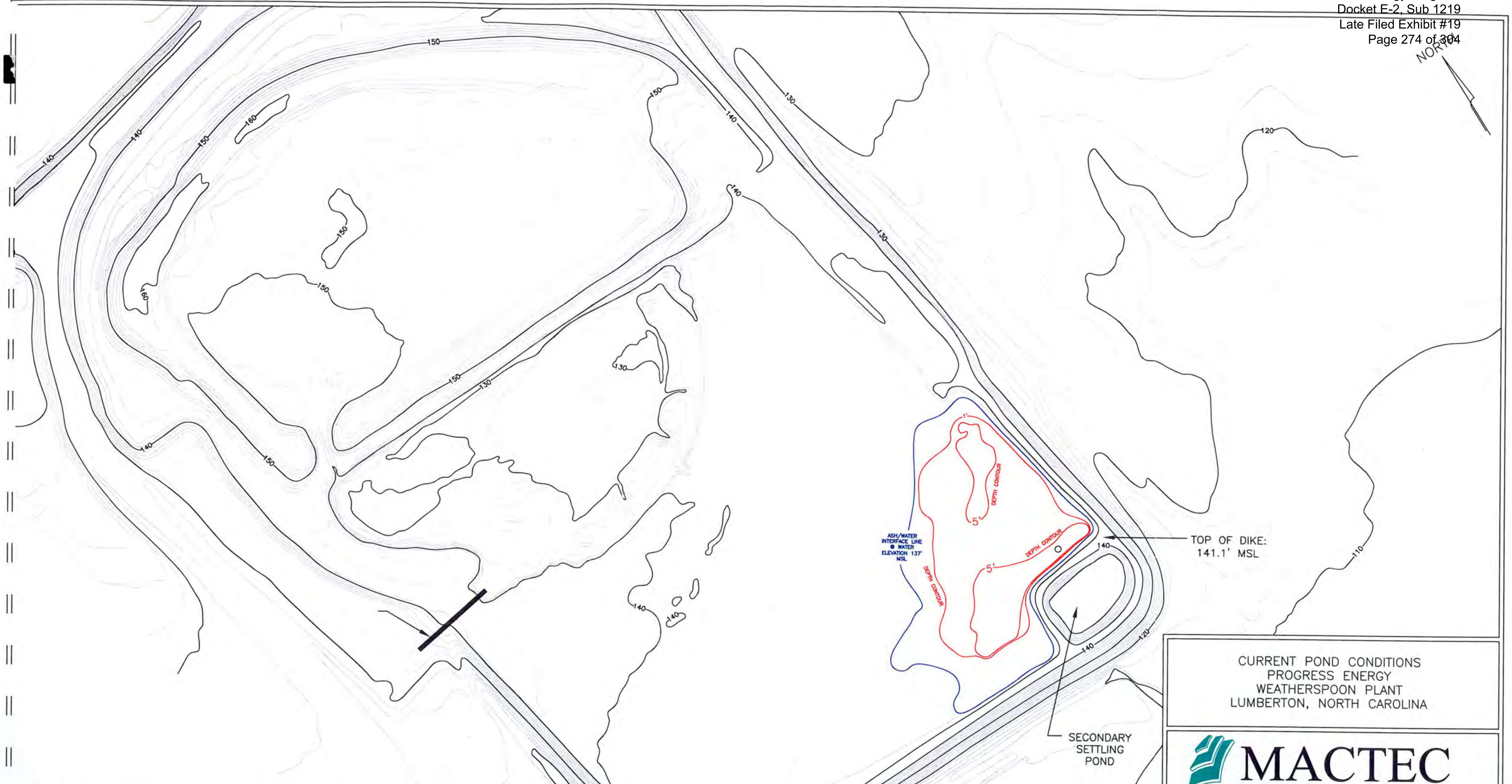
A long term ash management strategy would employ the combination of the ash excavation and stacking program with the use of Geotubes to extend the storage life to 20 years. The proposed Geotube configuration is provided in Figure 4; other configurations are possible depending on available space and the cell configuration. Geotubes can be used exclusively to achieve 20 years of ash storage, or in conjunction with the dig and stack program. By combining the two alternatives, the number and cost of Geotubes required to store ash over the 20-year planning interval is reduced, thus requiring less space in the pond for Geotube placement. Geotubes provide an option to store and de-water ash for future beneficial re-use or us as structural components in future dike construction.

A long-term concept that could also be considered is the construction of a regional ash landfill and conversion of the plant ash handling to a dry system. The costs of implementing a dry ash system are relatively high. Previous studies at the Asheville plant indicate costs on the order of $1.2 million for the ash handling system and $155 million for construction of a regional landfill. We understand such capital expenditures are very unlikely for the Weatherspoon plant due to its age and low generating capacity.

A cost comparative analysis of the alternatives evaluated for this study is provided in the Executive Summary. As illustrated in the cost comparison chart, the combined strategy of dig and stack/Geotube installation is the most cost-effective long term option.

FIGURES

FIGURES



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REFERENCE: 3/02 KUCERA AERIAL SURVEY AND 2/04 MACTEC SOUNDINGS

CURRENT POND CONDITIONS
PROGRESS ENERGY
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
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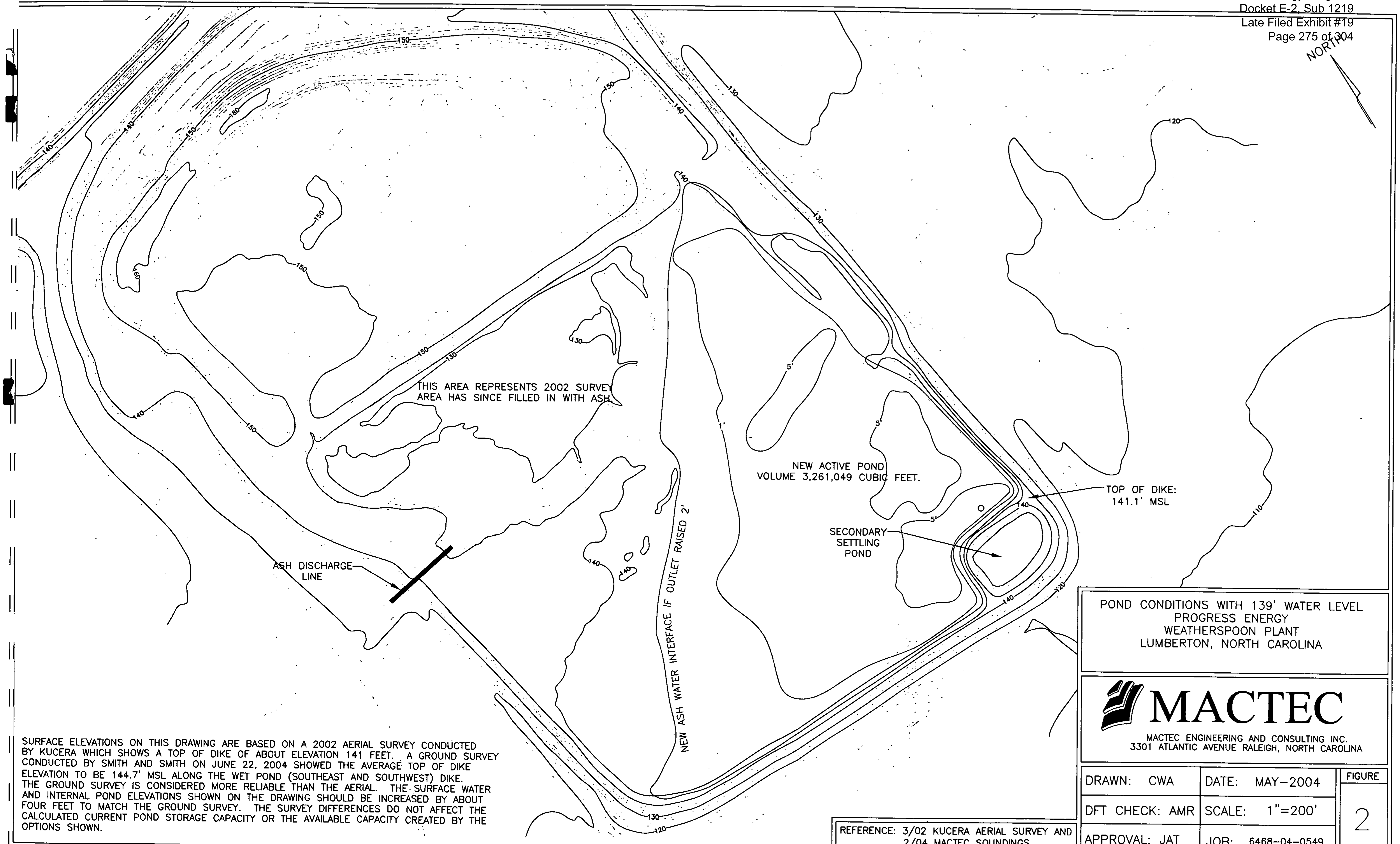
APPROVAL: JAT	JOB: 6468-04-0549	



SURFACE ELEVATIONS ON THIS DRAWING ARE BASED ON A 2002 AERIAL SURVEY CONDUCTED BY KUCERA WHICH SHOWS A TOP OF DIKE OF ABOUT ELEVATION 141 FEET. A GROUND SURVEY CONDUCTED BY SMITH AND SMITH ON JUNE 22, 2004 SHOWED THE AVERAGE TOP OF DIKE ELEVATION TO BE 144.7' MSL ALONG THE WET POND (SOUTHEAST AND SOUTHWEST) DIKE. THE GROUND SURVEY IS CONSIDERED MORE RELIABLE THAN THE AERIAL. THE SURFACE WATER AND INTERNAL POND ELEVATIONS SHOWN ON THE DRAWING SHOULD BE INCREASED BY ABOUT FOUR FEET TO MATCH THE GROUND SURVEY. THE SURVEY DIFFERENCES DO NOT AFFECT THE CALCULATED CURRENT POND STORAGE CAPACITY OR THE AVAILABLE CAPACITY CREATED BY THE OPTIONS SHOWN.

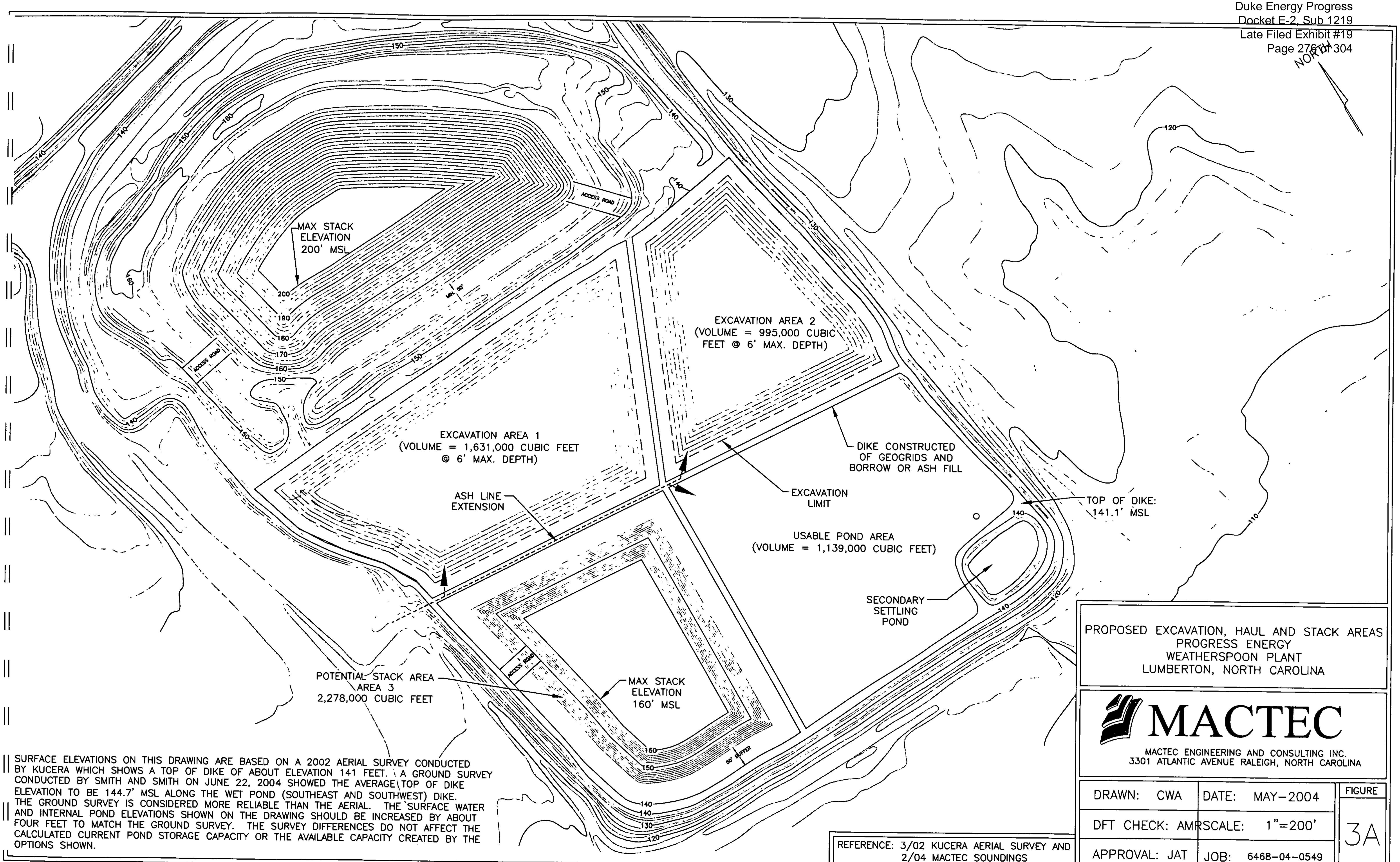
REFERENCE: 3/02 KUCERA AERIAL SURVEY AND 2/04 MACTEC SOUNDINGS

POND CONDITIONS WITH 139' WATER LEVEL
PROGRESS ENERGY
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK: AMR	SCALE: 1"=200'	2
APPROVAL: JAT	JOB: 6468-04-0549	



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REFERENCE: 3/02 KUCERA AERIAL SURVEY AND 2/04 MACTEC SOUNDINGS

PROPOSED EXCAVATION, HAUL AND STACK AREAS
PROGRESS ENERGY
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
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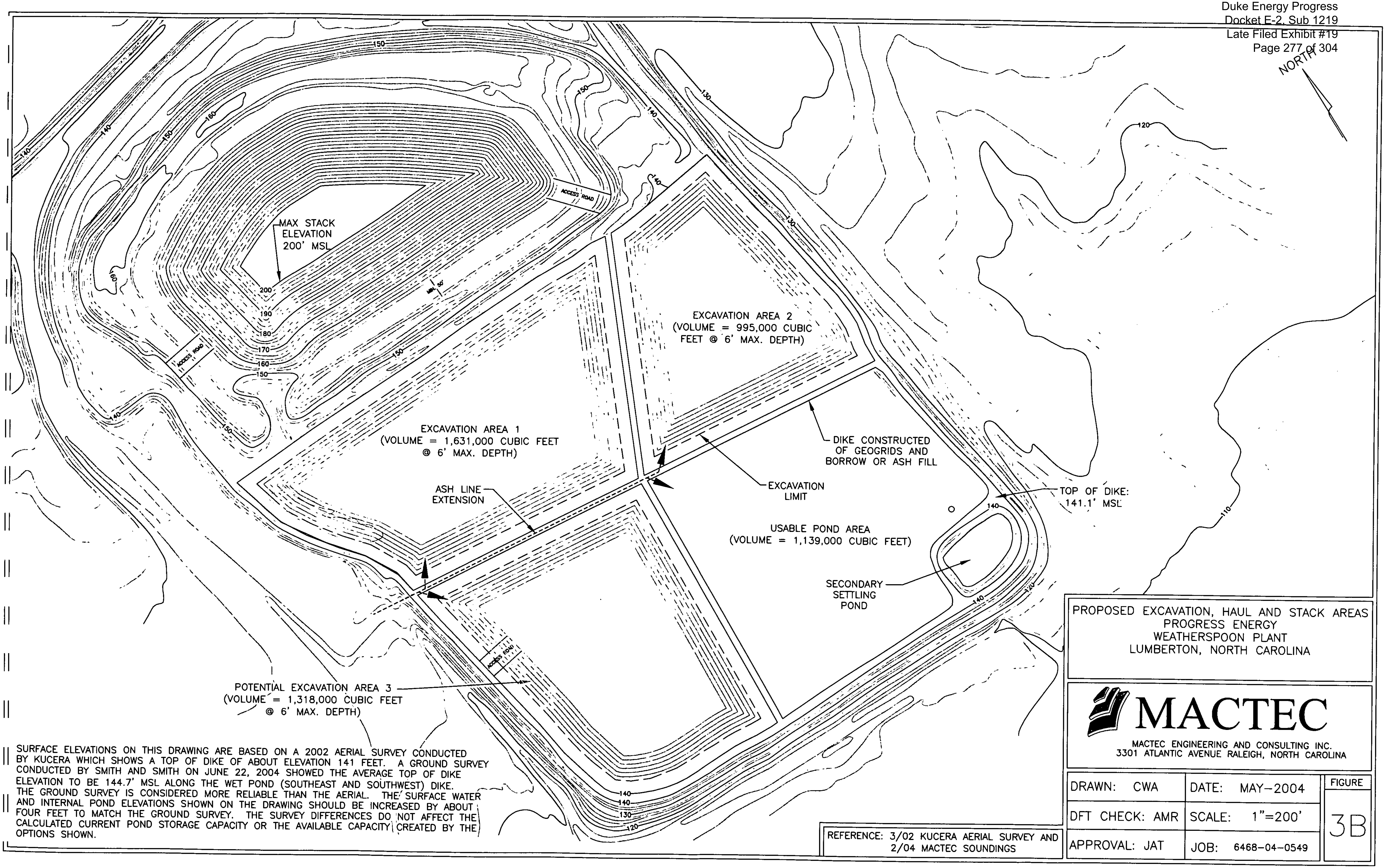
APPROVAL: JAT	JOB: 6468-04-0549	


NORTH
MAX STACK ELEVATION 200' MSL
ACCESS ROAD
EXCAVATION AREA 2 (VOLUME = 995,000 CUBIC FEET @ 6' MAX. DEPTH)
EXCAVATION AREA 1 (VOLUME = 1,631,000 CUBIC FEET @ 6' MAX. DEPTH)
DIKE CONSTRUCTED OF GEOGRIDS AND BORROW OR ASH FILL
ASH LINE EXTENSION
EXCAVATION LIMIT
TOP OF DIKE: 141.1' MSL
USABLE POND AREA (VOLUME = 1,139,000 CUBIC FEET)
SECONDARY SETTLING POND
POTENTIAL EXCAVATION AREA 3 (VOLUME = 1,318,000 CUBIC FEET @ 6' MAX. DEPTH)
SURFACE ELEVATIONS ON THIS DRAWING ARE BASED ON A 2002 AERIAL SURVEY CONDUCTED BY KUCERA WHICH SHOWS A TOP OF DIKE OF ABOUT ELEVATION 141 FEET. A GROUND SURVEY CONDUCTED BY SMITH AND SMITH ON JUNE 22, 2004 SHOWED THE AVERAGE TOP OF DIKE ELEVATION TO BE 144.7' MSL ALONG THE WET POND (SOUTHEAST AND SOUTHWEST) DIKE. THE GROUND SURVEY IS CONSIDERED MORE RELIABLE THAN THE AERIAL. THE SURFACE WATER AND INTERNAL POND ELEVATIONS SHOWN ON THE DRAWING SHOULD BE INCREASED BY ABOUT FOUR FEET TO MATCH THE GROUND SURVEY. THE SURVEY DIFFERENCES DO NOT AFFECT THE CALCULATED CURRENT POND STORAGE CAPACITY OR THE AVAILABLE CAPACITY CREATED BY THE OPTIONS SHOWN.
REFERENCE: 3/02 KUCERA AERIAL SURVEY AND 2/04 MACTEC SOUNDINGS
PROPOSED EXCAVATION, HAUL AND STACK AREAS
PROGRESS ENERGY
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA
MACTEC
MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA
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DATE: MAY-2004
FIGURE 3B
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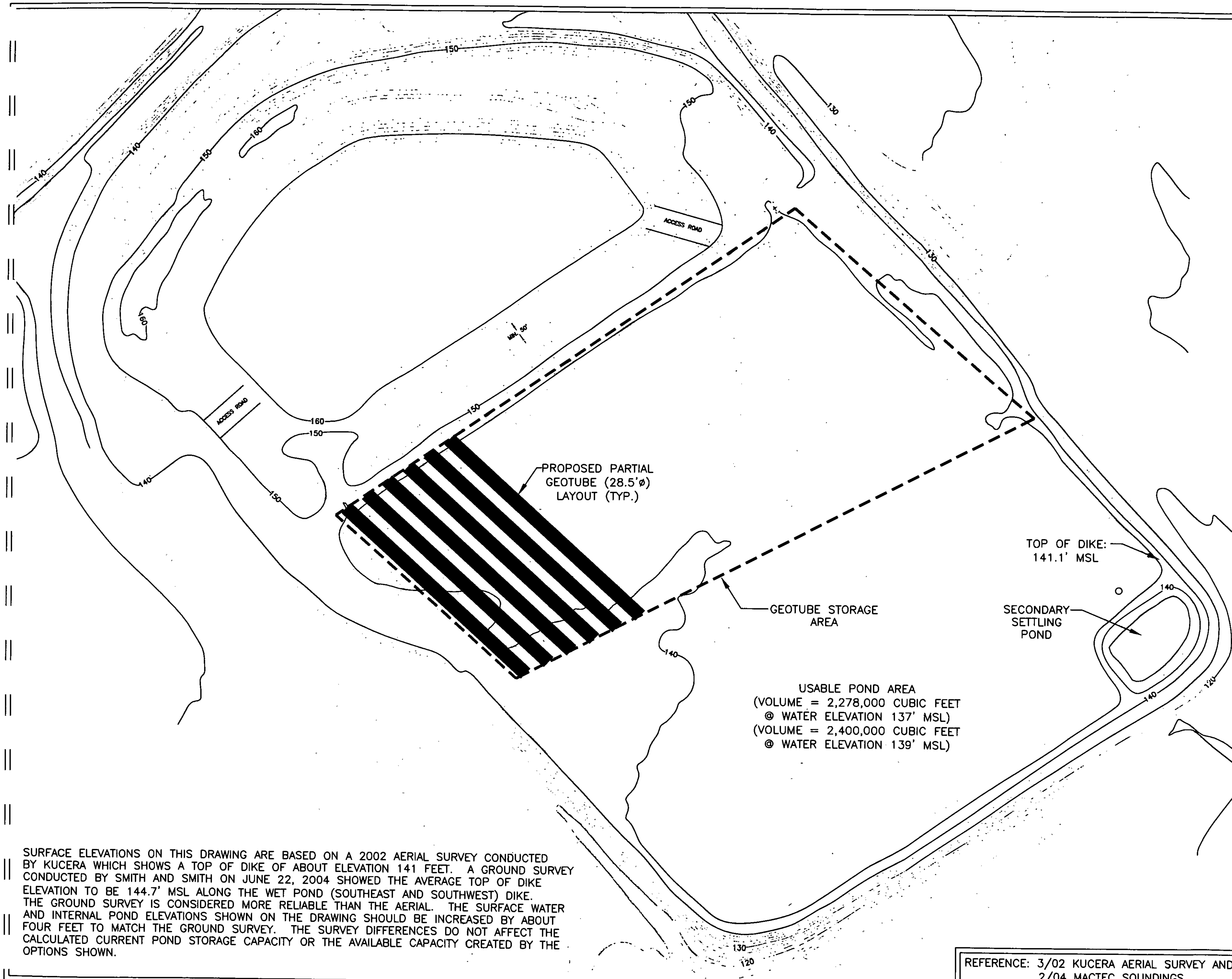
SCALE: 1"=200'
APPROVAL: JAT
JOB: 6468-04-0549



STACKED GEOTUBES

* UPON COVERING THE STORAGE AREA, ADDITIONAL LAYERS OF GEOTUBES WILL BE ADDED TO ACCOMODATE 20 YEARS OF ASH STORAGE

NOTES

1. GEOTUBE STORAGE AREA BASED ON CURRENT AVAILABLE AREA. STORAGE AREA MAY BE INCREASED AS ASH POND IS FILLED
2. MODIFICATIONS TO CURRENT ASH SLUICE PUMPS MAY BE REQUIRED TO ACCOMODATE THE PROPOSED GEOTUBE STACKING. EVALUATION OF THE ASH SLUICE PUMPS HAS NOT BEEN PERFORMED AS PART OF THIS PROJECT.
3. OPTIONAL STACKING IN AREA B IS SHOWN; GEOTUBES CAN BE USED AS A LONG-TERM STAND-ALONE ASH MANAGEMENT STRATEGY OR IN CONJUNCTION WITH A DIG AND STACK PROGRAM.
4. GEOTUBES SHOWN IN LAYOUT ARE A PORTION OF THE TOTAL NUMBER PROPOSED FOR STORAGE AND ARE SHOWN FOR ORIENTATION PURPOSES.

SURFACE ELEVATIONS ON THIS DRAWING ARE BASED ON A 2002 AERIAL SURVEY CONDUCTED BY KUCERA WHICH SHOWS A TOP OF DIKE OF ABOUT ELEVATION 141 FEET. A GROUND SURVEY CONDUCTED BY SMITH AND SMITH ON JUNE 22, 2004 SHOWED THE AVERAGE TOP OF DIKE ELEVATION TO BE 144.7' MSL ALONG THE WET POND (SOUTHEAST AND SOUTHWEST) DIKE. THE GROUND SURVEY IS CONSIDERED MORE RELIABLE THAN THE AERIAL. THE SURFACE WATER AND INTERNAL POND ELEVATIONS SHOWN ON THE DRAWING SHOULD BE INCREASED BY ABOUT FOUR FEET TO MATCH THE GROUND SURVEY. THE SURVEY DIFFERENCES DO NOT AFFECT THE CALCULATED CURRENT POND STORAGE CAPACITY OR THE AVAILABLE CAPACITY CREATED BY THE OPTIONS SHOWN.

REFERENCE: 3/02 KUCERA AERIAL SURVEY AND 2/04 MACTEC SOUNDINGS

PROPOSED GEOTUBE LAYOUT
PROGRESS ENERGY
WEATHERSPOON PLANT
LUMBERTON, NORTH CAROLINA

MACTEC

MACTEC ENGINEERING AND CONSULTING INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

DRAWN: CWA	DATE: MAY-2004	FIGURE
DFT CHECK: AMR	SCALE: 1"=200'	4
APPROVAL: JAT	JOB: 6468-04-0549	

TABLES

TABLES

TABLE 1.

WEATHERSPOON ASH POND STATISTICS

Plant Coal Usage	Current- 184.6k tons; Projected (max)- 283k tons (2007)
Pond Size and Capacity	32 acres; 240 acre-ft
Design Pond Max Elevation, ft	143
Present Pond Operating Elevation, ft	137[a], 141[b]
Age and Construction	25 years, 1979
Ash Production as % of Coal Usage	10%(contract coal); 20% (opportunity coal)
Annual Ash Production (contract coal), adjusted for LOI and different unit usage	Current -19,432 tons; maximum projected – 29,789 tons (2007); 5-yr projected average – 26,888 tons
Annual Ash Production (opportunity coal) adjusted for LOI and different unit usage	Current- 38,863 tons; maximum projected – 59,579 tons (2004); 5-yr projected average – 53,775 tons
Theoretical Pond Capacity at elevation 141 feet	793,600 cubic feet (21,800 tons @ 55 pcf)
Projected Life for 50/50 coal mix and average use at elevation 141 feet*	0.41 yrs
Theoretical Pond Capacity at elevation 143 feet	3,281,000 cubic feet (90,200 tons @55 pcf)
Projected Life for 50/50 coal mix and average use at elevation 141 feet*	1.6 yrs
Ash Interface Line to Pond Outfall (distance)	340 ft.
Daily Average Ash Sluice Discharge Rate	0.4 MGD
Daily Average Pond Discharge Rate	0.5 MGD
Average Water Velocity	0.15 fps
Average Ash Settleability Rate	99% in 15 minutes (1)
Ash Settling Distance	135 ft
Pond NPDES Requirements	None

(1) Ash settleability rate based on hydrometer testing of ash samples collected from Cape Fear ash pond. Settleability rates may vary between ponds and are dependent upon the coal sources.
2) Based on top of dike elevation at 141 ft from Kucera 2002 aerial topographic survey.

*Assuming fill up to 75% of remaining theoretical volume. See graph following Table 3 for illustration of change in projected life for varying percentages of opportunity coal.

a Elevation based on 2002 Kucera aerial survey
b Elevation based on 2004 Smith and Smith ground survey

Table 2.
Coal Use Projected Breakdown- 2004-2009
Progress Energy Carolinas
Weatherspoon Steam Plant

Year	Projected Annual Coal Usage, Tons
2004	184,600
2005	257,000
2006	275,100
2007	283,200
2008	279,200
2009	253,500
Average	255,433
Maximum	283,200

Source: Annual Coal Unit Summary, Carolinas

Table 3.
Summary of Coal Usage (2004-2009) and Resultant Pond Life
Progress Energy Carolinas
Weatherspoon Steam Plant
Lumberton, NC
MACTEC Project No. 6468-04-0549

Contract Coal Usage	Maximum (2007)	Current	Ave
Coal Usage 5-yr Projection (tons)	283,000	184,600	255,433
Coal % as Ash	10	10	10
Ash Production (tons)	28,300	18,460	25,543
Coal % as LOI	5	5	5
Annual Ash/LOI Productions (tons)	29,789	19,432	26,888
Opportunity Coal Usage			
Coal Usage 5 yr Projection (tons)	283,000	184,600	255,433
Coal % as Ash	20	20	20
Ash Production (tons)	56,600	36,920	51,087
Coal % as LOI	5	5	5
Annual Ash/LOI Productions (tons)	59,579	38,863	53,775

Theoretical Ash Storage at el 141 msl (ft^3)	793,587	(@ 55 pcf)
Theoretical Ash Storage at el 143 msl (ft^3)	3,281,744	(@ 55 pcf)
Theoretical Ash Storage at el 141 msl (tons)	21,824	(@ 55 pcf)
Theoretical Ash Storage at el 143 msl (tons)	90,248	(@ 55 pcf)

Estimated Pond Life Blending Contract Coal and Opportunity Coal- Current Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Pond Life, yrs at elev 141	at elev 143
100	0	19,432	0.8	3.5
90	10	21,375	0.8	3.2
80	20	23,318	0.7	2.9
70	30	25,261	0.6	2.7
60	40	27,204	0.6	2.5
50	50	29,148	0.6	2.3
40	60	31,091	0.5	2.2
30	70	33,034	0.5	2.0
20	80	34,977	0.5	1.9
10	90	36,920	0.4	1.8
0	100	38,863	0.4	1.7

Estimated Pond Life Blending Contract Coal and Opportunity Coal- Ave 5-yr Usage

%Contract Coal	%Opportunity Coal	Ash Produced, tons	Estimated Pond Life, yrs at elev 141	at elev 143
100	0	26,888	0.61	2.5
90	10	29,577	0.55	2.3
80	20	32,265	0.51	2.1
70	30	34,954	0.47	1.9
60	40	37,643	0.43	1.8
50	50	40,332	0.41	1.7
40	60	43,020	0.38	1.6
30	70	45,709	0.36	1.5
20	80	48,398	0.34	1.4
10	90	51,086	0.32	1.3
0	100	53,775	0.30	1.3

Estimated life taken as 75% theoretical volume and ash unit weight of 55 pounds per cubic foot

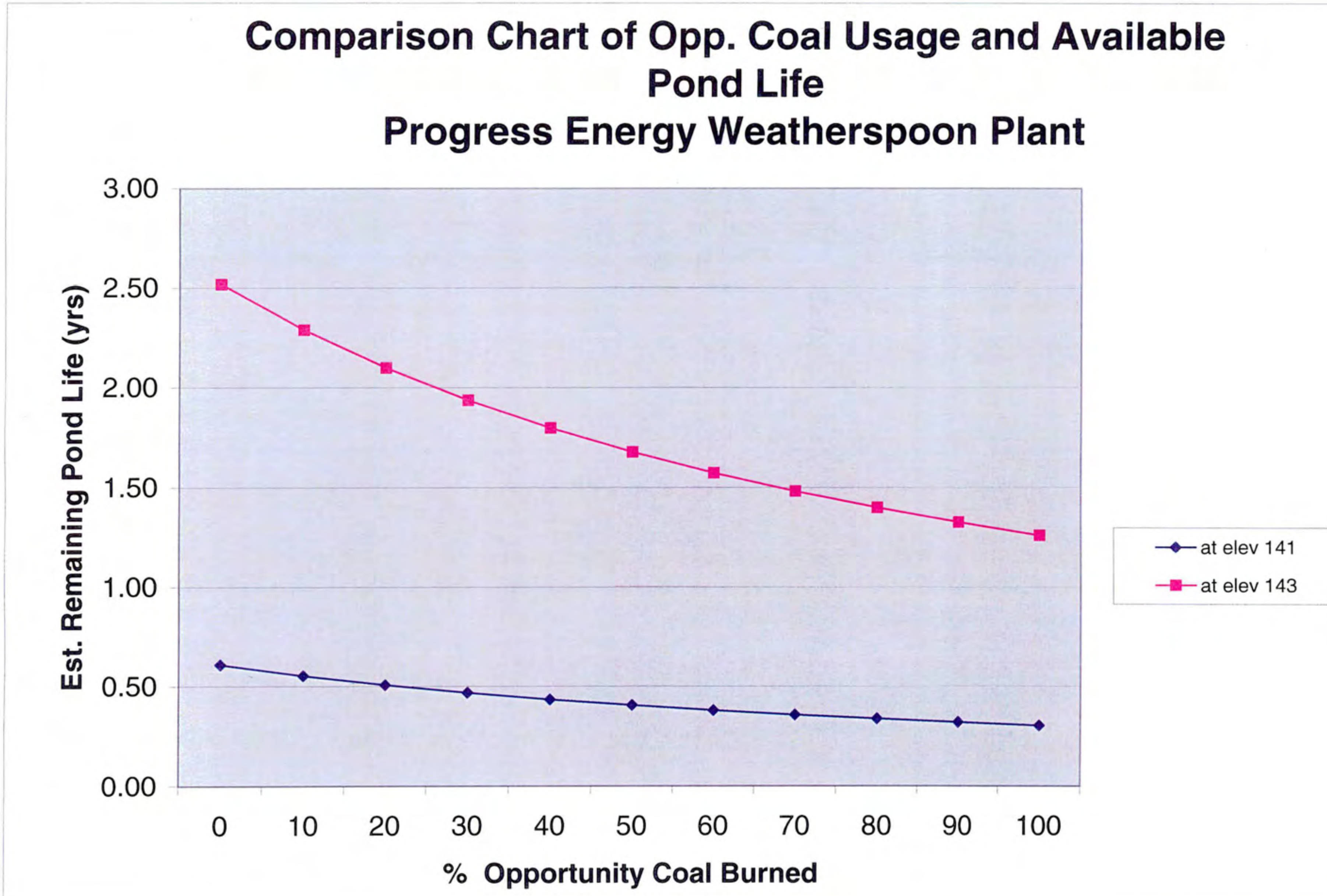

Comparison Chart of Opp. Coal Usage and Available Pond Life
Progress Energy Weatherspoon Plant
Est. Remaining Pond Life (yrs)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
10
20
30
40
50
60
70
80
90
100
% Opportunity Coal Burned
at elev 141
at elev 143

Table 4.
Ash Pond Present Volume Determination (@141 ft msl)
and Volume Determination @ 143 ft msl
Progress Energy Carolinas
Weatherspoon Steam Plant
MACTEC Project No.: 6468-04-0549

WE (MSL) (ft)	Available Ash Storage - Main Ash Pond							
	Depth (Ave)	Surface Area (ft^2)	Average Area (ft^2)	Ave. Thickness (ft)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (yd^3)	Cumulative Volume (tons @55 pcf)
141	0.66	145,791						
			131,821	2.78	366,462	366,462	13,573	10,078
	3.44	117,851						
			77,122	2.66	205,143	571,606	21,171	15,719
	6.1	36,392						
			36,392	6.1	221,991	793,597	29,392	21,824
143	0.4	784,638						
			634,949	2.41	1,530,226	1,530,226	56,675	42,081
	2.81	485,259						
			291,556	3.79	1,104,995	2,635,221	97,601	72,469
	6.6	97,852						
			97,852	6.6	645,823	3,281,044	121,520	90,229
75% Theoretical Volume				at 141 ft msl		595,198		16,368
				at 143 ft msl		2,460,783		67,672
From Elev 141 to elev 143 adds theoretical volume					2,487,448			68,405
75% Theoretical Volume					2,460,783			67,672

APPENDIX A

APPENDIX A
COST ESTIMATES

ENGINEERING COST ESTIMATES
ASH HANDLING OPTIONS
WEATHERSPOON PLANT

The workshop meetings on March 18, 2004 and April 27, 2004 resulted in identifying excavation and stacking in the Area B used for previous stacking as the best short-term approach. This needs to be implemented early in 2005. The basic plan for the work would follow the plan used in 2002, and the costs from that work can be a guide. Area B has sufficient room to allow multiple episodes of digging and stacking. The pond level can also be raised, although the plant has stated a desire not to do so due to their concerns about potential leakage at the riser. In order to implement continuing excavating and stacking, it will be necessary to create three cells within the pond to have room for storing ash during the excavating work.

Longer term approaches are to raise the dikes, construct a new ash pond (20-yr capacity) or use geotubes.

The preliminary estimated costs in today's dollars for the dig and stack option are as follows:

- Excavate and Stack five cycles of approximately 1.5 years of ash each over 9.8 years (without inflation) After 9.8 years, the available area for stacking in Area B is filled, and stacking can be conducted in Area 3 in the pond for an additional two years at a cost of $377,000. After that area is full, one of the long-term options must be implemented. Because stacking may be conducted in the pond, the impact on long term options is considerable (the active pond volume is reduced by approximately 33%). $1,979,600

o Engineering	$ 40,000	Cost per year (50/50 and avg)	$202,000
o Construction (dig and haul)	$1,532,600	Cost per ton/yr	$ 2.63
o Separator Dike Construction	$ 67,000		
o Soil Cap	$ 230,000		
o Drainage/Erosion Control	$ 30,000		
o Discharge Pipe Mods	$ 50,000		
o Additional Riser Construction (3)	$ 30,000		

For longer term projects, three options exist:

- Raise Dikes 6 feet (previous study, adds 4.3 yrs at 50/50 and avg coal use at pond elev of 147) $1,655,000

• Engineering and Permitting	$ 80,000	Cost per year (50/50 and avg)	$384,883
• Construction Monitoring	$ 75,000	Cost per ton/yr	$ 9.54
• Construction	$1,500,000		

- Construct New 20-yr Pond (50/50 and avg coal use) $4,760,000 w/o land cost

o Design and Permitting	$ 120,000	Cost per year	$238,000
o Construction Monitoring	$ 140,000	Cost per ton/yr	$ 5.90
o Construction	$4,500,000		
o Land needed ~ 95 acres	$??		

- Install Geotubes

As a Stand-Alone Strategy for 20-year storage:		$3,444,797	
o Design and Permitting	$ 20,000	Cost per year	$172,240
o Geotube Materials	$2,709,526	Cost per ton/yr	$4.59
o Construction	$ 684,959		
o Manifold	$ 30,311		

In Conjunction with a Dig-and-Stack Strategy (10 yrs storage):		$1,750,790	
o Design and Permitting	$ 20,000	Cost per year	$175,079
o Geotube Materials	$1,354,763	Cost per ton/yr	$3.60
o Construction	$ 346,158		
o Manifold	$ 29,869		

POSSIBLE TIME LINE FOR WEATHERSPOON EXCAVATE AND STACK APPROACH ASSUMING 50/50 MIX OF COALS, WATER LEVEL RAISE TO 139' MSL AND AVERAGE COAL USAGE

Duration of Activity (yrs)	Elapsed Time (yrs)	Activity	Main Pond Capacity Left (yrs)	Capacity Added by Area 1Dig (yrs)	Capacity Added by Area 2 Dig (yrs)	Total Time Left yrs
Now	0		1.6	0	0	1.6
0.33	0.33	Plan and Permit	1.3	0	0	1.3
0.75	1.1	Bid and Dig Area 1	0.6	1.1	0	1.7
0.3	1.4	Dig Area 2 Fill into Area 1	0.6	0.8	0	1.4
0.8	2.2	Complete fill in Area 1	0.6	0	0.8	1.4
0.8	3.0	Fill into Area 2 Dig Area 1	0.6	1.1	0	1.7
0.3	3.3	Dig Area 2 Fill into Area 1	0.6	0.8	0	1.4
0.8	4.1	Complete fill in Area 1	0.6	0	0.8	1.4
0.8	4.9	Fill into Area 2 Dig Area 1	0.6	0	0	0.6
0.3	5.2	Dig Area 2 Fill into Area 1	0.6	0.8	0	1.4
0.8	6.0	Complete fill in Area 1	0.6	0	0.8	1.4
0.8	6.8	Fill in Area 2 Dig Area 1	0.6	0	0	0.6
0.3	7.1	Fill Area 1 Dig Area 2	0.6	0.8	0	1.4
0.8	7.9	Complete fill in Area 1	0.6	0	0	0.6
0.8	8.7	Fill Area 2 Dig Area 1	0.6	0	0.8	1.4
1.1	9.8	Fill Area 1	0.6	0	0	0.6

TIME LINE Page 2

Theoretically, the cycles of digging and filling in Areas 1 and 2 can continue until the available stack area in Area B is filled. This is about 5 cycles. The main pond area remains available for emergency use, but most ash is put into Areas 1 and 2, back and forth. So, approximate life extension by digging and stacking is 9.8 yrs. An additional two years of life can be achieved through stacking in Area 3, either before or after the stacking is conducted in Area B.

If take dig and stack costs as $4.00 per ton stacked, assume 1.1 years of ash in Area 1 (44,365) and 0.8 years of ash in Area 2 (32,265) at 50/50 and average use, the ash quantity for five cycles is 5(76,630) or 383,154 tons. If we ignore inflation, the total cost for 5 dig and stack cycles is (383,154)($4.00) = ~$1,532,600.

NEW ASH POND DESIGN
WEATHERSPOON
50-50 AVE ASH

<u>Pond Design Weatherspoon</u>	
Ash Production (tons/yr)	40,332
Pond Life (yrs)	20
Pond Height (ft)	20
Pond Freeboard (ft)	2
Necessary Pond Excess (%)	25
Necessary Volume (ft^3)	33,610,000
Pond Length (ft)	2,225
Pond Width (ft)	1,000
Pond Surface Area (top)	2,225,000
Pond Surface Area (bottom)	1,888,364
Dike Slope Area	407,934
Pond Volume (ft^3)	33,885,576
Pond Outside Footprint (acres)	62.70
Land Area to purchase (acres)	75.24
<u>Pond Construction</u>	
Excavation Depth (ft)	3
Excavation Volume (ft^3)	6,613,810
Dike Perimeter (ft)	6,450
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20
Dike Volume (ft^3)	7,785,150

NEW ASH POND DESIGN
WEATHERSPOON
50-50 AVE ASH

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	3%	construction cost	$4,510,254	$121,777
Construction Testing/Monitoring	3%	construction cost	$4,510,254	$135,308
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	2,225,000	ft^2	$0	$89,000
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	244,956	yd^3	$3.00	$734,868
Soil Placement	288,339	yd^3	$5.00	$1,441,694
Sand Subgrade	85,048	yd^3	$6.00	$510,288
60 mil HDPE Liner	2,505,349	ft^2	$0.47	$1,177,514
Geosynthetic (Geogrid)	15,109	yd^2	$2.75	$41,549
Geotextile (wave protection)	2,389	yd^2	$1.80	$4,300
Rip Rap	10,320	tons	$22	$227,040
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$4,767,338
Construction Only (total less design and cmt				$4,510,254

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
WEATHERSPOON PLANT

Design Criteria and Specifications	
Average Annual Ash Production[1] (tons/yr)	40,332
Ash Production (yd^3/yr)	49,793
Geotube Life[2] (yrs)	20
Necessary Storage Volume (yd^3)	995,852
Storage Area (ft^2)	664,120
Storage Area - Average Length (ft)	1,150
Storage Area - Average Width (ft)	560
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	560
Geotube Area (ft^2)	15,960
Geotube Volume - Total (ft^3)	357,246
Geotube Volume - Ash (ft^3)	250,072
Geotube Volume (yd^3)	9,262
Number of Geotubes	108
Total Geotube Area (ft^2)	1,716,033
Geotube Levels	3.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	20,000	20,000
Geotube	60212	ft	$45	$2,709,526
Ash Line Manifold (12" diameter)	2,055	ft	$14.75	$30,311
Geotube and Line Installation	25%	construction cost	$2,739,838	$684,959
			Total Cost	$3,444,797

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
WEATHERSPOON PLANT

Design Criteria and Specifications	
Average Annual Ash Production[1] (tons/yr)	40,332
Ash Production (yd^3/yr)	49,793
Geotube Life[2] (yrs)	10
Necessary Storage Volume (yd^3)	497,926
Storage Area (ft^2)	664,120
Storage Area - Average Length (ft)	1,150
Storage Area - Average Width (ft)	560
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	560
Geotube Area (ft^2)	15,960
Geotube Volume - Total (ft^3)	357,246
Geotube Volume - Ash (ft^3)	250,072
Geotube Volume (yd^3)	9,262
Number of Geotubes	54
Total Geotube Area (ft^2)	858,017
Geotube Levels	1.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	20,000	20,000
Geotube	30106	ft	$45	$1,354,763
Ash Line Manifold (12" diameter)	2,025	ft	$14.75	$29,869
Geotube and Line Installation	25%	construction cost	$1,384,632	$346,158
			Total Cost	$1,750,790

GEOTUBE DESIGN- CONJUNCTION WITH STACKING PROGRAM
PROGRESS ENERGY CAROLINAS
WEATHERSPOON PLANT

Design Criteria and Specifications	
Average Annual Ash Production[1] (tons/yr)	40,332
Ash Production (yd^3/yr)	49,793
Geotube Life[2] (yrs)	6
Necessary Storage Volume (yd^3)	298,756
Storage Area (ft^2)	664,120
Storage Area - Average Length (ft)	1,150
Storage Area - Average Width (ft)	560
Geotube Circumference (ft)	90
Geotube Diameter (ft)	28.5
Geotube Average Length (ft)	560
Geotube Area (ft^2)	15,960
Geotube Volume - Total (ft^3)	357,246
Geotube Volume - Ash (ft^3)	250,072
Geotube Volume (yd^3)	9,262
Number of Geotubes	32
Total Geotube Area (ft^2)	514,810
Geotube Levels	1.0

1 - Assuming coal usage ratio of 50/50 (Contract/Opportunity)
2 - Remaining pond life (of 20 yrs) after excavation

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Engineering/Design	1	each	20,000	20,000
Geotube	18064	ft	$45	$812,858
Ash Line Manifold (12" diameter)	2,025	ft	$14.75	$29,869
Geotube and Line Installation	25%	construction cost	$842,727	$210,682
			Total Cost	$1,073,408

APPENDIX B

APPENDIX B
GEOTUBE INFORMATION

Dewatering & Containment Technologies, Inc.

Geotube Volume Spreadsheet

Known Flow Rates

Input

Project Name:	Progress Energy
Date:	30-Mar-04

Materials Information:

Type of Material to be Dewatered	Fly Ash
Specific Gravity of Solids Within The Sludge	1.40
Percent Solids of the Insitu Sludge	35.0
Bulking Factor of The Sludge While Pumping or Dredging	[illegible]
Target Percent of Solids After Dewatering With Geotubes	70
Percent of Solids Estimated In Effluent Water	0.000
Percent of Course Grain Solids in The Insitu Sludge	3%

Production Rates:

Dredge / Pumping Operation Rate (GPM)	1750
Dredge / Pumping Operation (Hours Per Day)	16.00
Dredge / Pumping Operation (Days Per Year)	1.00

Geotube Costs ($ Lin. Ft.):

30 Ft. Circumference
45 Ft. Circumference
60 Ft. Circumference
90 Ft. Circumference

Output

Production Rates:

Production Volume Wet (gal/day)	[illegible]
Production Volume Wet (cy/day)	8,317
Production Volume Wet (tons/day)	[illegible]
Production Volume Wet (cy/yr)	[illegible]
Production Volume Wet (tons/yr)	[illegible]
Bone Dry (tons/year)	2,725
Bone Dry (tons/day)	[illegible]

Reduction Due To Dewatering:

Reduction Factor	[illegible]
Dewatered Volume (cy/yr)	[illegible]
Dewatered Volume (tons/yr)	[illegible]

Geotube Cost:		**Length (ft.)**	**Total $**
30 Ft. Circumference	9.5 ø	2,191	$ 30,573.34
45 Ft. Circumference	14.3 ø	1,096	$ 23,567.76
60 Ft. Circumference	19.1 ø	710	$ 20,595.28
90 Ft. Circumference	28.6 ø	412	$ 18,556.37

3/30/2004 11:06 AM

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

<u>Pond Design Cape Fear</u>	
Ash Production (tons/yr)	128,400
Pond Life (yrs)	20
Pond Height (ft)	20
Pond Freeboard (ft)	2
Necessary Pond Excess (%)	25
Necessary Volume (ft^3)	107,000,000
Pond Length (ft)	3,650
Pond Width (ft)	1,800
Pond Surface Area (top)	6,570,000
Pond Surface Area (bottom)	5,993,064
Dike Slope Area	689,377
Pond Volume (ft^3)	107,770,176
Pond Outside Footprint (acres)	170.11
Land Area to purchase (acres)	204.13
<u>Pond Construction</u>	
Excavation Depth (ft)	1.9
Excavation Volume (ft^3)	12,417,509
Dike Perimeter (ft)	10,900
Dike Slope (interior)	3:1
Dike Slope (exterior)	3:1
Dike Crest Width (ft)	20
Dike Volume (ft^3)	14,658,647

NEW ASH POND DESIGN
CAPE FEAR
50-50- AVE ASH

Construction Costs

Description	Quantity	Unit	Unit Price	Total
Permitting/Design	2%	construction cost	$11,718,690	$210,936
Construction Testing/Monitoring	3%	construction cost	$11,718,690	$351,561
Equipment Mobilization	1	each	$50,000	$50,000
Drainage and Erosion Control	6,570,000	ft^2	$0	$262,800
Discharge Structure	1	each	$50,000	$50,000
Outfall Piping	1000	ft	$20	$20,000
Extend Ash Line Pipe	4,000	ft	$18.50	$74,000
Soil Excavation	459,908	yd^3	$3.00	$1,379,723
Soil Placement	542,913	yd^3	$5.00	$2,714,564
Sand Subgrade	247,498	yd^3	$13.00	$3,217,471
60 mil HDPE Liner	7,231,852	ft^2	$0.47	$3,398,971
Geosynthetic (Geogrid)	25,532	yd^2	$2.75	$70,214
Geotextile (wave protection)	4,037	yd^2	$1.80	$7,267
Rip Rap	17,440	tons	$22	$383,680
Roadway (ABC stone)	7500	tons	$12	$90,000
			Total Cost	$12,281,188
Construction Only (total less design and cmt				$11,718,690

Click on one of the industries below to view case studies

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste & Contaminates	Marine

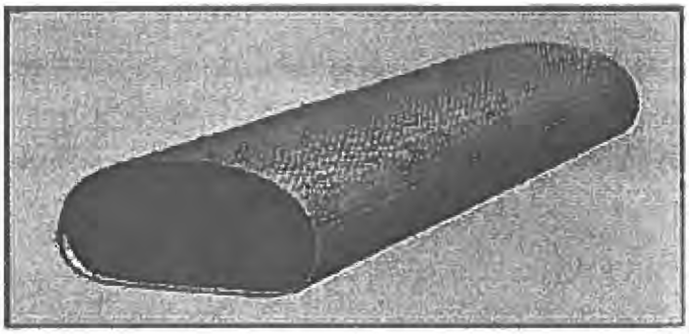
Home

What is a Geotube®?

How it all works

Miratech

Dewatering & Containment Technologies, Inc.



What is a Geotube®?

Geotubes® are constructed out of high strength woven geotextile fabric manufactured by Ten Cate Nicolon. The Geotube® is then fabricated by Miratech, a division c Ten Cate Nicolon.

Designed with appropriate sized openings, the Geotube® retains fill material to do one of two things: if you are using the GT500 it will allow water to permeate through the tube wall, if you use the GT100 for marine applications it will contain all the material for a ve1 long time.

Geotubes® are custom fabricated with seaming techniques that resist pressures during pumping operations.

e-mail us at:
geotubes@dewatercontain.com

U.S. Postal Address:
P.O. Box 740
Cedar Springs, Michigan 49319
616-784-3681 - Phone
616-784-3685 - Fax

Click on one of the industries below to view case studies

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste & Contaminates	Marine

Home

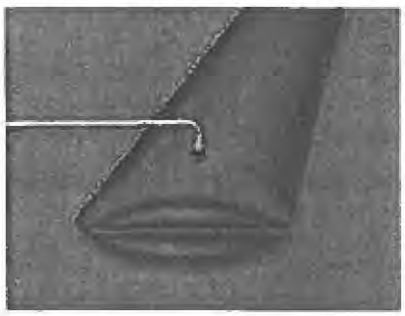
What is a Geotube®?

How it all works

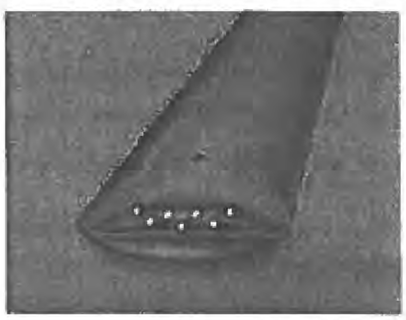
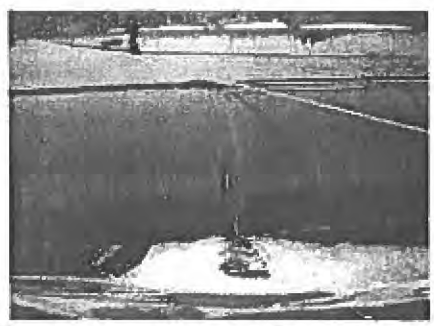
Miratech

Dewatering & Containment Technologies, Inc.

1) The Geotextile tube is pumped with sludge material.




2) As the liquid escapes from the tube, solid particles are trapped inside. The process is repeated until the tube is full.

3) Eventually the solids can be handled as dry material increasing options for transportation and disposal.


e-mail us at:
geotubes@dewatercontain.com

e-r
geotubes@dewatercont

Dewatering & Containment Technologies, Inc.

See the case studies in each industry below:

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste	Marine

Home

Dredging a Bay

Wastewater Treatment Plant

Dredging a 25-acre bay

The 25 acre bay was dredged to remove contaminated sediment.

120 Geotubes were installed to dewater over 87,000 cubic meters (95,000 cubic yards) of contaminated sediments

www.dewatercontain.com
e-mail us at:
geotubes@dewatercontain.com

e-m
geotubes@dewaterconta

Dewatering & Containment Technologies, Inc.

See the case studies in each industry below:

Mining, Chemical, Refining & Utility	Pulp & Paper	Municipal Waste	Marine

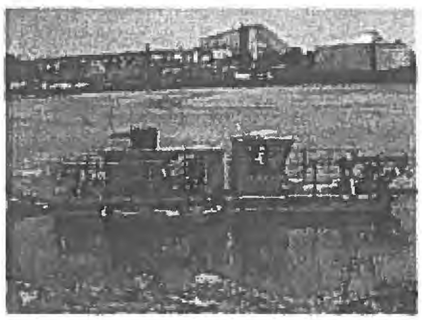
Home

Mineral Processing Plant

Mineral Processing Plant

Challenge: All titanium dioxide waste lagoons at this plant had reached capacity. To continue operations, lagoons must be emptied.

Solution: Geotube® containers are an excellent method to dewater industrial by-products. This plant was able to recycle the minerals during the process.



18 m (60') circumference X 61 m (200') long Geotube® containers were used to dewater 68,580 cubic meters (75,000 cubic yards) of sludge.

Pictured to the right is a partially filled Geotube® containing dewatered sludge at 60% solids.

www.dewatercontain.com
e-mail us at:
geotubes@dewatercontain.com

Duke Energy Progress, LLC
Late-Filed Exhibit No. 21

Duke Energy Progress
Docket E-2, Sub 1219
Late Filed Exhibit #21
October 30, 2020

Late filed exhibit on conversion to dry fly ash handling at Duke Energy Progress' Coal Plants

The request was for any studies, reports, cost/benefit analyses, or similar documents that the Company has been able to find that informed decisions on converting to dry ash.

Response

While the company has been unable to find specific studies, report, analyses, or cost/benefit analyses related to the conversion to dry fly ash as the Company's coal fired units (unless noted below), the following information has been obtained from information provided in the responses to the Late Filed Exhibits #5 and #19 in DEP's Docket E-2, Sub 1219 and through discussions with personnel from the Company's Fossil-Hydro organization and with personnel with historical experience with the sites.

Sluicing of fly ash, if basin capacity was available, remained the lowest cost option to manage ash generated at the stations, but options such as conversation to dry handling and subsequent landfilling of the ash were options to be explored if projected ash production was expected to exceed basin capacity at the time that the report was written.

It is important to note that the ash basins also received bottom ash and wastewater from plant operations, as they were the primary water treatment system at the plant. Accordingly, dry fly ash handling would not have eliminated the need for the basins, and, even for those plants that did have dry fly ash systems, the basins were utilized during unit startups and when the dry fly ash systems required maintenance.

Conversions to dry ash handling of both bottom ash and fly ash were not required by regulations until the passage of the Federal CCR Rule in 2015 and the North Carolina Coal Ash Management Act in September 2014. Prior to these regulations, conversions occurred either in response to site-specific environmental events, due to the marketability of the ash, or due to space constraints.

The NC Coal Ash Management Act:

- Prohibited the discharge of stormwater into CCR Surface Impoundments by December 31, 2019 for active plants and by December 31, 2018 for inactive plants
- Required conversion to dry bottom ash collection or retirement by December 31, 2019
- Required conversion to dry fly ash by December 31, 2018

The 2015 Federal CCR rule required that CCR and non-CCR waste streams cease being placed into a CCR unit within six months of a determination that the CCR unit was not in compliance with any location restriction or standard. The waste streams included stormwater, bottom ash and fly ash.

Conversions were also required in the Special Orders of Consent (SOC) negotiated between the North Carolina Department of Environmental Quality (NCDEQ) and the Company. Specifically for DEP, Roxboro's SOC required conversation to dry bottom ash collection by May 31, 2019.

Asheville Plant

The Asheville Plant did not convert to dry ash handling.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025, states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended dry conversion of ash with the construction of a new on-site monofill sited above the existing ash pond in order to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled "Coal Fired Plant." The Company approved design funding in mid-2006 for the recommendation (see "20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf").

In 2007 the Company began to evaluate the construction of a landfill above the existing basins, but earthquake and seismic concerns, as well as the site's proximity to the French Broad River, prevented this option from moving forward. Additional capacity in the basin was achieve through excavation from the basins for beneficial reuse as a structural fill, beginning in 2007.

In 2014, the Asheville site was listed as a high priority site in the Coal Ash Management Act (CAMA). In 2015's Mountain Energy Act, the site was exempted from the dry ash handling requirements of CAMA and was required to cease operation by January 31, 2020.

The Asheville Coal Plant retired in January 2020.

Cape Fear Plant

The Cape Fear Plant did not convert to dry ash handling.

The 2004 Strategic Assessment of Flyash Management at Cape Fear Steam Plant report included in Late Filed Exhibit #19 indicated a projected remaining physical storage life of 3.9 years. Several alternatives were evaluated for the short term and long-term ash management. The short-term management strategy recommended was to excavate/dredge and haul/transfer ash from the 1985 pond into the 1978 pond to allow for additional storage space in the 1985 pond. The long-term management strategy recommended was the use of Geotubes with the potential addition of a dig and stack program. A dry ash system was discussed in the document as a potential long-term (20-year life) alternative, with the statement "the costs of implementing a dry ash system are relatively high."

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025, states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended dry conversion of ash with the construction of a new on-site monofill sited above the existing pond in order to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled “Coal Fired Plant.” The Company approved design funding in mid-2006 for the recommendation (see “20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf”).

As further detailed in Late Filed Exhibit #3, in 2009 the Company proposed accelerating the retirement of the Cape Fear units. The retirement was approved by the North Carolina Utilities Commission in 2010. With the retirement, additional plans for an on-site monofill and dry ash conversion were cancelled.

The Cape Fear coal plant retired in 2012.

HF Lee Plant

The HF Lee Plant did not convert to dry ash handling.

The 2004 Strategic Assessment of Flyash Management at HF Lee Steam Plan report included in Late Filed Exhibit #19 indicated a projected remaining physical storage life of 3.7 years. A number of alternatives were evaluated for the short term and long-term ash management. The short-term management strategy recommended was to relocate a discharge line, install baffles, and implement a dry stacking program within the pond. The long-term management strategy recommended was a combination of excavation and dry stacking with Geotubes. A dry ash system was discussed in the document as a potential long-term (20-year life) alternative, with the statement “the costs of implementing a dry ash system are relatively high.”

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025,states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended the construction of a new lined pond on-site to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled “Coal Fired Plant.” The Company approved design funding in mid-2006 for the recommendation (see “20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf”).

As further detailed in Late Filed Exhibit #3, in 2009 the Company proposed accelerating the retirement of the HF Lee coal units as part of the CPCN approval process for the Lee Combined Cycle. The retirement was approved by the North Carolina Utilities Commission in late 2009.

The HF Lee coal plant retired in 2012.

Mayo Plant

The Mayo Plant was constructed with dry fly ash capability to allow for the sale of fly ash that met the required specification to be sold to the cement industry. Off-specification ash and bottom ash was sluiced to the ash basin. While the dry fly ash system was upgraded in 2009, fly ash that did not meet specification continued to be sluiced to the basin until the on-site monofill was constructed.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025, states that the current ash handling system is wet for both bottom ash and fly ash, with fly ash also managed dry. The report recommended dry conversion of bottom ash and the construction of a new on-site monofill to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled “Coal Fired Plant.” The Company approved design funding in mid-2006 for the recommendation (see “20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf”).

Mayo converted to dry bottom ash handling in 2013/2014 as part of an effort to meet NPDES permit limits, which were impacted after the installation of the FGD Scrubber system in 2009. The conversion to dry bottom ash was an interim action while the Company installed a zero-discharge vapor compression evaporator as part of a SOC with the North Carolina Department of Environmental Quality. The on-site monofill received its permit to operate in 2014.

A dry fly ash reliability project was placed in-service in 2016, which eliminated the need to sluice fly ash during start-ups and maintenance periods. Process water and stormwater projects that rerouted these flows to other treatment systems, away from the basin, were completed in 2019.

Robinson Plant

While the Robinson Plant did not fully convert to dry ash handling, an ash silo was installed in 2007/2008 to allow the Company to see some dry fly ash into the concrete market, if it met specifications for sale.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025,states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended dry conversion of ash with the construction of a new on-site monofill in order to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled “Coal Fired Plant.” The Company approved design funding in mid-2006 for the recommendation (see “20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf”).

The Robinson coal plant retired in 2012.

Roxboro Plant

The Roxboro Plan converted to dry ash handling in 1988/1989 due to selenium concerns within Hyco Lake, as part of a 1986 Consent Order with the North Carolina Department of Environmental Quality. While the dry fly ash system was under construction, the East Ash Basin was removed from service to allow for construction of the on-site landfill on top of the basin, and the West Ash Basin was expanded/reconfigured to allow for additional retention time within the basin before flows exited through the NPDES outfall. Unit 4 was constructed with dry fly ash capabilities.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025, states that the current ash handling system is wet for bottom ash and dry for fly ash. The report recommended dry conversion of bottom ash with the construction of a new on-site monofill in order to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled "Coal Fired Plant." As there was already a monofill on site to manage fly ash and capacity for bottom ash, the Company's operations did not change.

Roxboro converted to dry bottom ash management in 2018. Process water and stormwater water projects that rerouted these flows to other treatment systems, away from the basin, were completed in 2019. Upgrades that removed the need for fly ash to be sent to the basin during start-ups and maintenance were completed in 2020.

Sutton Plant

The Sutton Plan did not convert to dry ash handling.

The 2000 Report of Ash Pond Study prepared by Law Engineering and Environmental Services Inc. provided in Late Filed Exhibit #19, states that both bottom ash and fly ash were sluiced to the on-site impoundment. The report estimated that there was less than six years of useful storage remaining on-site. Alternatives evaluated included combinations of vertical expansions or excavations, with a dry ash system, and marketing the ash for beneficial reuse. Costs associated with conversion to a dry ash disposal system were provided in the estimate, based upon a study conducted for the Sutton Plant in 1995, corrected for inflation. Law Engineering recommended pursuing "beneficial use of ash coupled with vertical expansion and conversion to a dry ash process" in order to allow for long-term (>20 years) ash management.

The 2004 internal Sutton Long Term Ash Strategy Study Phase Report (AGO Wells Cross-Exam Exhibit 3, Docket No. E-2, Sub 1142), referenced in the request for Late Filed Exhibit 19, had a recommendation to utilize ash from the ponds in an off-site structural fill project. As shown in the response to the Attorney General Office's Data Request 7-1 in Docket E-2, Sub 1219, provided with the response to Late Filed Exhibit #19, this recommendation was not implemented but rather a rim ditch operation with stacking within the basin was executed to allow for additional on-site ash management.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025,states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended dry conversion of bottom ash with the construction of a new on-site monofill in order to allow for generation to continue through 2025. Cost estimates for dry ash conversion are included in the attachment provided with this Late Filed Exhibit labeled "Coal Fired Plant." The Company approved design funding in mid-2006 for the recommendation (see "20-Year CCP Management Plan for Asheville-Robinson-Sutton-Cape Fear-Mayo-Lee Plants.pdf").

As further detailed in Late Filed Exhibit #3, in 2009 the Company proposed accelerating the retirement of the Sutton coal units. The retirement was approved by the North Carolina Utilities Commission in 2010. With the retirement, additional plans for an on-site monofill and dry ash conversion were cancelled.

The Sutton Coal plant retired in 2013.

Weatherspoon Plant

The Weatherspoon Plant did not convert to dry ash handling.

The 1999 Ash Pond Study report performed by Law Engineering and Environmental Services, Inc. and provided in Late Filed Exhibit #19 states that both bottom ash and fly ash were sluiced to the on-site impoundment. The report estimated that there was less than two years of useful storage remaining on-site. Alternatives evaluated included combinations of vertical expansions with/without a dry ash system and marketing the ash for beneficial reuse. Costs associated with conversion to a dry ash disposal system were provided in the estimate, based upon a study conducted for the Asheville Steam Electric Plant, scaled for plant size and power output. The Company has not been able to locate the referenced Asheville study. Law Engineering recommended pursuing “beneficial use of ash coupled with one of the three proposed methods for vertical expansion, that includes conversion to a dry disposal process” in order to allow for long-term (>20 years) ash management.

Per the History of Construction located on the Company’s Public CCR Compliance website, a dry stack was constructed 2001-2002, therefore the Company determine that the low-cost option was dry stacking within the basin.

The 2004 Strategic Assessment of Flyash Management at Weatherspoon Steam Plan report included in Late Filed Exhibit #19 indicated a projected remaining physical storage life of 4 months. Several alternatives were evaluated for the short term and long-term ash management. The short-term management strategy recommended was to raise the pond operating level and implement a dry stacking program within the pond, which was the most cost-effective option. A dry ash system was discussed in the document as a potential long-term (20-year life) alternative, with the statement “the costs of implementing a dry ash system are relatively high.” The document also stated, “capital expenditures are very unlikely for the Weatherspoon plan due to its age and low generation capacity.” The recommended long-term strategy was a combination of excavation and stacking utilizing Geotubes.

The 2006 20-Year Ash Management Plan provided in Late Filed Exhibit #5, which focused on recommended long-term solutions to allow operations to continue from 2010-2025, states that the current ash handling system is wet for both bottom ash and fly ash. The report recommended the construction of a dike extension over the existing pond in order to allow for generation to continue through 2013 as that was when coal-fired generated was expected to end at the site.

Per the History of Construction located on the Company's Public CCR Compliance website, a new containment area utilizing Geotubes was constructed within the dry stack area, coupled with a vertical expansion, occurred in 2006-2007.

As further detailed in Late Filed Exhibit #3, in 2009 the Company proposed accelerating the retirement of the Cape Fear units. The retirement was approved by the North Carolina Utilities Commission in 2010.

The Weatherspoon coal plant retired in 2011.

Prepared for:

Progress Energy

COAL FIRED PLANTS CONVERSION OF ASH SYSTEMS TO DRY

JACOBS PROJECT NO. 17N89692

MARCH 22, 2006

REV. C

JACOBS

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3/22/06

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SECTION 1

1.0 EXECUTIVE SUMMARY

1.1 The coal fired plants in the Progress Energy system in the Carolinas remove some, if not all, of the ash generated by water means and discharge the ash/water mixture into ponds on site. The one coal fired plant in Florida, the Crystal River plant, disposes of all ash, both fly and bottom, dry. Therefore, no costs are included in this report for this plant. For various reasons, from running out of space in the ponds, to need for other use of the pond space, to containment failures, it has become necessary to consider converting all of the other ash removal and storage systems to dry type. This study has evaluated the systems and prepared order of magnitude cost estimates for these conversions.

The fly ash at all of the plants except Mayo and Roxboro is discharged to the ponds. In all plants the bottom ash is discharged to the ponds.

The converted systems will discharge the fly ash to silos with environmental control systems. From the silos, the ash will be discharged into trucks for disposal off the plant sites. The bottom ash will be pumped to dewatering bins, where the entrained water will be removed. From the bins, the bottom ash will also be discharged into trucks for disposal off the plant sites.

The order of magnitude costs for the conversions, by plant, are as follows:

	Fly Ash	Bottom Ash	TOTAL
Asheville Plant	$3,775,000	$2,325,000	$6,100,000
Cape Fear Plant	$3,775,000	$2,325,000	$6,100,000
Crystal River Plant	-	-	-
Lee Plant	$3,025,000	$1,425,000	$4,450,000
Mayo Plant	-	$3,175,000	$3,175,000
Robinson Plant	$3,025,000	$1,425,000	$4,450,000
Roxboro Plant	-	$6,100,000	$6,100,000
Sutton Plant	$4,900,000	$2,975,000	$7,875,000

SECTION 2

2.0 INTRODUCTION

2.1 General

The coal fired plants in the Progress Energy system in the Carolinas remove some, if not all, of the ash generated by water means and discharge the ash/water mixture into ponds on site. The one coal fired plant in Florida, the Crystal River plant, disposes of all ash, both fly and bottom, dry. Therefore, no costs are included in this report for this plant. For various reasons, from running out of space in the ponds, to need for other use of the pond space, to containment failures, it has become necessary to consider converting all of the ash removal and storage to dry type systems. This study has evaluated the systems and prepared order of magnitude cost estimates for these conversions.

The fly ash at all of the plants except Mayo and Roxboro is discharged to the ponds. In all plants the bottom ash is discharged to the ponds.

The converted systems will discharge the fly ash to silos with environmental control systems. From the silos, the ash will be discharged into trucks for disposal off the plant sites. The bottom ash will be pumped to dewatering bins, where the entrained water will be removed. From the bins, the bottom ash will also be discharged into trucks for disposal off the plant sites.

SECTION 3

3.0 DESCRIPTION OF WORK

Following are descriptions, by plant, of the modifications to be made to convert the plants to totally dry ash disposal:

3.1 Asheville Plant

The existing system at the plant is one in which the ash is disposed of in an ash pond. The fly ash is removed from the hoppers by vacuum created by high pressure water pumped through an exhauster, then passed through an air/water separator for air removal, then flows by gravity to the pond. The bottom ash is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The scope of this undertaking is to eliminate the flow of the ash to the pond.

The fly ash piping will have shutoff valves installed between the last pickups and the air/water separators. Upstream of the valves, new piping will be routed to the collection equipment on top of new ash silos, one for each of the two units. The silos will be installed at the rear of the plant, near the precipitators. The silos will be complete with the vacuum producing exhausters, environmental clean up equipment, controls, and unloaders to discharge the ash into trucks for disposal. Each silo shall be sized for 24 hours of storage. The ash generated by each unit is as shown in the simple flow sheet, numbered ASH-AF-1. The piping shall be so designed that ash from one unit can be diverted to the silo for the other unit in case of equipment failure.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located between the precipitators at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated by both units, with one bin receiving the ash and the other dewatering. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins.

3.2 Cape Fear Plant

The existing system at the plant is one in which the ash is disposed of in an ash pond. The fly ash is removed from the hoppers by vacuum created by high pressure water pumped through an exhauster, then passed through an air/water separator for air removal, then flows by gravity to the pond. The bottom ash is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The scope of this undertaking is to eliminate the flow of the ash to the pond.

The fly ash piping will have shutoff valves installed between the last pickups and the air/water separators. Upstream of the valves, new piping will be routed to the collection equipment on top of new ash silos, one for each of the two units. The silos will be installed at the rear of the plant, near the precipitators. The silos will be complete with the vacuum producing exhausters, environmental clean up equipment, controls, and unloaders to discharge the ash into trucks for disposal. Each silo shall be sized for 24 hours of storage. The ash generated by each unit is as shown in the simple flow sheet, numbered CF-AF-1. The piping shall be so designed that ash from one unit can be diverted to the silo for the other unit in case of equipment failure.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located between the precipitators at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated by both units, with one bin receiving ash while the other is dewatering. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins

3.3 Crystal River Plant

The Crystal River plant, disposes of all ash, fly and bottom, dry.
Therefore, no costs are included in this report for this plant.

3.4 Lee Plant

The existing system at the plant is one in which the ash is disposed of in an ash pond. The fly ash is removed from the hoppers by vacuum created by high pressure water pumped through an exhauster; then passed through an air/water separator for air removal, then flows by gravity to the pond. The bottom ash is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The scope of this undertaking is to eliminate the flow of the ash to the pond.

The fly ash piping will have a shutoff valve installed between the last pickup and the air/water separator. Upstream of the valve, new piping will be routed to the collection equipment on top of a new ash silo. The silo will be installed at the rear of the plant, near the precipitator. The silo will be complete with the vacuum producing exhauster, environmental clean up equipment, controls, and unloader to discharge the ash into trucks for disposal. The silo shall be sized for 24 hours of storage. The ash generated is as shown in the simple flow sheet, numbered LEE-AF-1.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located near the precipitator at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated, with one bin receiving ash while the other bin is dewatering. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins.

3.5 Mayo Plant

The existing system at the plant is one in which the bottom ash is disposed of in an ash pond. It is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The fly ash is already disposed of dry. The scope of this undertaking is to eliminate this flow of the bottom ash to the pond.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located near the precipitators at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated by both units, with one bin receiving ash while the other bin is dewatering. This arrangement is shown on the simple flow sheet, MAY–AF-1. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins.

3.6 Robinson Plant

The existing system at the plant is one in which the ash is disposed of in an ash pond. The fly ash is removed from the hoppers by vacuum created by high pressure water pumped through an exhauster, then passed through an air/water separator for air removal, then flows by gravity to the pond. The bottom ash is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The scope of this undertaking is to eliminate the flow of the ash to the pond.

The fly ash piping will have a shutoff valve installed between the last pickup and the air/water separator. Upstream of the valve, new piping will be routed to the collection equipment on top of a new ash silo. The silo will be installed at the rear of the plant, near the precipitator. The silo will be complete with the vacuum producing exhauster, environmental clean up equipment, controls, and unloader to discharge the ash into trucks for disposal. The silo shall be sized for 24 hours of storage. The ash generated is as shown in the simple flow sheet, numbered ROB-AF-1.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located near the precipitator at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated, with one bin receiving ash and the other bin dewatering. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins.

3.7 Roxboro Plant

The existing system at the plant is one in which this ash is disposed of in an ash pond. It is removed from the hoppers through exhausters and is conveyed to the pond by the water pressure. The fly ash is already disposed of dry. The scope of this undertaking is to eliminate this flow of the bottom ash to the pond.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to new dewatering bins, which will be located near the precipitators at the rear of the plant. There will be four bins installed, two for Units 1 & 2 and two for Units 3 & 4. The dewatering bins shall be sized to handle the amount of ash generated by the two units it serves, with one bin receiving bottom ash and the other bin dewatering. This is as shown on the simple flow sheet, ROX–AF-1. The piping shall be cross connected such that the flow to one set of dewatering bins can be diverted to the other in case of an equipment failure. The dewatering bins will discharge into trucks for disposal.

3.8 Sutton Plant

The existing system at the plant is one in which the ash is disposed of in an ash pond. The fly ash is removed from the hoppers by vacuum created by high pressure water pumped through an exhauster, then passed through an air/water separator for air removal, then flows by gravity to the pond. The bottom ash is removed from the hoppers through eductors and is conveyed to the pond by the water pressure. The scope of this undertaking is to eliminate the flow of the ash to the pond.

The fly ash piping will have shutoff valves installed between the last pickups and the air/water separators. Upstream of the valves, new piping will be routed to the collection equipment on top of new ash silos, one for each of the three units. The silos will be installed at the rear of the plant, near the precipitators. The silos will be complete with the vacuum producing exhausters, environmental clean up equipment, controls, and unloaders to discharge the ash into trucks for disposal. Each silo shall be sized for 24 hours of storage. The ash generated by each unit is as shown in the simple flow sheet, numbered SUT-AF-1. The piping shall be so designed that ash from one unit can be diverted to either of the silos for the other units in case of equipment failure.

The bottom ash piping will have shutoff valves installed downstream of the eductors and piping routed to two new dewatering bins, which will be located near the precipitators at the rear of the plant. The dewatering bins shall be sized to handle the amount of bottom ash generated by all units, with one bin receiving ash while the other bin is dewatering. The dewatering bins will discharge into trucks for disposal.

The controls will be integrated into the existing controls, which are part of the plant DCS. Any new controls required shall be furnished with the silos and bins.

SECTION 4

4.0 ESTIMATES

4.1 Asheville Plant

	Fly Ash	Bottom Ash
Ash Handling System	$2,450,000	$1,500,000
Silos	Incl.	-
Dewatering Bins	-	Incl.
Ash Piping	Incl.	Incl.
Controls	Incl.	Incl.
Foundations and Paving	$250,000	$200,000
Service Piping	$75,000	$25,000
Electrical/Controls	$75,000	$25,000
Relocation and Demolition	$50,000	$50,000
TOTAL CONSTRUCTION COST	**$2,900,000**	**$1,800,000**
Other Project Costs		
Engineering	$75,000	$50,000
Contingency @ 25%	$725,000	$450,000
Owner's Proj. Management Cost	$75,000	$25,000
Sub-total Other Project Costs	$875,000	$525,000
TOTAL PROJECT COSTS	**$3,775,000**	**$2,325,000**

4.2 Cape Fear Plant

	Fly Ash	Bottom Ash
Ash Handling System	$2,450,000	$1,500,000
Silos	Incl.	-
Dewatering Bins	-	Incl.
Ash Piping	Incl.	Incl.
Controls	Incl.	Incl.
Foundations and Paving	$250,000	$200,000
Service Piping	$75,000	$25,000
Electrical/Controls	$75,000	$25,000
Relocation and Demolition	$50,000	$50,000
TOTAL CONSTRUCTION COST	**$2,900,000**	**$1,800,000**
Other Project Costs		
Engineering	$75,000	$50,000
Contingency @ 25%	$725,000	$450,000
Owner's Proj. Management Cost	$75,000	$25,000
Sub-total Other Project Costs	$875,000	$525,000
TOTAL PROJECT COSTS	**$3,775,000**	**$2,325,000**

4.3 Lee Plant

	Fly Ash	Bottom Ash
Ash Handling System	$2,100,000	$750,000
Silos	Incl.	-
Dewatering Bins	-	Incl.
Ash Piping	Incl.	Incl.
Controls	Incl.	Incl.
Foundations and Paving	$150,000	$100,000
Service Piping	$25,000	$25,000
Electrical/Controls	$25,000	$25,000
Relocation and Demolition	$25,000	$50,000
TOTAL CONSTRUCTION COST	**$2,325,000**	**$1,125,000**
Other Project Costs		
Engineering	$60,000	$30,000
Contingency @ 25%	$600,000	$260,000
Owner's Proj. Management Cost	$40,000	$10,000
Sub-total Other Project Costs	$700,000	$300,000
TOTAL PROJECT COSTS	**$3,025,000**	**$1,425,000**

4.4 Mayo Plant

Bottom Ash Handling System	$2,000,000
Dewatering Bins	Incl.
Ash Piping	Incl.
Controls	Incl.
Foundations and Paving	$175,000
Service Piping	$75,000
Electrical/Controls	$75,000
Relocation and Demolition	$100,000
TOTAL CONSTRUCTION COST	**$2,425,000**
Other Project Costs	
Engineering	$90,000
Contingency @ 25%	$600,000
Owner's Project Management Cost	$60,000
Sub-total Other Project Costs	$750,000
TOTAL PROJECT COSTS	**$3,175,000**

4.5 Robinson Plant

	Fly Ash	Bottom Ash
Ash Handling System	$2,100,000	$750,000
Silos	Incl.	-
Dewatering Bins	-	Incl.
Ash Piping	Incl.	Incl.
Controls	Incl.	Incl.
Foundations and Paving	$150,000	$100,000
Service Piping	$25,000	$25,000
Electrical/Controls	$25,000	$25,000
Relocation and Demolition	$25,000	$50,000
TOTAL CONSTRUCTION COST	**$2,325,000**	**$1,125,000**
Other Project Costs		
Engineering	$60,000	$30,000
Contingency @ 25%	$600,000	$260,000
Owner's Proj. Management Cost	$40,000	$10,000
Sub-total Other Project Costs	$700,000	$300,000
TOTAL PROJECT COSTS	**$3,025,000**	**$1,425,000**

4.6 Roxboro Plant

Bottom Ash Handling System	$3,950,000
Dewatering Bins	Incl.
Ash Piping	Incl.
Controls	Incl.
Foundations and Paving	$350,000
Service Piping	$150,000
Electrical/Controls	$150,000
Relocation and Demolition	$100,000
TOTAL CONSTRUCTION COST	**$4,700,000**
Other Project Costs	
Engineering	$125,000
Contingency @ 25%	$1,175,000
Owner's Project Management Cost	$100,000
Sub-total Other Project Costs	$1,400,000
TOTAL PROJECT COSTS	**$6,100,000**

4.7 Sutton Plant

	Fly Ash	Bottom Ash
Ash Handling System	$3,200,000	$1,950,000
Silos	Incl.	-
Dewatering Bins	-	Incl.
Ash Piping	Incl.	Incl.
Controls	Incl.	Incl.
Foundations and Paving	$325,000	$250,000
Service Piping	$100,000	$50,000
Electrical/Controls	$100,000	$50,000
Relocation and Demolition	$75,000	$25,000
TOTAL CONSTRUCTION COST	**$3,800,000**	**$2,325,000**
Other Project Costs		
Engineering	$100,000	$50,000
Contingency @ 25%	$950,000	$550,000
Owner's Proj. Management Cost	$50,000	$50,000
Sub-total Other Project Costs	$1,100,000	$650.000
TOTAL PROJECT COSTS	**$4,900,000**	**$2,975,000**

SECTION 5

5.0 ATTACHMENTS

Dalton, Larry

From: Tom Helfert [tomhelfert@charter.net]
Sent: Wednesday, February 22, 2006 3:51 PM
To: Dalton, Larry
Subject: Dry Ash Conversion--Progress Energy Cape Fear

Larry,

I got the first one looked at so far. At Cape Fear I would try and put the Fly Ash in a common silo for both units.

When using Dewatering Bins, you need two of them. One for Filling and one for dewatering as it takes several hours to de-water, and more to unload.

An order of magnitude price for the design and supply of both systems is.....$3.6 M

This includes one fly ash silo and two dewatering bins.

We would extend the fly ash piping from existing headers to two Filter/Separators on top of the fly ash silo. We would include two new vacuum exhausters. It looks like you've got the existing Hydroveyor Exhauster in there as a stand-by. The silo unloading would include a conditioned ash unloader and a fluidizing system.

On Bottom Ash we would tie off from the existing Jetpulsion pump lines going to the pond and direct each Unit's header to the top of the bin. Discharge would be through a sluice door to a dump truck.

You show the drain going to probably the station sump. I assume this gets directed to a waste pond. If you need to clean this water up and recirculate it, you would need a settling tank and a surge tank and appropriate pumping systems to do this. I have not included this at this time.

I would think this would add about $1.0M to this design and supply price, but this is a guess.

Best Wishes,
Tom Helfert
UCC
828-327-2285

Dalton, Larry

From: Tom Helfert [tomhelfert@charter.net]
Sent: Wednesday, February 22, 2006 4:00 PM
To: Dalton, Larry
Subject: Progress Energy Cape Fear

Larry,

I meant to add something.

If you need two fly ash silos, per customer request or due to physical limitations, you would need to add about $350,000 to the price I gave you earlier.

Two silos also require a larger foundation.

I did not include foundations in my estimate.

Thanks!
Tom Helfert
UCC
828-327-2285

Dalton, Larry

From: Tom Helfert [tomhelfert@charter.net]

Sent: Friday, February 24, 2006 1:49 PM

To: Dalton, Larry

Subject: Re: Progress Energy Budget Quotes

Larry,

I have looked at **Lee #3** and came up with **$2,750,000.00** for design and supply.
I included a one day fly ash silo and two dewatering bins similar in scope as described previously for Cape Fear.
Again you would add $1M for a settling/surge re-circulation system for the Dewatering Bins.

I will continue to work on the rest and get them to you as I go.

Have a nice weekend!
Tom Helfert
UCC
828-327-2285

At 05:28 PM 2/21/2006 -0500, you wrote:

> Tom - attached are the files we discussed last week. There is a description for each plant, as well as a flow sheet. They are for the ash systems at the Progress Energy plants where you have equipment. We are preparing a very quick, Order of Magnitude estimate for converting each plant to dry ash. At Roxboro it will only involve installing dewatering bins for the bottom ash. At the other plants, it will involve adding ash silos and their associated equipment and dewatering bins. I have shown on the drawings how we intend to combine functions.
>
> The ash flows on the drawings are annual averages, so for equipment sizing, please double the flows for real world situations.
>
> What I need is a real quick, real OOM cost for equipment and piping. For cost purposes, assume we will have to install 500 feet of pipe for each silo and dewatering bin. We will add the cost for supplying power, water, and foundations. If you have a realistic cost for erection, I'd be glad to have it. If not, we'll come up with it.
>
> I'll be out of the office tomorrow, but I'll have my cell phone. I'll be on my way over and back to Salisbury, so if you have any questions, please call me.
>
> When I say quick, if you can give me numbers in a day or two, it's not too fast. I don't want you spending a lot of time on this effort. If it gets real, we'll get into detail more.
>
> C. Larry Dalton, P.E.
> Chief Engineer, Power & Utilities
> Jacobs Engineering, Inc.
> 111 Corning Road, Suite 200
> Cary, NC 27511
> E-mail - larry.dalton@jacobs.com
> Phone - 919-859-5052
> FAX - 919-859-5151
> Cell - 919-612-0749

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Dalton, Larry

From: Tom Helfert [tomhelfert@charter.net]
Sent: Friday, February 24, 2006 3:56 PM
To: Dalton, Larry
Subject: Re: Progress Energy Budget Quotes

Larry,

Here are two more, similar scope:

Robinson......$2,750,000.00 (same as Lee #3)

Sutton..........$4,800,000.00

I will be able to have Roxboro by Monday.

Thank you,
Tom Helfert
UCC
828-327-2285

At 05:28 PM 2/21/2006 -0500, you wrote:

> Tom - attached are the files we discussed last week. There is a description for each plant, as well as a flow sheet. They are for the ash systems at the Progress Energy plants where you have equipment. We are preparing a very quick, Order of Magnitude estimate for converting each plant to dry ash. At Roxboro it will only involve installing dewatering bins for the bottom ash. At the other plants, it will involve adding ash silos and their associated equipment and dewatering bins. I have shown on the drawings how we intend to combine functions.
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> Cary, NC 27511
> E-mail - larry.dalton@jacobs.com
> Phone - 919-859-5052
> FAX - 919-859-5151
> Cell - 919-612-0749

Dalton, Larry

From: Tom Helfert [tomhelfert@charter.net]
Sent: Monday, February 27, 2006 2:43 PM
To: Dalton, Larry
Subject: RE: Progress Energy Budget Quotes

Larry,

We have looked at the Roxboro system and have come up with the attached flow diagram.

We have assumed the bins would be about 500 ft. from the existing bottom ash hoppers.

These bins will be approximately 26 ft. diameter, sized on an acceptable particle rise rate based on the flow to the bin. One can only convey to one bin at a time, while the other is dewatering and unloading. Thus we have a pair serving Units 1 and 2. We figure they can convey from Unit 1and sequentially from Unit 2.

Based on the same principle, we can have a pair of bins serving Units 3A and 3B, and a pair serving Units 4A and 4B. Currently I believe they pull bottom ash from A and then sequentially from B. Four bins allows them to convey from either furnace on 3 or 4 at the same time.

The total design/supply price per the above and the attached sketch is...........$4,950,000.00

If the plant can live with pulling bottom ash from only one Unit at a time, and convey each furnace in sequence (i.e. 3A, 3B, 4A and 4B), we can supply one pair of bins to serve both Units 3 and 4. These would be larger to handle the additional storage, but would save you $1,000,000.00 versus four smaller bins.

In all cases we would size the bins to allow the customer to have a 64 hour non-unloading period based on the ash generation rates on your bid flow sheet. In other words he can go from 4:00pm on Friday until 08:00am on Monday without unloading a bin.

I trust this suits your needs at this time. If you need anything further, please do no hesitate to call.

Tom Helfert
UCC
828-327-2285 office
828-781-6387 cell

At 07:44 AM 2/23/2006 -0500, you wrote:

> Thanks!!
>
> C. Larry Dalton, P.E.
> Chief Engineer, Power & Utilities
> Jacobs Engineering, Inc.
> 111 Corning Road, Suite 200
> Cary, NC 27511
> E-mail - larry.dalton@jacobs.com
> Phone - 919-859-5052
> FAX - 919-859-5151
> Cell - 919-612-0749

From: Tom Helfert [mailto:tomhelfert@charter.net]
Sent: Wednesday, February 22, 2006 12:17 PM
To: Dalton, Larry
Subject: Re: Progress Energy Budget Quotes

Larry,

I have received this request and plan on working on it this afternoon. I will send you each plant estimate as I get them done. I have to be at a job site tomorrow, but plan to finish this Friday for you.

Thanks,
Tom Helfert
UCC
828-327-2285 office
828-781-6387 cell

At 05:28 PM 2/21/2006 -0500, you wrote:

> Tom - attached are the files we discussed last week. There is a description for each plant, as well as a flow sheet. They are for the ash systems at the Progress Energy plants where you have equipment. We are preparing a very quick, Order of Magnitude estimate for converting each plant to dry ash. At Roxboro it will only involve installing dewatering bins for the bottom ash. At the other plants, it will involve adding ash silos and their associated equipment and dewatering bins. I have shown on the drawings how we intend to combine functions.
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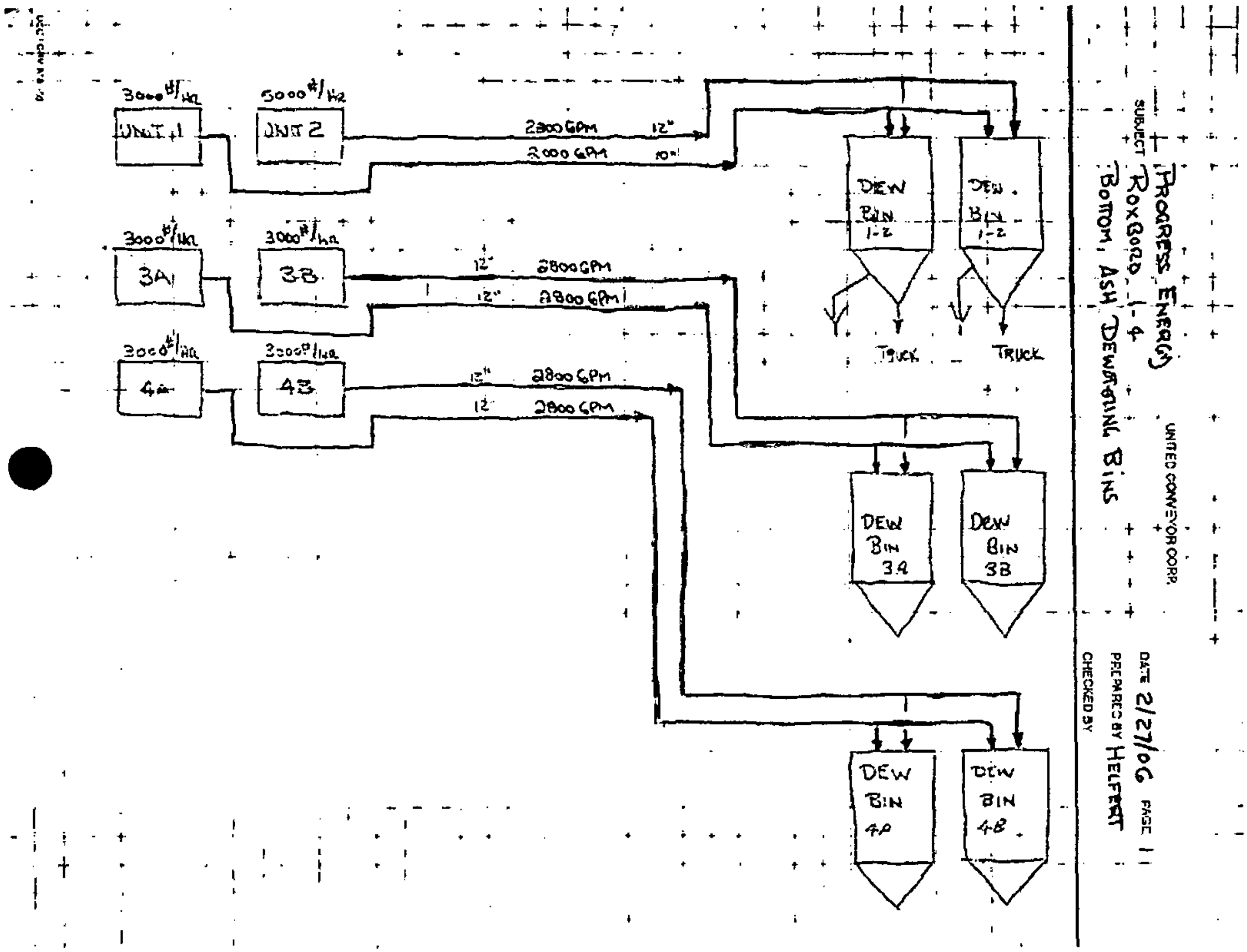
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TRUCK
TRUCK
DEW BIN 3A
DEW BIN 3B
DEW BIN 4A
DEW BIN 4B
PROGRESS ENERGY
SUBJECT ROXBORO 1-4
BOTTOM ASH DEWATERING BINS
UNITED CONVEYOR CORP.
DATE 2/27/06
PAGE 1
PREPARED BY HELFERT
CHECKED BY

Dalton, Larry

From: Ford, Henry J [HJFord@diamondpower.com]
Sent: Monday, February 27, 2006 3:32 PM
To: Dalton, Larry
Cc: Edwards, Thomas W; Zotti, Louis A; Cunningham, Dave; Saunders, Matthew S; Piechocki, Matthew A
Subject: RE: Progress Energy Budget Quotes
Importance: High

Hello again Mr. Dalton,

Sorry this took a few days longer than expected, the principle estimaters were both out of the office last week. I have been asked to pass along our "best guess" budgetary pricing based on the limited scope description provided for each site.

Budget Price for Asheville is estimated for installation of Dewatering Bin, Carbon Steel Silos with Unloaders, associated ash transport piping, valves, vacuum pumps, and collectors. This pricing estimate is FOB jobsite, using present day prices, world sourcing, and standard ASH Terms & Conditions.
Equipment Only Budget Pricing is $2,865,000.00.
An estimate of the turnkey installation as described isbe $2,500,000.00.
Total Budget estimate for Asheville is $5,365,000.00.

Budget Price for Mayo is estimated for installation of Dewatering Bin. This pricing estimate is FOB jobsite, using present day prices, world sourcing, and standard ASH Terms & Conditions.
Equipment Only Budget Pricing is $1,370,000.00.
An estimate of the turnkey installation as described would be $1,100,000.00.
Total Budget estimate for Mayo is $2,470,000.00.

These are our best guesses based on present knowledge. We welcome the opportunity to work with you to develop firm purchase pricing for these two projects. Please feel free to contact Tom and me for clarification of information or scope. I can be available for a site visit to Mayo, if necessary.

Thanks,
Henry J. Ford, Senior Sales Engineer
Diamond Power International, Inc.
Mobile: (252) 904-8929
FAX: (888) 269-9139
hjford@diamondpower.com

From: Ford, Henry J
Sent: Tuesday, February 21, 2006 6:33 PM
To: 'Dalton, Larry'; Edwards, Thomas W
Subject: RE: Progress Energy Budget Quotes

Hi Mr. Dalton,

I am Henry Ford the other half of this project. I was the first to see your note and I have forwarded your request to our New Equipment and Turnkey Groups for immediate processing. I have asked for some kind of answer by noon on THU.

Tom and I will respond to you once we have received the information.

Thanks,

Henry J. Ford, Senior Sales Engineer
Diamond Power International, Inc.
Mobile: (252) 904-8929
FAX: (888) 269-9139
hjford@diamondpower.com

From: Dalton, Larry [mailto:Larry.Dalton@jacobs.com]
Sent: Tuesday, February 21, 2006 5:35 PM
To: Edwards, Thomas W; Ford, Henry J
Subject: Progress Energy Budget Quotes

Tom - attached are the files we discussed last week. There is a description for each plant, as well as a flow sheet. They are for the ash systems at the Progress Energy plants where you have equipment. We are preparing a very quick, Order of Magnitude estimate for converting each plant to dry ash. At Mayo, it will only involve installing a dewatering bin for the bottom ash. At Asheville, it will involve adding ash silos and their associated equipment and a dewatering bin. I have shown on the drawings how we intend to combine functions.

The ash flows on the drawings are annual averages, so for equipment sizing, please double the flows for real world situations.

What I need is a real quick, real OOM cost for equipment and piping. For cost purposes, assume we will have to install 500 feet of pipe for each silo and dewatering bin. We will add the cost for supplying power, water, and foundations. If you have a realistic cost for erection, I'd be glad to have it. If not, we'll come up with it.

I'll be out of the office tomorrow, but I'll have my cell phone. I'll be on my way over and back to Salisbury, so if you have any questions, please call me.

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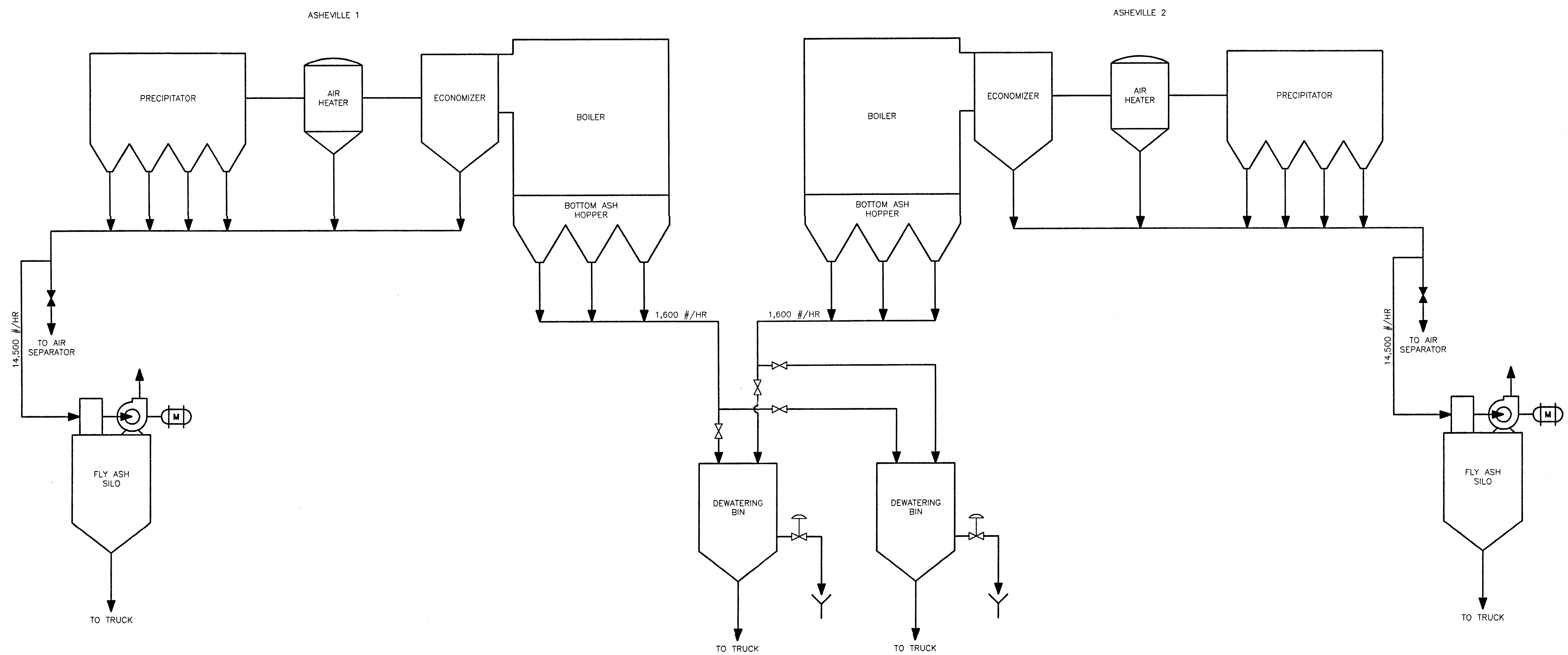

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NOTES:

REV.	DESCRIPTION	DRAWN	CHKD	APPRVD	DATE
B	ISSUED FOR REPORT	JZC	CLD	CLD	03/21/06
A	ISSUED FOR BUDGET QUOTES	JDB	CLD	CLD	2/20/06

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DWG NO.	REV.	TITLE

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POWER OPERATIONS GROUP

FACILITY: | UNIT: | SYSTEM:

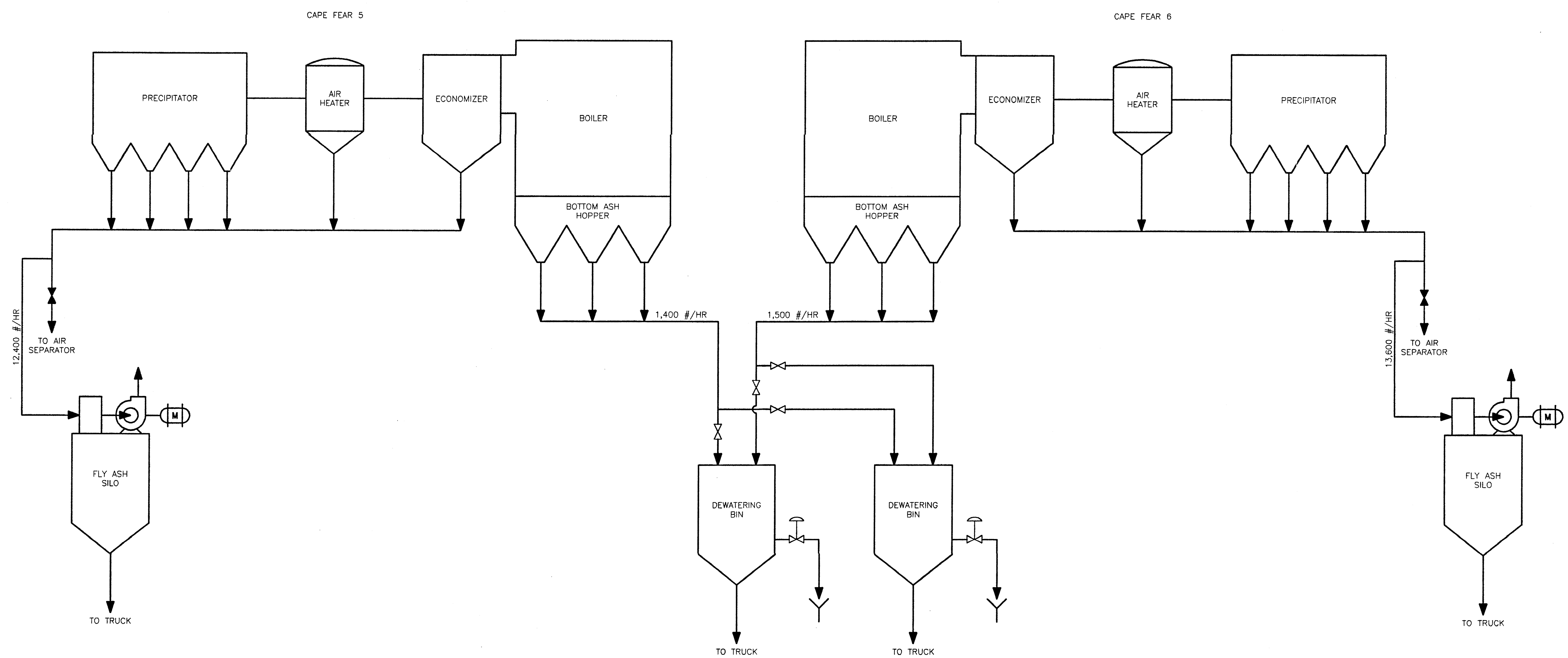
PROJECT NO: | EC NO: | W.O. NO:

SIZE: ARCH–D | SCALE: NTS | PLOT: 1=1

Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION ASHEVILLE PLANT – P & ID

SHT OF | DWG NO: ASH–AF–1 | REV: B



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A	ISSUED FOR BUDGET QUOTES	JDB	CLD	CLD	2/20/06

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POWER OPERATIONS GROUP

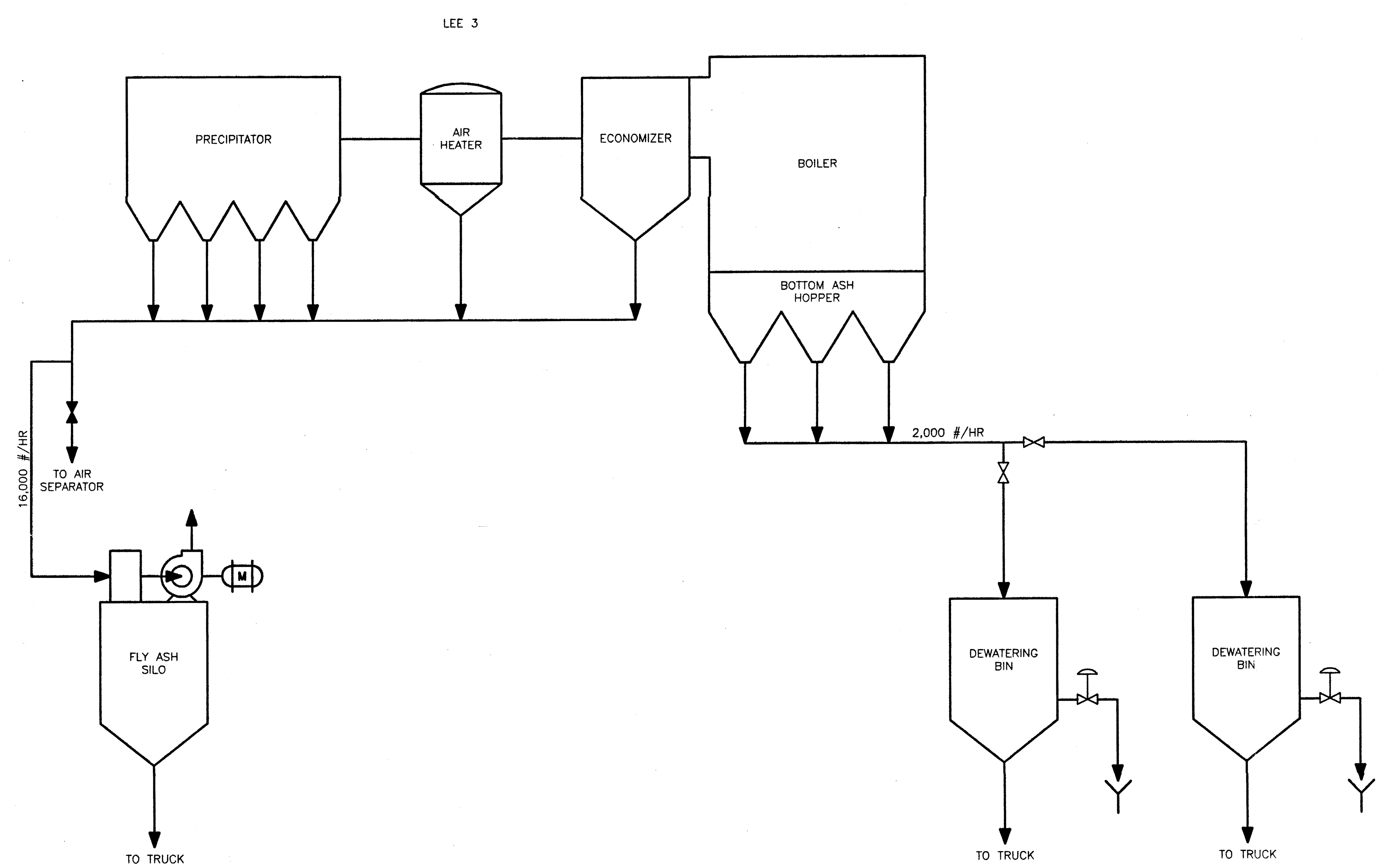
FACILITY:	UNIT:	SYSTEM:
PROJECT NO:	EC NO:	W.O. NO:
SIZE: ARCH–D	SCALE: NTS	PLOT: 1=1

Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION CAPE FEAR PLANT – P & ID

SHT OF | DWG NO: CF–AF–1 | REV: B

DID NO.:



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NOTES:

DWG NO.	REV.	TITLE

DRAWING REFERENCES

REV.	DESCRIPTION	DRAWN	CHKD	APPRVD	DATE
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PROJECT NO:	EC NO:	W.O. NO:
SIZE: ARCH–D	SCALE: NTS	PLOT: 1=1

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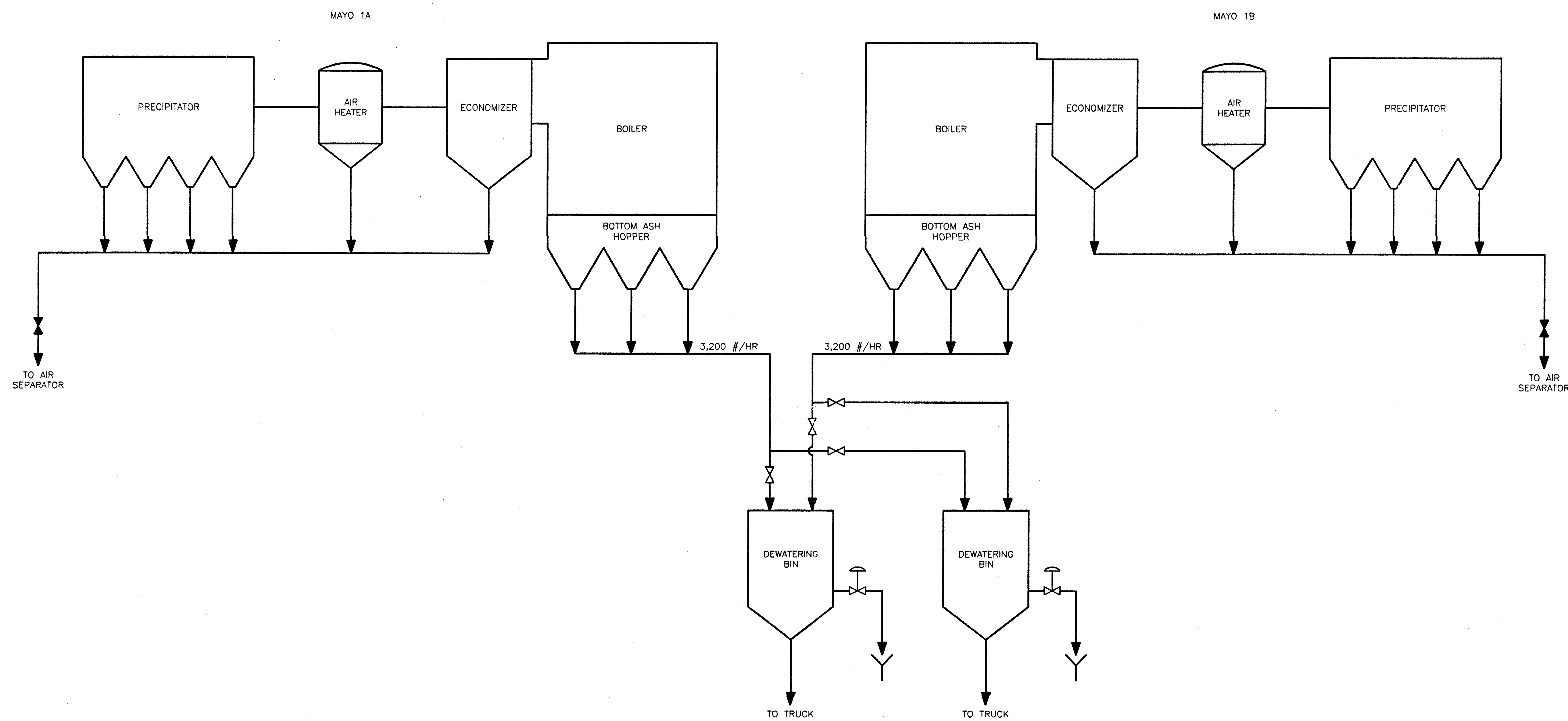
Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION LEE PLANT – P & ID

SHT OF | DWG NO: LEE–AF–1 | REV: B

DWG NO.:



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DWG NO.	REV.	TITLE

DRAWING REVISIONS

REV.	DESCRIPTION	DRAWN	CHKD	APPRVD	DATE
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A	ISSUED FOR BUDGET QUOTES	JDB	CLD	CLD	2/20/06

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JACOBS

111 Corning Rd., Suite 200 Cary, NC 27511 919-859-5000

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PROGRESS ENERGY CAROLINAS, INC.

POWER OPERATIONS GROUP

FACILITY:	UNIT:	SYSTEM:
PROJECT NO:	EC NO:	W.O. NO:
SIZE: ARCH–D	SCALE: NTS	PLOT: 1=1

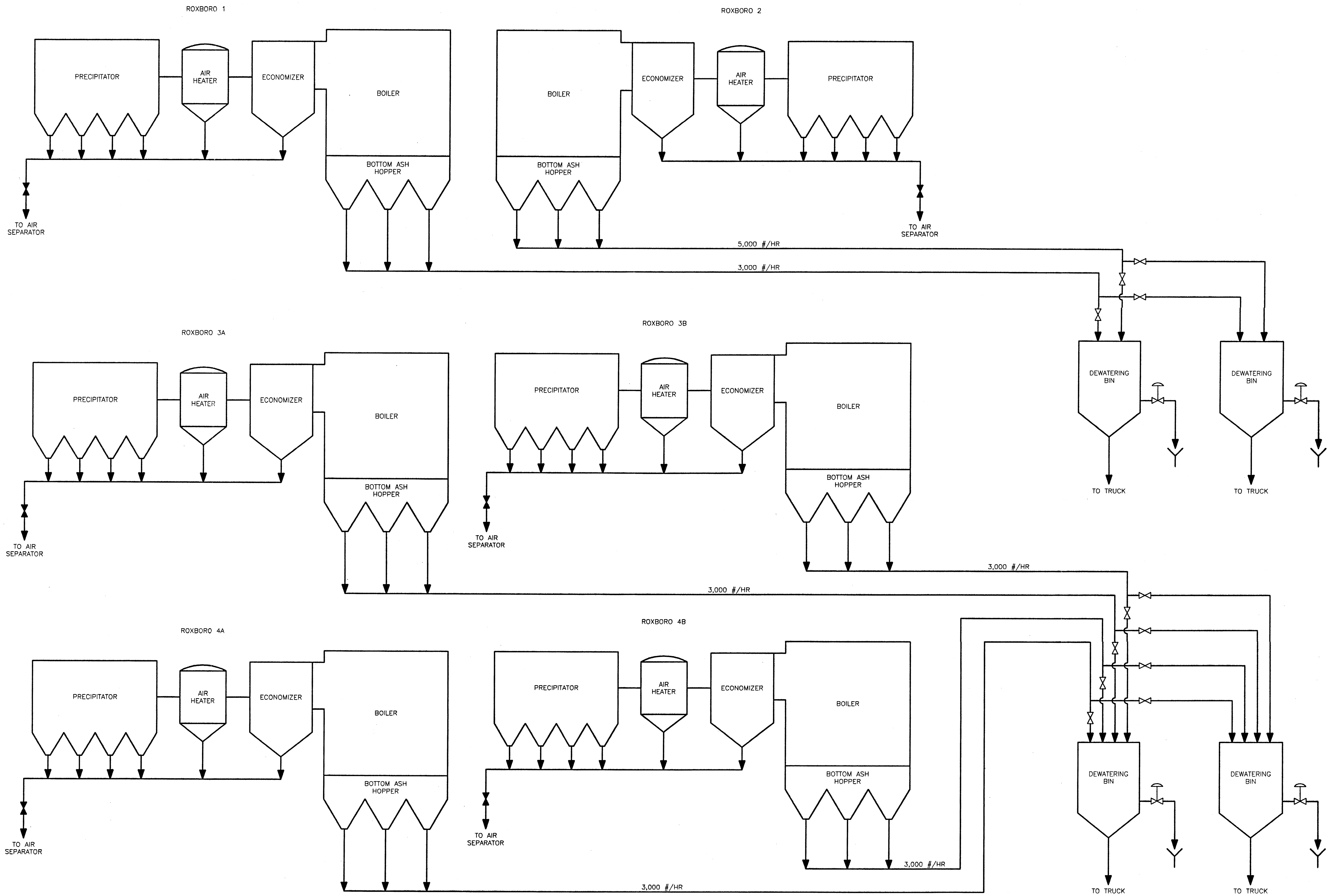
Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION MAYO PLANT – P & ID

SHT OF

DWG NO: MAY–AF–1

REV: B



Preliminary—do not use for construction

NOTES:

DWG NO.	REV.	TITLE

DRAWING REFERENCES

REV.	DESCRIPTION	DRAWN	CHKD	APPRVD	DATE
B	ISSUED FOR REPORT	JZC	CLD	CLD	03/21/06
A	ISSUED FOR BUDGET QUOTES	JDB	CLD	CLD	2/20/06

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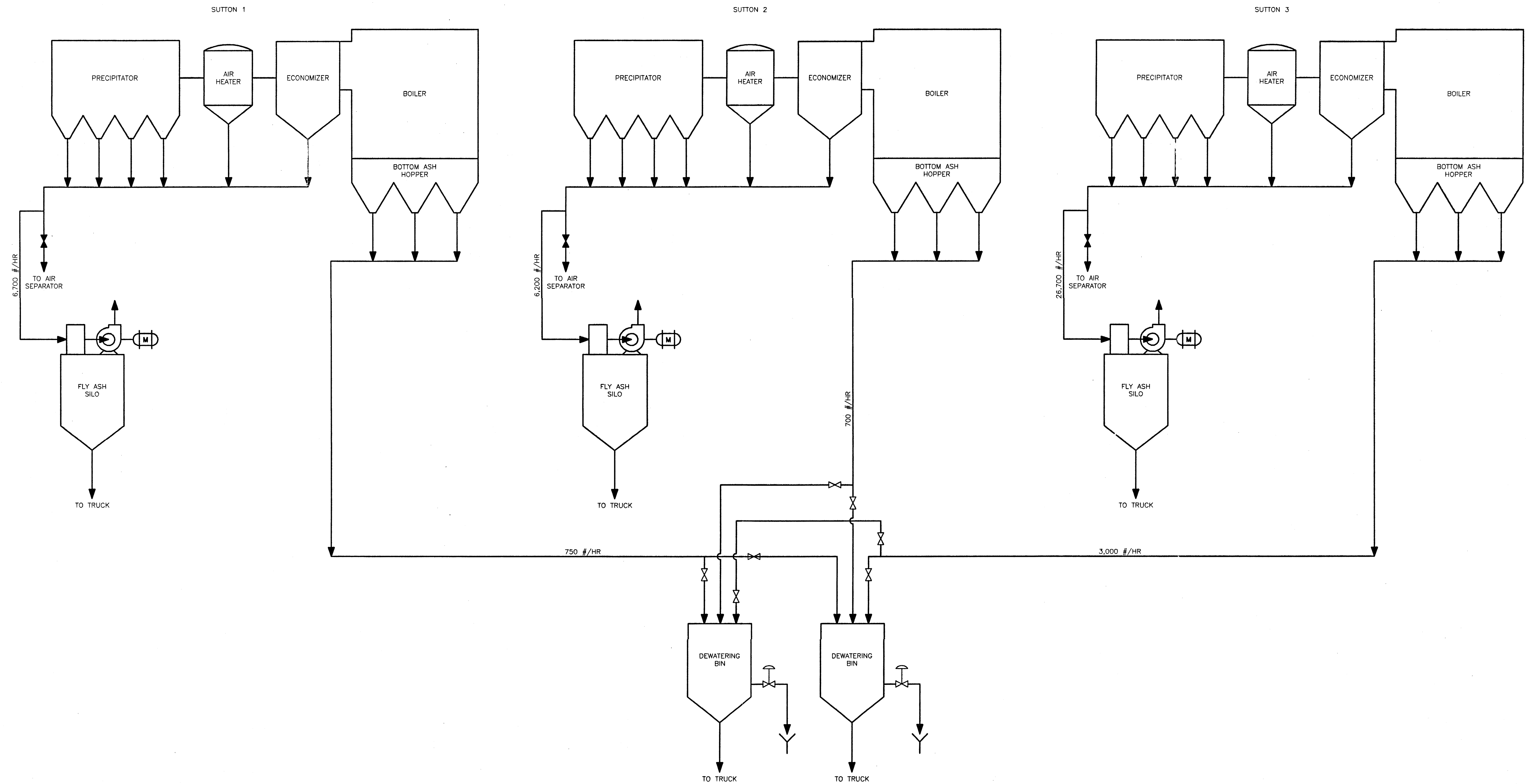
POWER OPERATIONS GROUP

FACILITY:	UNIT:	SYSTEM:
PROJECT NO:	EC NO:	W.O. NO:
SIZE: ARCH–D	SCALE: NTS	PLOT: 1=1

Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION ROXBORO PLANT – P & ID

SHT OF | DWG NO: ROX–AF–1 | REV: B



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NOTES:

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POWER OPERATIONS GROUP

FACILITY:	UNIT:	SYSTEM:
PROJECT NO:	EC NO:	W.O. NO:
SIZE: ARCH-D	SCALE: NTS	PLOT: 1=1

Progress Energy

TITLE: DRY FLY ASH AND DEWATERING BIN INSTALLATION SUTTON PLANT – P & ID

SHT OF | DWG NO: SUT-AF-1 | REV: B

DID NO:

20 Year CCP Management Plan
Asheville, Robinson, Sutton, Cape Fear, Mayo & Lee Power plants
Business Analysis Package

v11 **6/16/06**

Sponsoring Business Unit: Power Operations

Funding Legal Entity: Progress Energy Carolinas, Inc.

Date Prepared: May 2006

Key Project Contacts:

Role, Department/Group	Name	Phone #
Vice President, Fossil Generation	Charlie Gates	919-546-5454
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Executive Summary

Project Basic Information

Description:	Design and implement CCP facilities to provide a disposal outlet until 2025.
Location:	Asheville, Robinson, Sutton, Cape Fear, Mayo & Lee coal-fired power plants.
EESY+ Master Project #:	Asheville - 92203 Cape Fear - 92215 Lee - 92218 Mayo - 92212 Robinson - 92209 Sutton - 92206
Schedule:	➢ New CCP facilities *designed, constructed and ready to receive CCP* for Asheville, Robinson and Sutton by 1/1/10. ➢ New CCP facilities *designed* for the following plants by 1/1/08: Cape Fear, Mayo and Lee.

Recommendation and High Level Discussion

Ash ponds within our system are at or near capacity and the pending installation of SO_2 removal technology will double our coal combustion product (CCP) generation by 2009. Environmental regulations are tightening discharge limits thereby increasing the risk of ash pond operations. To objectively create a disposal home for our CCP at each facility, a 20-year CCP Management Plan was completed in April 2006 for the engineered management and disposal of coal combustion products for all PEC & PEF coal-fired plants. CCP considered are bottom ash, fly ash, and flue gas desulfurization (FGD) byproducts of both wet and dry scrubbers. Furnace Sorbent Injection (FSI) is also included in CCP plan.

This BAP supports the request for design funding for Asheville, Robinson, Sutton, Cape Fear, Mayo and Lee plants. Implementation costs (for Asheville, Robinson and Sutton) are shown for informational purposes and approval of these funds will be requested upon completion of the design phase.

Individual Project Authorization Forms (PAF's) have been prepared for each of the six aforementioned plants. (*Future PAF's will need to be prepared for Weatherspoon, Roxboro and Crystal River. They are not in this BAP for the following reasons: Weatherspoon – indefinite life span and will apply only short term solutions as needed; Roxboro – already operates a monofill, continue with current operations and develop next cell as necessary; Crystal River – strong market demand for gypsum means outlets for 100% FGD production and therefore current ash operations at CR will be unaffected.*)

This CCP Plan concentrates on long-term CCP disposal options (2010-2025), provides an evaluation of each of the viable wet and/or dry options, and ultimately provides a single recommended option for the management of CCPs on a plant-by-plant basis. Care was taken to evaluate a wide-array of disposal options and not to limit the potential solutions to only technologies currently utilized. Potential options that were either clearly impractical or known to have unacceptably high costs or risks due to lack of product/technology development, or have unproven performance in the industry, were not considered for this study. Disposal options included both wet and dry disposal, based primarily on proposed FGD technology; overall CCP forecasted production rates, the plants' existing infrastructure, and the economics of converting an existing wet handling system to a dry handling system.

Several motives are provided as the basis for changes in CCP management methods. The drivers for change will greatly impact both plant operations and the means by which CCP management is carried out and planned for in the future. Those drivers with the greatest level of impact generally include the following categories: regulatory; environmental and public pressures; increasing fuel variability; past CCP management practices; and emission control systems impacts. In addition, more stringent regulations for water quality standards, air emission controls, regulated pollutants and ash discharge permits are significantly impacting our approach to CCP management.

The 20-year CCP Management Plan discussed and evaluated the following items for each of the PEC & PEF plants:

- Existing CCP management and future CCP projections for ash and FGD materials;
- Current and future beneficial reuse opportunities;
- Plant-specific assumptions;
- On-site and off-site land use options; and
- Comparative evaluation of each of the viable disposal options specific to each plant.

Not all disposal options were considered for each plant, since the selected SO_2 removal technology impacts whether the CCP disposal system can be wet or dry. The options considered were based primarily on existing site constraints, land availability, type and quantity of CCP materials being disposed, proposed FGD technology, and finally Progress' preference. The comparative evaluation of each viable disposal option for each plant was based on four key screening criteria believed to be the most critical to the success of the long-term CCP Management Plan. The evaluation criteria and their respective weighting include: Technical Considerations (5% weight); Environmental, Permitting and Regulatory Considerations (25% weight); Site Development/Land Availability Considerations (5% weight); and Economic Considerations (65% weight).

Beneficial Reuse Contracts: Gypsum disposal quantities were reduced according to existing or anticipated contracts for Asheville, Mayo, Roxboro and Crystal River. Ash disposal quantities were reduced for Mayo, Roxboro and Crystal River.

Cost Assumptions

As part of the cost evaluation, each of the alternatives were evaluated for the long-term disposal of CCP and costs were categorized into either capital costs, O&M costs, or miscellaneous costs. Several costing assumptions were used to develop the study cost estimates; however a few of the most pertinent costing assumptions are the following:

- Study costs presented in earlier presentations, were presented in 2006 dollars for CCP management through the year 2025. Costs did not include inflation ("time value of money" is not considered) or Allowance for Funds Used During Construction (AFUDC).

- Study cost estimates included a 15% markup on capital costs to account for unknown and unlisted items and a 10% markup on capital costs to account for a contingency and for engineering, consulting and permitting. No markup or other contingency was included for the O&M costs.
- Study costs were developed by our consultants retained to assist in the study, URS, and are +/- 25%.

In addition to the cost estimation that has been conducted for each of the viable disposal options considered at each plant, a generalized CCP Capital Cash Flow Projection has been developed for each plant. This projection provides a visual layout of the estimated capital costs for the disposal option recommended for each plant.

For this BAP, the costs presented include escalation per EESY outputs. They were created by using the 20-year CCP Management Plan study costs and adjusting for time value of money future escalation, capital/O&M splits, etc. through the EESY^{plus} program. The EESY^{plus} analysis was prepared by the Treasury & Enterprise Risk Management Department.

Overall Plan Recommendations & Costs

In summary, each plant has been evaluated at a conceptual level in accordance with the overall project assumptions as well as several plant-specific assumptions. A summary of the recommended disposal options for the six plants included in this BAP and their respective total costs (capital and O&M) and NPV are provided in the following table. The NPV is representative of the total estimated project costs from 2006 – 2025.

A comparison of the alternatives for each site can be found in Economic Analysis - Detailed Discussion of Results.

Summary of Recommended CCP Disposal Options (Captital + O&M from 2006- 2025)			
Plant	**Recommended Disposal Option**	**Estimated Total Costs ($000's)***	**NPV ($000's)**
Asheville	D2 – Monofill* Sited Over Existing Pond Over Separatory Liner	$60,171	($23,303)
Robinson	D1 - New Monofill* Onsite	$34,969	($13,463)
Sutton	D1 - New Monofill* Onsite	$57,827	($22,190)
Cape Fear	D2 – Monofill* Sited Over Existing Pond Over Separatory Liner	$48,191	($17,434)
Mayo	D1 - New Monofill* Onsite	$59,592	($19,780)
Lee	W1 - New Lined Ash Pond	$22,220	($9,227)
Total (6 sites)		**$282,969**	**($105,397)**

**A monofill is considered a landfill solely for CCP.*
***Includes all capital costs and operation of CCP facility from 2006-2025. Does not credit current O&M CCP costs.*

Funding Requirements and Source ($000's)

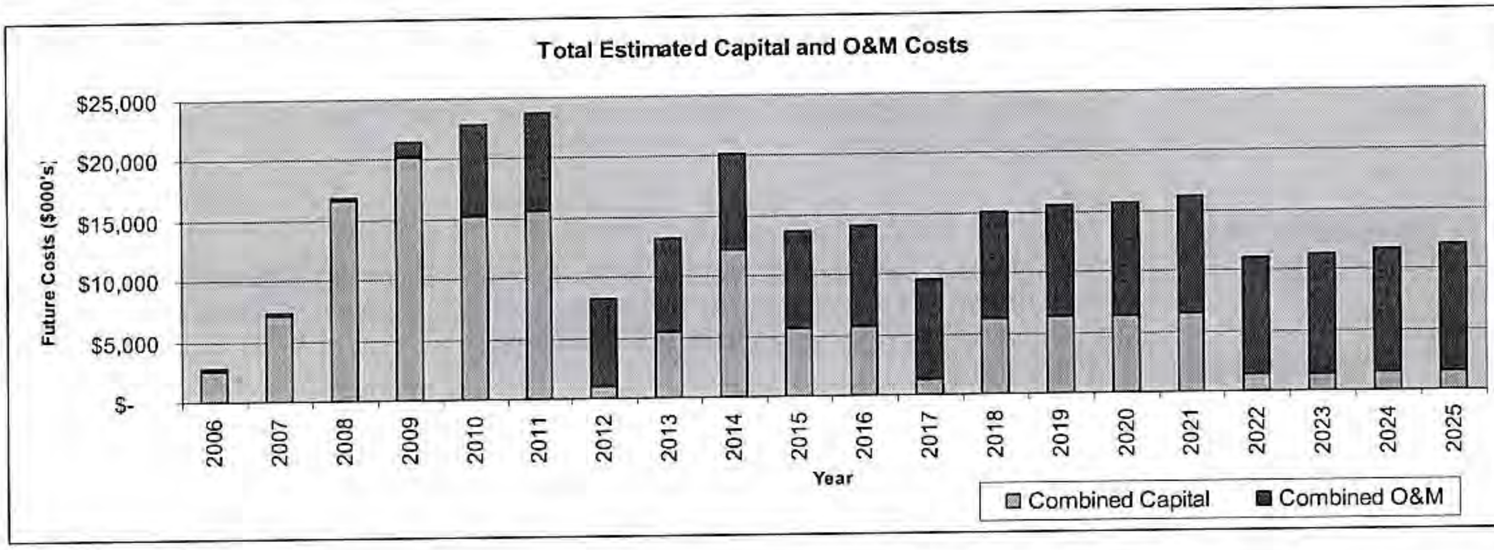
The funding requirements in the table below represent design and implementation costs associated with Phase I builds from 2006 – 2009. For total projected project costs, see the table above.

	2006		2007		2008		2009	
	Design	Implement	Design	Implement	Design	Implement	Design	Implement
Asheville	$674	$0	$652	$1,967	$0	$6,459	$0	$6,601
Robinson	$316	$0	$283	$1,067	$0	$4,289	$0	$4,370
Sutton	$539	$0	$512	$1,572	$0	$6,095	$0	$6,226
Cape Fear	$571	$0	$588	$0	$0	$0	$0	$1,629
Mayo	$392	$0	$404	$0	$0	$0	$0	$2,012
Lee	$319	$0	$329	$0	$0	$0	$0	$660
Totals	$2,812	$0	$2,768	$4,606	$0	$16,843	$0	$21,499

2006 $ are unbudgeted and will be reprioritized into POG's capital spending plan. 2007-2009 budget submissions will include capital spending requirements outlined in this presentation. POG will be unable to fund these costs within current capital guidelines and will require reprioritization at PGN level .

Cashflow Graph

The cash flow graph represents the total capital and O&M expenditures by year for all six recommended alternatives (listed above). All dollar amounts have been escalated and represent expected future costs.



Strategic Fit

The implementation of the 20-year CCP Management Plan allows for continued reliable operation of our coal-fired fleet. It also is driven by compliance with applicable clean air regulations (CAIR, Clean Smokestacks.) Implementation of these long-term solutions will reduce the operational risk of current ash ponds and ensure environmental compliance for the future. Dry conversions of ash handling at select plants will also allow for increased beneficial reuse potential, although reuse potentials did not drive our alternative selections.

Key Risk Analysis

Market Risk

Price Risk: There is a low commodity risk associated with these CCP solutions since most costs are labor, fuel and earthwork. Minimal concrete or steel work would be required.

Interest Rate Risk:

Hedges:

Credit Risk (Summarization of credit review)

Non-Performance:

Default:

Guaranty:

Business Risk

Economy:

Weather:

Environment: There exists a permitting risk in the implementation of new CCP disposal facilities. Our monofills will likely be perceived as landfills by the neighboring public and opposition to new CCP construction could be considerable in more densely populated areas (i.e. Asheville). Part of the monofill approval process includes public hearings. Delays in CCP permitting could necessitate implementation of additional short term CCP solutions at plants.

Also if adequate CCP facilities are not in place, risks of potential notice of violations due to ash pond overflows or high TSS levels are greater.

Modeling: Cost estimates were developed by our consultant, URS, using a proprietary model they developed and maintain. There is a risk of modeling errors existing in that model.

Data from the consultant's model was entered into EESY^{plus}, which is the standard model used by the Company.

Operational Risk

Reliability: Implementation of new CCP facilities will ensure the ability to manage the products of coal combustion. We are currently at full ash pond capacities at several plants and exceedences of discharge permits would impact unit availabilities.

Asset Performance: See above.

Control Area:

Regulatory Risk

Described in the Regulatory Impact Analysis section

Key Assumptions

Item	Assumption	Owner
Dry scrubbers (DFGD)	Dry FGD requires a dry conversion of ash handling since the commingled product (ash and calcium sulfite) is cementitous.	Technical Services
Wet scrubbers (WFGD)	Wet scrubbers produce the byproduct gypsum, which may have market value. Since the ash and gypsum are not commingled, they may be conveyed by different methods. Ash can be conveyed wet, but gypsum requires a dry conveyance method.	Technical Services
SO_2 technology schedule	The recommendations of the 20-year CCP Management Plan are heavily influenced by the current selection of SO_2 removal technologies. The following are impacts of potential changes to the current SO_2 selection: ➢ **Asheville plant** – already wet FGD; no change can be made. ➢ **Robinson plant** – dry FGD is the current preferred choice, and if selected, would force dry conversion and monofill. If wet FGD is selected, could construct Option W1 - New Lined Ash Pond for ash handling. Thiswe would reduce be unable to wet sluice gypsum (ruling out wet disposal costs by approximately 30-40%* from Option D1 - New Monofill. ➢ **Sutton plant** - dry FGD is the current preferred choice,options) and if selected,therefore Option D1 - New Monofill would still be chosen. ➢ **Sutton plant** - ash pond legacy issues and real estate constraints force dry conversion and monofill. This Option D1 – New Monofill would be applicable for any SO2 removal technology, whether wet FGD or dry FGD. ➢ **Cape Fear plant** - Furnace Sorbent Injection (FSI) is planned to be trialed at Cape Fear. Regardless of the current preferred choice,trial's success and if eitherwhether FSI, dry FGD or wet FGD is selected, wouldultimately installed, the recommended option D1 – New Monofill will be a comprehensive solution to the plant's CCP disposal options. ➢ **Mayo** – wet FGD being constructed; no change can be made. ➢ **Lee** – no SO_2 removal technology is currently planned to be installed at Lee. This allows us to choose the installation of a new lined ash pond at Lee. If dry FGD (or FSI) is installed at any Lee unit, it would necessitate dry conversion and new monofill construction. (This would increase Lee's CCP disposal costs by 50-60%*). **Costs impacts referenced above are based on the 20-year CCP Management Plan study (prior to EESY adjustments). These options were not input into EESY since they were eliminated as logical options. See "Narrowing the Options by Plant" Section on Pg. 12.*	Plant Construction
Generation & Fuel Forecast (GFF)	The November 2005 GFF was used as basis for this study and is a reasonable representation of projected coal burns and FGD product generation.	System Planning
Evaluation Period	2006-2025, beginning with design expenditures.	Technical Services
Escalation	The original study was done with 2006 $ and no inflation. This analysis uses the corporate standard assumptions for general escalation and labor escalation. The corporate standard assumptions were verified with independently published rates for utility and construction labor from JD Energy and Global Insight	Treasury

Item	Assumption	Owner
	for verification	

Project Alternatives Analysis

Alternatives considered and basis of selection

The following wet disposal options were evaluated for plants not planned for Dry Scrubbers:

- Option W1 – New Lined Pond
- Option W2 – Multiple Cycled Ponds and Monofill Disposal
- Option W3A – Ash Pond Excavation, Monofill Disposal, and Pond Relining
- Option W3B – Ash Pond Excavation, and Restacking Over a Separatory Liner
- Option W4 – Dike Extensions on Existing Pond Over Separatory Liner
- Option W5 – Geotubes Stacked on Existing Pond Over Separatory Liner
- Option W6 – Geotubes Over Separate Lined Structure

The following dry disposal options were evaluated for all plants:

- Option D1 – [On-Site] Monofill (*For Asheville only, Option D1 consisted of a new off-site monofill*)
- Option D2 – Monofill Sited on Existing Pond Over Separatory Liner.
- Option D3 – Future monofill with initial off-site trucking *(This option applies only to Mayo*).

The following are descriptions of each option:

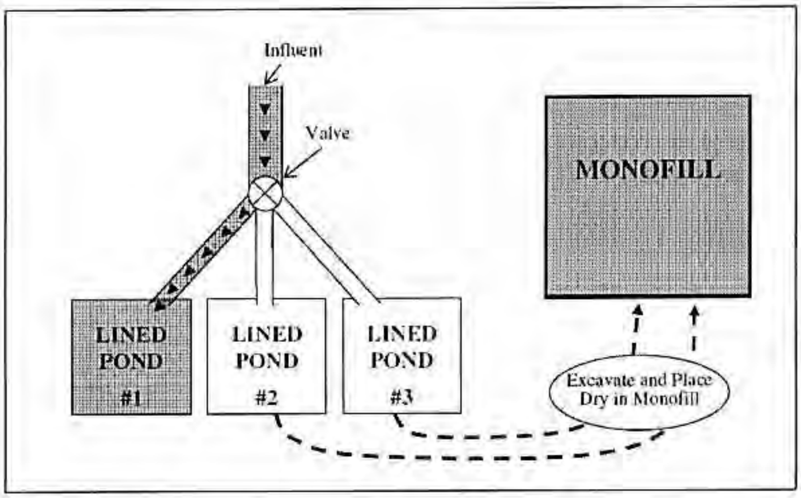
Items to Note: Gypsum cannot be wet sluiced. Implementation of a dry FGD forces dry conversion and dry handling of a mixed CCP product.

Option W1: New Lined Pond

A new ash pond will be constructed incorporating a modern liner system, likely a composite liner system, composed of a flexible membrane liner overlying a recompacted clay liner or geosynthetic clay liner (GCL). When constructed, ash (bottom ash and fly ash) can be sluiced to the new structure.

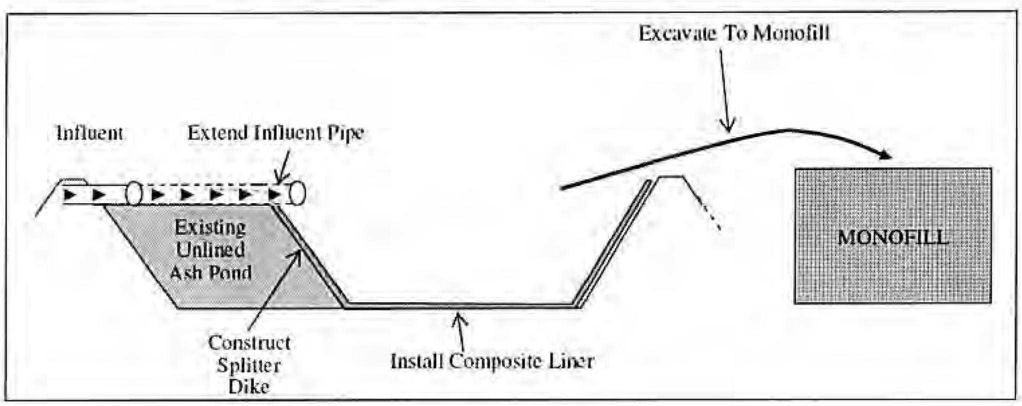
Option W2: Multiple Cycled Lined Ponds and Monofill Disposal

This option involves constructing a series of relatively small lined ponds and an adjacent monofill facility. Under this scenario, the first pond is filled to near its capacity upon which sluicing is then directed to the second pond. Once the first pond has adequately dewatered, the ash is then excavated from the pond, and transferred to the adjacent monofill. The first pond can then be reused for ash collection. The cycle is then repeated with the second pond, and so on. This method may require the construction of 3 or more ponds to allow time for the ash in the pond to dewater adequately.



Option W3A - Ash Pond Excavation, Monofill Disposal, and Pond Relining

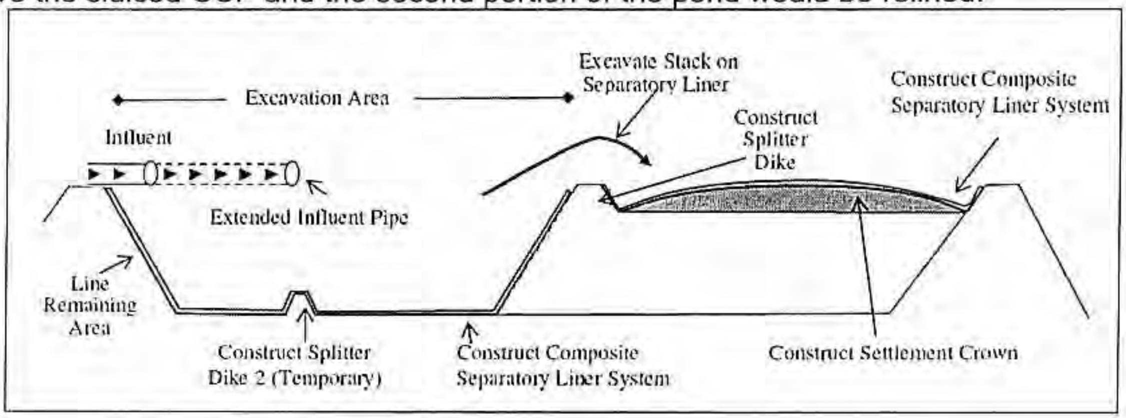
This option initially involves construction of a new lined monofill (on PE owned property) and the construction of a temporary separatory dike in the existing unlined pond, to allow for continued sluicing of the ash. The ash is then dewatered, and subsequently excavated from a portion of the unlined pond. Most or all of the ash is then transferred into the new lined monofill while a portion (or potentially the entire existing pond) is relined. Continued sluicing of ash into the relined facility can be initiated.



Option W3B - Ash Pond Excavation and Restacking Over a Separatory Liner

This alternative initially involves construction of a temporary separatory dike in the existing unlined pond in order to allow the material in the restacking area to dewater. Once this area is sufficiently dewatered, construction of a settlement crown and separatory liner over the restacking area can commence.

Ash is then excavated from the active portion of the pond and placed on the newly lined restacking area. Upon completion of the restacking operation, the active portion of the pond must be drained to allow for relining of the pond. A portion of the site must remain active to dewater the sluiced ash. A dike is constructed to allow for continued sluicing on one portion of the excavated pond while construction of a separatory liner on the other portion of the excavated pond is carried out. Once a portion is relined, the newly lined portion would begin to receive the sluiced CCP and the second portion of the pond would be relined.

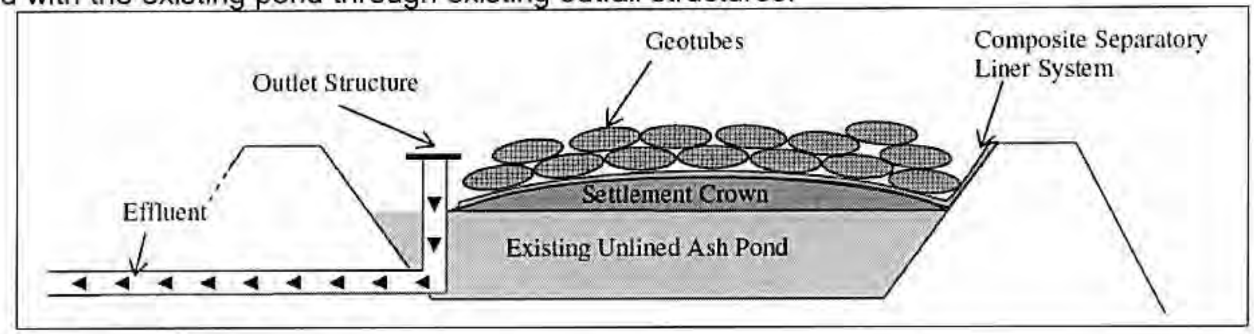


Option W4 - Dike Extensions on Existing Pond Over Separatory Liner

This alternative initially involves construction of a temporary separatory dike in the existing unlined pond, creating two compartments. Continued sluicing of the ash and/or gypsum will occur into one compartment while construction commences in the other compartment. A portion of the existing ash pond is then dewatered and a separatory liner and vertical dike extensions are constructed in this dewatered compartment. Once the separatory liner and dike extension is completed in this compartment, CCP can be sluiced into this area. At that time, this operation is repeated in the remaining compartment.

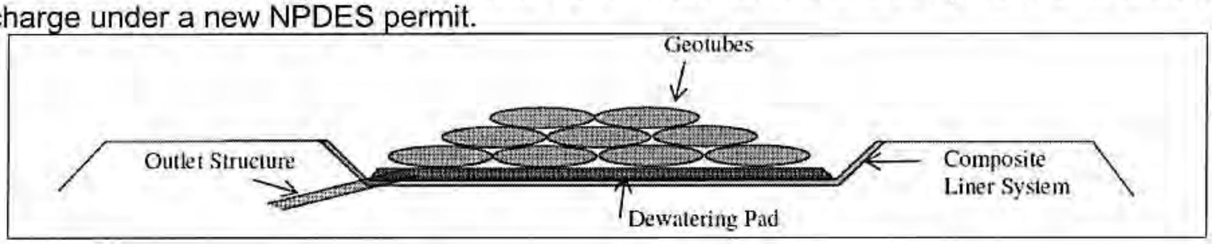
Option W5 - Geotubes Stacked on Existing Pond Over Separatory Liner

This option involves sluicing ash and/or gypsum into woven fabric dewatering tubes (Geotubes) located on the existing ash pond over a new separatory liner. Geotubes are used as a means to achieve solids removal in order to meet the TSS limit of the NPDES permit requirements. Discharge of sluice water will be as previously conducted with the existing pond through existing outfall structures.



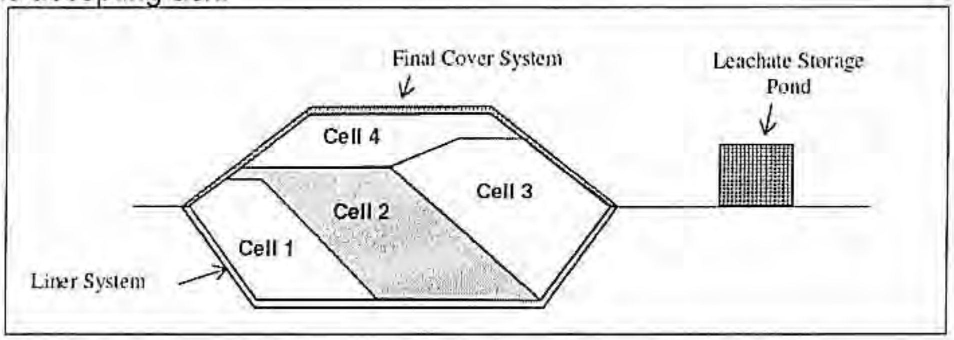
Option W6 - Geotubes Over Separate Lined Structure

This option involves sluicing ash and/or gypsum into woven fabric dewatering tubes (Geotubes) located on a new, shallow lined pond-like structure that is located in a separate location from an existing pond. Geotubes are stacked inside the separate lined structure leaving an approximately 10-foot wide space from the edge to collect the Geotube effluent along with storm water runoff from the site for conveyance back to the plant and/or discharge under a new NPDES permit.



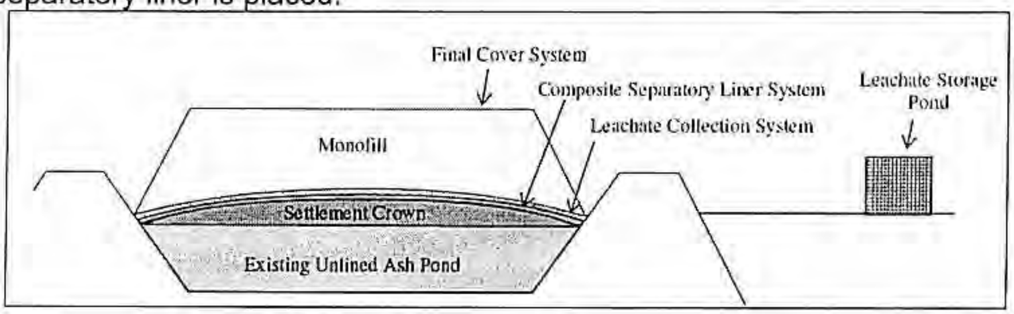
Option D1 - Monofill

This option involves conveying material dry, by either conveyor or truck, to a new or existing lined monofill site and placing and compacting the material in controlled lifts in a monofill, typically lined with a composite liner system composed of a flexible membrane liner (FML) and recompacted clay liner or GCL. All storm water which comes in contact with the CCP would be considered leachate and treatment would be required prior to its discharge. The facility is constructed in sub cells (of 5 years capacity) to allow capital expenditures to be spread out over the life of the facility.
Once the facility has reached its storage capacity, it will be closed using a closure cap system and monitored for a period of 10-30 years. The plant's ash systems would need to be converted from wet to dry for this disposal option. For permitting purposes, monofills accepting gypsum and/or dry FGD byproduct are treated the same as monofills accepting ash.



Option D2 - Monofill Sited on Existing Pond Over Separatory Liner

This option is the same as D1, except the monofill is located over an existing ash pond after the pond is dewatered and a separatory liner is placed.



Narrowing the Options by Plant

The following options could be eliminated from our evaluation for the following reasons:

Asheville: Real estate constraints allow for only the smallest CCP footprint, therefore all new wet solutions were eliminated. Depending on heights, monofill can use 50% less space than wet ash ponds.
SO_2 removal technology and DFGD is the current preferred choice for RobinsonDFGD souldould ndisposal Unit 3is scheduled for SO_2 removal technology and DFGD is the current preferred choiceouldould disposal for the plant
Robinson: Plant is scheduled for SO_2 removal technology and DFGD is the current preferred choice for Robinson. DFGD system would result in a mixed CCP product that could not be sluiced. Therefore only dry disposal options were considered. Also, we are unable to work within the existing ash pond footprint due to legacy issues, thereby eliminating Option D2 – Monofill Over Existing Ash Pond. Further, if wet FGD was selected, we could not wet sluice gypsum and therefore only dry disposal Option D1 would be possible.

Sutton: Unit 3 is scheduled for SO_2 removal technology and both wet and dry FGD's are currently being considered. Existing ash pond legacy issues would inhibit the construction of new wet disposal options. Therefore only dry disposal options were considered for Sutton. Dry options (monofills) would be appropriate for either wet FGD or dry FGD systems.

Cape Fear: Plant is scheduled for a Furnace Sorbent Injection (FSI) trial later this year. Also, dry FGDs and wet FGDs are being evaluated for the site. Both FSI and DFGD would result in a mixed CCP product that could not be sluiced over the long term, which would allow only dry disposal options. If wet FGDs are selected, we could not wet sluice gypsum and therefore only dry disposal options (Options D1 & D2) would be possible.

Mayo: Wet FGD is being constructed.

- Plant currently has dry ash handling system therefore all wet options were eliminated. Also, with wet FGD's producing gypsum, we want to have a facility to handle any excess gypsum which cannot be sold (in this case to the wallboard facility). We will not wet sluice gypsum, so this is another reason wet options were eliminated for Mayo.
- An Option D3 – "Monofill with Initial FGD Transportation to Roxboro" was considered for Mayo only. This option would continue to utilize existing ash ponds for Mayo's ash until it reaches capacity. All FGD produced would be trucked to Roxboro for either use at the BPP plant or monofill disposal. A new on-site monofill at Mayo would be ready in 2016. This option would accelerate the timing for Roxboro's next monofill cell/phase. This Option would require 50 truck trips per day, 5 days per week when Mayo is producing 300,000 tons FGD per year. Sustaining this magnitude of heavy truck traffic for 7 years is not realistic. Therefore, for Mayo option D1 – New Monofill is recommended for Mayo, despite having an NPV of $1M less than Option D3.

Lee: All options were reviewed, since plant is not scheduled to receive SO_2 removal technology.

Consequences of Non- Authorization and Deferral

- The most critical plants (Asheville, Robinson and Sutton) could either be forced to shut-down or put on restricted operation should action not be taken to provide an outlet for CCP.
- Deferral could result in the necessity to truck all CCP off-site at considerable expense should a CCP facility not be ready.
- Deferral would increase the risk of potential ash pond breaches / overflows or water permit non-compliance. Fines and/or Notice of Violations could result.

Economic Analysis Detail

Each project alternative outlined above was evaluated to determine the Net Present Value. The basis for each evaluation was the total cost as projected in the "20 Year CCP Management Plan" report prepared by URS and Progress Energy. These costs were then allocated by year from 2006-2025 based on expected project schedules at each location (provided by Technical Services Section). The costs were also escalated to generate expected future costs using corporate standard assumptions for general escalation and labor escalation. The corporate standard assumptions were verified with independently published rates for utility and construction labor from JD Energy and Global Insight.

The cash flow projections were based on the implementation schedule outlined in "Option 3" of the Capital Expenditure Schedule [internal] dated April 24, 2006. This schedule puts CCP facilities at Asheville, Robinson, and Sutton in service in January 2010. CCP facilities at Cape Fear, Lee, and Mayo are delayed two years, and go in service in January 2012. The interim costs of CCP management from 2010 – 2012 at these three sites have been included in the economic analysis.

Capital and O&M costs were broken out based on guidance received from the Property, Plant and Materials Accounting group (referenced to FERC 311 – guidance for the addition of a new ash disposal area). The implementation of each disposal facility was assumed to occur in three separate phases approximately five years apart. Phase related capital costs were allocated to Phase I at 50% and Phases II and III at 25% each. O&M expenses begin on the in-service date and are assumed to be equal (before escalation) for all years of operation.

Once the cash flow projections were completed, each alternative was analyzed using EESY-Plus to determine the NPV of the project. The most economic option for CCP disposal is the alternative with the least negative NPV.

Detailed Discussion of Results and Summary of Financial Indicators

The table below summarizes the results of the economic analyses performed for each alternative considered by site. All analyses follow the methodology outlined in the section above. Additional site specific discussion can be found in the appendices to this report.

The recommended alternative is highlighted within the table. For all sites except Mayo, the most economic alternative (least negative NPV) is the recommended alternative.

For Mayo, Option D3 – Monofill with Initial Transportation to Roxboro was identified as the least costs alternative. However, this option would require approximately 50 trucks / day 5 days / week to carry FGD product from Mayo to Roxboro. Sustaining this level of heavy truck traffic for the 7 year period was considered unrealistic. Therefore, Option D1 – New Monofill Onsite is the recommended alternative.

Asheville	**NPV**
D1 - Monofill Offsite	($35,651)
D2 - Monofill Onsite	($23,303)

Sutton	**NPV**
D1 - New Monofill Onsite	($22,190)
D2 - Monofill Sited on Existing Pond	($23,268)

Robinson	**NPV**
D1 - New Monofill Onsite	($13,463)

Cape Fear	**NPV**
D1 - New Monofill Offsite (PE property)	($17,696)
D2 - Monofill On Existing Pond	($17,434)

Mayo	NPV
D1 - New Monofill Onsite	($19,780)
D2 - Monofill Sited on Existing Pond	($20,333)
D3 - Monofill w/ Initial FGD Transportation to Roxboro	($18,694)

Lee	NPV
D1 - New Monofill Onsite	($11,747)
D2 - Monofill on Existing Pond Over Separatory Liner	($12,862)
W1 - New Lined Pond	($9,227)
W2 - Multiple Cycled Lined Ponds & Monofill Disposal	($11,517)
W3A - Ash Pond Excavation, Monofill Disposal, and Pond Relining	($15,913)
W3B - Ash Pond Excavation & Restacking Over Separatory Liner	($14,132)
W4 - Dike Extensions on Existing Pond Over Separatory Liner	($11,430)
W5 - Geotubes Stacked on Existing Pond Over Separatory Liner	($15,615)
W6 - Geotubes Over Separate Lined Structure	($14,847)

Scenario Analysis

Best and worst case scenarios were not run for these projects. However, a 25% contingency on capital costs has been built into each alternative.

Major NPV Components

See appendices for major NPV components related to each site.

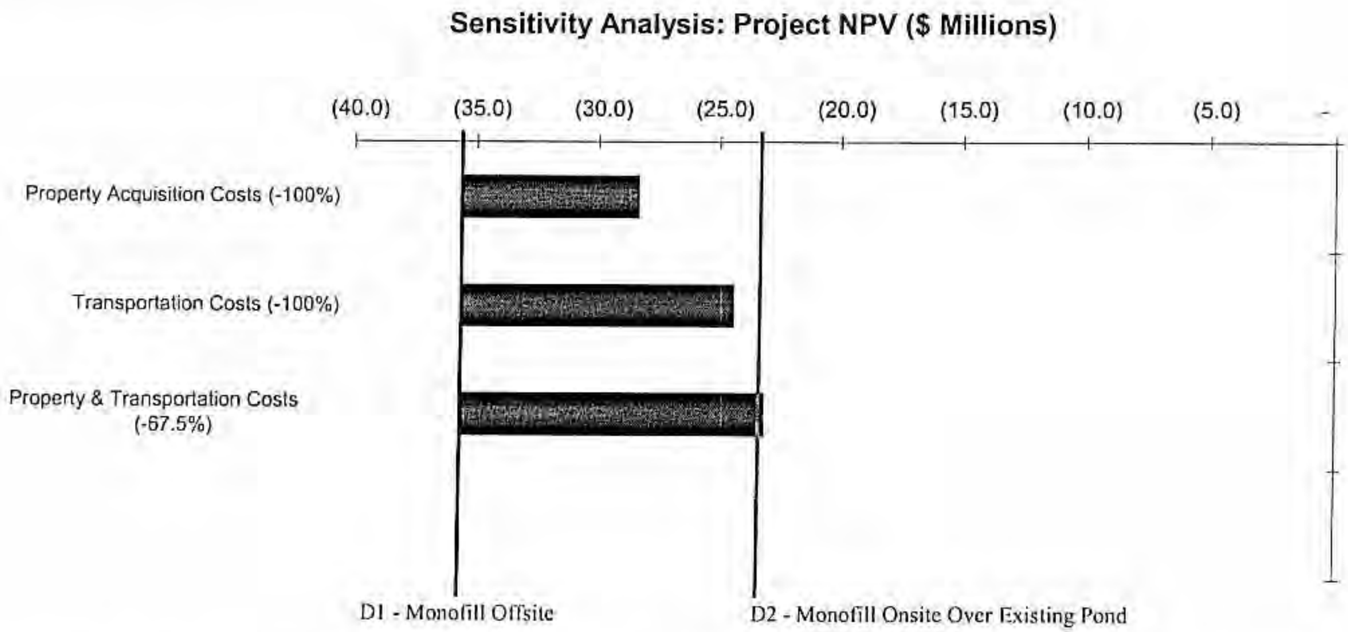
Modeling Tool Used/ Description of Changes/ Approval

EESY-Plus was used for the economic analysis.

Sensitivity Analysis Detail *(Asheville only)*

Sensitivity analyses were not performed on the project alternatives for Cape Fear, Lee, Mayo, Robinson, and Sutton. This was because the cost drivers for each of the alternatives were common to all alternatives for the site in each case. As such, stressing any single variable would change the NPV of all alternative by a similar amount and would not change the recommended alternative.

A scenario analysis was performed for the two Asheville CCP disposal options. There were significantly different cost drivers in the D1 – Offsite Monofill option and D2 – Onsite Monofill option. The offsite monofill option was driven by property costs and high transportation costs for a 20 mile round trip to the offsite location. These two variables were stressed down in order to see if lower property costs and/or and closer monofill location would make option D1 more competitive. The results are shown in the tornado chart below.



The red line on the left side of the chart represents the NPV of the current D1 – Monofill Offsite option. The green line on the right represents the D2 – Monofill Onsite option. The chart shows that if either property acquisition costs or transportation costs were $0, the NPV of the new project would still be more negative than an onsite monofill. Both property and transportation costs would have to decrease by approximately 67.5% each in order to become NPV equivalent to an onsite monofill. This would represent property acquisition costs of $2.6 million ($13,000/acre based on 200 acre size requirement) and transportation costs of $10.9 million ($1.82/ton unescalated). This would represent a transportation distance of 6.5 miles roundtrip.

Operational Analysis Detail

For Asheville, Robinson, Sutton and Cape Fear plants, the proposed operations call for a conversion from wet (sluicing) to dry handling of bottom and fly ash and the construction of a CCP monofill on each site. (Mayo plant will also have a monofill, however the fly ash system is already dry.) These monofills will be designed as lined solid waste facilities and constructed in 5-year cells. Where applicable, fly ash and gypsum will be separated within the cell to allow for future reclamation potential.

Lee plant is recommended to continue with wet sluicing operations to a new lined ash pond facility.

Regulatory Impact Analysis

The project being proposed is consistent with the requirements set out by the North Carolina Public Utility Commission in Rule R8-5 "Inspection of plant and equipment (a) Each utility shall maintain its plant, distribution system and facilities at all times in proper condition for use in rendering safe and adequate service." In addition PEC has an obligation to remain in compliance with all relevant environmental regulations. For utility costs to be included in rates they must be both: prudently incurred; and just and reasonable. In order for PEC and PEF to ensure the continued availability of their respective coal plants they must arrange for the disposal of the waste resulting from operation. Thus, they have no choice but to incur waste disposal costs. The , so the costs will be deemed prudently incurred provided that based upon a proper analysis, the least cost practical option was chosen. It appears such an analysis was done and in each instance the least cost practical option was chosen. With regard to whether the costs are just and reasonable, this test is concerned with whether the project was properly managed. Thus, the extent to which all of the actual costs incurred are recoverable will depend upon whether the construction of the facilities and their operation are properly managed. Assuming costs will be properly managed, the costs necessary for this project would be considered prudently incurred and therefore recoverable within existing base rates.

Market Analysis

Customer Analysis: N/A

Competitor Analysis: N/A

Non- Financial Considerations / Intangibles / Un-quantified Financial Considerations, Others

- Legacy issues at Sutton plant restrict its available CCP options to dry options.
- Legacy issues at Robinson plant restrict the retrofit options of current ash pond.

Integration and Project Performance Assessment Plan

Organizational Requirements/ Integration Issues

Organization	Roles, responsibilities and impacts
Plant Construction Department	Conduct and/or oversee the study, design and implementation phases of any new on-site or off-site CCP disposal facility. Provide project management services.
Technical Services Section	Periodic technical support to Plant Construction Department (PCD) for monofill development. Annual update of 20-yr CCP plan based on Nov GFF.
Regulated Fuels Department	FGD product and ash reuse at select plants. Coal quality inputs into GFF.
Systems Planning	GFF forecasts
Environmental Services Section	Guidance on regulatory changes or other issues which could impact plan implementation. PCD assistance in permitting new CCP facilities.

See Appendices for complete CCP Roles & Responsibilities document.

Project Objectives/ Goals/ Expected Benefits

Project Objective: Implement a CCP Management Plan that will create adequate long-term CCP capacity that allows plants to operate without facing reoccurring ash pond capacity or water quality limit issues.

Goals:

1. Have new CCP facilities *designed, constructed and ready to receive CCP* for Asheville, Robinson and Sutton by 1/1/10.

2. Also have CCP facilities *designed* for the following plants by 1/1/08: Cape Fear, Mayo and Lee.

Expected Benefits: CCP management is a cost of doing business. While there is no positive cash flow associated with these projects, substantial money could be saved in avoidance of purchased power as a result of plant shutdowns or reduced operations should ash pond capacities be reached or water quality limits exceeded.

Benefits Assessment Methodology, Schedule and Responsibility for Assessment

Methodology:	Once constructed, monofill volumes shall be checked annually against predicted vs. actual coal burns. Remaining cell life shall be calculated for each facility.
Schedule:	Done annually after Nov GFF issued.
Responsibility:	Annual volume checks will be done by Technical Services Section in coordination with input from SPOD, RFD and PCD.

Wrap Up Conclusions and Recommendations (Pros and Cons)

Action is needed to maintain an outlet for CCP as a product of electricity generation at our coal-fired facilities. The SO_2 removal devices are doubling our CCP quantity that requires disposal. Other drivers (environmental regulations and PE's commitment to USWAG of groundwater monitoring around all our ash ponds) make conversion to dry ash handling and CCP placement in on-site monofills the selected option at all but 2 of the 9 plants (Lee and Weatherspoon plants being the exception to dry conversion).

Recommend approval to begin design and permitting of new CCP facilities (and dry conversion as needed) for Asheville, Robinson, Sutton, Cape Fear, Mayo and Lee plants. Implementation costs in this BAP are shown for informational purposes and approval of these funds will be requested upon completion of the design phase.

Recommended alternatives by plant are:

Asheville	Option D2 – Monofill Sited over Existing Pond over Separatory Liner
Robinson	Option D1 – New Monofill On-Site
Sutton	Option D1 – New Monofill On-Site
Cape Fear	Option D2 – Monofill Sited over Existing Pond over Separatory Liner
Mayo	Option D1 – New Monofill On-Site
Lee	Option W1 – New Lined Ash Pond

End of initial document

APPENDICES

CCP Project Authorization Forms (12 pgs.):

- **Asheville 1 & 2:** ASH-06-92080
- **Robinson:** ROB-06-92207
- **Sutton:** SUT-06-92204
- **Mayo:** MAYO-06-92210
- **Cape Fear:** CF-06-92213
- **Lee CCP PAF:** LEE-06-92216

NPV Components & Comparison Charts
(12 pgs.)

Other Documents (2 pgs.)

- **CCP Roles & Responsibilities** [internal]

☐ Initial ☐ Revision (If Checked, enter revision no) ________ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Asheville 1 & 2: Coal Combustion Products Management Plan Prioritization Category: Regulatory

Department: Fossil Generation Location: Asheville Charge To: ______

EESY™ Record #: ASH-06-92080 Initiation Date 2006 Acctng System Phase #: ________ Acctng System Master Project #: ________

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0% ☐ Emergency If Emergency, Authorized By ________

Project Manager: Robinson, John M. Project Sponsor: Gates, Charlie Benefit Assessment Date: July 31, 2007

Schedule	☐ Outage Required	Study	Design	Implementation	Source of Funds: Budget X Other
	Start Date		July 1, 2006	July 1, 2007	
	End Date		July 1, 2007	December 31, 2009	Total Direct Cost
Direct Cost	2006	$0	$674,000	$0	$674,000
	2007	$0	$652,000	$1,967,000	$2,619,000
	2008	$0	$0	$6,459,000	$6,459,000
	2009	$0	$0	$6,601,000	$6,601,000
	Project Total	$0	$1,326,000	$15,027,000	$16,353,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project * If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		B/C Ratio	NPV	Discounted Breakeven Year
Base Case		0.00	($23,302,687)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006-1138		Note: Proforma for entire term must be attached to approval.	
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

Approval Levels	Approval Signatures	Date	Approval Levels	Approval Signatures	Date
All 3 Phase Projects require these approvals	☑ Project Manager: J. M. Robinson	6/1/06	Project direct cost > $1M	☑ Senior Vice President	6/27/06
	☑ Project Sponsor:	6/16/06		☐ PEC or PEF President & CEO | Pres. - Progress Ventures | Exec. VP Diversified Ops:	
	☐ PRG Chairperson:			☑ ~~Subsidiary Director or Progress Energy Service Co. Pres. & CEO~~ | Subsidiary Director or Progress Energy, Inc. Pres. & CEO:	7/5/06
	☑ Business Services Mgr. or Supervisor Financial Services: G Sue Hardison	6/8/06	Project direct cost > $5 M	☑ Subsidiary Treasurer or Progress Energy, Inc. Treasurer:	6/21/06
Project direct cost > $250K	☐ Department Head - DH:			☑ Subsidiary Director or Progress Energy, Inc CFO: Peter M. Scott	7/6/06
	☑ Department Head - DH, Charge-By Org. (Required for facilities projects): Joel Y Kamya	6/12/06		☑ Subsidiary Chairman or Progress Energy, Inc. Chairman & CEO: Robert B McGehee	7/7/06

Return Original to PRG Administrator, who must maintain a file of the signed original:
Executed Lease Evaluation Form, FRM-SUBS-01110 must be attached to approval if the recommended project includes a lease.
Signatures as Subsidiary Directors or Officers based on legal entity sponsoring project.

Capital Planning and Control Review (initial and Date): Cup 06/21/06

FRM-SUBS-00690
Rev. 9 10/05

☐ Initial ☐ Revision (If Checked, enter revision no) ________ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Robinson: Coal Combustion Products Management Plan **Prioritization Category:** Regulatory

Department: Fossil Generation **Location:** Robinson (Fossil) **Charge To:** ______

EESY™ **Record #:** ROB-06-92207 **Initiation Date** 2006 **Acctng System Phase #:** ________ **Acctng System Master Project #:** ________

☐ **Emergency** **If Emergency, Authorized By** ________

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0%

Project Manager: Robinson, John M. **Project Sponsor:** Gates, Charlie **Benefit Assessment Date:** July 31, 2007

Schedule	☐ **Outage Required**	**Study**	**Design**	**Implementation**	**Source of Funds:** Budget X Other
	Start Date		July 1, 2006	July 1, 2007	
	End Date		July 1, 2007	December 31, 2009	**Total Direct Cost**
Direct Cost	**2006**	$0	$316,000	$0	$316,000
	2007	$0	$283,000	$1,067,000	$1,350,000
	2008	$0	$0	$4,289,000	$4,289,000
	2009	$0	$0	$4,370,000	$4,370,000
	Project Total	$0	$599,000	$9,726,000	$10,325,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project * If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		**B/C Ratio**	**NPV**	**Discounted Breakeven Year**
Base Case		0.00	($13,463,444)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006 - 1139		Note: Proforma for entire term must be attached to approval.	
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

☐ Initial ☐ Revision (If Checked, enter revision no) ______ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Sutton: Coal Combustion Products Management Plan Prioritization Category: Regulatory

Department: Fossil Generation Location: Sutton Charge To: ______

EESY Record #: SUT-06-92204 Initiation Date 2006 Acctng System Phase #: ______ Acctng System Master Project #: ______

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0% ☐ Emergency If Emergency, Authorized By ______

Project Manager: Robinson, John M. Project Sponsor: Gates, Charlie Benefit Assessment Date: July 31, 2007

Schedule	☐ Outage Required	Study	Design	Implementation	Source of Funds: Budget X Other
	Start Date		July 1, 2006	July 1, 2007	
	End Date		July 1, 2007	December 31, 2009	Total Direct Cost
Direct Cost	2006	$0	$539,000	$0	$539,000
	2007	$0	$512,000	$1,572,000	$2,084,000
	2008	$0	$0	$6,095,000	$6,095,000
	2009	$0	$0	$6,226,000	$6,226,000
	Project Total	$0	$1,051,000	$13,893,000	$14,944,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project* If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		B/C Ratio	NPV	Discounted Breakeven Year
Base Case		0.00	($22,190,034)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006-1140		Note: Proforma for entire term must be attached to approval.	
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

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Approval Levels	Approval Signatures	Date	Approval Levels	Approval Signatures	Date
All 3 Phase Projects require these approvals	☑ Project Manager: J. M. Robinson	6/1/06	Project direct cost > $1M	☑ Senior Vice President:	6/27/06
	☑ Project Sponsor:	6/16/06		☐ PEC or PEF President & CEO | Pres. - Progress Ventures | Exec. VP Diversified Ops:	
	☐ PRG Chairperson:			☑ ~~Subsidiary Director or Progress Energy Service Co. Pres. & CEO~~ | Subsidiary Director or Progress Energy, Inc. Pres. & COO:	7/05/06
	☑ Business Services Mgr. or Supervisor Financial Services: G Sue Hardison	6/21/06	Project direct cost > $5 M	☑ Subsidiary ~~Treasurer or Progress Energy, Inc. Treasurer~~:	6/21/06
Project direct cost > $250K	☐ Department Head - DH:			☑ Subsidiary Director of Progress Energy, Inc CFO:	7/13/06
	☑ Department Head - DH, Charge-By Org. (Required for facilities projects): Joel T Kamp Jr	6/12/06		☑ Subsidiary Chairman or Progress Energy, Inc. Chairman & CEO: Robert B McGehee	7/7/06

Return Original to PRG Administrator, who must maintain a file of the signed original: __________

Executed Lease Evaluation Form, FRM-SUBS-01110 must be attached to approval if the recommended project includes a lease.

Signatures as Subsidiary Directors or Officers based on legal entity sponsoring project.

Capital Planning and Control Review (initial and Date): CWP 06/21/06

☐ Initial ☐ Revision (If Checked, enter revision no) ______ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Mayo: Coal Combustion Products Management Plan **Prioritization Category:** Regulatory

Department: Fossil Generation **Location:** Mayo **Charge To:** ______

EESY™ **Record #:** MAYO-06-92210 **Initiation Date** 2006 **Acctng System Phase #:** ______ **Acctng System Master Project #:** ______

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0% ☐ **Emergency** **If Emergency, Authorized By** ______

Project Manager: Robinson, John M. **Project Sponsor:** Gates, Charlie **Benefit Assessment Date:** July 31, 2007

Schedule	☐ Outage Required	Study	Design	Implementation	Source of Funds: Budget X Other
	Start Date		July 1, 2006	June 1, 2009	
	End Date		July 1, 2007	December 31, 2011	Total Direct Cost
Direct Cost	2006	$0	$392,000	$0	$392,000
	2007	$0	$404,000	$0	$404,000
	2009	$0	$0	$2,012,000	$2,012,000
	2010	$0	$0	$8,144,000	$8,144,000
	2011	$0	$0	$8,346,000	$8,346,000
	Project Total	$0	$796,000	$18,502,000	$19,298,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project * If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		B/C Ratio	NPV	Discounted Breakeven Year
Base Case		0.00	($19,780,319)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006-1143		Note: Proforma for entire term must be attached to approval.	
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

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Rev. 9 10/05

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Approval Levels	Approval Signatures	Date	Approval Levels	Approval Signatures	Date
All 3 Phase Projects require these approvals	☑ Project Manager: J. M. Robinson	6/1/06	Project direct cost > $1M	☑ Senior Vice President	6/27/06
	☑ Project Sponsor:	6/16/06		☐ PEC or PEF President & CEO | Pres. - Progress Ventures | Exec. VP Diversified Ops:	
	☐ PRG Chairperson:			☑ Subsidiary Director or Progress Energy Service Co. Pres. & CEO | Subsidiary Director or Progress Energy, Inc. Pres. & COO: William Johnson	7/05/06
	☑ Business Services Mgr. or Supervisor Financial Services: G Sue Harrison	6/8/06	Project direct cost > $5 M	☑ Subsidiary Treasurer or Progress Energy, Inc. Treasurer:	6/21/06
Project direct cost > $250K	☐ Department Head - DH:			☑ Subsidiary Director or Progress Energy, Inc CFO:	7/6/06
	☑ Department Head - DH, Charge-By Org. (Required for facilities projects): Joel Y Kamya	6/12/06		☑ Subsidiary Chairman or Progress Energy, Inc. Chairman & CEO: Robert B McGehee	7/7/06

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Executed Lease Evaluation Form, FRM-SUBS-01110 must be attached to approval if the recommended project includes a lease.
Signatures as Subsidiary Directors or Officers based on legal entity sponsoring project.

Capital Planning and Control Review (initial and Date): CLP 06/21/06

☐ Initial ☐ Revision (If Checked, enter revision no) ________ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Cape Fear: Coal Combustion Products Management Plan **Prioritization Category:** Regulatory

Department: Fossil Generation **Location:** Cape Fear **Charge To:** ______

EESY™ **Record #:** CF-06-92213 **Initiation Date** 2006 **Acctng System Phase #:** ______ **Acctng System Master Project #:** ______

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0% ☐ **Emergency** **If Emergency, Authorized By** ______

Project Manager: Robinson, John M. **Project Sponsor:** Gates, Charlie **Benefit Assessment Date:** July 31, 2007

Schedule	☐ Outage Required	Study	Design	Implementation	Source of Funds: Budget X Other
	Start Date		July 1, 2006	June 1, 2009	
	End Date		July 1, 2007	December 31, 2011	Total Direct Cost
Direct Cost	2006	$0	$571,000	$0	$571,000
	2007	$0	$588,000	$0	$588,000
	2009	$0	$0	$1,629,000	$1,629,000
	2010	$0	$0	$7,150,000	$7,150,000
	2011	$0	$0	$7,348,000	$7,348,000
	Project Total	$0	$1,159,000	$16,127,000	$17,286,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project* If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		**B/C Ratio**	**NPV**	**Discounted Breakeven Year**
Base Case		0.00	($17,434,117)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006-1141		Note: Proforma for entire term must be attached to approval.	
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

FRM-SUBS-00690
Rev. 9 10/05

Report Generated: 5/30/2006 3:22:11PM

Approval Levels	Approval Signatures	Date	Approval Levels	Approval Signatures	Date
All 3 Phase Projects require these approvals	☑ Project Manager: J. M. Robinson	6/1/06	Project direct cost > $1M	☑ Senior Vice President:	6/27/06
	☑ Project Sponsor:	6/16/06		☐ PEC or PEF President & CEO | Pres. - Progress Ventures | Exec. VP Diversified Ops:	
	☐ PRG Chairperson:			☑ ~~Subsidiary Director or Progress Energy Service Co. Pres. & CEO~~ | Subsidiary Director or Progress Energy, Inc. Pres. & COO:	7/05/06
	☑ Business Services Mgr. or Supervisor Financial Services: G Sue Anderson	6/8/06	Project direct cost > $5 M	☑ Subsidiary Treasurer or Progress Energy, Inc. Treasurer:	6/21/06
Project direct cost > $250K	☐ Department Head - DH:			☑ Subsidiary Director or Progress Energy, Inc CFO:	7/6/06
	☑ Department Head - DH, Charge-By Org. (Required for facilities projects): Joel Y K	6/12/06		☑ Subsidiary Chairman or Progress Energy, Inc. Chairman & CEO: Robert B McGehee	7/7/06

Return Original to PRG Administrator, who must maintain a file of the signed original:____________________________

Executed Lease Evaluation Form, FRM-SUBS-01110 must be attached to approval if the recommended project includes a lease.
Signatures as Subsidiary Directors or Officers based on legal entity sponsoring project.

Capital Planning and Control Review (initial and Date): ____________________________________

☐ Initial ☐ Revision (If Checked, enter revision no) ________ Phase: ☐ Study ☒ Design ☐ Implement

Project Title: Lee: Coal Combustion Products Management Plan **Prioritization Category:** Regulatory

Department: Fossil Generation **Location:** Lee **Charge To:** ______

EESY™ **Record #:** LEE-06-92216 **Initiation Date** 2006 **Acctng System Phase #:** ______ **Acctng System Master Project #:** ______

Account Class: O&M 5.0% Capital 95.0% Fuel 0.0% ☐ **Emergency** **If Emergency, Authorized By** ______

Project Manager: Robinson, John M. **Project Sponsor:** Gates, Charlie **Benefit Assessment Date:** July 31, 2007

Schedule	☐ Outage Required	Study	Design	Implementation	Source of Funds: Budget X Other
	Start Date		July 1, 2006	June 1, 2009	
	End Date		July 1, 2007	December 31, 2011	Total Direct Cost
Direct Cost	2006	$0	$319,000	$0	$319,000
	2007	$0	$329,000	$0	$329,000
	2009	$0	$0	$660,000	$660,000
	2010	$0	$0	$3,382,000	$3,382,000
	2011	$0	$0	$3,764,000	$3,764,000
	Project Total	$0	$648,000	$7,806,000	$8,454,000

		Before-Tax $
Will there be obsolete inventory as a result of the project that will require the write-off of inventory* If yes, enter $ value in the box	☐ Yes ☐ No	
Will new inventory be added as a result of the project * If yes enter the $ value in the box.	☐ Yes ☐ No	

* Notify Business Unit Financial Services support, Manager, Property Plant and Materials Accounting, Director-Supply chain and CSD Salvage Group. Discuss in detail below.

Economic Analysis		B/C Ratio	NPV	Discounted Breakeven Year
Base Case		0.00	($9,226,707)	9999
If > $5M	Best Case Scenario			
	Worst Case Scenario			
	Treasury Control #: 2006 - 1142	Note: Proforma for entire term must be attached to approval.		
Other Metrics	Regulation: Fine Frequency: Fine: $0			

We, the undersigned, agree that the project assumptions are reasonable and key risks have been identified and accurately considered.

Approvals: Thresholds based on total project direct costs. All must sign in sequence.

FRM-SUBS-00690
Rev. 9 10/05

Report Generated: 5/30/2006 3:22:43PM

Approval Levels	Approval Signatures	Date	Approval Levels	Approval Signatures	Date
All 3 Phase Projects require these approvals	☑ Project Manager: J. M. Robinson	6/1/06	Project direct cost > $1M	☑ Senior Vice President	6/27/06
	☑ Project Sponsor:	6/16/06		☐ PEC or PEF President & CEO | Pres. - Progress Ventures | Exec. VP Diversified Ops:	
	☐ PRG Chairperson:			☑ ~~Subsidiary Director or Progress Energy Service Co. Pres. & CEO~~ | Subsidiary Director or Progress Energy, Inc Pres. & COO: William D Johnson	7/05/06
	☑ Business Services Mgr. or Supervisor Financial Services: G Sue Harrison	6/8/06	Project direct cost > $5 M	☑ Subsidiary Treasurer or Progress Energy, Inc. Treasurer:	6/21/06
Project direct cost > $250K	☐ Department Head - DH:			☑ Subsidiary Director or Progress Energy, Inc CFO:	7/04/06
	☑ Department Head - DH, Charge-By Org. (Required for facilities projects):	6/12/06		☑ Subsidiary Chairman or Progress Energy, Inc. Chairman & CEO: Robert B McGehee	7/13/06

Return Original to PRG Administrator, who must maintain a file of the signed original:

Executed Lease Evaluation Form, FRM-SUBS-01110 must be attached to approval if the recommended project includes a lease.

Signatures as Subsidiary Directors or Officers based on legal entity sponsoring project.

Capital Planning and Control Review (initial and Date): CUP 06/21/06

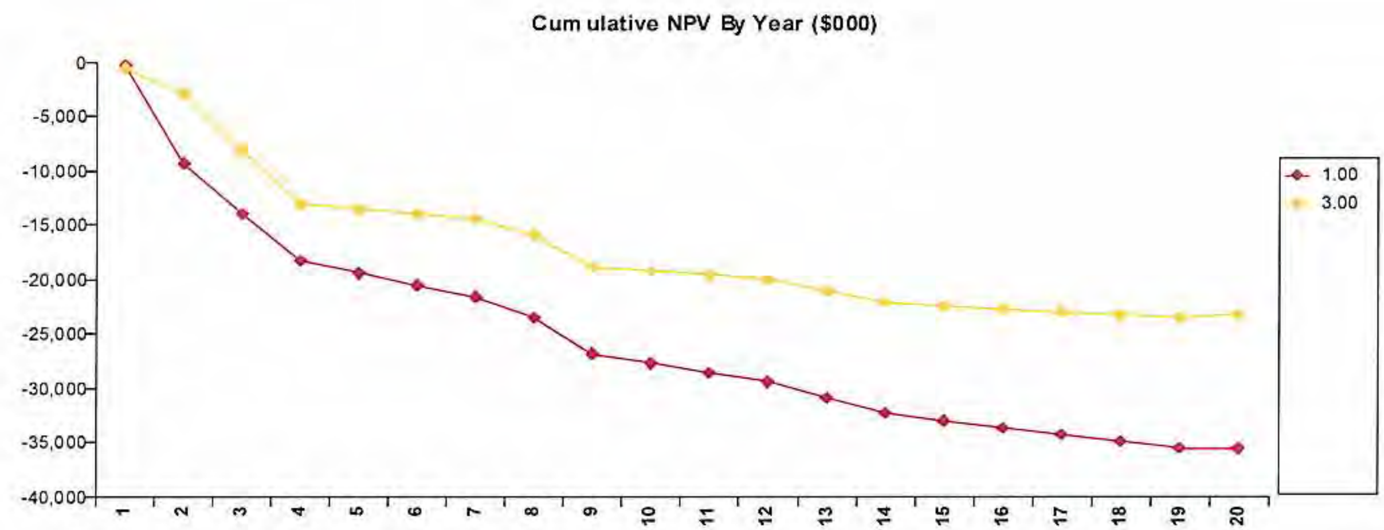
Report Generated: 5/30/2006 3:22:43PM

Asheville – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	DBEP	DBEY
*	3	D2 - Monofill Onsite	-23,303	0	N/A	N/A
	1	D1 - Monofill Offsite	-35,651	0	N/A	N/A
Note: The * indicates the alternative that has been selected for prioritization.						

Cumulative NPV Comparison Chart



Major NPV Components

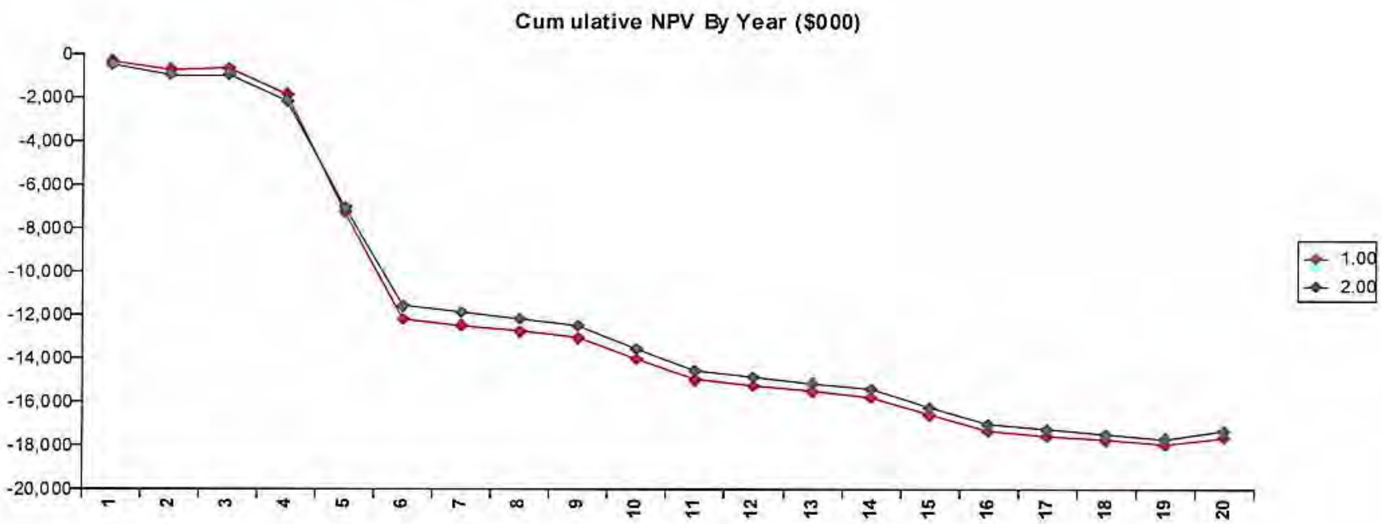
NPV By Item ($000)	
ALTERNATIVE TITLE: D2 - Monofill Onsite	
Item Title	**Expected**
Groundwater Monitoring Req. & Reporting	-21.4
II - Splitter Dike	-27.1
III - Mobililzation/Demobilization	-31.1
III - Intracell Separation System	-34.6
Erosion & Sediment Control	-35.2
II - Mobililzation/Demobilization	-40.6
Closure Cap 2025	-43.5
II - Intracell Separation System	-45.1
Closure Cap 2024	-46.0
Closure Cap 2023	-48.5
Closure Cap 2022	-51.3
I - Splitter Dike	-52.8
Topography Survey & Capacity Monitoring	-53.5
Closure Cap 2021	-54.1
Closure Cap 2020	-57.1
I - Intracell Separation System	-58.6
Closure Cap 2019	-60.3
Closure Cap 2018	-63.6
Closure Cap 2017	-67.0
Closure Cap 2016	-70.7
Closure Cap 2015	-74.6
III - Leachate Management System	-77.8
Closure Cap 2014	-78.6
Closure Cap 2013	-82.9
Closure Cap 2012	-87.4
Closure Cap 2011	-92.1
Closure Cap 2010	-97.1
II - Leachate Management System	-101.5
I - Mobililzation/Demobilization	-105.6
III - Settlement Crown Construction	-147.3
II - Settlement Crown Construction	-192.1
III - Design Phase Work	-205.5
Add'l Markup for Construction During Cont. Ops.	-214.1
PE Labor	-241.3
I - Leachate Management System	-263.9
II - Design Phase Work	-268.0
Post Closure Maint. & Monitoring	-334.5
Contractor's Profit	-344.8
Pore Water Management Improvements	-351.9
Re-Route In-Plant Drains	-351.9
Transmission Line Relocation	-374.5
I - Settlement Crown Construction	-499.6
Back-Up Wet Disposal System	-527.8
III - Composite Liner	-713.1
Design Phase Work	-771.0
II - Composite Liner	-930.1
Bottom Ash Dewatering Bins	-1,208.5
Contingency - Unknown Items	-2,177.2
Total CCP Operations Cost	-2,298.4
I - Composite Liner	-2,419.1
Dry Fly Ash Conversion	-2,689.3
Transportation	-4,019.6
TOTAL NPV	**-23,303**

Cape Fear – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	NBC RATIO	DBEP	DBEY
	2	D2 - Monofill On Existing Pond	-17,434	0	-0.46	N/A	N/A
	1	D1 - New Monofill Offsite	-17,696	0	-0.45	N/A	N/A
Note: The * indicates the alternative that has been selected for prioritization.							

Cumulative NPV Comparison Chart



Major NPV Components

NPV By Item ($000)	
ALTERNATIVE TITLE: D2 - Monofill On Existing Pond	
Item Title	**Expected**
Dry Ash Conversion	-3,914.3
Transportation	-2,189.7
Total CCP Operations Cost	-1,909.4
I - Composite Liner	-1,782.3
Contingency - Unknown Items	-1,652.8
II - Composite Liner	-684.5
Design Phase Work	-649.2
III - Composite Liner	-524.1
Deferral Costs	-466.2
Pore Water Management Improvements	-316.9
Contractor's Profit	-286.4
Post Closure Maint. & Monitoring	-276.2
I - Settlement Crown Construction	-276.0
PE Labor	-263.3
I - Leachate Management System	-237.6
II - Design Phase Work	-203.0
Add'l Markup for Construction During Cont. Ops.	-175.1
III - Design Phase Work	-155.4
II - Settlement Crown Construction	-106.0
I - Mobilization/Demobilization	-95.1
II - Leachate Management System	-91.3
III - Settlement Crown Construction	-81.2
Closure Cap 2012	-71.5
III - Leachate Management System	-69.9
Closure Cap 2013	-67.8
Closure Cap 2014	-64.3
Closure Cap 2015	-61.0
Closure Cap 2016	-57.9
Closure Cap 2017	-54.9
I - Intracell Separation System	-52.8
Closure Cap 2018	-52.0
Closure Cap 2019	-49.3
Closure Cap 2020	-46.7
Closure Cap 2021	-44.3
Topography Survey & Capacity Monitoring	-44.2
Closure Cap 2022	-41.9
II - Intracell Separation System	-40.6
Closure Cap 2023	-39.7
Closure Cap 2024	-37.6
II - Mobilization/Demobilization	-36.5
Closure Cap 2025	-35.6
Erosion & Sediment Control	-31.7
III - Intracell Separation System	-31.1
III - Mobilization/Demobilization	-27.9
Clear and Grub Area	-21.4
Groundwater Monitoring Req. & Reporting	-17.7
TOTAL NPV	**-17,434**

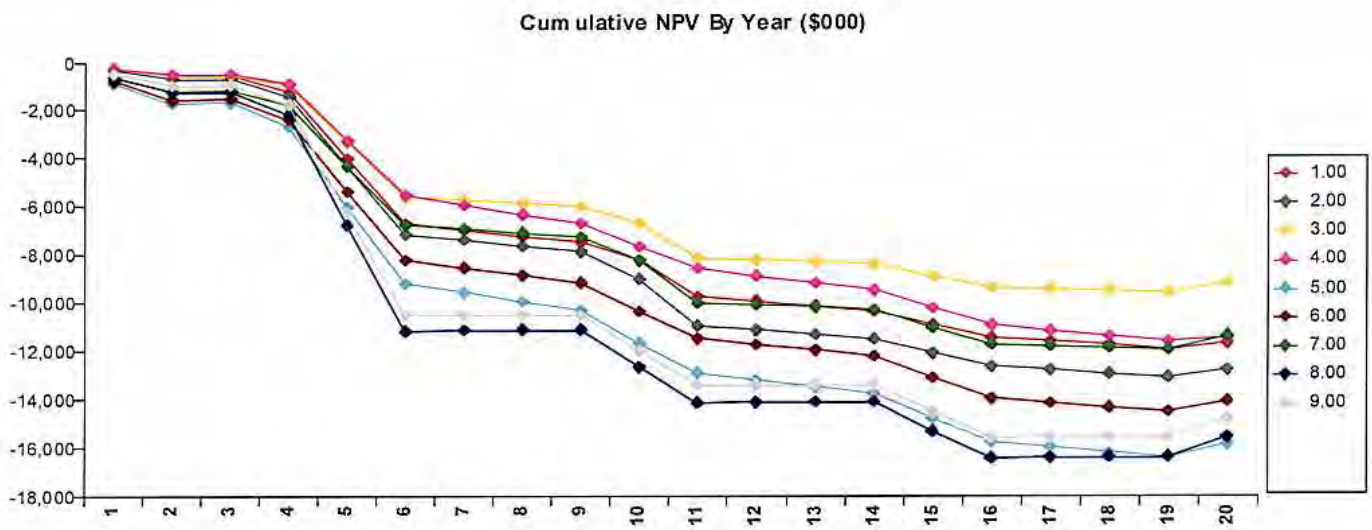
Lee – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	DBEP	DBEY
*	3	W1 - New Lined Pond	-9,227	0	N/A	N/A
	7	W4 - Dike Extensions on Existing Pond Over Separatory Liner	-11,430	0	N/A	N/A
	4	W2 - Multiple Cycled Lined Ponds & Monofill Disposal	-11,517	0	N/A	N/A
	1	D1 - New Monofill Onstie	-11,747	0	N/A	N/A
	2	D2 - Monofill on Existing Pond Over Separatory Liner	-12,862	0	N/A	N/A
	6	W3B - Ash Pond Excavation & Restacking Over Separatory Liner	-14,132	0	N/A	N/A
	9	W6 - Geotubes Over Separate Lined Structure	-14,847	0	N/A	N/A
	8	W5 - Geotubes Stacked on Existing Pond Over Separatory Liner	-15,615	0	N/A	N/A
	5	W3A - Ash Pond Excavation, Monofill Disposal, and Pond Relining	-15,913	0	N/A	N/A

Note: The * indicates the alternative that has been selected for prioritization.

Cumulative NPV Comparison Chart



Major NPV Components

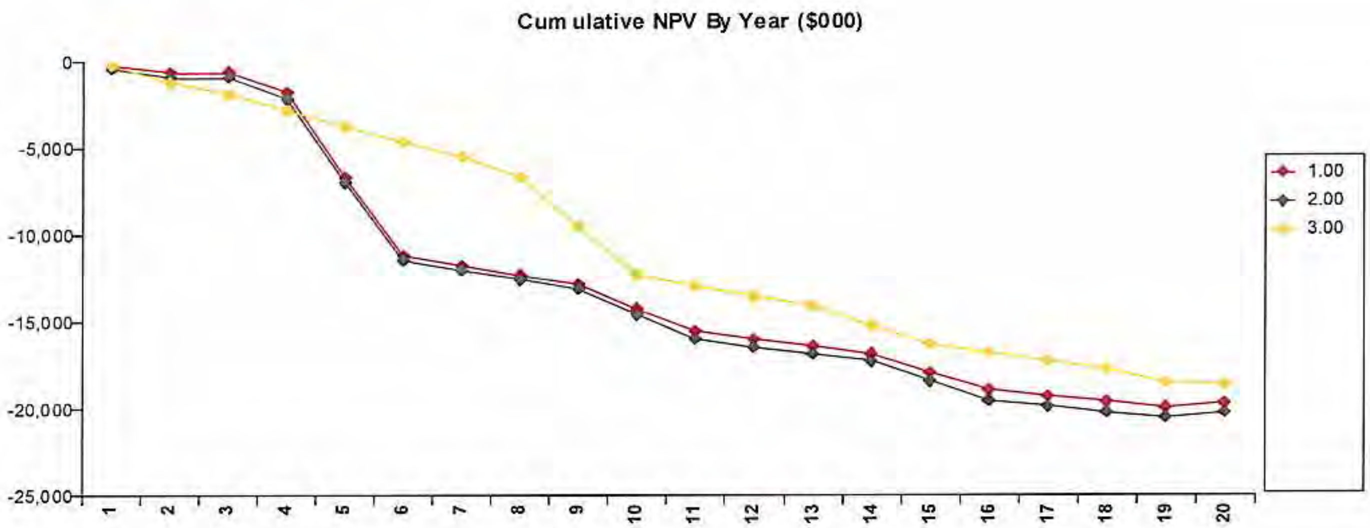
NPV By Item ($000)	
ALTERNATIVE TITLE: W1 - New Lined Pond	
Item Title	Expected
III - Mobilization/Demobilization	-9.3
II - Mobilization/Demobilization	-12.2
Groundwater Monitoring Req. & Reporting	-17.7
Contractor's Profit	-31.6
I - Mobilization/Demobilization	-31.7
Topography Survey & Capacity Monitoring	-44.2
Ash Pumping System Upgrade	-46.6
Closure Cap 2025	-63.3
Closure Cap 2024	-66.9
Closure Cap 2023	-70.6
Closure Cap 2022	-74.6
Closure Cap 2021	-78.7
Closure Cap 2020	-83.1
Closure Cap 2019	-87.6
Clear and Grub Area	-91.3
Erosion & Sediment Control	-91.3
Closure Cap 2018	-92.5
Closure Cap 2017	-97.5
III - Design Phase Work	-102.3
Closure Cap 2016	-102.9
Closure Cap 2015	-108.5
Restacking - Deferral Cost	-113.6
Closure Cap 2014	-114.4
Closure Cap 2013	-120.6
Closure Cap 2012	-127.1
Discharge Management	-132.6
II - Design Phase Work	-135.2
III - Dike: Earthwork + Finish Grading	-144.9
II - Dike: Earthwork + Finish Grading	-189.3
Total CCP Operations Cost	-210.4
Transportation (wet: sluiced)	-216.7
PE Labor	-231.8
Post Closure Maint. & Monitoring	-276.2
III - Composite Liner	-372.7
Design Phase Work	-432.4
II - Composite Liner	-486.8
I - Dike: Earthwork + Finish Grading	-492.9
Piping Config/Construction	-774.4
Initial Earthwork - Excavation	-883.4
Contingency - Unknown Items	-1,100.1
I - Composite Liner	-1,267.4
TOTAL NPV	-9,227

Mayo – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	DBEP	DBPY
	3	D3 - Monofill with Initial FGD Transportation to Roxboro	-18,694	0	N/A	N/A
*	1	D1 - New Monofill Onsite	-19,780	0	N/A	N/A
	2	D2 - Monofill on Existing Pond Over Separatory Liner	-20,333	0	N/A	N/A
Note: The * indicates the alternative that has been selected for prioritization.						

Cumulative NPV Comparison Chart



Major NPV Components

NPV By Item ($000)	
ALTERNATIVE TITLE: D1 - New Monofill Onsite	
Item Title	Expected
Groundwater Monitoring Req. & Reporting	-16.6
III - Mobilization/Demobilization	-27.9
III - Intracell Separation System	-31.1
II - Mobilization/Demobilization	-36.5
II - Intracell Separation System	-40.6
Topography Survey & Capacity Monitoring	-44.2
Closure Cap 2025	-48.4
Closure Cap 2024	-51.1
I - Intracell Separation System	-52.8
Closure Cap 2023	-54.0
Closure Cap 2022	-57.0
Closure Cap 2021	-60.2
Closure Cap 2020	-63.5
Closure Cap 2019	-67.0
III - Lechate Management System	-69.9
Closure Cap 2018	-70.7
Clear & Grub Area	-74.1
Closure Cap 2017	-74.6
Closure Cap 2016	-78.7
Closure Cap 2015	-82.9
Closure Cap 2014	-87.5
II - Lechate Management System	-91.3
Closure Cap 2013	-92.2
I - Mobilization/Demobilization	-95.1
Closure Cap 2012	-97.2
Dry Ash Conversion	-113.6
III - Design Phase Work	-130.6
Erosion & Sediment Control	-148.3
Deferral Costs - Roxboro Capital 2009	-163.2
II - Design Phase Work	-170.6
PE Labor	-231.8
I - Lechate Management System	-237.6
Post Closure Maint. & Monitoring	-259.9
Contractor's Profit	-286.4
Deferral Costs - Roxboro Capital 2011	-390.8
Deferral Costs - Roxboro Capital 2010	-446.7
Design Phase Work	-545.7
Initial Earthwork - Excavation	-717.7
III - Composite Liner	-757.0
II - Composite Liner	-988.8
Deferral Costs - Roxboro O&M	-1,209.1
Contingency - Unknown	-1,388.6
Interim - Truck to Roxboro	-1,657.4
Total CCP Operations Cost	-1,909.4
I - Composite Liner	-2,574.4
Transportation	-3,887.7
TOTAL NPV	**-19,780**

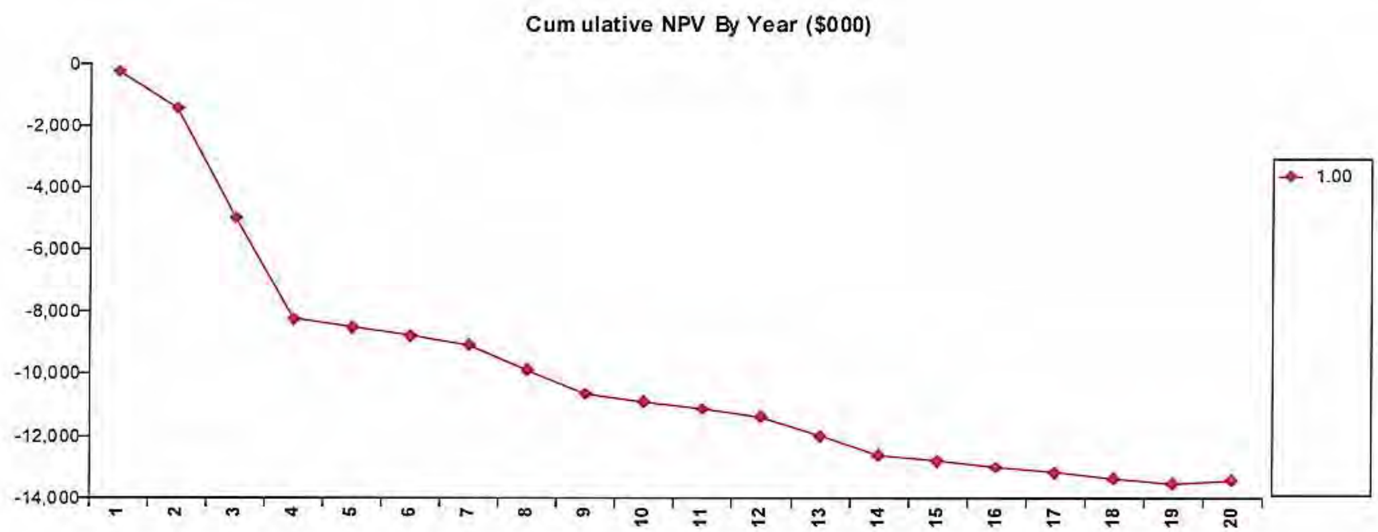
Robinson – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	DBEP	DBE?
*	1	D1 - New Monofill Onsite	-13,463	0	N/A	N/A

Note: The * indicates the alternative that has been selected for prioritization.

Cumulative NPV Comparison Chart



Major NPV Components

NPV By Item ($000)	
ALTERNATIVE TITLE: D1 - New Monofill Onsite	
Item Title	**Expected**
Groundwater Monitoring Req. & Reporting	-21.4
Closure Cap 2025	-23.7
Closure Cap 2024	-25.1
Closure Cap 2023	-26.5
Closure Cap 2022	-28.0
Closure Cap 2021	-29.5
III - Mobilization/Demobilization	-31.1
Closure Cap 2020	-31.1
Closure Cap 2019	-32.9
Closure Cap 2018	-34.7
Closure Cap 2017	-36.6
Clear & Grub Area	-38.0
Closure Cap 2016	-38.6
II - Mobilization/Demobilization	-40.6
Closure Cap 2015	-40.7
Closure Cap 2014	-42.9
Closure Cap 2013	-45.2
Closure Cap 2012	-47.7
Closure Cap 2011	-50.2
Closure Cap 2010	-52.9
Topography Survey & Capacity Costs	-53.5
Erosion & Sediment Control	-76.0
III - Lechate Management System	-77.8
II - Lechate Management System	-101.5
I - Mobilization/Demobilization	-105.6
III - Design Phase Work	-113.9
II - Design Phase Work	-148.5
Initial Earthwork - Excavation	-177.1
PE Labor	-241.3
I - Lechate Management System	-263.9
Post Closure Maint. & Monitoring	-334.5
Contractor's Profit	-344.8
III - Composite Liner	-389.0
Design Phase Work	-427.3
II - Composite Liner	-507.3
Contingency - Unknown	-1,207.3
I - Composite Liner	-1,319.5
Transportation	-1,388.9
Total CCP Operations Cost	-2,298.4
Dry Fly Ash Conversion	-3,170.1
TOTAL NPV	**-13,463**

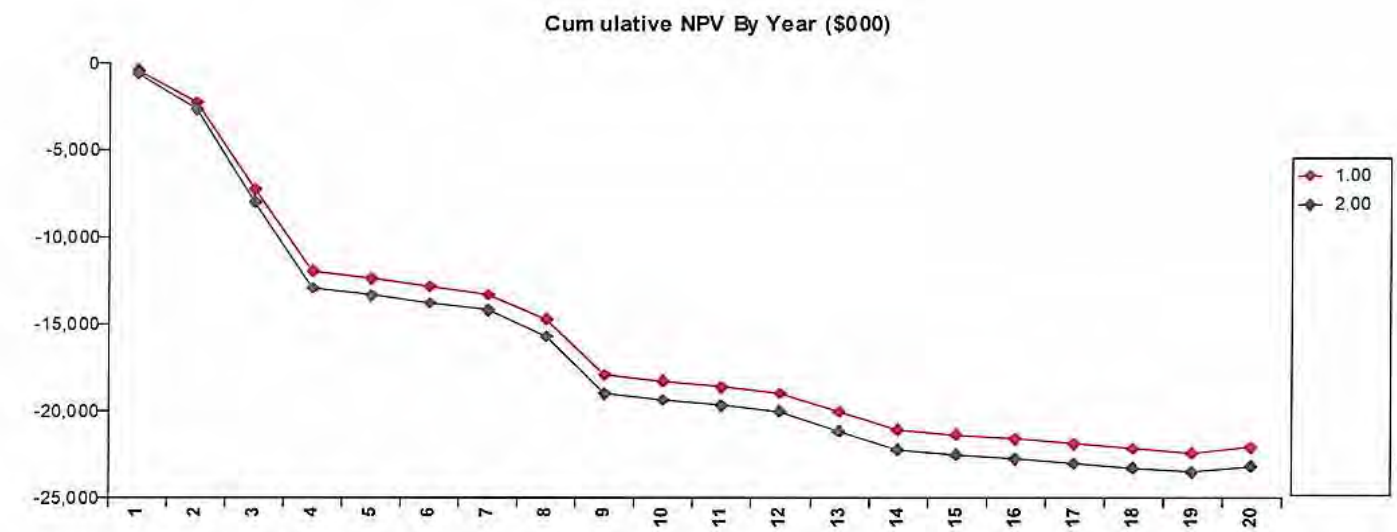
Sutton – Economic Analysis Detail

NPV of Analyzed Alternatives

	Alt #	Alternative Title	NPV ($000)	BC RATIO	DBEP	DB[illegible]Y
*	1	D1 - New Monofill Onsite	-22,190	0	N/A	N/A
	2	D2 - Monofill Sited on Existing Pond	-23,268	0	N/A	N/A

Note: The * indicates the alternative that has been selected for prioritization.

Cumulative NPV Comparison Chart



Major NPV Components

NPV By Item ($000)	
ALTERNATIVE TITLE: D1 - New Monofill Onsite	
Item Title	**Expected**
Groundwater Monitoring Req. & Reporting	-21.4
III - Mobilization/Demobilization	-31.1
III - Intracell Separation System	-34.6
II - Mobilization/Demobilization	-40.6
II - Intracell Separation System	-45.1
Closure Cap 2025	-47.5
Closure Cap 2024	-50.1
Closure Cap 2023	-53.0
Topography Survey & Capacity Monitoring	-53.5
Closure Cap 2022	-55.9
I - Intracell Separation System	-58.6
Closure Cap 2021	-59.0
Closure Cap 2020	-62.3
Closure Cap 2019	-65.7
Closure Cap 2018	-69.3
Closure Cap 2017	-73.1
Clear & Grub Area	-76.0
Closure Cap 2016	-77.1
III - Lechate Management System	-77.8
Closure Cap 2015	-81.3
Closure Cap 2014	-85.8
Closure Cap 2013	-90.4
Closure Cap 2012	-95.3
Closure Cap 2011	-100.5
II - Lechate Management System	-101.5
I - Mobilization/Demobilization	-105.6
Closure Cap 2010	-105.9
Erosion & Sediment Control	-152.0
Initial Earthwork - Excavation	-170.3
III - Design Phase Work	-206.2
PE Labor	-241.3
I - Lechate Management System	-263.9
II - Design Phase Work	-268.9
Post Closure Maint. & Monitoring	-334.5
Contractor's Profit	-344.8
Design Phase Work	-773.7
III - Composite Liner	-777.9
II - Composite Liner	-1,014.6
Bottom Ash Dewatering Bins	-1,546.4
Contingency - Unknown	-2,184.5
Total CCP Operations Cost	-2,298.4
I - Composite Liner	-2,639.0
Dry Fly Ash Conversion	-3,490.7
Transportation	-3,664.7
TOTAL NPV	**-22,190**

Coal Combustion Products (CCP)

Roles & Responsibilities

(As agreed upon per Progress Energy departments)

Technical Services Section (TSS), Strategic Engineering Unit

- Collaborate with Plant Construction to optimize environmental compliance strategies
- Develop and maintain a 20-year CCP management plan. Update yearly based on GFF, fuel strategies, and VISTA modeling
- Maintain data on current CCP disposal costs by plant.
- Track disposal area usage and expected life
- Improve combustion processes in generating plants to improve CCP quality
- Evaluate new technologies for disposal, positive re-use of CCP, and CCP quality improvement
- Provide engineering input on potential re-uses of CCP
- Develop technical specifications for inclusion in CCP sales/re-use contracts
- Determine appropriate technical responses to CCP management programs based on changes in environmental regulations
- Participate in industry groups for technology transfer and benchmarking – such as American Coal Ash Association (ACAA)
- Chair and provide at least 1 member on the CCP Review team.

Regulated Fuels Department, By-Products and Reagents Unit (BPRU)

- Develop and implement a business plan to optimize beneficial reuse, mitigate risk associated with reuse and minimize reliance upon onsite CCP disposal.
- Serve as Designated Representative for CCP disposal, transportation, sales contracts
- Develop and manage contracts for CCP re-use
- Document and report monthly on CCP production and beneficial reuse.
- Participate in industry groups for the purpose of technology transfer and benchmarking – such as American Coal Ash Association (ACAA)
- Outline and/or create an internal decision and management approval process to evaluate CCP beneficial reuse opportunities.
- Provide at least 1 member on the CCP Review team.

Environmental Services Section (ESS)

- Rank CCP beneficial reuses according to environmental risk.
- Provide environmental and permitting support to the company, the plants, and the CCP Review Team
- Provide overall measurement, monitoring and reporting regime to ensure regulatory compliance of CCP disposal and re-use program
- Provide updates on environmental regulatory changes that affect or will affect current CCP management
- Provide biannual regulatory updates to all stakeholders
- Work in conjunction with Public Affairs to influence positive regulatory climate for disposal and re-use
- Procure funding for, and participate in EPRI Coal Combustion Product target areas
- Develop forward-looking advice regarding potential regulations impacting beneficial reuse.
- Participate in the Utility Solid Waste Activities Group (USWAG)
- Provide at least 1 member on the CCP Review team.

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing *Late-Filed Exhibit Nos. 17, 19 and 21* as filed in Docket No. E-2, Sub 1219, were served via electronic delivery or mailed, first-class, postage prepaid, upon all parties of record.

This, the 2nd day of November, 2020.

/s/Mary Lynne Grigg
Mary Lynne Grigg
McGuireWoods LLP
501 Fayetteville Street, Suite 500
PO Box 27507 (27611)
Raleigh, North Carolina 27601
Telephone: (919) 755-6573
mgrigg@mcguirewoods.com

Attorney for Duke Energy Progress, LLC

Plant Construction Department (PCD)

- Conduct and/or oversee the study, design and implementation phases of any new on-site or off-site CCP disposal facility. Provide project management services.
- Budget for individual plant disposal options (Capital).
- Conduct searches for off-site CCP disposal facilities, if needed.
- Provide at least 1 member on the CCP Review team.

Fossil Generation Department, Regional Engineering and Plants

- Identify and resolve operational issues related to increase in CCP production
- Budget for individual plant disposal options (O&M)
- Provide project management for disposal project implementation
- Provide at least 1 member per region to CCP Review team.

Ad-Hoc Resources to CCP Project Review Team:

Capital Planning

- Provide capital funding for study, design, permitting and construction of CCP disposal facilities. (Monofills will be developed in 5-yr cells.)
- Assist with preparation of any three-phase project authorizations and/or Business Analysis Plans (BAPs).

Legal/Regulatory

- Assist with negotiations to minimize legal liabilities and ensure regulatory compliance.
- Provide periodic support and attendance as requested to CCP Review team.

Accounting

- Ensure financial systems, processes, and procedures correctly account for and document CCP transactions.
- Annually update CCP Review team on any accounting changes that may impact CCP management decisions.

Public Affairs

- Influence positive regulatory, community climate for reuse