



SPECIFICATION COVER SHEET

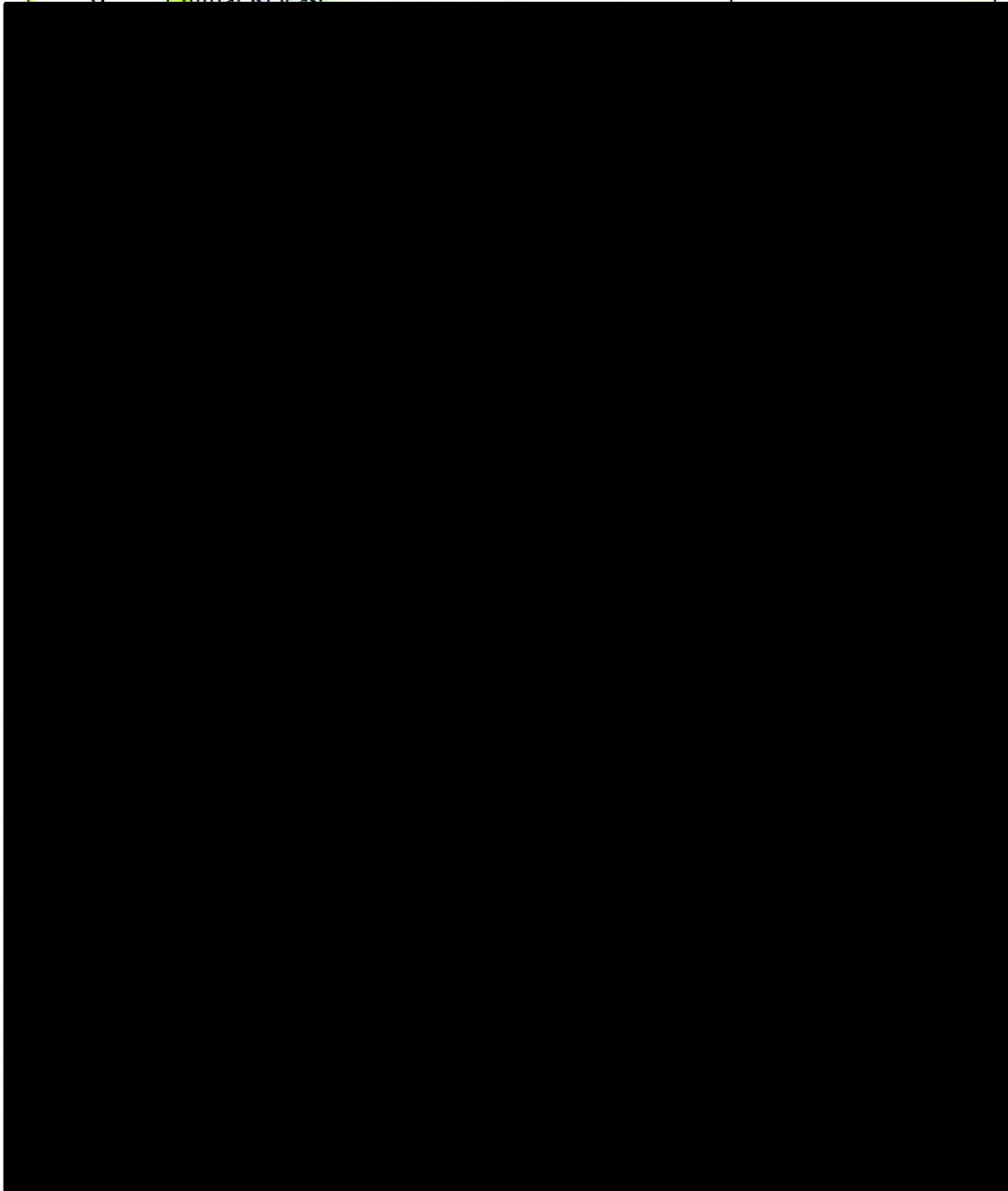
TITLE: Performance Specification for Limestone Wet Flue Gas Desulfurization (WFGD) System

SPECIFICATION NUMBER: BS-12-AECE-093004

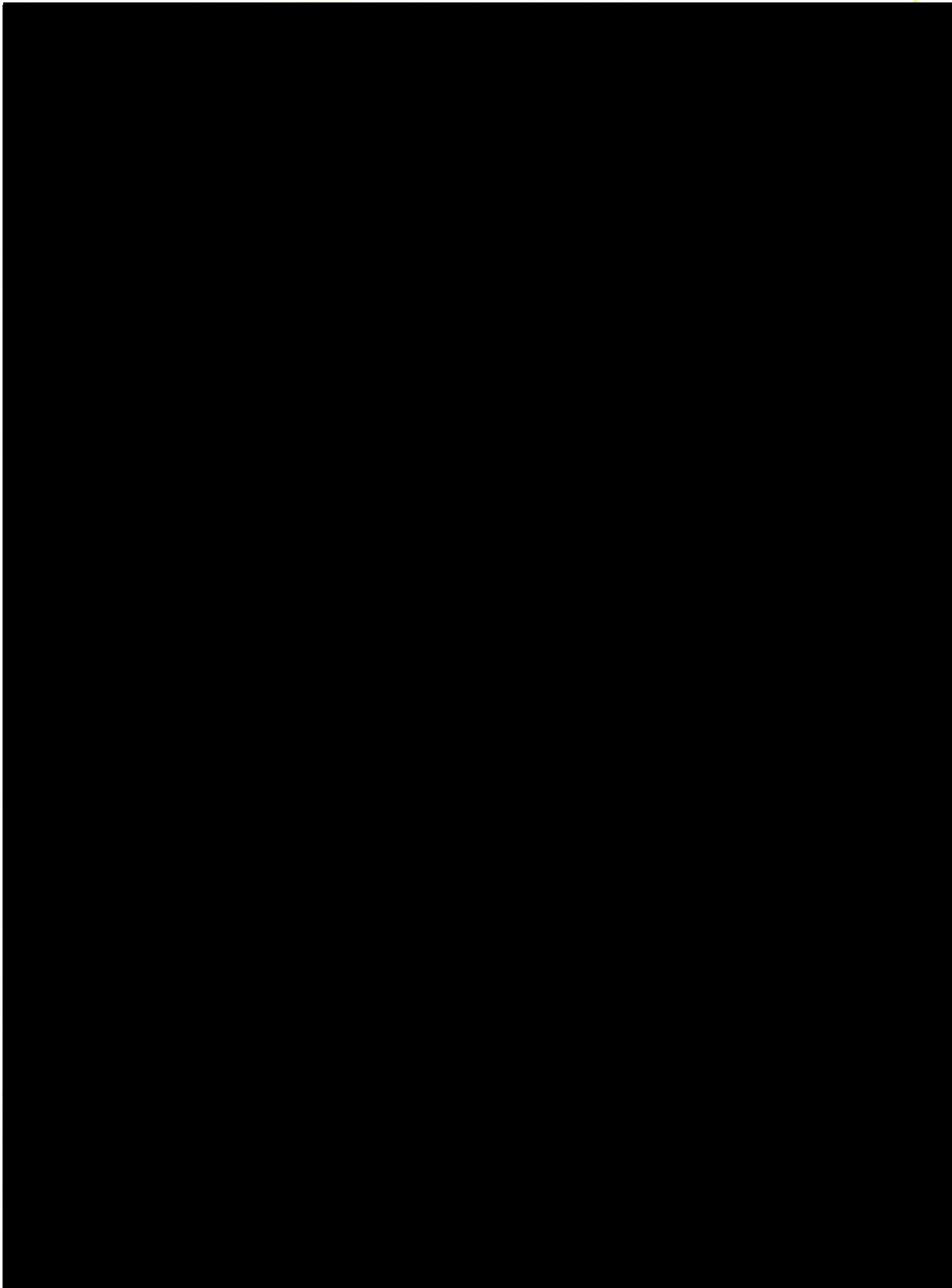
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AUTHOR: L.G.Robinson / T.E.Kaforey			<i>T.E.Kaforey</i> 6/10/05
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APPROVAL: E.M.Pfund			<i>E.M.Pfund</i> 6/10/05

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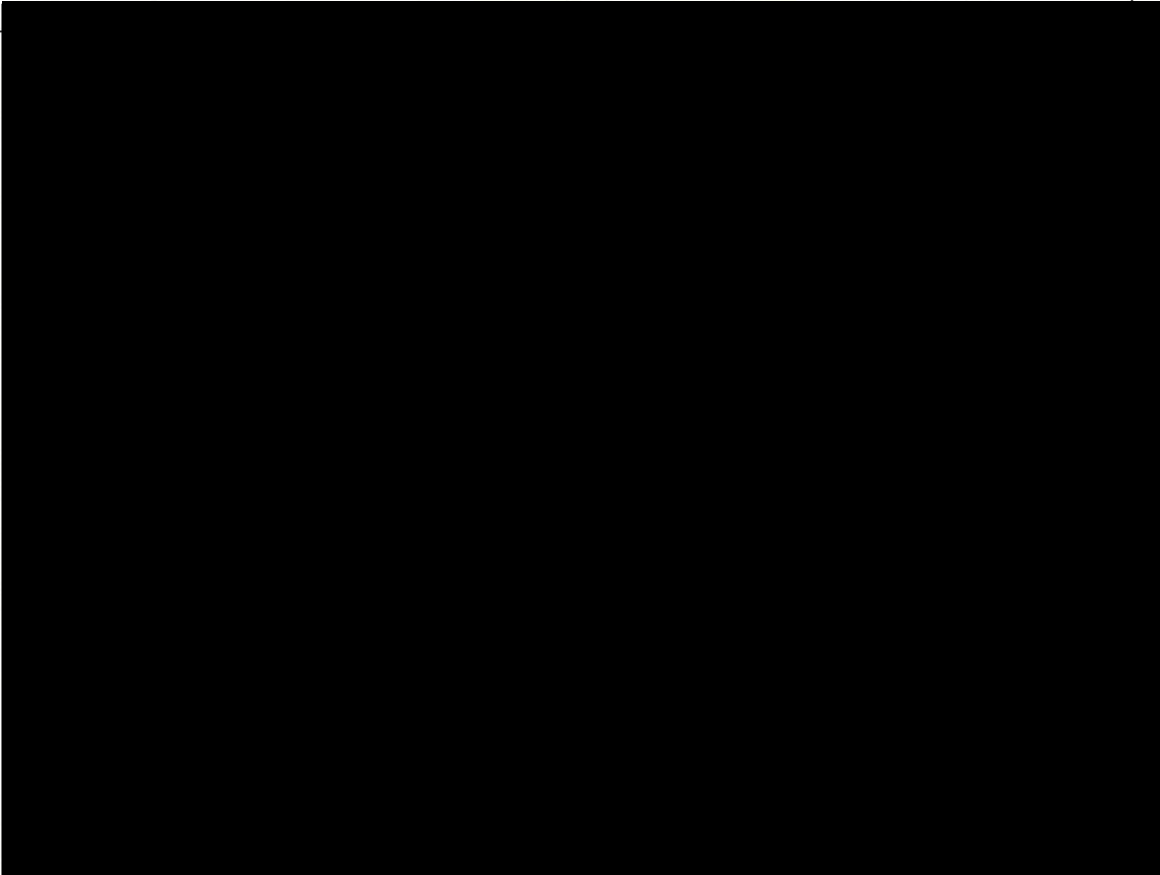


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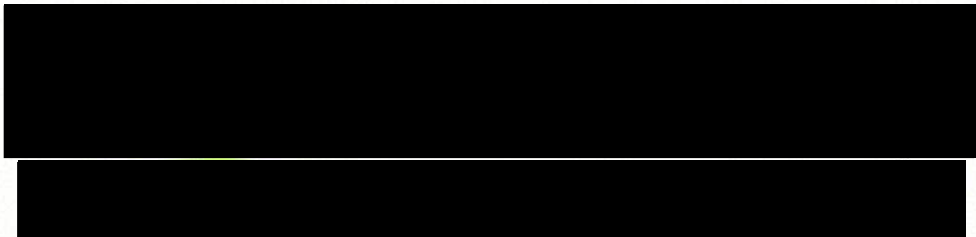
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1.0 PURPOSE

The purpose of this specification is to establish the requirements for the engineering, design, fabrication, delivery, start-up, guarantee and performance of equipment, materials and components for a limestone forced oxidation wet flue gas desulfurization (WFGD) system for the American Electric Power coal fired generating Units 1 & 2 at Big Sandy Plant. Unit 1 is a 260 MW unit, and Unit 2 is an 800 MW Unit.

It is the Owner's intent to buy a limestone forced oxidation WFGD System that will meet the required performance specifications, provide the capability for producing landfill quality gypsum as a byproduct, operate with a high degree of availability and reliability, provide ease of access for maintenance and require low maintenance during all modes of operation throughout the life of the facility. The flue gas from both units must be treated independently of each other, but the system shall be designed to share reagent preparation and dewatering systems. The Unit 1 absorber module is to be offered as an incremental option, however the reagent preparation and dewatering systems are to be sized to accommodate both units. The Owner must have the ability to perform major repairs on any of the system's equipment with one unit out of service.

It is also the intent of the Owner for the Seller to utilize to the greatest extent possible, standard sized equipment and arrangements (absorber modules, pumps, fans, motors, instruments, ball mills, agitators, etc.) that give the Owner the capability for interchangeable equipment and spare parts with other Limestone WFGD Systems on the American Electric Power System.

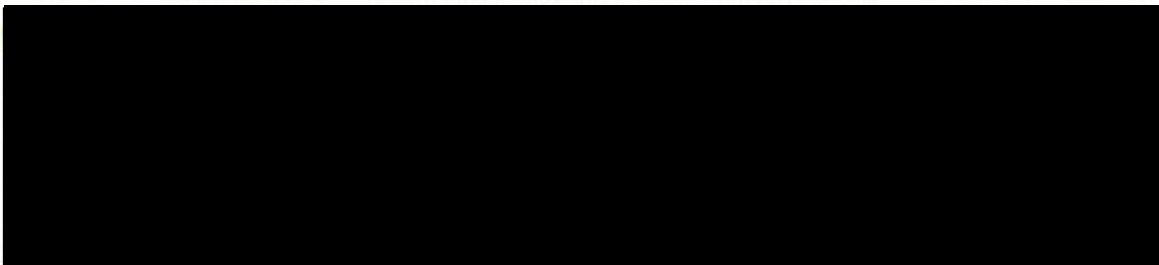
This specification consists of eight (8) sections. The Seller Scope Of Work Section summarizes the Seller's responsibilities. The Owner Scope Of Work Section summarizes the equipment and services provided by the Owner. Technical Requirements Section identifies the design basis requirements for the WFGD System. Performance Guarantees, Acceptance Testing Section specifies the required performance guarantees and the testing to determine compliance. Miscellaneous Deliverables After Contract Award Section specifies the additional Seller deliverables and services that are required after award of the contract. Proposal Requirements Section specifies all information and data that must be submitted as part of the Seller's proposal. The Attachment Section includes the proposal data/information sheets and other supplemental information necessary to understand the Seller's scope of supply.

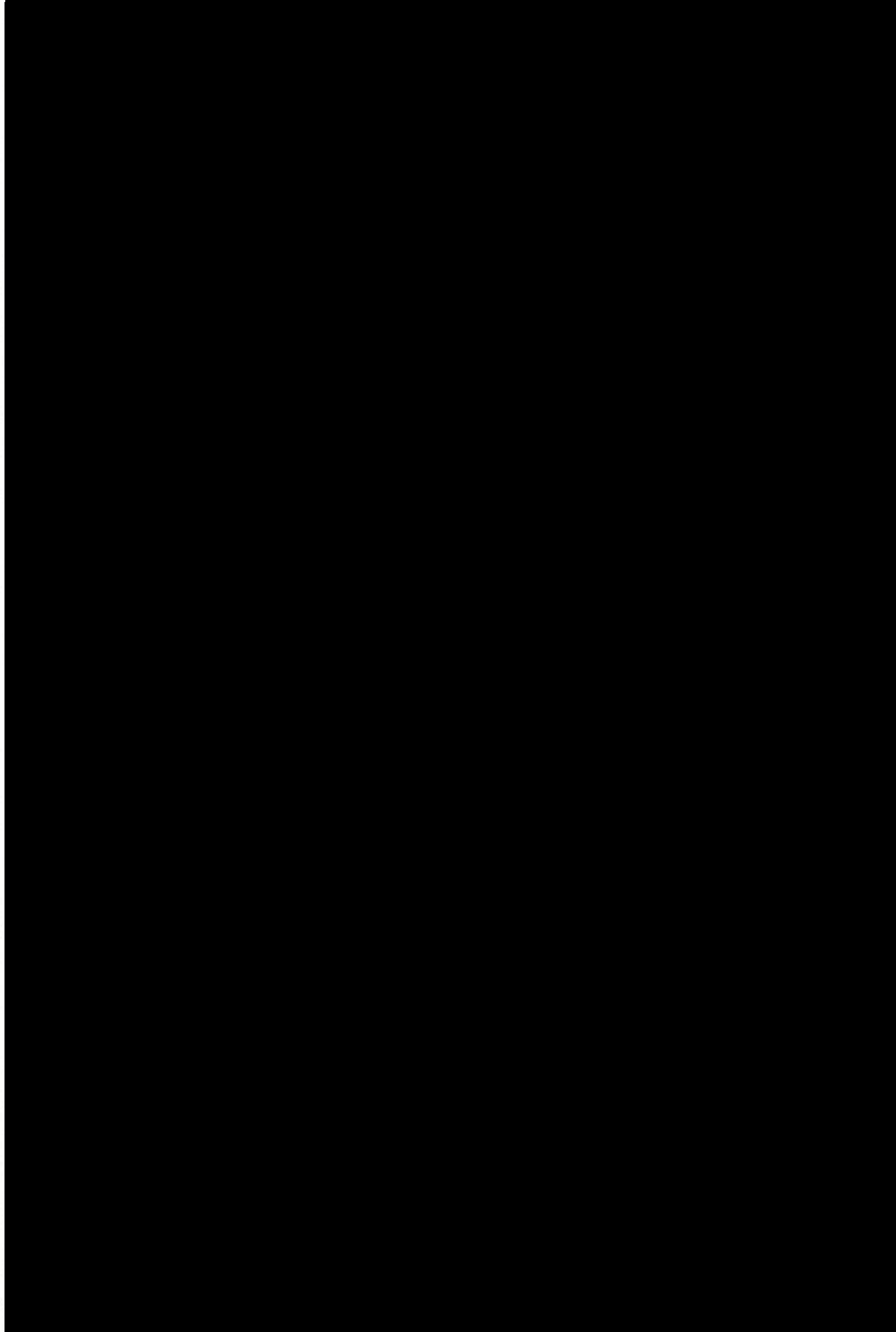
2.0 SELLER SCOPE OF WORK

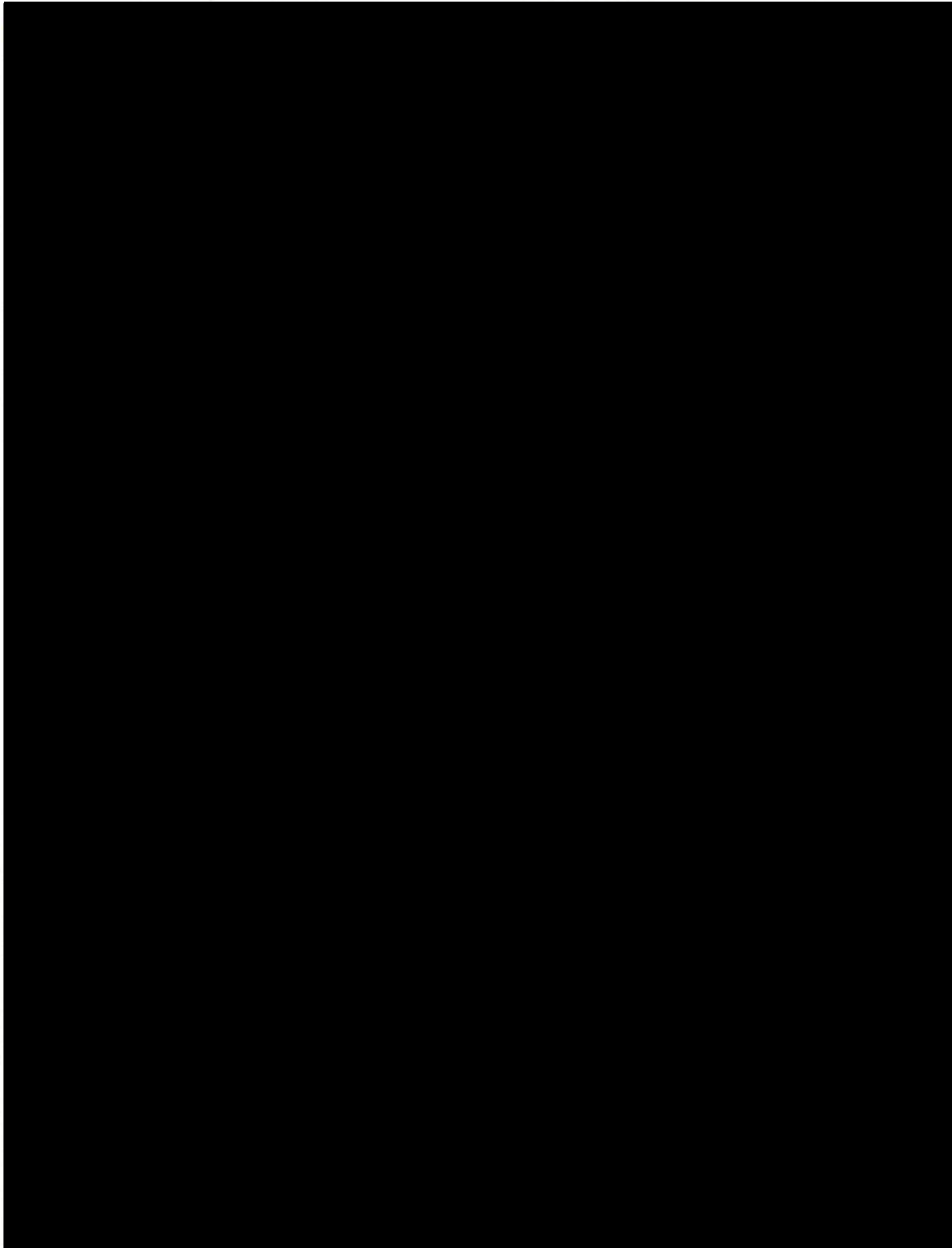
This section of the specification covers the general scope of work for the Seller. See table 1 for division of work.

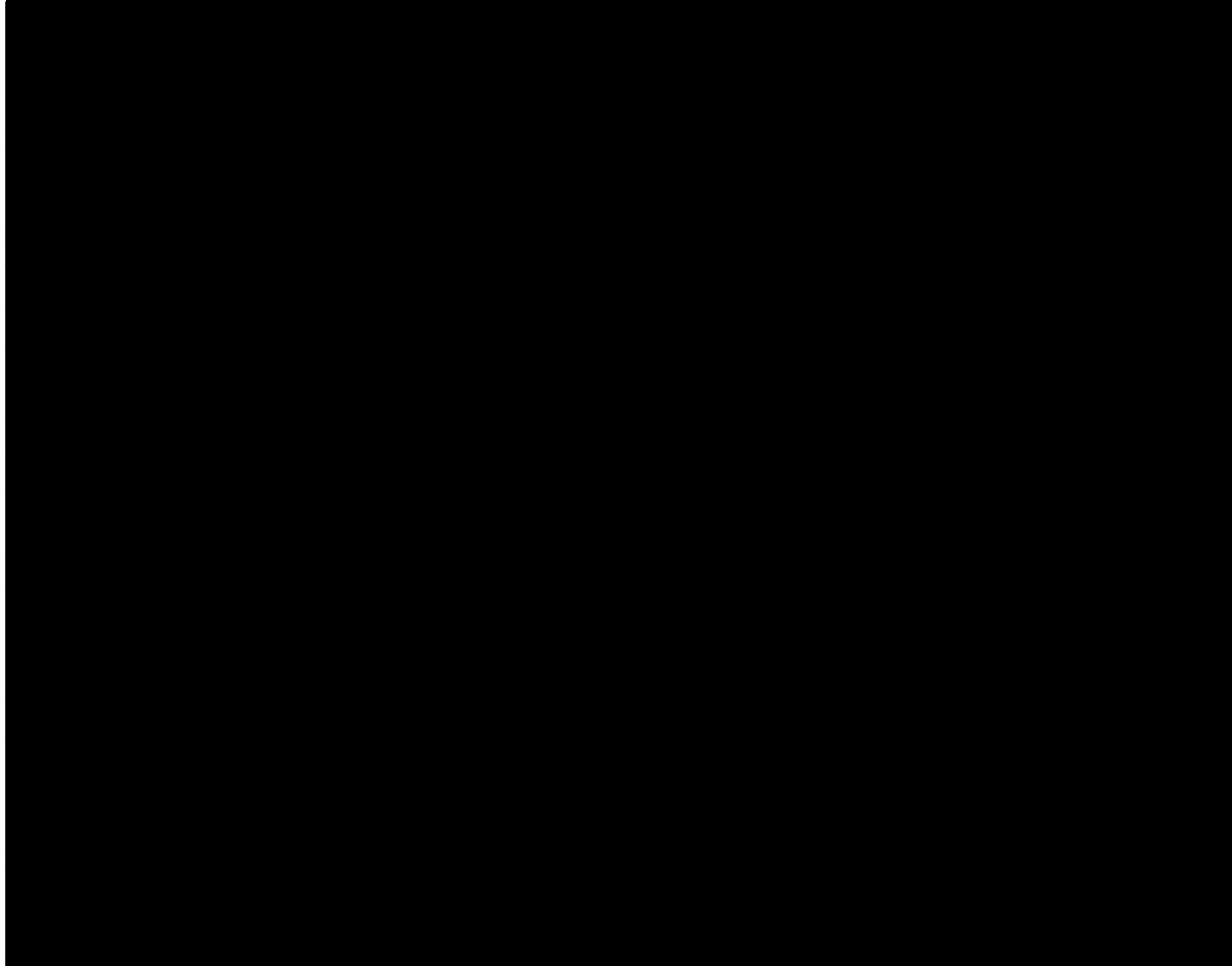
2.1 WFGD SYSTEM EQUIPMENT

The Seller shall engineer, design and deliver WFGD system equipment, components and materials necessary to meet the technical requirements stated in Section 4.0, performance and guarantee requirements stated in Section 5.0 and miscellaneous deliverable requirements stated in Section 6.0. This includes, but is not limited to, the following equipment and materials:









2.1.5 AUXILIARY PLANT SERVICES

The Owner will provide to each process island all required auxiliary plant services such as service water, seal water, compressed air, purge disposal, fire protection water, etc. The Seller shall provide one (1) flanged connection at each process island for connection to the Owner's auxiliary service with the exception of fire protection water. The Owner shall design, furnish, and install all required fire protection distribution system(s).

The Seller shall also design and supply all distribution piping, valves and instrumentation necessary for supply of these auxiliary services to the equipment and components within the specified Islands as furnished under this specification.

2.1.6 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

The Seller shall design and supply all HVAC equipment, components and material necessary for FGD process equipment within their scope of supply. Ventilation air shall be designed for a minimum of six air changes per hour.

2.1.7 DUST COLLECTION

The Seller shall design and supply all dust collection equipment, components and material necessary for limestone day bin storage silos, limestone feeders and any other FGD process

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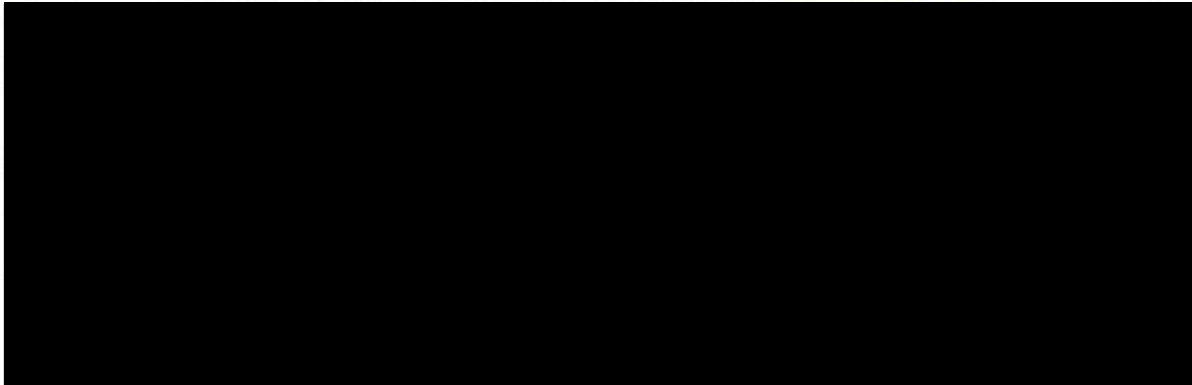
equipment within their scope of supply. Dust collection shall conform to applicable environmental regulations.

2.1.8 HOUSEKEEPING

The Owner shall supply adequate maintenance compressed air and water hose wash stations to facilitate washing and housekeeping activities in all islands at all elevations, where appropriate.

2.1.9 HANGERS AND SUPPORTS

The Owner is responsible for hangers and supports design.



2.1.11 INSULATION AND FREEZE PROTECTION

The Owner is responsible for design and supply all thermal insulation and freeze protection necessary for all equipment and components furnished under this specification.

2.1.12 PROTECTIVE COATINGS

All steel components (stair towers, ladders, rails, etc.) need to be protected by either painting or galvanizing. All external process vessel and tank stiffeners, etc. need to be primed.

2.2 ENGINEERING SERVICES AND INFORMATION

The Seller shall provide information to allow the Owner to interface and design all auxiliary plant services.

The Seller shall provide the information necessary for the Owner to design all other systems, equipment, structural steel, foundations, buildings & structures, etc. outside of the Seller's scope of supply, but necessary to interface with the Seller's scope of supply.

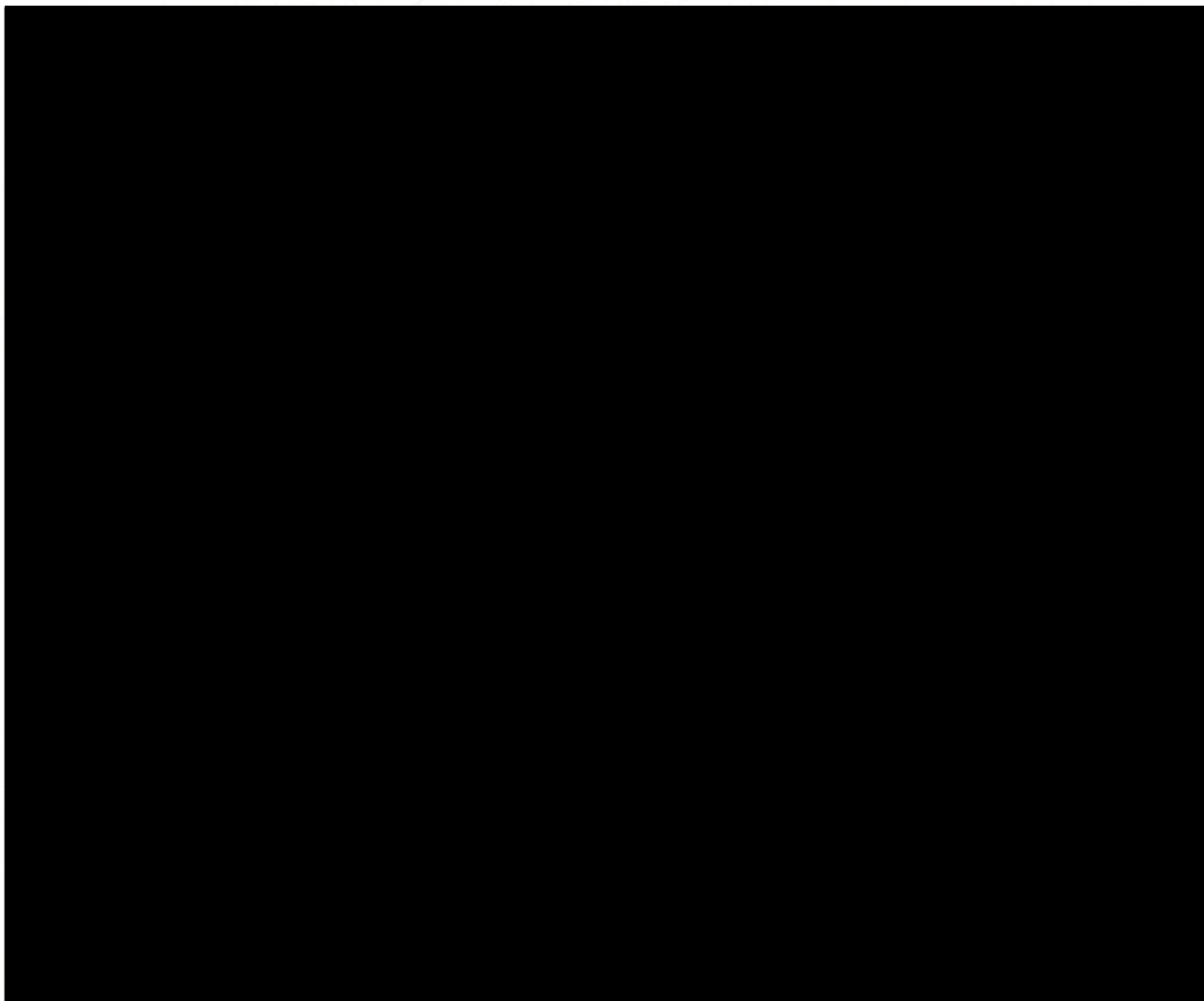
The Seller shall provide all drawings and documentation necessary for erection, checkout, start-up and acceptance testing of the WFGD System.

The Seller shall provide all engineering services necessary for erection, checkout, start-up and acceptance testing of the WFGD System.

The Seller shall provide all technical services necessary to satisfy the various documentation and drawing requirements identified in this specification.

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Seller is responsible for verifying all critical design parameters and dimensions at the existing plant site. This includes any operating parameters and Owner supplied drawing information.



3.0 OWNER SCOPE OF WORK

This section of the specification summarizes the general scope of work for the Owner.

3.1 EQUIPMENT AND PLANT AUXILIARY SERVICES

The Owner will provide the following equipment, materials and plant auxiliary services.

3.1.1 ELECTRICAL

The Owner will provide the auxiliary power system, all necessary cables, conduits, cable trays, connectors and terminations. The service shall be based on the Seller's identification of the design requirements for such service including load requirements, voltage requirements, power feed redundancy requirements, control, protection and monitoring requirements.

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The electrical power sources that will be available for connection to the Seller supplied motors are as follows:

<u>Motor Size</u>	<u>Power Source</u>
hp > 5,000	13.8 kv
200 < hp < 5,000	4.16 kv
5 < hp < 200	480 volt
hp < 5	Use Industry Standard Voltage

3.1.2 AUXILIARY PLANT SERVICES

The Owner will provide all required auxiliary plant services such as service water, seal water, compressed air, instrument air, purge disposal, etc. The Owner will also provide all drinking water, fire water, and plumbing systems. These services shall be based upon the Seller's identification of all requirements necessary for the design of such services.

3.1.3 INSTRUMENTATION AND CONTROLS

The Owner will provide a Distributed Control System (DCS). For each process island, the Owner shall provide a remote I/O cabinet. The Owner shall be responsible for all necessary cable, conduit, cable trays, connectors and termination cabinets for interface with the DCS.

3.1.4 EMISSION MONITORING SYSTEMS

The Owner will provide all required flue gas emission monitoring systems.

3.1.5 INDUCED DRAFT FAN(S)

The Owner will provide any necessary upgrades to the existing FD Fans and provide any new ID or Booster Fan(s) required for the WFGD System.

3.1.6 STACK

The Owner will provide the wet stack or other device used for discharge of the process flue gas leaving the WFGD system.

3.1.7 LIMESTONE UNLOADING AND STORAGE

The Owner will provide the equipment necessary for the receiving, unloading and storage of the limestone delivered to the plant site.

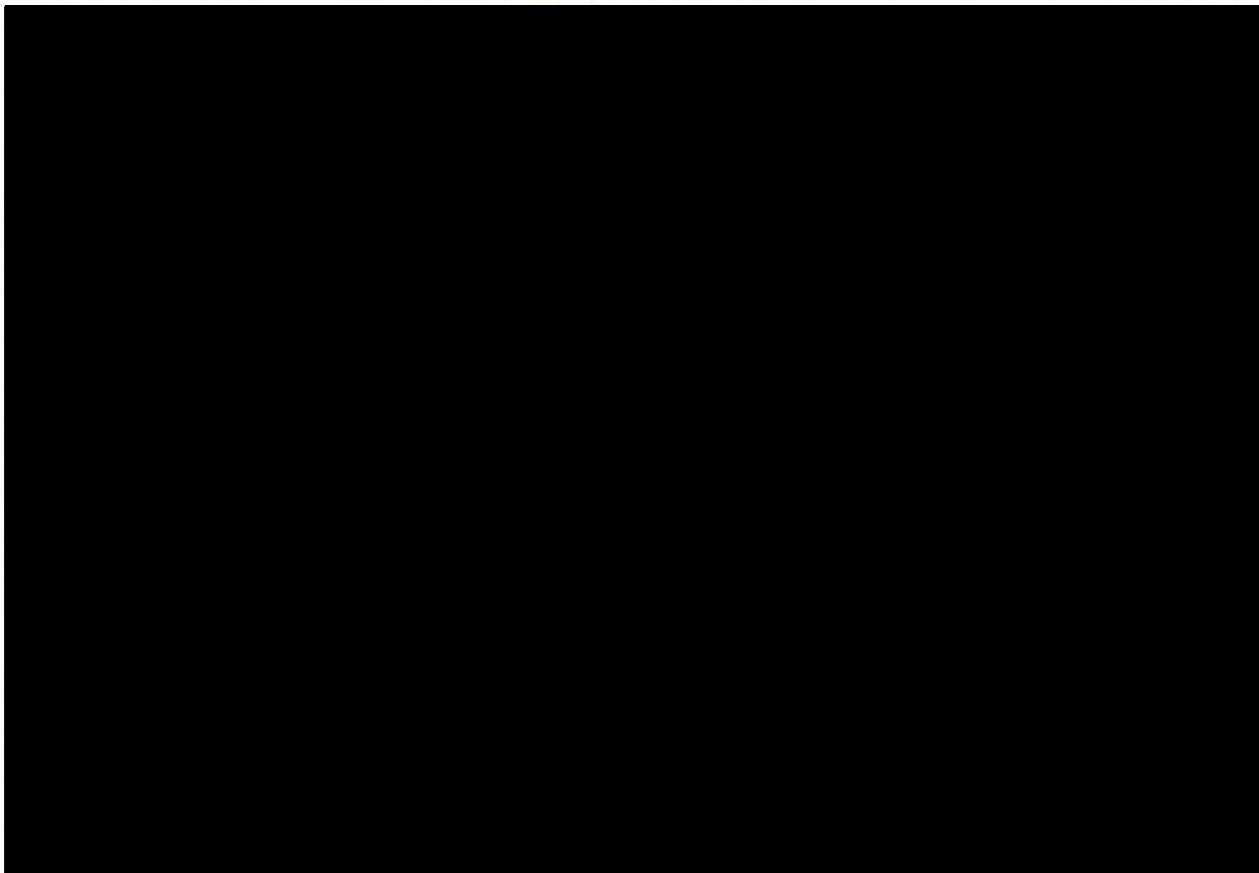
3.1.8 WFGD BY-PRODUCT DISPOSAL

The Owner will be responsible for equipment necessary for WFGD byproduct removal from the discharge of the secondary dewatering device to the final disposal or storage point.

3.1.9 STATION DRAINAGE, ROADWAY AND YARD LIGHTING

The Owner will be responsible for all station drainage, roadways and yard area lighting.

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3.3 OWNER PROVIDED SERVICES

The Owner will supply the following services.

3.3.1 ERECTION

The Owner is responsible for the erection of the Seller supplied equipment and materials not including those items listed in Section 2.4 in accordance with the Seller's erection instructions. The Owner is responsible for the identification and relocation of buried piping and electrical equipment.

As an option, Seller may provide a proposal to erect the equipment and materials supplied under this specification.

3.3.2 ENGINEERING SERVICES

The Owner is responsible for review and acceptance of all Seller and equipment supplier's drawings, flow model protocols and results, erection manuals, operation and maintenance manuals, vendor literature, control procedures and set points, system descriptions, start up procedures, training program and other documentation.

3.3.3 RECEIVING AND HANDLING

The Owner is responsible for the receiving, handling and storage of all Seller supplied equipment and materials in accordance with the Seller's instructions.

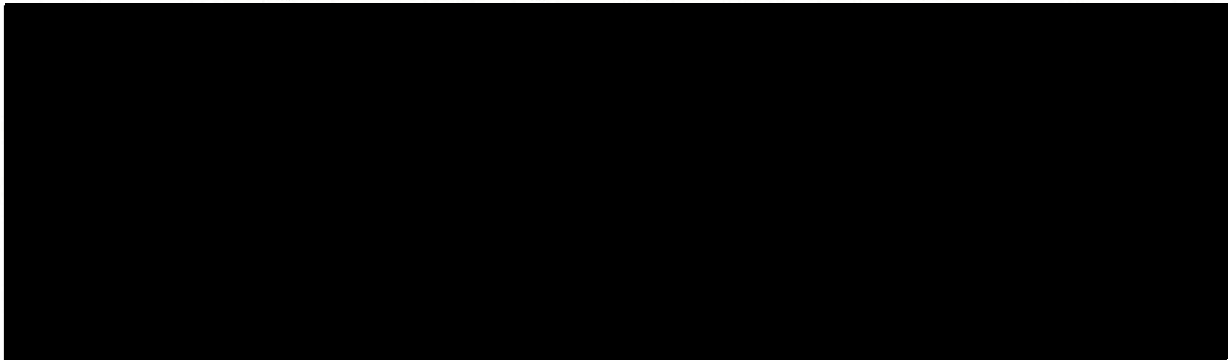
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4.0 TECHNICAL REQUIREMENTS

This section of the specification covers design basis and performance requirements, expected as-fired coal properties, limestone properties, flue gas conditions, equipment arrangement, unit operating conditions and auxiliary plant services available to the WFGD System.

4.1 DESIGN BASIS REQUIREMENTS

The following items establish the design basis requirements for the WFGD System.



4.1.3 SYSTEM PRESSURE DROP

The WFGD System ductwork and JBR absorber module shall be designed in such a way to minimize the flue gas pressure drop. The design pressure drop shall be based on the design pH operating point. It shall be measured to determine the total flue gas pressure drop across the Seller supplied ductwork and the absorber.

4.1.4 EQUIPMENT MODULARIZATION

In order to minimize field construction costs and on-site storage requirements, the WFGD system shall be engineered to maximize the extent of off-site equipment fabrication and component modularization. The modularization concepts must be reviewed and accepted by the Owner. The Seller shall coordinate the delivery of the components with the Owner's erection schedule to minimize on site storage requirements. Owner desires overall least-cost project that includes material/equipment, erection labor and professional services. The proposed modularization and off site fabrication will be evaluated for field construction cost savings and those savings will be taken into account in the Owner's total evaluated life cycle cost review of the Seller's offering.

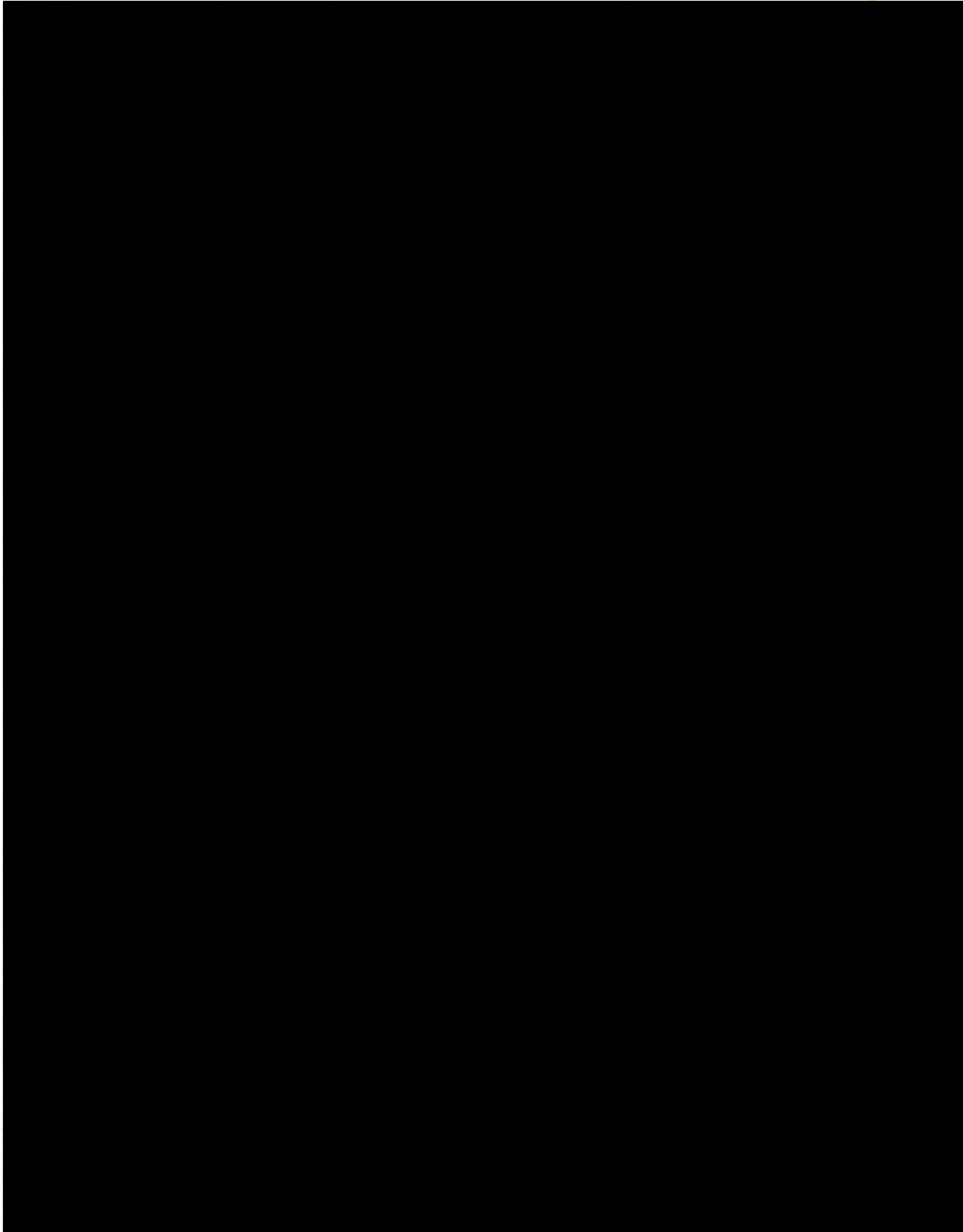
The Seller shall provide drawings of all modularized components and assembly requirements.

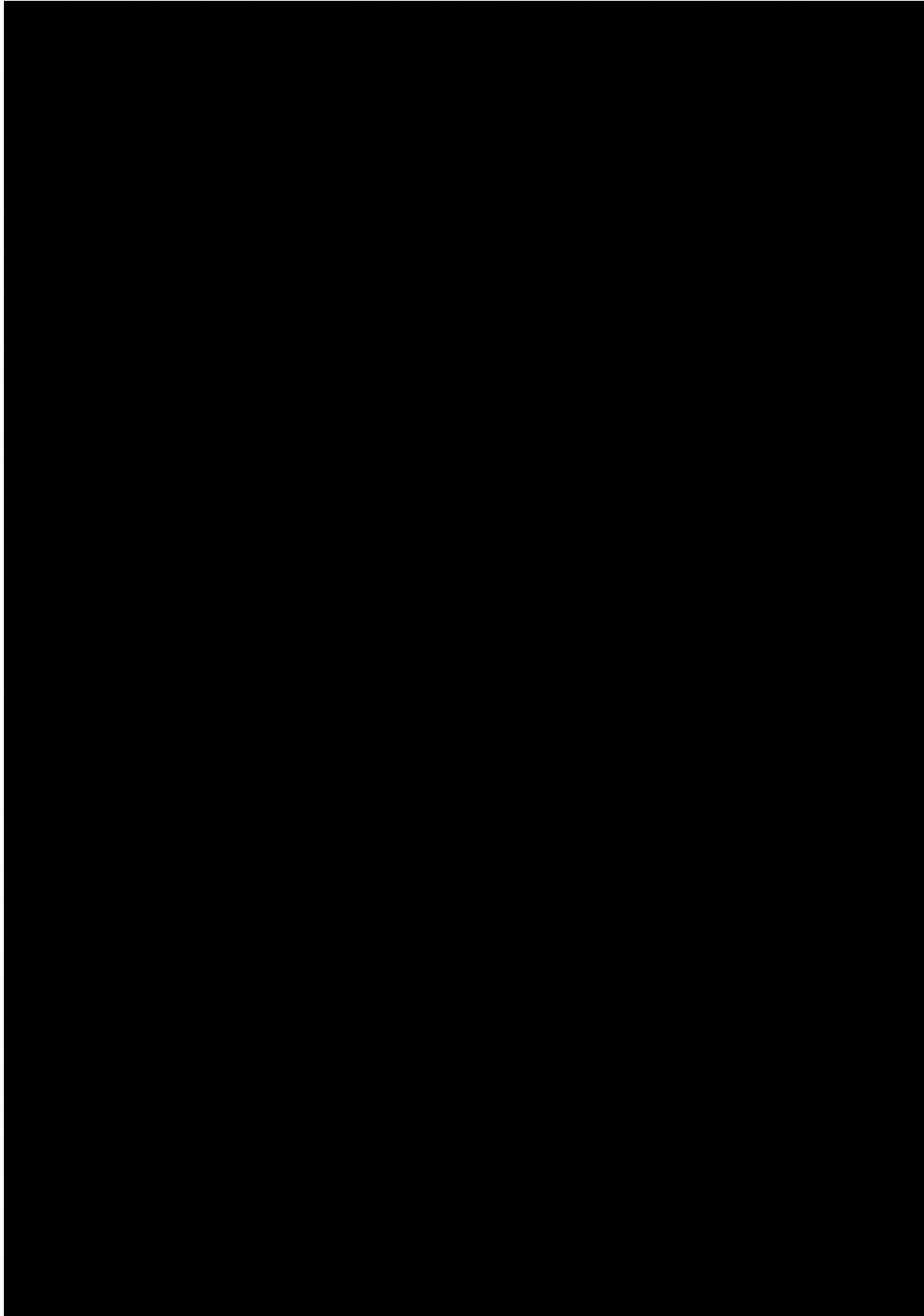
The Seller shall provide all special lifting equipment and beams. The Seller shall also supply all lifting lugs and attachments needed to lift and move the Seller's modular components and material.

4.1.5 STANDARIZED EQUIPMENT

The Seller shall utilize to the greatest extent possible, standard or generic sized equipment and arrangements (absorber modules, pumps, fans, motors, instruments, ball mills, agitators, etc.) that allow for duplicate equipment between Limestone WFGD Systems on other 600, 800 and 1300 MW coal fired generating units at American Electric Power System plants.

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4.1.8

4.1.9

4.1.10 FUEL DATA

The WFGD system for Big Sandy 1 & 2 shall be designed to operate and perform as specified with the steam generators firing any coal whose properties are defined by the ranges stated below in Table A. Big Sandy Units 1 & 2 cannot handle 4.5 lb SO₂/mmBtu without significant boiler modifications. However, the absorber tower shall be designed for 4.5 lb SO₂/mmBtu coal while maintaining the removal rate. Number 2 Fuel Oil meeting ASTM Specification D-396 shall also be used for light-off and flame stabilization periods.

The typical performance coal quality and ash properties expected for Big Sandy Units 1 & 2 WFGD System operation are based upon a fully washed Central Ohio high sulfur coal up to 4.5 lbs SO₂/mmBtu. These are listed below as "Typical" in Table B. The WFGS system must be able to accommodate the broad spectrum of fuels while controlling chlorides, fines and purge water quality. The "Typical", "Maximum" and "Minimum" values shown in Tables A and B are to be used for material balance calculations.

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Coal and Ash Properties

Table A – Design Range for Big Sandy Units 1 & 2

Coal and ash Analysis, As Received, percent (%) by weight	<u>Expected Range</u>	<u>Minimum</u>	<u>Maximum</u>
Sulfur		0.6	3
Moisture	6 - 8	4	10
Ash	Minimum	5	11
Volatile Matter	30 – 42	25	None
Chlorine			0.2
Heating Value, Btu/lb	12,000 - 12,500	11,700	None
# SO2/mmBtu			4.5

Table B – Typical

Proximate Analysis, As Received, Percent (%) by weight	<u>Typical</u>
Fixed Carbon	47.33
Volatile Matter	36.15
Moisture	6.63
Ash	9.89
Total	100.00
Sulfur	2.69
Heating Value, Btu/lb (as-fired)	12,490
# SO2/mmBtu	4.31
Ultimate Analysis, Dry Basis, Percent (%) by weight	<u>Typical</u>
Carbon	74.25
Hydrogen	5.00
Nitrogen	1.43
Chlorine	0.05
Moisture	
Ash	10.59
Sulfur	2.88
Oxygen	5.80
Total	100.00
Ash Analysis, Dry Basis, Percent (%) by weight	<u>Typical</u>
Silica, SiO ₂	20.76
Alumina, Al ₂ O ₃	40.59
Titania, TiO ₂	0.93
Ferric Oxide, Fe ₂ O ₃	28.56
Lime, CaO	2.72
Magnesia, MgO	0.72
Potassium Oxide, K ₂ O	1.67

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Sodium Oxide, Na ₂ O	0.46
Sulfur Trioxide, SO ₃	2.32
Phosphorus Pentoxide, P ₂ O ₅	0.46
Undetermined	<u>0.81</u>
Total	100.00

4.1.11 GENERATING UNIT / STEAM GENERATOR INFORMATION

Big Sandy 1

Full Load Firing Rate	2,604 million BTU/hr
Nominal Unit Rating (Gross / Net)	275 / 260* MW
Boiler Type	Pressurized Dry Bottom
Firing Method	Wall fired
[REDACTED]	[REDACTED]
Annual Starts (Hot / Cold)	6 / 4
[REDACTED]	[REDACTED]
Minimum Load Firing Rate	861 million BTU/hr
Unit Ramp Rate	3 MW/min
Air Heater Type	Ljungstrom Rotary Bi-Sector
Ignition Fuel	#2 Fuel Oil
Particulate Control Device	ESP (cold)
Combustion Control Devices	Low NO _x Burner
Other Emission Control Devices	None
Nominal Flue Gas O ₂ @ Economizer Outlet	3.5 % (by volume – wet)
Max (upset) Flue Gas O ₂ @ Economizer Outlet	4.5 % (by volume – wet)

Big Sandy 2

Full Load Firing Rate	8,180 million BTU/hr
Nominal Unit Rating (Gross / Net)	865 / 800* MW
Boiler Type	Pressurized Dry Bottom
Firing Method	Wall fired
[REDACTED]	[REDACTED]
Annual Starts (Hot / Cold)	6 / 4
[REDACTED]	[REDACTED]
Minimum Load Firing Rate	3,017 million BTU/hr
Unit Ramp Rate (SCR in/out of service)	5 / 10 MW/min
Air Heater Type	Ljungstrom Rotary Tri-Sector
Ignition Fuel	#2 Fuel Oil
Particulate Control Device	ESP (cold)
Combustion Control Devices	Low NO _x Burner
Other Emission Control Devices	SCR (High Dust, 2003)
Nominal Flue Gas O ₂ @ Economizer Outlet	3.5 % (by volume – wet)
Max (upset) Flue Gas O ₂ @ Economizer Outlet	4.5 % (by volume – wet)

4.1.12 FLUE GAS CONDITIONS

The WFGD System shall be designed to treat the expected nominal inlet flue gas conditions downstream of the ESP at full load. The Seller is responsible for validating the expected nominal inlet flue gas conditions.

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Big Sandy 1

Mass Flow	3.044 * million lbs/hr wet
Volumetric Flow Rate	1,020,483 * acfm (at 350°F & 0" H ₂ O static pressure)
Average Flue Gas Temperature	350 ° F
Flue Gas Particulate Loading	0.236 lb/MMBtu
Percent of Flue Gas Treated	100 %
Flue Gas SO ₃	ppmv (ozone season)
Flue Gas NOx	0.50 lb/MMBtu **

Big Sandy 2

Mass Flow	9.71 * million lbs/hr wet
Volumetric Flow Rate	3,255,758 * acfm (at 350°F & 0" H ₂ O static pressure)
Average Flue Gas Temperature	350 ° F
Flue Gas Particulate Loading	0.236 lb/MMBtu
Percent of Flue Gas Treated	100 %
Flue Gas SO ₃	27 ppmv (ozone season)
Flue Gas NOx (SCR in/out of service)	0.114 / 0.09 lb/MMBtu



4.1.14 WFGD BY-PRODUCT DATA

The WFGD System shall be designed with the operational flexibility to dewater the gypsum to the level that will allow truck transport to a landfill. The dewatered gypsum shall meet the Kentucky Landfill Gypsum Specification identified in the table below:

Kentucky Landfill Gypsum Specification.

<u>Parameter</u>	<u>Limit</u>	<u>Reporting Basis & Unit</u>	<u>Reference Test Method</u>	<u>Testing Frequency</u>	<u>Testing Facility</u>
Free Water	15%	As-received (%, by weight)	ASTM C471 - Section 7	Daily	Plant

4.1.15 WATER BALANCE AND SUPPLY

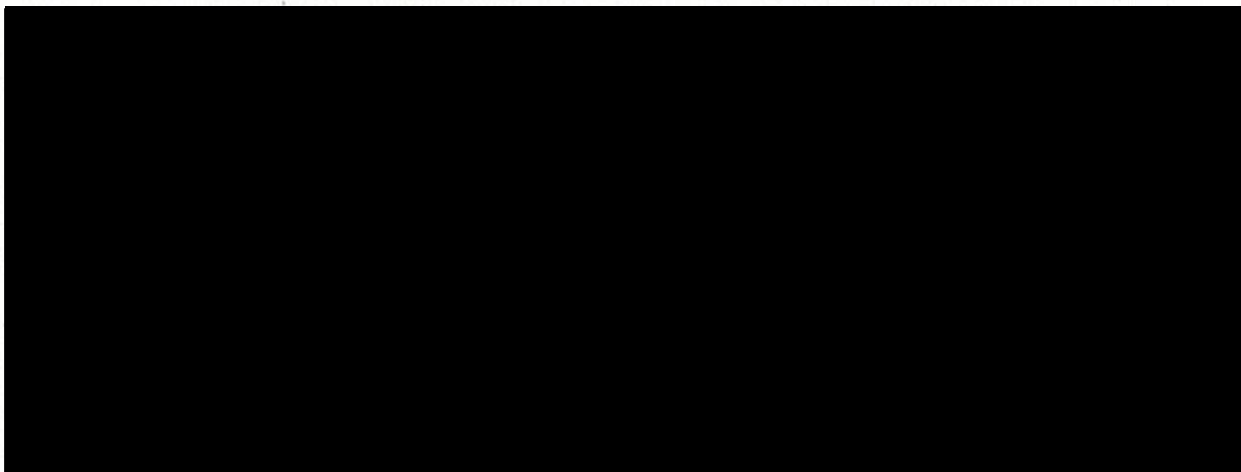
The WFGD System shall be designed to operate with the only water losses permitted being by evaporation, purge stream and that leaving with the WFGD by-product. The water balance shall be designed in such a manner that the requirements for fresh makeup water are minimized.

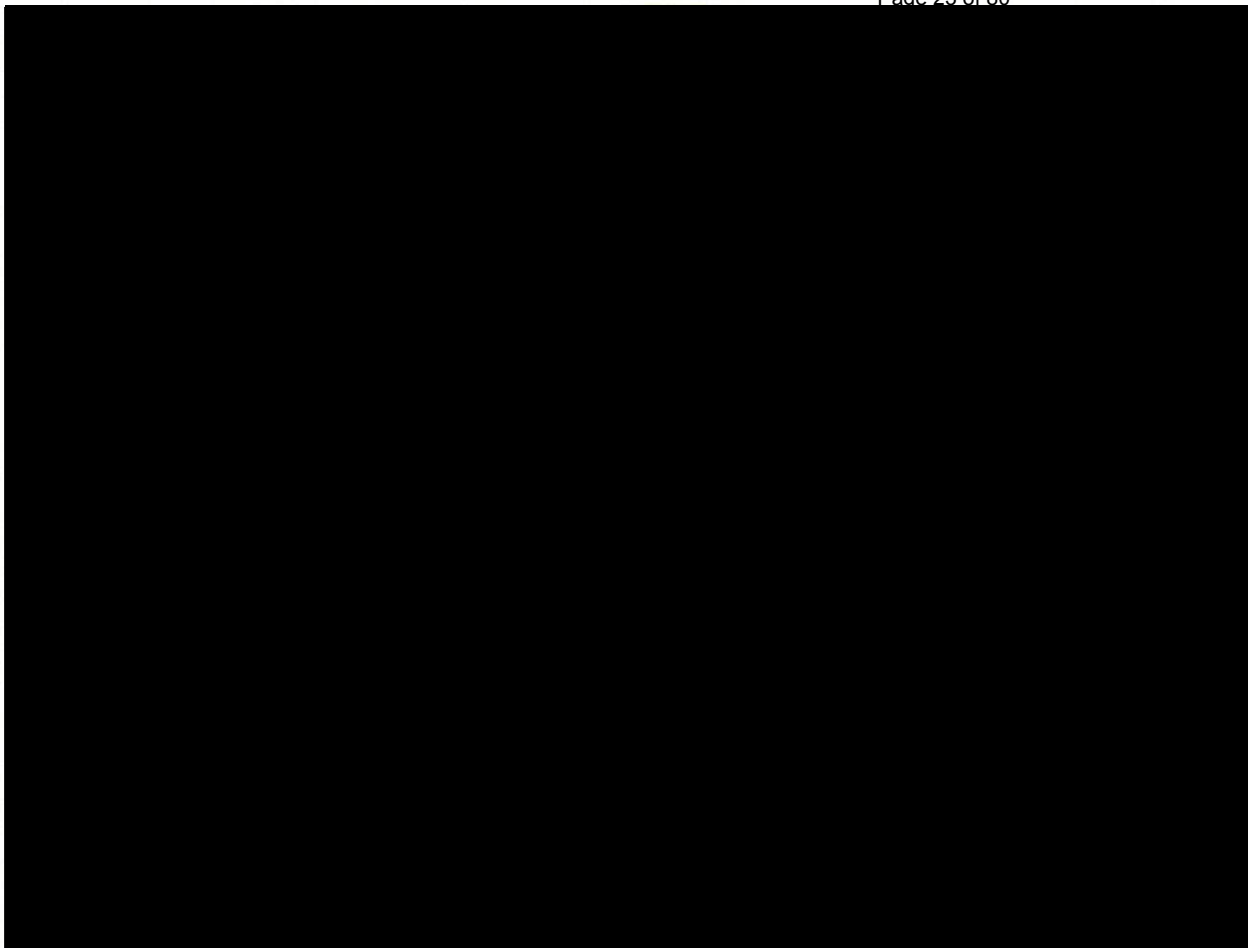
The normal water supply for process water to the WFGD System shall be strained Big Sandy River water as defined by the ranges stated in the following tabulated data.

River Water Analysis

	<u>Average</u>	<u>Range</u>
Iron, Fe (mg/L)	1.00	0.5-5.39
Copper, Cu (ug/L)	5.43	2-10
Sulfate, SO4 (mg/L)	53.33	32-183
Total Hardness, as CaCO3 (mg/L)	153.14	96-260
Chloride, Cl (mg/L)	18.69	7.7-24
Conductivity @ 25 °C (umho)	450.53	210-697
TSS (mg/L)	178.81	6-1300
PH @ 25 °C	7.66	6-8.1
Magnesium (mg/L)	48.82	15-83

Pump seal water (except for liquid ring vacuum pump) shall be filtered river water. The Seller shall specify the required quality and quantity of seal water in the proposal.

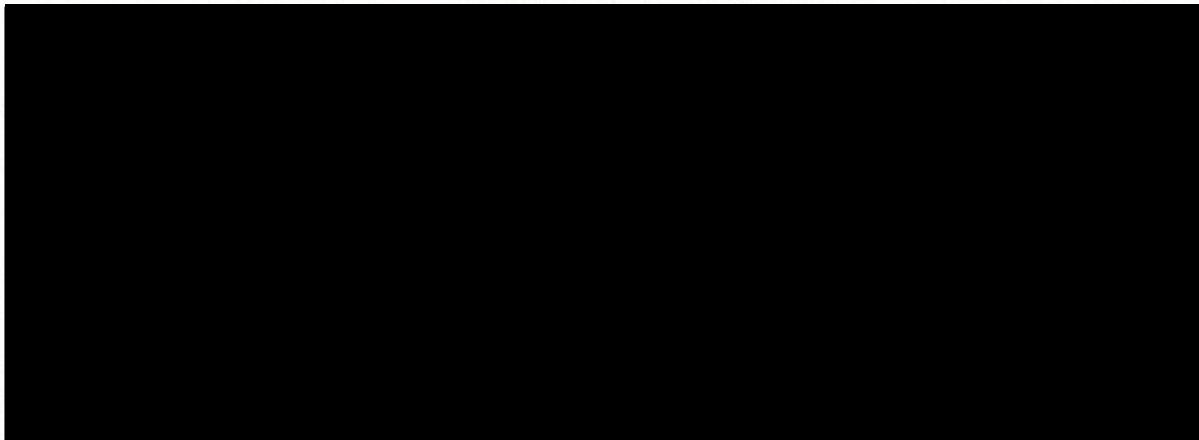


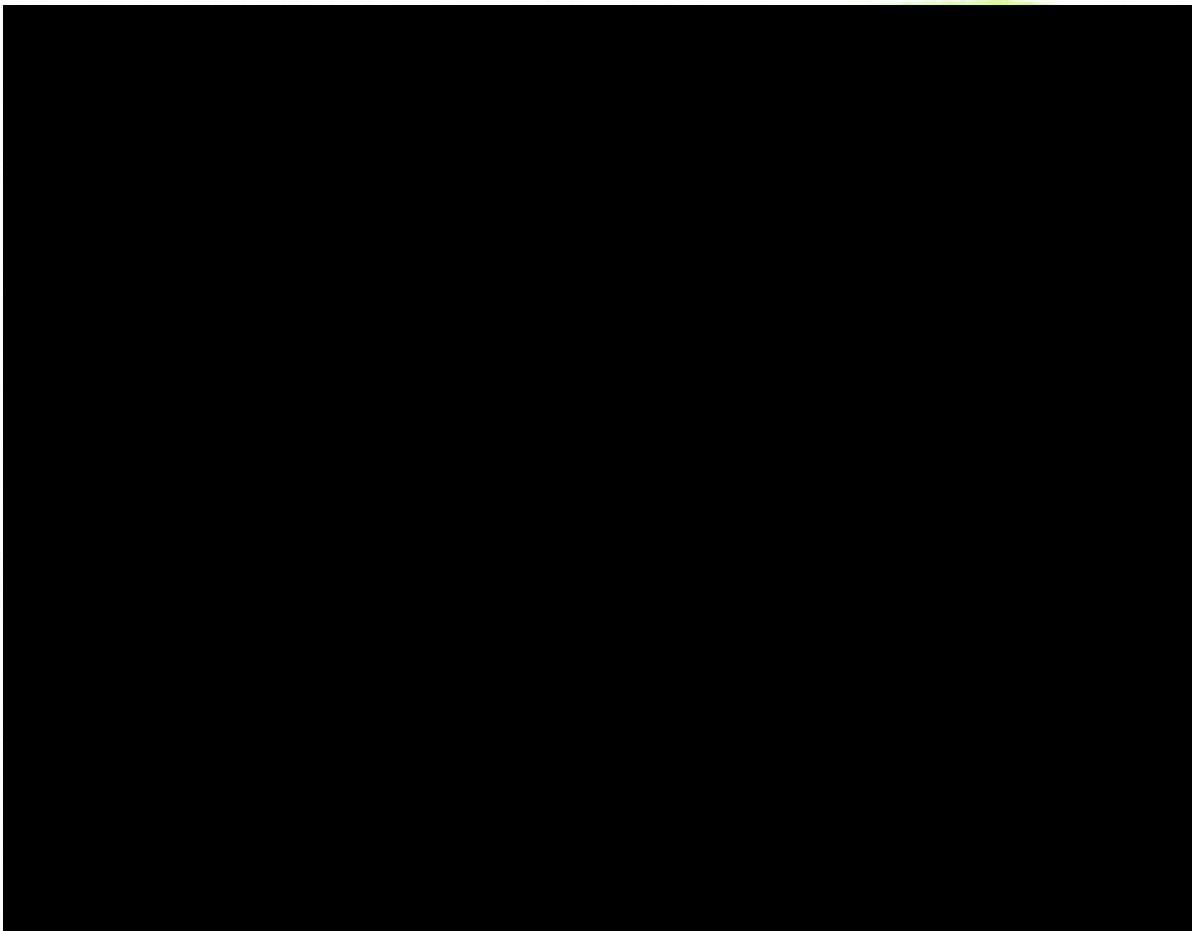


4.1.18 APPLICABLE CODES AND STANDARDS

All local, State and Federal codes and regulations in effect at the time the contract commitment is made shall govern the design, material and fabrication of the equipment and components furnished under this specification.

The Seller shall provide a listing of the codes, standards and regulations that they intend to adhere to in the design of the equipment and components furnished under this specification.





4.1.20 SPECIFICATION CONFLICTS

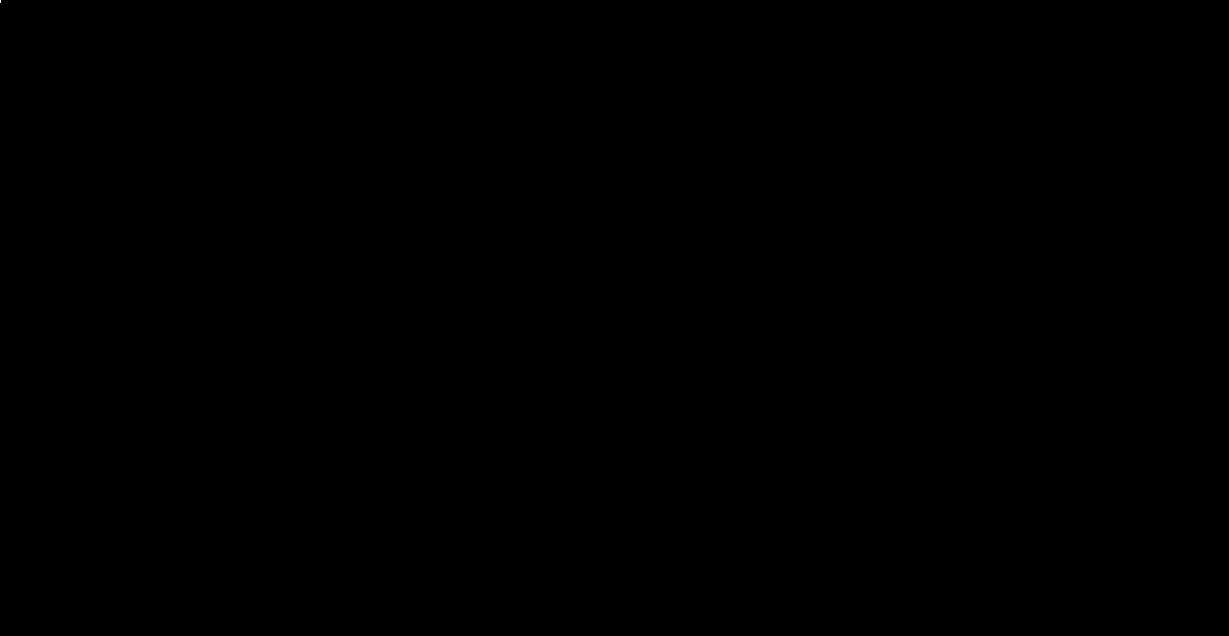
If there are any areas in which a code, standard, regulation or specification conflicts with other codes, standards, regulations or specifications including the Owner's specifications, the Seller shall promptly bring the matter to the attention of the Owner in writing for resolution by the Owner. In all cases, except when waived by the Owner, the stricter code, standard, regulation or specification shall govern.



4.1.23 EQUIPMENT SIZING AND REDUNDANCY

Equipment for the reagent preparation modules and the by-product dewatering modules shall be sized for the maximum sulfur coal case (4.5 lbs SO₂/Mbtu) and 98.0 % SO₂ removal without having to use the standby equipment. [Redacted]

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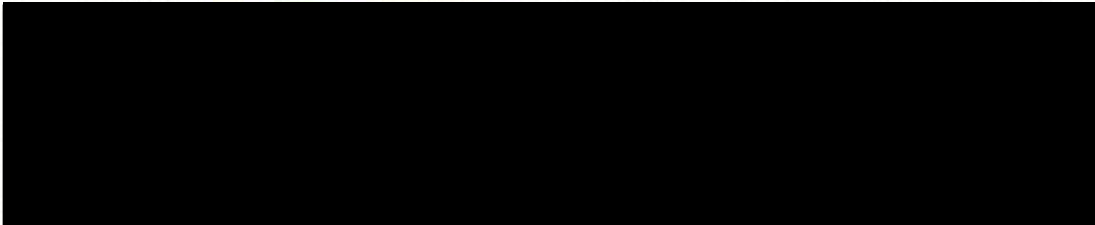


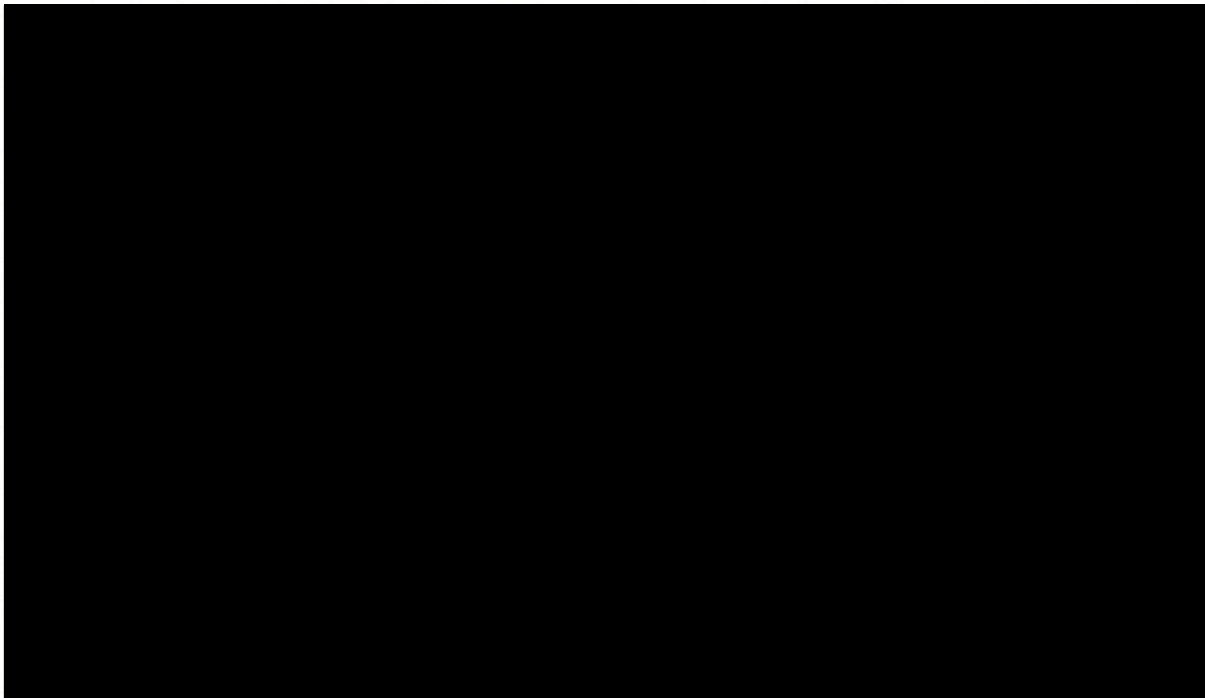
4.3 OPERATING CONDITIONS

The WFGD System shall be designed to operate under each of the following conditions without impeding the normal operation of the steam generator while continuously achieving the specified sulfur dioxide (SO₂) removal efficiency.

- During all periods of steam generator operation from initial start-up to full load.
- Continuous service at the maximum absorber inlet flue gas conditions.
- Continuous service at minimum load.
- During steam generator load swings from 33 to 100 percent of the maximum inlet flue gas flow rate.
- During extended periods of the steam generator start-up while burning No. 2 Fuel Oil, coal, or any combination thereof.
- Weekly start-up following weekend shutdown of approximately 48 hours duration.

The Owner anticipates that the following type of operating abnormalities may occur to varying degrees throughout the operating life of the plant. While specific design criteria for all possible conditions cannot be defined herein, the Seller shall be aware of the Owner's concern and consequently make necessary design provisions to insure that the following potential abnormalities do not cause catastrophic failure to the WFGD System equipment or its auxiliary equipment.

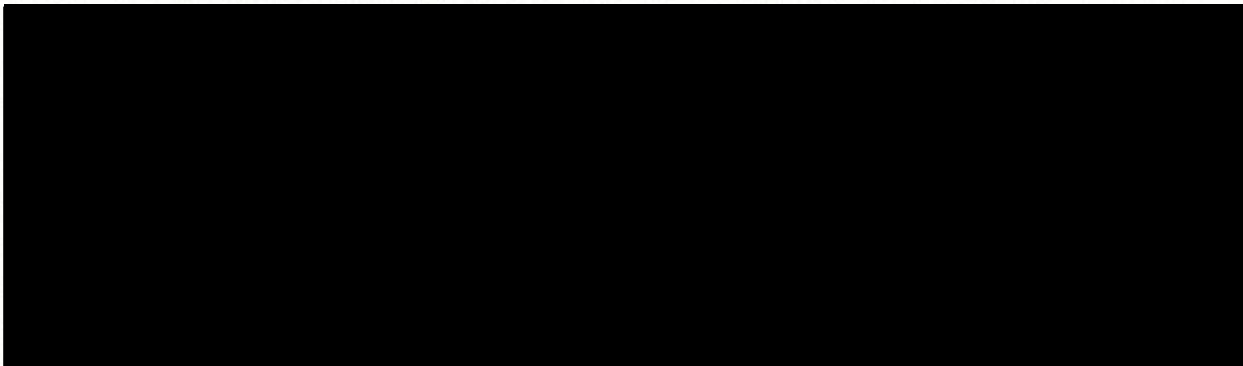


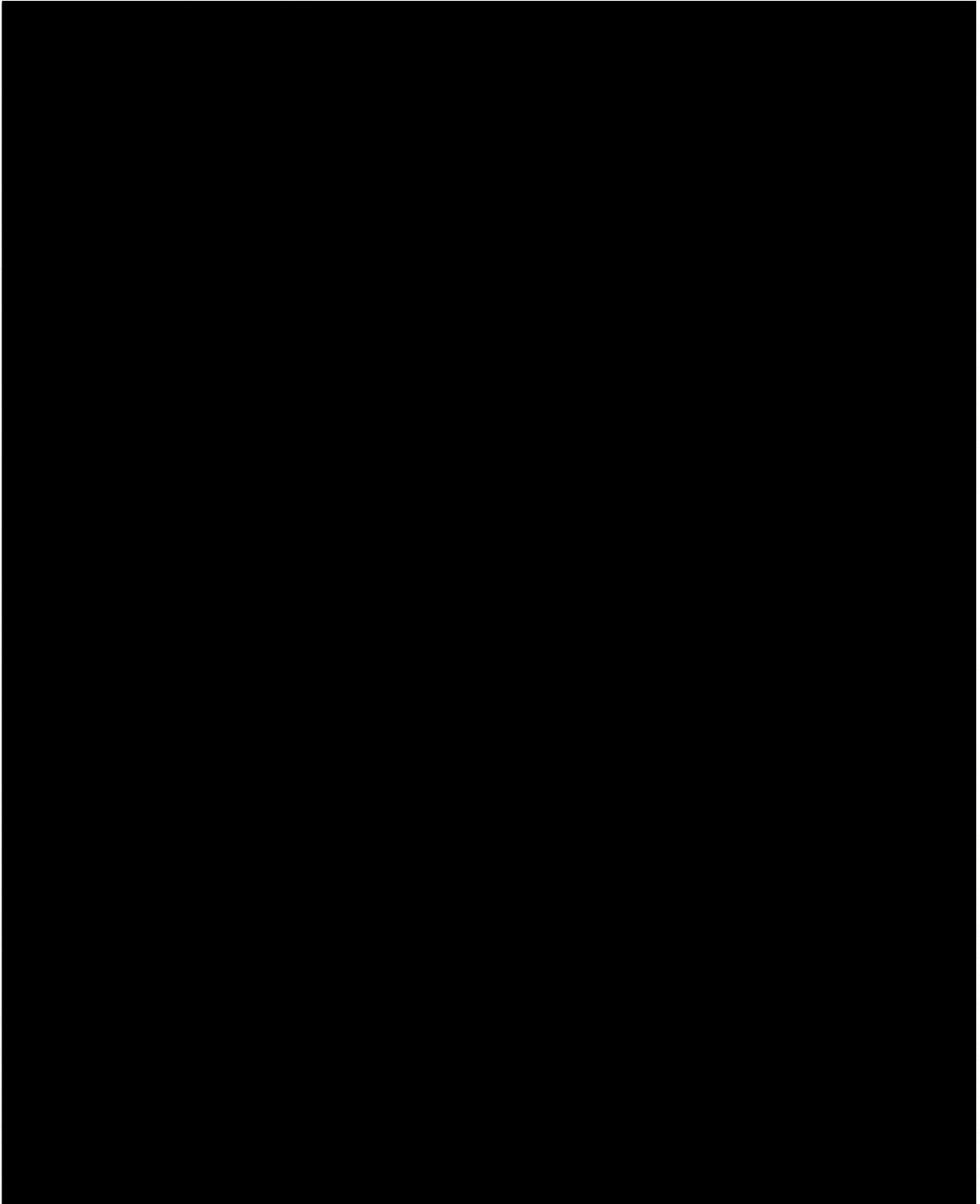


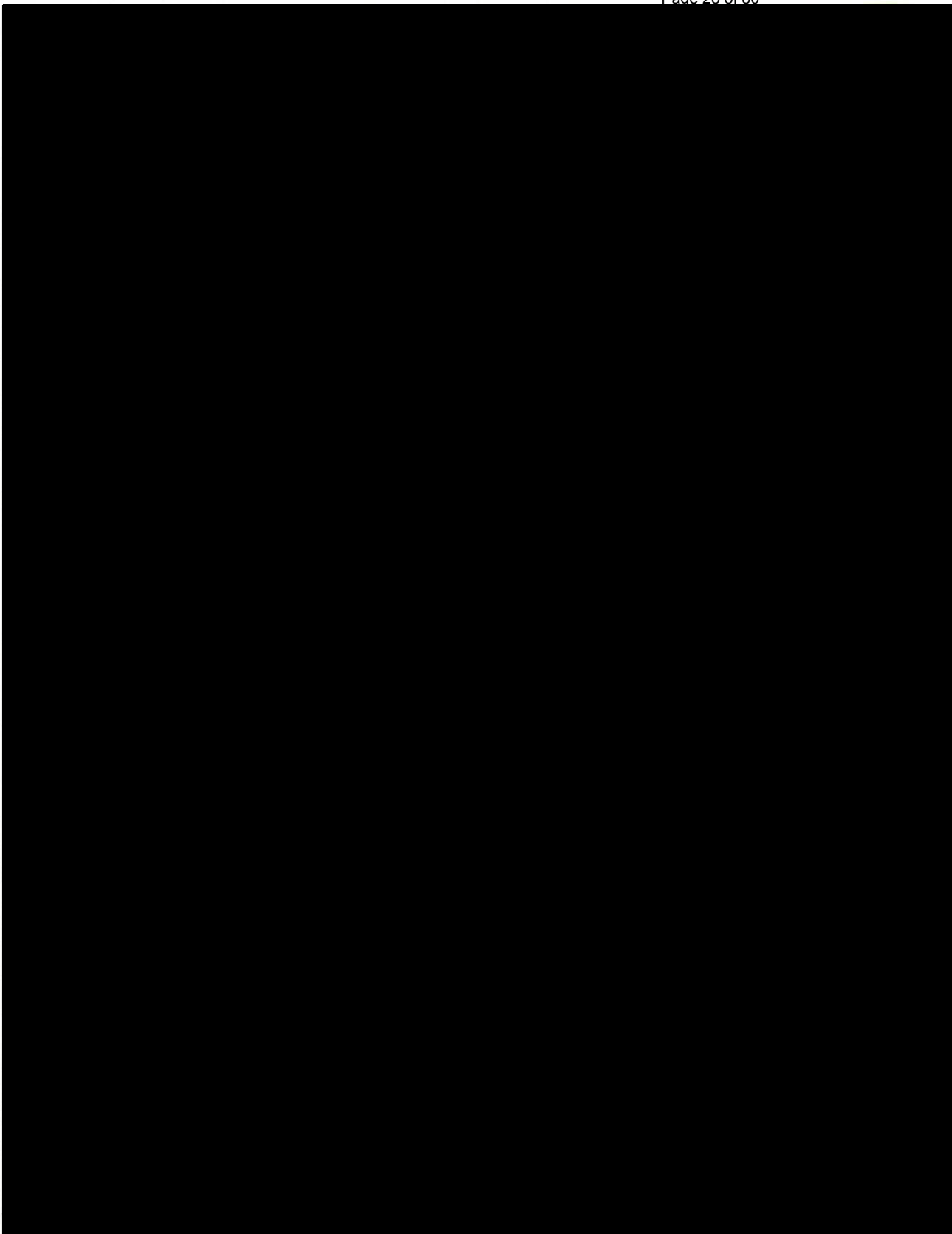
4.5 SITE ENVIRONMENTAL CONDITIONS

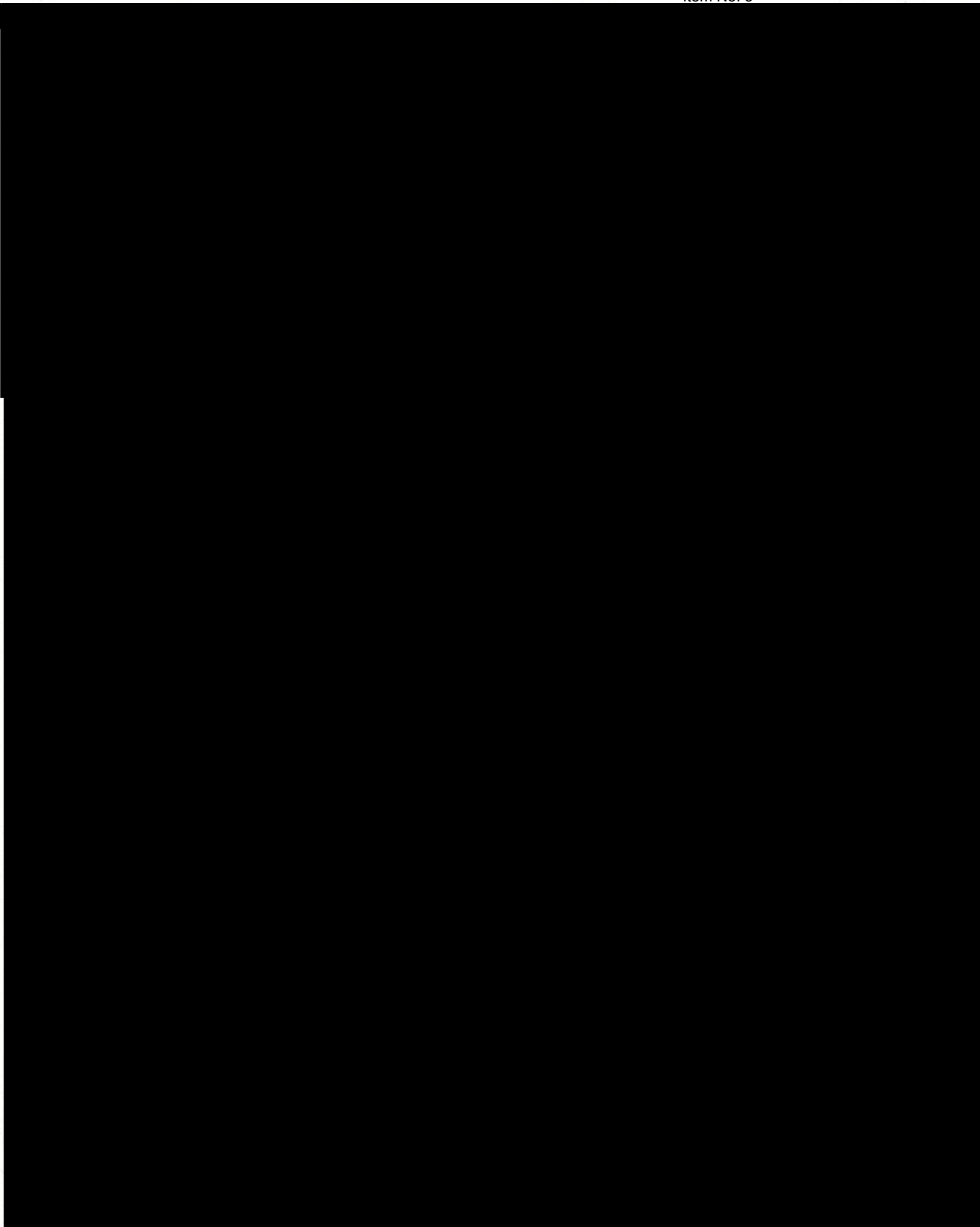
The table below lists the general Big Sandy Plant site environmental conditions.

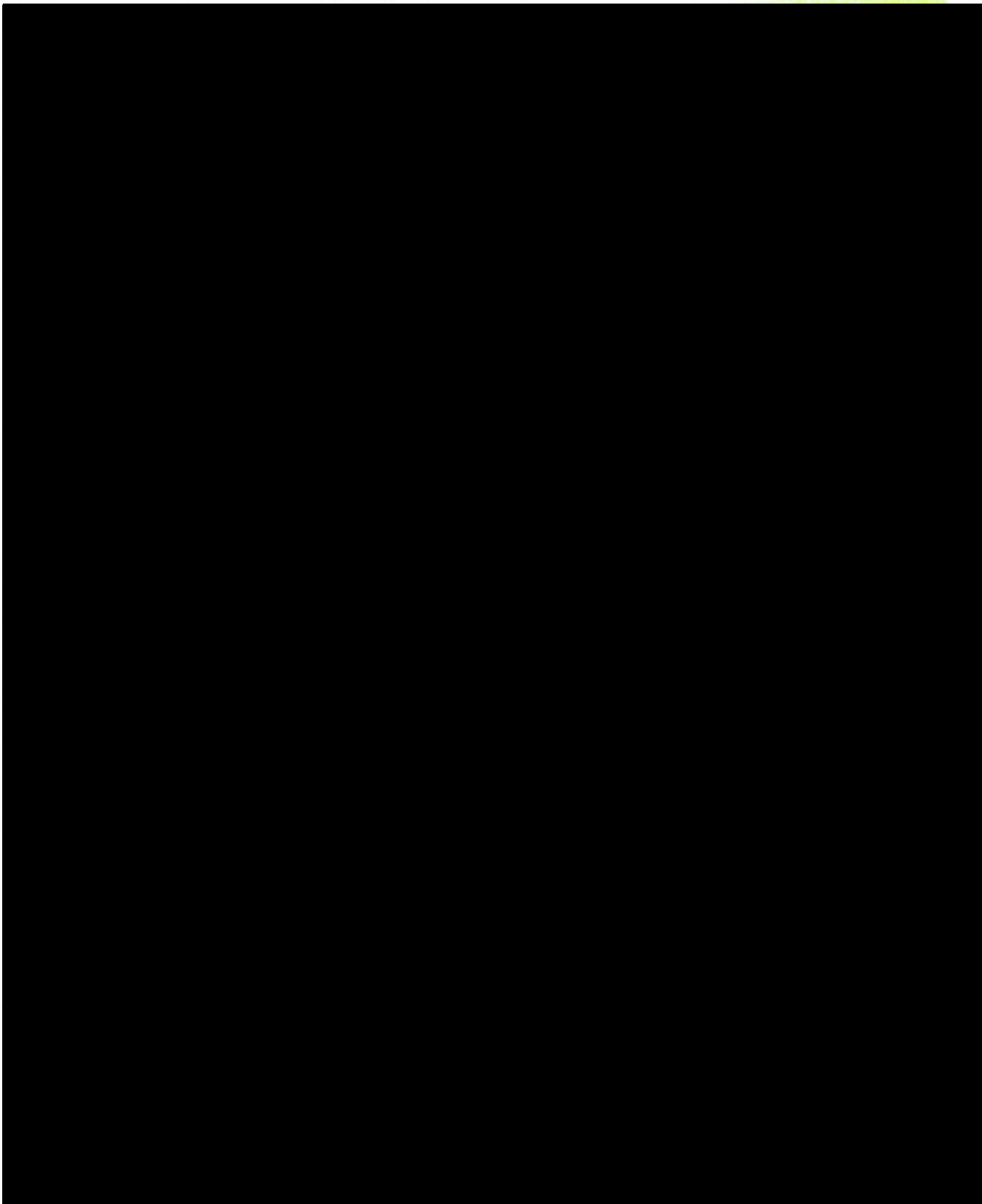
<u>Condition</u>	<u>Value/Range</u>
Plant Elevation at Grade	568 ft above sea level
Ambient Temperature Normal Range, °F	-20 to 97
Ambient Relative Humidity Range, %	25 to 100
Annual Average Temperature, °F	56.1
Annual Average Relative Humidity, %	70
Annual Average Summer Temperature, °F	74.3
Annual Average Winter Temperature, °F	37.5
Average Wind Velocity (mph)	6.7
Prevailing Wind Direction (Degrees)	186
Annual Average Precipitation (inches)	43.06

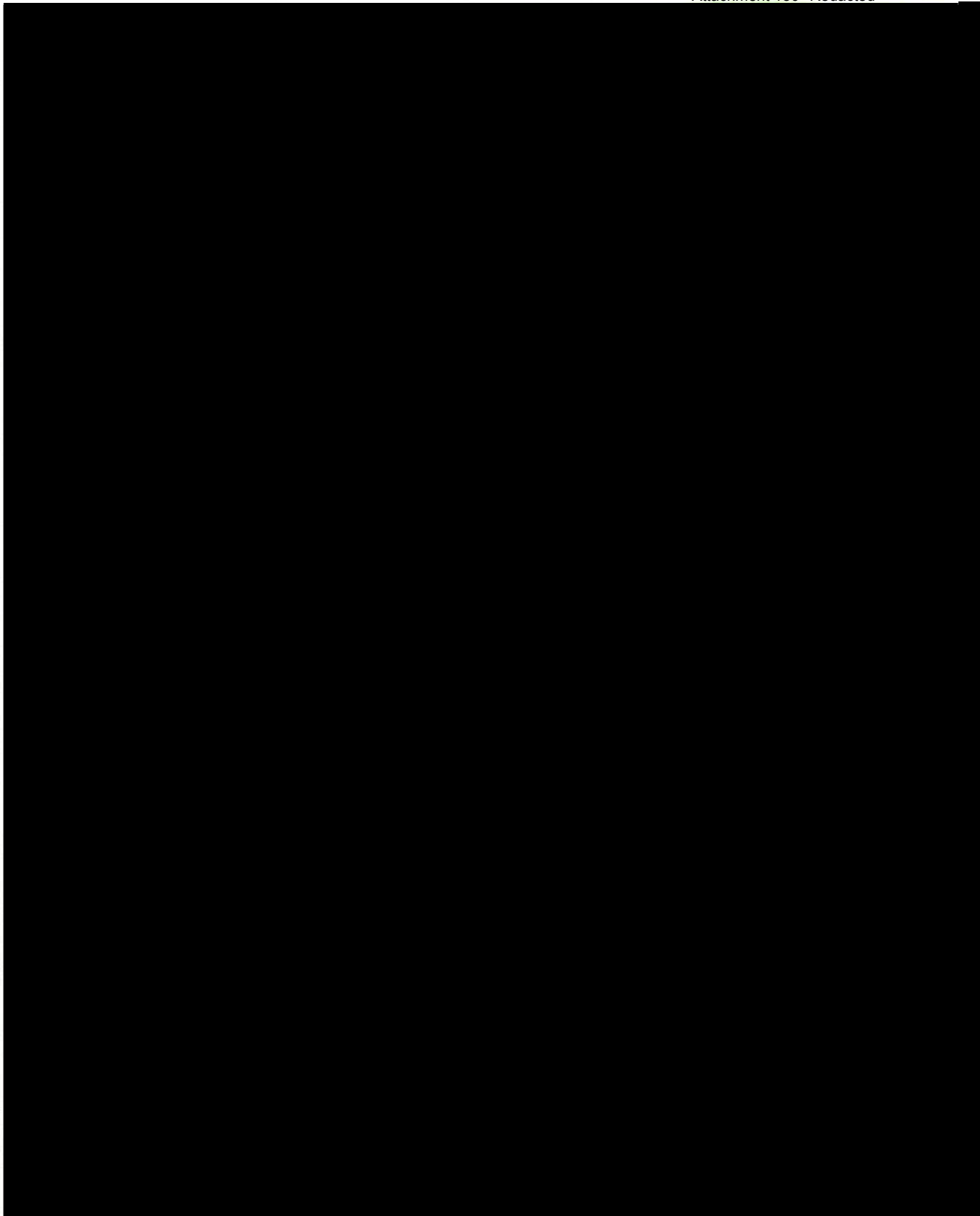


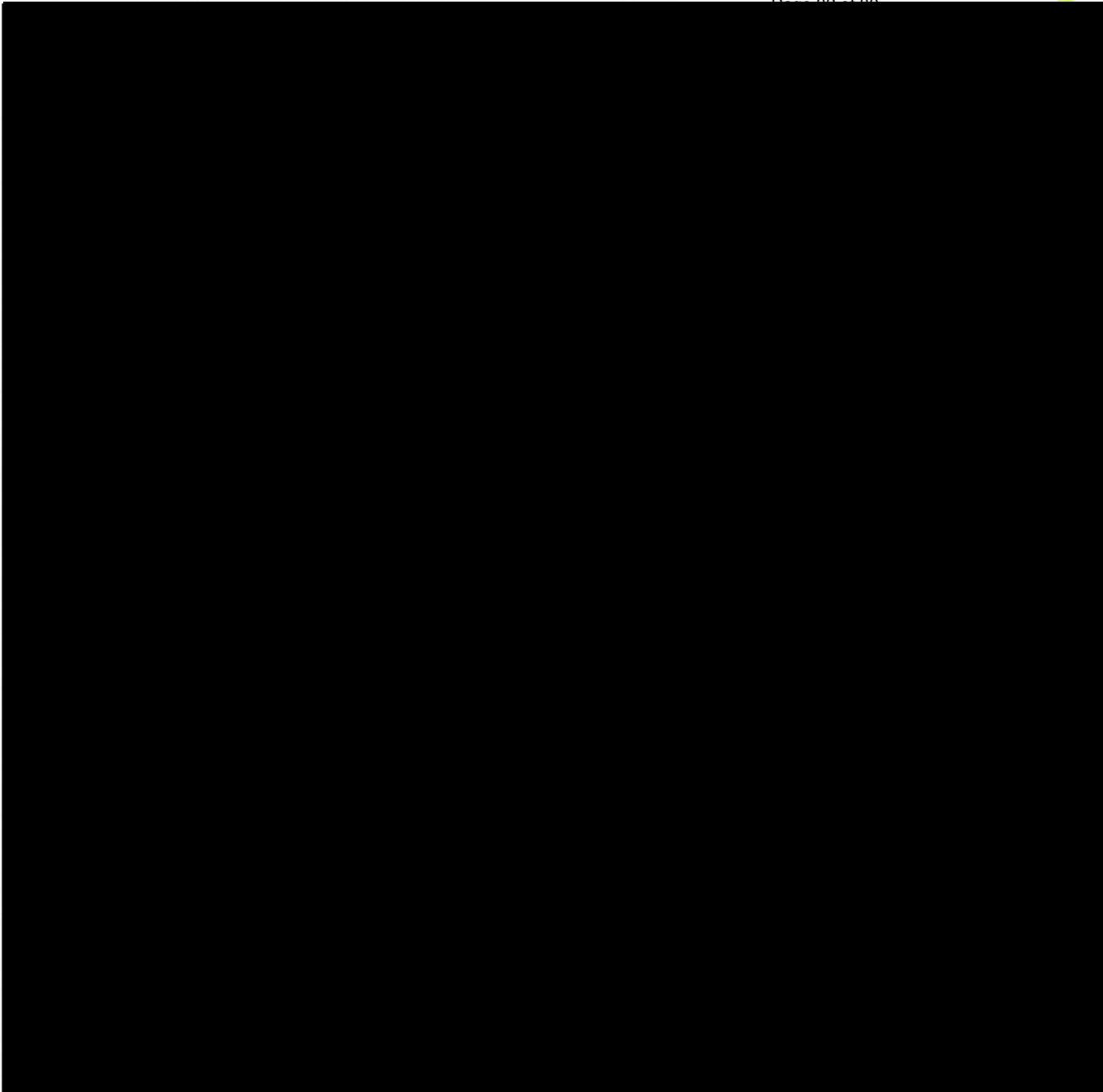






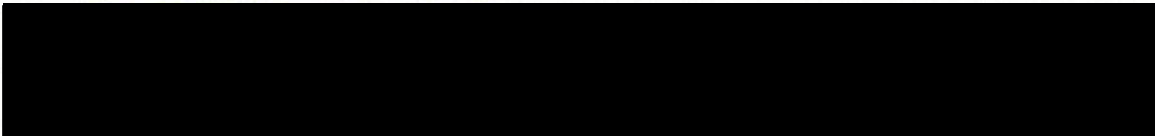




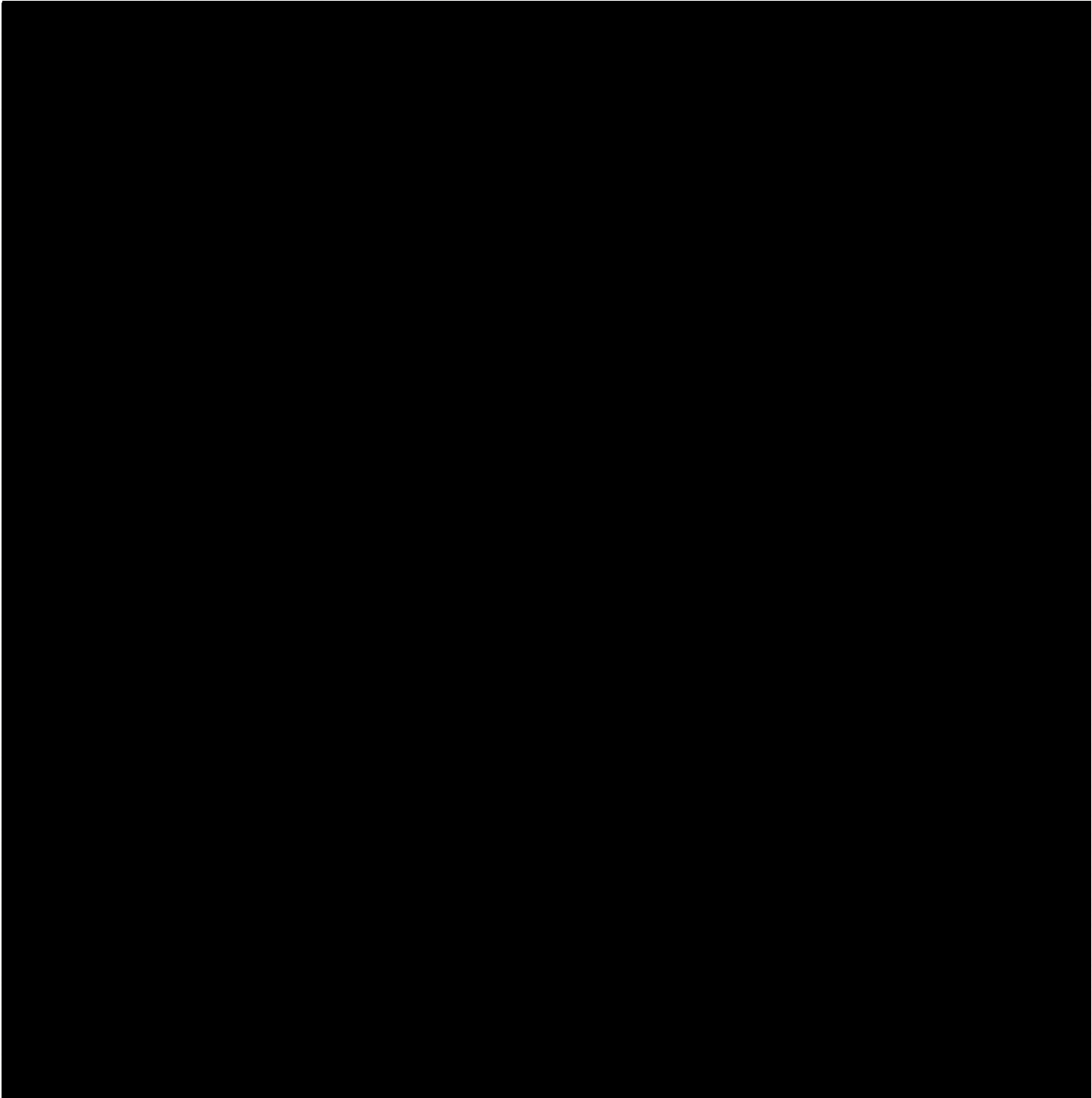


5.7.6 POWER CONSUMPTION

The Seller's guaranteed maximum total power consumption for a typical 24 hour period shall be as provided on the System Performance Data Sheets included in the Seller's proposal which considers process specific FGD loads with no electrical loads for lighting, heating, convenience power, etc.



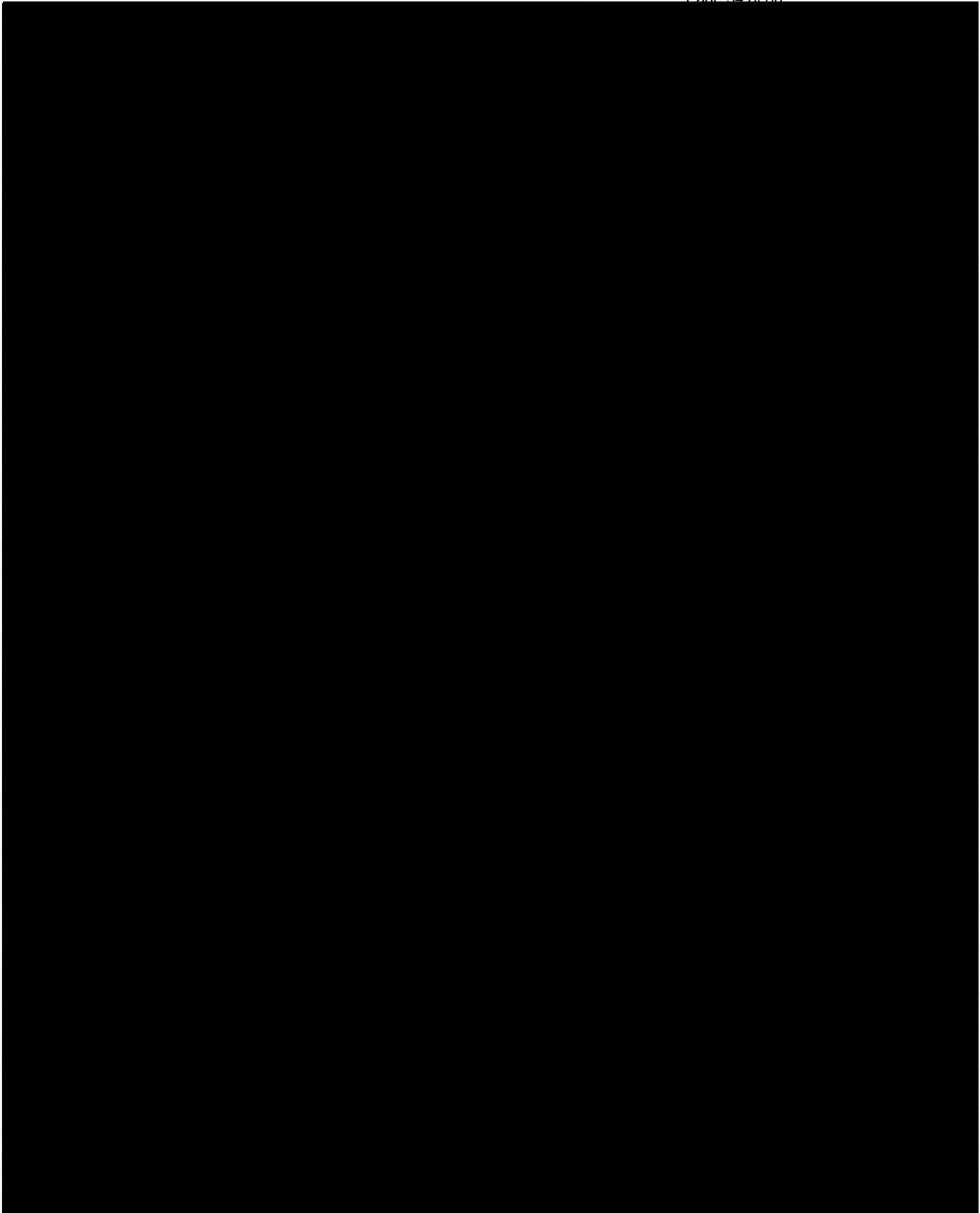
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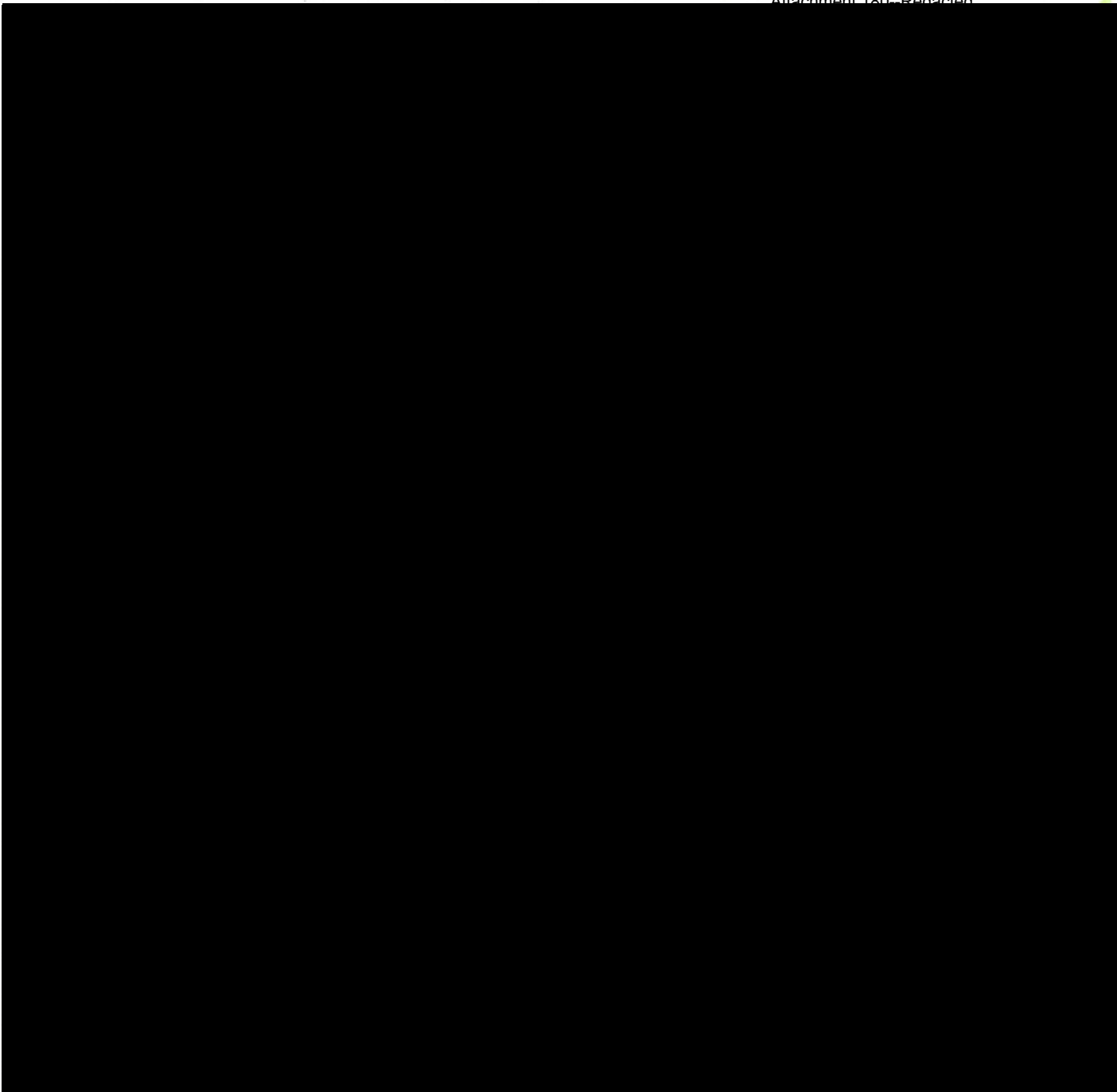


6.0 MISCELLANEOUS DELIVERABLES AFTER CONTRACT AWARD

This section summarizes the miscellaneous information and services required of the Seller after award of the contract.

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6.2 DRAWINGS AND LISTS

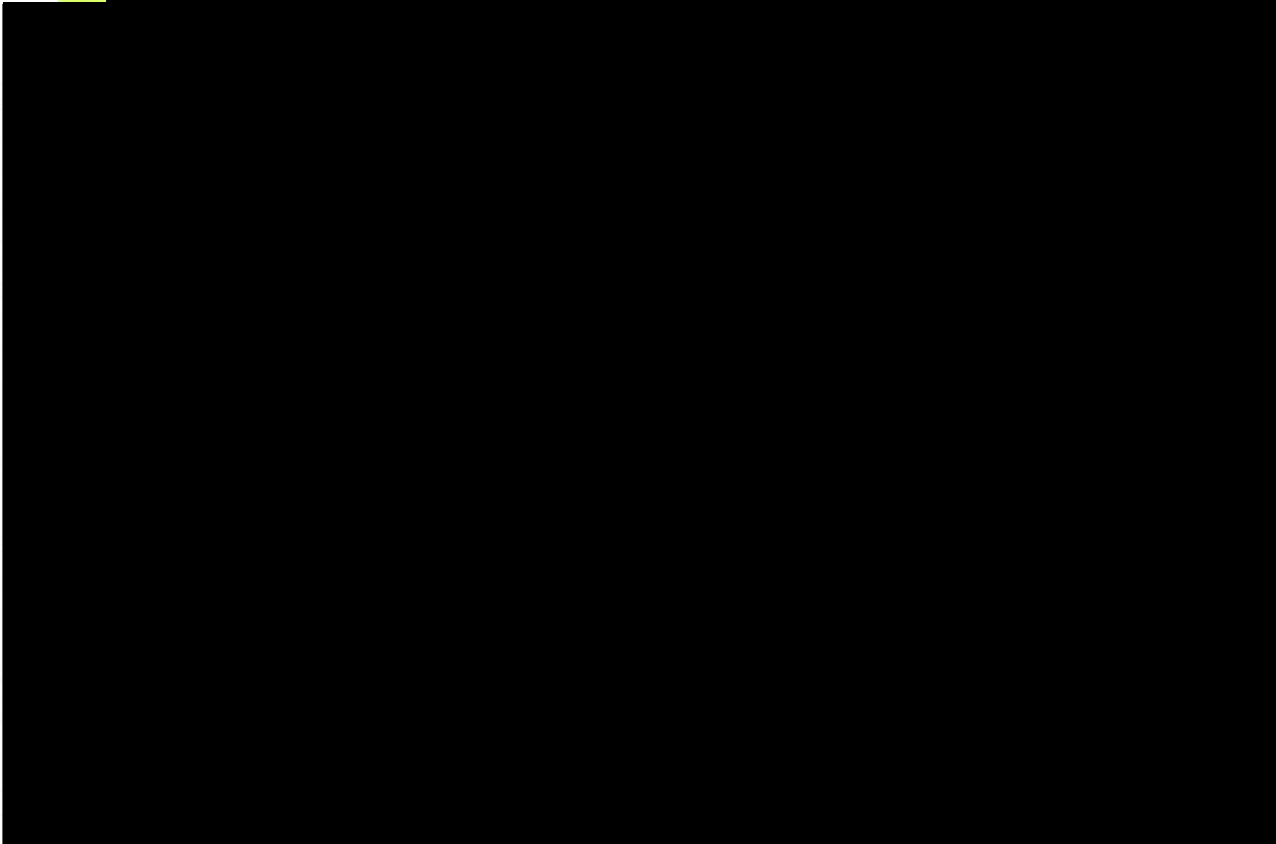
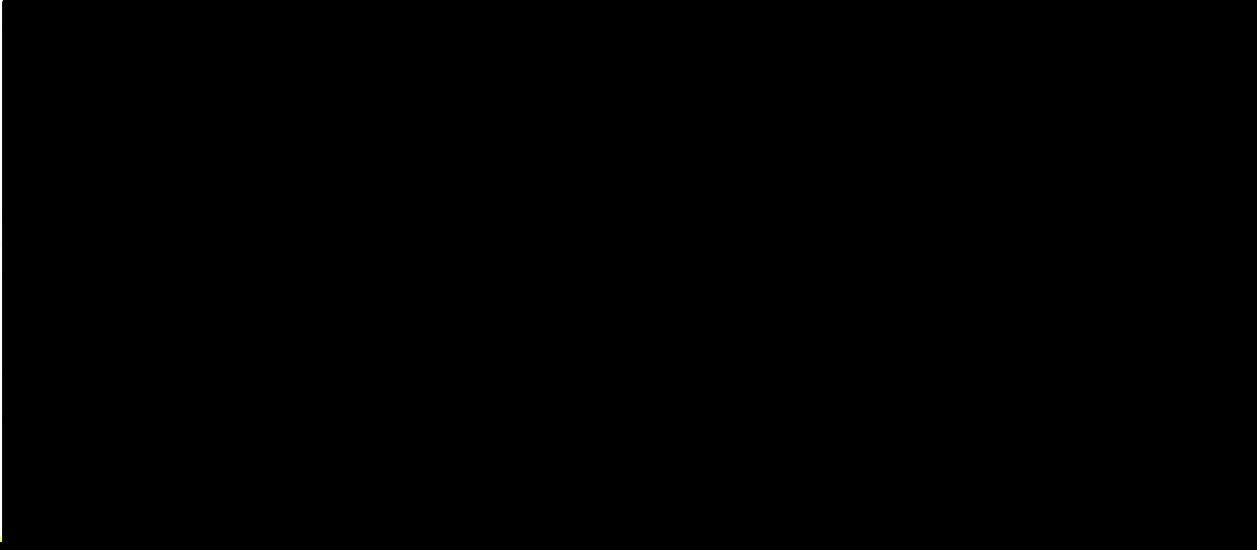
The Seller shall submit drawings for Owner's review and acceptance in accordance with the procedures outlined in Section 6.18 of this Specification.

Drawings shall be in sufficient detail to permit the effective erection, operation and maintenance of the equipment and components furnished under this specification. This includes, but is not limited to the following details: size, arrangement, weight, breakdown for shipment, operation of components, required access provisions, external connections, degree of assembly or prefabrication, anchorages, supports required, and the dimensions needed for installation and connection with other materials and equipment.

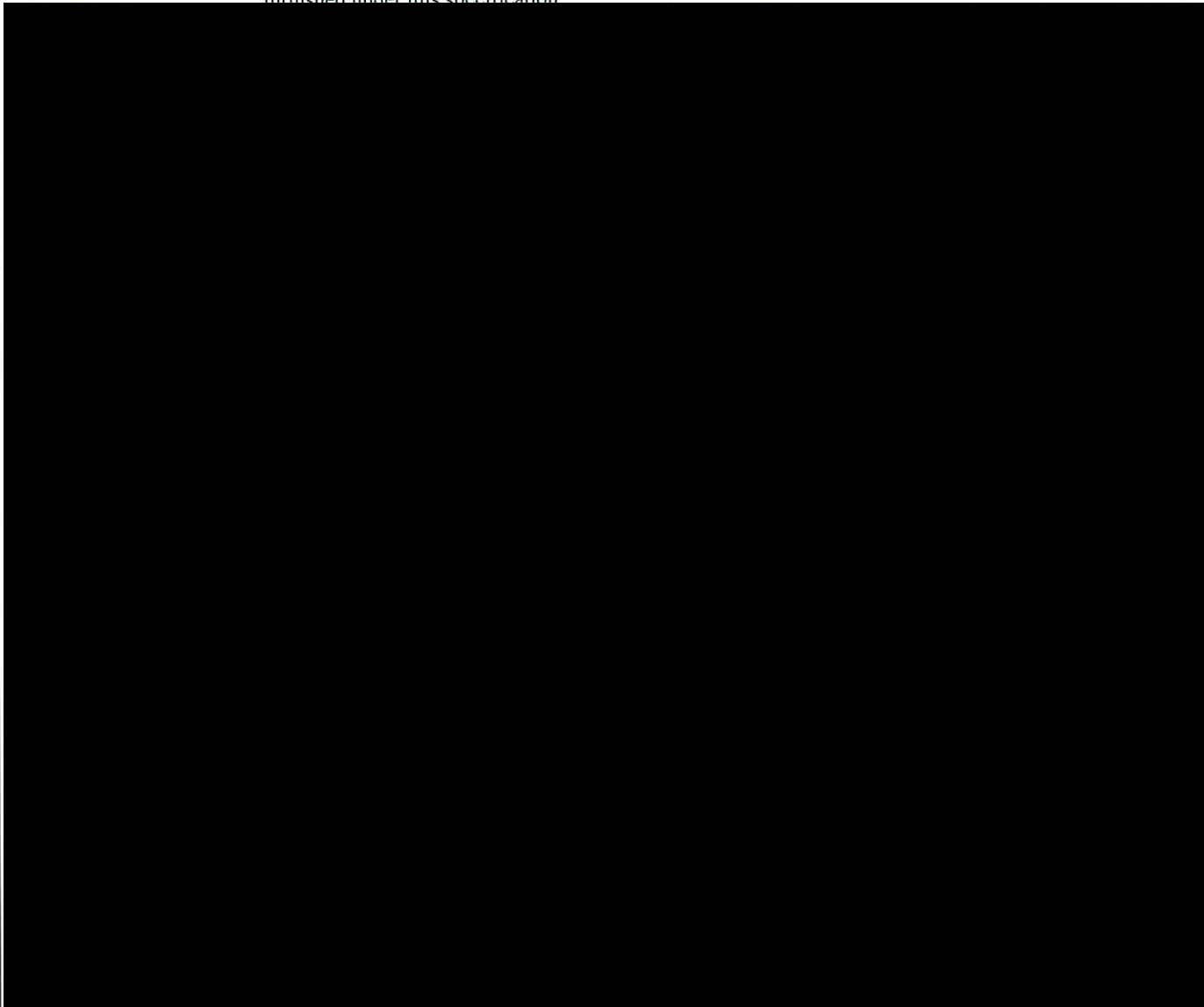
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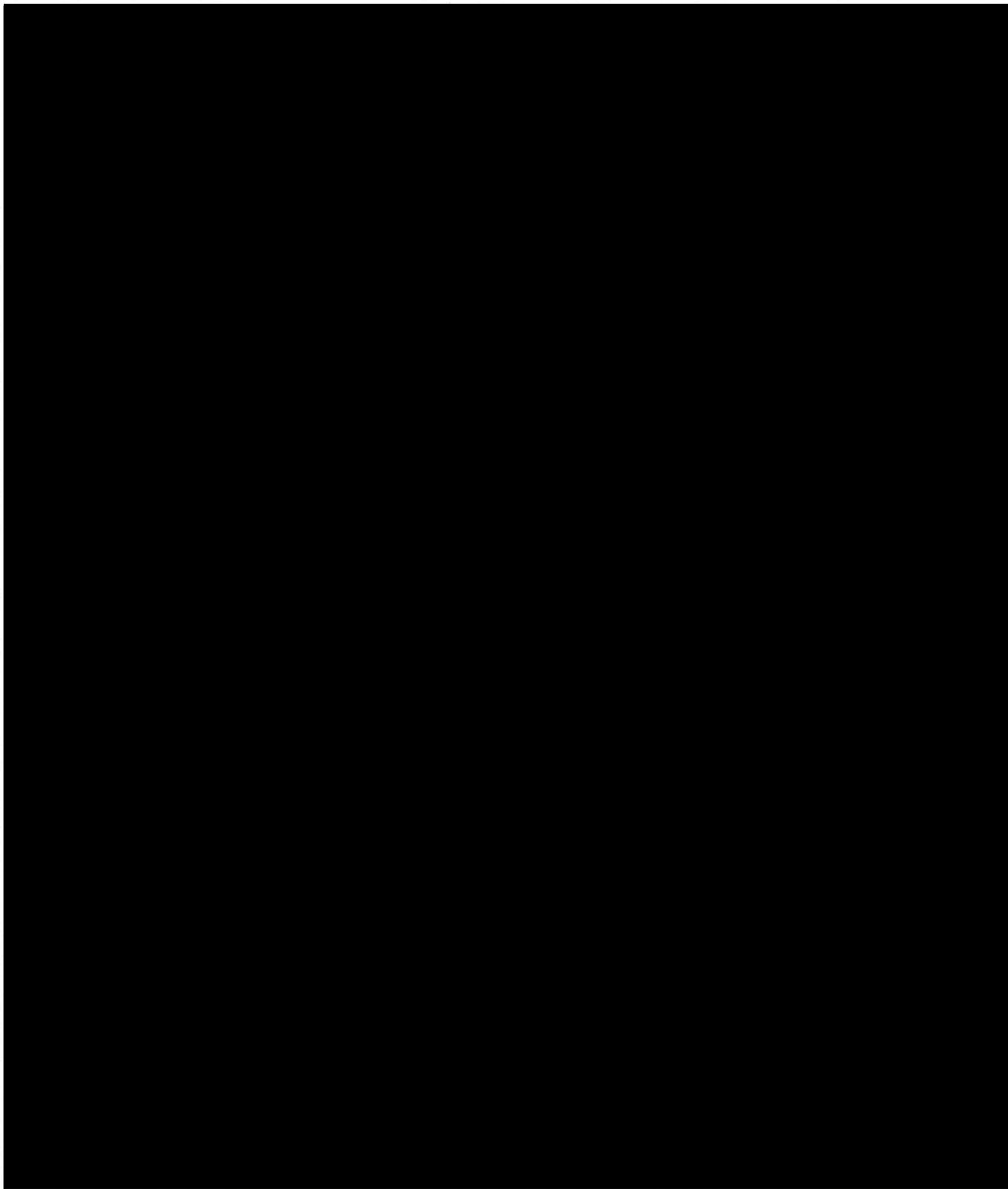
The following drawings and lists are required for all equipment and components supplied by the Seller after award of contract:

- 6.2.1 General arrangement drawings including both plan and elevation of equipment, troughs and sumps, maintenance and access openings, platforms and stairways.
- 6.2.2 Process Piping and Instrumentation Diagrams

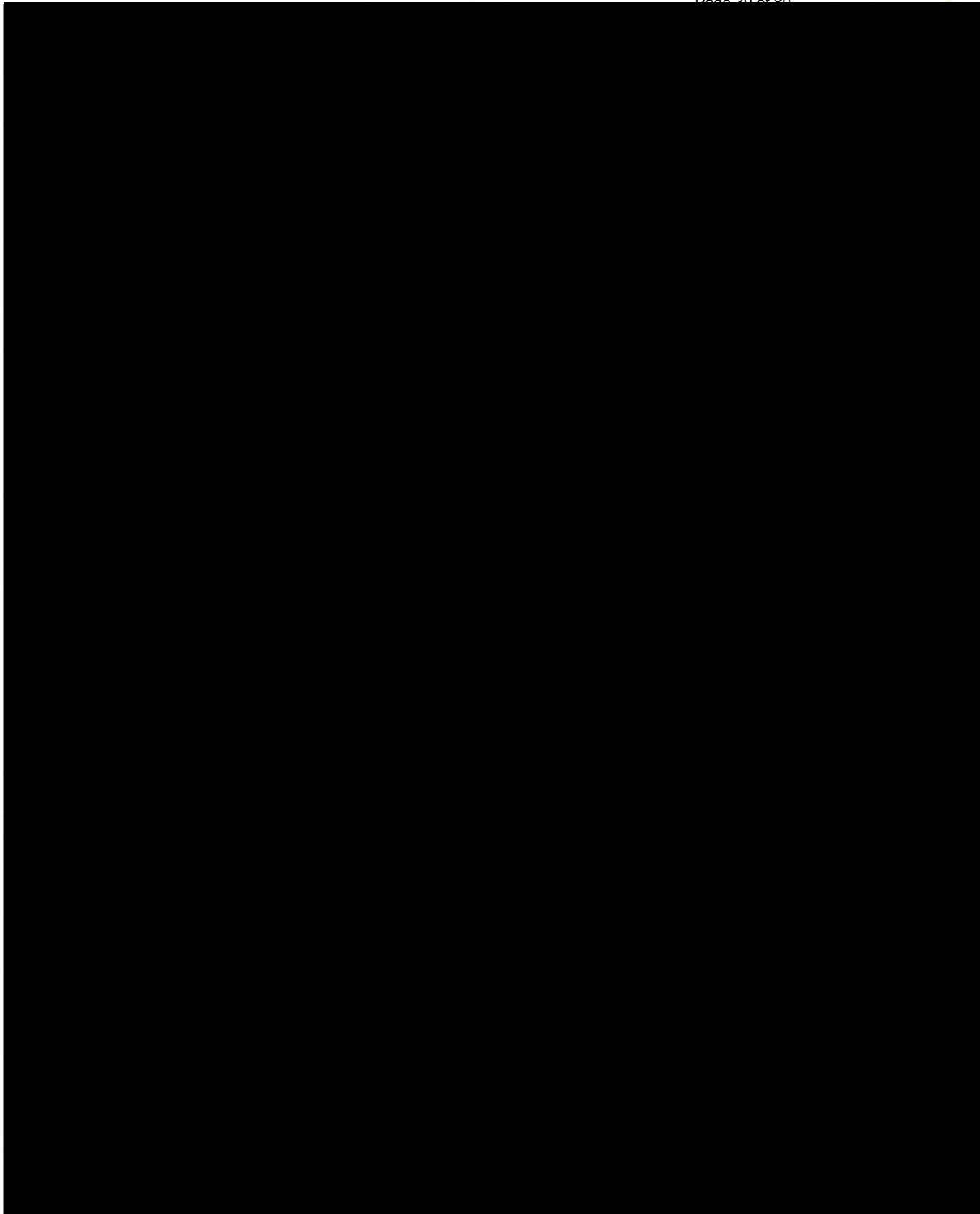


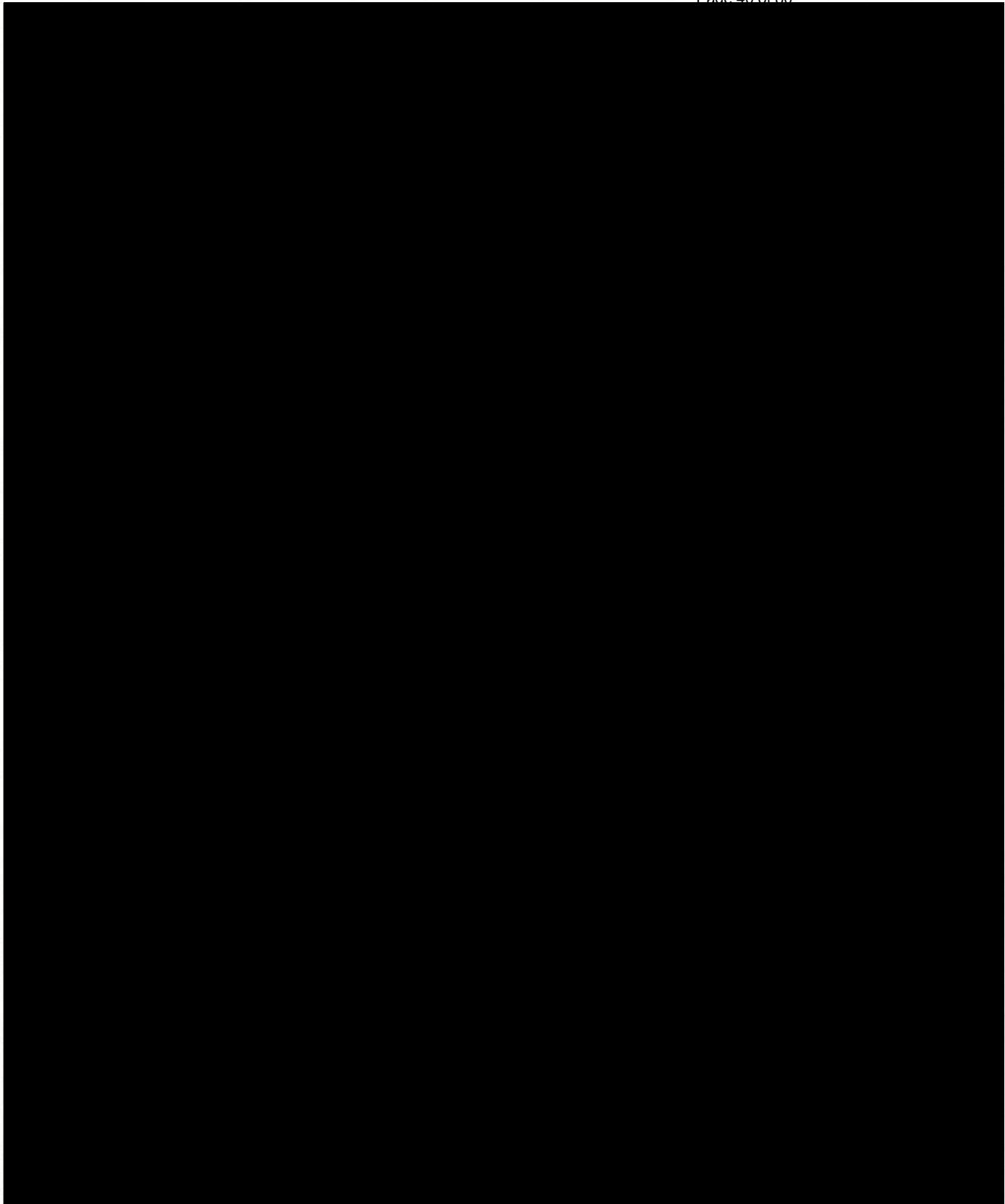
- 6.2.15 Instrument Location Diagrams
- 6.2.16 Instrument Installation Details
- 6.2.17 Instrument Loop Sheets
- 6.2.18 Vendor Drawings
- 6.2.19 Detailed outline, cross-section, and assembly drawings of all equipment and components provided.
- 6.2.20 Detailed Erection Drawings
- 6.2.21 All other drawings necessary to erect, operate and maintain the equipment and components furnished under this specification

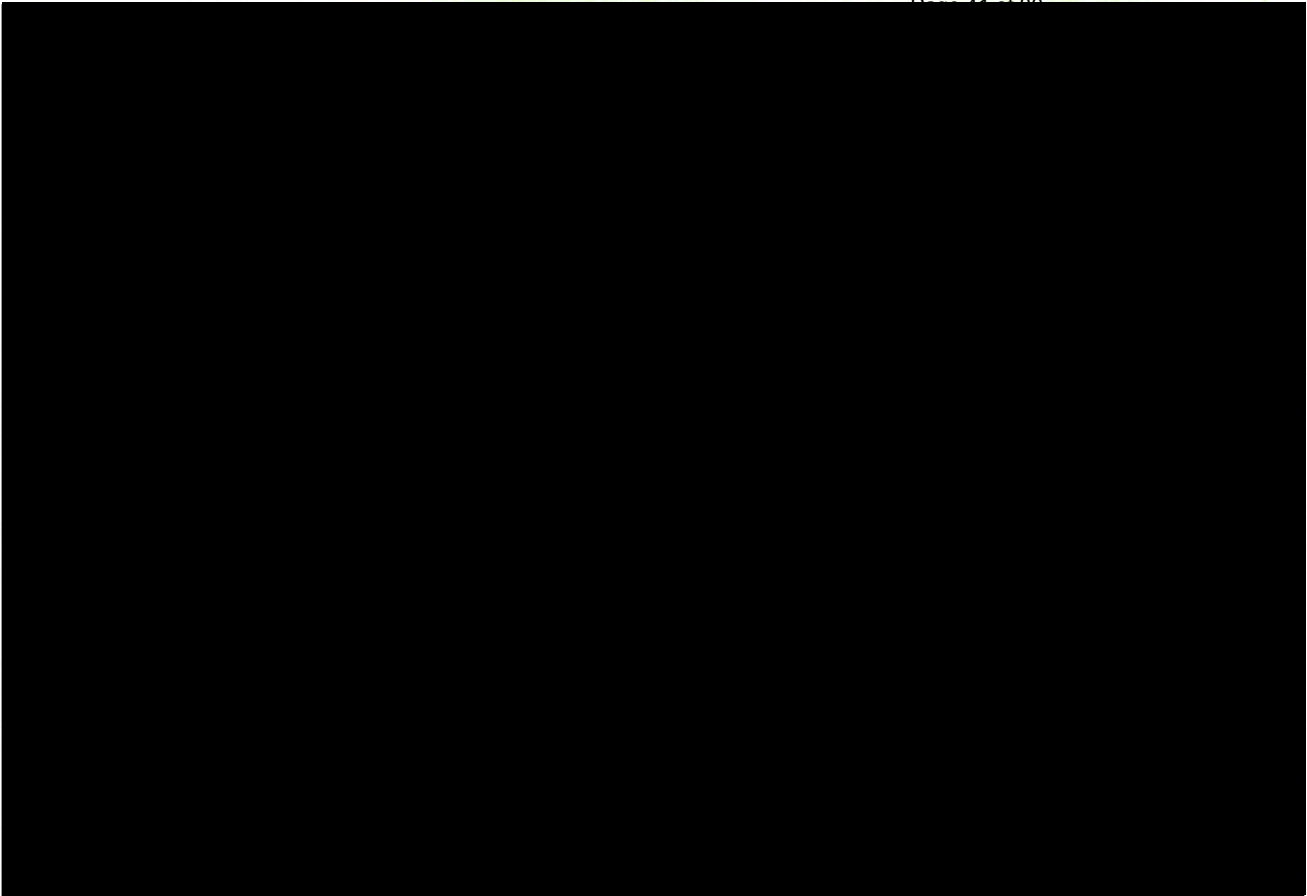




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6.6 LUBRICATION MANUAL

The Seller shall furnish five (5) bound copies of a lubrication manual and provide the Owner with one (1) electronic copy. Two (2) proofed copies shall be submitted to the Owner for acceptance approximately twelve (12) months prior to initial start-up. After acceptance, the remaining copies shall be submitted within two (2) months.

All equipment requiring lubrication shall be identified with the following:

- Component Name
- Amount of Lubricant Required
- Listing of Lubricant Points
- Diagrams or sketches showing Lubrication Points
- Recommended Lubrication Schedule
- Three (3) Acceptable Types of Oil by Manufacturer
- Three (3) Acceptable Types of Grease by Manufacturer

6.7 TRAINING PROGRAM

The Seller shall administer a comprehensive training program at the plant site to the Owner's engineers, operators and maintenance personnel approximately six (6) months prior to the initial WFGD System start-up. This program shall consist of audio/visual classroom displays and a physical walk down of the systems.

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The following items shall be discussed in detail as part of the training program:

- Chemistry
- System Descriptions
- Component Descriptions
- Instrumentation and Controls
- Initial Start-up
- Normal Operation (i.e. equipment/system start-up, shutdown and normal operation)
- Maintenance
- Testing Procedures
- Emergency Procedures

The training program material shall be prepared in bound booklets. The Seller shall furnish fifty (50) bound copies of the training program and provide the Owner with one (1) electronic copy. Two (2) proofed copies and a detail description of the program shall be submitted to the Owner for acceptance approximately twelve (12) months prior to initial start-up. After acceptance, the remaining copies shall be provided during the training sessions.

The training program, materials and equipment shall become the property of the Owner.

Proposed cost for the Seller supplied training program shall be based upon providing training for the WFGD System, including training for sub-vendors equipment, to 4 groups of persons at each plant site. Each group shall be trained for a minimum of 10 days. Only one group will participate in the training session on a given day.

6.8

BILL OF MATERIALS

The Seller shall prepare a detailed Bill of Materials list to assist field personnel in equipment receipt and storage and to provide a detailed record of all Seller supplied components.

The Bill of Materials shall be reviewed and updated on a monthly basis and ten (10) copies shall be made available to the Owner upon each revision.

Each item listed in the Bill of Materials shall be described as follows:

- Component Name
- Seller Tag Number
- Vendor Tag Number
- Seller Purchase Order Number
- Quantity
- Manufacturer and Model Number
- Special Receiving, Handling and Storage Instructions

6.9

SPARE PARTS LISTS

The Seller shall provide a recommended spare part and price list twelve (12) months prior to initial start-up for all equipment and components furnished under this specification.

The spare parts list shall contain the following information:

- Component Name
- Seller Tag Number
- Vendor Tag Number

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- Recommended Number of Spares
- Design/Operating Parameters
- Materials of Construction
- Manufacturer and Model Number
- Weight
- Special Receiving, Handling and Storage Instructions
- Current price

6.10 ERECTION ADVISOR

Seller shall supply a sufficient number of Erection Advisor(s) to provide technical assistance during the key phases of the WFGD System erection work. The Seller shall state in the proposal the number of Advisors to be provided and a cost thereof.

The Seller shall provide a detailed list of erection hold points during which the Erection Advisor shall inspect the material provided under this contract.

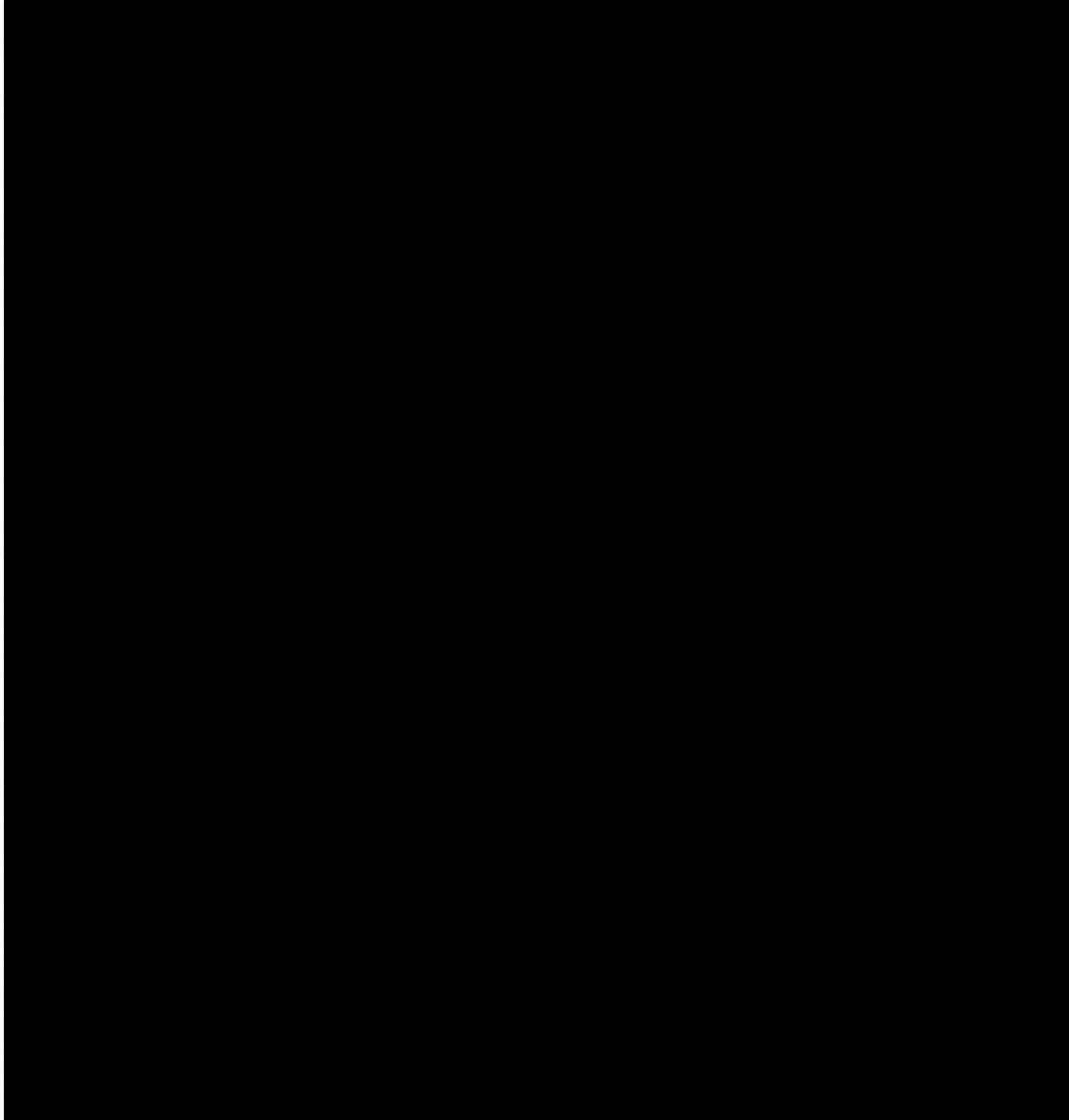
The Seller's proposed pricing for installation / erection of the Seller supplied equipment shall include the cost for the Erection Advisor technical support services identified under this section of the specification.

The Erection Advisor's responsibilities shall include, but are not limited to, the following:

- 6.10.1 Check foundation alignment, elevations, anchor bolt sizing and placement.
- 6.10.2 Provide technical assistance and advise on erection procedures.
- 6.10.3 Determine that proper storage procedures are followed for all equipment and components.
- 6.10.4 Determine that the erection is proceeding in accordance with the Seller's and Owner's drawings, standards, and specifications and to promptly call any discrepancies to the attention of the Owner.
- 6.10.5 Immediately upon arrival at the job site and monthly thereafter (or more frequently if Seller deems necessary), the Erection Advisor shall determine the condition of all material and notify the Owner in writing of its condition. This report shall include reasons for any deteriorating conditions (if any) and the Erection Advisor's suggested method of correcting the same.
- 6.10.6 Should the Seller's or the Owner's personnel subsequently find discrepancies in workmanship and/or material, which was previously approved by the Erection Advisor, the Seller shall repair or replace all such discrepancies at the Seller's expense for both material and labor. Such corrective work shall be performed as to maintain the Owner's construction schedule. The Seller shall adhere to all project agreements and shall employ appropriate personnel in the performance of such corrective work.
- 6.10.7 During all phases of the job, inspections shall be made of the work previously accomplished. These inspections shall be made to insure that the work is in full compliance with the Seller's specifications. Each inspection shall be made by the Erection Advisor with the results submitted in writing to the Owner. This report should include the method of inspection, date and results of inspection, and the person(s) performing inspections.
- 6.10.8 Should the material installed by, or workmanship employed by Erection Contractor, not be to the Seller's satisfaction, the Erection Advisor is to immediately submit a written report to the Owner. This report shall include the problem, reason and suggested resolution.

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- 6.10.9 Submit a written report weekly to the Owner, covering the weekly activities, progress of construction and the acceptability of the job to date.
- 6.10.10 Upon Owner's request, attend any meeting to discuss erection of the equipment, discrepancies in Seller's Specification and/or drawings, etc.



6.12 SUPPORT SERVICES

The Seller shall furnish a sufficient number of support personnel as required to resolve preliminary operating problems as they develop until satisfactory operation of the WFGD System is achieved. They shall instruct and advise the Owner's personnel in the start-up and placing of the equipment into successful service.

Start-up personnel shall be on-site up to four (4) months prior to the initial start-up of the WFGD System. The reporting date and duration of start-up support service will be defined later by the Owner.

Additional support personnel shall be on-site during the Acceptance Test and the reliability demonstration run.

The proposed cost for the Seller supplied Start-Up Advisor services and technical support services to be present during the Acceptance Test and Reliability Demonstration Run shall be based upon a total of 380 man days for Big Sandy Plant. When completing the proposal pricing datasheet, show the cost for the Seller supplied start-up, commissioning, tuning and testing support services on the line item labeled "Start-Up Advisors".

6.13 QUALITY CONTROL / QUALITY ASSURANCE PROGRAM

The Seller shall provide a written copy of their Quality Control/Quality Assurance Program (QC/QA) for the engineering, design and fabrication of the equipment and components furnished under this specification.

The QC/QA program shall be subject to Owner's acceptance.

A finalized copy of the approved program is required prior to the start of engineering, design, procurement and fabrication.

6.14 EQUIPMENT AND COMPONENT TESTING

The Seller shall provide any certified testing, required to meet local, state and federal codes and regulations, of all off-site fabricated equipment and components. Written notice shall be submitted to the Owner ten (10) business days prior to the start of any such testing to allow the Owner to make arrangements to observe the testing. The Seller shall also provide detailed on-site testing procedures to ascertain the physical and operational condition of all equipment and components supplied under this contract. These procedures shall include such items as the non-destructive testing, hydrostatic/pneumatic testing of all vessels and piping, air testing of the modules and ductwork, pump performance testing, etc.

The absorber vessel and internal alloy components must be inspected for carbon (iron) contamination prior to acceptance in the shop or field.

6.15 FABRICATION AND DELIVERY SCHEDULE

The Seller shall provide a detailed fabrication and delivery schedule for Owner acceptance within six (6) months after award of contract. Monthly reports shall be submitted to the Owner indicating the work completed during all phases of the project. This schedule shall as a minimum indicate the following information for all major equipment and components:

- Fabrication start date
- Fabrication completion date
- Percent fabrication complete (if applicable)

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- Shipping date
- Arrival date

6.16 STORAGE REQUIREMENTS

The Seller shall provide a detailed list of special storage requirements for equipment and components such as heated, rain-protected, etc.

The Seller shall also identify the area required for equipment and component storage based on the delivery schedule.

The storage requirements information shall be provided within twelve (12) months after award of contract and shall be updated as needed.

6.17 EQUIPMENT INDEX

The Seller shall provide an index of all components, equipment and major equipment sub-sections, furnished under this specification. As a minimum, the index shall include:

- A description of the item
- Seller's item identification number
- Seller's print numbers on which the item is represented or detailed
- Manufacturer's model number
- Manufacturer's print numbers on which the item is represented or detailed

6.18 DOCUMENT AND DRAWING REQUIREMENTS

This section specifies the required procedures for the development, submittal, review, and acceptance of all Seller supplied prints, documents and drawings related to the WFGD System.

All drawings, documents and reproducible, including structural shop and erection drawings, shall become the property of the Owner.

6.18.1 DRAWING DEVELOPMENT

All drawings and documents shall be submitted in accordance with AEP specification PE-FL-DC-0001, Rev 0, "Engineering Documentation Submittals" and AEP specification PE-FL-DC-0002, Rev 1, "Vendor Electronic Documentation Submittal Requirements".

A transmittal letter shall be submitted by the Seller for each submittal. . The transmittal letter and submittal shall be sent to the AEP external eRoom. A copy of the transmittal shall be emailed to the following:AEP Project Manager

- AEP Project Engineer
- AEP Project Administrator

6.18.2 DOCUMENT INSTRUCTIONS

Documents developed by the Seller (i.e., System Descriptions, Erection Manual, Operation and Maintenance Manual, Lubrication Manual, etc.) may be submitted to the Owner in one of the two following forms.

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"Preliminary" shall mean documents not fully completed, checked or approved by the Seller; however, they shall be reasonably complete and suitable for the Owner's use in establishing basic plant arrangement, design requirements, etc.

"Certified" shall mean documents fully complete and certified by the Seller.

No documents shall be final until approved by the Owner.

All document correspondence shall be submitted to:

- o AEP Project Manager
- o AEP Project Engineer
- o AEP Project Administrator
- o AEP External eRoom

6.18.3 DEVELOPMENT SCHEDULE

Prior to the initial submittal of any documents and drawings, a document and drawing register, listing all documents and drawings and a timeline for the initial issue shall be submitted to the Owner for review and approval. The register and timeline shall be resubmitted as required to indicate revisions to the list.

Upon receipt of a previously un-reviewed document or drawing, the Owner shall have four (4) calendar weeks to review and return comments to the Seller. When returned unapproved, the Seller shall have four (4) calendar weeks (provided the original release date is met) to review, comment and resubmit the document or drawing to the Owner. Upon re-submittal both the Owner and Seller shall have two (2) calendar weeks to review and process the document or drawing.

6.19 CONSTRUCTION BID PACKAGES

Seller shall provide Construction Bid Packages to AEPSC as well as provide technical support during the bid and contracting process. This will include breakdown of the work into quantities, scope definition for each package, and installation specifications. The bid/AFC (Approved for Construction) packages will include all appropriate technical drawings and specifications.

The scope of the construction bid package work will include specifications, drawings, and documents for all FGD equipment not included within the furnish and erect packages. The furnish and erect packages include the JBR shell, JBR internals, and field erected tanks. The construction bid packages will be submitted to support the Owner's construction procurement activities at approximately the 60% completion stage.

6.20 PROJECT ESTIMATE

Seller shall provide an estimate and supporting documentation per the specification listed in Table 2 of this specification. If the Seller's material and supply scope is a firm price offer, the Seller may leave the equipment and component costs unpriced, but shall provide the quantities.

The project estimate documentation will include an unpriced bill of quantities to describe the equipment and materials to be included in the construction scope packages. In addition, unpriced total project bills of quantities shall be submitted to support the Owner's overall phased budgeting efforts.

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6.21 COMPUTER AIDED DRAFTING (CAD) REQUIREMENTS

Seller shall provide all drawings using AEPSC "G" size borders and utilize the drawing numbers per the AEP drawing number guideline listed in Table 2 of this specification. The Seller shall prepare a CAD procedure for Owner review and approval. The expectation is to have the Seller's CAD drawing format (layout and information) and CAD drawing attributes such as layers, fonts, fonts sizes, symbols, etc. conform to AEPSC standards.

7.0 PROPOSAL REQUIREMENTS

This section of the specification covers the instructions to Sellers, proposal pricing and the proposal data requirements.

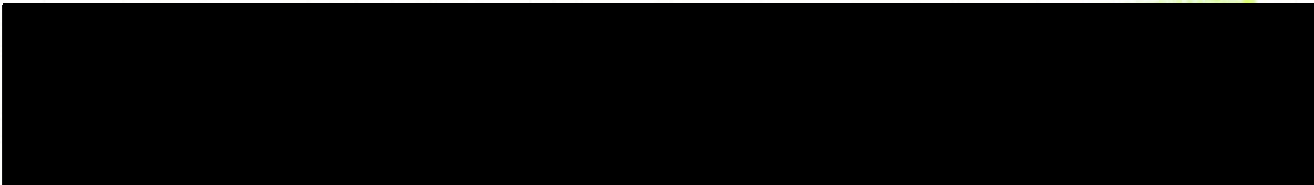
7.1 GENERAL INSTRUCTIONS

Each Seller shall submit complete and definitive information on its offering in sufficient detail to permit a complete analysis of the offer. All proposals shall be prepared and submitted in accordance with the instructions.

All proposals shall conform to the details of this specification. Alternative designs to this specification will be considered. However, final acceptance of any such alternate shall be determined solely by the Owner. The Seller shall provide a detailed price breakdown of all such alternates with the proposal.

7.2 PROPOSAL INFORMATION AND DATA REQUIREMENTS

This section of the specification covers the minimum technical information that must be submitted with the Seller's proposal. The below items are required to clearly define the design basis for the WFGD System equipment and provide the Owner with sufficient technical information to fully understand and evaluate the Seller's offering.



7.2.2 DRAWINGS AND LISTS

The following conceptual drawings and information shall be submitted with each proposal. All drawings shall be in sufficient detail to permit engineering studies to be conducted during the proposal evaluation phase of the project.

- General Arrangement drawings in both plan and elevation of equipment and platforms.
- Mass Balance diagrams as specified in Section 6.3.

Mass balance requirements for the proposal. Submit six mass balances for Big Sandy Unit 2 and Unit 1 (if included). These mass balances will be based on the full and minimum load firing rates and burning coals with varying SO₂ loading values and 0.2 %wt chlorine. Use the percent O₂ and gas temperature information provided in the table under Section 6.3.

- Flow diagrams or process Piping and Instrument diagrams (P&ID) for the WFGD System showing all process monitoring and final control elements. These items are to be identified with unique numbers.
- Typical drawings (i.e. previous projects) of major process piping runs in plan and elevation view indicating line size, major valve locations and access provisions.
- Typical drawings (i.e. previous projects) of the major equipment and components described in the System Descriptions indicating dimensions, structures, operational components, inspection and testing ports, access doors, etc.
- Listing of Seller supplied major electrical equipment specifying the electrical rating (Volts, horsepower or watts) and the equipment's general location.
- Listing of equipment requiring special storage requirements such as "protect from rain", "heated storage", etc.
- Listing of auxiliary service requirements such as compressed air, service water, seal water, fire protection water, wastewater disposal, etc. The list should indicate continuous service requirements, instantaneous service requirements and minimum/maximum pressure and/or temperature requirements.
- Provide a list of Users, locations and equipment sizes to indicate Seller's experience with ball mills, vacuum filters, gas cooling pumps and other FGD system major equipment, similar to that proposed for AEP, that has been utilized elsewhere in an FGD application.

7.2.3 SELLER'S SPECIFICATIONS AND DESIGN CRITERIA

The Seller shall provide a listing of the codes, standards and regulations they intend to adhere to in the design of the equipment and components furnished under this specification.

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The Seller shall also submit their standard specifications and design criteria that they intend to follow, which are not addressed by AEP Design Criteria as identified in Section 4.1.19 for Owner's review and proposal evaluation.

7.2.4 OFF-SITE FABRICATION AND MODULARIZATION DETAILS

The Seller shall provide sufficient information to allow the Owner to understand the extent of off-site fabrication and component modularization intended to be utilized.

A list shall be provided itemizing all modularized components indicating dimensions, weights, number of pieces, material of construction, special erection requirements, etc.

7.2.5 PERFORMANCE GUARANTEES

The Seller shall detail the extent and conditions associated with each guarantee specified in Section 5.7. This shall include a detailed description of the test program(s) proposed by the Seller to verify compliance with each guarantee.

7.2.6 EXPECTED SYSTEM PERFORMANCE

The Seller shall furnish the information as requested on the attached System Performance Data Sheets found in the Attachment Section.

The Seller shall also submit the parametric graphs, as specified in Section 5.5.

7.2.7 EQUIPMENT PERFORMANCE CURVES

The Seller shall furnish performance curves for the following equipment:

Pump curves detailing head-capacity, efficiency, BHP, and required NSPH from 0% to maximum run-out conditions.

Blower, fan and compressor characteristic curves for discharge pressure versus volumetric capacity.

7.2.8 OPERATING PROCEDURES

The Seller shall include with the proposal a summary of WFGD System operating procedures. This summary should be brief yet provide the Owner with a basic understanding of the system operation. It shall include a discussion of such items as system start-ups, shutdown, emergency operations, turndown operations, the placement of equipment into and out of service, etc.

7.2.9 INTERPRETATION OF SCOPE

The Seller shall provide a detailed list of the materials and services included within the proposed scope of work. The list shall itemize the equipment and components the Seller shall supply. This list shall include equipment size, manufacturer and materials of construction and serve as a tool for clarification of interface boundaries and when necessary address design philosophies.

The Seller shall also provide a detailed description of the support steel, platforms and stairways to be supplied by the Seller under this contract.

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7.2.10 SCHEDULES

The Seller shall provide a drawing schedule, which shall indicate both the earliest possible drawing submittal date and the date required for Owner acceptance of the drawings.

The Seller shall also provide a milestone type schedule detailing engineering, fabrication and delivery of all components and equipment.

7.2.11 SPARE PARTS INFORMATION

The Seller shall furnish a recommended spare parts list that includes itemized prices and anticipated lead times.

7.2.12 SUBCONTRACTORS, FABRICATORS AND EQUIPMENT SUPPLIERS

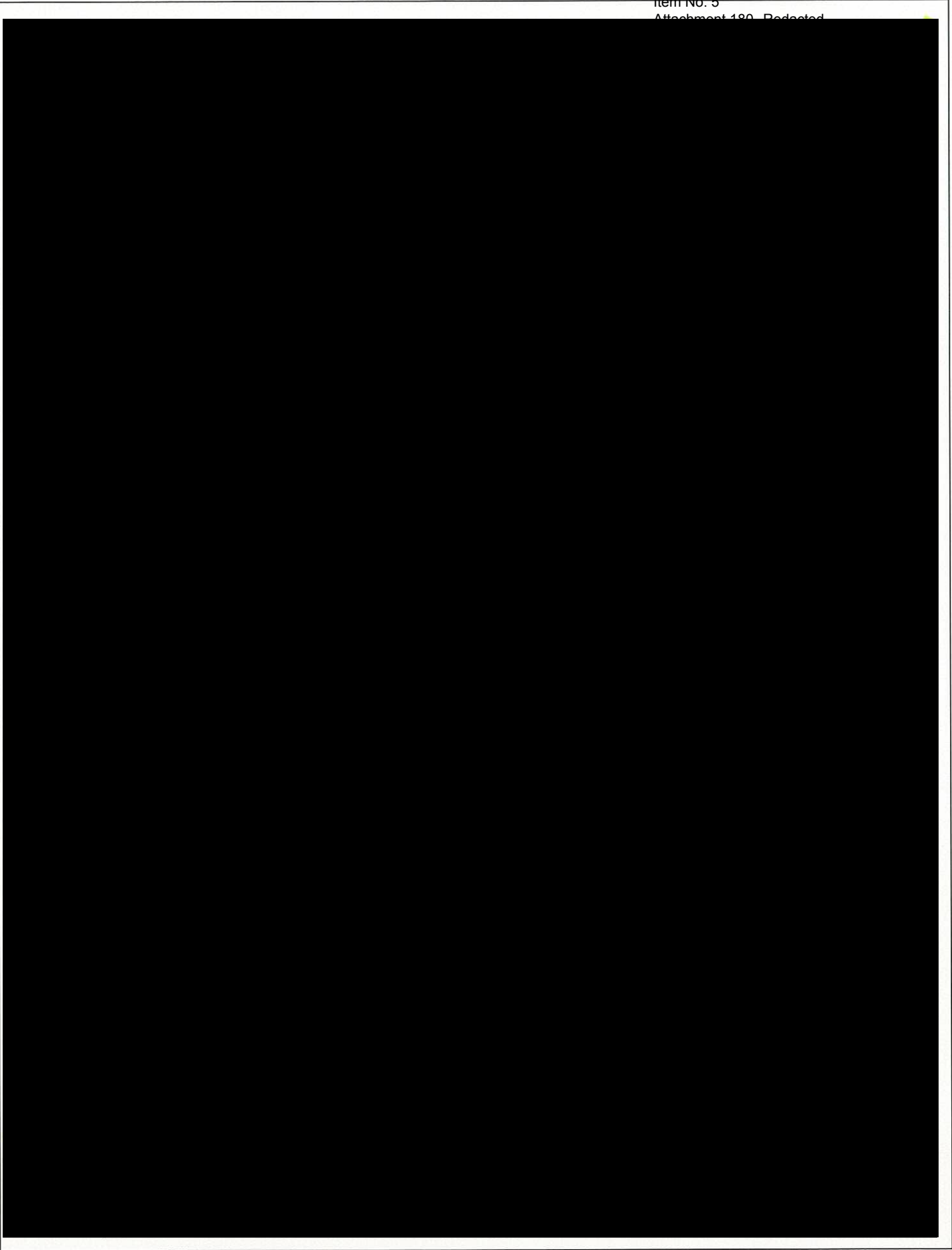
The Seller shall complete the Subcontractors, Fabricators and Major Equipment Suppliers Data Sheet found in the Attachment Section regarding all potential subcontractors, fabricators and equipment suppliers whose products or services they intend to utilize in the design of the WFGD system.

7.2.13 SUPPLEMENTAL INFORMATION

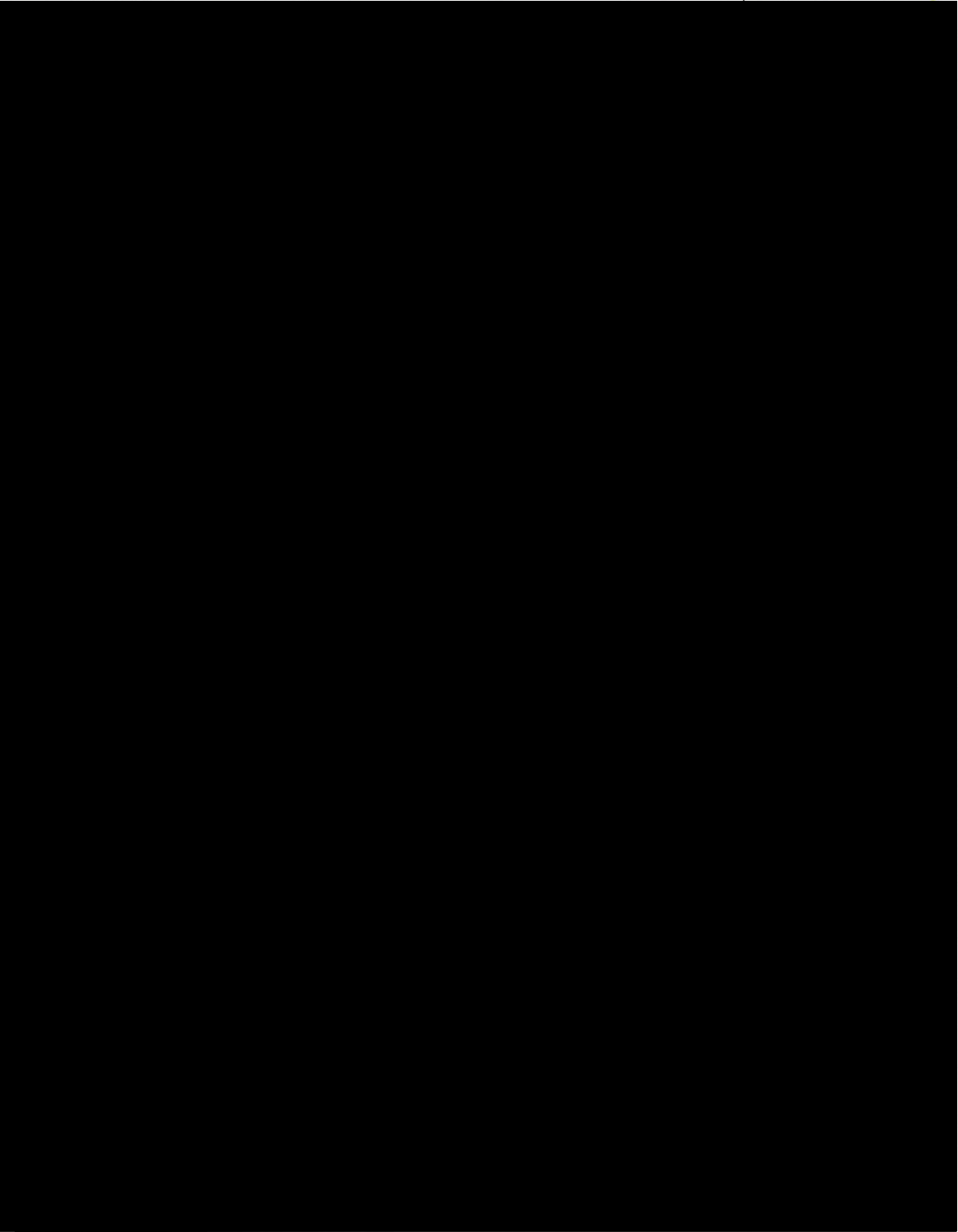
The Seller shall provide the following supplemental information with the proposal:

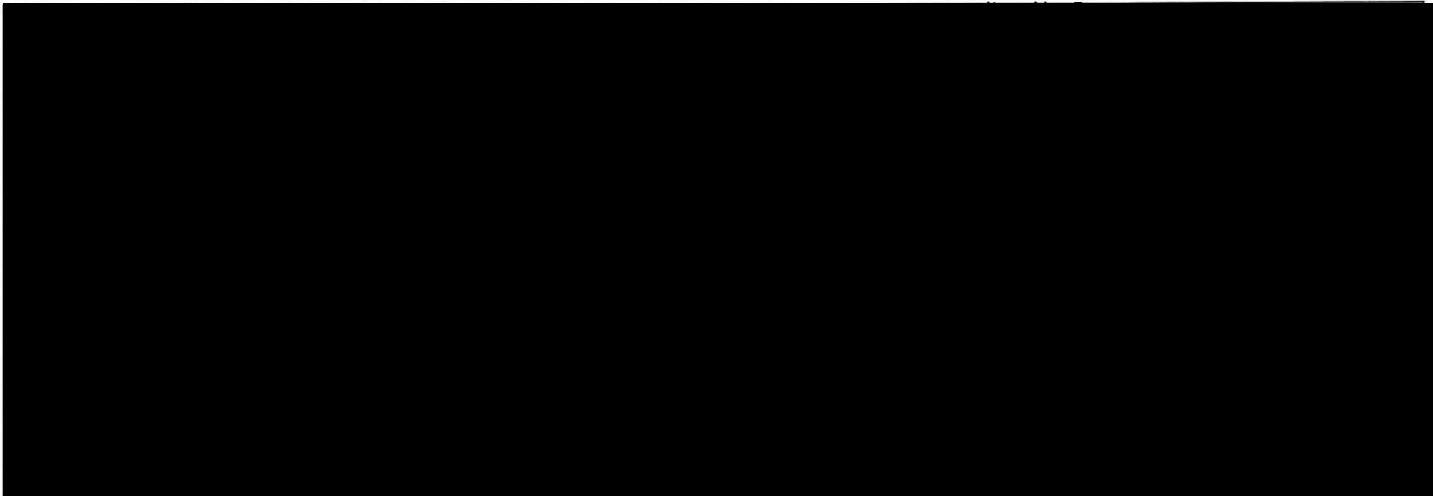
- Preliminary details of the training program specified in Section 6.7.
- Preliminary details of the Seller's Fabrication and Erection Quality Control/Quality Assurance Program.
- A list of all codes, standards and specifications utilized in the design of the WFGD system. This listing shall give the complete code reference and the type of component for which the code applies.
- Expected staffing requirements (operating and maintenance) as defined in the Manpower Requirements Data Sheet found in the Attachment Section.
- Preliminary details of all equipment and component testing as specified in Section 6.14.

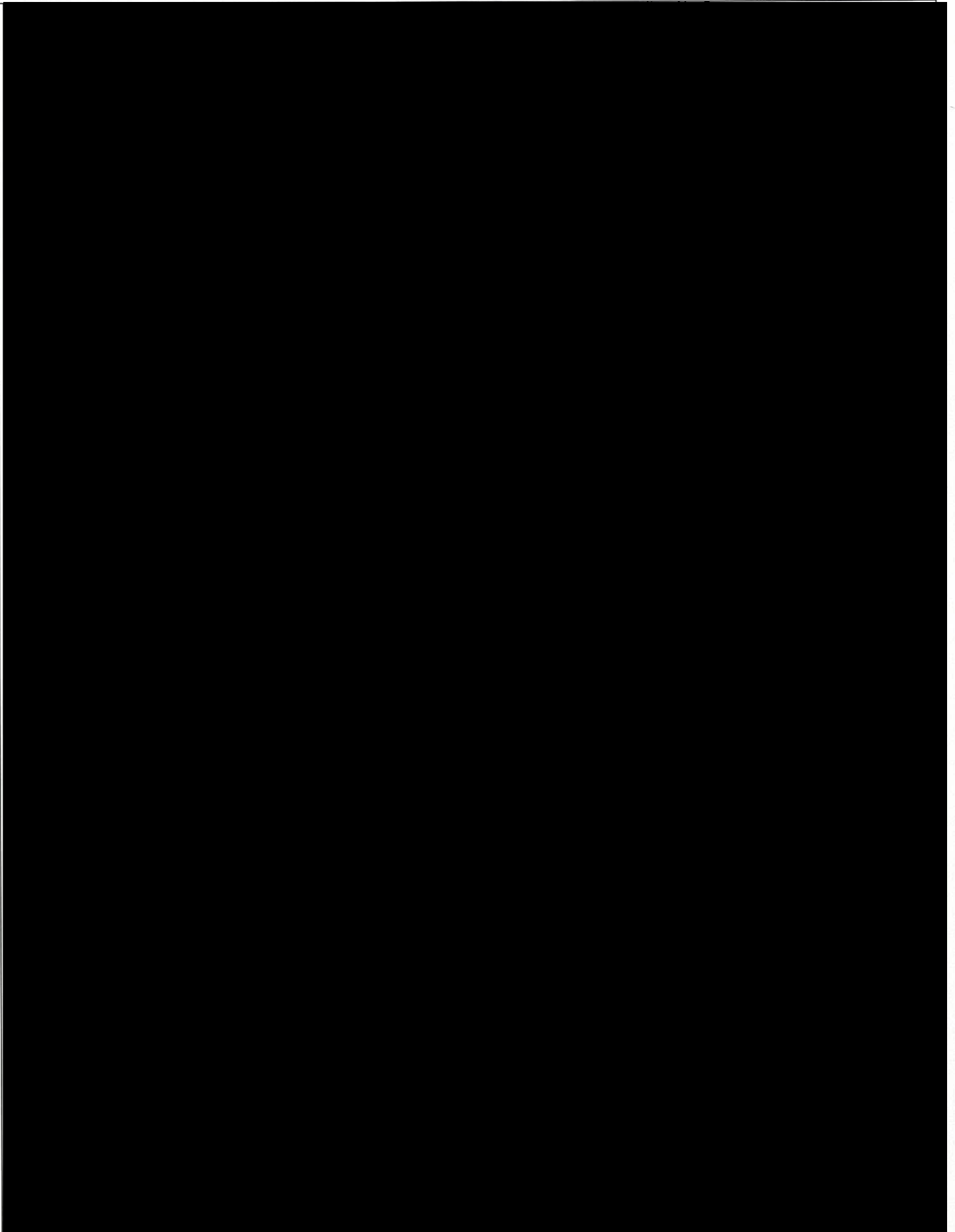


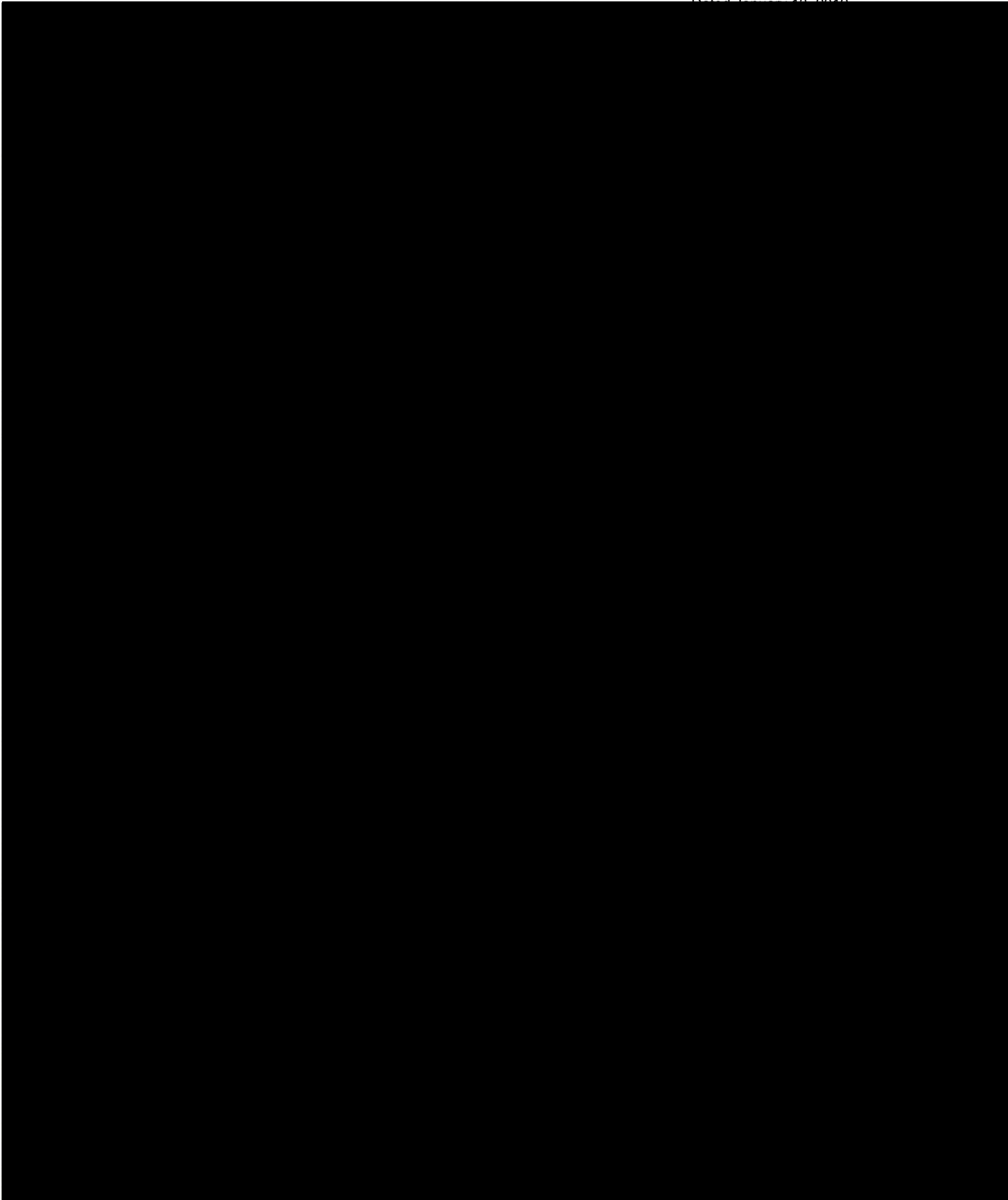


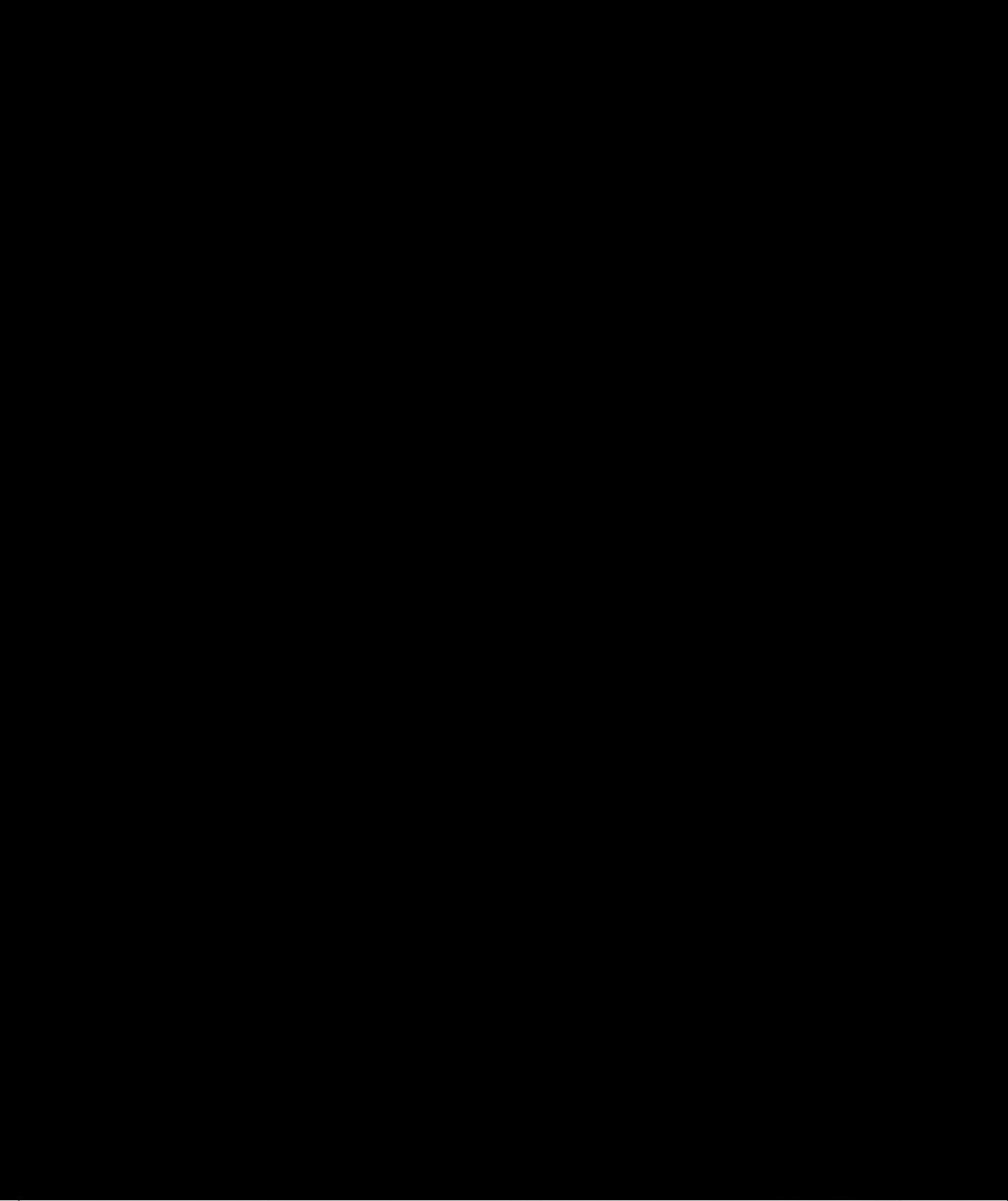












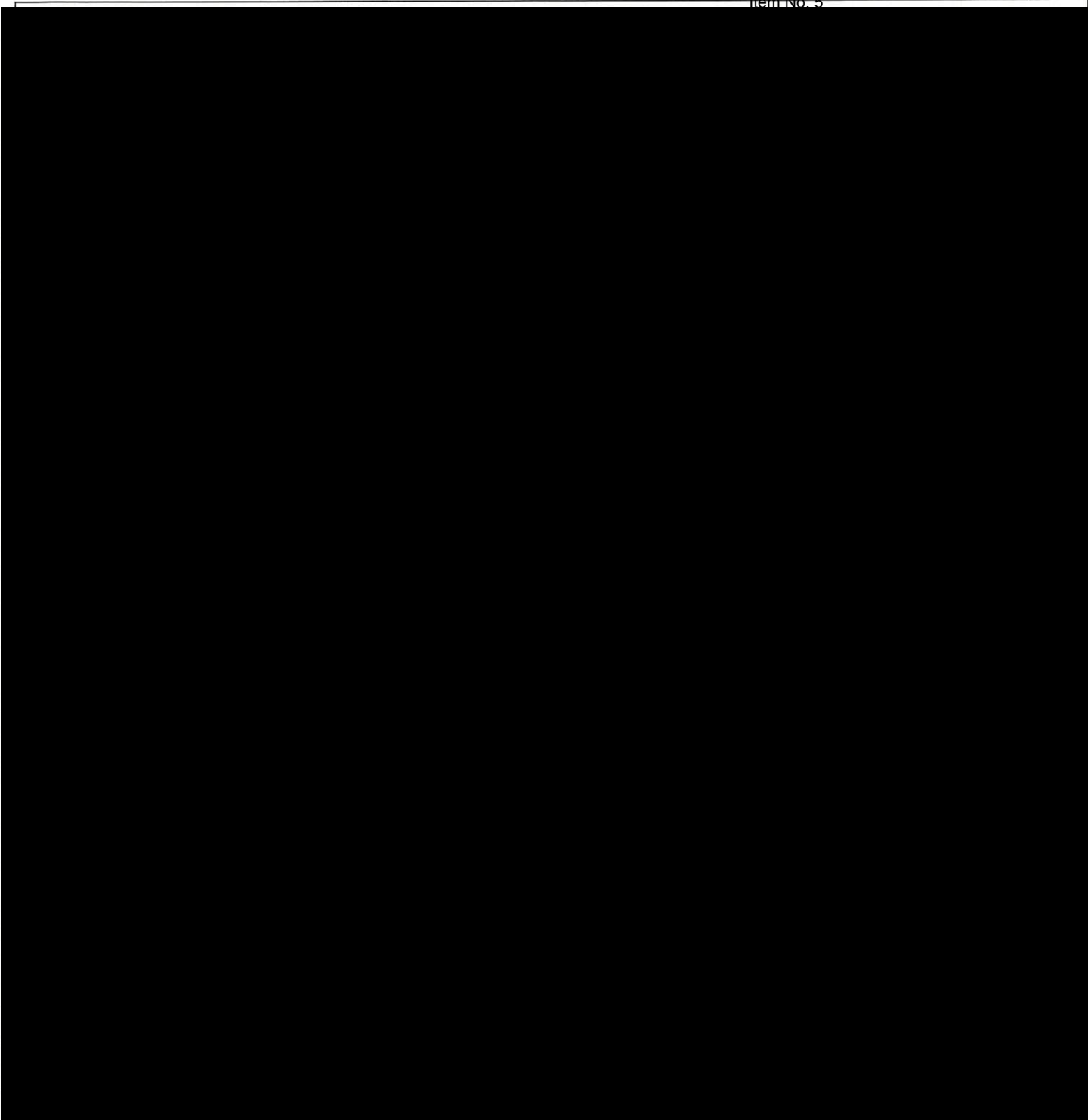
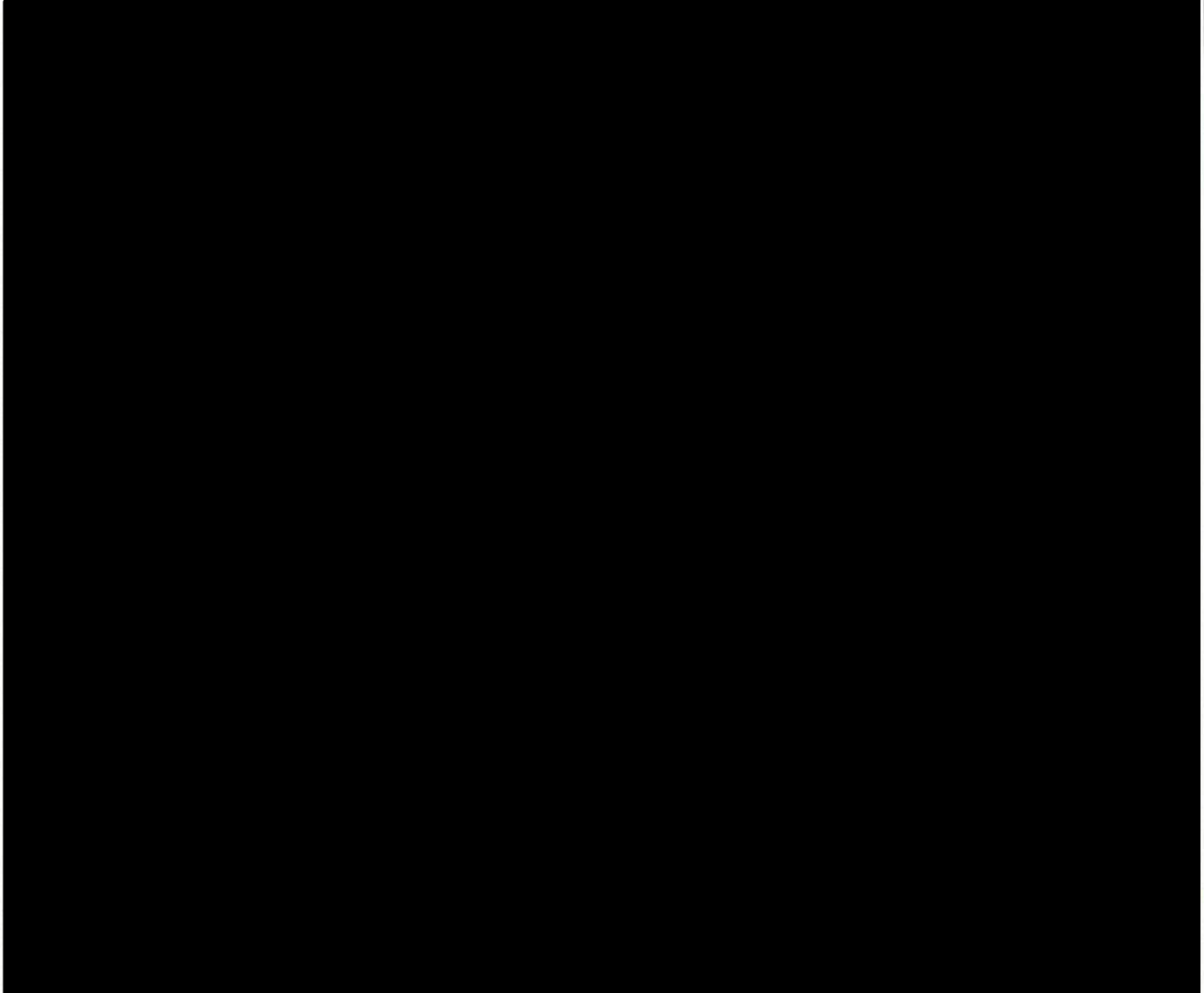
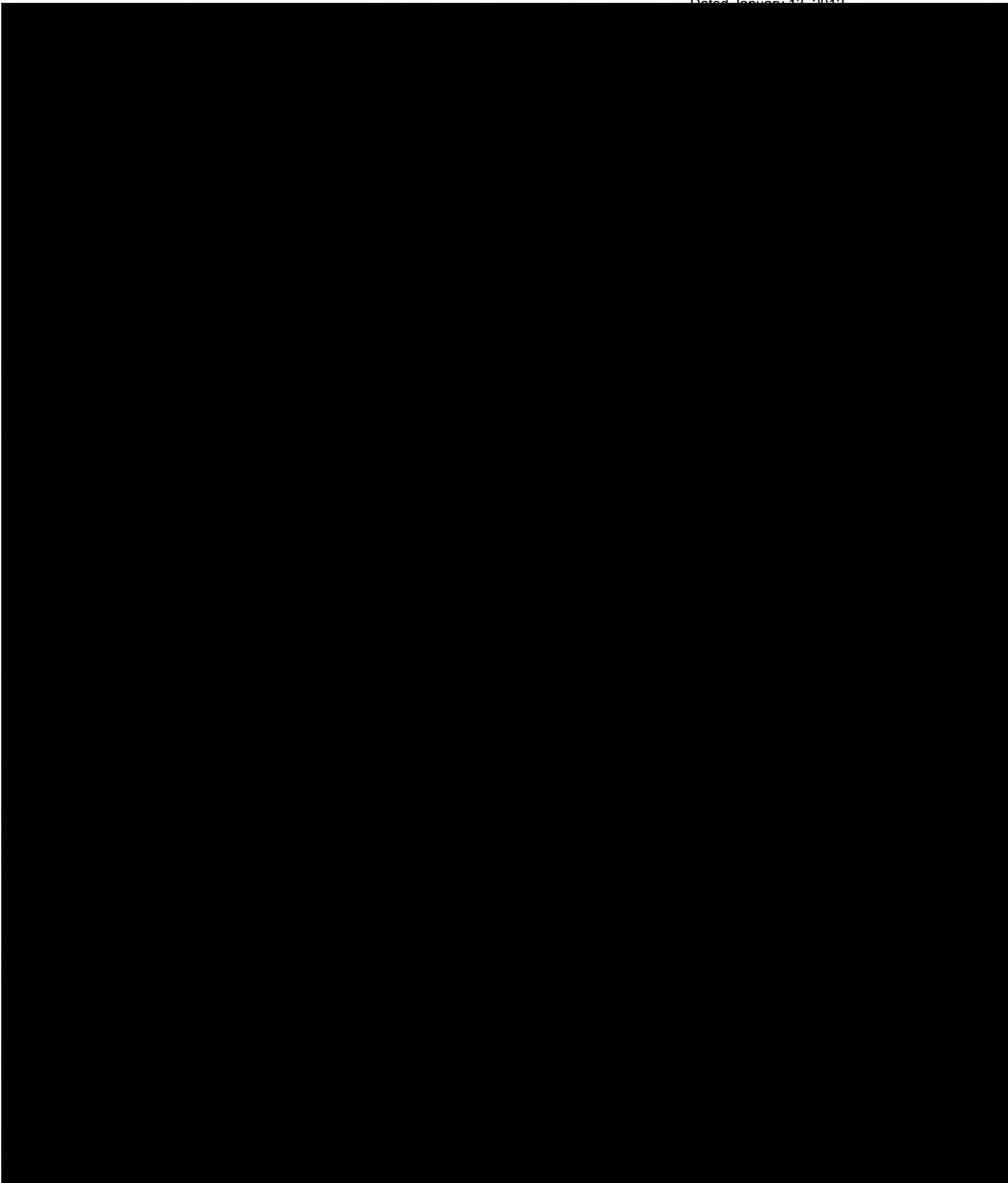
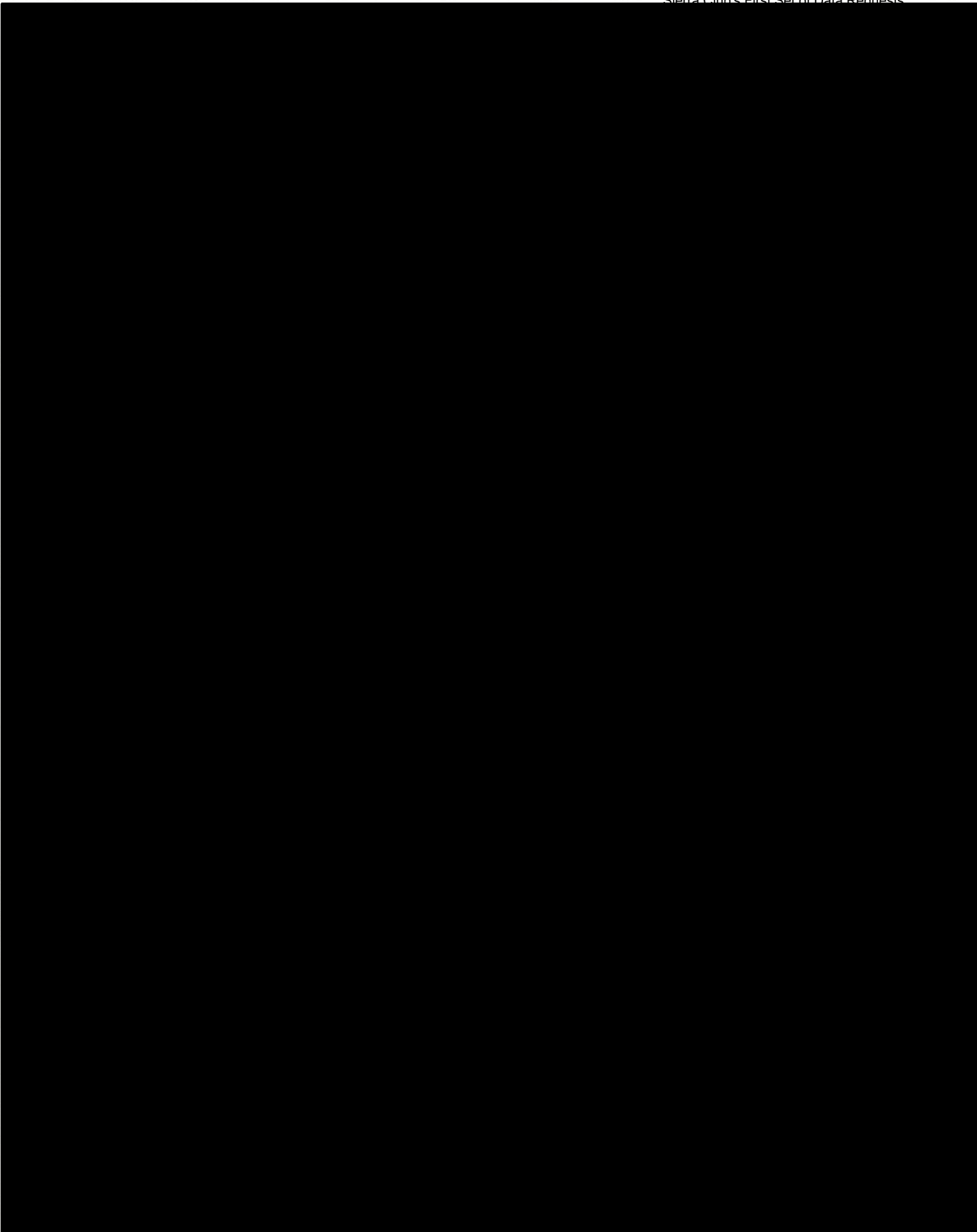


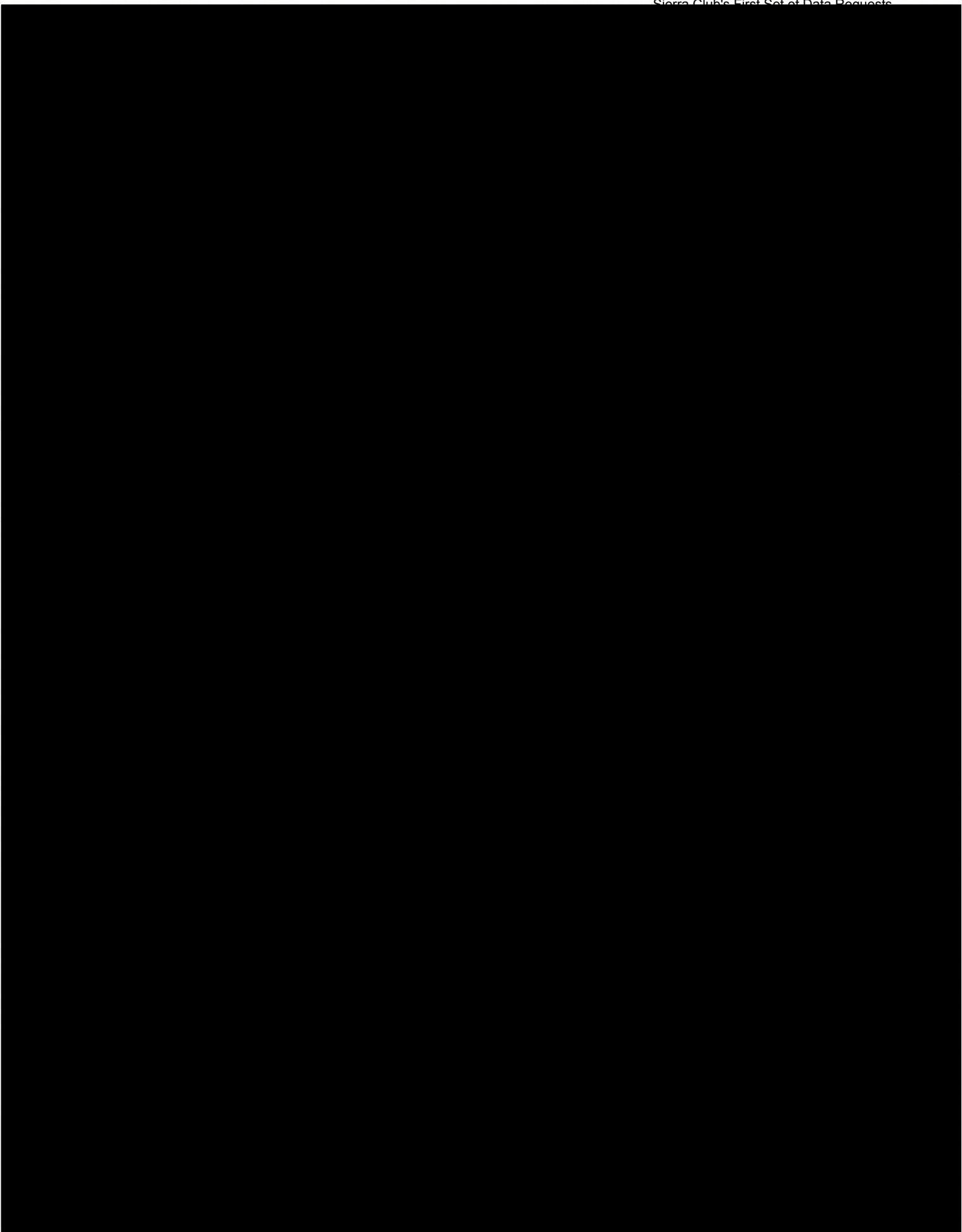
Table 1
Division of Work

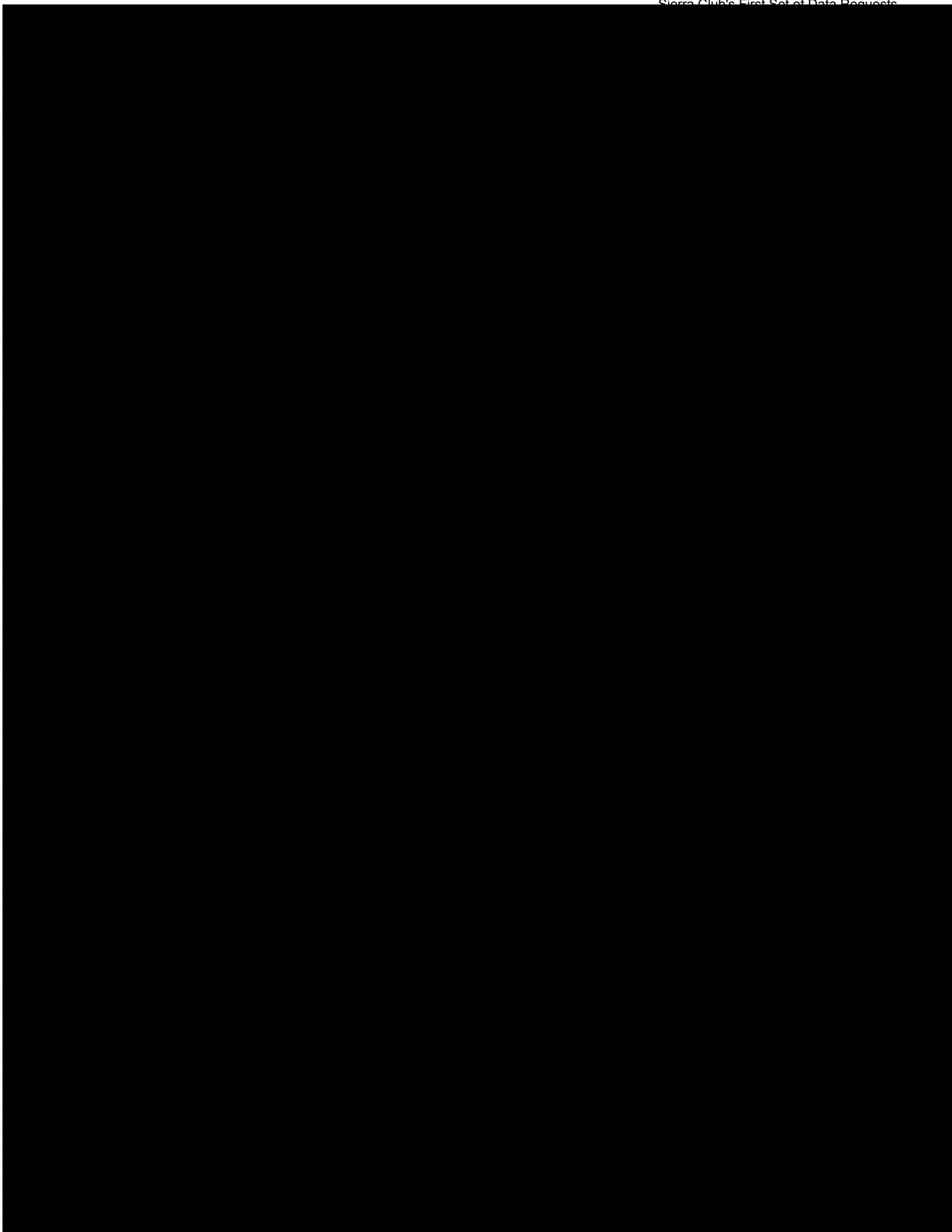
ITEM	DOCUMENT ID	REV. DATE	REV	DOCUMENT DESCRIPTION
1	N/A			Big Sandy FGD Division of Work (DOW)
2	N/A			Big Sandy I&C Division of Work
3	PG-209 Project Guideline - Rev 1	1-May-05	1	Project Guideline - Commissioning Delineation of Work

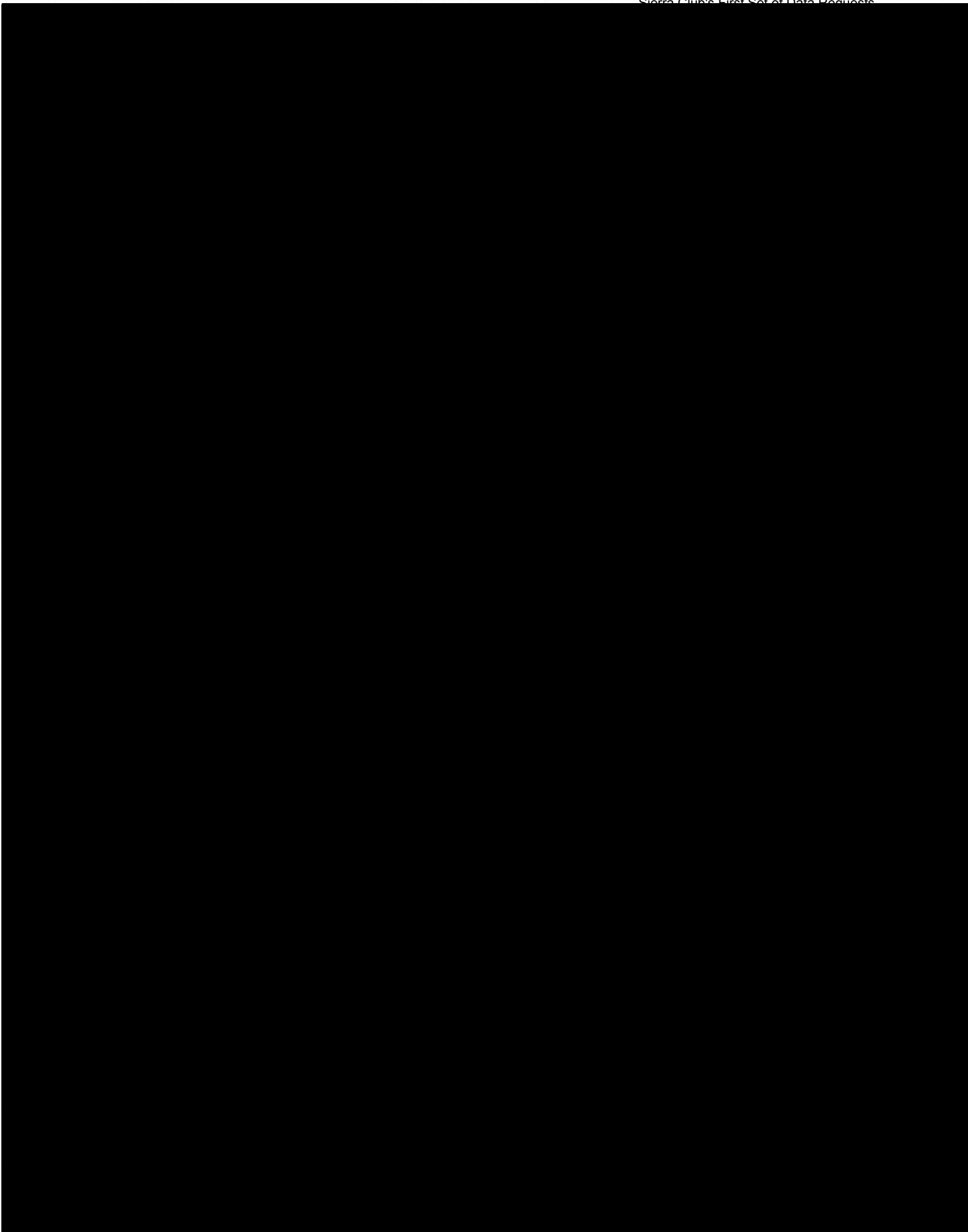


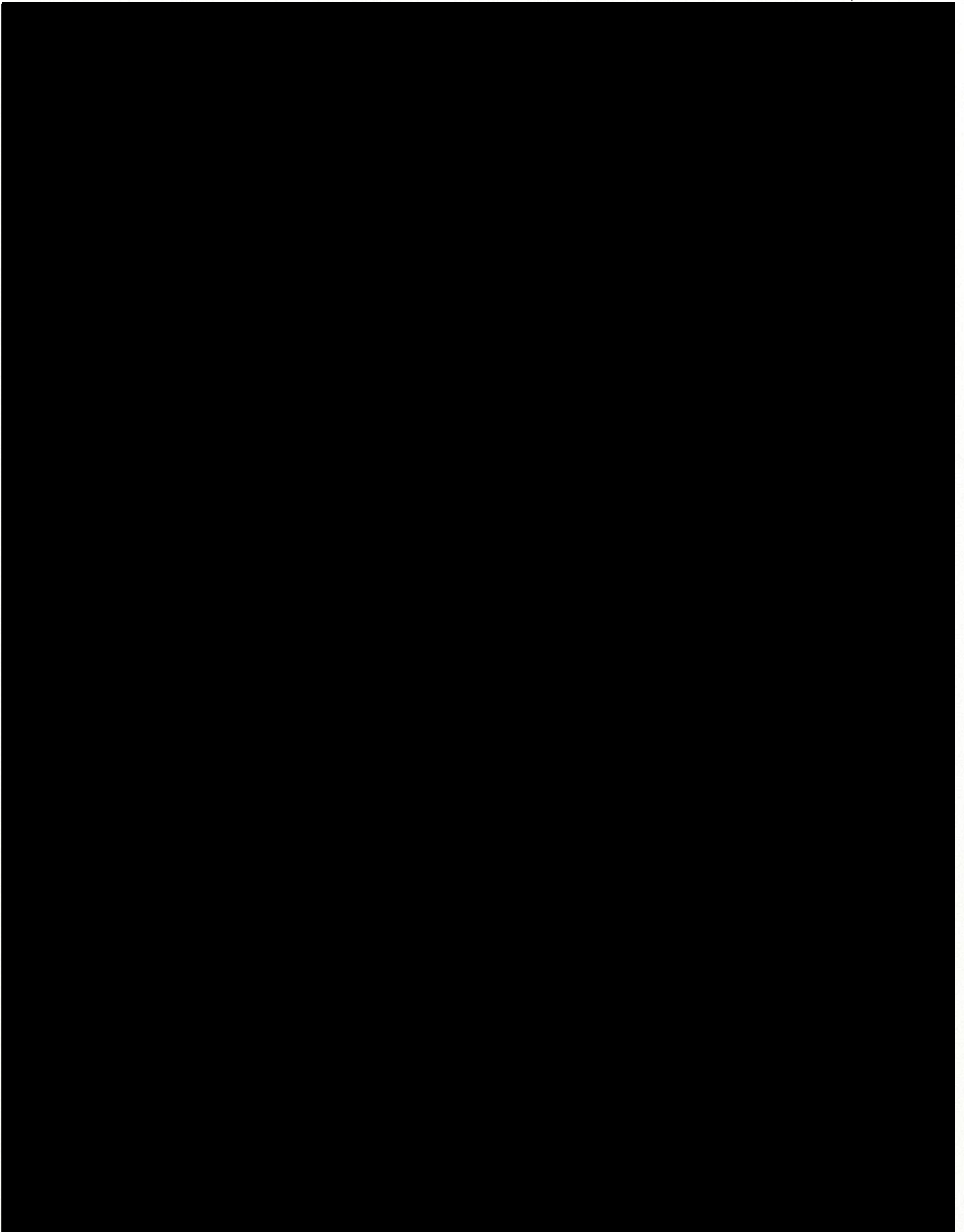


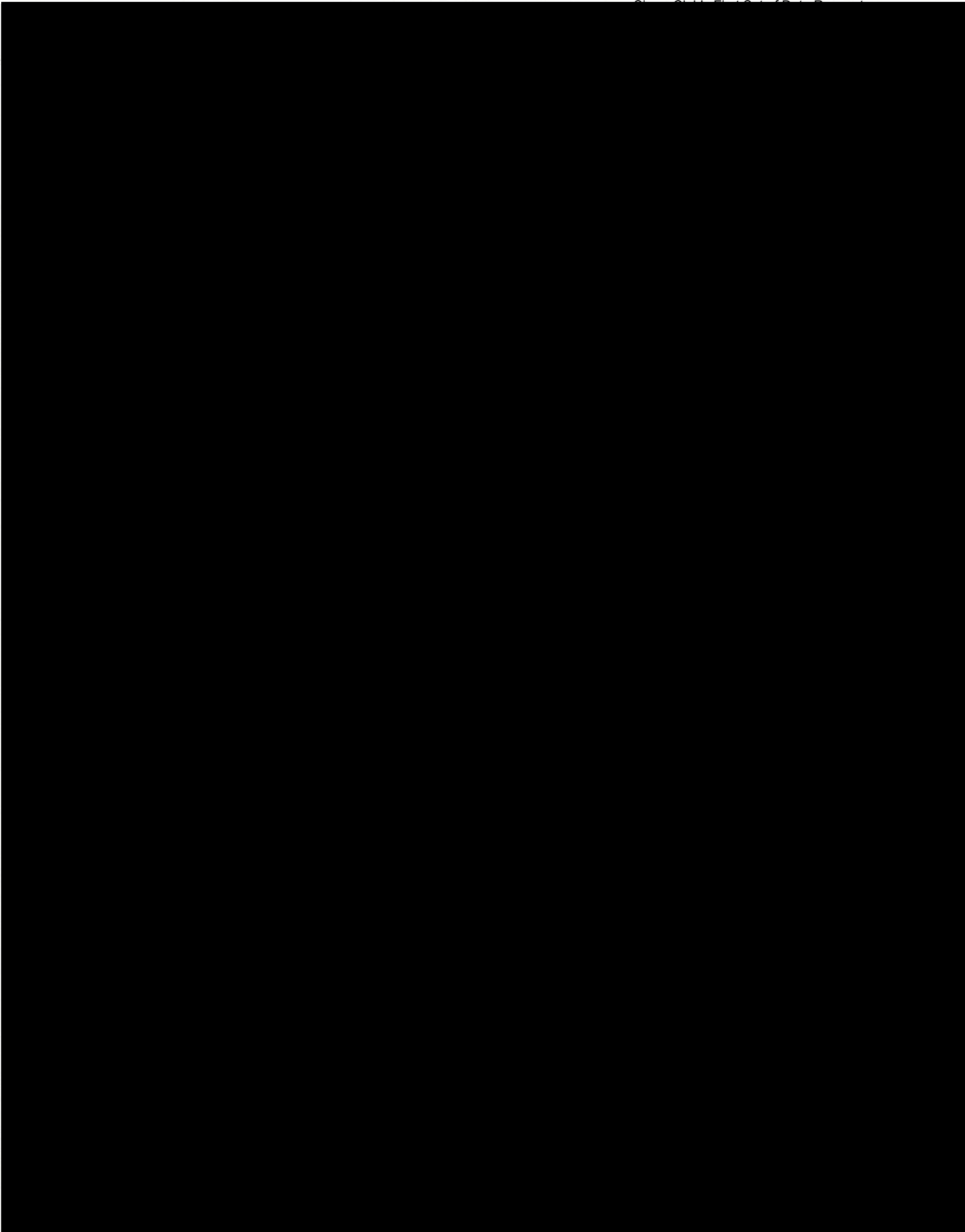


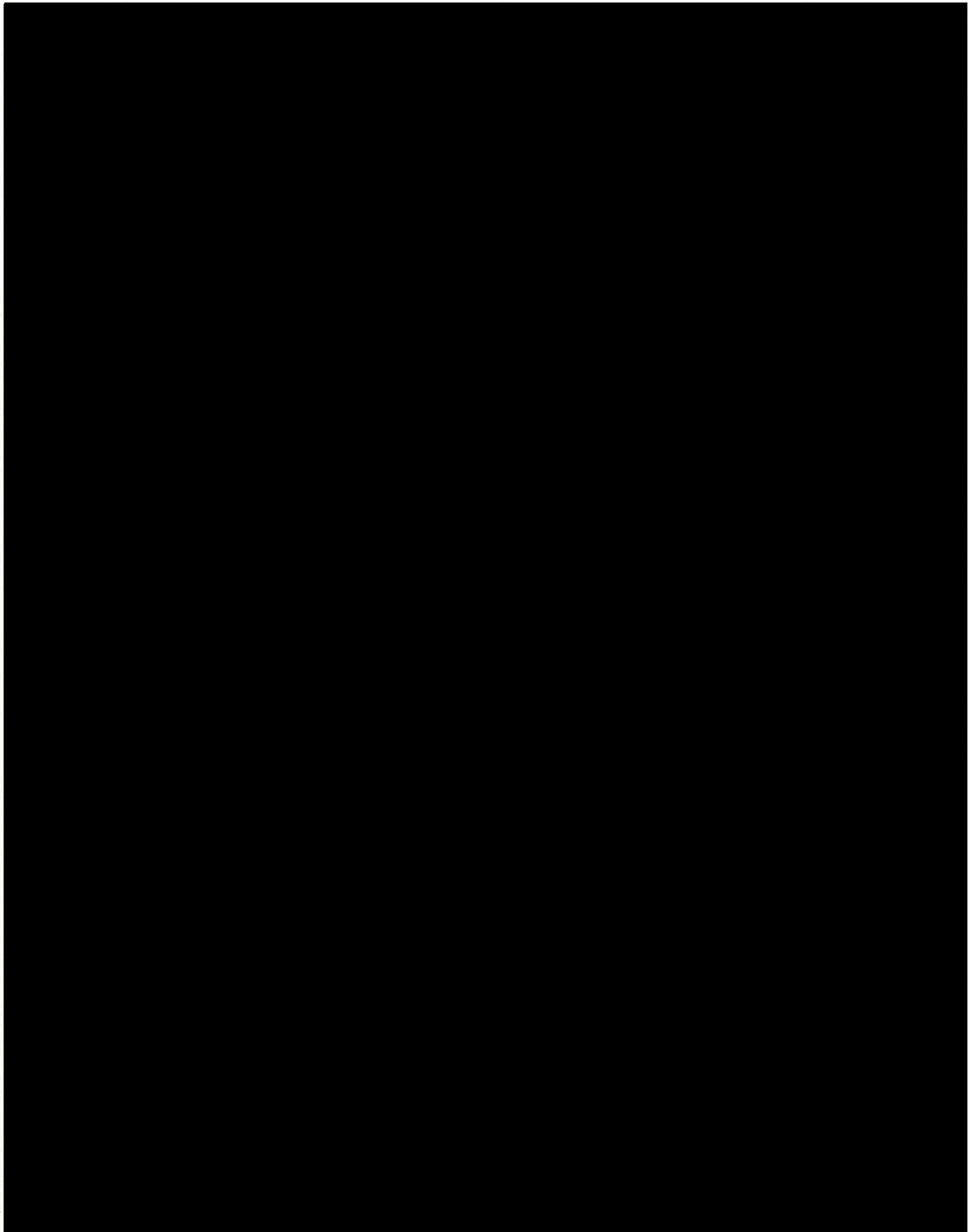


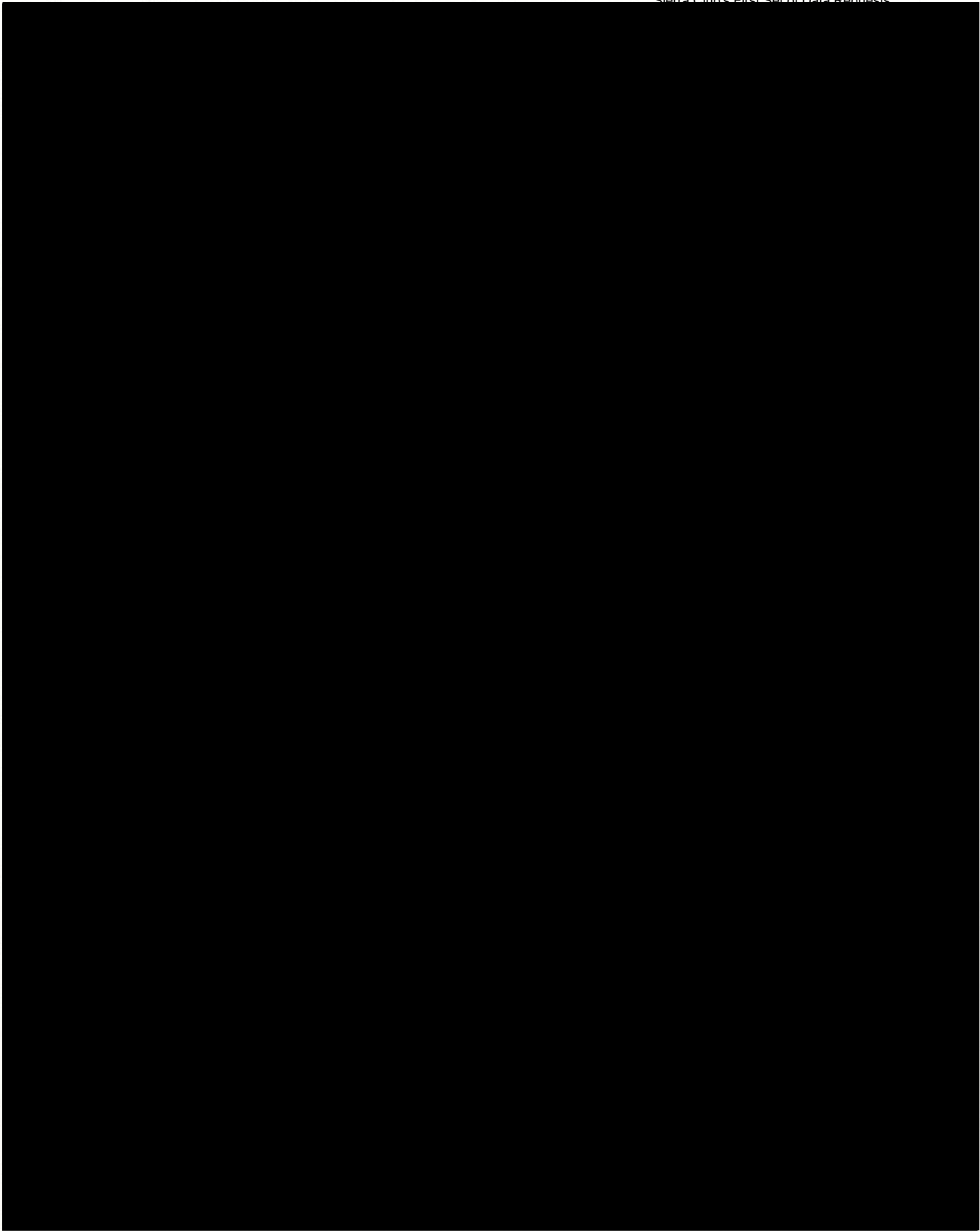


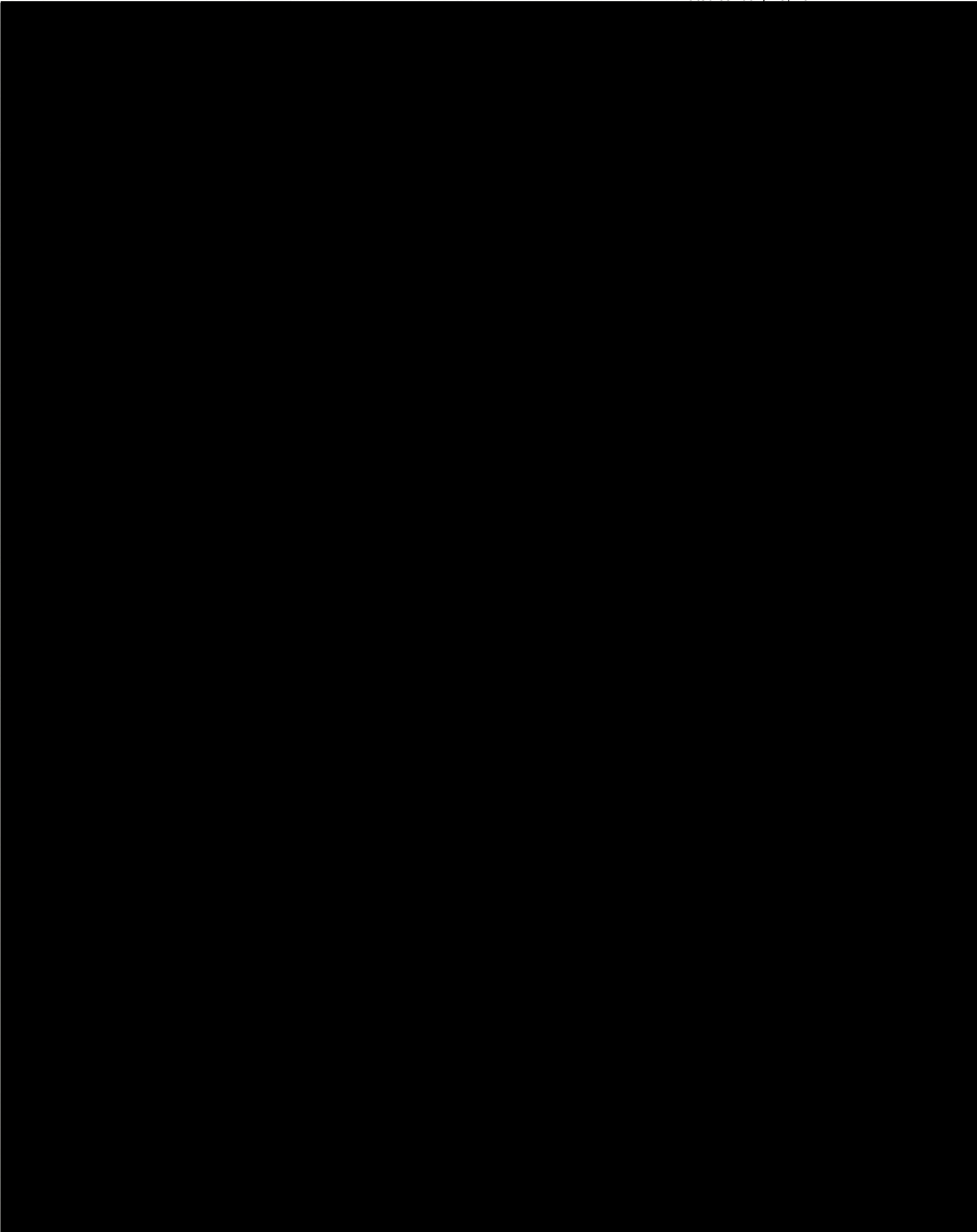


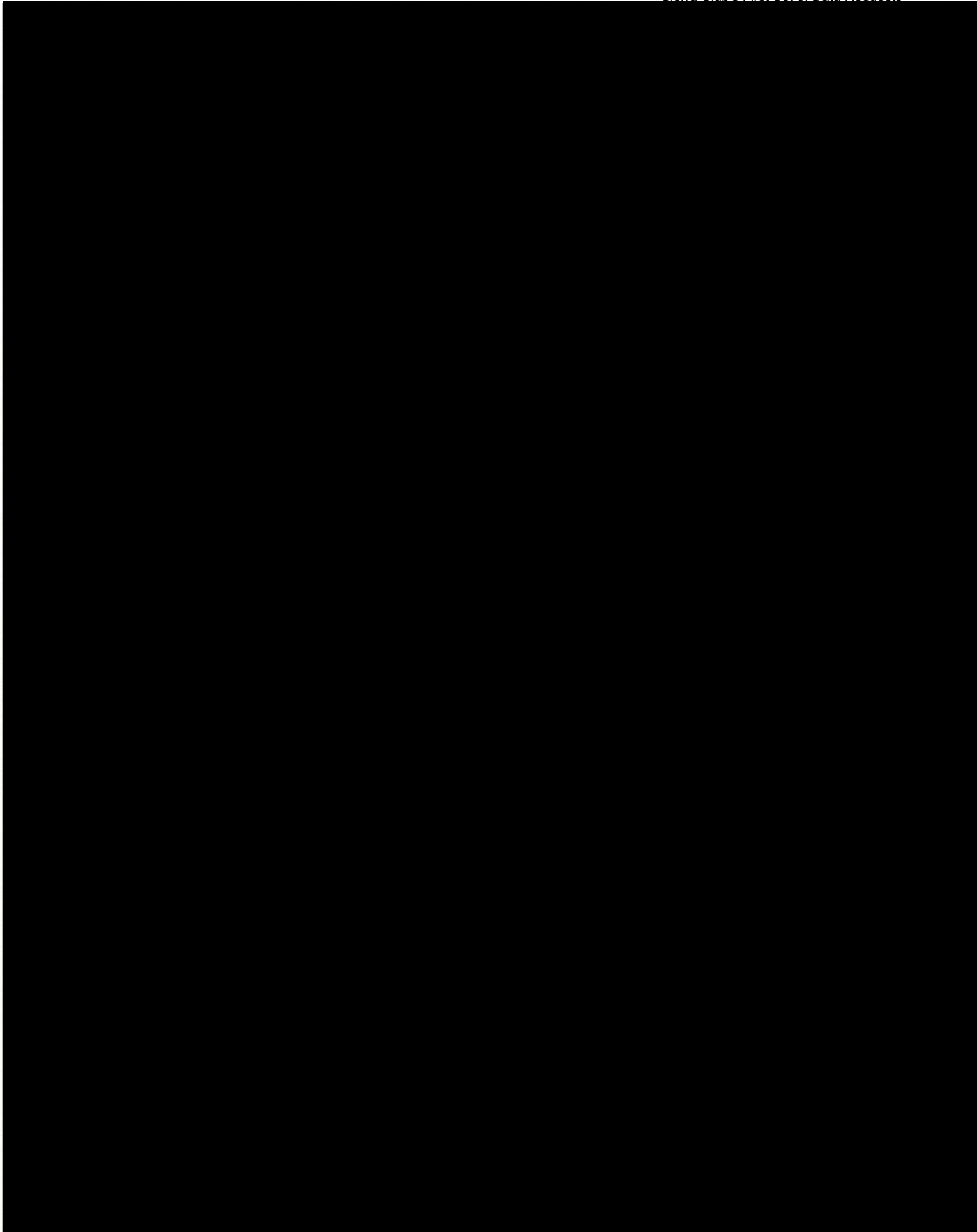


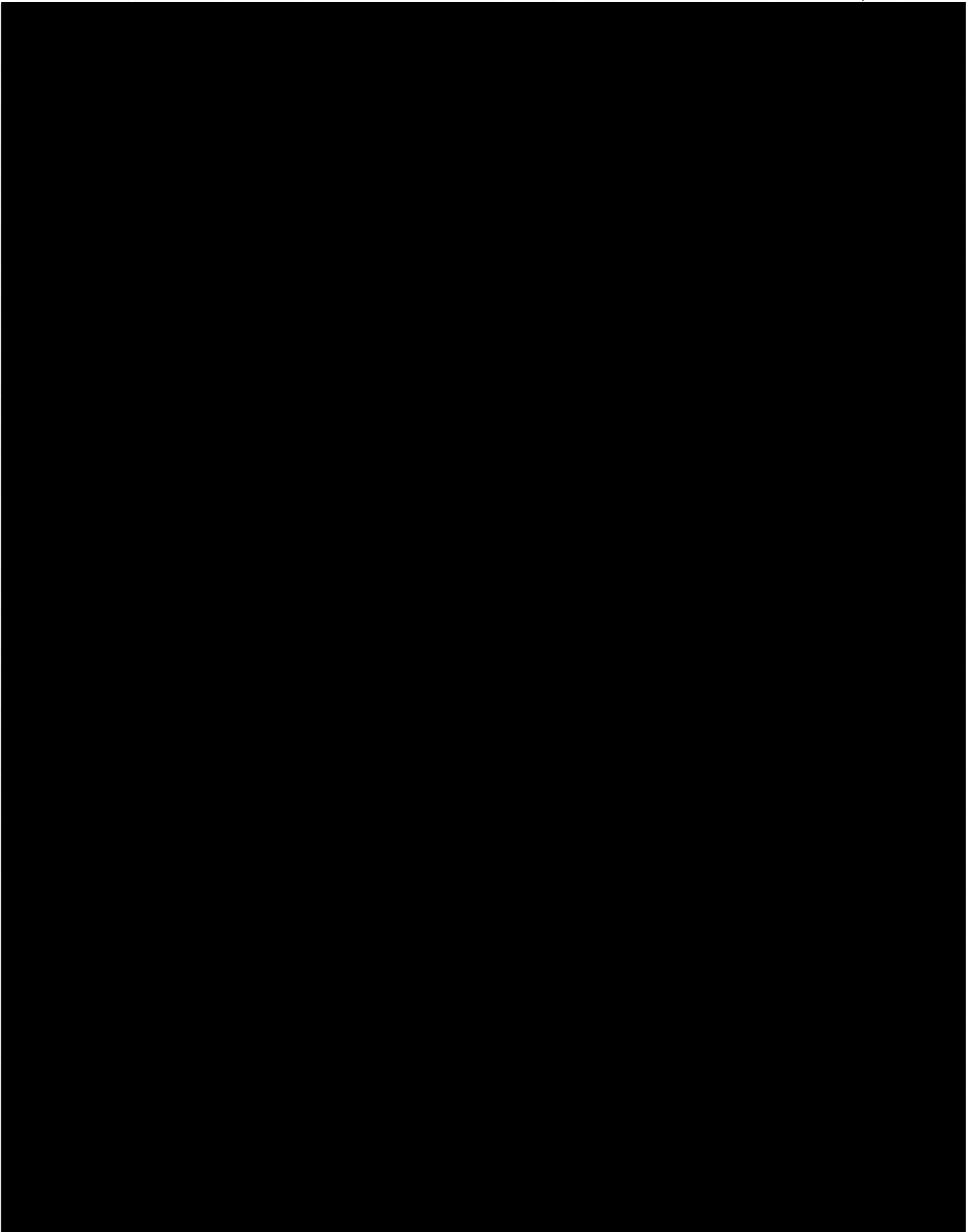


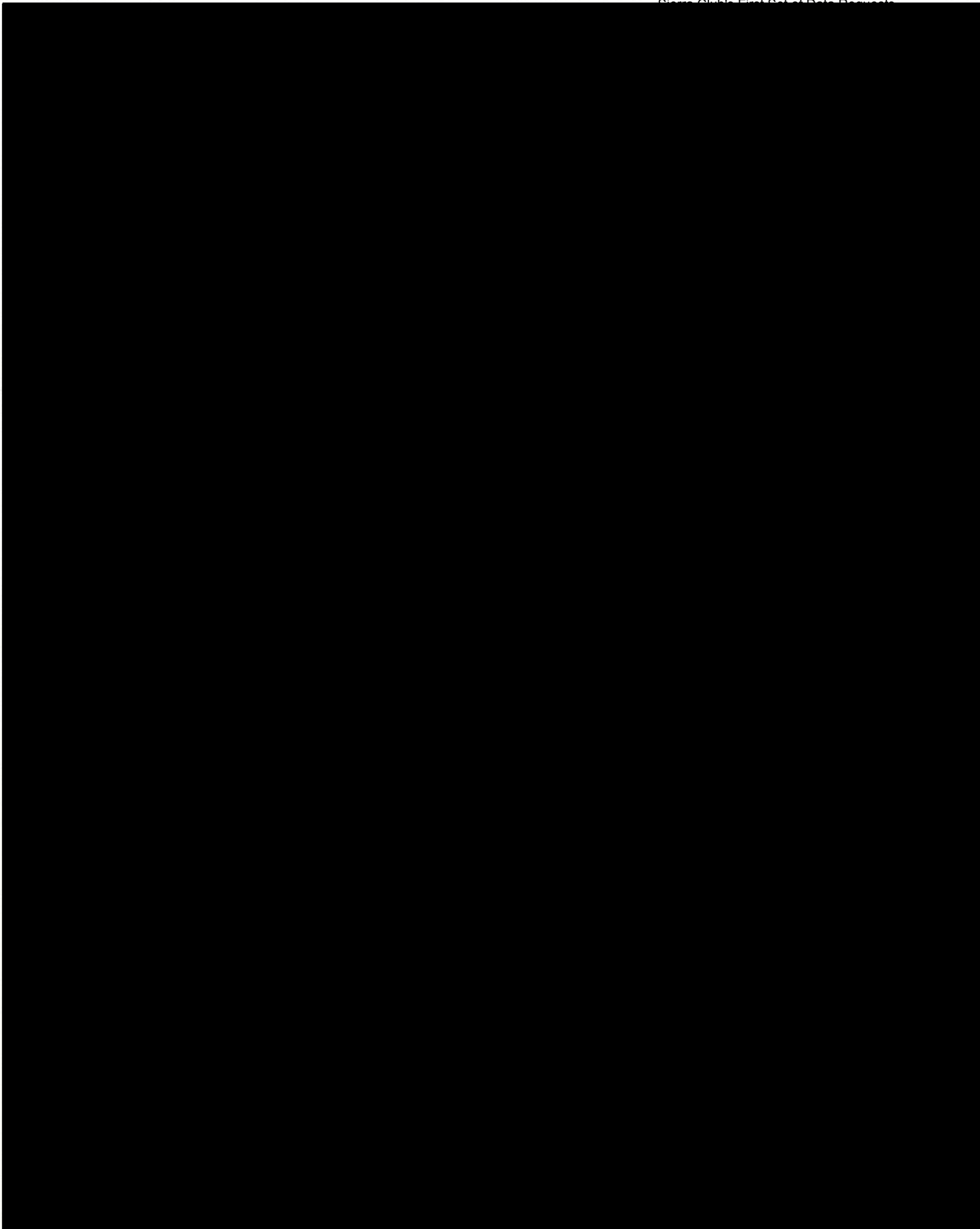


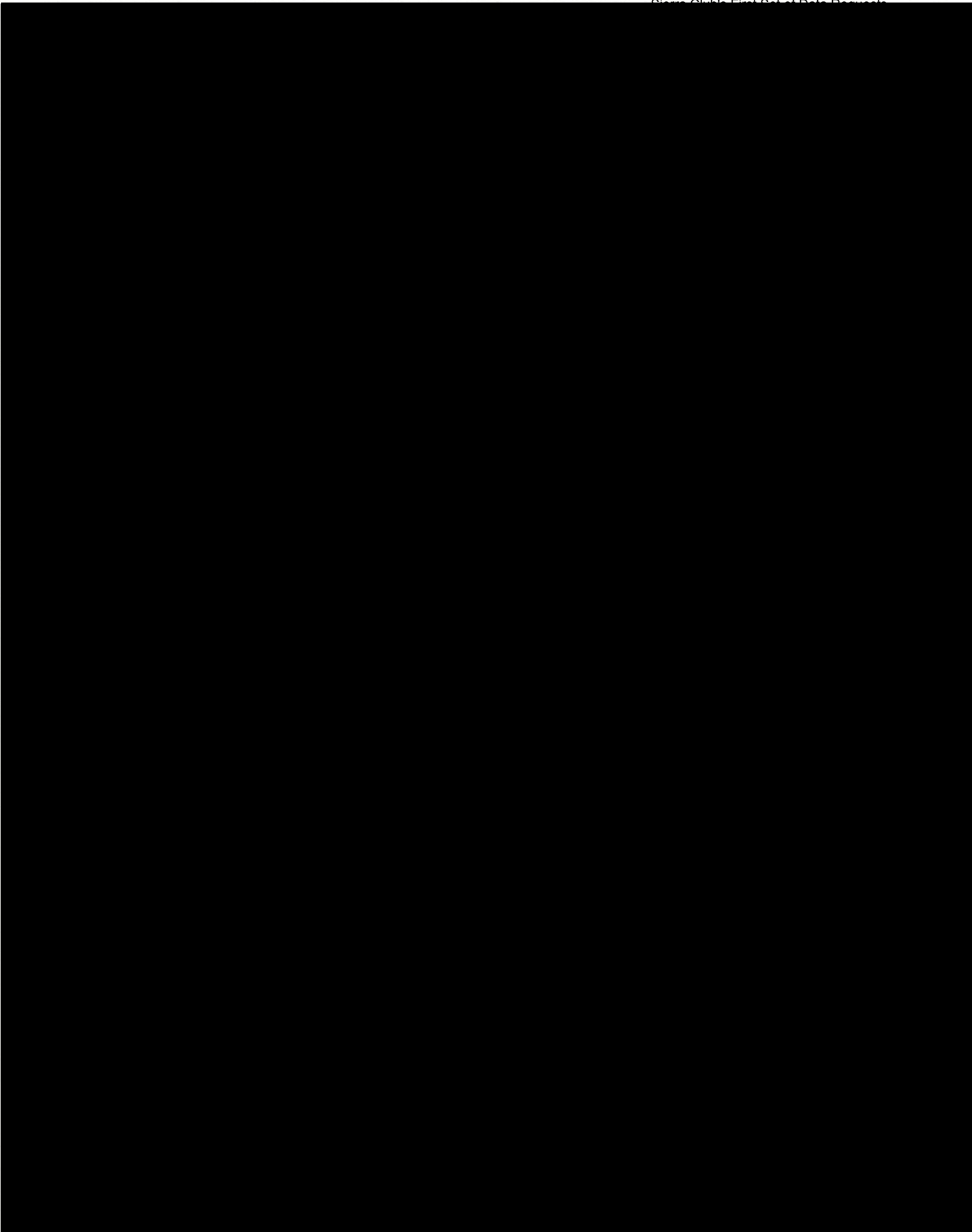


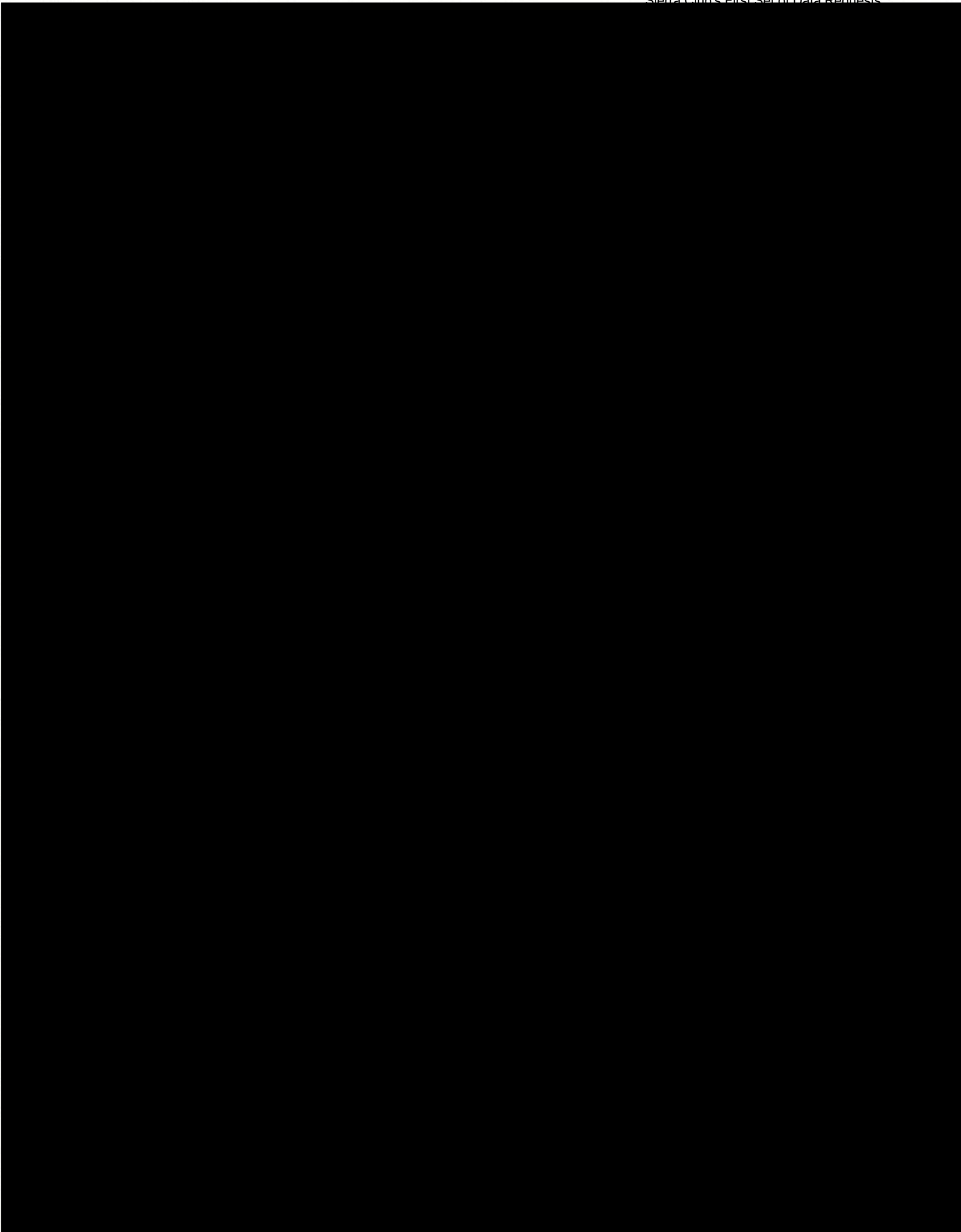


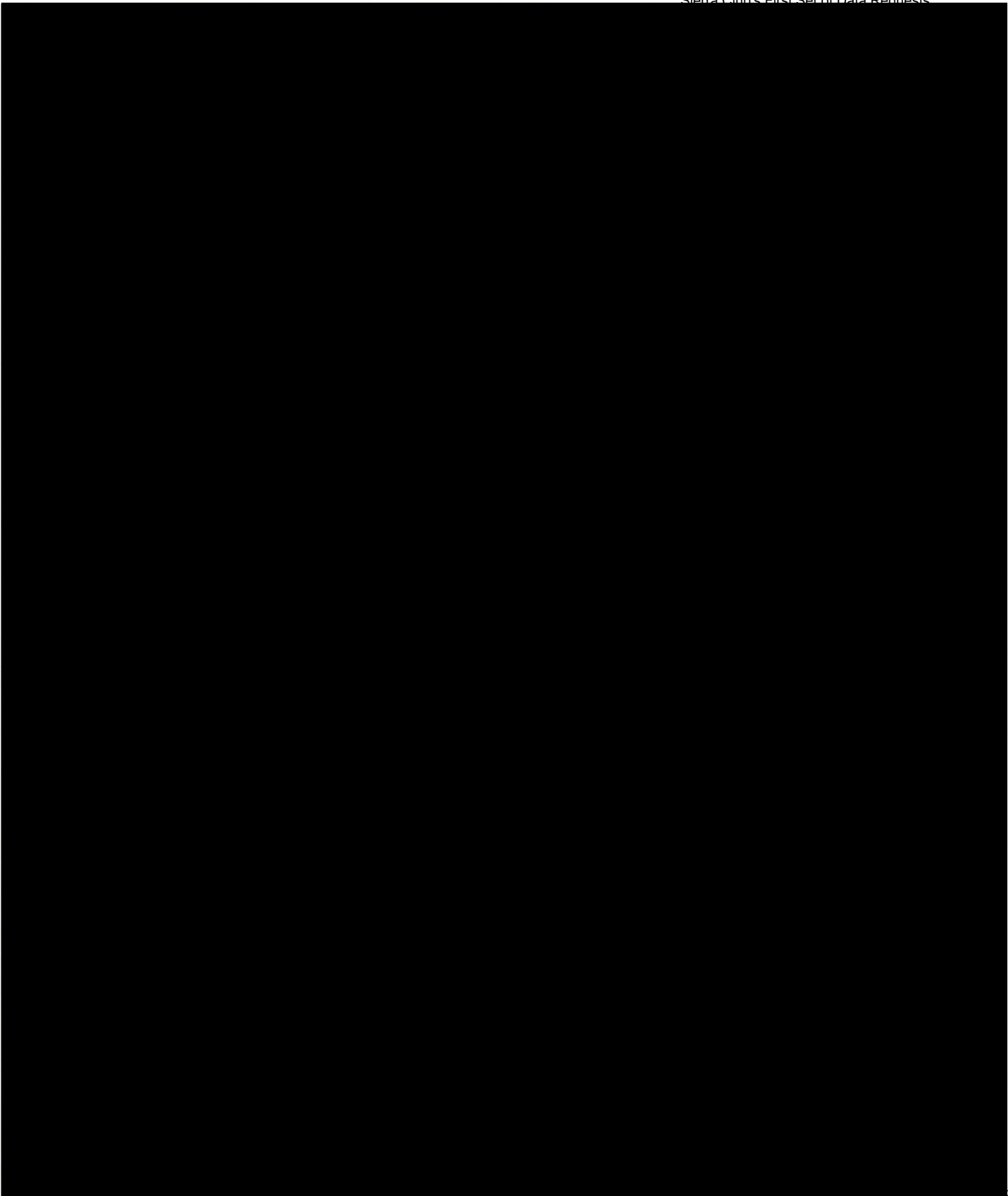












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