LS POWER GRID MID-ATLANTIC

2021 New Jersey Offshore Wind Option 1B Transmission Proposal

September 17, 2021

Clean Energy Gateway

TABLE OF CONTENTS

Introduction of Proposals

LS Power Grid Mid-Atlantic, LLC (LSPG) is pleased to provide six proposals to the New Jersey Board of Public Utilities (BPU) and PJM as transmission solution options to integrate offshore wind generation (OSW) into the New Jersey transmission system [redacted]

Solution Studies

[redacted]

Table 1
AC Solution
Advantages

[redacted]

- [redacted]

- A coordinated plan will minimize impacts to the community and environment while maximizing the amount of OSW that can be integrated as summarized in Table 2.

Table 2 Coordinated Plan Advantages

Coordinated Advantage	Discussion
Consolidate Onshore Corridors	Minimizes environmental and community impacts through a smaller footprint and avoiding repeated disturbances. [redacted]
Consolidate Shore Landings	Minimizes environmental and community impacts through a smaller footprint and avoiding repeated disturbances. Maximizes the OSW generation capability as viable shore landing locations that are constructible, environmentally viable, socially acceptable, and proximate to BOEM OSW lease areas are limited.
Consolidate Offshore Cables	Minimizes environmental impacts through a smaller footprint. [redacted]

- Solutions should be flexible to accommodate a wide range of OSW interconnection scenarios given flexibility provided by the BPU Solicitation 2 awards and likelihood that renewable energy goals will be expanded in New Jersey.
- Solutions should have a shore landing located [redacted].
  - The onshore transmission system in southern New Jersey is weak and unable to accommodate more than [redacted] of OSW without significant upgrades. [redacted]
  - Areas north of [redacted]
- Solutions should place [redacted] This will minimize community and environmental impacts through [redacted] to the existing transmission system.
- Option 3 proposals (i.e., an offshore network) provide [redacted].

[redacted]

Option 2 Proposal

[redacted]

I. Executive Summary

LS Power Grid Mid-Atlantic, LLC (LSPG) is pleased to provide this Proposal to the New Jersey Board of Public Utilities (BPU) and PJM for an onshore (Option 1B) transmission solution to integrate offshore wind (OSW) into the New Jersey transmission system (the "Clean Energy Gateway" or "Project").

The Clean Energy Gateway is a cost-effective and highly reliable networked AC solution independently capable of integrating 5,600 MW of OSW. This allows New Jersey to exceed its current renewable energy goals and accommodate a total of nearly 10,000 MW of OSW. [redacted] The Project is modular to provide flexibility in implementation [redacted] Each phase can be constructed sequentially or simultaneously to accommodate a wide range of generation connection scenarios in a cost effective manner, including the ability to accommodate no, partial, or full interconnections from [redacted] The Clean Energy Gateway provides New Jersey with the opportunity to avoid substantial network upgrades and invest those dollars in a complete transmission solution to exceed its OSW goals.

The Clean Energy Gateway will be completed by LS Power, a New Jersey based company, who is [redacted]. Cost certainty is provided by [redacted].

[redacted]

Project Benefits

The Clean Energy Gateway provides a highly reliable and resilient design with storm-hardened substations and underground redundant transmission paths to independently integrate 5,600 MW of new OSW. The Project is more cost effective, reliable, and efficient with lower implementation and operating risks, lower impacts to the environment and communities, and a longer operating life [redacted] The primary benefits of the Clean Energy Gateway include:

- ✓ Enhanced reliability from the use of [redacted] that minimize OSW curtailment risk and increase New Jersey's transmission system resiliency;
- ✓ Flexibility and modularity to accommodate a wide range of OSW generator and/or offshore transmission system interconnections that have varying schedules to maximize OSW value;
- ✓ Ability to accommodate OSW exceeding state goals allowing New Jersey to efficiently increase its clean energy independence;
- ✓ Significant cost savings from avoided network upgrades, resolving multiple PJM identified reliability violations, and [redacted]
- ✓ Minimized environmental, community, and tourism impacts (onshore and offshore) throug [redacted]
- ✓ Increased load and capacity market savings providing greater benefits that accrue to New Jersey ratepayers;
- ✓ Significant emissions reductions [redacted];

- ✓ Substantial state economic benefits from [redacted] the Project; and
- ✓ Ratepayer protection provided by a [redacted].

Cost and Cost Certainty

LSPG estimates the Clean Energy Gateway will cost $1.48 billion in 2021 dollars, or $1.64 billion in nominal year of occurrence dollars. These estimates include all costs necessary to implement and place the project in service including financing costs (AFUDC) and contingency [redacted]

[redacted]

Constructability

[redacted]

[redacted]

[redacted]

[redacted]

Operations & Maintenance

The Clean Energy Gateway will be operated by LS Power using its certified, modern control centers that operate extra-high voltage transmission [redacted]

This proposal for the Clean Energy Gateway provides the BPU and New Jersey with a unique opportunity to solidify its path to a future of 100% clean energy by ensuring delivery of large quantities of OSW in a cost effective, reliable, and least impact manner. LSPG's rigorous and flexible design with firm commitments and thoughtful environmental and community protections guarantees the BPU a low risk solution to meet the State's OSW goal and provides value to New Jersey ratepayers. LSPG looks forward to the opportunity to partner with the BPU to provide a critical link to expanding New Jersey's clean energy economy.

II. Project Proposal Identification

Table 2-1 Proposal ID

Proposing Entity Name	LS Power Grid Mid-Atlantic, LLC[1]
Company ID	CNTLTM
Project Title	Clean Energy Gateway
PJM Proposal ID	629 / 627 / 72

About LS Power Grid Mid-Atlantic

LS Power Grid Mid-Atlantic, LLC ("LSPG") is a wholly owned subsidiary of LS Power formed to implement, own, and operate transmission infrastructure in New Jersey. LS Power is a New Jersey based transmission and power generation company that owns and manages one of the largest and most diverse independent power generation and transmission portfolios in the United States, which includes operating transmission and generation assets in New Jersey. [redacted]

Figure 2-1 LS Power Footprint

[redacted]

LS Power has been awarded seven new competitively solicited transmission projects (230, 345 and 500 kV) primarily under FERC Order 1000. A summary of LS Power's relevant transmission experience is provided in [redacted] and at www.LSPower.com and www.LSPowerGrid.com.

The value provided by LS Power through competitive transmission solicitations has been recognized by a majority of Independent System Operators. LS Power was selected to implement competitive transmission projects in: 1) PJM for its first competitive solicitation; 2) MISO for its first competitive solicitation; 3) NYISO for the largest competitive transmission project in the United States to date; and 4) CAISO for three separate solicitations. This success, further outlined in Table 2-2, demonstrates LS Power's unique ability to successfully implement competitive projects while providing significant value to ratepayers.

Table 2-2 Competitive Transmission Experience

Project	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[2] MISO Selection Report Duff-Coleman EHV 345 kV Competitive Transmission Project

				✓ [redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	Operating	PJM	✓ [redacted]
[redacted]	[redacted]	Partially In-Service	New York ISO	✓ [redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Proposal Team

[redacted]

III. Project Summary

The Clean Energy Gateway is a cost effective, efficient, and reliable solution that individually facilitates up to 5,600 MW of OSW allowing New Jersey to exceed its OSW goal of 7,500 MW [redacted]. The Project provides a networked solution, receiving OSW at a new substation (Lighthouse Substation) [redacted] and delivering it through new [redacted] substation (Crossroads Substation) located proximate [redacted]. From Crossroads, the Project will integrate to the existing transmission system through three connections:

- A new 500/230 kV transformer interconnected to the existing Larrabee 230 kV substation;
- A new overhead 500 kV transmission line located [redacted] to the Smithburg 500/230 kV substation; and
- A new overhead 500 kV transmission line located [redacted] to Gardenview Substation, which is a new substation [redacted].

The Clean Energy Gateway can accommodate connections directly from generator-owned cables or from offshore transmission solutions (Option 2 proposals) and can accommodate full, partial, or no [redacted] The Project will allow OSW generators to connect directly to Cardiff (as currently planned) and eliminates the need to complete substantial system upgrades. As further described in Section III.1, [redacted] will provide New Jersey ratepayers with the best overall value by significantly reducing the need for system upgrades through the interconnection process. The Project will be phased over time to match the timing of planned OSW additions to provide ratepayer savings.

Figure 3-2 shows a geographical representation of the Project and a description of each component is provided below.

[redacted]

New Substations

The Project includes four new substations strategically located to connect offshore cables with new onshore cables and the existing transmission infrastructure. Multiple sites have been identified for each substation and preliminary diligence has been completed to confirm environmental compatibility and constructability. [redacted]

- Lighthouse Substation [redacted] The substation will be capable of interconnecting [redacted] at 275 kV and/or 345 kV from OSW or an offshore transmission system (Option 2 proposals) and transform them to 500 kV via four transformers (a spare transformer will also be installed to provide redundancy). Reactive support for submarine and underground cables is provided by a switched shunt reactor for each line position. The substation is designed to incorporate all necessary FACTS devices to reliably integrate large quantities of OSW as described further below. Three sites have been identified to locate the substation that are suitable and currently available (see Section VI).
    - FACTS Devices: reactive support, short circuit support, and harmonic filtering devices will be required to reliably integrate large quantities of OSW into the transmission system. Although these devices are not required as part of the transmission solution, they are incorporated into the design of Lighthouse Substation to support power factor deficiencies the OSW generators are expected to have. Failure to properly plan for these devices could jeopardize the feasibility of the overall solution. The design for Lighthouse Substation includes plans for (1) Static Synchronous Compensators (STATCOMs) to provide power factor correction and dynamic voltage support, (2) Synchronous Condensers to improve short circuit strength, provide grid inertia, and enhance dynamic voltage recovery, and (3) Harmonic Filters to provide active filtering of harmonic distortion introduced from inverter based generation resources. The quantities and sizing of the FACTS devices will be determined based on the location of OSW selected by the BPU in future solicitations and generator specifications.
    - Reactors for offshore cables: reactive support at Lighthouse Substation will be required for offshore cables with shunt reactors included in the design. [redacted] he final size of the shunt reactors will be dependent on BPU's selection for Option 2 proposals or the location of the OSW selected in future solicitations. Shunt reactors required for all onshore cables are included in this proposal.
    - Cables to shore: [redacted]

[redacted]

- Crossroads Substation: is a new gas insulated 500/230 kV substation located [redacted] This substation will connect new underground cables from the Lighthouse Substation to the existing Larrabee substation through a new 500/230 kV transformer, the existing Smithburg 500 kV substation through a new overhead 500 kV transmission line, and the new Gardenview 500 substation through a new overhead 500 kV transmission line. Reactive support for the underground cables is provided by a shunt reactor for each underground cable. Dynamic reactive support and short circuit support to ensure system stability, and system optimization is provided by multiple synchronous condensers.
- Gardenview Substation: is a new gas insulated 500 kV switchyard located adjacent to [redacted]. The substation will [redacted] interconnect the new 500 kV transmission line from Crossroads with sufficient capability to deliver OSW.
- Old York Substation: is a new gas insulated 500/230 kV substation located south of [redacted]. The substation will connect the East Windsor (Gardenview) to New Freedom 500 kV transmission line with the existing Burlington to Trenton 230 kV transmission lines via two transformers (to avoid a single contingency).

Underground Transmission Cables

500 kV cross link polyethylene cable (XLPE) will be installed in duct banks encased in concrete and [redacted] (to the top of the duct bank) below the surface in public rights of way. Cables will be spliced in underground manhole vaults located approximately every 2,000 ft. along the route. Where trenching and installation of traditional duct banks are not feasible, (i.e. crossing of waterways, major highways, etc.), the cables will be installed in casings installed by drilling under the obstruction. Thermal concrete, grout and backfill materials with superior thermal resistivity will be used for duct bank construction and in the casings installed under obstructions to enable sufficient power transfer capability. Cable routing and manhole layout, duct bank and manhole details, major trenchless crossing details, and cable specifications are provided in Attachment 3-4, Attachment 3-5, Attachment 3-6, and Attachment 3-7, respectively.

- Lighthouse-Crossroads: consists of six (6) new 500 kV circuits traversing approximately [redacted] between Lighthouse Substation and Crossroads Substation. Two duct banks will be located [redacted] minimize community and environmental impacts with the cables installed in phases to minimize costs.

Overhead Transmission Lines

The Project includes two new overhead 500 kV transmission lines located [redacted]. The new overhead transmission lines will be located [redacted] Transmission route details and cross sections are provided in Attachment 3-9 and Attachment 3-10, respectively.

- Crossroads-Smithburg: traverses approximately 12 miles in the [redacted]. The existing Smithburg [redacted] new Crossroads to Smithburg 500 kV transmission line. The Crossroads to Smithburg 500 kV transmission towers will be built [redacted]
- Crossroads-Gardenview: traverses approximately 21 miles in [redacted] between Crossroads Substation and Gardenview Substation. The [redacted] line. The [redacted] no longer necessary and will be retired as part of the Project.

Changes to Existing Infrastructure

The incumbent transmission owner (TO) will need to complete certain improvements on its system to accommodate interconnection of the Project or ensure the full capability of the Project can be achieved. This work includes:

- Larrabee Substation: will be expanded to receive one new 230 kV circuit from Crossroads Substation. The incumbent TO has already developed a plan for this expansion.
- Smithburg Substation: will be expanded to receive one new 500 kV circuit from Crossroads Substation. The incumbent TO has already developed a plan for this expansion.
- Smithburg – Deans 500 kV Transmission Line: will be rebuilt to increase the rating of the transmission line to be able to accommodate the delivery of OSW enabled by the Project.
- Deans Substation: will be upgraded to accommodate the increased rating associated with the Smithburg to Deans 500 kV transmission line.
- East Windsor (Gardenview) – New Freedom 500 kV Interconnection: to connect the existing 500 kV transmission line to Old York Substation.

- Burlington – Trenton 230 kV Interconnections: to connect the existing 230 kV transmission lines to Old York Substation.
- Gilbert-Springfield 230 kV Transmission Line: terminal equipment will be upgraded to increase the winter emergency line rating (currently 903 MVA) to match its conductor rating (1,031 MVA).

III.1 PROJECT OPTIONALITY, FLEXIBILITY AND MODULARITY

The Clean Energy Gateway offers flexibility and optionality in a reliable manner that limits impacts to the environment and communities. The Project is modular with individual components that can be completed simultaneously or extended over time to provide the best overall value to ratepayers as additional OSW is integrated. LSPG has identified Project modules summarized in Table 3-1 with further detail included in Attachment 3-10. The Project modules provide natural breakpoints during construction and are designed to ensure reliable operations throughout all phases and avoid repeated, prolonged construction outages.

Table 3-1 Project Module Overview

Module	High-level description of work to be completed
1	Initial construction at Lighthouse Substation and Crossroads Substation Construction of two Lighthouse – Crossroads circuits Construction of Crossroads – Smithburg transmission line
2	Full construction of Gardenview Substation Construction of two additional Lighthouse – Crossroads circuits Construction of Crossroads – Gardenview transmission line Upgrade the existing Smithburg – Deans transmission line
3	Construction of two additional Lighthouse – Crossroads circuits
4	Full construction of Old York Substation

These modules can be combined to cost effectively achieve various levels of OSW integration as may be desired by BPU during implementation of the Project. Table 3-2 provides a summary of the module sets with approximate levels of OSW enabled during each phase.

[redacted]

The Clean Energy Gateway can accommodate a wide range of options to integrate the OSW selections made by the BPU in Solicitation 2 and future solicitations to exceed the state's goal of 7,500 MW. [redacted] LSPG has identified three interconnections scenarios summarized in Table 3-3.

[redacted]

The three interconnection scenarios provide a range of potential approaches BPU may take as it plans for integration of OSW. Scenario 1 represents the most cost effective scenario for New Jersey ratepayers with [redacted] remaining OSW connecting to the Project at Lighthouse Substation [redacted]. In this scenario, limited expansion is needed at Cardiff to accommodate the new connection since both cables can connect to the

currently open substation position.[8] The PJM interconnection process demonstrates that connecting ~1,500 MW at Cardiff will result in significant network upgrades costs ([redacted]).[9] [redacted] to the Clean Energy Gateway. In this case, New Jersey can avoid spending hundreds of millions of dollars on upgrades for [redacted] and instead invest those dollars in a comprehensive solution to meet its overall OSW goals.

Scenario 2 represents an approach where [redacted] to the Project at Lighthouse Substation [redacted]. This scenario provides significant savings [redacted]

Scenario 3 represents no [redacted] connecting to the Project with future OSW benefitting from the Clean Energy Gateway. In this scenario, each phase of the Project could be constructed later in time and the Project would facilitate OSW levels far exceeding the state's goals.

[redacted]

Table 3-5 Project Phasing

Project Phasing	Scenario 1	Scenario 2	Scenario 3
Module 1	2028	2028	2030
Module 2	2028	2030	2031
Module 3	2031	2033	Future
Module 4	2031	2033	2033

III.2 INTERDEPENDENCY OF OPTIONS

[redacted]

[redacted]

[redacted]

III.3 OVERVIEW OF BENEFITS

The Clean Energy Gateway provides New Jersey with certainty that it can exceed its goals to integrate 7,500 of OSW in a manner that is cost effective, reliable, low risk, and limits impact to the environment and communities. Benefits of the Project include:

- Stand-alone delivery of 5,600 MW of OSW with the potential ability to accommodate full, partial, or no connections from [redacted], allowing New Jersey to increase energy independence and supply from clean energy;
- Significant cost savings from avoided network upgrades and eliminating the need for onshore generator lead lines ([redacted]);
- Minimized environmental and community impacts through a single shore landing location [redacted]
- Ratepayer protection provided by a [redacted]
- Enhanced reliability from the use of underground transmission and storm hardened substations;
- Energy load savings from increased energy from OSW and increases to the benefit to New Jersey customers by approximately 12% per MWh;
- Capacity market savings from increases to the CETL for EMAAC and increased local capacity;
- Significant emissions savings from additional OSW enabled; and
- Substantial state economic benefits from local investments and job creation caused directly by the Project and the OSW enabled by the Project.

III.4 OVERVIEW OF MAJOR RISKS AND STRATEGIES TO LIMIT RISK

The Clean Energy Gateway is designed to limit risk to New Jersey ratepayers. Extensive due diligence was completed to provide New Jersey with certainty that the Project is feasible, can be completed in a timeframe that meets the state's OSW timeline, and is cost effective. Ultimately, LSPG is insulating New Jersey ratepayers from project risks by providing firm cost containment commitments and a schedule guarantee. The most impactful project risks and strategies taken to mitigate the risks are summarized below:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

- [redacted]

III.5 OVERVIEW OF COSTS, COST CONTAINMENT AND COST RECOVERY

The Clean Energy Gateway is estimated to cost $1.48 billion in 2021 dollars or $1.64 billion in nominal year of occurrence dollars. These estimates are inclusive of all development, financing (AFUDC), commissioning, and other costs necessary to place the Project in-service. Project cost will be recovered through traditional cost-of-service based transmission formula rates with provisions that limit ratepayer risk. This approach provides the best overall value to customers because they are protected from cost overruns by binding commitments while benefiting from lower rates if actual costs are below estimates.

[redacted]

LSPG anticipates that investments in the Project will be placed in rates over a period of 3-5 years, as early as 2027 as project phases are completed to match the OSW procured by the BPU. [redacted]

IV. Proposal Benefits

The Clean Energy Gateway provides certainty that New Jersey can exceed its goal to integrate 7,500 of OSW in a manner that is cost effective and reliable with the lowest overall impact to the environment and local communities. As compared to a traditional generator lead/radial approach, the Project is:

- Lower cost, negating the need for substantial network upgrades and reducing OSW lead/radial line costs;
- Lower impact, placing new transmission lines overhead in existing transmission lien corridors or underground in common corridors and avoiding repeated disturbances;
- More reliable, with a networked solution that meets NERC planning criteria and includes storm hardened infrastructure; and
- Lower risk, reducing reliance on uncoordinated network upgrades through the interconnection process.

The Project provides transmission system and reliability benefits, public policy benefits, market efficiency benefits, environmental benefits, and additional benefits to the community.

IV.1 TRANSMISSION SYSTEM & RELIABILITY BENEFITS

The Clean Energy Gateway individually ensures reliable delivery of up to 5,600 MW of OSW to New Jersey load. The Project incorporates thoughtful solutions to meet reliability criteria, solve system violations, and enhance grid resiliency. Project components incorporate rigorous design criteria with the ability to withstand extreme weather events to provide high availability.

Transmission System Benefits

The Clean Energy Gateway provides BPU with the opportunity to integrate OSW [redacted] with the Project to resolve major overloads on New Jersey's existing transmission system, shown in Table 4-1, saving hundreds of millions of dollars in unnecessary rebuilds and associated environmental/community impacts.

The Project provides significant new transfer capacity between New Jersey's existing 500 kV system, the existing 230 kV system in the eastern part of the state, and the existing 230 kV system in the western part of the state. During times of reduced or no OSW wind generation, the Project facilitates more efficient and reliable transfer of energy from onshore resources to load. Additionally, during outages on the existing system, the Project's transfer capacity adds significant system resilience. The Project's added resilience will be particularly beneficial during extreme weather events, like hurricanes, that can cause transmission towers to fall into adjacent circuits causing outages on multiple overhead transmission facilities that commonly occupy joint corridors in New Jersey (often 4+ circuits). This circumstance recently occurred in Entergy's footprint where they simultaneously lost all eight overhead circuits delivering power into New Orleans from Hurricane Ida resulting in weeks of power outages and billions of dollars in economic damage and losses.

Reliability Benefits

LSPG implemented the principle to provide a highly reliable project design while also providing a cost-effective solution with the least risk. Particular importance was placed on reliability because of the large scale of the solution and New Jersey's future reliance on OSW. The Project traverses an area that incurs frequent severe weather events including hurricanes, thunderstorms, lightning strikes, tornados, and ice storms. Design elements were incorporated to enhance reliability including meeting rigorous design criteria and specific measures to protect the Project against severe weather. Specific design elements incorporated into the Project to ensure reliability include:

- Underground Transmission Lines: all new underground transmission lines are placed in concrete encased duct banks protected from extreme weather events. Fully redundant fiber paths placed inside the duct banks provide communications for system protection and control. Emergency cable ratings are sufficient [redacted] Spare power cable and fiber optic cable will be maintained within the project area to quickly address any issues.

- Overhead Transmission Lines: all new overhead transmission lines are rated [redacted] Emergency conductor ratings are [redacted]. Spare conductor and structures will be maintained within the project area to quickly address any issues.
- Substations: all new substations are gas insulated with breakers, switches, and protection and control equipment protected inside buildings. Above ground infrastructure is rated to withstand [redacted] All substations will have a [redacted] to ensure that a breaker failure or bus fault does not cause overloads on the Project. Substations with transformers will include an installed spare to prevent prolonged outages for long-lead equipment. Each substation will have redundant communication equipment/paths and redundant power sources plus provisions for backup generators. In addition to traditional spare parts, spare reactors and GIS equipment will be maintained within the project area.
- FACTS Devices: Lighthouse Substation and Crossroads Substation each include provisions for redundant STATCOMs to provide dynamic reactive support. In addition, Lighthouse Substation includes provisions for synchronous condensers and harmonic filters. These devices will be used to ensure that the Project and interconnected OSW do not cause stability, voltage, power factor, or power quality issues. The devices are not required at Lighthouse Substation for project reliability, however they will be required for OSW generators to meet system power factor requirements. If FACTS devices were not factored into the plans at Lighthouse Substation, OSW generators would need to construct them in the area to correct reactive power deficiencies, and remove harmonics, increasing impacts to the environment and communities.

IV.2 PUBLIC POLICY BENEFITS

The Clean Energy Gateway provides a reliable, low impact, and economical transmission solution to exceed New Jersey's clean energy goals, which target 7,500 MW of OSW by 2035. The Project will reduce the cost of OSW lead/radial lines as well as reduce cost and increase certainty for network upgrades that result from the interconnection process. As a networked solution, the Project will reduce the risk of OSW energy curtailment and system congestion.

Offshore Wind Cost Savings

Ratepayers will benefit from the Clean Energy Gateway's ability to reduce the cost of offshore wind. First, the Project enables fair competition among OSW developers based on the merits and economics of their wind projects without one developer having a significant advantage or

disadvantage based on their interconnection plans. The proximity of the Project's point of interconnection (Lighthouse Substation) to current and future OSW lease areas allows for economical [redacted] in amounts that far exceed New Jersey's OSW goals. [redacted] The primary savings for OSW include:

- Interconnection Cost Savings: one of the most significant benefits of the Project is the ability to provide increased certainty and savings on the cost to interconnect OSW projects into the New Jersey transmission system. This benefit alone will more than pay for the cost of the Project. The magnitude of interconnection cost savings are demonstrated through the OSW projects selected in Solicitation 2 and in other OSW projects in the interconnection queue. For example, Atlantic Shores Offshore Wind proposes to interconnect 1,510 MW at the Cardiff substation. [redacted] Table 4-2 shows the most recent interconnection cost estimates completed by PJM in consultation with the incumbent transmission owners. This table demonstrates the how significant system upgrade costs can become when integrating a large quantity of OSW generation in an uncoordinated manner. The Clean Energy Gateway combined with Option 1A solutions can deliver more OSW generation at a substantially lower cost while providing additional benefits and having a lower environmental impact. Additionally, incumbent TOs provide no cost certainty and no schedule certainty for network upgrades placing New Jersey ratepayers at risk.

[redacted]

- Generator Lead Line Cost Savings: another significant cost benefit of the Project is the ability to reduce the cost of radial transmission lines constructed by the generator to the point of interconnection ("generator lead lines"). OSW projects connecting to the Clean Energy Gateway [redacted] In addition, the proximity of the Project to OSW lease areas (Hudson south call area, Atlantic Shores, and Ocean Wind) [redacted] 4-3 demonstrates the magnitude of the generator lead/radial line costs that could be avoided by the Clean Energy Gateway.

[redacted]

Increased Offshore Wind Goals

The Clean Energy Gateway provides New Jersey with the opportunity to go beyond its goal of 7,500 MW of OSW. The Project can integrate up to 5,600 MW of OSW into the New Jersey transmission system. As shown in Table 4-4, the Project will facilitate total OSW connections that exceed the state's goals. The level of total OSW connected to New Jersey is dependent on whether the BPU elects [redacted] The table below, which references the three connection scenarios discussed in Section III, shows that integrating less OSW generation from Solicitation 2 into the Project will enable significantly more OSW for the state. However, it is important to note that Scenario 2 and Scenario 3 will not save as much as Scenario 1 related to network upgrade costs and generator lead line costs.

[redacted]

An important element of the Clean Energy Gateway is that it integrates a large quantity of OSW in a condensed set of corridors to reduce impacts on ratepayers, the environment, and communities. This leaves alternate shore landing locations and transmission line corridors for future expansion of OSW capacity.

IV.3 MARKET EFFICIENCY BENEFITS

The Project maximizes energy and capacity market benefits for New Jersey ratepayers by enabling nearly 10,000 MW of offshore wind to be integrated into PJM while reducing deliverability constraints to New Jersey load including the Deans to Brunswick and Windsor to Clarksville 230 kV transmission lines.

The size and expandability of the Project allows New Jersey to get 8% closer to achieving 100% clean energy in PJM. New Jersey would be close to energy independent, providing almost all of its energy requirements from in-state resources. At the same time, New Jersey would rely less on both in and out of state fossil generation further reducing emissions in New Jersey.

LSPG used the results from the recent 2022/23 PJM Base Residual Auction in combination with a load deliverability analysis to assess the

capacity market benefits provided by the Project. [redacted]

The supporting analysis and benefits quantifications (including assumptions and analyses) to support the market efficiency benefits for the Project are described in the Market Efficiency Planning Study included as Attachment 4-1.

IV.4 OTHER BENEFITS

In addition to reliability, cost, and market efficiency benefits, the Clean Energy Gateway provides environmental and economic benefits to New Jersey.

Environmental Benefits

The primary environmental benefit of the Project is certainty that a large quantity of OSW renewable generating resources can delivered to New Jersey. This solution ensures that the state can reliably use OSW resources to reduce reliance on fossil-fueled generating resources, significantly reducing emissions. In addition, the Project facilitates the efficient transfer of energy across the state, reducing transmission system losses and delivering the maximum amount of renewable resources.

[redacted]

The reduction in emissions provided by the Project was determined using the production cost modeling described above. [redacted]

The Clean Energy Gateway was designed to minimize environmental impacts in a cost effective and reliable manner. Key environmental benefits of the Project include:

- Transmission lines are consolidated in common corridors with very low risk of impacts to sensitive species or wetlands;

- Construction in phases that are coordinated and avoid repeated disturbances; and
- A [redacted] with a coordinated plan for all drilling operations under the beach minimizes impacts to beach habitat and marine species.

Economic and Community Benefits

Considerable attention was given to reducing the impact of the Project on New Jersey communities. Specific steps taken to reduce impacts include placing all new transmission lines [redacted] or public rights-of-way (underground); locating duct banks in common corridors with construction coordinated to minimize disturbance; and imposing time of year, week, and month restrictions on construction. Particular importance was placed on the shore landing location because it determines the communities impacted by offshore cables, landing locations, and onshore cables. [redacted]

In addition to being low impact, the Clean Energy Gateway will provide substantial benefits to local communities and the state of New Jersey. These benefits include:

- Economic Development: the Clean Energy Gateway represents a significant infrastructure investment for the state and local communities. This investment will have direct, indirect, and induced GDP growth benefits, creating substantial new jobs. Additionally, the Project will enable connection of 5,600 MW of OSW providing billions of dollars in additional economic growth.
- Taxes: [redacted]
- Host Community Agreements [redacted]
- Road Improvements [redacted]

In addition to the benefits discussed above, LSPG is committing to make the following community investments if it is selected to implement the Clean Energy Gateway:

- [redacted]
- New Jersey workforce and scholarship program [redacted]
- [redacted]
- [redacted]
- Maintenance Facilities: [redacted]

V. Proposal Costs, Cost Containment Provisions, and Cost Recovery

LSPG implemented the principle that it would not sacrifice safety, reliability, or quality while still providing a cost effective solution with the least risk. Substantial efforts were expended to inform a detailed cost estimate and support the cost containment measures, which protect New Jersey ratepayers from the most significant commercial risks to implement the project. Design measures were incorporated into the design beyond the minimum requirements to increase reliability, provide flexibility, increase certainty, and reduce implementation and operational risks. These efforts benefit BPU and PJM by ensuring that the cost estimate is realistic, achievable, and backed by guarantees from a trusted entity with a track record of success.

V.1 COST RECOVERY MECHANISM

LSPG will recover its costs and returns through standard regulated cost recovery for transmission assets, subject to its cost containment mechanism. Costs will be recovered through a cost-of-service transmission formula rate using a projected test year and subsequent true-up to actual costs. Unlike the typical formula rates, LSPG will incorporate its cost containment provisions (described below) into its formula template to ensure its commitments are memorialized in the cost recovery mechanism. LSPG considered alternative cost recovery mechanisms (such as a fixed revenue requirement) and determined that this approach provides the best value for New Jersey customers. Ratepayers benefit from protections of cost overruns through firm commitments but retain the savings if actual costs are less than estimated without paying for expensive risk premiums that typically accompany fixed-price structures. LSPG's capped cost-of-service approach also ensures that ratepayers benefit from items like the investment tax credit for transmission infrastructure that is currently proposed by the U.S. legislature.

Cost Recovery Inputs

The cost of the Project to New Jersey ratepayers is materially impacted by several key inputs that differ between project sponsors. In addition to the Project capital cost, and asset life the overall return on equity and debt rate are a major drivers to ratepayer costs. [redacted]

[redacted]

Return on Equity (ROE): [redacted]

Capital Structure: [redacted]

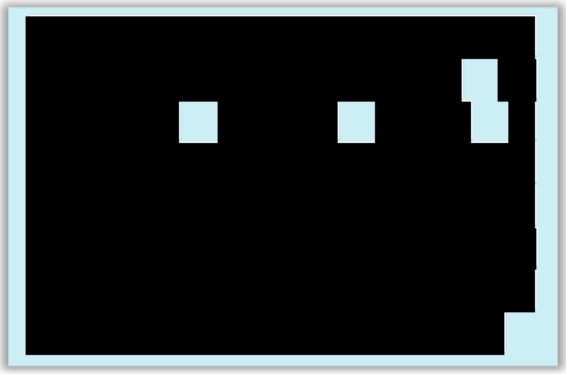
Debt Rate: [redacted]

[10] 2021 Formula Rate Projection posted on https://www.pjm.com/markets-and-operations/billing-settlements-and-credit/formula-rates

[11] LSPG affiliate, Silver Run Electric, debt rate for the same period - 2021 Formula Rate Projection posted on https://www.pjm.com/markets-and-operations/billing-settlements-and-credit/formula-rates

[redacted]

Project Life/Depreciation: the Project will be operated and maintained in a manner that provides a physical life that exceeds 40 years. Project components (for example IGBT modules in the STATCOM) that have an expected life of less than 40 years will be replaced to match or exceed the life of other components. The cost of these replacements are provided in ongoing capital expenditure estimate (see Section V.2.). The depreciable life will be set, consistent with FERC precedent for new utilities, by a depreciation study completed after the assets are placed in service which will set the timeframe for cost recovery. The asset life is expected to be consistent with affiliate companies that own similar assets.



[redacted]

[redacted]

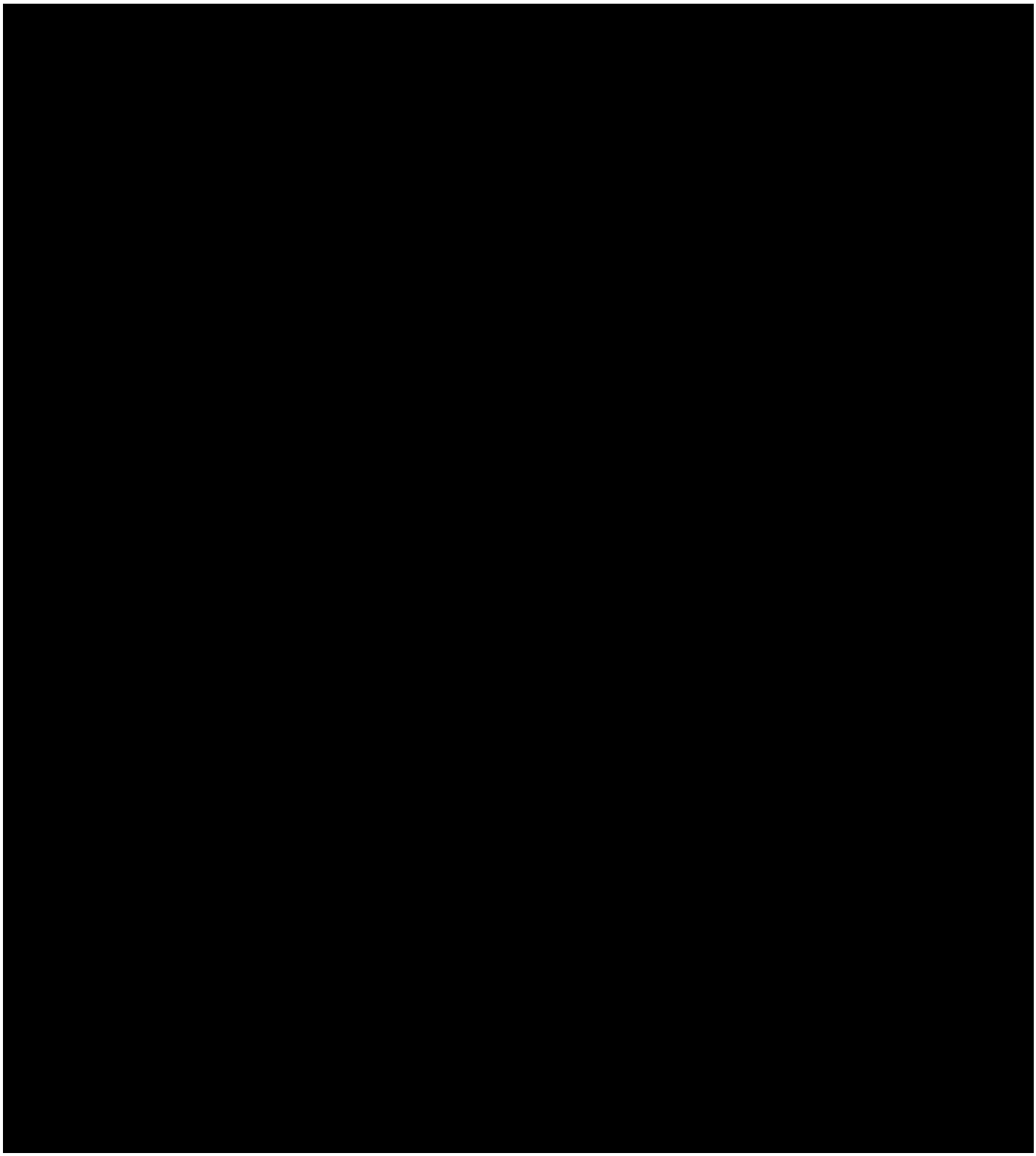
Taxes: the project will be subject to income taxes in New Jersey and at the federal level as well as property taxes as discussed below. Long-term estimates for income and property taxes applicable

to the project are included in the projection of annual transmission revenue requirements provided in Attachment 5-1.

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Operations, Maintenance, General and Administrative Expenses: the project will be operated and maintained by LS Power leveraging its existing programs supplemented by new maintenance resources dedicated to the project. LS Power's existing NERC certified control centers, that currently operate transmission infrastructure in New Jersey and PJM, will operate the project. [redacted] Table 5-3 provides a summary of these expenses.

[redacted]



Spare Parts: LSPG will maintain Project specific local spare parts to ensure a high level of reliability, which will be included in transmission rates. A list of the planned spare parts and their estimated cost is included in Attachment 5-2. These spare parts were included in the revenue requirement estimate included as Attachment 5-1.

Annual Transmission Revenue Requirement

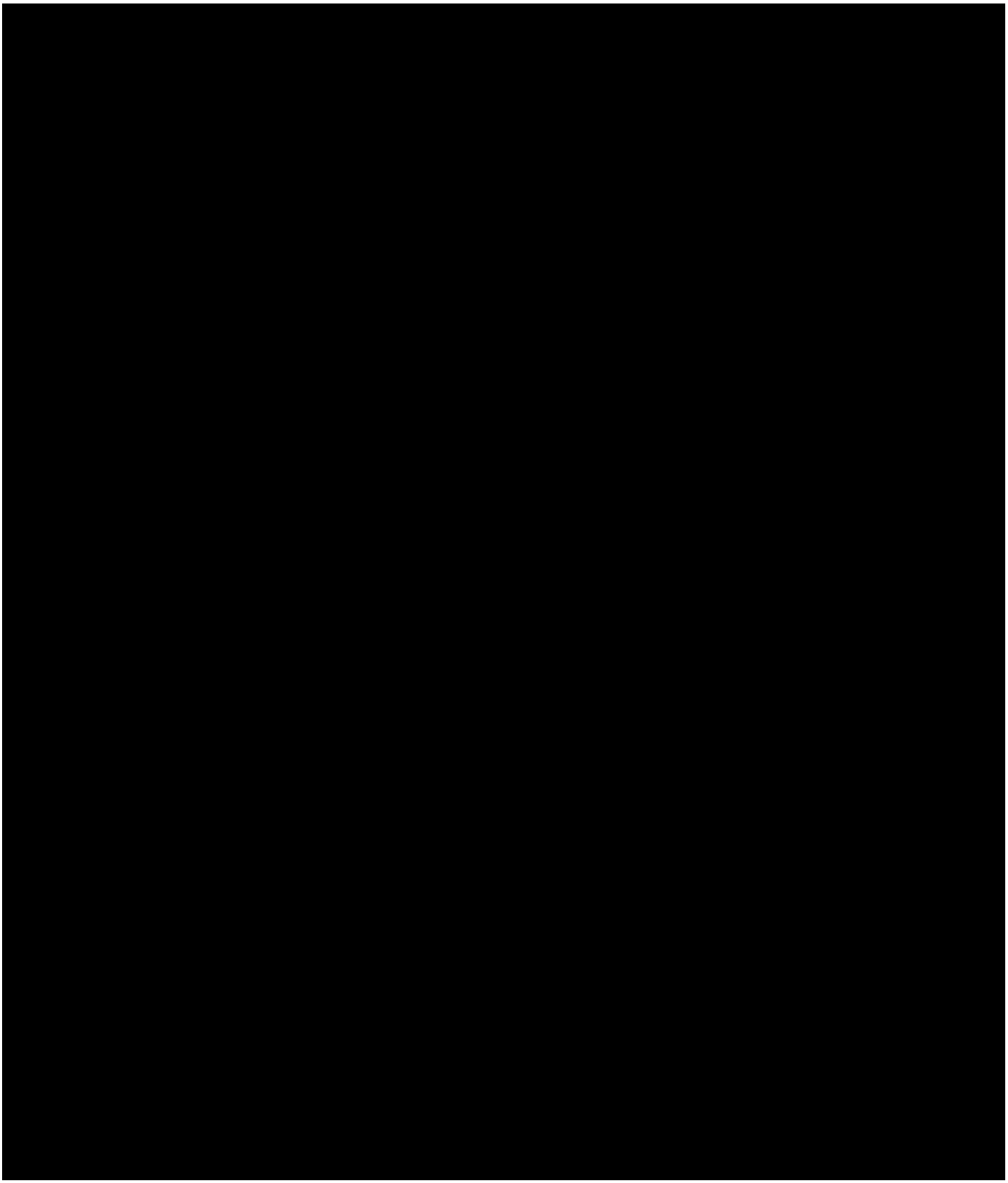
LSPG estimated the annual revenue requirement for the life of the project in Attachment 5-1 reflecting the inputs discussed above and the projected project costs and ongoing capital expenditures. LSPG is providing [redacted]

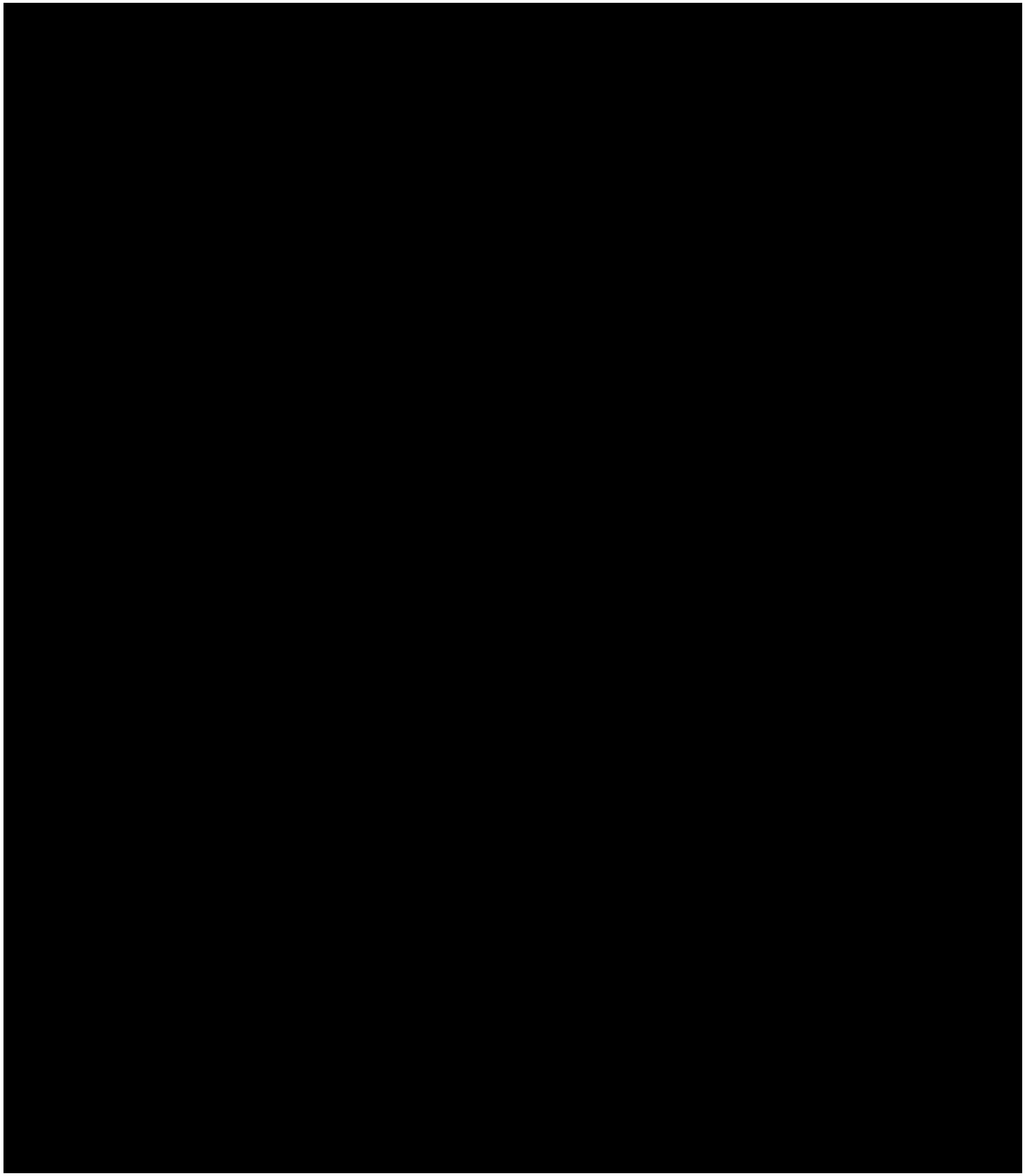
V.2. PROJECT COST ESTIMATES

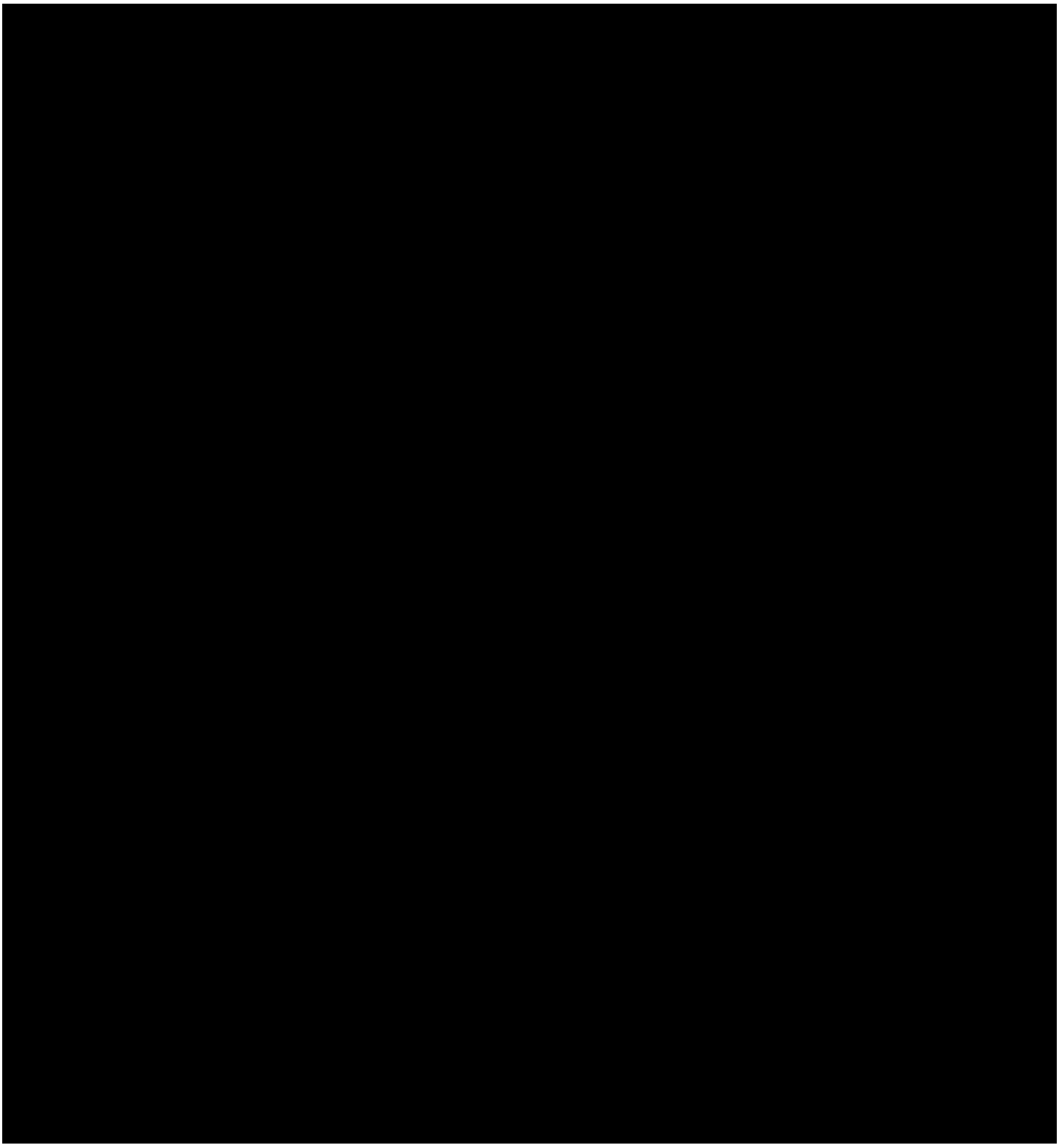
[redacted]

Cost Estimate Detail

[redacted]







Ongoing Capital Expenditures

The Project is designed to provide long useful life without the need for significant ongoing capital expenditures. Transmission lines and substation operating equipment (breakers and switches) are protected from the elements by being placed underground or in protective buildings. Substations are also storm-hardened with all equipment designed to withstand extreme weather and raised above flood levels. Ongoing capital expenditures is anticipated for a limited set of items because the technology is not designed to match the operating life of the remainder of the Project components. Table 5-14 shows the anticipated ongoing capital expenditure intervals and their ongoing costs.

It is worth noting that the IGBT modules and associated controller equipment are the same

V.3. COST CONTAINMENT

LSPG is proposing [redacted] binding cost containment commitments that protect New Jersey ratepayers, which include: [redacted]. The terms and conditions for these binding rate commitments are included in Attachment 5-3. These cost containment measures provide substantial value and protections for New Jersey and ratepayers providing cost certainty for all components of the revenue requirement.

To effectuate these cost commitment measures, LSPG will file with FERC to incorporate the cost containment provisions into its formula rates and these provisions can be included in the Designated Entity Agreement.

Binding Project Cost Cap

LSPG is providing a binding Project Cost Cap of [redacted]

[redacted]

[redacted]

[redacted]

[12] https://www.pjm.com/-/media/committees-groups/subcommittees/cds/postings/handy-whitman-index.ashx

The transmission ratepayer would typically be exposed to all of these risks, associated increases in costs, and increased revenue requirements, which are significant for a project of this magnitude. Any one of the risks identified above could result in tens millions to hundreds of millions of dollars in additional cost to the project. Altogether, absent the binding Project Cost Cap commitment, the ratepayer would otherwise be exposed to hundreds of millions of dollars in potential cost increases or overruns. The Project Cost Cap provides assurance to BPU that the value of the Clean Energy Gateway to New Jersey customers will not be eroded by cost increases.

The binding Project Cost Cap is being provided at no premium to ratepayers – if project costs are below the cap, then only the actual costs will be included in the rate base. However, if project costs are above the cap, then ratepayers will only pay rates on a rate base of [redacted] for the project.

[redacted]

[redacted]

Return on Equity (ROE) Cap

LSPG is committing to a Binding Return on Equity Cap of [redacted]. This provides ratepayers certainty related to the cost of equity for the entire life of the Clean Energy Gateway. Ratepayers would otherwise be exposed to potential rate increases due to prevailing market conditions for the cost of equity or ROE adders/incentives over time.

[redacted]

Equity Percentage Cap

LSPG is committing a binding cap on the actual or hypothetical capital structure used for determining its revenue requirements and AFUDC such that the equity component does [redacted]. The debt/equity ratio is a significant contributor to the cost of capital and the revenue requirement associated with the project. Because the ROE is typically much higher than the cost of debt, a lower percentage of equity will act to lower the weighted average cost of capital.

[redacted]

[redacted]

[redacted]

[redacted]

V.4. ENERGY LOSSES

[redacted]

V.5. COST IMPACT BY SELECTION OF A SUBSET

[redacted]

VI. Project Risks and Mitigation Strategy

[redacted]

[redacted]

Schedule Management

[redacted]

Cost Management

[redacted]

[redacted]

Project Communication

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

Quality Management

[redacted]

Issue Management

[redacted]

[redacted]

Safety Management

[redacted]

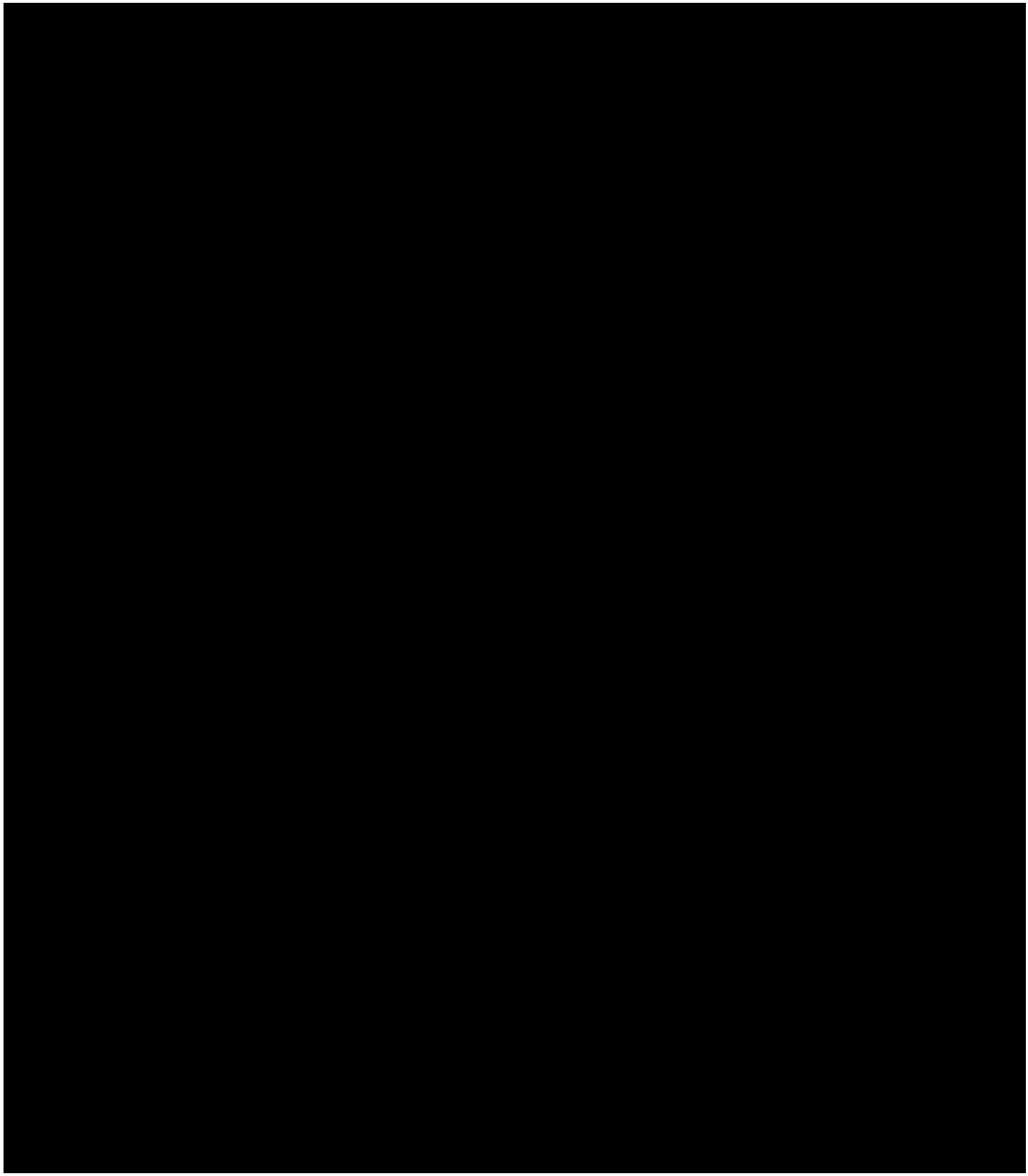
VI.1 RISK MITIGATION MEASURES

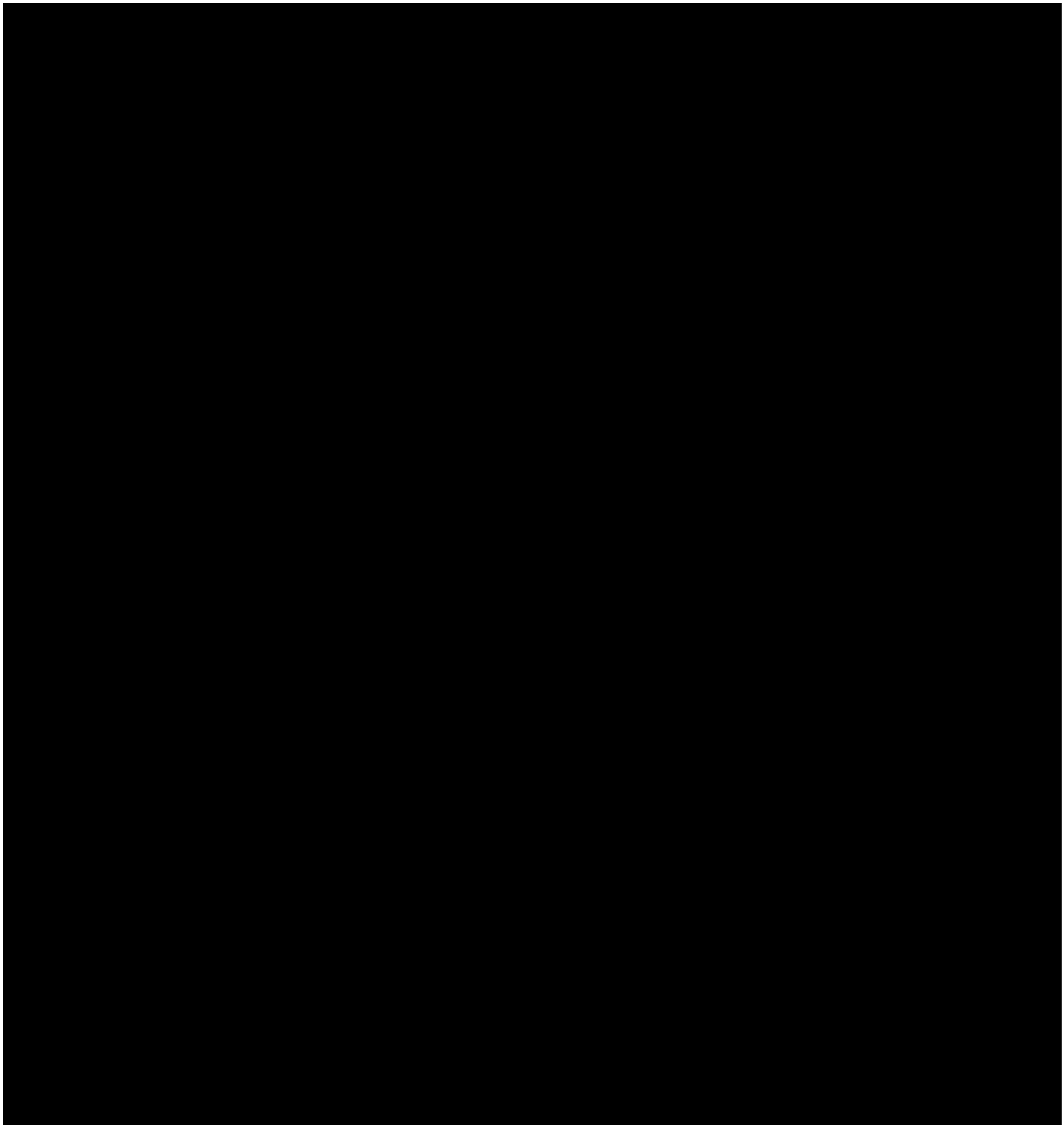
[redacted]

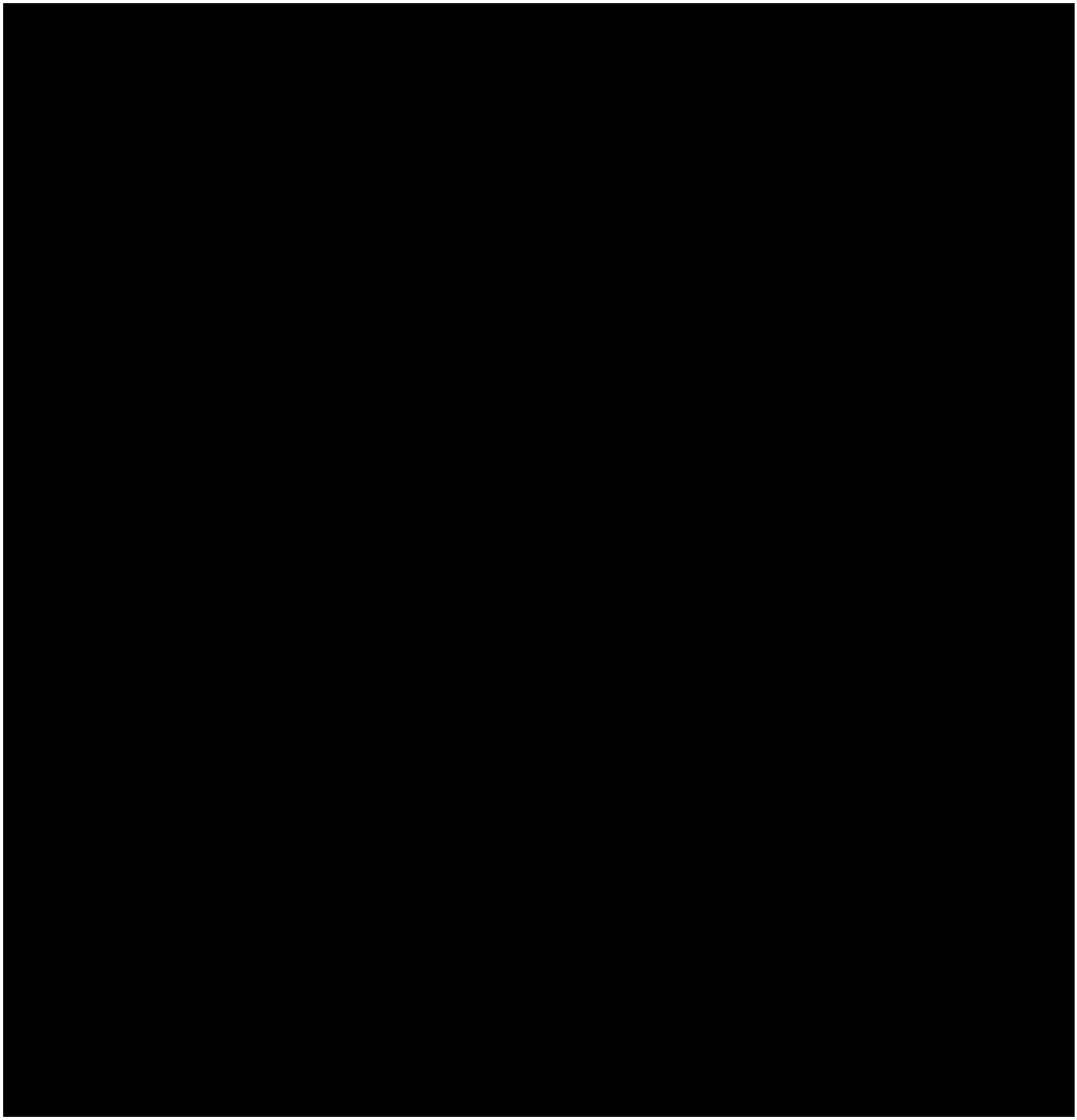
[redacted]

Engineering Risks & Mitigations Measures

LSPG has crafted a project solution designed specifically to integrate offshore wind generation into NJ in the most efficient and least cost manner. [redacted]



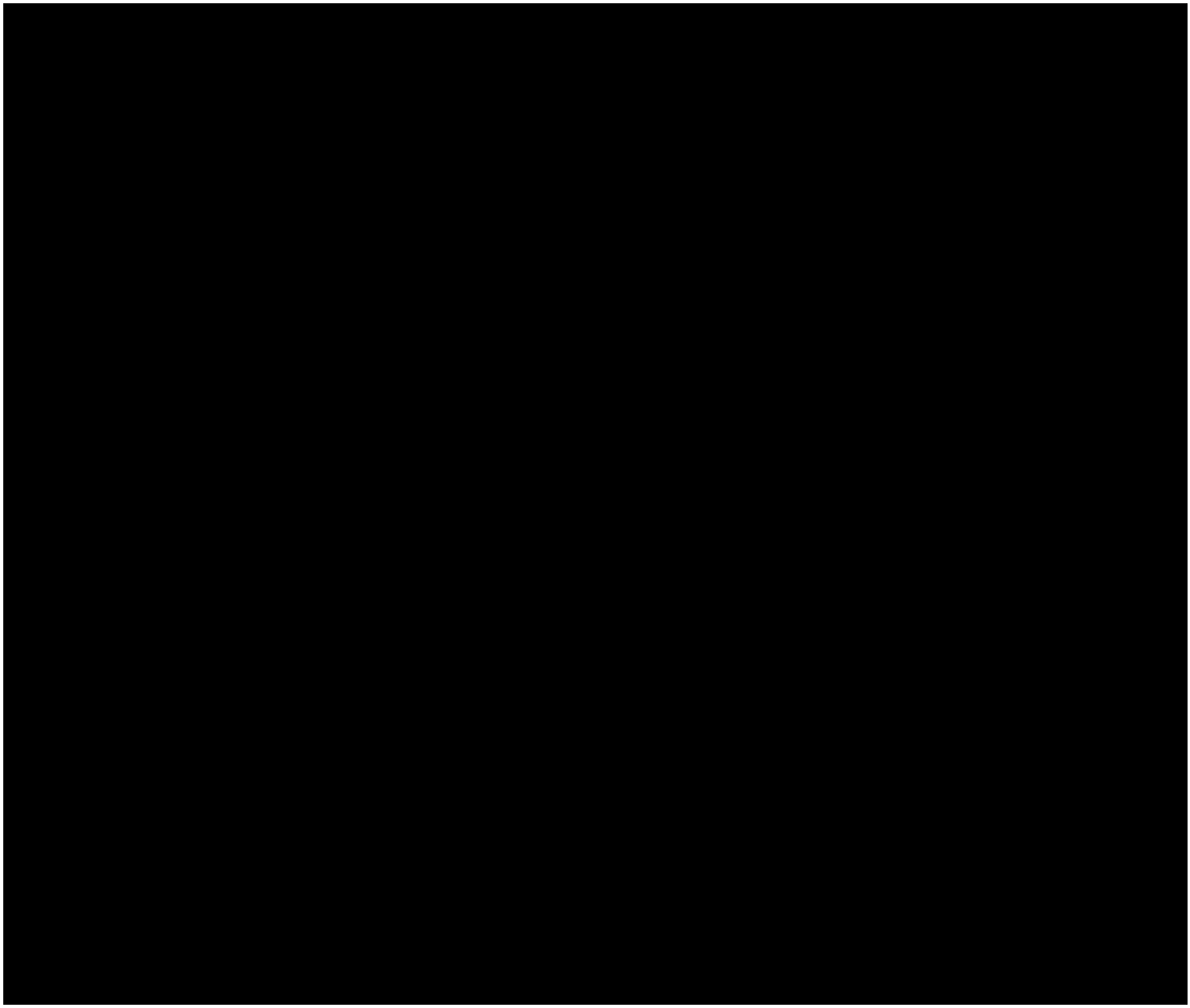




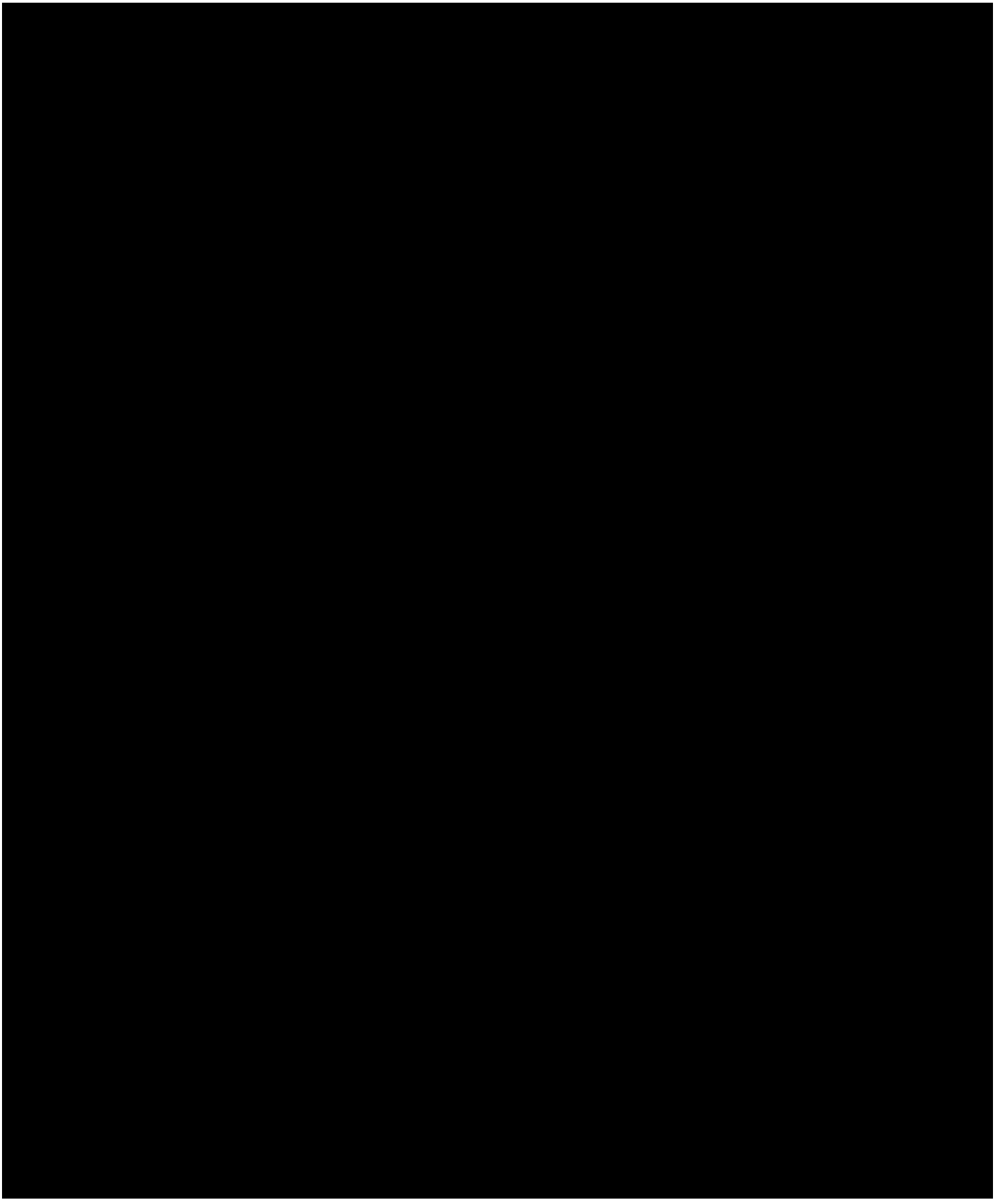
Supply Chain Risks & Mitigations Measures

[redacted]

[redacted]



Environmental & Permitting Risks & Mitigations Measures



[redacted]

Project-on-Project Risks & Mitigation Measures

[redacted]

[redacted]

[redacted]

VI.2 SITE CONTROL PLAN

[redacted]

Routing Study

[redacted]

[redacted]

Land Rights Required

[redacted]

[redacted]

Plan to Obtain Site Control

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Underground Cables and Duct Banks

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Public Utility Easements

[redacted]

Municipality, County, and State Streets and Real Property

[redacted]

- [redacted]
- [redacted]

[redacted]

[redacted]

VI.3 STAKEHOLDER ENGAGEMENT PLAN

[redacted]

[redacted]

LSPG conducted initial stakeholder outreach and adjusted or eliminated Project routes to reduce stakeholder opposition risks.

- [redacted]
- [redacted]
- [redacted]

[redacted]

Engagement Plan Goals

[redacted]

Outreach Strategy

[redacted]

Public Engagement and Involvement

[redacted]

- [redacted]
- [redacted]

[redacted]

[redacted]

VI.4 SUPPLY CHAIN PLAN

[redacted]

[redacted]

Identify and Qualify Suppliers

[redacted]

[redacted]

Material Sourcing

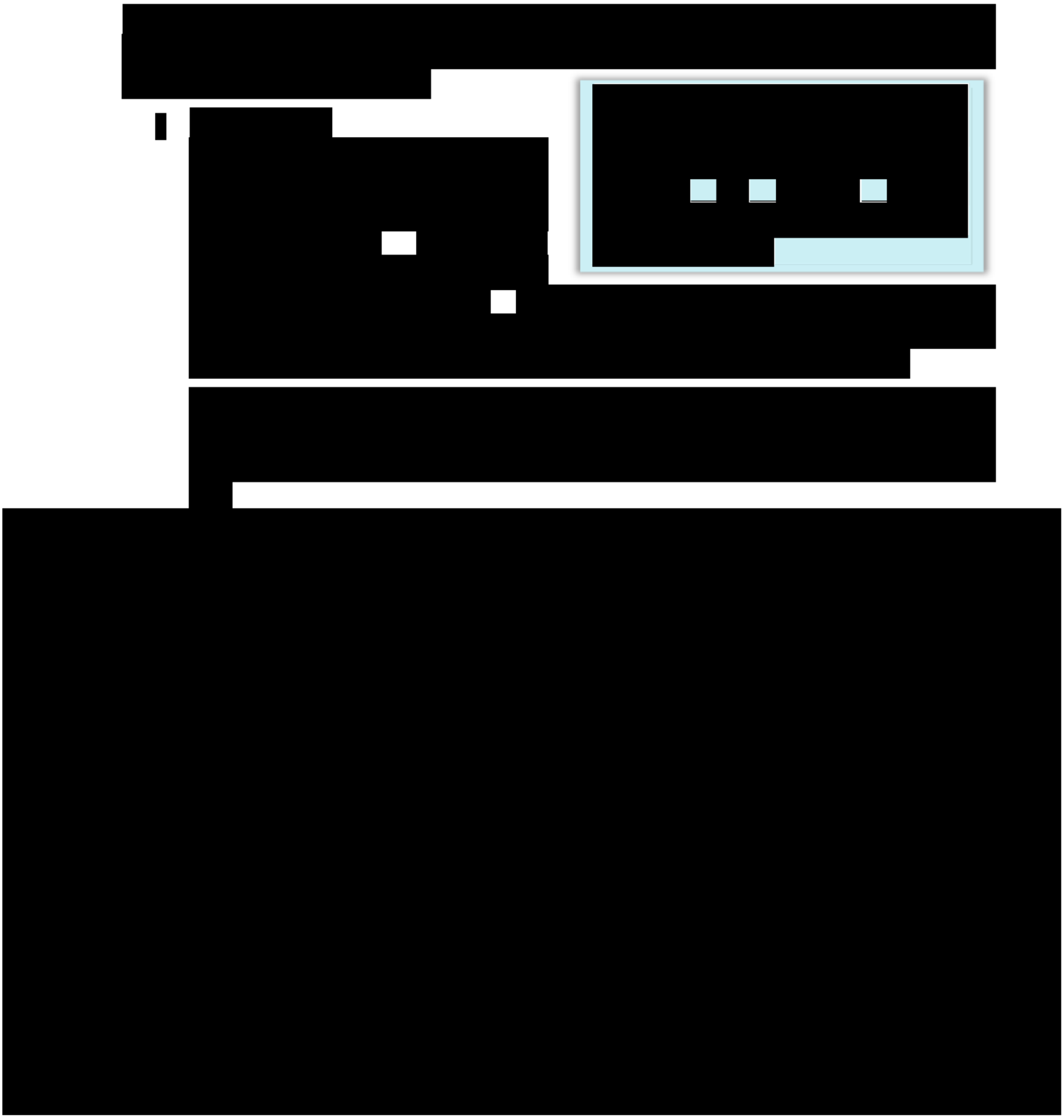
[redacted]

Material Testing, Inspection and Fabrication

[redacted]

Supply Chain Risk Mitigation and Controls

[redacted]



- [redacted]
- [redacted]
- [redacted]
- [redacted]

VI.5 CONSTRUCTION PLAN

[redacted]

[redacted]

Splice Vault

[redacted]

[redacted]

[redacted]

Trenchless Crossings

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Duct Bank Installation

[redacted]

[redacted]

[redacted]

Cable Pulling & Splicing

[redacted]

[redacted]

Substation Installation

[redacted]

VI.6 PROJECT SCHEDULE

[redacted]

[redacted]

Table 6-13 In-Service Date Summary

Module	Projected In-Service Date
1	8/1/2027
2	4/1/2028
3	5/1/2030
4	5/1/2030

[redacted]

Schedule Guarantee

[redacted]

Schedule Drivers

[redacted]

[redacted]

Duct Bank Installation

[redacted]

[redacted]

[redacted]

Schedule Constraints

[redacted]

[redacted]

[redacted]

Critical Path Schedule by Module

Module 1

[redacted]

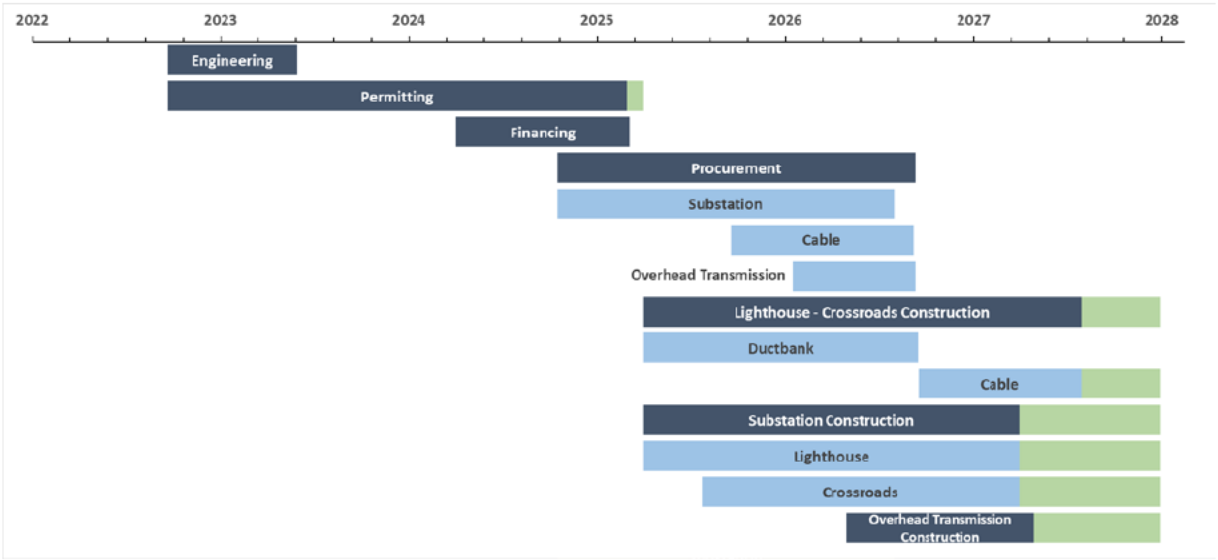


Figure 6-16 Module 1 Critical Path

[redacted]

[redacted]

Module 2

[redacted]

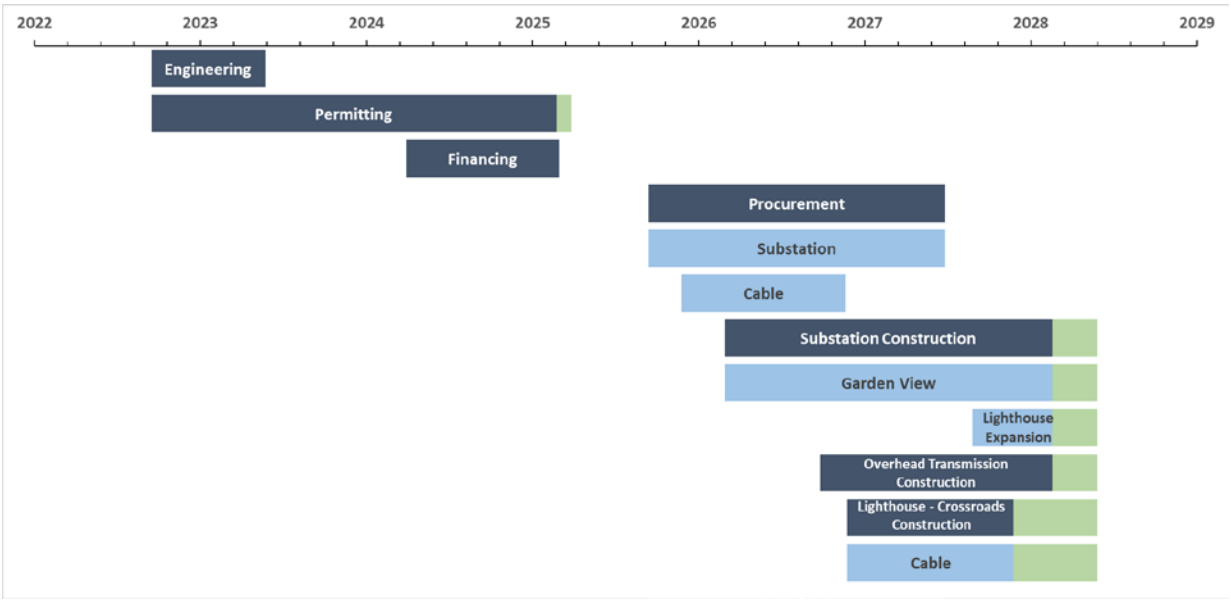


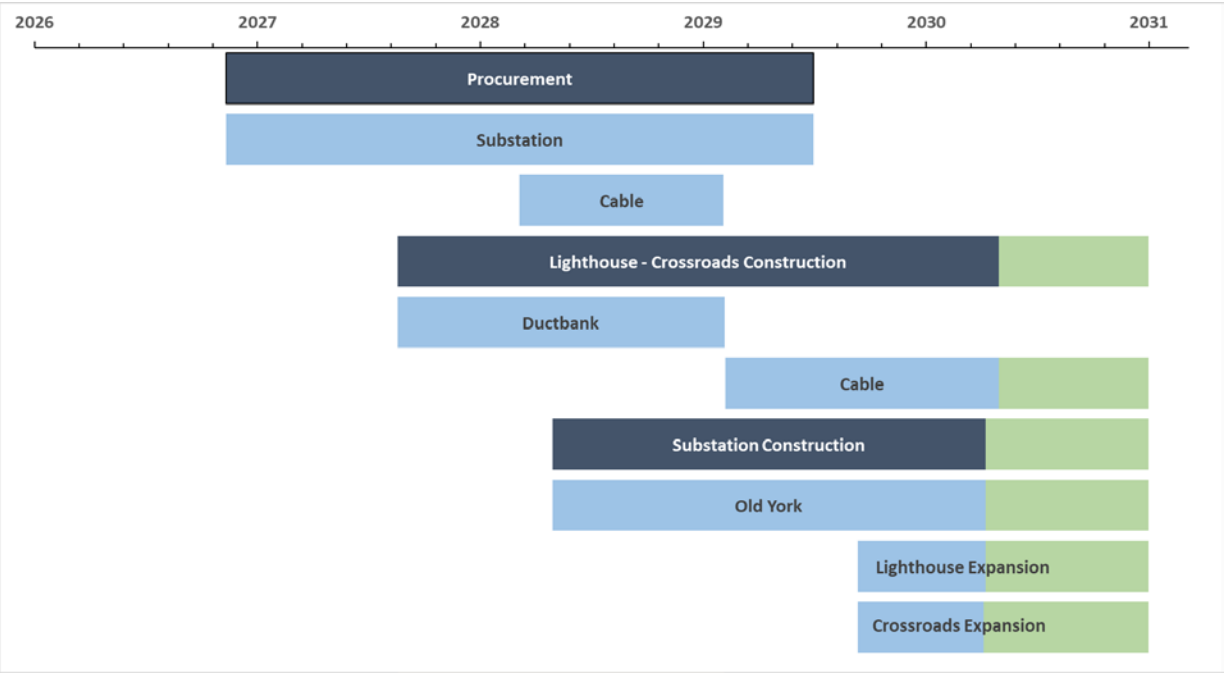
Figure 6-17 Module 2 Critical Path

[redacted]

Modules 3 and 4

[redacted]

Figure 6-18
Module 3 & 4
Critical Path



[redacted]

VII. Environmental Impacts and Permitting

[redacted]

VII.1 Environmental Benefits vs Radial Lines

[redacted]

Fisheries, Habitat, and Sensitive Resources

[redacted]

[redacted]

[redacted]

[redacted]

Environmental Impacts

[redacted]

[redacted]

Quantification of Impacts

[redacted]

[redacted]

[redacted]

[redacted]

Direct Ocean and Ecological Observations

[redacted]

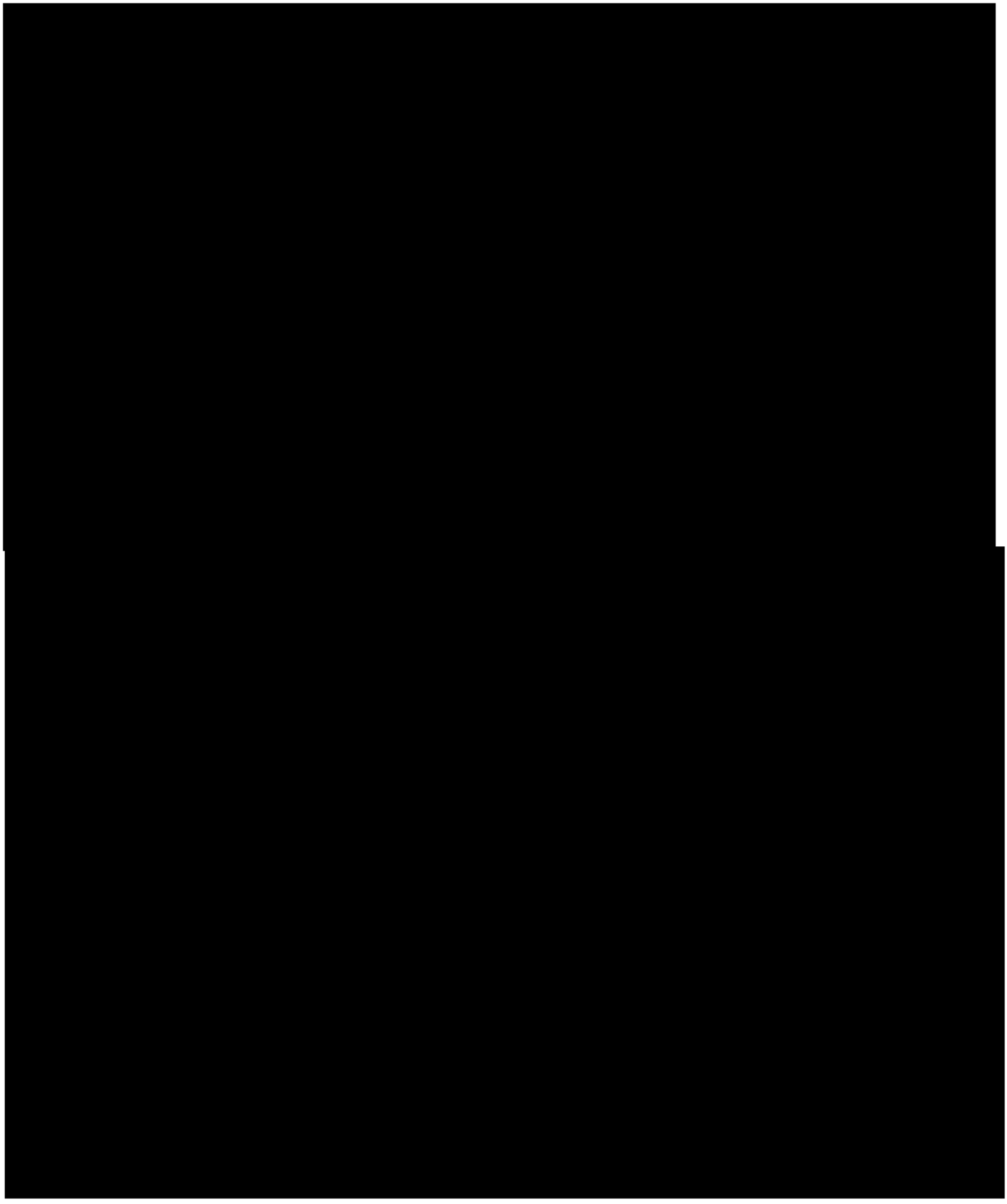
VII.2 Environmental Protection Plan

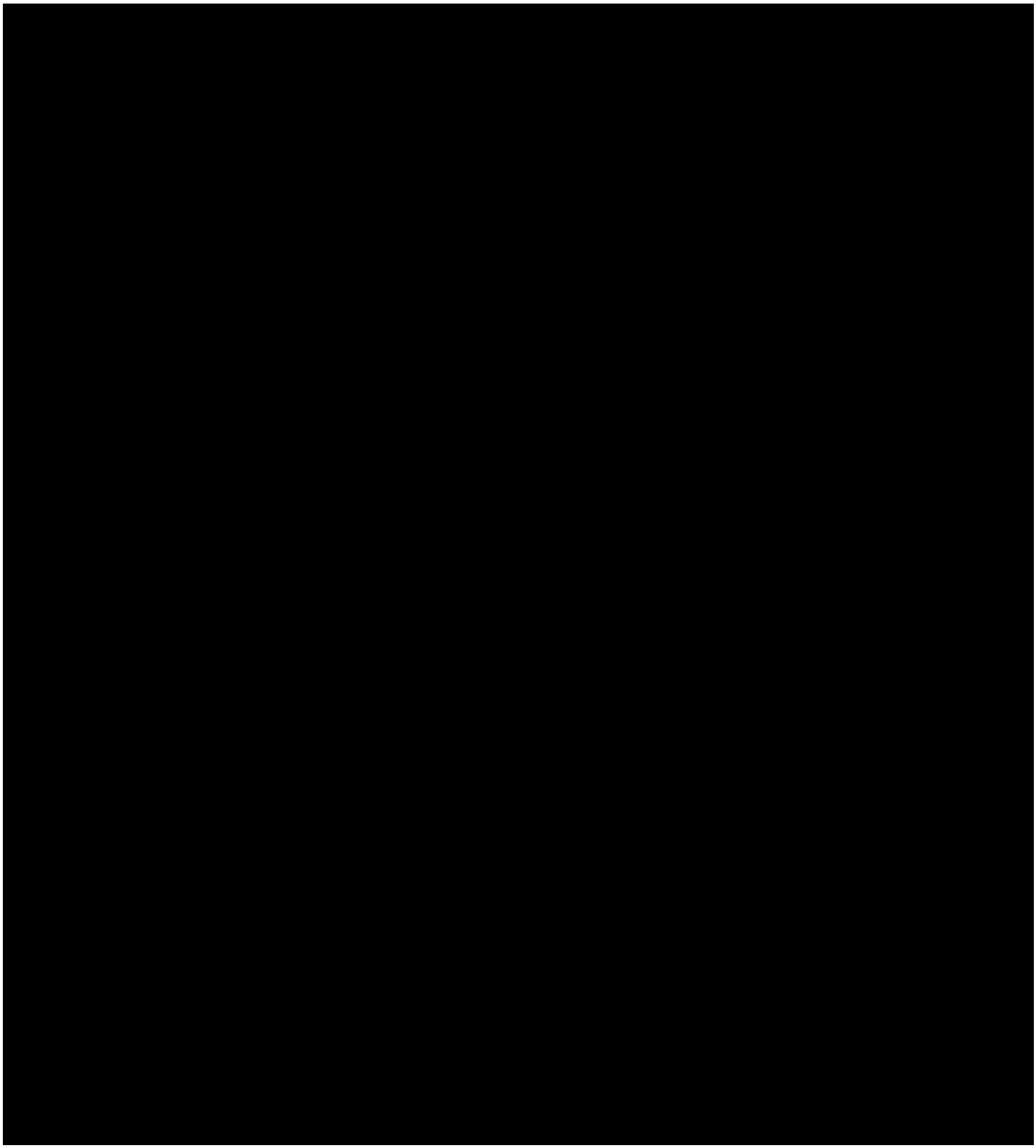
[redacted]

Physical, Biological, and Socioeconomic Resources

[redacted]

Cultural Resources





[15] See Map 4a in Attachment 7-2

[16] See Maps 4a, 5a, and 6a in Attachment 7-2

[17] See Map 7a in Attachment 7-2

[18] See Maps 6a and 7a in Attachment 7-2

Quantification of Potential Impacts to Resources

[redacted]

[redacted]

Threatened and Endangered Species

[redacted]

[redacted]

[redacted]

[redacted]

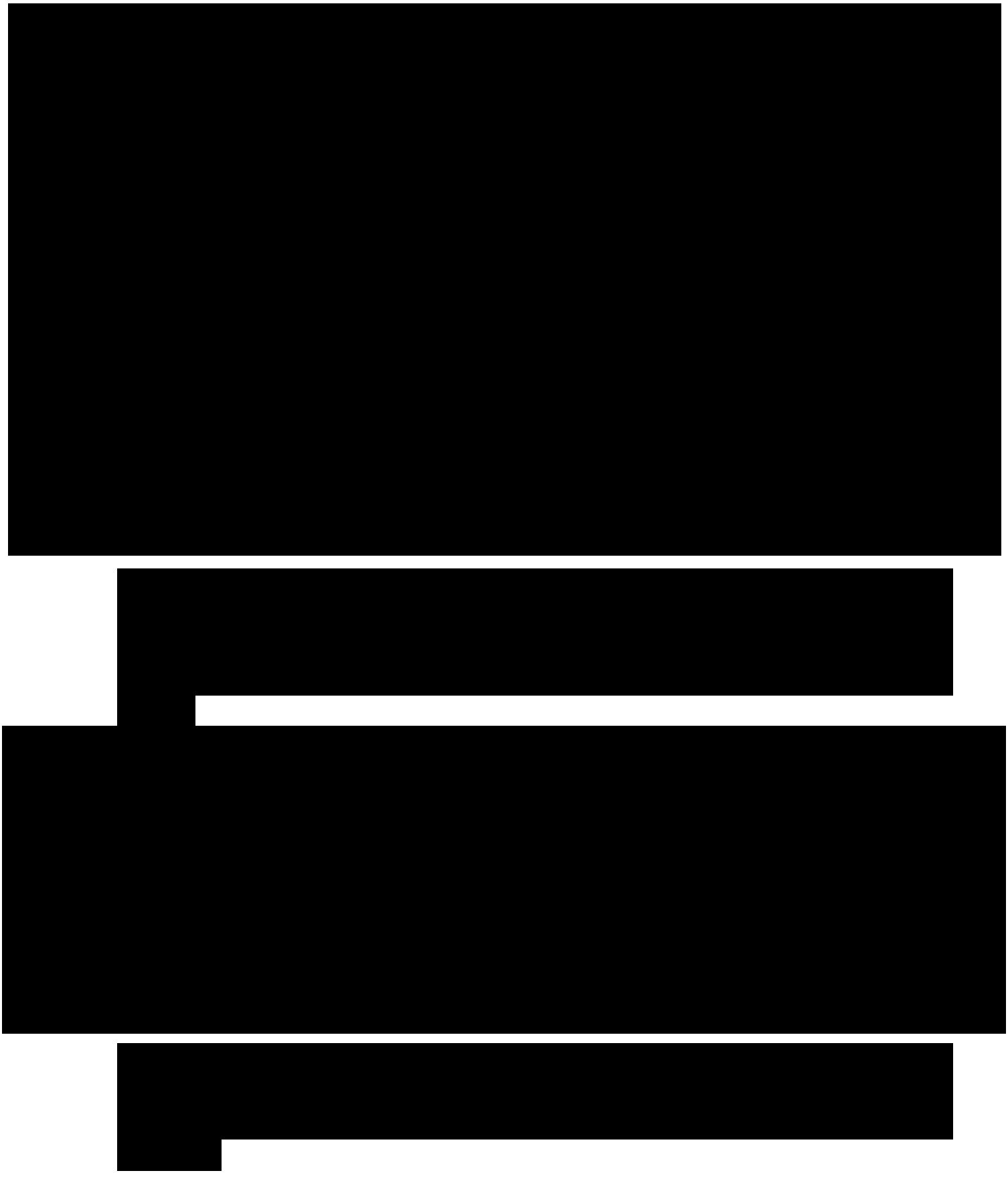
[redacted]

[redacted]

[redacted]

Aquatic Resources and Sensitive Habitats

[redacted]



[redacted]

[redacted]

- Lighthouse Substation
  - [redacted]

Construction Traffic and Emission Estimates

[redacted]

[redacted]

Exclusion Zones

[redacted]

Avoidance, Minimization and Mitigation Measures

[redacted]

Planning

- [redacted]

- [redacted]
- [redacted]
- [redacted]

Construction

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

VII.3 Fisheries Protection Plan

[redacted]

VII.4 Environmental and Fisheries Stakeholder Engagement

[redacted]

Environmental Justice

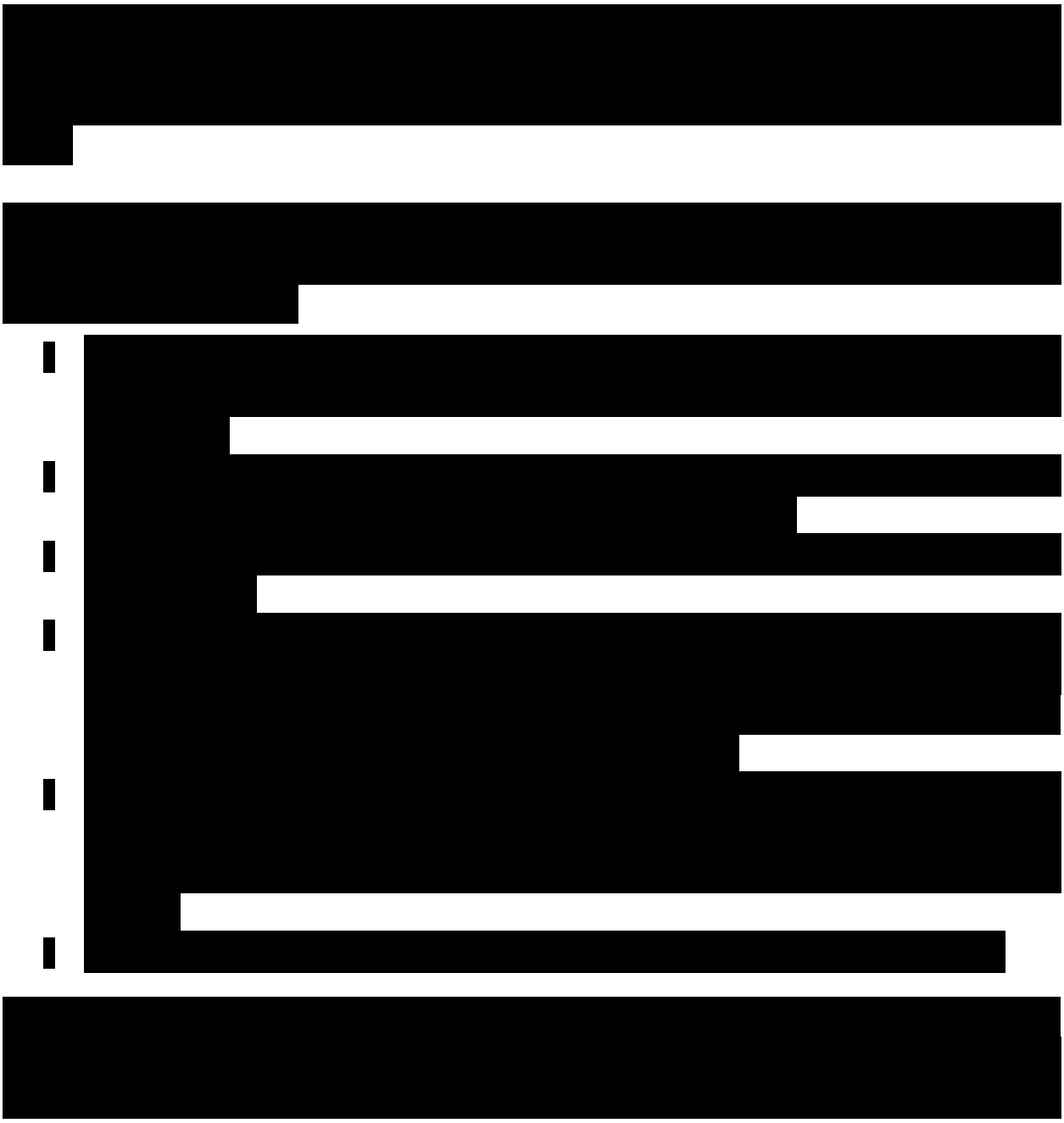
[redacted]

VII.5 Permitting Plan

[redacted]

Agency Consultation

[redacted]



Permit Process and Timelines

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

[redacted]

[21] N.J. Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.), Section 401 of the Federal Clean Water Act (33 U.S.C. §1341), Section 402 of the Federal Clean Water Act (33 U.S.C. §1342), Section 404 of the Federal Clean Water Act (33 U.S.C. §1344), Sections 9 and 10 of the Rivers and Harbors Act (33 U.S.C. §403 and 404).

Key Permitting Implications

[redacted]

Construction Plan Implications

[redacted]

Land Use and Compatibility

[redacted]

[22] Special Economic Development Zone

[23] Rural Agricultural

VIII. Attachment Index

SECTION	Attachment	CONFIDENTIAL INFORMATION: YES/NO	Description
I			
[redacted]			