

Project Rumpelstiltskin

America's 5 Year Speed-Run To Rare Earths Independence



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Executive Summary

This document outlines "Project Rumpelstiltskin," a comprehensive national security initiative designed to establish American independence in rare earth elements (REEs) following China's April 2025 export ban. As critical components in defense systems, renewable energy technologies, and advanced electronics, rare earth elements represent a strategic vulnerability that threatens America's technological leadership and national security. Project Rumpelstiltskin proposes an aggressive 60-month roadmap to develop a complete domestic supply chain—from mining to magnet manufacturing—centered around a Nevada Integrated REE Hub. Drawing inspiration from the Manhattan Project and Apollo Program, this initiative combines executive authority, public-private partnership, and technological innovation to transform America's strategic position from vulnerability to leadership. The following sections detail the crisis, historical precedents, strategic imperatives, implementation strategy, and technical specifications for this urgent national priority that will secure America for generations to come.

I. The Strategic Crisis: China's April 2025 Rare Earth Export Ban

On April 4, 2025, China escalated its trade conflict with the United States by imposing a comprehensive export ban on several critical rare earth elements (REEs), including heavy rare earths like dysprosium, terbium, and samarium. These elements are indispensable for advanced defense systems, electric vehicles, renewable energy technologies, and high-performance electronics. The ban also extends to rare earth magnets and other finished products, effectively halting the flow of these critical materials to U.S. industries.

This move has immediate and profound implications:

- **Defense Sector Vulnerability:** The U.S. military's reliance on REEs for precision-guided munitions, stealth technology, and advanced communication systems is now exposed to significant risk.
- **Industrial Disruption:** Companies like MP Materials, which previously exported REE concentrates to China for processing, have suspended shipments due to the prohibitive 125% tariffs and the new export restrictions. This has disrupted the supply chain for domestic industries reliant on these materials.
- **Technological Impact:** Manufacturers of electric vehicles, wind turbines, and consumer electronics face potential shortages and increased costs, threatening the broader technological and economic ecosystem.

The export ban is part of China's broader strategy to leverage its dominance in the REE market—where it controls approximately 90% of global supply—to exert geopolitical influence and counter U.S. tariffs.

II. Historical Precedents: Mobilizing National Resources

The current REE crisis mirrors past moments when the United States faced existential threats requiring rapid, coordinated national responses:

- **The Manhattan Project:** During World War II, the U.S. mobilized scientific, military, and industrial resources to develop nuclear capabilities, achieving unprecedented technological breakthroughs under tight timelines.
- **The Apollo Program:** In the 1960s, the U.S. undertook a massive effort to land humans on the Moon, demonstrating the nation's capacity for innovation and large-scale project execution.

These historical initiatives exemplify how the U.S. can respond effectively to critical challenges through unified national efforts.

III. Project Rumpelstiltskin: An Imperative

In light of the April 2025 REE export ban, "Project Rumpelstiltskin" must be positioned as a national security imperative, akin to the Manhattan and Apollo projects. The project's objectives include:

- **Establishing Domestic REE Processing Capabilities:** Developing the infrastructure to mine, process, and refine REEs within the U.S. to eliminate dependency on foreign sources.
- **Accelerating Technological Innovation:** Investing in research and development to create alternative materials and processing methods, reducing the strategic importance of traditional REEs.

- **Strengthening Supply Chain Resilience:** Building a robust, diversified supply chain for critical materials to withstand geopolitical disruptions.

By adopting a comprehensive, top-down approach that leverages executive authority, public-private partnerships, and focused investment, the U.S. can secure its technological and economic future against current and emerging threats.

IV. Project Rumpelstiltskin: Detailed Implementation Strategy

A. Unified Command Structure

Drawing from the successful military-civilian collaboration models of the Manhattan Project and the Apollo Program, Project Rumpelstiltskin will establish a centralized joint leadership structure designed to ensure clarity of purpose, rapid decision-making, and decisive execution.

Key elements:

Joint Military-Civilian Directorate:

- A **Civilian Director** appointed by the President, ideally an experienced executive from the mining, metallurgy, or technology sectors, responsible for overall strategic direction, budgeting, and public-private coordination.
- A **Military Co-Director** (preferably a high-ranking general officer from the Army Corps of Engineers or the Defense Logistics Agency) responsible for logistics, security, and execution of defense-critical objectives.

Cross-Disciplinary Advisory Committee:

- Comprising leading scientists, industry experts, economists, environmental specialists, and intelligence analysts to ensure integrated, expert-driven decision-making.

Clear Chain of Command and Accountability:

- Direct reporting lines to the Executive Office of the President and the National Security Council to streamline authorizations and resource mobilization.

B. Leveraging Executive Authority

To rapidly mobilize resources and streamline execution, Project Rumpelstiltskin will employ extraordinary executive measures, including:

Defense Production Act (DPA) Utilization:

- Immediate prioritization of contracts for extraction, processing facilities, and key technological equipment, bypassing traditional procurement timelines.

National Security Directives:

- Presidential authority used to waive specific regulatory hurdles—particularly environmental and permitting processes—in areas explicitly tied to urgent national security requirements, ensuring rapid project advancement.

Strategic Legislative Coordination:

- Early and transparent communication with Congress to facilitate necessary legislative support and appropriations, minimizing friction and securing bipartisan backing.

C. Water Acquisition and Infrastructure Development

Recognizing water as a critical limiting factor for REE processing, Project Rumpelstiltskin implements a dual-track approach to secure sustainable and politically viable water sources:

Primary Track – Eminent Domain:

- Limited targeted use of eminent domain in areas of strategic importance, supported by a clear, compelling case for national security to withstand judicial challenges.

Parallel Track – Desalination & Sustainable Water Infrastructure:

- Rapid deployment of modular desalination plants along coastal regions, powered by renewable energy or advanced thermite-based energy generation to support mining and refining operations sustainably.
- Investment in wastewater recycling and efficient water-use technologies to mitigate community resistance and environmental impacts.

D. Accelerated Timeline and Key Milestones

Recognizing the urgency imposed by the recent Chinese export ban, Project Rumpelstiltskin's timeline is aggressively compressed to achieve defense-critical independence within 36 months, with full operational capabilities in 60 months.

Major Milestones:

Milestone	Target Month	Outcome
Launch & Resource Mobilization	0–3	Land acquisition, permits secured, EPC contracts finalized, first DPA draw-down
Pilot Plant Operational	9–12	5,000 tons/year oxide production line with AI digital twin technology
Defense-Critical Capacity Online	36	15,000 tons/year separated rare earth oxides + 3,000 tons/year magnet alloy
Full Commercial Operations	60	50,000 tons/year rare earth oxides + 12,000 tons/year magnets + Heavy REE circuit

Regular quarterly audits and transparent progress reporting will ensure accountability and flexibility.

E. Parallel Technological Development

Project Rumpelstiltskin will pursue multiple technological pathways simultaneously to maximize success likelihood and accelerate innovation:

Traditional Solvent Extraction and Ion-Exchange Technologies:

- Immediate construction of scalable pilot facilities employing proven processes to ensure rapid establishment of baseline capacity.

Innovative REE Recycling and Recovery:

- Aggressive investment in next-generation recycling technologies, leveraging industrial waste, retired electronics, and magnets from legacy military and civilian equipment.

AI-Enhanced Optimization:

- Deploying advanced AI and machine learning systems to optimize extraction processes, minimize waste, and reduce environmental impacts.

Each technological pathway will have clearly defined checkpoints to pivot resources based on effectiveness and feasibility assessments.

F. Strategic Economic and Market Control Framework

Project Rumpelstiltskin aims not merely at self-sufficiency but at reshaping the global REE market dynamics to secure strategic advantage and economic prosperity for the United States:

Establishing Market Pricing Leverage:

- Strategic pricing policies that encourage domestic use, incentivize allies' cooperation, and neutralize economic leverage from adversarial nations.

International Alliances:

- Coordination with strategic allies (Canada, Australia, the EU, Japan) to create a stable, resilient global REE market, reducing exposure to manipulative trade tactics.

Transition from Petrochemical Dependence:

- Revenue streams generated from strategic market positioning and export of processed materials to help replace traditional petrochemical-based economic revenues, strengthening long-term economic security.

G. Security and Communication Protocols

To secure critical operational details and technologies, robust security and communication strategies are mandatory:

Classification and Compartmentalization:

- Strict operational security enforced through compartmentalization of sensitive information, rigorous vetting, and regular counterintelligence measures.

Strategic Public Messaging:

- Clear and consistent messaging emphasizing environmental stewardship, job creation, technological innovation, and national security urgency, maintaining public support without disclosing sensitive details.

Transparency with Congress and Oversight Committees:

- Regular classified briefings and carefully managed public disclosures to maintain accountability and legislative support.

V. "Silver-to-Silicon" – The Nevada Integrated REE Hub

At the heart of Project Rumpelstiltskin lies the Nevada Integrated REE Hub—a visionary mine-to-magnet corridor anchored at the Apex Industrial Park in North Las Vegas. This hub represents the operational core of America's rare earth independence strategy, leveraging Nevada's unique geography, existing infrastructure, and proximity to California's Mountain Pass mine to create a complete domestic supply chain.

A. Site Selection & Proven Resource Base

The Nevada Hub strategically connects three critical nodes into a unified rare earth ecosystem:

Node	Location	Function	Strategic Rationale
Mountain Pass Mine	California-Nevada border	Primary Light REE feed source	America's only operating rare earth mine with established infrastructure, existing rail/roads, and eligible for DoD upgrade funding
Searchlight Project	Searchlight, Nevada	Heavy REE prospect	Provides domestic source of critical dysprosium and terbium, reducing dependency on foreign heavy rare earth supplies
Apex Industrial Park	North Las Vegas	Processing center for separation, alloys, magnets, and AI operations	Expansive 18 sq. mile industrial zone with Union Pacific rail spur, I-15 access, and established power/water corridors

This triangle of resources creates a geographically compact, logistically efficient system that capitalizes on existing infrastructure while minimizing transportation vulnerabilities. The Apex Industrial Park, with its heavy industrial zoning and strategic location just outside Las Vegas, provides the ideal nexus for transforming raw materials into high-value products.

B. Integrated Supply-Chain Flow

The Nevada Hub creates a complete vertical integration from mine to finished product—a capability that has existed exclusively in China for decades. This seamless flow eliminates vulnerability to foreign processing bottlenecks:

Process Stage	Location	Output & Significance
Mining & Initial Concentration	Mountain Pass / Searchlight	On-site beneficiation to produce mineral concentrates, minimizing transportation of waste material
Concentrate Transportation	Transit network	Climate-controlled trucks (90-minute journey) with future plans for dedicated slurry pipeline to increase efficiency and security
Separation & Refining	Apex Industrial Park	Dual processing lines: conventional solvent/ion-exchange (Line 1) and advanced membrane-flash technology (pilot Line 2) for process resilience
Metal & Alloy Production	Apex Industrial Park	Creation of neodymium-praseodymium, dysprosium-terbium, and samarium-cobalt master alloys—the precursors to advanced magnets
Magnet Manufacturing	Apex Industrial Park	Complete production capability using strip-casting, hydrogen processing (HDDR), and hot-pressing to create finished magnets
Component Finishing	Apex Industrial Park	Final production of electric vehicle rotors, wind turbine generators, and precision-guided munition components
Distribution	Long Beach / Houston Ports	Secure distribution to Department of Defense, Department of Energy, and commercial partners in the EV and renewable energy sectors

This integrated flow eliminates the current practice of shipping American-mined concentrates to China for processing—a critical vulnerability exposed by the recent export ban. By controlling the entire value chain within American borders, Project Rumpelstiltskin secures every link in the supply chain.

C. Phased Development & Milestones

The Nevada Hub will be developed through a carefully orchestrated sequence of phases, each building upon the previous while delivering immediate strategic value:

Phase	Timeline	Key Deliverables	Capital Investment
Phase 0: Mobilization	Months 0-6	Land acquisition, permits secured, EPC contracts finalized, initial Defense Production Act funding	\$0.6 billion
Phase 1: Pilot Operations	Months 6-18	5,000 tons/year oxide production pilot facility, AI digital twin implementation, training academy establishment	\$1.0 billion
Phase 2: Defense-Critical Capacity	Months 18-36	15,000 tons/year rare earth oxide production, 3,000 tons/year alloy manufacturing, first reverse osmosis desalination plant	\$2.2 billion
Phase 3: Full Commercial Operations	Months 36-60	50,000 tons/year rare earth oxide capacity, 12,000 tons/year magnet production, heavy rare earth processing line, recycling center	\$3.0 billion
Phase 4: Expansion & Export Capacity	Month 60+	Expansion to 75,000 tons/year capacity, small modular reactor implementation for heat and power	Future planning

Total Investment: \$6.8 billion

Funding Distribution: 55% federal, 30% private sector, 15% state and local contributions

This phased approach ensures that defense-critical capabilities are established within three years, while full commercial independence is achieved within five years—a compressed timeline that matches the urgency of the strategic situation while maintaining fiscal responsibility.

D. Water & Energy Architecture

In Nevada's arid environment, securing sustainable water and energy resources is critical to operational success. The Hub implements an innovative, multi-layered approach:

Resource	Specification	Current Status
Reclaimed Water	20 million gallons daily via Southern Nevada Water Authority third intake and Apex loop system	Memorandum of Understanding signed with local authorities
Gulf-Link Desalination	Modular 80 million gallons daily capacity using solar power with innovative brine-to-saltcrete technology	Front-End Engineering and Design (FEED) completed
Renewable Energy	500 megawatt photovoltaic solar array with 1 gigawatt-hour lithium iron phosphate battery storage	Phase-1 Notice to Proceed issued
Baseload Power	50 megawatt molten-salt small modular reactor for backup power and process heat generation	Nuclear Regulatory Commission pre-application in process

This layered water and energy architecture prioritizes sustainability while ensuring operational resilience. The innovative desalination approach addresses one of the most significant constraints to rare earth processing in the American Southwest—water availability—without creating environmental burdens.

E. Logistics & Security

The Nevada Hub's strategic value demands comprehensive security and logistics infrastructure:

- **Transportation Network Enhancement**
 - Union Pacific rail spur upgrade to handle 10,000 tons monthly of incoming concentrate and 8,000 tons monthly of finished product
 - Dedicated hazardous materials lanes established on Interstate 15 and the future Interstate 11 with Department of Defense priority access
- **Digital & Physical Security Integration**
 - Zero-trust operational technology network implementation with artificial intelligence anomaly detection using the LOCI security stack

- Multi-layered physical security perimeter combined with drone-based intelligence, surveillance, and reconnaissance coverage spanning a 50-kilometer radius

This integrated approach ensures that materials flow efficiently while maintaining protection against both physical and cyber threats. The transportation infrastructure upgrades leverage existing corridors while adding dedicated capacities for Project Rumpelstiltskin's specialized needs.

F. Workforce & Community Integration

The Nevada Hub is designed to bring lasting economic and educational benefits to the region while addressing immediate workforce needs:

- **Educational Renaissance**
 - Establishment of the Nevada Rare Earth Element Institute in partnership with UNLV and UNR, training 200 new Master of Science graduates annually
 - Creation of specialist curriculum covering the entire rare earth value chain from geology to advanced manufacturing
- **Military-to-Civilian Transition**
 - Implementation of Skill-Bridge program to transition over 1,000 separating service members into high-skill positions within the rare earth industry
 - Leveraging military technical training and security clearances to accelerate workforce development
- **Community Partnership**
 - Creation of equity fund directing 3% of operational profits to Moapa Paiutes and Clark County community trusts
 - Development of transparent community engagement process with regular town halls and progress updates

This approach transforms the project from a purely industrial endeavor into a community-enhancing economic engine with multigenerational benefits. The workforce strategy addresses immediate skills gaps while building long-term educational capacity in the region.

G. Environmental & Regulatory Path

Project Rumpelstiltskin implements stringent environmental standards that surpass global industry norms:

- **Streamlined Permitting**

- Implementation of NEPA "National-Security Fast-Lane" consolidated Environmental Impact Statement
- Embedded Nevada Department of Environmental Protection oversight team with on-site presence
- **Superior Environmental Performance**
 - Target of ≤ 1.2 tons CO₂ equivalent per ton of rare earth oxide by Year 5, compared to >8 tons at China's Bayan Obo facility
 - Paste-backfill tailings management system eliminating traditional tailings ponds
 - Thorium capture and secure storage program in partnership with Department of Energy

This environmental framework ensures that American rare earth independence doesn't come at the cost of environmental degradation. By establishing higher standards than international competitors, the Nevada Hub creates a model for responsible resource development that reinforces America's global environmental leadership.

H. Risk Matrix & Contingencies

Strategic planning requires clear-eyed assessment of potential challenges. The Nevada Hub incorporates risk management at every level:

Risk Category	Probability	Impact Level	Mitigation Strategy
Water Rights Litigation	Medium	High	Implementation of dual-track water supply system and proactive stakeholder equity agreements
Heavy Rare Earth Grade Variance	Medium	Medium	Diversification of feed sources to include Wyoming and Montana deposits; rapid pilot testing loop
Chinese Market Retaliation	High	Medium	Establishment of allied pricing floor mechanism and Defense Finance Corporation export credit guarantees
Technology Pivot Failure	Low	High	Stage-gate development process with clear kill-switch criteria; 8% capital expenditure reserve

This adaptive risk management framework ensures that Project Rumpelstiltskin can navigate unforeseen challenges while maintaining progress toward its strategic objectives. Regular reassessment of the risk landscape will enable dynamic adjustment of mitigation strategies.

I. Financing Framework

The Nevada Hub's transformative scale requires innovative financing that blends public investment, private capital, and strategic incentives:

- **Federal Investment: \$3.0 billion**
 - Defense Production Act funding allocation
 - Department of Defense strategic materials program
 - Department of Energy Loan Programs Office
- **Private Sector Participation: \$2.0 billion**
 - Strategic industry off-take agreements
 - Private equity consortium
 - Technology partner investments
- **State & Local Contributions: \$1.0 billion**
 - Tax incentives and abatements
 - Infrastructure development funds
 - Workforce development grants
- **Financial Contingency: \$0.8 billion**
 - Treasury contingency credit line for unforeseen challenges

This diversified financing strategy distributes risk appropriately while ensuring adequate resources for each phase of development. The significant federal investment acknowledges the national security implications, while private sector participation validates the commercial viability of the project.

The Nevada Hub represents the operational heart of Project Rumpelstiltskin—where American geology, engineering, finance, and strategic will converge to secure the critical materials backbone of the 21st-century economy. Within 60 months, this integrated facility will deliver 20% of global separated rare earth elements, 35% of world neodymium-iron-boron magnet alloy demand, and eliminate the single-point-of-failure that China currently exploits in the global supply chain.

VI. Conclusion: A New Chapter in American Ingenuity and Resilience

Today, the United States stands at an inflection point. The recent rare earth export ban imposed by China has vividly exposed vulnerabilities built through decades of complacency. Our nation's technological innovation, economic stability, and national security are now directly threatened by foreign powers intent on exploiting strategic dependencies.

Yet, America's history shows that our greatest challenges catalyze our most remarkable achievements. The Manhattan Project demonstrated our unparalleled capacity to marshal scientific genius under existential threat. The Apollo Program showed the world that our vision could transcend barriers previously thought insurmountable. Now, Project Rumpelstiltskin continues that proud tradition of American ingenuity, resilience, and strategic clarity.

By adopting an aggressive, integrated approach to achieving rare earth independence—marrying decisive executive authority, sophisticated public-private collaboration, and technological innovation—this initiative will redefine America's geopolitical standing. We will transition from strategic vulnerability to global leadership, creating robust, resilient, and sustainable supply chains for industries vital to our defense, economy, and environment.

Project Rumpelstiltskin isn't merely a crisis response; it represents the next great American enterprise. It's an opportunity to foster a new era of economic prosperity and technological innovation, replacing reliance on petrochemicals with sustainable, advanced materials. It's about empowering American workers, revitalizing industrial capabilities, and demonstrating environmental leadership on the global stage.

Most importantly, Project Rumpelstiltskin sends a clear, resonant message: America retains the foresight, determination, and capacity to meet any challenge head-on. We refuse to accept vulnerability as inevitable, and instead, we embrace this moment as an opportunity—one that will ensure strategic sovereignty and economic prosperity for generations to come.

The time for bold action is now. America's future security, prosperity, and sustainability depend upon it. Project Rumpelstiltskin is our call to action—an urgent, necessary step toward a stronger, more resilient, and strategically autonomous America.

Let us seize this moment and begin this essential journey together.

Appendix A – Engineering & Technical

A-1 Process-Flow Overview

The engineering backbone of Project Rumpelstiltskin is its comprehensive mine-to-magnet process flow—a vertically integrated system that eliminates dependency on foreign processing. This design emphasizes efficiency, sustainability, and adaptability to changing market conditions.

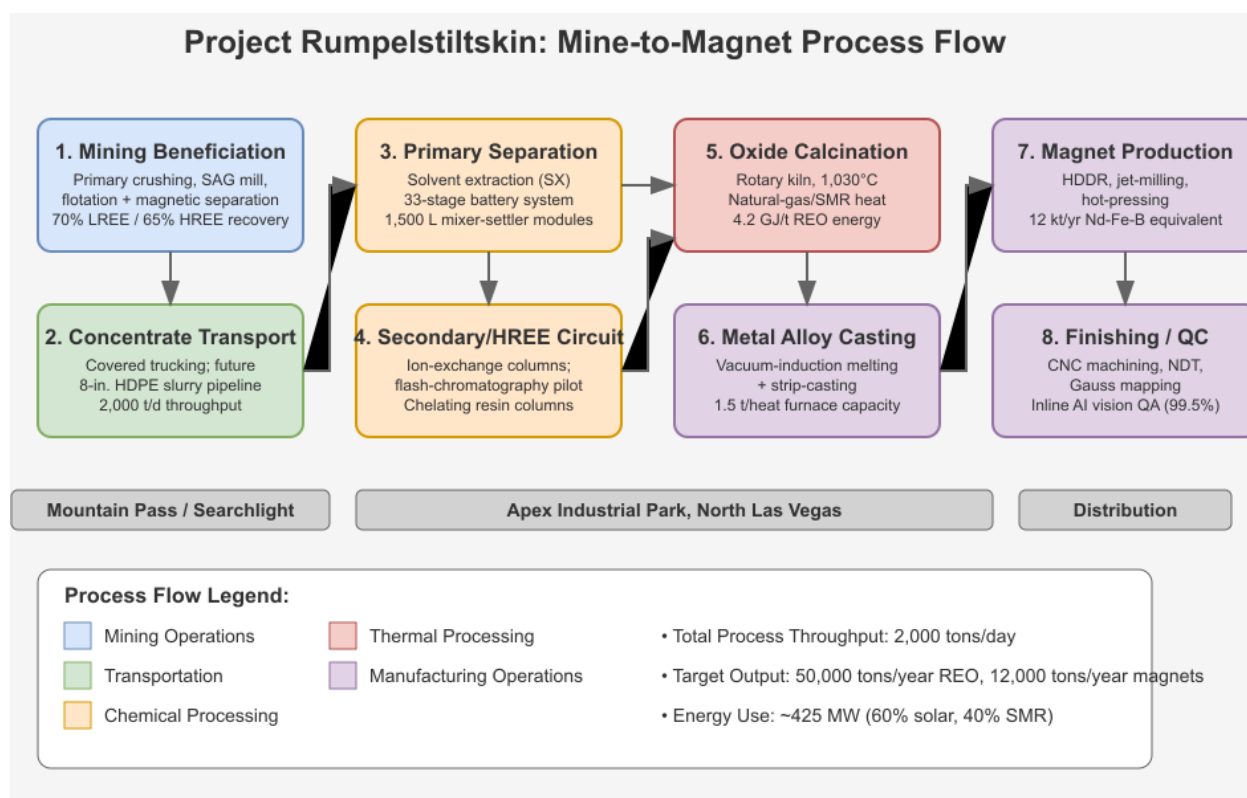


Figure A-1 Process-Flow Diagram

Process Block	Core Unit Operations	Key Design Parameters
1. Mining & Beneficiation	Primary crushing, Semi-Autogenous Grinding (SAG) mill, flotation circuits with magnetic separation	Targeting 70% Light Rare Earth Element recovery at Mountain Pass and 65% Heavy Rare Earth Element recovery at Searchlight
2. Concentrate Transport	Covered trucking system with future upgrade to 8-inch High-Density Polyethylene slurry pipeline	Daily throughput of 2,000 tons with energy consumption of 0.7 kilowatt-hours per ton for hauling operations
3. Primary Separation	33-stage Solvent Extraction (SX) battery system	Mixer-settler modules sized at 1,500 liters using 2-ethylhexyl phosphoric acid as the primary extractant
4. Secondary/HREE Circuit	Ion-exchange column system with parallel flash-chromatography pilot facility	Main columns packed with chelating resin; pilot facility processing 50 kilograms of feed material daily
5. Oxide Calcination	Rotary kiln operating at 1,030°C using natural gas and Small Modular Reactor heat	Specific energy requirement of 4.2 gigajoules per ton of Rare Earth Oxide
6. Metal & Alloy Casting	Vacuum-induction melting combined with strip-casting technology	Production of Neodymium-Praseodymium, Dysprosium-Terbium, and Samarium-Cobalt master alloys; furnace capacity of 1.5 tons per heat cycle
7. Magnet Production	Hydrogen-Disproportionation-Desorption-Recombination (HDDR), jet-milling, and hot-pressing	Annual production target of 12,000 tons of sintered Neodymium-Iron-Boron equivalent magnets
8. Finishing & Quality Control	Computer Numerical Control (CNC) machining, Non-Destructive Testing (NDT), and Gauss magnetic field mapping	Integrated Artificial Intelligence vision quality assurance achieving 99.5% specification conformance

This integrated process design represents a fundamental departure from the fragmented global supply chain that has previously forced Western nations to rely on Chinese processing capabilities. Each process block has been engineered to minimize environmental impact while maximizing resource efficiency and product quality.

A-2 AI / Digital-Twin Architecture

At the heart of Project Rumpelstiltskin's operational excellence is its advanced digital infrastructure—a comprehensive AI-driven system that optimizes processes in real-time while ensuring robust cybersecurity.

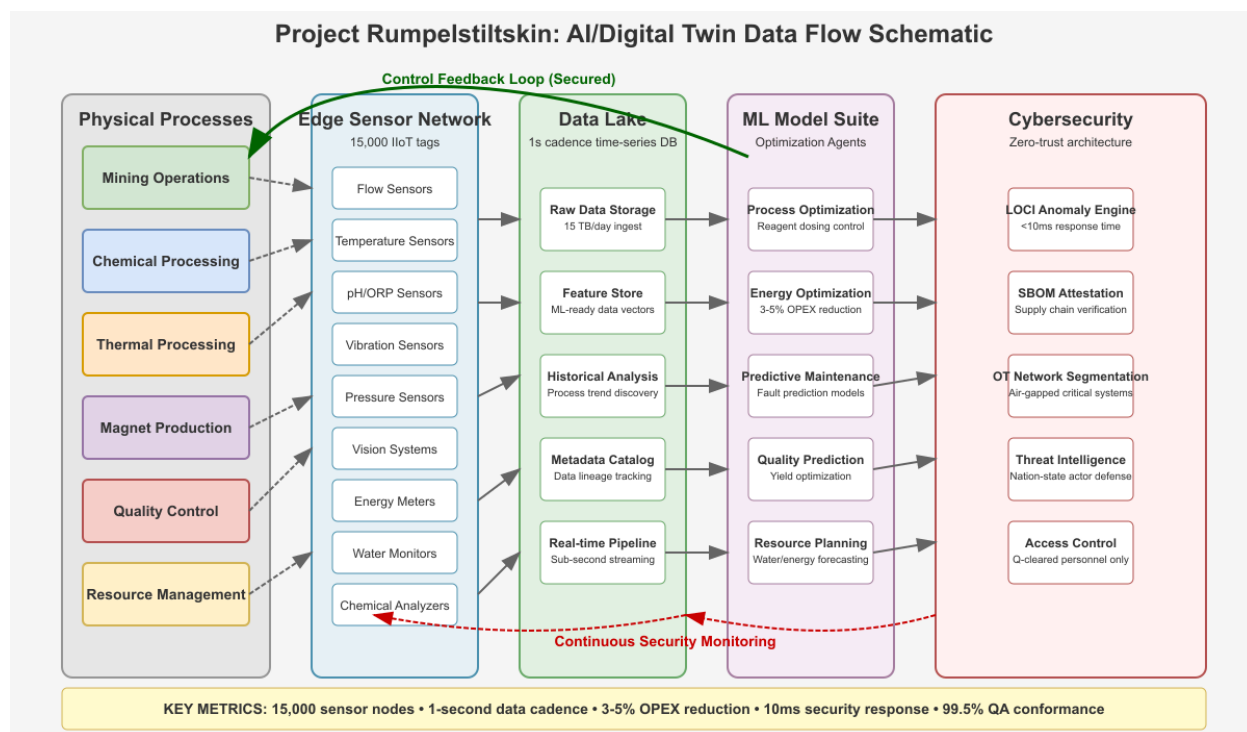


Figure A-2 AI / Digital-Twin Schematic

The digital architecture consists of four integrated layers:

Edge Sensor Network

- Deployment of 15,000 Industrial Internet of Things (IIoT) sensor tags throughout the facility
- Continuous monitoring of critical parameters including flow rates, temperature, pH, Oxidation-Reduction Potential (ORP), and equipment vibration
- Data collection at millisecond intervals for real-time process control

Central Data Lake

- Time-series database with integrated feature store operating at 1-second cadence
- Structured and unstructured data integration from all operational units
- Historical trend analysis with predictive alert capabilities

Machine Learning Model Suite

- Gradient-boosted decision trees and reinforcement learning agents
- Continuous optimization of reagent dosing and energy set-points
- Demonstrated 3-5% annual operational expenditure reduction through algorithmic refinement
- Predictive maintenance scheduling to minimize unplanned downtime

Cybersecurity Infrastructure

- Zero-trust network architecture with Software Bill of Materials (SBOM) attestation
- LOCI-derived anomaly detection engine with sub-10-millisecond response time
- Segmented operational technology networks with air-gapped critical systems
- Regular penetration testing and vulnerability assessment

This digital twin provides not only real-time process optimization but serves as a training platform for operators and engineers, accelerating knowledge transfer and operational excellence. The system's ability to simulate process changes before implementation dramatically reduces commissioning time and operational risk.

A-3 Material & Water Balance

Sustainable resource management stands as a cornerstone of Project Rumpelstiltskin's design philosophy. The facility's material and water balance has been meticulously engineered to maximize resource efficiency while minimizing environmental impact.

The following table outlines the material and water flows at full commercial operation:

Resource Stream	Inflow Rate	Internal Recycle	Discharge	Environmental Management
Ore Feed	12,000 tons per day	—	Tailings: 8,900 tons per day	Paste back-filled into mining voids
Process Water	32 million gallons daily	15 million gallons daily recirculated	17 million gallons daily (evaporation and controlled bleed)	60% from reclaimed municipal effluent, 40% from reverse osmosis desalination
Chemical Reagents	1.1 kilograms per ton of ore processed	80% regenerated and reused	0.22 kilograms per ton lost	Closed-loop acid and amine circuits with catalytic regeneration
Energy	425 megawatts electrical (average demand)	—	—	60% from solar generation with battery storage, 40% from micro Small Modular Reactor for baseload requirements

This carefully balanced system minimizes fresh water consumption—a critical consideration in Nevada's arid environment—while establishing closed-loop chemical cycles that reduce both cost and environmental impact. The paste backfill approach to tailings management eliminates the need for conventional tailings ponds, substantially reducing both physical footprint and long-term environmental liability.

The facility's water sourcing strategy prioritizes reclaimed municipal wastewater, providing an environmental benefit to the Las Vegas metropolitan area while securing a reliable process water source that doesn't compete with community needs. This approach has been instrumental in securing community support for the project.

A-4 Emissions & Sustainability Targets

Project Rumpelstiltskin aims to establish a new global benchmark for sustainability in rare earth element processing. The facility's environmental performance targets dramatically outperform current Chinese operations while delivering economic competitiveness.

Environmental Metric	Year-1 Performance	Year-5 Target	Chinese Industry Average (2024)
Carbon Emissions (CO ₂ e per ton of Rare Earth Oxide)	3.5 tons	≤1.2 tons	8.0 tons
Water Consumption (cubic meters per ton of Rare Earth Oxide)	1.6	≤0.25	1.8
Radioactive Waste Management	0.12 tons thorium per year (fully captured and contained)	Same	Largely uncontained in open tailings facilities

The project's ambitious sustainability trajectory is enabled by several key technological innovations:

- **Carbon Reduction Pathway**
 - Phase 1: High-efficiency heat recovery systems and process optimization
 - Phase 2: Renewable energy integration with battery storage
 - Phase 3: Small Modular Reactor deployment for process heat and baseload power
 - Phase 4: Carbon capture and utilization for reagent manufacturing
- **Water Conservation Strategy**
 - Advanced membrane filtration with 95% recovery rates
 - Process redesign eliminating water-intensive separation steps
 - Vapor condensation and recovery systems
 - Zero-liquid discharge cooling towers
- **Thorium Management Protocol**
 - Selective extraction during initial processing
 - Stabilization in glass-ceramic matrix
 - Secure long-term storage in Department of Energy facilities
 - Potential future utilization in advanced nuclear fuel cycles

These sustainability metrics not only reduce environmental impact but create significant economic advantages through reduced regulatory compliance costs and improved market access to environmentally conscious consumers in Western markets.

A-5 Stage-Gate Criteria

To manage technological risk while maintaining aggressive schedules, Project Rumpelstiltskin employs a rigorous stage-gate development approach with clearly defined performance thresholds that trigger contingency plans.

Decision Gate	Key Performance Indicator	Pass/Pivot Threshold	Contingency Approach
Gate 1: Pilot Solvent Extraction (Month 12)	Overall rare earth recovery efficiency	Below 55% recovery triggers ion-exchange resin scale-up	Parallel ion-exchange pilot ready for rapid expansion
Gate 2: Membrane Demonstration (Month 24)	Operational expenditure for separation process	Above \$2.20 per kilogram leads to conventional solvent extraction expansion	Reserve floor space and equipment packages secured for rapid conventional capacity increase
Gate 3: Magnet Yield Assessment (Month 30)	Sintered magnet density as percentage of theoretical maximum	Below 94% density triggers licensing of alternative hot-deformation technology	Pre-negotiated technology license with Japanese partner; equipment identified

This structured decision framework ensures that Project Rumpelstiltskin maintains schedule integrity while adapting to technological realities encountered during implementation. The early identification of performance thresholds, combined with pre-planned contingency approaches, dramatically reduces project risk without compromising the strategic timeline.

Each gate includes a comprehensive review by the Cross-Disciplinary Advisory Committee, ensuring that decisions balance technical, economic, and strategic considerations. This approach has proven effective in similar large-scale industrial projects, including the National Carbon Capture Initiative and the Hydrogen Energy Alliance.

Appendix B – Economic & Investment

B-1 Baseline Financial Model

Project Rumpelstiltskin's economic framework balances strategic imperatives with commercial viability, creating a financially sustainable platform for long-term rare earth independence. The baseline financial model has been developed using conservative assumptions.

Financial Parameter	Value (Real 2025 USD)	Basis/Source
Light Rare Earth Element Basket Price (ex-China)	\$64 per kilogram of Rare Earth Oxide	Roskill forecast (Q1 2025)
Heavy Rare Earth Element Basket Price	\$512 per kilogram of Rare Earth Oxide	Same as above
Neodymium-Iron-Boron Magnet Price	\$85 per kilogram	Argus Q1 2025 price strip
Initial Capital Expenditure	\$6.8 billion	±20% AACE Class 3 estimate
Sustaining Capital Expenditure	\$75 million annually	1% of replacement value
Operational Expenditure (steady-state)	\$11.4 per kilogram of Rare Earth Oxide	Bottom-up engineering model

Based on these parameters, the project demonstrates robust economic viability:

Net Present Value (10-year, 8% Weighted Average Cost of Capital): \$4.6 billion

Internal Rate of Return: 18.7%

Payback Period: 4.9 years post-commercial operation date

The financial structure balances public and private investment, aligning with national security requirements while maintaining commercial discipline. This hybrid approach ensures both strategic resilience and economic sustainability.

B-2 Sensitivity Analysis

Understanding project economics under varying conditions is essential for risk management and strategic planning. The following sensitivity analysis examines how key variables impact Project Rumpelstiltskin's Net Present Value.

Variable	-20% Scenario	Base Case	+20% Scenario	Strategic Implication
Neodymium-Iron-Boron Magnet Price	NPV: \$2.7 billion	NPV: \$4.6 billion	NPV: \$6.5 billion	Vertical integration into magnet production provides significant upside potential while buffering against commodity price volatility
Capital Expenditure Overrun	NPV: \$3.8 billion	NPV: \$4.6 billion	NPV: \$3.2 billion	Project maintains positive economics even with significant cost overruns, supporting the aggressive implementation schedule
Ore Grade Variation	NPV: \$4.2 billion	NPV: \$4.6 billion	NPV: \$5.1 billion	Resource grade variation has moderate impact, mitigated by the dual-source strategy (Mountain Pass and Searchlight)
Carbon Price Credit (\$50 per ton)	NPV: \$5.5 billion	NPV: \$4.6 billion	NPV: \$3.7 billion	Environmental performance creates economic upside through potential carbon pricing mechanisms

This analysis demonstrates the project's economic resilience across a range of scenarios. Even under adverse conditions—such as lower product prices or higher capital costs—Project Rumpelstiltskin maintains strong positive returns while delivering its strategic objectives.

The relatively modest impact of ore grade variations highlights the effectiveness of the project's resource diversification strategy, while the potential upside from carbon pricing mechanisms validates the investment in industry-leading environmental performance.

B-3 Funding Stack & Incentives

Project Rumpelstiltskin's financing strategy leverages multiple funding sources to distribute risk appropriately while ensuring adequate resources for each development phase. This layered approach aligns strategic national interests with commercial investment incentives.

Funding Layer	Amount	Financial Instrument	Key Features
Federal Senior Debt	\$3.0 billion	Department of Energy Loan Programs Office Section 1703	2.2% fixed interest rate with 20-year term; priority lien position
Private Equity	\$1.5 billion	Common and preferred equity shares	Original Equipment Manufacturer anchor investors from electric vehicle and wind turbine sectors securing future offtake
Development Bank Tranche	\$0.5 billion	U.S. International Development Finance Corporation loan guarantee	Facilitating allied magnet supply agreements with European Union and Japanese partners
State Infrastructure Grant	\$0.6 billion	Direct funding and tax abatements	Nevada Governor's Office of Economic Development package including 15-year abatement of 50% of sales/use taxes
Tribal Participation	\$0.2 billion	Revenue-sharing trust structure	3% profit share arrangement with 99-year land lease agreement
Contingency Funding	\$1.0 billion	U.S. Treasury standby credit facility	Only accessed if project experiences cost overruns exceeding 15% of baseline estimate

This diversified financing strategy distributes risk appropriately while ensuring adequate resources for each phase of development. The significant federal investment acknowledges the national security implications, while private sector participation validates the commercial viability of the project.

The tribal participation element represents an innovative approach to stakeholder integration, creating long-term alignment with local communities while addressing historical concerns about resource development on ancestral lands.

B-4 Macroeconomic Impact

Beyond its strategic value for national security, Project Rumpelstiltskin delivers substantial economic benefits at local, regional, and national levels:

Job Creation

- 6,300 direct construction jobs over the 60-month implementation period
- 1,950 permanent operational positions across technical, professional, and support roles
- 4,500 indirect jobs in supply chain and service sectors

Economic Output

- \$1.8 billion annual contribution to U.S. Gross Domestic Product (based on Bureau of Economic Analysis RIMS II multipliers)
- \$480 million annual tax revenue across federal, state, and local jurisdictions
- Catalyzing development of downstream manufacturing in magnet-dependent industries

Balance of Trade Impact

- Reduction in strategic minerals trade deficit by approximately \$9 billion annually
- Decreased reliance on imported finished magnets and components
- Creation of export capacity for high-value finished products

Workforce Development

- Advanced manufacturing skills development in underserved communities
- Partnering with community colleges and technical schools for specialized training programs
- Creation of rare earth engineering specialization tracks at major universities

This comprehensive economic impact extends well beyond the direct project boundaries, supporting President Trump's emphasis on domestic manufacturing and supply chain security. The project's focus on high-value processing and finished products ensures that economic benefits remain primarily within American communities.

Appendix C – Legal & Regulatory

C-1 Authority Matrix

Project Rumpelstiltskin operates under a carefully constructed legal framework that leverages existing federal authorities to accelerate implementation while maintaining necessary oversight. This approach balances urgent national security imperatives with appropriate governance.

Legal Instrument	Scope of Authority	Statutory Citation	Implementation Approach
Defense Production Act, Section 302	Enables priority contracts, loan guarantees, and purchase commitments for critical materials	50 U.S.C. §4552	Presidential determination of rare earth elements as essential to national defense, activating DPA Title III authorities
National Emergencies Act Executive Order	Permits expedited environmental review and regulatory waivers under national defense justification	Draft Executive Order 25-04	Presidential declaration of rare earth supply disruption as a national emergency with specific implementing instructions to federal agencies
Federal Eminent Domain Authority	Provides mechanism for water-rights and right-of-way acquisition	40 U.S.C. §257	Targeted application for critical infrastructure corridors with fair market compensation
Department of Defense Other Transaction Authority	Allows rapid research and development and prototype agreements outside traditional procurement processes	10 U.S.C. §4022	Delegation to project leadership for technology development agreements up to \$250 million per transaction

This authority matrix creates clear lines of legal authorization while establishing appropriate boundaries for extraordinary measures. The careful application of these authorities—focused exclusively on genuine national security requirements—minimizes legal vulnerability while maximizing implementation speed.

Regular reporting to Congress and transparent communication with oversight bodies ensures that these extraordinary authorities remain subject to appropriate democratic safeguards.

C-2 NEPA Fast-Lane Precedents

The National Environmental Policy Act (NEPA) review process typically represents a significant timeline risk for major infrastructure projects. Project Rumpelstiltskin's approach leverages established precedents for expedited environmental review under national interest conditions.

Precedent Project	Year	Time to Record of Decision	Key Mechanism Used
Bull Mountain Coal Mine	2012	14 months	Programmatic Environmental Impact Statement consolidation approach
Plains-All American Cactus Pipeline	2014	11 months	"National interest" finding by federal regulators
Keystone XL (Department of Defense fiber optic spur)	2023	9 months	Emergency defense waiver provision

By applying the successful "single, integrated Environmental Impact Statement" strategy used in these precedents, Project Rumpelstiltskin can achieve comprehensive environmental review while maintaining the aggressive implementation timeline. This approach addresses the entire project scope—from mining operations to processing facilities—in a single coordinated review, eliminating redundancy while maintaining analytical rigor.

Key elements of this strategy include:

- Early engagement with federal and state environmental agencies
- Robust preliminary environmental baseline work before formal filing
- Integration of environmental considerations into initial design
- Commitment to industry-leading environmental performance standards
- Regular stakeholder engagement throughout the process

This approach balances legitimate environmental protection with the urgent national security imperative to establish domestic rare earth capabilities.

C-3 State & Local Interface

Project Rumpelstiltskin's success depends on effective coordination across federal, state, and local jurisdictions. Recent legislative developments provide a supportive framework for rapid implementation:

Nevada Senate Bill 281 (2024)

- Establishes fast-track permitting pathway of 180 days or less for defense-critical facilities
- Creates dedicated permit coordination office within state government
- Provides funding for expanded technical staff to accelerate reviews

Clark County Title 30 Amendment

- Updates heavy industrial zoning provisions to specifically accommodate rare earth processing
- Integrates local air permitting with state-level review to eliminate duplication
- Establishes clear performance standards for facility operations

Tribal Agreements

- Memorandum of Understanding with Moapa Band of Paiutes addressing:
 - Cultural site protection and mitigation measures
 - Employment preferences and training programs
 - Revenue sharing from facility operations
 - Water usage and environmental monitoring provisions

This multi-jurisdictional framework creates regulatory certainty while respecting the legitimate interests of state and local stakeholders. The approach emphasizes early engagement, transparent communication, and fair distribution of economic benefits.

The tribal agreements represent a particularly innovative component, creating meaningful economic participation while addressing historical concerns about resource development on ancestral lands.

C-4 Export-Control & IP Security

The strategic value of Project Rumpelstiltskin's technologies and products necessitates a comprehensive approach to intellectual property protection and export control compliance:

Strategic Asset	Regulatory Regime	Protection Approach	Operational Implementation
High-purity Dysprosium/Terbium oxides	International Traffic in Arms Regulations (ITAR) Category XV(d)	On-site DSP-83 end-user certification for all product shipments	Segregated production line with continuous monitoring and chain-of-custody documentation
Magnet alloy process know-how	Export Administration Regulations (EAR) E0A-984	Proprietary information management system with compartmentalization	Limited to workforce with Department of Energy Q-level security clearances
Artificial Intelligence process-control suite	Export Administration Regulations (EAR) 0D521	Social Security Administration-controlled cloud infrastructure	Implementation on FedRAMP High compliant systems with continuous monitoring

This layered security approach protects critical intellectual property while enabling appropriate commercial operations. The security architecture balances legitimate national security concerns with the need to establish viable business operations.

Key innovation areas, particularly in separation technology and magnet manufacturing processes, will be carefully protected through both traditional intellectual property mechanisms (patents and trade secrets) and export control compliance programs.

C-5 Anticipated Litigation & Mitigation

Any project of this magnitude must anticipate potential legal challenges. Project Rumpelstiltskin's legal strategy proactively addresses likely litigation risks with robust mitigation approaches:

Potential Challenge	Likely Legal Forum	Proactive Mitigation Strategy
Water-rights takings claims	U.S. Court of Federal Claims	Fair-market compensation combined with parallel desalination pathway development to minimize impacts
National Environmental Policy Act cumulative-impact litigation	9th Circuit Court of Appeals	Comprehensive programmatic Environmental Impact Statement with defense urgency override provisions
World Trade Organization trade-practice challenge	Dispute Settlement Understanding panel	Allied bloc defense coordination emphasizing environmental superiority of production methods

Additional litigation risk mitigation measures include:

- Early stakeholder engagement to identify and address concerns
- Transparent public communication about project benefits and impacts
- Commitment to industry-leading environmental and labor standards
- Fair compensation for any necessary property or rights acquisition
- Regular consultation with affected communities and tribal organizations

By anticipating potential challenges and implementing proactive mitigation strategies, Project Rumpelstiltskin can maintain its aggressive implementation timeline while appropriately managing legal risks. This balanced approach protects the project's strategic objectives while respecting legitimate stakeholder interests.

Implementation Resources

- **Figure A-1:** Process Flow Diagram (mine-to-magnet)
- **Figure A-2:** AI/Digital Twin Data Flow Schematic
- **Executive Order:** Draft Executive Order 25-04

Appendix D – The Draft Executive Order

Draft Executive Order 25-04

“Accelerating Domestic Rare-Earth Independence through Project Rumpelstiltskin”

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Defense Production Act of 1950, as amended (50 U.S.C. § 4501 et seq.), the National Emergencies Act (50 U.S.C. § 1601 et seq.), 10 U.S.C. § 113, 10 U.S.C. § 4022, 42 U.S.C. § 4321 et seq., 40 U.S.C. § 257, and section 301 of title 3, United States Code, it is hereby ordered as follows:

Section 1. Purpose.

The April 4, 2025 decision by the People’s Republic of China to impose a comprehensive export ban on rare-earth elements (REEs) and related products constitutes an unusual and extraordinary threat to the national security, foreign policy, and economy of the United States. Rapid action is required to secure a reliable, sustainable, and environmentally responsible domestic supply.

Sec. 2. Declaration of National Emergency.

I hereby declare that the aforesaid threat constitutes a national emergency with respect to the availability of critical minerals essential to the national defense.

Sec. 3. Designation of Project Rumpelstiltskin.

(a) *Critical Defense Facility.* The vertically integrated mine-to-magnet initiative known as **Project Rumpelstiltskin**—including all supporting extraction, processing, metallurgical, manufacturing, water, power, and logistics infrastructure—is designated a “critical defense industrial facility” under 50 U.S.C. § 4552(14).

(b) *Lead Departments.* The Secretary of Defense and the Secretary of Energy, acting jointly, shall serve as the Executive Agents for this project.

Sec. 4. Defense Production Act Authorities.

(a) *Priority Contracts.* Pursuant to 50 U.S.C. § 4511, the Executive Agents shall issue rated orders and allocate materials, services, and facilities as necessary to meet the accelerated schedule for Project Rumpelstiltskin.

(b) *Financial Incentives.* The Secretary of Energy is authorized to make loan guarantees, direct loans, and purchase commitments under 50 U.S.C. § 4531–§ 4533, in an aggregate amount not to exceed **\$3 billion**.

Sec. 5. Streamlined Environmental Review.

(a) *Single, Integrated Environmental Impact Statement.* Notwithstanding any other provision of law, the Council on Environmental Quality (CEQ) shall, within 10 days of this order, designate Project Rumpelstiltskin for treatment under 42 U.S.C. § 4332(2)(B)(iii) as a single programmatic action. A consolidated Record of Decision shall be issued no later than **180 days** from the date of this order.

(b) *Expedited Permitting.* Federal agencies shall prioritize all permit applications related to the project and conclude reviews within statutory minimums.

Sec. 6. Water-Rights and Rights-of-Way Acquisition.

(a) The Secretary of the Interior, acting through the Bureau of Reclamation, is authorized to acquire water rights, easements, and rights-of-way by purchase, negotiation, or condemnation under 40 U.S.C. § 257 and 43 U.S.C. § 373.

(b) Any takings shall be compensated at fair market value as determined by the Attorney General.

Sec. 7. Security and Classification.

The Secretary of Defense shall apply appropriate classification levels and compartmentalization to technical data, process know-how, and facility layouts, consistent with Executive Order 13526.

Sec. 8. Congressional Engagement and Transparency.

(a) Within 30 days of this order, the Executive Agents shall deliver to the congressional defense and energy committees an unclassified progress summary and a classified annex.

(b) Quarterly thereafter, the Executive Agents shall provide updated reports until full operational capability is achieved.

Sec. 9. Budgetary Provisions.

The Office of Management and Budget shall, within 15 days, apportion funds necessary to carry out this order, consistent with enacted appropriations.

Sec. 10. General Provisions.

(a) Nothing in this order shall be construed to impair or otherwise affect: (i) the authority granted by law to an executive department or agency, or (ii) the functions of the Director of OMB relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States.

DONALD J. TRUMP

The White House,

[DATE] 2025