Electric Plan

TD-8108 – Asset Data Asset Management Plan

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Contents

Tables

Figures

1. Executive Summary

This Asset Data Asset Management Plan (AMP) outlines Electric Asset Knowledge Management's (AKM) strategic plan and objectives for asset data management. The document serves as a roadmap for achieving the asset management strategy and objectives for this asset family consistent with Utility Plan TD-8100, "Strategic Asset Management Plan (SAMP)," and the requirements established in International Standards Organization (ISO) 55001.

This AMP provides specific actions for a multi-step approach that involves the following:

1. A system assessment of the asset base.
2. An assessment of asset condition and performance.
3. Asset prioritization based on current criteria that ties to enterprise strategic objectives.
4. Current and planned initiatives to improve asset management.
5. The development of specific controls and mitigations for the risk associated with asset data management.

The Asset Data AMP is complementary and aligned to the eight AMPs that focus on physical electric assets (as opposed to data assets) in the asset management system. Other guiding documents are discussed in the relevant sections.

The plan aligns with the PG&E True North Strategy, Integrated Grid Planning (IGP), and Office of Energy Infrastructure Safety (OEIS) Wildfire Data Governance objectives. This plan will be implemented through the initiatives described herein to enhance data quality, data access, and data governance with the goal of mitigating risks, optimizing performance, and managing investments in electric physical assets and associated business processes. Available resources will be deployed in the most critical areas.

In 2023, Lloyd's Register Quality Assurance (LRQA) determined that PG&E had resolved its minor non-conformance for asset data management by instantiating the governance, processes, and controls needed to effectively manage its asset-related data in accordance with ISO 55001. LRQA's finding recognized that PG&E had the programs in place to address key gaps around the timeliness of As-Built asset data, the accuracy of its Asset Registry data, synchronization of data between core systems (SAP/Graphical Information System [GIS]), and access to and integration of asset-related data.

The 2023 Asset Data AMP continues to focus on management of the foundational Asset Registry data (critical asset records, master data/critical data elements [CDEs]) and expands to begin addressing other asset data types (e.g., Condition Data, Operating History Data). This iteration of the AMP makes the following modifications to the previous AMP:

- Improves alignment with physical asset family AMPs

- Aligns with company strategic objectives, including True North Strategy Data Management Strategy
- Integrates new standards and programs (e.g., Asset Registry Data Standard, Data Management Oversight Program, Asset Data Quality Program)
- Aligns with the new, standard format established by the Electric Asset Excellence team

1.1 Asset Introduction

The Electric Asset Data asset family is characterized by Electric Operations (EO) as a distinct asset family similar to the electric physical asset families (e.g., Distribution Overhead), requiring its own AMP to maintain the health of data assets and optimize performance. The Electric Asset Data family was created to ensure appropriate focus on managing the data "assets" (data sets) critical to PG&E's safe and effective operations and physical asset life cycle management. The role of asset information within the physical asset management framework is shown in Figure 1 below. As illustrated, asset information (data) informs all stages of the asset management life cycle, from strategy and planning through life cycle delivery and risk management.

Figure 1. Role of Asset Information in Asset Management Cycle

The foundation of these data assets is the Asset Registry systems of record (SORs) which capture the spatial (physical location) and "As-Built" attributes and electrical connectivity that define PG&E's entire electric asset infrastructure system.

The systems for managing asset data, along with other data that support construction, operations, inspection, and maintenance, have evolved organically from paper-based records and processes to digitized records and control/management systems. This evolution has resulted in siloed data systems with varying levels of data quality (e.g., accuracy, completeness), governance, and accessibility/integration which pose a significant risk to PG&E's objectives to deliver safe, clean, and reliable energy to its customers. This Asset Data AMP defines the strategies and initiatives to address these issues and associated risks for EO with a primary focus on the Asset Registry data type.

The asset data types cover all critical asset data used by physical asset family owners (AFOs) to manage their assets. The asset data framework (see Figure 2 below and Subsection 5.1.1, "Asset Data Framework," starting on Page 42) defines and categorizes key data sets based on how data is generated and used in management of the end-to-end physical asset life cycle.

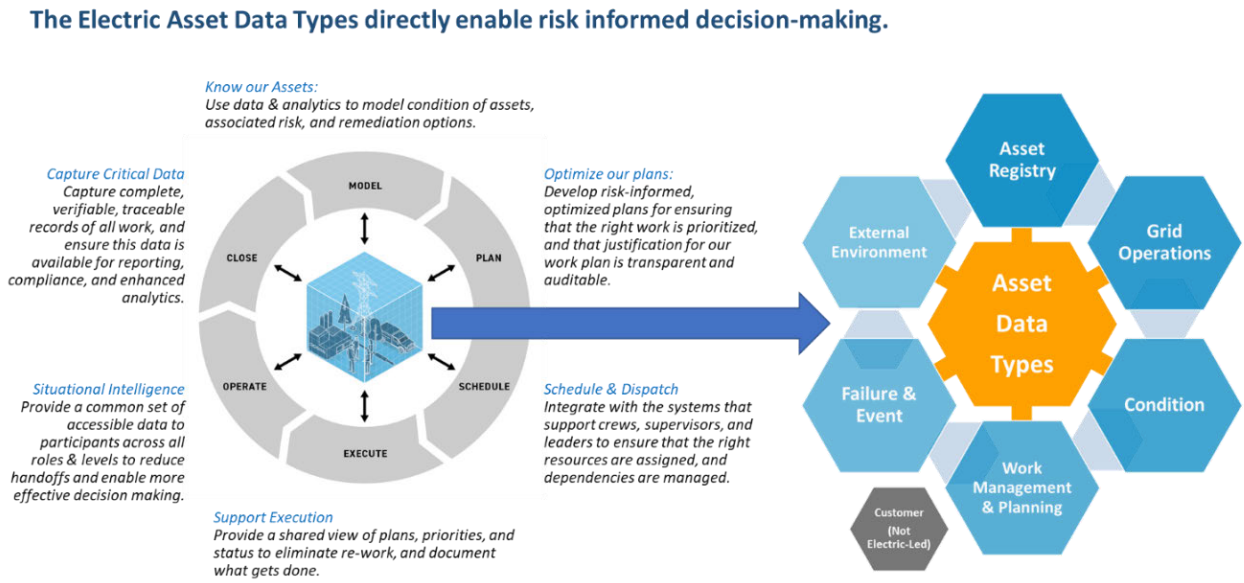

Figure 2. Asset Data Framework

The Asset Data family consists of key data sets in support of critical mission and business processes, which reside in 140 data sources identified through AKM's data inventory efforts. The inventory of critical data sets is currently focused on only the top asset drivers of risk but will be expanded significantly in 2024 as part of the Asset Data Quality Program and associated L1 key performance indicators (KPIs). A summary of asset data types, the SORs, and representative CDEs for each of the physical asset families is provided in Subsection 5.2, "Data Source Inventory," starting on Page 45. These critical data assets were defined in consultation

with AFOs following a risk-prioritized methodology (described in Subsection 2.3, "Asset Risk Drivers," starting on Page 14).

1.2 Risk and Strategy Overview

This document serves as a roadmap to optimize management of asset data centered on providing timely access to accurate, traceable, verifiable, and complete information for AFOs and managers, such that they can effectively make data-driven decisions to manage their physical assets throughout the asset life cycle, with a focus on asset failure and risk management.

This AMP takes a risk-informed approach to managing data assets and is guided by the enterprise risk metrics, where applicable. The Asset Data AFO team prioritizes the focus of its asset data management strategies using quantified asset failure risk and subject matter expert (SME) assessments of the criticality of the asset data type in supporting the management of assets that drive the risk. The key safety risk for asset data stems from the use of inaccurate or incomplete asset data by asset managers to manage equipment failure and wildfire risks.

The asset data management strategic objectives are guided by PG&E's True North Strategy and regulatory commitments around data management, including the 2023–2025 Wildfire Mitigation Plan (WMP). The plan outlines key strategies to achieve its objectives, including:

1. Expanding the reach of data management standards to data types outside the Asset Registry.
2. Ensuring conformance with Utility Standard TD-9212S, "Electric Operations Asset Registry Governance," (the "Asset Registry Standard") for all electric assets.
3. Ensuring timely and accurate ingestion of asset data into the electric Asset Registry for newly constructed assets.
4. Improving quality and completeness of the electric Asset Registry.
5. Integrating critical data sets in the company's Asset Inventory and Condition Database (Palantir Foundry) for use in asset management and analytics.

1.3 Performance Overview

PG&E must maintain and execute a consistent asset management strategy to ensure the data required by physical AFOs is available to meet safety and operating performance objectives while balancing risk, performance, and cost. To manage performance against these objectives, key performance metrics for the management of the Asset Registry data, detailed in Table 25, "Strategic Objective Progress," starting on Page 66 and Table 30, "Programs and Program Objectives," starting on Page 80, include:

1. Physical asset types with defined and managed Asset Registry SORs
2. Asset Registry As-Built cycle time and backlog (non-emergency, emergency)

3. Asset Registry map corrections cycle time
4. L1 KPI for critical data assets (data ownership, metadata, data quality monitoring and improvement)
5. Number of critical data sets integrated into Palantir Foundry

1.4 Continuous Improvement

AKM has made significant progress closing core gaps in its asset data management capabilities and data quality. This progress was recognized by PG&E's third-party auditor, Lloyd's Register (now LRQA) as reflected in its closure of the prior ISO 55001 minor non-conformance related to asset data management.

Through the strategies listed in Subsection 1.2, "Risk and Strategy Overview," on Page 10 and related initiatives, AKM will maintain a focus on continuous improvement, including advancing the accuracy and completeness of asset-related data, improving timeliness and completeness of updates to the Asset Registry, and making data accessible and connected for analytics. AKM will continue to apply a risk-based approach to its continuous improvement efforts and align with physical asset managers to ensure efforts are focused on their top data priorities.

2. Safety and Risks

Asset data plays a central role in understanding and mitigating asset-related risk across PG&E's electric asset data families. The AKM team is aligning its asset data management efforts to the top risks for the physical asset families using the enterprise risk framework. A quantitative characterization of physical asset risk is combined with qualitative assessment of asset data risk to provide the basis for risk-informed strategies, programs, and initiatives to manage asset data.

The Enterprise Operational Risk Management (EORM) team has not developed risk quantification methods specific to asset data; however, it is recognized that asset data is vital to the successful operation of the electric system and in the risk mitigation strategies for each physical asset family. Inadequacies in data management could affect financial and safety conditions or present a regulatory risk to the organization. In this way, asset data can be thought of as a risk driver, as inaccurate data could be a significant factor in the likelihood of a risk occurring.

In the absence of an enterprise framework to quantify an asset data-specific risk assessment, the data-related risks for the physical asset families are determined by the event-based risk models developed for each physical asset family by the Electric Asset Management (EAM) and EORM groups, along with the aggregated wildfire risk model that encompasses risk drivers from all electric assets. These risk models describe and quantify the risk's drivers, outcomes, and consequences and inform prioritization of asset data management initiatives.

The asset data AFO supplements the event-based asset risk assessment by evaluating the impact for asset data on core processes used in managing physical assets (e.g., asset inspections, risk analysis, asset failure analysis). Asset data that is central to these asset management processes for the top asset risk drivers is prioritized for inclusion in asset data management strategies.

2.1 Enterprise Risks

The asset data AFO leverages the 2021 Safety Model Assessment Proceeding (S-MAP) Revised Lexicon (D.18-12-014) to prioritize the team's area of focus. The S-MAP provides a framework for quantifying risk that is uniform across all California investor-owned utilities; the framework can further be adapted by each individual utility. The basis of the risk quantification is identification of "risk event" as "an occurrence or change of a particular set of circumstances that may have potentially adverse consequences and may require action to address." For each event-based risk in the PG&E Risk Register, consistent with the S-MAP settlement decision, PG&E has implemented, through its enterprise risk model, a risk calculation methodology[1] using

[1] For more details on the components of this risk calculation methodology, see 2022 WMP, Section 4.5.1(a).2, "Relevant terms." The focus of the discussion is the wildfire risk, but the framework is the same for all risks.

multi-attribute value function (MAVF)[2] and bowtie analysis as the basis of its risk modeling. This risk model produces a risk score which reflects the likelihood of occurrence of a risk event, as well as its potential safety, financial, and reliability impact. Risk scores are then used to prioritize Asset Registry data projects and data work to correct errors and reduce the risk of wildfire.

Table 1 below lists all nine electric-related risks currently identified in the Event-Based Risk Register along with the baseline risk score (baseline risk is the risk in the system based on historical failures that considers the ongoing control programs but not the mitigations).

Table 1. Electric Asset Risk Summary

Risk ID	Sub-Driver	Risk Score
DOVHD+WLDFR	Conductor damage or failure	2,658
DOVHD+WLDFR	Other equipment/facility failure	986
DOVHD+WLDFR	Insulator and brushing damage or failure	852
DOVHD+WLDFR	Connection device damage or failure	799
DOVHD+WLDFR	Fuse damage or failure	675
DOVHD+WLDFR	Crossarm damage or failure	661
DOVHD+WLDFR	Pole damage or failure	555
DOVHD+WLDFR	Transformer damage or failure	494
DOVHD+WLDFR	Capacitor/booster/regulator	279

2.2 Risk Analysis

The EORM and EAM teams have developed detailed risk models for each of the events identified in Table 1 above, as illustrated in the wildfire risk bowtie model (see Figure 3, "Asset Failure Risk Bowtie," on Page 14).

[2] For more details on the MAVF and its components, see 2022 WMP, Section 4.2.A.

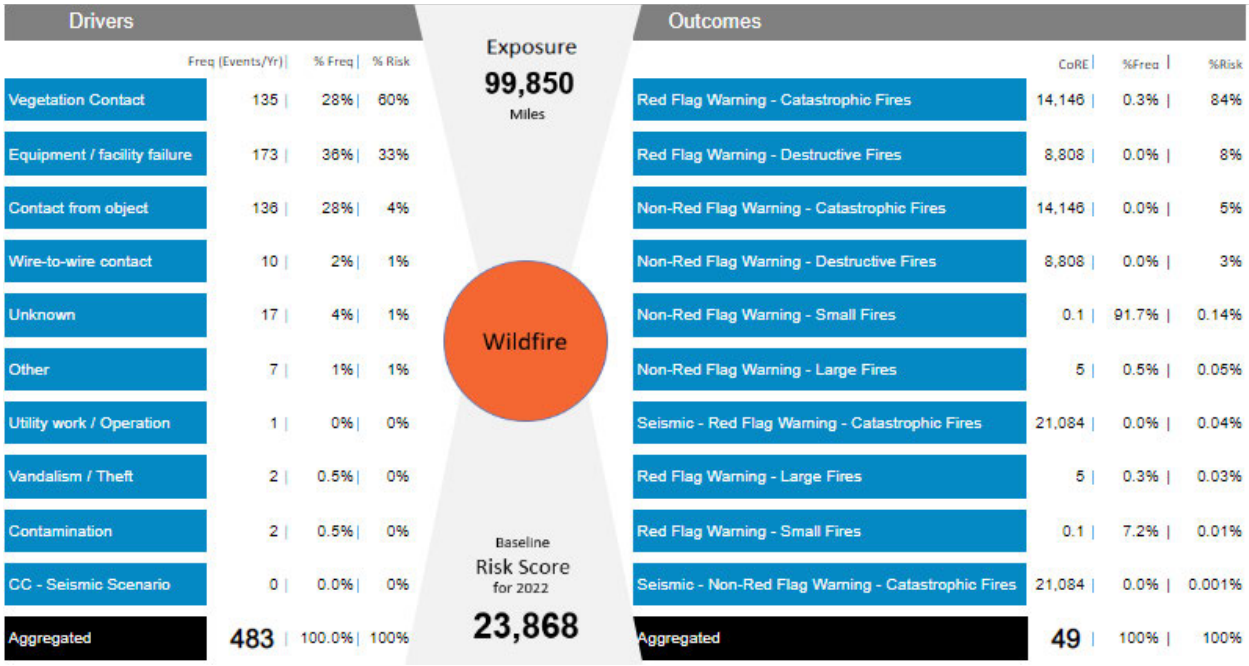

Figure 3. Asset Failure Risk Bowtie

In this example, the model highlights that vegetation contact with electric equipment is the highest contributor and equipment/facility failure is the second highest contributor to wildfire risk.

The objective of this version of the Asset Data AMP is to focus on asset data that directly supports the physical asset families in defining and understanding their assets and associated equipment failure risks. Vegetation Management data is not directly addressed in this AMP. There are several programs focused on improving vegetation management to address wildfire risk and, while asset data is a critical element in those programs, the following methodology does not use vegetation contact risk factors. AKM will review the asset data requirements and contributions to these risk models and mitigations with Vegetation Management leadership to assess critical dependencies and potential issues related to asset data.

To better understand the equipment failure risks and subsequently establish asset data priorities, it is necessary to understand the associated asset family bowtie models and risk drivers, including their relationship to wildfire risks.

2.3 Asset Risk Drivers

For this version of the Asset Data AMP, the intent is to address the key asset data sets used to manage wildfire-related and non-wildfire-related electric equipment failure risks for the top asset drivers of these risks. These include equipment failure risk drivers and sub-drivers for all asset failure-related outcomes, which, in turn, align with primary asset classes within each asset family. With support from EORM and EAM, risk tables were derived for each asset family that aggregate the information from the wildfire risk model (asset failure associated with ignition) and

all other primary asset failure outcomes (not associated with ignition). This aggregated model provides an objective methodology to risk-rank asset classes within an asset family and across asset families, as the risk scores are normalized.

Table 2 below provides the primary asset class risk sub-drivers comprising approximately 86% of asset-driven wildfire and non-wildfire risk. The **Risk ID** column indicates the risk model(s) used to determine the **Risk Score**, where "+WLDFR" indicates that there is a contribution from the wildfire risk model for that sub-driver. This list forms the basis for the risk-driven approach taken to prioritize the areas of focus for the asset data AFO.

Table 2. Primary Asset Class Risk Sub-Drivers

Risk ID	Asset Family	Driver	Sub-Driver	Frequency	Risk Score
DOVHD+WLDFR	Distribution Overhead (OH)	Distribution Line (D-Line) Equipment Failure	Conductor	1,045	2,658
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Insulator/ Wood Pin	360	852
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Connector/ Splice/ Jumper/ Kearney	1,319	799
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Cutout/Fuse	771	675
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Crossarm	853	661
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Pole	897	555
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Transformer	3,521	494
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Capacitor/ Booster/ Regulator	89	279
TOH+WLDFR	Transmission OH	Transmission Line (T-Line) Equipment Failure	Conductor	23	108
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Anchor/ Anchor Guy	1	68
TOH+WLDFR	Transmission OH	T-Line Equipment Failure	Insulator	23	60
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Surge Arrestor	142	55

The full list of 56 asset classes evaluated across EO asset families listed under the Corporate Risk Register (excluding Operational Assets and Systems and streetlights) is provided in Appendix C, "EO Asset Class Risk Ranking," starting on Page 75.

2.4 Asset Data Risk Drivers

In addition to the physical asset family risks summarized in Table 2, “Primary Asset Class Risk Sub-Drivers,” on Page 15, AKM has identified asset data-specific risks. The quantitative physical asset risk assessment outlined in Subsection 2.3, “Asset Risk Drivers,” starting on Page 14 can be combined with the qualitative asset data risk assessment to provide the basis for risk-informed strategies, programs, and initiatives to manage asset data.

Table 3. Asset Data-Specific Risks by Strategic Focus

Strategy Category	Asset Data Management Strategic Focus	Risks
Master Data Management (MDM)	**Standards**	• Gaps in conformance with the Asset Registry Standard (TD-9212S) across asset families including resourcing for business data stewards (BDSs) to drive business ownership of data and data standards implementation. • Key data assets (aside from Asset Registry) are not governed by standards; formal owners not established. • There is no standardized approach to risk-prioritize and manage asset data types aside from Asset Registry data (e.g., asset condition, asset operating history).
	Systems of Record	• Formal Asset Registries do not exist for Substation, Remote Grid, Remote Monitoring Sensors. • Core Asset Registry system (Esri ArcGIS) will not be supported by the vendor beyond 2027; simultaneous re-platforming is planned to occur with SAP and Customer Care and Billing (CC&B).
	Metadata Management	• The inventory of critical data assets is nascent and incomplete; covers only the top asset-risk drivers. • Metadata development lacks standardization and technological readiness.
	As-Built/Data Ingestion	• Paper processes continue to drive inefficiency and inaccuracy in Asset Registry updates. • Long As-Built cycle time for major emergency events results in inaccurate Asset Registry due to lag time.
Data Quality (DQ) Management	**DQ Remediation** **DQ Monitoring**	• Gaps in completeness and locational accuracy for some critical data features (e.g., primary and secondary poles). • Gaps in completeness and accuracy for some critical data attributes (e.g., installation date, material). • Critical data is not synchronized between Asset Registry (i.e., GIS) and other core systems (e.g., SAP, CC&B, Advanced Distribution Management System [ADMS]).

Strategy Category	Asset Data Management Strategic Focus	Risks
		• The program to systematically monitor DQ for critical data sets has not been expanded to all critical data. • The volume of DQ issues outstrips the capacity/budget to address them, creating a significant backlog.
Data Governance	**Data Management Oversight** **Standards and Procedures**	• There are insufficient controls on Asset Registry data entry, resulting in incomplete, incorrect data. • For asset data types other than Asset Registry, there are no constraints on establishing unsanctioned data sources.
Data Products and Analytics	**Central Data Platform**	• Critical data continues to reside in purpose-built, disparate systems, making it difficult for AFOs and operations teams to access, analyze, and derive insights to support asset management and operations.

3. Goals and Objectives

3.1 Strategic Alignment

The Asset Data asset family's strategic objectives are developed to optimize the data asset life cycle by monitoring, maintaining, and improving asset data condition and mitigating risks. These strategic objectives have been established to align investments in data improvement with the Asset Management Strategy and with the physical AFO's needs, as reflected in the risk quantification in Section 2, "Safety and Risks," starting on Page 12. The objectives are also aligned to PG&E's True North Strategy and Electric Engineering, Planning, and Strategy's objectives detailed in Utility Plan TD-8100, "Strategic Asset Management Plan (SAMP)."

The elements of the True North Strategy have been defined in 23 business plans. The Electric Asset Data asset family is involved in several of these plans, though most directly the following:

- **True North Strategy – Enterprise Data Management (EDM):** Establishing and maturing foundational data management practices to improve the quality and timeliness of data-driven insights in support of asset management and operational activities. The near-term objectives are focused on the following:
    - **Data Governance:** Defining an operating model for data decision-making.
    - **Data Quality (DQ) Management:** Defining and establishing an operating model with tools and practices for data profiling, cleansing, and quality monitoring.
    - **Metadata Management:** Defining and establishing an operating model for metadata management with business glossaries, data dictionaries, and data lineage.
    - **Master Data Management (MDM):** Ensuring that PG&E's core data (e.g., Electric Asset Registry) are created and maintained according to defined standards.
- **Integrated Grid Planning (IGP):** Ensuring access to high-quality data to support development of stable, multi-year capital and maintenance plans to drive improvements in asset health, risk, capacity, reliability, and cost by accounting for multiple needs (i.e., bundling work to optimize support for IGP strategic objectives).
- **Wildfire Mitigation Plan (WMP):** Providing access to high-quality, integrated data to inform wildfire risk modeling, risk management, capital investment and operations to mitigate wildfire risk.

3.2 Strategic Goals

In alignment with the True North Strategy, the vision for the Asset Data asset family is to advance the Electric Engineering, Planning, and Strategy organization's ability to make data-driven decisions by improving the accessibility, quality, and governance of data, maturing

analytical capabilities, and deploying analytical products. Table 4 below lists specific strategic goals for the Asset Data asset family.

Table 4. Asset Data Asset Family Strategic Goals

Strategy Category	Strategic Goals
Master Data Management	• **Asset Data Systems of Record:** Establish governed and maintained SORs for each physical asset family and asset type. • **As-Built:** Establish timely, governed, and maintained processes to deliver asset data entered into the SOR. • **Metadata Management – Critical Asset Data Inventory:** Establish an inventory of critical asset data, develop business glossaries, data dictionary, and data lineage in a metadata SOR. • **Data Management Maturity:** Establish KPIs to systematically track progress on critical data inventory, ownership, quality, and remediation for critical data.
Data Quality Management	• **Asset Data Quality Measurement:** Systematically measure asset data quality using system-based tools. • **Asset Data Quality Control:** Implement detective and preventative controls on data quality. • **Asset Data Discrepancy Remediation:** Identify data quality issues and remediate the issues on a risk-prioritized basis through projects and programs.
Data Governance	• **Data Decision Making:** Establish operating model, policies, and procedures to effectively manage data decision-making. • **Asset Data Management and Governance:** Establish clear and scalable governance requirements for critical data, including procedures and tools to measure conformance with governance requirements.
Data Products and Analytics	• Provide access to high-quality, integrated, and governed data sets to support critical processes, analytics, and decisions. • Develop and deploy high-value analytic tools to enable data-driven insights and decision-making for critical processes.

3.3 Wildfire Mitigation Plan (WMP) Objectives

The 2023–2025 WMP continues to inform the Asset Data Management Program priorities and aligns well to PG&E's business needs. In 2023, the OEIS significantly revised the guidance for California investor-owned utilities' WMPs, including guidance related to data management and governance. Revisions included a broadened Utility Maturity Model Survey with increased focus on *"Asset Inventory and Condition Database maturity*." In response to the survey questions regarding Asset Inventory and Condition Database maturity, PG&E set the following targets:

1. Commitment: Increase the fraction of assets and components that have age data (Installation Date) from baseline (as of January 1, 2024) to a weighted average of at least 90% by December 2025 and at least 99% beyond 2026 (unspecified target date).
2. Objective: Integrate distribution and transmission equipment inspection data into the Foundry enterprise data platform by December 2023.
3. Objective: Integrate distribution equipment operating history data (including overload data) into the Foundry enterprise data platform by December 2023.
4. Objective: Integrate transmission equipment operating history data (including overload data) into the Foundry enterprise data platform by December 2024.
5. Objective: Establish annual review by SMEs of data quality for the Asset Inventory and Condition Database by December 2023.

In addition to the objectives set around the OEIS Utility Survey, PG&E set an objective to address findings from the OEIS's review of the 2022 WMP which defined PG&E-specific *"areas of continuous improvement*" (ACI) related to asset data gaps. In response to this ACI, PG&E proposed to make progress on addressing targeted gaps in asset inventory data through a continuous improvement program. The program focuses on increasing the fill rate for a set of five attributes for targeted, risk-prioritized asset types that drive ~86% of PG&E's wildfire and asset failure risk.

For the purposes of the utility survey and ACI objectives, PG&E has defined the "Asset Inventory and Condition Database" as the Palantir Foundry data platform. All objectives are focused on the nine asset types that represent 86% of asset failure risk, including wildfire and asset failure risk, as defined in Section 2, "Safety and Risks," starting on Page 12.

3.4 Performance

PG&E must maintain and execute a consistent asset management strategy to ensure the data required by physical AFOs to maintain safety and operating performance while balancing risk, performance, and cost. To manage performance against these objectives, the asset data AFO has established the following KPIs for the management of Asset Registry data. As the Asset Management Program matures, the asset data AFO intends to build a more comprehensive set of program metrics, consistent with a focus on continuous improvement.

1. Asset Registry As-Built cycle time (major emergency and non-emergency As-Builts)
2. Asset Registry map corrections cycle time
3. Asset Registry locational accuracy (percent of assets conflated)
4. L1 KPI (b): quality of critical data assets
5. L1 KPI (a): percent of critical data assets managed within formal "data management" program
6. Critical data sets integrated into Palantir Foundry
7. Other project- and program-specific metrics

4. Strategy

Asset data strategy requires an efficient balance of risk, performance, and cost to achieve strategic objectives. The asset data AFO develops, matures, harmonizes, and evolves its strategies through continuous improvement, including improvement of its strategic planning processes. These efforts require ongoing communication and coordination across EDM, physical asset AFOs, and electric AKM Program teams. The Plan, Do, Check, Act model in Figure 4 below represents AKM's framework for continuous improvement of its asset management practices.

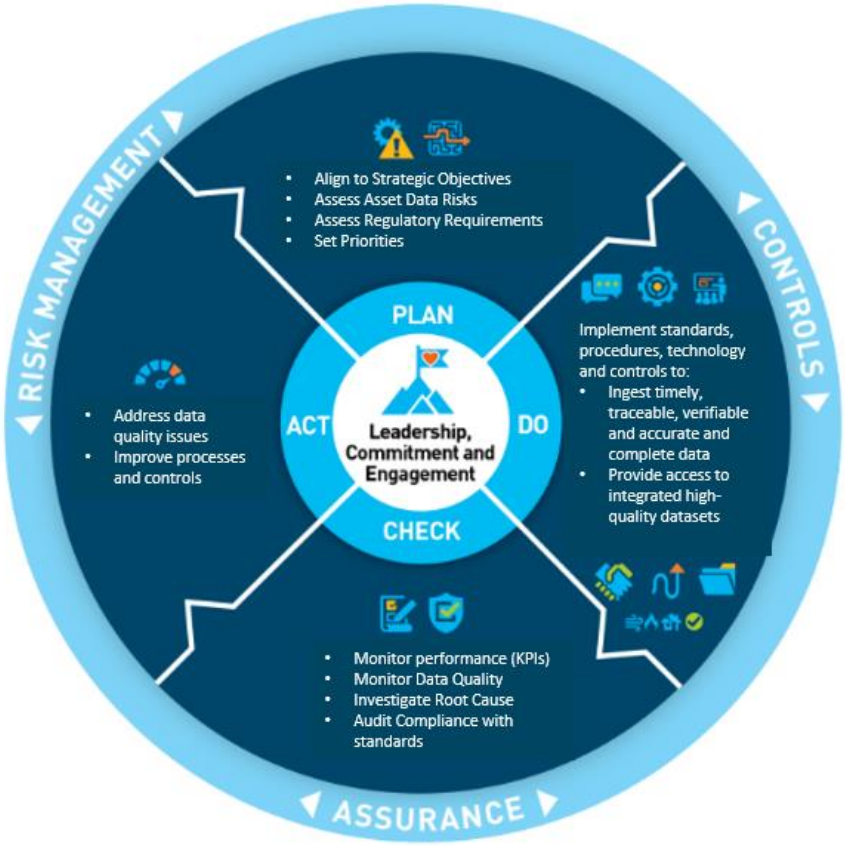

Figure 4. Plan, Do, Check, Act Model

4.1 Strategic Alignment – Physical Assets

Risk assessment and prioritization is at the core of electric AKM's data management strategic planning. AKM coordinates closely with the physical AFOs and Enterprise and Operational Risk Management teams to align to a common risk model to assess and prioritize asset and asset data risk. AKM has leveraged findings from the Integrated Factors for System Safety (IFSS) strategy with a focus on the risk bowtie model results discussed in Section 2, "Safety and Risks," starting on Page 12 to inform its priorities and goals in alignment to physical asset family

priorities. In the future, AKM will partner with physical AFOs to leverage other elements of the IFSS (e.g., Threat Matrix, Failure Mode Effects Analysis [FMEA], and Facility Damage Action [FDA] codes) to define and prioritize improvements to asset data management strategies and programs. As discussed in Section 3, "Goals and Objectives," starting on Page 19, the asset data AFO has aligned its strategies to focus on asset data associated with the top physical assets.

Table 5. Integrated Factors for System Safety

#	Factors	Data Asset Implications
1	Risk Bowtie	Risk informs relative priority of specific physical asset types.
2	Threat Matrix	Informs new data types that may be needed to support asset management.
3	FMEA	Informs data collection, data model, and data integration needs. Sets priority for data attributes subject to data management efforts.
4	Inspection Checklist	Informs data collection, data model, and data integration needs. Sets priority for data attributes subject to data management efforts.
5	Facility Damage Action Codes	Informs data collection, data model, and data integration needs. Sets priority for data attributes subject to data management efforts.

Figure 5. Integrated Factors for System Strategy

4.2 Strategic Planning and Alignment

AKM continually updates its data management strategies through the following activities:

- **Strategic Alignment:** Ongoing leadership coordination via structured monthly and quarterly operating reviews and ad hoc communications.
- **Program Alignment:** Internal alignment of strategies/strategic objectives to True North Strategies and AKM Program/program objectives.
- **Risk and Issue Identification:** Specific asset and asset data risk identification, via the models previously outlined, and issue identification via stakeholder communications and active internal monitoring of data quality and data management issues.
- **Stakeholder Identification and Communications:**
    - Ongoing internal communications with business partners and new teams supporting or requiring asset data management.
    - Coordination with key business partners to research and identify regulatory and other external stakeholders with applicable utility oversight responsibility.

Strategies and strategic objectives are updated in this AMP on an annual basis.

4.2.1 Strategic Alignment – True North Strategy

AKM partners closely with the EDM organization to develop True North Strategy objectives for EDM; strategies and strategic objectives are described in the extract from the EDM business plan below (see Figure 6). AKM has adopted these strategies and strategic objectives into its AMP.

True North Strategy: Enterprise Data Management Objectives

	Near-Term Objectives 2023	Mid-Term Objectives 2024-2026	Long-Term Objectives 2027-2033
Data Governance	Define and establish an enterprise operating model with clear roles and responsibilities for data decision-making	Expand data governance, including creation, approval, and implementation of data standards	All of PG&E's most critical data assets are effectively and efficiently governed, and data quality milestones and metrics are regularly reviewed by executives
Data Quality Management	Define and establish an enterprise operating model with tools and practices for data profiling, cleansing, and quality monitoring	Improve operational efficiency with data quality management and expand data quality management	Establish and share best practices and successful approaches to data quality management with industry peers
Metadata Management	Define and establish an enterprise operating model for metadata management with business glossaries, data dictionaries, and data lineage	Improve operational efficiency for metadata management (e.g., through automated technical metadata and lineage capture), and expand metadata management	Metadata are captured for all relevant categories and classifications of managed data domains, and accurately reflects the implemented data layer of the organization
Data Lifecycle Management	Ensure compliance with external regulations by identifying data owners and facilitating approval of minimum required data retention and disposition standards	Business needs and legal requirements for capturing and storing historical data are defined and met for PG&E's most critical data assets	Data archives reflect all business and regulatory requirements
Master Data Management	Define a strategy for master data management that ensures PG&E's core data are created and maintained according to defined standards that include all stakeholder requirements	Selected, prioritized master data are fully integrated, centrally managed, and delivered as needed for multiple functional areas/business purposes	All PG&E's master data is fully integrated, centrally managed, and delivered as needed for multiple functional areas/business purposes

Figure 6. True North Strategy Objectives for Enterprise Data Management

4.3 Strategy Summary

Table 6 below provides a summary of AKM's data management strategies aligned to PG&E's True North Strategy objectives for EDM. See the sections that follow for current status, planned improvements, and strategic objectives.

Table 6. Summary of Strategies

Category	Strategy	Summary Definition
Data Governance	Data Management Oversight	AKM functional oversight forums and overarching governance coordination. Includes identification of external stakeholder (e.g., regulator) requirements.
	Standards and Procedures	Development, documentation, and communication of asset data standards and practices.
Data Quality Management	Data Quality Maturation and Stewardship	Enterprise best practices coordination across AKM, EDM, and Asset Strategy/BDS teams.
	Data Quality Monitoring	Practices, tools, measures, and metrics for monitoring and measuring data quality and tracking data quality improvements.
	Data Quality Remediation	Identification and remediation of data quality issues on a risk-prioritized basis.
	Data Quality Control	Implementation of quality control measures to prevent erroneous data.
Master Data Management	As-Built/Data Ingestion	Quality, timely processes to ingest asset data into the SOR.
	Asset Registry Systems	Management and maintenance of GIS and SAP SORs and interfaces.
	Metadata Management	Critical asset data with business glossaries, data dictionaries, and data lineage.
	Systems of Record	Managed SORs for each physical asset family.
	Non-Asset Data	Ownership and data management practices for non-asset data layers.
Data Products and Analytics	Central Data Platform	Integrating critical data sets into the Asset Inventory and Condition Database.
	Product Development	Standardized, reusable analytics product development. Includes EO IGP, work visualization, and work bundling tools.

4.4 Data Governance

4.4.1 Data Management Oversight

AKM's strategy for data management oversight is focused on establishing an operating model, policies, and procedures to manage data decision-making. It includes functional oversight forums to ensure consistent, coordinated, and high-quality decision-making regarding the management of asset-related data, as well as overarching governance coordination to ensure that AKM has established appropriate oversight across all its data management activities.

The primary functional oversight forums are as follows:

- **Data Governance Forum (DGF):** Forum with defined roles/responsibilities to guide decision-making with respect to complex, cross-functional data issues.
- **Data Management Front Door Council (FDC):** Forum with defined roles/responsibilities to intake, prioritize, and assign ownership of asset-related data quality issues.
- **Design Authority (DA):** Forum with defined roles/responsibilities to guide changes to GIS Asset Registry technology enhancements, such as data schema updates.
- **As-Built Governance Committee:** Forum to review and approve proposed As-Built process and package updates and to confirm As-Built information to be provided to GIS Mapping meets data quality standard criteria.
- **Initiation Gating Committee (IGC):** Forum to approve the initiation of new data quality initiatives to ensure alignment with strategic data management priorities.
- **Project Steering Committees:** Forums dedicated to a specific program or project, supporting project decision making, escalation, and gate review.
- **Minimum Acceptance Criteria:** Control review to define and confirm the minimum acceptable requirements for bulk data to be ingested into GIS.

In addition to the above forums, AKM will initiate a quarterly governance review of all governance activities. This review will be designed to identify and remediate gaps in AKM governance across all its data management activities.

Gaps and Opportunities for Continuous Improvement: In 2023, AKM identified several gaps within its governance architecture:

- Functional governance forums have been developed organically to respond to a specific functional need with limited strategic "top-down" direction.
- Inconsistent practices for initiating new projects.
- Inconsistent assignment of project-steering committees and steering committee responsibilities. AKM will remain vigilant in monitoring additional internal stakeholder requirements as new enterprise strategies and programs are formed.

- AKM recognizes the need to increase its awareness of external (e.g., regulator) stakeholder requirements (see Subsection 5.5, "Compliance Requirements and Commitments," on Page 58) and enhance its governance paradigm as needed to address data life cycle management requirements. The Data Management Oversight Program will be initiated in 2024 to address these gaps and AKM's overarching governance needs.

Supporting Programs:

- Enterprise Data Management Program (L1 KPIs for critical data asset management)
- Data Management Oversight Program (to be initiated in 2024), GIS Quality Review Program (QRP)

4.4.2 Standards and Procedures

AKM's strategy is to establish, document, and align clear data management standards, governance procedures, and guidance communications (e.g., minimum acceptance criteria, 5MMs) to address requirements for critical data assets, including procedures and tools to measure conformance with governance requirements. In addition, AKM facilitates guidance for the awareness and adoption of requirements. The Asset Registry Standard (ARS) (TD-9212S, "Electric Operations Asset Registry Governance") is the foundational standard for asset registry data management.

Physical AFOs require a complete, accurate, and consistent record of their assets' physical characteristics (i.e., attributes), geographic location, and electrical connectivity to effectively manage their portfolio of assets. The designated Asset Registry for each asset type should contain this data in a single system and allow for a single point of entry for data contained in that system.

Many current asset-related data quality issues can be traced to a lack of governance for Asset Registry data (e.g., multiple systems for data entry, multiple systems for data storage). In 2022, AKM established the company's first Asset Registry Standard (TD-9212S) and is in the process of implementing this standard. The ARS governs the Asset Registry for each Asset Family across the data life cycle, from data creation/ingestion to maintenance and retirement. To help mitigate asset data risks, each AFO has a responsibility to ensure conformance with the ARS. Conformance is achieved by developing and maintaining documented processes in support of and adherence to relevant requirements contained within the ARS. Conformance is maintained by reviewing documented processes and procedures connected to this section during annual AMP update cycles. Reviews of this section will be conducted in conjunction with AKM to capture ARS updates.

TD-9212S requires that each AFO take the following actions:

- **Asset Identification:** Identify assets subject to the Asset Registry on an annual basis, or as needed, and timely report additions/removals/changes to AKM.

- **Asset Registry Specifications:** Maintain (define and update) documentation of Asset Registry specification for each asset type to support asset life cycle management:
    - **System of Entry (SOE)/System of Record (SOR):** Maintain (define and update) an official SOE and SOR for the Asset Registry, to be reviewed on an annual basis or as needed.
    - **Critical Assets and Critical Data Elements (CDEs):** Identify critical assets/CDEs and record the following criteria in the Asset Registry:
        - Asset types
        - Asset record fields and attribute fields (if mandatory in support of the asset life cycle)
        - Asset record fields and attribute fields that must be replicated in SAP to support inspection and maintenance processes
- **Data Quality Review:** Evaluate quality of CDEs on an annual basis or more frequently, as needed.
- **Data Quality Remediation:** Identify and prioritize within the functional area data quality issues for remediation.
- **Data Quality Improvement:** Participate in data quality improvement initiatives, when necessary.

Gaps and Opportunities for Continuous Improvement:

- In 2023, the Asset Registry Standard Implementation Program identified the following gaps with respect to Asset Registry Standard (TD-9212S) requirements:
    - Governance procedures do not yet exist to provide guidance for some supporting processes.
    - Improvements to Asset Registries are required to hold critical asset data and CDEs for certain physical asset families.
- AKM also identified the need for governance, ownership, and risk prioritization for important non-Asset Registry data assets.
- AKM began its MyCatalog Document Management Program in 2023 to improve access to AKM's library of guidance documentation (procedures, 5MMs). Continuous improvements are expected for this program in 2024. See Subsection 4.4.3, "Strategic Objectives – Data Governance," on Page 29 for additional information.

Supporting Programs:

- Asset Registry Standard Implementation
- MyCatalog Document Management
- Non-Asset Data Governance

- Data Management Oversight Program (to be initiated in 2024)

4.4.3 Strategic Objectives – Data Governance

Table 7. Strategic Objectives – Data Governance

Near/Mid-Term Objectives	Longer-Term Objectives
Data Management Oversight	
• Mature operating model with clear roles and responsibilities (R&Rs) for data-related decision-making. • Establish risk-based criteria and a unified, coordinated project management governance across AKM. • Expand data governance, including creation, approval, and implementation of data standards beyond Asset Registry data types. • Ensure compliance with regulations by identifying data owners and facilitating approval of minimum required data retention and disposition standards. • Identify enhanced powerline safety settings (EPSS) asset data requirements and gaps. • Define and ensure compliance with business needs and legal requirements for capturing and storing PG&E's most critical data assets. (NOTE: Enterprise Records and Information Management [ERIM] is not in the scope of this AMP document.)	• Electric Engineering and Operations' most critical data assets are effectively and efficiently governed. • Data systems reflect all business and regulatory requirements.
Standards and Procedures	
• Develop and communicate new Asset Registry procedures to address ARS governance gaps. • Implement tools/processes to support ARS conformance monitoring. • Develop and communicate a new Asset Condition (Notification) Standard in partnership with EDM. • Develop and communicate a new Asset Condition (Inspection Data) Standard in partnership with EDM. • Expand MyCatalog library to include all AKM critical guidance documentation.	• Develop and communicate a new Unstructured Data (Imagery/Light Detection and Ranging [LiDAR]) Standard in partnership with EDM. • Efficient management of ARS conformance monitoring.

4.5 Data Quality Management

AKM's data quality management strategies identify, define, and coordinate best practices for data quality management. Strategies also define methodologies and practices for measuring and monitoring data quality and for data quality remediation. These strategies involve close

coordination with teams across PG&E and Electric Engineering, including EDM and physical AFOs and their respective BDSs.

4.5.1 Asset Data Quality Program

The Asset Data Quality (ADQ) Program was developed in 2022 in consultation with EDM and in parallel with similar efforts in Gas Operations. The program establishes foundational data management capabilities, KPIs, tools, processes, and procedures to improve and increase consistency of data management practices across PG&E functional areas. The program focuses on implementing the following data management capabilities:

- **Critical Data Inventory:** Establish an inventory of critical data assets subject to the foundational data management capabilities. AKM has partnered with AFOs to define data attributes/elements that support critical business processes for assets that drive ~86% of asset failure risk.
- **Metadata Documentation:** Document metadata for critical data assets to provide technical and business context to data users. In conjunction with Information Technology (IT) and EDM, a metadata management system (Collibra) is being deployed and populated with this inventory as well as the associated business and technical metadata.
- **Data Ownership:** AKM and EDM have developed a business data steward (BDS) program, the goal of which is to clarify and drive ownership of each critical data asset for defining the metadata, developing data quality rules, and monitoring data quality. Although the ADQ Program is managed by AKM, the BDSs within EAM (and beyond) play a central role in this program as they have the knowledge and business context to identify critical data assets, document business-related metadata, define acceptable levels of data quality, and prioritize data quality issues for remediation.
- **Data Quality Monitoring:** Measure the condition of critical data assets and identify and prioritize data quality issues. AKM has partnered with BDSs to develop data quality rules for each critical data asset. These rules are deployed to monitor the quality of data in the data quality SOR, which is housed in the Foundry enterprise platform.
- **Data Quality Remediation:** Track improvements to data quality. AKM has established the Data Management Front Door Council forum to intake, triage, and prioritize data quality issues identified by BDSs and other stakeholders.

These data management capabilities are also addressed in the Asset Registry Standard (TD-9212S).

Gaps and Opportunities for Continuous Improvement:

- Staffing support for the BDS role is insufficient to significantly expand the scope of the ADQ Program, as the BDS role is typically taken on by EAM personnel as an addition to their primary role/responsibility. AKM recognizes the need to continue to mature and improve the effectiveness of its coordination with BDSs to improve identification of critical assets and CDEs, data quality rules, and remediation prioritization. In 2023, AKM also identified the need to expand the BDS Program to address asset data types other than Asset Registry.
- The L1 KPIs related to the ADQ Program require refinement as they are opaque and do not provide sufficient insight into progress on improvements to data management and data quality improvements.
- Data ownership and responsibility for critical electric data beyond the Asset Registry asset data type has not been established.

Supporting Programs:

- Asset Data Quality Program
- Enterprise Data Management Program
- EO Business Data Stewardship Program

4.5.2 Data Quality Remediation

AKM has established a data quality remediation strategic focus to identify, prioritize, and address data quality issues related to ensuring a complete, accurate, and consistent Asset Registry. This focused effort includes the following coordinated activities:

- Measuring data quality to detect issues (measurement is performed systematically for a subset of high-risk assets and also ad hoc)
- Issue identification by AFO or AKM
- Intaking data quality issues into the Data Management Front Door Council
- Assessing risk and prioritizing data quality issues (e.g., prioritize data issues associated with high-risk assets and in High Fire Threat District [HFTD] areas)
- Evaluating the cause of the data quality issue
- Implementing data corrections in the SOR
- Implementing controls and countermeasures to address the cause

Identification of data quality issues is done either through ad hoc means (e.g., AFO teams identify suspected data quality issues while interacting with the data; front line workers identify data inaccuracies while in the field), or through systematic data profiling through the ADQ Program. AKM has two primary programs focused on data quality improvements: (1) Map Corrections and (2) project-based Data Remediation Program.

The Map Correction Program leverages front-line workers to correct data errors found while performing work in the field. Front-line workers performing construction or inspection work may identify missing or erroneous asset records and submit requests for the GIS Mapping team to update asset records in the Asset Registry. These map correction requests are reviewed by mappers using desktop tools; validated changes are incorporated into the Asset Registry. As of October 27, 2023, there have been 387,144 map corrections completed in 2023.

AKM also develops, governs, and manages a portfolio of data quality improvement projects. The portfolio of data quality issues and improvements is actively managed by the Data Management Program Management Office (PMO) and, as of November 9, 2023, is managing 97 active issues and has a backlog of 77 issues. KPIs for the program are being developed.

Gaps and Opportunities for Continuous Improvement:

- There are significant gaps in completeness and accuracy for some critical data features and attributes.
- The volume of data quality issues outstrips the capacity/budget to address them, creating a significant backlog – prioritized, efficient backlog management is required.

Supporting Programs:

- Data Management Program Management Office (Front Door Intake, Project Management, Portfolio Management)
- Map Correction Program
- Asset Data Quality (ADQ) Program (to measure progress on improving data quality), Asset Conflation (geospatial rectification and asset registry validation)

4.5.4 Strategic Objectives – Data Quality Management

Table 8. Strategic Objectives – Data Quality Management

Near/Mid-Term Objectives	Longer-Term Objectives
Asset Data Quality Program	
• Improve L1 KPIs to clearly measure progress on critical data management and quality improvement. • Improve operating model for data profiling and quality monitoring. • Expand data quality management within Asset Registry data and to other asset data types. • Define and standardize the BDS engagement model, including regular (minimum: annual) review of data quality and ontology objects under their purview. • Onboard additional BDSs to support data management for targeted critical data assets based on risk-prioritization. • Develop long-term ADQ roadmap.	• Establish and share best practices and successful approaches to data quality management with industry peers. • Develop annual goals for BDS to include in annual performance objectives. • Expand ADQ coverage to all data related to top enterprise risks (e.g., wildfire and non-wildfire electric asset failure).
Data Quality Remediation	
• Improve operating model and tools for prioritized, efficient data quality issue backlog management to reduce backlog queue. • Improve Data Remediation Program throughput with “fast track” program for low-effort improvements.	• Improve data quality issue management operating model to systematically improve the remediation of highest-priority data quality issues of CDEs. • Improve map correction management operating model to systematically improve the remediation of highest-priority data quality issues of CDEs.

4.6 Master Data Management

AKM recognizes the standard definition of master data management (MDM) as a technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency, and accountability of the enterprise's official shared master data assets. However, by this definition, MDM could encompass all asset data management strategies for master data assets, including Asset Registry data. AKM has separated Governance and Data Quality Management as unique strategic categories to align with PG&E’s True North Strategy, and to bring attention to different functional disciplines.

For the purposes of this AMP, MDM is focused on Asset Registry, and MDM requirements are primarily defined in the Asset Registry Standard (TD-9212S) as discussed previously. AKM also recognizes that non-asset data may be considered critical master data and is expanding its

focus to address these additional critical data assets. The following strategies support AKM's MDM strategy:

- **As-Built/Data Ingestion:** Primary processes for ingestion of critical asset data (master data assets) into the Asset Registry.
- **Asset Registry Systems:** Asset Registry systems management to support maintenance and distribution of critical asset data (master data assets); this includes maintenance of system interfaces to downstream systems consuming asset data.
- **Metadata Management:** Establishing enterprise inventory, definitions of critical asset data (master data assets), and SOR to maintain this information for common enterprise access.
- **Systems of Record (SOR):** Identification of critical assets and CDEs (master data assets) and appropriate development of Asset Registry systems to hold all required data for critical asset records.
- **Non-Asset Data:** Practices and procedures for managing non-asset critical data layers.

4.6.1 As-Built/Data Ingestion

To ensure the timely, accurate, traceable, and verifiable ingestion of Asset Registry data for newly built assets into the SOR, AKM has developed the As-Built process and associated controls and metrics. AKM has defined the roles and responsibilities for end-to-end management of As-Built information and established KPIs to track and manage the timeliness of ingestion. AKM has also implemented a process ("IDOC" [Incomplete Documentation]) to ensure that incomplete documentation is updated to provide a complete record. Efforts are underway to move the As-Built process from a paper-based process to a fully digital process, which will reduce documentation errors and improve timeliness.

Gaps and Opportunities for Continuous Improvement:

- There is a large backlog of As-Built jobs to be processed, and As-Built information is not ingested/updated in a timely manner, which results in an inaccurate Asset Registry. This is a particular concern for major emergencies.
- Asset Registry data received by GIS for mapping may be incomplete or inaccurate.

Supporting Programs and Initiatives:

- Asset Registry Standard Implementation
- As-Built Program
- Mobile Digital Job Package Program
- Production/Base Mapping Program

4.6.2 Asset Registry System Operation and Maintenance

The SORs for electric asset data (GIS) and the system interfaces used to transfer master data to other data systems (e.g., SAP, CC&B, ADMS), are managed to perform requirements by the GIS Technology and Non-Asset Data team within AKM. Further, the controls needed to ensure the integrity of data entered into the SOR are defined by the GIS Compliance and Improvement team and implemented by the appropriate sub-teams within AKM. Finally, the development of procedures relating to MDM is managed by the GIS Standards and Training team in GIS.

Gaps and Opportunities for Continuous Improvement:

- Most controls on master data are detected controls downstream from the point-of-data entry; there are insufficient controls on Asset Registry data entry resulting in incomplete, incorrect data.
- Critical data is not fully synchronized between Asset Registry and other core systems (e.g., SAP, CC&B, ADMS).
- AKM also lacks a specific business partner to coordinate SAP management of Asset Registry for master data stored in SAP (e.g., substation asset data).
- The core Asset Registry system (Esri ArcGIS) will not be supported after 2027, resulting in the need for a transition to the new Esri platform (Utility Network [UN] Model).

Supporting Programs and Initiatives:

- Asset Registry Standard Implementation
- Electric GIS Compliance and Improvement
- Electric GIS Metrics and Reporting
- M Program (Synchronization Monitoring)
- Utility Network Model Program (to be initiated in 2024)
- Propel Program – SAP S/4HANA upgrade

4.6.3 Metadata Management

The term “metadata” refers to data that provides information about PG&E’s critical data, but not the content of the data itself. Metadata includes technical metadata (e.g., source system and table, data structure), business context metadata (e.g., business definitions, relevant business processes), administrative data (e.g., BDS, permissions), and other dimensions. Metadata helps asset data users understand, find, and access relevant data and helps to organize data resources.

The objective of the Metadata Management strategy is to establish an operating model and tools for capturing and managing metadata, ultimately creating an inventory of critical asset data with business glossaries, data dictionaries, and data lineage in a metadata SOR.

In 2022, AKM began systematically implementing metadata management practices for targeted data as part of the Asset Data Quality (ADQ) Program in partnership with EDM and BDSs. Metadata was first cataloged in offline Excel spreadsheets but is being moved to a metadata SOR called Collibra. Collibra will provide a searchable user interface for metadata and will automate some metadata collection.

Gaps and Opportunities for Continuous Improvement:

- The inventory of critical asset data for which metadata is being actively managed is limited to data currently under management within the ADQ Program (i.e., Asset Registry data associated with the top asset risk-drivers).
- Metadata development lacks standardization and is a manual and labor-intensive program.
- The metadata management system (Collibra) is in the early stages of development and lacks capabilities and workflows to effectively manage metadata.

Supporting Programs and Initiatives:

- Asset Registry Standard Implementation
- Enterprise Data Management Program
- Asset Data Quality (ADQ) Program
- EO Data Stewardship Program

4.6.4 Systems of Record

The objective of the System of Record strategy is to establish a governed and maintained SOR for each physical asset family. The Asset Registry Standard (TD-9212S) sets a requirement for each physical asset family to establish a formal SOR for its Asset Registry data (master data). EAM primarily uses the Esri-based GIS platform as the SOR for its Asset Registry data with the exceptions noted in "Gaps and Opportunities for Continuous Improvement" below.

Gaps and Opportunities for Continuous Improvement:

- Some asset families (e.g., substation) and asset types (e.g., grid sensing devices) do not have sanctioned asset registry systems and adequate processes to manage Asset Registry data.
- The Transmission Asset Registry data model does not contain critical data attributes needed to manage the assets.
- Streetlights and surge arrestors have fragmented asset registries, with elements in CC&B, EDGIS, SAP, and Salesforce.

Supporting Programs:

- Asset Registry Standard Implementation
- Data Management Program Management Office
- Substation Asset Registry Initiative
- Utility Network Model Program

4.6.5 Non-Asset Data

AKM is extending its MDM strategic focus to establish ownership and data management procedures for non-asset data layers. This data includes static information that relates to and informs management of assets such as geospatial data, environmental data (e.g., corrosion zone), and risk-related data (e.g., HFTD designation), but does not reflect characteristics of the assets themselves. Rigorous management of this data is critical to performing Asset Management functions. The GIS Technology and Non-Asset Data team currently leads the development of procedures for non-asset data layers.

Gaps and Opportunities for Continuous Improvement:

- Some non-asset data layers do not have owners.
- Non-asset data lacks a comprehensive standard outlining requirements for data management throughout the data life cycle.

Supporting Programs:

- Non-Asset Data Program

4.6.6 Strategic Objectives – Master Data Management

Table 9. Strategic Objectives – Master Data Management

Near/Mid-Term Objectives	Longer-Term Objectives
As-Built/Data Ingestion	
• Improve major emergency order process, reporting, and aged order volumes. • Complete Mobile Digital Job Package pilot.	• Expand Mobile Digital Job Package deployment to distribution overhead, transmission overhead, and substation asset families.
Asset Registry Systems	
• Maintain and improve performance of core Asset Registry systems (e.g., GIS, SAP). • Stabilize and improve performance of GIS-SAP interface.	• Improve program performance. • Ensure integration into Utility Network Model and SAP S/4HANA system upgrades.

Near/Mid-Term Objectives	Longer-Term Objectives
• Establish system-based monitoring and reporting for data synchronization across system. • Identify SAP IT partnership for collaborative Asset Registry system management.	
Metadata Management	
• Define and establish an enterprise operating model and tools for metadata management with business glossaries, data dictionaries, and data lineage. • Improve operational efficiency for metadata management (e.g., through automated technical metadata and lineage capture), and expand metadata management.	• Metadata are captured for all relevant categories and classifications of managed data domains and accurately reflect the implemented data layer of the organization.
Systems of Record	
• Define a strategy for MDM that ensures PG&E's core data are created and maintained according to defined standards that include all stakeholder requirements. • Selected, prioritized master data are fully integrated, centrally managed, and delivered as needed for multiple functional areas and business purposes. • Establish SOR for Substation, Remote Monitoring Sensors, Remote Grid, and other new, risk-prioritized asset types.	• Pilot the population and deployment of new Esri Utility Network Model. • Implement next generation GIS (Esri Utility Model) in close coordination with other system re-platforming efforts (e.g., SAP, CC&B). • Establish SOR for streetlights and other low-risk assets.
Non-Asset Data	
• Establish ownership of 18 non-asset data layers, with 6 more pending; establish data management standard and procedures.	• All PG&E's master data is fully integrated, centrally managed, and delivered as needed for multiple functional business areas/business purposes.

4.7 Data Products and Analytics

The objective of the Data Products and Analytics strategy is to provide access to high-quality, integrated, and governed data sets to support critical processes, analytics, and decisions. Integrating critical data sets in the company's Asset Inventory and Condition Database (Palantir Foundry) for use in asset management and analytics.

4.7.1 Central Data Platform

As part of AKM's strategy to improve accessibility and useability of asset-related data for physical asset AFOs, AKM is developing a central repository of integrated, high-quality asset registry, asset condition, asset operating history, and risk management data within the Palantir Foundry enterprise data platform. To-date efforts have focused on high-risk asset types that contribute to ~86% of asset failure (wildfire and non-wildfire) risk. AKM also develops data objects in Foundry for broad use in asset management and planning, such as Isolation Zone.

This central asset data repository contains trusted, optimized, and accessible data (ontology – see Figure 7 below) in a governed platform which is necessary for critical business decision-making for physical asset risk management. This repository integrates data across the asset data framework (e.g., Asset Registry, Asset Condition, Asset Operating History, Customer Data, and Environmental data sets) from disparate built-for-purpose SORs into a single environment, enabling access to data in support of data management, asset planning, risk management, operations, and embedded data analytics capabilities.

Within this repository, data objects are curated, data attributes are defined, data sources are documented, data pipelines are governed, and key connections between disparate data sets are established. PG&E has leveraged Foundry to develop data quality dashboards, business intelligence dashboards, operational support tools, analytics, and data science models.

The Foundry data platform and the associated data management practices significantly advance PG&E's ability to make data-driven decisions around physical asset and risk management by improving the accessibility, quality, and use of data, maturing analytical capabilities, and enabling deployment and scaling of analytical products.

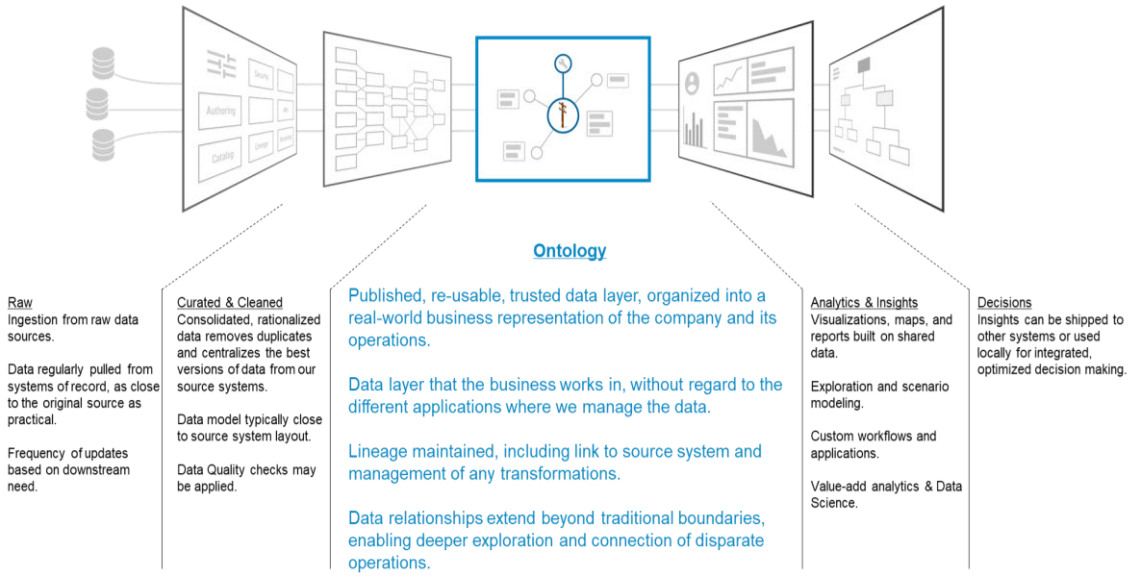

Figure 7. Ontology at the Center of the Data Relationship

Gaps and Opportunities for Continuous Improvement:

- Critical data continues to reside in purpose-built, disparate systems, making it difficult for AFOs and operations teams to access, analyze, and derive insights to support asset management and operations.
- Input from BDSs is required (as per the IT Ontology Standard v1.8) to design and deploy data objects for public use. It has been challenging to secure BDS resources to support development of ontology resources, primarily due to resource constraints.

Supporting Programs and Initiatives:

- Electric Ontology Program
- Electric Business Data Stewardship Program
- IT Ontology Development Program
- IT Ontology Governance Program

4.7.2 Product Development

The objective of the Product Development strategy is to create standardized, reusable analytics products to support data-driven insights, decisions, and operations aligned to the True North Strategy. As part of this strategy, the AKM team's Data Management and Analytics organization has deployed a product development operating model and leverages a portfolio of analytic platforms/tools, including the Foundry enterprise data platform, Esri, and Power BI (Business Intelligence). The team has its own product management and product development resources, but also partners closely with the IT Data and Analytics and Enterprise Data Science organizations to develop products. The team also partners closely with the Enterprise Change Management organization to ensure analytic products are successfully deployed and integrated into business operations, standards, and processes.

In 2023, the team developed analytic tools focused on EO Work Visualization and Bundling, Regionalization Situational Intelligence, Customer Outage Situational Intelligence, Pole Test and Treat (PT&T) Compliance, CEMI-5, Asset Failure, and Reliability Management.

Gaps and Opportunities for Continuous Improvement:

- Demand for new products outstrips the product management and development resources available.
- KPIs must be matured to effectively measure the impact of the products.
- Product intake and prioritization processes must be improved to ensure consistent prioritization.
- Extensive change management support is required for successful deployment of products, but is not always available.

Supporting Programs:

- Data and Analytic Product Development Program

4.7.3 Strategic Objectives – Data Products and Analytics

Table 10. Strategic Objectives – Data Products and Analytics

Near/Mid-Term Objectives	Longer-Term Objectives
Central Data Platform	
• Refine operating model to standardize approach to planning and executing ontology development work. • Integrate Asset Operating History and Condition data into Foundry for targeted assets. • Deliver unstructured (image and LiDAR data) into Foundry.	• Expand scope of Foundry data on a risk-informed basis to include asset data types beyond Asset Registry, Operating History, and Condition. • The Asset Inventory and Condition Database contains the geospatial path of each transmission and distribution circuit (including locations of poles and lines which deviate from the average direction), as well as each transformer and switch gear in accordance with the GIS reporting standards published by Energy Safety. • Deliver As-Switched grid configuration historical data into Foundry to enable time series analysis.
Product Development	
• Established operating model to standardize approach to analytic product development work. • Deliver high-value products supporting True North Strategy objectives, including IGP, Waste Elimination (e.g., Work Bundling, Regionalization, Wildfire/Safety). • Expanded the Data Products and Analytics organization to include the GIS Analytics team, providing specialized, geospatial analytic capabilities.	• Expand portfolio of high-value products supporting True North Strategy objectives, including capacity and other focus areas. • Create a full-3D, engineering-grade digital twin of transmission system. • Develop data sets and tools to support consistent/programmatic asset health management capabilities as part of IGP.

5. Asset Portfolio

Utility Plan TD-8100, "Strategic Asset Management Plan (SAMP)," defines the asset data asset management scope as all **critical data**, characterizing the Electric Transmission (ET), Substation, Distribution, Streetlight, and Operational assets and associated landbase data, including static data such as physical attributes and dynamic data, such as condition and operating status. This includes the core Asset Registry data and data required to understand and manage the physical assets (e.g., asset condition data, operating history data, environmental data). AKM takes a risk-prioritized approach to managing the electric asset data and, for the time being, focuses primarily on the Asset Registry data, given the foundational and critical nature of this data to managing asset failure risk.

5.1 Data Assets in Scope

This section provides an overview of the data assets that are in-scope for the AMP using a framework for characterizing the full universe of asset-related data. In alignment with TD-8100, AKM has adopted the following definition of critical data in consultation with the EDM team to bound the scope of information to be managed under this AMP:

> ***Critical data*** *is data vital to the successful operation of the organization and is associated with PG&E mission-critical or business-critical processes. If not properly managed, critical data could pose a significant safety, legal, financial, or regulatory risk to the organization*.

While a broad range of **critical data** assets are in-scope, the focus of data management efforts continues to be on the Asset Registry data given the foundational nature of this data in enabling physical asset managers to achieve their AMP objectives, and the limited resources available to manage asset data. The Data Access and Integration strategy and associated analytic data products are expanding to address asset data types beyond Asset Registry data, including Asset Condition, Asset Operations, and Work Planning. The scope of the AMP will broaden to address other critical data assets on a risk-prioritized basis, as the management of Asset Registry data is stabilized and resources become available.

AKM applies data management strategies to specific critical data based on several factors, including risk-prioritization, alignment to the True North Strategy, and regulatory commitments/requirements. AKM also consults regularly with the physical AFOs and critical business process owners (e.g., risk management, maintenance inspections) to ensure priorities are aligned with scoping strategies for asset data management.

5.1.1 Asset Data Framework

AKM developed the asset data classification framework (Asset Data Framework) to characterize the data types necessary to effectively manage electric physical assets, including static physical

attributes and dynamic data outside of physical asset characterization (e.g., operational, environmental, customer data).

In conjunction with the risk-based framework described in Section 2, "Safety and Risks," starting on Page 12, the Asset Data Framework informs the approach to identify, prioritize, and address asset data-related risk by providing a comprehensive and standardized view of the data used to manage assets throughout their life cycle. This enables a more intentional and coordinated approach to govern and manage the data assets across asset families.

The Asset Data Framework also provides the foundational guide for organizing asset data to align to the functions that support management of physical assets, rather than aligning to a data system view (e.g., GIS, SAP) and guides the development of an integrated data model in the company's enterprise data platform, Palantir Foundry.

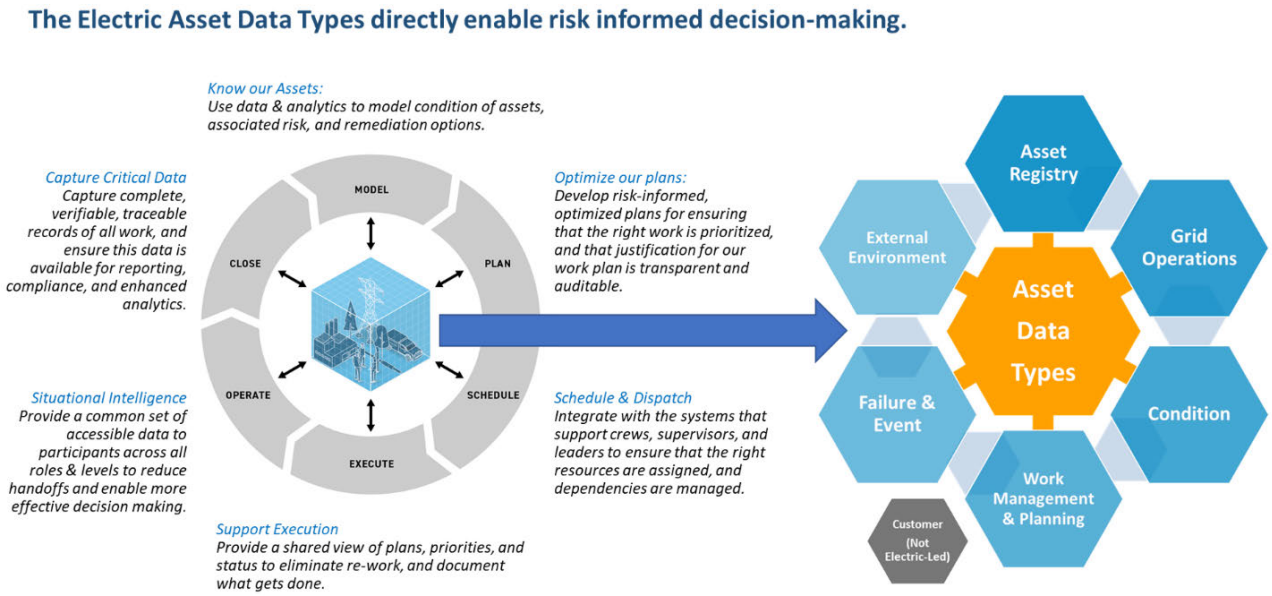

Figure 8. EO Asset Data Framework

Table 11, "Asset Data Type Overview," on Page 44 provides an overview of EO asset data types, including a brief description, data examples, and examples of associated data systems (SORs) and the number of associated data systems. This system count is not exhaustive as it includes only data systems registered in IT's database of sanctioned data systems (i.e., ATLAS).

Table 11. Asset Data Type Overview

Asset Data Type	Description	Data Examples	Data Systems Examples	System Count
Asset Registry	Data relating to asset inventory, geospatial location, and asset attributes	• Support structures • Primary overhead conductor	• ETGIS • EDGIS • SAP	15
Condition	Data relating to condition assessment of assets	• Inspection data • Electric Corrective (EC) and Line Corrective (LC) notifications • PT&T	• SAP • Bentley CBM	22
Operational	Data relating to operations of electric grid	• As-operated connectivity • Supervisory Control and Data Acquisition (SCADA) data • Outage data • Historic loading	• DMS • TOTL, OIS, ILIS • ET-PI, ED-PI • LoadSEER, CYME	60
Failure and Events	Data relating to performance of assets, including outages, failures, and other critical events	• Outage data • Wires down • Ignition events	• ILIS • OMS	31
Work Management and Planning	Data relating to historical and planned replacement, repair, and modification of assets	• Work orders • Notifications	• SAP	2
Customer	Data relating to customer spatial location and electrical connectivity	• Service points/ premises • Parcels	• CC&B • EDGIS	2
External Environment	Data relating to external environmental conditions to which assets are exposed	• Landbase • Parcel data • Tribal boundaries • Historic weather • HFTD boundaries	• ELVIS • LBGIS • Meteorology	8

5.1.2 Data Assets Out-of-Scope

The Asset Data management efforts in this plan are separate from the existing Enterprise Records and Information Management (ERIM) organization, which provides the framework for policy, strategy, and guidance for records and information[3]. Data and functions not in-scope for the Asset Data AMP are defined as:

- Financial data
- Customer data
- Vegetation Management data
- Meteorology data
- ERIM information, contracts, licenses, legal, regulatory, and statutory documents, policies, standards, guidance notes, technical instructions, procedures, operating criteria, paper inspection reports, etc.
- Cyber Security initiatives defending data from malicious attacks which is managed centrally through a comprehensive Enterprise Security Program
- IT system operations of asset data systems

5.2 Data Source Inventory

As discussed in Subsection 5.1.1, “Asset Data Management,” starting on Page 42, asset data reside within a broad array of data systems (data sources) associated with the array of asset data type. To provide a holistic perspective and help define priority areas of focus for asset data management strategies, AKM generated a preliminary inventory of asset data sources by asset data type which includes various metadata including Business Owner, Technical Owner, Description, Usage, Location, and IT Management Tier. The IT Management Tier is particularly instructive in assessing risk associated with the data source itself (a lower number indicates a more robustly managed system). Table 12, “Asset Type by Tier,” on Page 46 reflects the current understanding of asset data sources based on the ongoing electric data source inventory efforts.

[3] A record is any information created, received, and maintained while conducting business to document specific operational actions, commercial transactions, contractual obligations, formal business decisions, legal commitments, or similar.

Table 12. Asset Type by Tier

Asset Data Type	IT Data Source Management Tier					Grand Total
	1	2	3	4	5	
Asset Condition/Inspections	2	4	3	5	8	22
Asset Failure and Events	12	6	3	5	5	31
Asset Registry	3	3	1	4	4	15
Customer Management	1	1				2
External Environment		2		2	4	8
Grid Operations	18	20	7	10	5	60
Work Management and Grid Planning	1		1			2
Grand Total	**37**	**36**	**15**	**26**	**26**	**140**

The immediate concern relates to Tier 3 and above sources for Asset Registry, although many of the 15 Asset Registry systems contain supplemental asset information and not the primary Asset Registry data. These are being addressed through the implementation of the Asset Registry Standard (TD-9212S).

5.2.1 Asset Registry

The EAM organization's Asset Registry consists of built-for-purpose data systems that maintain the electric asset As-Built inventory and attributes, spatial location, and electrical connectivity data. The Asset Registry serves as the SOR for physical assets, combining As-Built and spatial characteristics to enable planning and execution of asset management work and is at the core of the overall asset management system. The electric Asset Registry is supported by the following two primary technology elements:

Geographic Information System (GIS): In general, GIS is considered the SOR for asset location and primary functional attributes, including connectivity. Based on Esri technology and comprised of three primary GIS databases (Electric Transmission Geographic Information System [ETGIS], Electric Distribution Geographic Information System [EDGIS], and Landbase GIS [LBGIS]), this architecture provides the ability to capture and analyze spatial and tabular attribute data for electric assets, as well as geographic information that describes PG&E's territory and its attributes (e.g., PG&E right of way, land ownership plot maps, HFTD, corrosion zones); GIS asset data typically includes the location (latitude, longitude) of the asset, as well as key attributes and the electrical connectivity of the assets.

Enterprise Resource Planning (ERP): SAP supports asset work management and inherits many asset-related data fields from GIS (e.g., location, functional attributes). The inherited asset records and attributes are required to support inspection and maintenance processes managed in SAP.

Figure 9. Asset Data Ingestion Process Flow

The definition of the current and approved Electric Asset Registry SOEs and SORs for each electric physical asset family and their identified asset types can be found in the AMPs of each physical asset family (see Appendix B, "Related Documents," on Page 74 for related documents).

5.3 Asset Inventory, Condition and Monitoring

Given that the Asset Registry is at the core of the asset management system, deficiencies in completeness, conformity, synchronization, accuracy, and governance are key drivers of risk associated with asset data. Therefore, many strategies in this document relate to understanding and improving the condition of this data. Data quality measurement programs and quality assurance programs have been developed to define the condition of the most critical Asset Registry data.

5.3.1 Asset Registry Data Quality Monitoring

PG&E has historically monitored data quality through several programs and projects and is moving to consolidate this monitoring into the ADQ Program. This program was developed in consultation with the EDM organization to systematically inventory critical data, capture metadata, measure the data quality of critical data sets, identify critical gaps for remediation, and track ongoing status and improvements. This program directly supports EDM's Data Governance True North Strategy and the OEIS's Data Governance Survey questions in the 2023–2025 WMP.

The ADQ dashboards built in the Foundry enterprise data platform (Enterprise Data Quality Reports) provide AKM and other users with the ability to view an overview of data quality (see Figure 10, "ADQ Program DQ Monitoring Dashboard," on Page 48) and to drill down to

understand data quality related to a specific asset type, asset component, CDE, and specific data quality rule.

As of November 2023, the ADQ Program has identified and established data quality monitoring for 773 CDEs associated with transmission and distribution asset types and that drive ~86% of wildfire risk and non-wildfire risk. A total of 2,082 active data quality rules have been implemented with an additional 538 rules proposed. These rules primarily measure completeness, conformity, consistency, and synchronization of CDEs, such as Installation Date, Material Type, and Manufacturer. Accuracy is not directly measured in the ADQ Program, as it is challenging to establish a record of truth against which to assess the accuracy of data. Typically, accuracy issues are identified through field visits or desktop review of supplemental data (e.g., LiDAR, imagery, construction records), after which any erroneous records are submitted for correction. The program will continue to expand to support a broad range of electric critical asset data, asset condition data, and asset failure data.

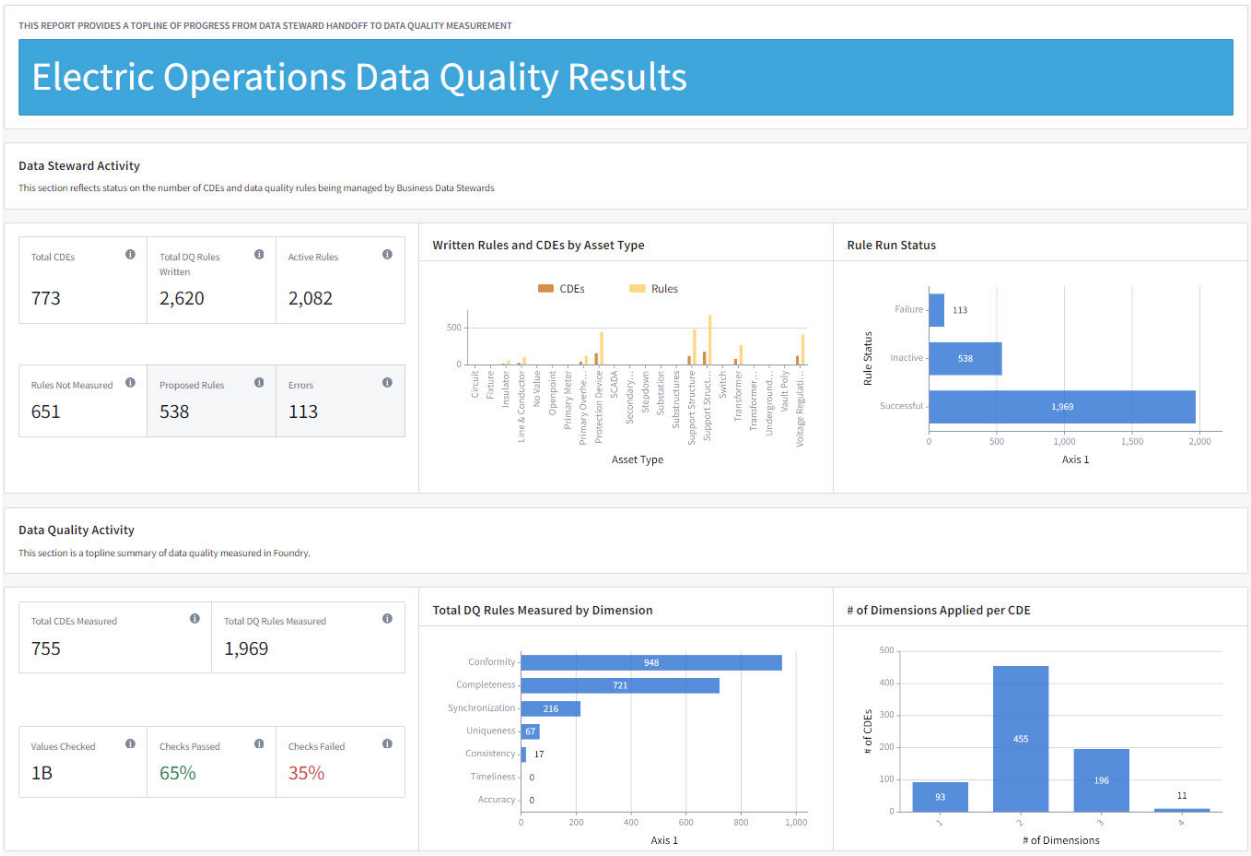

Figure 10. ADQ Program DQ Monitoring Dashboard

5.3.2 Asset Registry Data Quality – Conformity

Data conformity refers to the degree to which CDEs meet expected formats, valid values, or ranges of values (minimum/maximum). An example is the format used to enter an installation

date – month/day/year or day/month/year. Conformity rules are applied to all CDEs within the ADQ Program. For data characterized as critical to serve business processes, a high conformance rate is expected as this data should be collected in the specified format to allow the data to be used for analytics and process/program management.

As shown in Figure 11 below, 431 conformity rules (46%) have a conformity rate between 90–100% and 478 (51%) of rules have a completeness rate of greater than 70%. Figure 11 also reveals a bi-modal distribution with a large number (260, or 28%) of rules having lower than a 10% completion rate. While it is possible that the related data has a low conformity rate, preliminary analysis of the data suggests that rules with low pass rates were not correctly designed and require remediation. AKM's review of the conformity rules also revealed that the rules were counting "null" (incomplete) data as failing the conformity test. Null values are intended to be detected and counted as rule failures in the completeness data quality tests; however, it appears that they are detected in both the conformity and completeness tests. This insight has also led to containment and countermeasures within the ADQ Program to increase the quality of rules before deploying to production in Foundry.

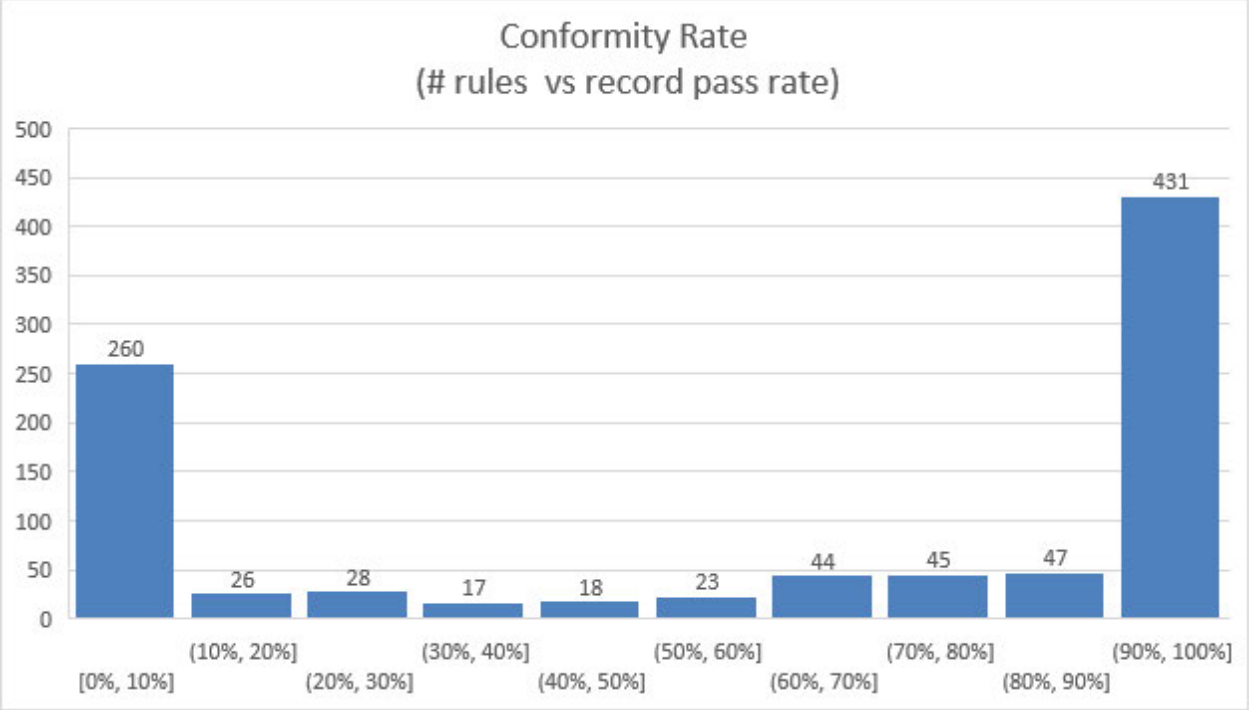

Figure 11. CDE Conformity Rates

5.3.3 Asset Registry Data Quality – Completeness

The **completeness** data quality dimension reflects whether data is present in the Asset Registry for a CDE or has an absent/null value. Completeness is measured broadly within the ADQ Program with 733 active rules. For data characterized as critical to serve business processes, a

high completion rate is expected as this data should be required to be collected as part of As-Built, Inspections, and Outage Management processes, or other data collection process.

As shown in Figure 12 below, 428 rules (58%) have a completeness rate between 90–100%, and 508 (69%) of rules have a completeness rate of greater than 70%. Similar to Figure 11, "CDE Conformity Rates," on Page 49, Figure 12 also reveals a bi-modal distribution with a large number (111, or 15%) of rules having lower than a 20% completion rate. Preliminary review of completeness rules with very low pass rates suggests that some of these rules were applied to a wider subset of critical Asset Data than intended. These rules require remediation. For completeness rules that are correctly formulated and have a very low pass rate, the data has not historically been collected, which implies that: (1) the data may not be critical, or (2) the data was added to the ADQ Program in anticipation of future data collection. AKM will work with BDSs to confirm the criticality of the asset data with very low pass rates.

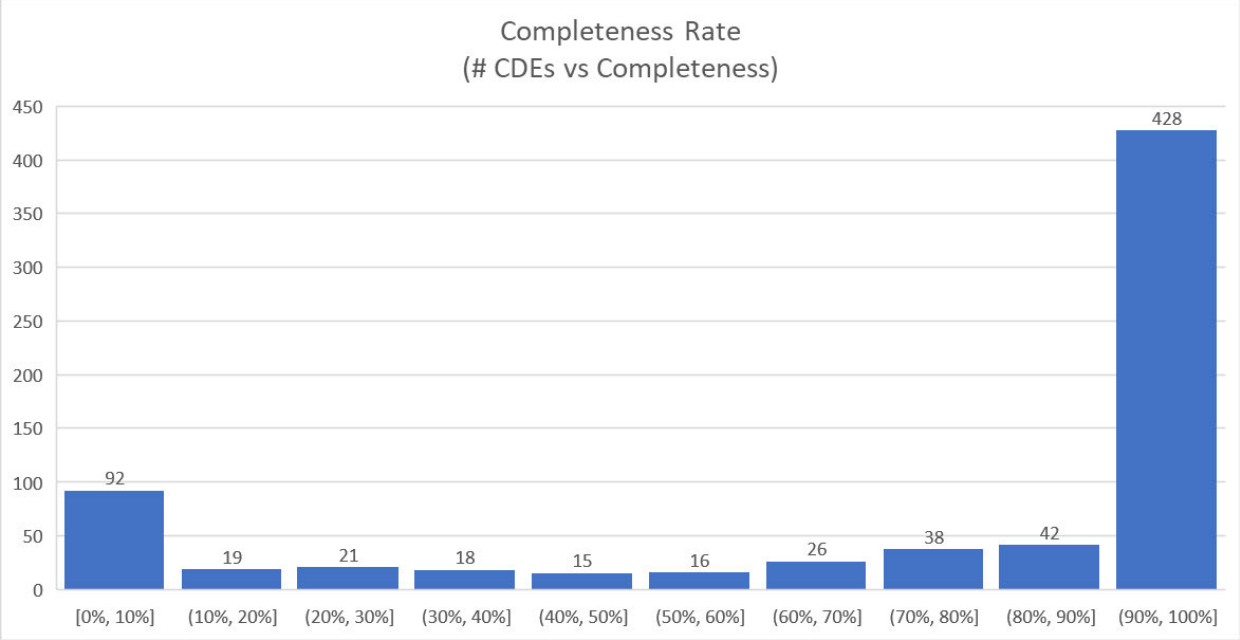

Figure 12. CDE Completeness Rates

Table 13, "ADQ Asset Data Improvement Scope," on Page 51 reflects the Completeness of risk-prioritized Asset Data being addressed as part of PG&E's 2023–2025 WMP. In the WMP, PG&E committed to improve the completeness or "fill rate" for Installation Date from its current state (88.1%) to a weighted average of 90% across the asset components by December 2025. Also, in response to PG&E's 2022 WMP, the OEIS identified the need for PG&E to address an area of continuous improvement (ACI) targeted at critical data gaps. The attributes in Table 13, aside from Installation Date, are the focus of PG&E's ACI addressing data gaps. There are no specific targets for the ACI.

Table 13. ADQ Asset Data Improvement Scope

Asset Family	Asset Type	Asset Component	Asset Count: All	Install Date Fill Rate	Material Type Fill Rate	Mfg. Fill Rate	Mfg. Date Fill Rate	Nominal Voltage Fill Rate
Transmission OH	Support Structure	Tower	24,519	80.6%	/A	33.0%	20.1%	NA
Transmission OH	Support Structure	Pole	94,152	46.1%	80.3%	82.6%	79.0%	NA
Transmission OH	Conductor	Conductor	5,056	55.4%	?	0.9%	0.0%	99.9%
Transmission OH	Insulator	Insulator	169,156	59.7%	100.0%	2.9%	0.0%	NA
Distribution OH	Support Structure	Support Structures (Poles)	2,261,376	97.5%	100.0%	81.9%	80.0%	NA
Distribution OH	Primary Overhead Conductor	Primary Overhead Conductor	1,671,801	72.9%	99.9%	NA	NA	100.0%
Distribution OH	Protection Device	Dynamic Protection Device	17,099	93.2%	NA	98.4%	63.8%	NA
Distribution OH	Protection Device	Fuse	158,184	98.1%	NA	88.8%	3.2%	100.0%
Distribution OH	Protection Device	Surge Arrestor	40,278	91.7%	NA	NA	NA	NA
Distribution OH	Voltage Regulating Equipment	Capacitor Bank	11,135	98.8%	NA	41.4%	20.2%	100.0%
Distribution OH	Voltage Regulating Equipment	Voltage Regulator	7,267	94.7%	NA	100.0%	66.6%	100.0%
Distribution OH	Transformer	Service Transformer	1,023,270	99.2%	NA	99.7%	76.7%	99.9%
		TOTALS	5,483,293	88.1%	89.2%	83.1%	71.5%	100.0%

5.3.4 Asset Registry Data Quality – Synchronization

In addition to monitoring the condition of targeted critical data within the Asset Registry, PG&E has instituted a program to monitor and systematically address gaps detected in the synchronization between the Asset Registry (EDGIS and ETGIS) and the SAP work management system for Distribution Overhead and Transmission Overhead assets.

The “M Program” is focused on monitoring and eliminating synchronization issues and addressing issues as they arise.

5.3.5 Distribution Asset Registry Synchronization

Table 14 below, Table 15, “M2 Distribution Overhead Equipment Records in SAP Not in GIS,” on Page 53, and Table 16, “M3 Distribution Attribute Differences Between SAP and GIS,” on Page 53 provide insight into the synchronization data quality dimension for the Distribution Overhead Asset Registry. Table 14 provides a count of Distribution Overhead records by feature that are registered in GIS but do not appear in SAP over time, starting in January 2021. Because EDGIS is considered the primary SOR for Distribution Asset Registry records, the synchronization to SAP work management systems is critical. As can be seen, synchronization from GIS to SAP has been well-managed. When issues do arise with the GIS-to-SAP interface that drives synchronization, they have been detected through the M Program and quickly remediated.

Table 14. M1 Distribution Overhead Features in GIS Not in SAP

M1	1/4/2021	4/5/2021	7/6/2021	10/4/2021	1/3/2022	4/4/2022	7/5/2022	10/3/2022	1/2/2023	2/6/2023	3/6/2023	4/3/2023	5/1/2023	6/5/2023	7/3/2023	8/7/2023	9/4/2023	10/2/2023	10/9/2023	10/16/2023	10/23/2023	10/30/2023	11/6/2023
Features in GIS missing in SAP																							
Capacitor units.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Controller.	6	1	0	7	1	2	0	0	0	0	1	0	4	0	0	0	0	2	2	6	2	2	3
Device Group.	3	0	0	0	0	1	0	0	2	0	0	0	0	0	0	2	1	0	0	5	0	1	0
DPD.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	1
Fault Indicators.	0	0	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	2	0	0	1
Network Protector.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open Point.	5	0	0	7	1	24	5	0	0	0	0	0	0	0	0	0	1	0	0	22	1	0	20
PadMount Structures.	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
StepDown Unit.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streetlights.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SubSurfaceStructures.	1	2	1	0	0	1	3	0	0	0	0	0	0	1	1	0	0	2	1	7	0	1	0
Support Structures	19	31	95	19	8	6	3	0	2	0	0	0	0	0	5	0	0	0	0	30	0	0	5
Switch	0	0	0	1	1	3	2	1	0	0	2	0	0	2	0	0	2	1	0	5	0	0	4
Transformer Device.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Transformer Unit	1	21	2	6	1	8	1	0	0	0	0	0	0	0	0	3	0	0	3	46	0	0	0
Voltage Regulator.	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	37	56	98	40	12	46	18	1	4	0	3	0	6	4	6	5	5	5	7	131	3	4	34

Table 15 provides a count of primary asset class records that are registered in SAP but do not have a corresponding record in GIS. As the streetlight asset family does not currently use GIS for an asset registry, it is known/accepted that these records will not be present. The records for transformers are of more concern as they could potentially represent assets that are not in service or potentially have yet to be installed. Given that SAP is the work management system for inspections and maintenance plans, these discrepancies represent a significant risk. As can be seen, synchronization from SAP to GIS has been well-managed, with the known exception of streetlights. When issues do arise with the SAP-to-GIS interface that drives synchronization, they have been detected through the M Program and quickly remediated.

Table 15. M2 Distribution Overhead Equipment Records in SAP Not in GIS

M2	1/4/2021	4/5/2021	7/6/2021	10/4/2021	1/3/2022	4/4/2022	7/5/2022	10/3/2022	1/3/2023	2/6/2023	3/6/2023	4/3/2023	5/1/2023	6/5/2023	7/3/2023	8/7/2023	9/5/2023	10/2/2023	10/9/2023	10/16/2023	10/23/2023	10/23/2023	11/6/2023
Equipment in SAP missing in GIS																							
NetTrf	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Pole	92697	92783	71620	62400	239	64	38	7	1	0	1	1	0	0	4	6	0	11	0	0	2	0	0
Auto-trf-swt	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
booster	0	0	0	2	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
capacitor	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
controller	552	547	532	529	529	523	287	268	270	270	270	255	1	0	2	0	0	1	3	1	0	0	0
elbow	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
subsurf enc	1	0	0	0	14	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Fault ind	0	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
interrupter	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
padmount.	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
recloser	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0
regulator	7	0	0	1	5	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sectionalizer.	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
streetlight	231981	231980	231978	231979	231975	232079	232177	232179	232028	231998	231998	231999	232014	232026	232028	232029	232029	232026	232026	232026	232026	232026	232033
switch	4	0	0	0	13	2	0	1	0	0	0	0	0	1	0	0	0	0	0	22	0	0	2
stepdown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
transformer	12725	13154	13685	14167	14951	15667	17909	16563	7318	7273	7275	7234	5815	5675	3650	3716	3549	2364	2332	2394	2407	2400	2417
vault	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
device group	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ground swt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Net Jntc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Prot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net swt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCC	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
XD_NETW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	338004	338503	317853	309115	247777	248411	250449	249066	239654	239578	239583	239527	237867	237739	235721	235791	235615	234440	234398	234486	234472	234463	234489

In addition to the asset records, it is necessary to replicate and synchronize certain attributes of each asset record in both GIS and SAP. These discrepancies are monitored in the M3 Report (see Table 16 below), which provides a count of instances where attributes within an asset record do not match between GIS and SAP. Attribute-level issues are generally more difficult to resolve than asset record-level issues, as it must be determined which system contains the correct attribute value on a case-by-case basis and the causes of asynchronous values vary widely. The total number of attribute-level synchronization issues has been reduced from a high of 7 million (7M) in January 2021 to approximately ~3.4M (against a total population of ~169M attributes, or ~2%). Further, analysis has shown that approximately 1.2M of the existing attribute-level discrepancies are related to the “City” field, which is thought to be an artifact of the last EDGIS system upgrade.

Table 16. M3 Distribution Attribute Differences Between SAP and GIS

M3	9/7/2020	1/6/2020	1/4/2021	7/6/2021	1/3/2022	4/4/2022	7/5/2022	10/3/2022	1/3/2023	2/6/2023	3/6/2023	4/3/2023	5/1/2023	6/5/2023	7/3/2023	8/7/2023	9/4/2023	10/2/2023	11/6/2023
Attribute differences																			
Capacitor units	2,170	5,855	7,509	8,579	9,113	7,924	7,815	7,590	3,597	3,593	3,588	3,596	3,568	3,563	3,560	3,549	3,548	3,541	3,535
Controller	24,928	24,628	23,828	23,226	22,817	34,486	35,161	32,931	33,160	33,219	33,342	33,378	33,526	33,706	33,859	34,032	34,265	34,415	34,690
Device Group	132,335	199,981	141,643	147,953	148,400	151,097	146,065	145,574	135,763	135,738	135,706	135,832	135,127	135,101	135,048	135,340	135,298	135,585	134,423
DPD	6,667	11,783	19,247	23,772	22,744	21,979	22,197	21,974	8,099	8,081	8,103	8,119	8,185	8,214	8,285	8,325	8,374	8,423	8,522
Fault Indicators	15,457	30,096	27,837	26,819	17,636	17,580	17,763	18,315	14,632	14,335	14,321	14,314	14,286	14,263	14,250	14,222	14,205	14,216	14,139
Network Protector	6,770	6,773	6,721	6,681	6,656	8,016	8,136	8,155	8,173	8,164	8,186	8,148	8,146	8,127	8,127	8,136	8,136	8,133	8,136
Open Point	209,769	364,945	319,439	340,557	229,783	351,655	360,049	363,601	293,882	294,403	295,728	296,124	297,338	299,257	300,700	302,303	304,417	306,568	309,449
PadMount Structures	7,161	171,402	54,629	59,145	60,997	61,800	44,390	45,338	45,590	45,742	46,150	41,113	41,050	40,992	40,977	40,926	40,956	40,956	40,865
StepDown Unit	386	841	748	1,004	1,662	1,659	1,640	718	251	250	250	251	250	249	249	249	249	247	246
Streetlights	332,715	468,300	440,400	451,119	445,024	444,873	435,303	435,437	429,731	429,801	429,825	429,871	429,283	429,421	429,603	429,589	429,519	429,753	429,737
SubSurfaceStructures	56,731	637,438	156,031	159,433	160,275	161,916	154,100	157,148	157,785	158,261	159,611	144,116	144,000	144,050	144,011	143,711	143,667	143,688	143,550
Support Structures	1,604,416	3,812,155	2,735,355	2,725,330	3,027,461	2,356,197	2,137,925	2,105,001	1,950,745	1,945,844	1,728,180	1,643,813	1,626,205	1,587,750	1,528,769	1,503,494	1,486,622	1,465,242	1,442,879
Switch	129,228	198,938	198,876	297,378	211,625	182,099	187,445	185,492	44,290	44,252	44,098	44,114	43,884	43,638	43,581	43,455	43,359	43,348	43,348
Transformer Unit	427,795	1,108,763	858,664	891,885	790,348	936,751	956,514	956,369	688,174	691,759	695,288	698,467	700,230	705,021	708,023	712,592	716,898	721,367	727,020
TransformerDevice	6,944	6,933	6,924	6,841	6,718	6,689	7,821	7,875	6,730	6,735	6,686	6,690	6,666	6,652	6,659	6,647	6,629	6,628	6,625
Voltage Regulator	8,275	15,899	14,425	13,388	13,141	12,833	12,166	11,990	5,688	5,672	5,667	5,638	5,609	5,578	5,543	5,504	5,479	5,465	5,435
Totals:	2,971,747	7,064,730	5,012,276	5,183,110	5,174,400	4,757,554	4,534,490	4,503,508	3,826,290	3,825,849	3,614,729	3,513,584	3,497,353	3,465,582	3,411,244	3,392,074	3,381,621	3,367,575	3,352,599

5.3.6 Transmission Asset Registry Synchronization

Tables 17 and 18 below and Table 19, "Monthly ET M3 Report Summary," on Page 55 provide insight into the Transmission Asset Registry consistency or synchronization. Table 17 provides a count of asset class features present in GIS but not appearing in SAP over time, starting in July 2022. Because ETGIS is considered the primary SOR for Transmission Asset Registry records, the synchronization to SAP work management systems is critical for work planning and execution against the assets. The synchronization of Transmission Asset Registry records between GIS and SAP is monitored on a weekly basis through the M Program.

Table 17. M1 Transmission Features in GIS Not in SAP

ET M1	SAP Object Type	7/13/2022	8/1/2022	9/6/2022	10/3/2022	11/7/2022	12/5/2022	1/3/2023	2/6/2023	3/6/2023	4/3/2023	5/1/2023	6/5/2023	7/3/2023	8/7/2023	9/4/2023	10/2/2023	11/6/2023	11/13/2023	11/20/2023	Weekly Change
Features in GIS Missing in SAP																					
Cable - UG Conductor Info	ETU.CABL	N/A	N/A	4	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	0
Cable Box (Non-PGE-Owned Manhole)	ETU.CBBX	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cathode	ETU.CATH	N/A	N/A	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
Cathodic Protection	ETL.CATH	N/A	N/A	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FAA Lights	ETL.FAAL	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fault Indicator	ETL.FALT	N/A	N/A	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0
Insulators	ETL.INSL	N/A	243	17	16	7	15	50	4	4	13	0	9	50	4	1	3	46	1	0	-1
Lightning Arrestor - OH	ETL.LIAR	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lightning Arrestor - UG	ETU.LIAR	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manhole (PGE-Owned)	ETU.MANH	N/A	N/A	11	11	11	11	11	11	11	11	11	7	7	7	7	7	7	7	7	0
Marker Ball	ETL.MKBL	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multi-Pole Structure Child Pole (PLST)	ETL.PLST	N/A	0	0	0	0	0	12	0	0	1	0	0	9	0	3	0	0	0	0	0
OH Conductor Info	ETL.CDIF	N/A	N/A	4	4	4	4	4	4	4	4	4	4	4	5	4	4	5	5	5	0
Pole Structure	ETL.POLE	45	1	19	49	24	27	86	19	1	13	0	0	37	0	0	0	31	0	0	0
Pump Plant	ETU.PMPP	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Splice	ETL.SPLC	N/A	N/A	10	10	10	11	11	11	0	0	0	0	0	0	0	0	0	1	0	-1
Structure Foundation	ETL.FOND	N/A	N/A	39	38	37	37	39	39	0	0	0	0	0	0	0	1	0	2	1	-1
Switch	ETL.SWIT	N/A	N/A	25	24	24	24	24	24	24	25	23	23	23	23	23	23	25	25	26	1
Terminal	ETL.TERM	N/A	N/A	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	0
Tower Structures	ETL.TOWR	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		45	1	149	176	139	151	259	136	62	85	56	61	148	57	56	56	132	59	57	-2

Table 18 below provides a count of Transmission asset class records that reside in SAP but do not have a corresponding record in GIS. As reflected below, the number of asynchronous records has declined substantially from 2,024 (September 2022) to 133 (November 2023).

Table 18. M2 Transmission Features in SAP Not in GIS

ET M2	SAP Object Type	7/13/2022	8/1/2022	9/6/2022	10/3/2022	11/7/2022	12/5/2022	1/3/2023	2/6/2023	3/6/2023	4/3/2023	5/1/2023	6/5/2023	7/3/2023	8/7/2023	9/4/2023	10/2/2023	11/6/2023	11/13/2023	11/20/2023	Weekly Change
Equipment in SAP Missing in GIS																					
Cable - UG Conductor Info	ETU.CABL	N/A	N/A	76	76	76	76	76	76	0	0	0	0	0	0	0	0	0	0	0	0
Cable Box (Non-PGE-Owned Manhole)	ETU.CBBX	N/A	N/A	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	0
Cathode	ETU.CATH	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cathodic Protection	ETL.CATH	N/A	N/A	48	48	37	37	37	37	3	0	0	0	0	0	0	0	0	0	0	0
FAA Lights	ETL.FAAL	N/A	N/A	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
Fault Indicator	ETL.FALT	N/A	N/A	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
Insulators	ETL.INSL	N/A	1615	1604	1581	1493	1416	1413	1379	1382	1131	789	494	357	145	24	20	65	20	20	0
Lightning Arrestor - OH	ETL.LIAR	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lightning Arrestor - UG	ETU.LIAR	N/A	N/A	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Manhole (PGE-Owned)	ETU.MANH	N/A	N/A	36	36	36	36	36	36	14	14	14	14	14	14	14	14	14	14	14	0
Marker Ball	ETL.MKBL	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multi-Pole Structure Child Pole (PLST)	ETL.PLST	N/A	0	3	2	1	0	12	0	3	4	0	0	9	24	3	0	0	0	0	0
OH Conductor Info	ETL.CDIF	N/A	N/A	38	38	38	38	38	38	1	0	0	0	0	0	0	0	3	0	0	0
Pole Structure	ETL.POLE	42	13	16	51	25	27	85	17	0	10	1	3	37	0	27	0	26	0	1	1
Pump Plant	ETU.PMPP	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Splice	ETL.SPLC	N/A	N/A	21	21	21	22	22	22	0	0	0	0	0	0	0	0	0	0	0	0
Structure Foundation	ETL.FOND	N/A	N/A	9	9	9	9	6	5	1	0	0	0	0	0	0	0	1	0	0	0
Switch	ETL.SWIT	N/A	N/A	31	28	28	28	28	29	1	0	0	0	0	0	0	0	0	0	1	1
Terminal	ETL.TERM	N/A	N/A	59	59	59	59	59	59	23	23	23	23	23	23	23	23	23	23	23	0
Tower Structure	ETL.TOWR	N/A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		42	14	2024	2032	1906	1831	1895	1781	1502	1256	901	608	514	280	165	131	206	131	133	2

AKM also monitors the monthly synchronization of attribute-level records for the Transmission Support Structure asset type in the M3 Report (see Table 19 below). This report provides a count of instances where attributes within a Transmission asset record do not match between GIS and SAP. As with distribution asset records, the attribute-level issues are generally more difficult to resolve than asset record-level issues. The total number of attribute-level synchronization issues for support structures has been reduced from a high of 192,000 (January 2023) to approximately ~10,000 (November 2023).

Table 19. Monthly ET M3 Report Summary

ET M3 - Summary	1/9/2023	2/13/2023	3/6/2023	4/3/2023	5/2/2023	5/22/2023	6/5/2023	9/5/2023	10/2/2023	11/6/2023	Monthly Change
Attribute Differences											
Single Pole Structures	134,016	114,843	81,571	69,385	69,656	58,255	52,474	10,501	1,031	543	-488
Multi-Pole Structures - Parent Structures	5,361	5,178	5,168	4,507	4,636	3,578	3,575	52	25	19	-6
Multi-Pole Child Records	21,587	21,565	21,443	8,183	7,884	7,799	7,859	4	0	0	0
Tower Structures	31,347	30,272	29,832	27,506	22,814	22,865	22,699	19,296	19,751	9,981	-9,770
Total	192,311	171,858	138,014	109,581	104,990	92,497	86,607	29,853	20,807	10,543	-10,264

5.3.7 Other Asset Registry Data Condition Issues

In addition to the asset data condition issues previously discussed, AKM has identified other deficiencies in the condition and management of Asset Registry data. High-level deficiencies are outlined in Table 20 starting below, and initiatives to address these deficiencies are described in Section 7, "Continuous Improvement," starting on Page 65 and in Appendix F, "Profile and Status of Key Initiatives," starting on Page 98.

Table 20. Key Deficiencies and Asset Registry Risks

Strategy	Risk/Issue	Extent of Condition	Impact
As-Built/Data Ingestion	Asset records out-of-date or missing due to significant backlogs in the As-Built order process.	• 1,785 aged orders (non-emergency) • 48 aged orders (emergency)	Compromised ability to manage asset risk.
Data Quality Monitoring	Locational data associated with support structures and conductors has been identified as erroneous by comparing the Asset Registry locational data to recent LiDAR surveys.	More than 99% of HFTD support structures reviewed and conflated to improve accuracy. Non-HFTD/High Fire Risk Area (HFRA) structures have not been reviewed and conflated, but the Conflation Program is on a 10-year timeline to improve locational data.	Incorrect locational data can impact inspection and maintenance planning, as well as Public Safety Power Shutoff (PSPS) and other event management.
Data Quality Monitoring	Some assets are missing from the Asset Registry.	Full extent of condition has not been defined as rules to measure baseline "completeness" of the	Inability to manage asset risks.

Strategy	Risk/Issue	Extent of Condition	Impact
		assets are challenging to develop. Applies to all transmission and distribution asset data.	
Data Quality Monitoring	There are gaps in accuracy (beyond locational accuracy) for some critical data features and attributes.	Full extent of condition has not been defined as rules to measure baseline accuracy are challenging to develop. Applies to all transmission and distribution asset data.	Limited ability to manage asset risk.
Data Quality Monitoring	The Transmission Asset Registry does not contain critical data relating to some critical components.	Applies to all transmission OH lines. Risk-based priority is on collecting data from HFTD areas and modifying ETGIS to accommodate ingestion of this data.	Limited ability to manage asset risk. Compliance with federal probation requirements.
Systems of Record	Substation Asset Registry data is housed in multiple systems and requires integration/migration to the Substation Geographic Information System (SUBGIS).	Applies to all substation assets.	Ability to view substation data in a single, cohesive view is not possible.
Systems of Record	Some asset families and asset types do not have sanctioned Asset Registry systems and adequate processes to manage Asset Registry data.	• Streetlights • Remote grid assets • New grid sensor types	Compromised ability to manage asset risk.

5.4 Threats and Hazards, Mitigations and Programs

Table 21, "Primary Threats and Hazards, and Currently Planned Mitigations and Programs," on Page 57 contains a list of primary threats and hazards and the current mitigations and programs to address them. A detailed list of projects supporting the mitigations can be found in Appendix F, "Profile and Status of Key Initiatives," starting on Page 98.

Table 21. Primary Threats and Hazards and Currently Planned Mitigations and Programs

Strategy	Issue	Extent of Condition	Mitigations	Programs
Asset Registry Systems **Systems of Record**	The core Asset Registry system (Esri ArcGIS) will not be supported after 2027.	• Esri ArcGIS serves as the Asset Registry for all Distribution and Transmission asset types; also serves as a partial source of Substation data.	• Develop plan and staffing to support transition to new platform (Utility Network Model). • Conduct near-term pilot projects to inform transition plan.	• Utility Network Model
As-Built/Data Ingestion	Asset Registry data received by GIS for mapping may be incomplete or inaccurate.	• Distribution As-Built Program team has quantified that approximately 9% of As-Builts require reprocessing due to data quality errors.	• Quantify extent of condition and determine cause(s). • Institute controls within As-Built process to ensure data is complete and accurate. • Digitize As-Built process to reduce errors from manual data capture.	• As-Built Program
Central Data Platform	Asset-related data resides in separate purpose-built data sources and is challenging for asset managers to access and integrate.	• 140+ separate source systems for asset-related data identified as part of the Asset Data AMP.	• Partner with EDM and IT to initiate governance for creation of new Electric asset-related data source.	• Data Ontology Program • Data Governance

5.5 Compliance Requirements and Commitments

Several laws and regulations guide which data needs to be maintained, managed, and reported. The key governing regulations are described in Table 22 below.

Table 22. Compliance Requirements and Commitments

Requirement	Description
OEIS Wildfire Safety Division (WSD) GIS Reporting Standard	Quarterly data reporting for wildfire in a CPUC Wildfire Division (WFD) defined schema.
OEIS WMP	The OEIS requires PG&E to submit a yearly WMP which includes utility survey questions and narrative descriptions of the data governance for the Asset Inventory and Condition Database. PG&E established a commitment to improve the "Installation Date" completeness of its Asset Inventory and Condition Database to 90% by December 2025. PG&E also established the following objectives **(not commitments)**: • Integrate Transmission and Distribution asset condition data into database by December 2023. • Integrate Distribution Operating History data into database by December 2023. • Integrate Transmission Operating History data into database by December 2024. • Improve completion rate of five data attributes in addition to "Installation Date" in response to the OEIS-defined ACI (no timeline established).
Federal Energy Regulatory Commission (FERC)	EO Compliance maintains requirements in the Enterprise Compliance Requirement Repository (MetricStream), which contains various FERC requirements.
State of California	EO Compliance maintains requirements in the Enterprise Compliance Requirement Repository (MetricStream), which contains various State of California requirements.
California Independent System Operator (CAISO)	EO Compliance maintains requirements in the Enterprise Compliance Requirement Repository (MetricStream), which contains various CAISO requirements.
California Public Utilities Commission (CPUC)	EO Compliance maintains requirements in the Enterprise Compliance Requirement Repository (MetricStream), which contains various CPUC requirements.
North American Electric Reliability Corporation (NERC)	EO Compliance maintains requirements in the Enterprise Compliance Requirement Repository (MetricStream), which contains various NERC requirements.
CalFire	Ad hoc data requests.

6. Work Plan – Desired State, Asset Objectives, Programs, and Risk Mitigations

The need for holistic and programmatic management of asset data consistent with ISO 55001 guidelines was instantiated in 2019 with the establishment of the AKM team. The funding and resourcing for the program have grown as the program has demonstrated value through addressing key gaps in data quality, process management, and data management standards which have yielded significant improvements in data quality, access, and useability. In addition to direct funding, the program receives significant support from IT for large-scale technology projects and from the centralized Enterprise Data Management Program.

The total investment level for asset data management is established by the General Rate Case (GRC), the Transmission Operations (TO) Rate Case, and the WMP, subject to reprioritization through the Enterprise Investment Planning function. For 2024, the allocated expense budget for asset data management work is approximately $50M. Funding is apportioned to work aligned to the funding source (e.g., work funded via the WMP focuses directly on addressing data issues related to wildfire). Supplemental funding is provided through centralized funding for large-scale technology efforts to support asset data management (e.g., Esri Utility Network Model, Palantir Foundry enterprise data platform). For 2024, the supplemental funding allocated for asset data-related work is on the order of $24M. Current investment levels are largely adequate to address the gaps in asset data management and quality in a risk-prioritized manner, with exceptions addressed in Subsection 6.4, “Investment Gap and Consequences,” starting on Page 63.

AKM has defined 12 strategies, more than 20 programs, and numerous underlying initiatives to support the Asset Management Plan strategy and objectives – see the following sections for descriptions:

- Subsection 4.3, “Strategy Summary,” on Page 25
- Appendix D, “Programs and Program Objectives,” starting on Page 80
- Appendix F, “Profile and Status of Key Initiatives,” starting on Page 98

This section outlines the initiatives at a high level and demonstrates alignment with asset management and asset data objectives.

6.1 Investment Strategy

The current asset data investment approach seeks to align with the True North Strategy (e.g., foundational data management capabilities, wildfire/safety focus), and meet key regulatory and external commitments (e.g., WMP data governance commitment and objectives).

Programmatic efforts to achieve strategic objectives and goals are planned based primarily on physical asset risk, but also account for data management-driven risks. Programs are intended

to ensure a balance of risk, cost, and performance to provide asset managers and operators with data needed to effectively manage the electric system.

The prioritization and allocation of funding by the asset data AFO is informed by parameters reflected in the AKM "Loading Order." The AKM Loading Order aligns to the Enterprise Investment Planning loading order and True North Strategy objectives and reflects variables such as the impact of data and data management efforts on wildfire risk, public safety, regulatory commitments, customers, and emergency preparedness. AKM uses this Loading Order to allocate funds to programs, projects, and initiatives that support strategic objectives.

Table 23. AKM Loading Order Examples

Priority	Loading Order	Examples (not comprehensive)
1	Work that prevents fire ignition	Data improvements supporting high-risk asset types in HFTD areas, WMP commitments, high-impact maintenance tags in HFTD areas, near-term emergency work.
2	Work with a strong safety link	Data improvements supporting repair tags, conductor replacement, work that prevents wires down, surge arresters, system hardening/conductor replacement.
3	Compliance/commitments with strong safety link	Data improvements that support patrol and inspections, poles, vegetation, CAISO.
4	Emergency preparedness	Data improvements that support PSPS, cameras, weather stations.
5	Underground/network (strong safety link)	Data improvements that support network replacement, maintenance tags, critical operating equipment (COE), emergency.
6	Mitigates systemwide failure risk	Data improvements that support system operations, highest-priority substation asset replacement (can include foundational projects).
7	New business, work at the request of others (WRO)	Data improvements that support new business connections, capacity, and relocations.
8	Compliance/commitments (but low safety risk)	Data improvements that support asset inventory work in non-HFTD areas, non-threatening tags, and CAISO.
9	GRC commitments	Data improvements that support GRC commitments, such as distribution reconductoring, underground cable.
10	Waste elimination/cost saving	Data improvements that support improvement of program efficiency or unit-cost.
11	Reliability (low safety risk)	Data improvements that support improved reliability (with low safety risk), TripSavers, underground replacement, Non-Cust Capacity, Asset Replacement.

6.1.1 Base Programs

PG&E takes a programmatic approach to achieve the strategic objectives and goals for the Asset Data asset family. These base programs are intended to ensure a balance of risk, cost, and performance to effectively manage asset data. Table 24 below provides an overview of the high-level base programs related to asset data and the key strategies supported by those base programs.

Table 24. Summary of Asset Data Programs

MWC	MAT	Base Program Description	Key Strategies Supported	Cost Category
GE	GEO	Base Mapping	Data Quality Remediation As-Built/Data Ingestion	GRC, TO, Wildfire (WF) Expense
GE	GEO	GIS Technical Enhancements	Asset Registry Systems	GRC, TO, WF Expense
GE	GEO	GIS Asset Data Improvements	Data Quality Remediation System of Record	GRC, TO, WF Expense
GE	GE#	As-Built Program	As-Built/Data Ingestion	GRC, TO, WF Expense
GE	GEP	Data Management and Analytics	Central Data Platform Product Development	GRC, TO, WF Expense
JV		IT Project Funding	Asset Registry Systems Metadata Management System of Record Central Data Platform Product Development	GRC, WF Capital
2F		IT Project Funding	Asset Registry Systems Metadata Management System of Record Central Data Platform Product Development	GRC, WF Capital

6.2 Near-Term Investment Plan

Near-term investment planning focuses on strategic objectives, including key program stabilization and maturation, the need to establish SORs for targeted asset types, Asset Registry data governance, high-consequence data quality improvements, and data access and integration. Near-term asset data investments include, but are not limited to, the following key strategies:

Expense

- **System of Record (SOR):** Establish an SOR for substation and new asset types (e.g., Remote Grid, Early Fault Detection [EFD] Sensors).
- **As-Built/Data Ingestion, Data Quality Remediation:** Continue base mapping support for key strategic programs (As-Built, map corrections).
- **As-Built:** Improve major emergency order process, reporting, and aged order volumes.
- **Data Quality Remediation, SOR:** Complete ingestion of asset information collection (AIC) transmission asset data into ETGIS for all WF and WF-contiguous circuits.
- **Data Quality Remediation:** Continue county-based transmission, distribution, landbase conflation (asset registry validation) in targeted counties (10-year program).
- **Data Quality Remediation:** Meet WMP commitment to increase fill rate for high-impact data (e.g., Installation Date) for targeted assets that drive asset failure risk.
- **Data Quality Remediation:** Create a “fast-track” remediation program to accelerate resolution of low-complexity data quality issues.
- **As-Built/Data Ingestion, Data Quality Remediation:** Deploy tools to improve asset failure data collection rate and quality.
- **Data Quality Monitoring:** Expand ADQ Program to support additional asset types and critical non-asset data (e.g., condition data).
- **Standards and Procedures:** Drive conformance with the Asset Registry Standard (TD-9212S) across asset families; develop standards and requirements.
- **Data Quality Remediation, As-Built/Data Ingestion:** Strengthen data quality controls for As-Built job packages, map corrections, and production mapping data entry to ensure data completeness and accuracy.
- **Central Data Platform, Product Development:** Continue collecting and provisioning LiDAR and imagery data for use across asset management, engineering and inspections, and other teams.

Capital

- **Asset Registry Systems:** Pilot the population and deployment of the new Esri Utility Network Model.
- **As-Built/Data Ingestion:** Complete Mobile Digital Job Package pilot.
- **Product Development:** Data products to support asset failure and system inspections.
- **Product Development:** Data products to support asset work visualization and work bundling.
- **Central Data Platform:** Develop and deploy curated data sets for asset condition and operating history.

6.3 Long-Term Investment Plan

Long-term investments focus on longer-life projects, program development/maturation, and major data management infrastructure upgrades. Note that key programs such as Base Mapping, As-Built, Foundry Data Product Development, and Data Quality Improvement, which are listed as short-term investments, will also continue as part of long-term asset data risk management. Note that some of the programs below are not sufficiently funded to achieve the strategic objectives (see Subsection 6.4 starting below for more details). Within the 10-year timeframe, asset data investments include but are not limited to the following key areas:

Expense

- **Data Quality Remediation (Synchronization):** Expand the M Program to monitor synchronization between GIS and other core systems (e.g., CC&B, ADMS).
- **System of Record:** Develop streetlight Asset Registry (low risk).
- **As-Built/Data Ingestion:** Expand Mobile Digital Job Package deployment to Distribution Overhead, Transmission Overhead, and Substation asset families (contingent on funding).

Capital

- **Asset Registry Systems:** Implement next generation GIS (Esri Utility Model) in close coordination with other system re-platforming efforts (e.g., SAP, CC&B).
- **As-Built:** Expand Mobile Digital Job Package deployment to distribution overhead, transmission overhead, and substation asset families (contingent on funding).
- **Product Development:** Create a full-3D, engineering-grade digital twin of transmission system.
- **Product Development:** Develop data sets and tools to support consistent/programmatic asset health management capabilities as part of IGP.

6.4 Investment Gap and Consequences

Program funding is generally sufficient to achieve the Asset Data AMP strategic objectives, with the following key exceptions:

1. **Digital Job Package (As-Built):** As-Built processes create the foundational data (through job packages) which are needed to populate the Asset Registry with timely, traceable, accurate, verifiable, and complete information. These processes are currently manual and paper-based, which results in delays and inaccuracies in updating the Asset Registry. Digitizing the As-Built for distribution, transmission, and substation from end-to-end would significantly improve the quality of the Asset Registry; however, the project has only been funded for a pilot focused on distribution underground work. In the absence of full-scale digitization, the Asset Registry will continue to reflect inaccuracies

that result from the conversion of paper-based records to digitized records. Also, the Asset Registry will continue to reflect out-of-date records due to the long cycle time for processing paper-based records. This could affect safety, compliance, and operational decisions based on Asset Registry records.

2. **Asset Registry Validation:** The Asset Registry Validation (i.e., Conflation) Program is on a 10-year timeline. Expeditious validation of the Asset Registry would more quickly eliminate risks faced by electric asset managers and operations teams associated with absence or mis-location of physical assets in the Asset Registry systems. Although risk-based prioritization of the Conflation Program can help ensure that highest-impact assets and regions are addressed first, the level of risk management is contingent on funding.

7. Continuous Improvement

PG&E continues to maintain a focus on continuous improvement, including efforts furthering the accuracy, timeliness, and availability of data. The asset data management strategies outlined in this document provide opportunities for continuous improvement in multiple areas, from how PG&E generates and captures data, to how it is used in supporting data-driven business decisions with respect to asset management and operations. AKM's significant progress in improving the management of Electric's asset data was reflected in Lloyd's Register Quality Assurance audit which recently removed the minor non-conformance relating to information management.

7.1 Recent Asset Data Continuous Improvements

Table 25, "Strategic Objective Progress," starting on Page 66 describes recent progress in support of the Asset Data AMP strategic objectives.

Table 25. Strategic Objective Progress

Strategy	Program	Prior Condition	Progress
Asset Registry Systems	Electric GIS Systems Program	EDGIS and ETGIS issues with system uptime and user experience made system reliability and user experience challenging.	• Completed EDGIS and ETGIS system re-architecture projects to address performance and usability issues.
As-Built/Data Ingestion	As-Built Program	Significant backlog of aging orders. Lack of end-to-end process, process ownership, and KPIs.	• Completed **~28,000** Distribution backlog initiative in 2022 (3-year initiative). • Reduced population of aged jobs completed in more than 1 year from ~3,100 to ~2,400 since January 1, 2022. • Established director-level process governance. • Reviewed **~10,500** major emergency jobs as part of 2023 storms. • Established Distribution As-Built cycle time KPIs of **60 days** for non-major emergency and **120 days** for major emergency.
Data Quality Remediation Systems of Record	Data Management Program Management Office	Team did not exist.	• Q3 2023: Built team and operating model to drive data quality, data governance, metadata, and ownership.
Central Data Platform Product Development	Data and Analytic Product Development Program	Teams established in 2022 to curate data and build trusted, high-impact data/analytic products for physical AFO and EO.	• Established operating model to standardize approach to data and product development work. • Expanded the organization to include GIS Analytics team, providing specialized geospatial analytic capabilities.
As-Built/Data Integration	Mobile Digital Job Package Program	Paper-centered documentation of As-Built work prior to ingestion into SAP and mapping created long	• Completed proof of concept (POC). • Initiated pilot to complete 5 underground (UG) jobs end-to-end: Estimating/Construction/Mapping in 2023.

Strategy	Program	Prior Condition	Progress
		cycle time and errors in updating Asset Registry.	
Data Quality Remediation	Map Correction Program		• In 2022, completed 260,500 Distribution (year-over-year [YOY] +670%) and 5,300 Transmission (YOY +130%) corrections; in 2023, completed over 300,000 map corrections. • Avoided $6.2M cost through bulk upload process.
Data Quality Remediation	Asset Conflation	The existence and location of assets in HFTD and non-HFTD areas were not systematically field-verified to ensure the accuracy of the electric Asset Registry.	• Established a program to leverage LiDAR and aerial imagery to verify location and existence of assets. • 99% WF area primary support structures and related circuits "conflated" using LiDAR data. • Expanding program to cover non-wildfire (NWF) areas and other asset types over a 10-year period.
Data Quality Remediation	Transmission Asset Attributes T-Line Critical Component Asset Registry Enhancements (AIC) (Major Project Initiative)	Inadequate attribution of transmission assets to support risk management.	• Completed probation-driven condition, including collection of available digital record data for all transmission structures (towers and poles) in PG&E's WF areas. • 548 circuits • 619 Asset Feature Lists (AFLs) • 45,062 structures • Collected asset data for ~2.5M asset components • Preparing to ingest into Registry
Asset Data Quality	Service Point to Transformer Relationship: Mis-Assigned (Major Project Initiative)	Algorithm, risk prioritization methods, and workflows were not optimized.	• Created production grade workflows and user interfaces to increase efficiency of process. • Updated algorithm to provide more accurate targeting of potentially mis-mapped customer services. • Remapped 5,000 high-priority customer-to-transformer.

Strategy	Program	Prior Condition	Progress
Data Quality Maturation and Stewardship Data Quality Monitoring	EO Business Data Stewardship Program, Asset Data Quality (ADQ) Program	AKM and the enterprise lacked a process for critical data management from inventorying the data, to describing with metadata, to applying data quality rules to measure condition of the data.	• Created risk-driven framework to prioritize focus of asset data management and improvement efforts. • On-boarded data stewards to "own" critical data. • Partnered with BDSs to inventory 855 risk-prioritized critical data assets. • Developed and applied 2,500+ data quality rules. • Created and deployed systems to automatically measure data quality and capture metadata. • Established program framework to expand to other functional areas and data types.
Non-Asset Data	Non-Asset Data Program	Lack of clear ownership and management requirements for critical non-asset data layers (e.g., HFTDs).	• Established ownership of 18 non-asset data layers with 6 more pending; established data management procedures.
Standards and Procedures As-Built/Data Ingestion Asset Registry Systems Metadata Management Systems of Record	Asset Registry Standard Implementation	In Q4 2022, AKM developed and published first-of-kind PG&E standard to define system and governance requirements for Asset Registry data for all electric asset families. No standard previously existed for electric Asset Registry or other data sets in PG&E.	• Developed draft procedures for standard implementation. • Integrated reference to the standard into physical asset AMPs to codify commitments to meet the standard. • Conducted gap analysis against standard to identify areas for improvement.
Product Development	Data and Analytic Product Development Program	Teams established in 2022 to curate data and build trusted, high-impact data/analytic products for physical AFOs and EO.	• Established operating model to standardize approach to data and product development work. • Expanded the organization to include GIS Analytics team, providing specialized geospatial analytic capabilities.

Strategy	Program	Prior Condition	Progress
Central Data Platform	Data Ontology Program	Data sets required for effective management of electric assets were contained in siloed, purpose-built systems and were not easily accessed and integrated to enable analytics.	• 50+ integrated, high-quality, reusable, electric ontology objects developed in Foundry, with a focus on electric assets that drive ~86% of asset failure risk. • 60+ connected data source systems.
Product Development	Data and Analytic Product Development Program	Work planning data and asset data were contained in disparate systems and were not visualized (i.e., mapped), making it difficult to manage work in an integrated and efficient manner.	• Developed and deployed Electric Distribution (ED) Work Visualization and Bundling tool with EO team – 600+ users in work coordination, work analyses, and execution. • Developing ET Work Visualization and Bundling tool.

7.2 Asset Data Opportunities for Continuous Improvement

There are gaps in the Asset Data AMP that have not been fully built out at this stage; these gaps are highlighted in Table 26 below. These are areas that will continue to evolve and improve as AKM continues to make investments in projects, programs, and processes supporting asset data management.

Table 26. Areas for Continuous Improvement

Strategy	Issue	Programs
Standards and Procedures As-Built/Data Ingestion Asset Registry Systems Metadata Management Systems of Record	The Asset Registry Standard (ARS) (TD-9212S) has not been fully implemented for all asset families and asset types.	• Asset Registry Standard Implementation
Systems of Record	Some asset families and asset types do not have sanctioned Asset Registry systems and adequate processes to manage Asset Registry data.	• Asset Registry Standard Implementation
As-Built/Data Ingestion	The Asset Registry system is not updated in a timely manner through the As-Built process, particularly for major emergencies.	• As-Built Program
As-Built/Data Ingestion	Asset Registry data received by GIS for mapping may be incomplete or inaccurate.	• As-Built Program
Data Quality Remediation	Some CDEs within the Asset Registry are erroneous or missing.	• Asset Data Quality (ADQ) Program • Map Correction Program • Distribution Asset Information Collection Program (building from project AI-11)
Data Quality Remediation	Asset Registry is missing asset records.	• As-Built Program • Map Correction Program
Data Quality Monitoring	Critical asset attributes across all transmission and distribution asset families are not synchronized.	• M Program (Synchronization Monitoring) • ADQ Program
Data Quality Monitoring	The GIS-SAP interface is the focus for synchronization monitoring. Synchronization monitoring should	• M Program (Synchronization Monitoring)

Strategy	Issue	Programs
	be expanded to validate successful CDE synchronization with other critical downstream systems (e.g., Distribution Management System [DMS], ADMS, CC&B).	• ADQ Program
Data Quality Remediation	Large backlog of data quality issues.	• Data Management Project Management Office
Non-Asset Data, Central Data Platform	Asset-related data resides in separate, purpose-built data sources and is challenging for asset managers to access and integrate.	• Non-Asset Data Program • Data Ontology Program

APPENDICES

Appendix A – Standards, Procedures, and Guidelines

The relevant standards, procedures, and guidelines are listed in Table 27 below.

Table 27. Relevant Standards, Procedures, and Guidelines

Guidance Document	Process
TD-9212S	Asset Registry Standard

Appendix B – Related Documents

Table 28 below lists the documents associated with this strategic AMP.

Table 28. Related Documents

Related Document	Document Number/ Description	Location
Electric Asset Management Commitment	TD-04	Technical Information Library (TIL)
Strategic Asset Management Plan (SAMP)	TD-8100	
Transmission Line Overhead Asset Management Plan	TD-8101	
Transmission Line Underground Asset Management Plan	TD-8102	
Substation Asset Management Plan	TD-8103	
Operational Assets and Systems Asset Management Plan	TD-8104	
Distribution Line Overhead Asset Management Plan	TD-8105	
Distribution Line Underground Asset Management Plan (Excluding Network System)	TD-8106	
Distribution Network Asset Management Plan	TD-8107	
Streetlight Asset Management Plan	TD-8109	
Remote Grid	TD-8110	
Strategic Risk Management Plan – Electric	TD-8200	
Technical Standard, Ontology Minimum Requirements	V1.7	
My Catalog – Catalog of all published GIS Production Mapping and GIS Quality Management Technology and Projects (QMT&P) documents not hosted in the TIL	MyCatalog	

Appendix C – EO Asset Class Risk Ranking

Table 29 below provides the relative risk ranking of all EO asset types as identified in the risk models for the Transmission Overhead, Transmission Underground, Substation, Distribution Overhead, Distribution Underground, and Distribution Network asset families. This ranking combines the frequency and risk scores for base asset family equipment failure risk models with the associated wildfire risk model, where appropriate (indicated by "+WLDFR" in the **Risk ID** column).

Complete versions of the models can be accessed by contacting EO AKM. Note that the values are based on 2023 models.

Table 29. EO Asset Class Risk Ranking

Risk ID	Family	Driver	Sub-Driver	Frequency	Risk Score
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Conductor damage or failure	1,045	2,658
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Other equipment/ facility failure	342	986
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Insulator and brushing damage or failure	360	852
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Connection device damage or failure	1,319	799
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Fuse damage or failure	771	675
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Crossarm damage or failure	853	661
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Pole damage or failure	897	555
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Transformer damage or failure	3,521	494
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Capacitor/booster /regulator	89	279
TOVHD+WLDFR	Transmission OH	Equipment/facility failure	Conductor damage or failure	23	108
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Anchor/guy damage or failure	1	68

Risk ID	Family	Driver	Sub-Driver	Frequency	Risk Score
TOVHD+WLDFR	Transmission OH	Equipment/facility failure	Insulator and brushing damage or failure	23	60
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Surge arrestor	142	55
DUNGD	Distribution UG	Distribution Underground Line (DU-Line) Equipment Failure	UG – Conductor	522	33
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Transformer	886	23
TOVHD+WLDFR	Transmission OH	Equipment/facility failure	Pole damage or failure	18	18
TOVHD+WLDFR	Transmission OH	Equipment/facility failure	Connection device damage or failure	26	16
DSBSN+WLDFR	Distribution Substation	Equipment/facility failure	Voltage regulator/ booster damage or failure	0	15
DOVHD	Distribution OH	D-Line Equipment Failure	Secondary/ service	385	10
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Elbow	164	10
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Connector/ splice	144	9
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Network protector failure	5	7
DSBSN	Distribution Substation	Substation Equipment failure	Transformer	8	7
DSBSN	Distribution Substation	Substation Equipment failure	Circuit breaker	8	6
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Secondary cable failure	1	4
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Switch	78	4

Risk ID	Family	Driver	Sub-Driver	Frequency	Risk Score
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Primary splice failure	3	3
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Switch damage or failure	65	3
DSBSN	Distribution Substation	Substation Equipment failure	Auxiliary	6	3
DSBSN	Distribution Substation	Substation Equipment failure	Relay	6	3
TOVHD	Transmission OH	T-Line Equipment Failure	Non-steel structure	18	3
TOVHD	Transmission OH	T-Line Equipment Failure	Steel structure	18	3
TOVHD	Transmission OH	Other	Unknown outage cause	42	3
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Primary cable failure	4	2
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Transformer failure	1	2
DOVHD+WLDFR	Distribution OH	D-Line Equipment Failure	Recloser/ sectionalizer damage or failure	51	2
DSBSN	Distribution Substation	Substation Equipment failure	Insulator	3	2
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Fuse	34	2
TSBSN	Transmission Substation	Substation Equipment failure	Circuit breaker	2	2
TSBSN	Transmission Substation	Substation Equipment failure	Transformer	1	2
DOVHD	Distribution OH	D-Line Equipment Failure	Support structure	47	1
DSBSN	Distribution Substation	Substation Equipment Failure	Arrestor	1	1
DSBSN	Distribution Substation	Substation Equipment Failure	Bushing	1	1

Risk ID	Family	Driver	Sub-Driver	Frequency	Risk Score
DSBSN	Distribution Substation	Substation Equipment Failure	Switch	3	1
DUNGD	Distribution UG	DU-Line Equipment Failure	Other	22	1
DUNGD	Distribution UG	DU-Line Equipment Failure	Secondary/ service	128	1
TOVHD	Transmission OH	T-Line Equipment Failure	Switch	12	1
TSBSN	Transmission Substation	Substation Equipment Failure	Arrestor	0	1
TSBSN	Transmission Substation	Substation Equipment Failure	Insulator	1	1
TSBSN	Transmission Substation	Substation Equipment Failure	Relay	1	1
TSBSN	Transmission Substation	Substation Equipment Failure	Switch	1	1
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Secondary connector failure	0	0
DNTWK	Distribution NTWK	Underground Network Equipment Failure	Switch failure	0	0
DSBSN	Distribution Substation	Substation Equipment Failure	Conductor	0	0
DSBSN	Distribution Substation	Substation Equipment Failure	Mechanical relay	1	0
DSBSN+WLDFR	Distribution Substation	Equipment/Facility Failure	Other equipment/ facility failure	1	0
DSBSN	Distribution Substation	Substation Equipment Failure	Reactor	0	0
DSBSN	Distribution Substation	Substation Equipment Failure	Recloser	0	0
DSBSN	Distribution Substation	Substation Equipment Failure	Regulator	1	0
DUNGD	Distribution UG	DU-Line Equipment Failure	Capacitor/ booster/regulator	2	0

Risk ID	Family	Driver	Sub-Driver	Frequency	Risk Score
DUNGD	Distribution UG	DU-Line Equipment Failure	Recloser/ sectionalizer	0	0
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Bus	8	0
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Bushing	10	0
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Interrupter	6	0
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Splice Box	0	0
DUNGD	Distribution UG	DU-Line Equipment Failure	UG – Stepdown	1	0
TOVHD+WLDFR	Transmission OH	Equipment/Facility Failure	Crossarm damage or failure	0	0
TSBSN	Transmission Substation	Substation Equipment Failure	Auxiliary	0	0
TSBSN	Transmission Substation	Substation Equipment Failure	Bushing	0	0
TSBSN	Transmission Substation	Substation Equipment Failure	Regulator	0	0
TSBSN	Transmission Substation	Other	Unknown outage cause	0	0
TUNGD	Transmission UG	Transmission Underground Line (TU-Line) Equipment Failure	Connector/ hardware	0	0

Appendix D – Programs and Program Objectives

Table 30. Programs and Program Objectives

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Data Management Oversight Program (to be initiated in 2024)	Data Management Oversight Standards and Procedures	R: Not yet identified A: [redacted]	Coordination and harmonization of AKM governance standards, practices, and procedures, including overarching governance oversight. Provides top-down guidance for governance practices to ensure AKM governance is complete across all data management activities and gaps are addressed. Topics include: new functional governance requirements, external stakeholder requirements, project management governance, and steering committee requirements.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Define and establish an enterprise operating model with clear R&Rs for data decision-making. • Establish risk-based criteria and a unified, coordinated project management governance across AKM. • Expand data governance, including creation, approval, and implementation of data standards beyond Asset Registry data types: (1) develop and communicate a new Asset Condition (Notification) Standard and (2) develop and communicate a new Asset Condition (Inspection Data) Standard. • Identify external, regulator stakeholder requirements, and identify gaps with current asset data management plan. Ensure compliance with regulations by identifying data owners and facilitating approval of minimum required data retention and disposition standards.		• Develop and communicate a new Unstructured Data (Imagery/LiDAR) Standard. • Electric Engineering and Operations' most critical data assets are effectively and efficiently governed.
	Standards and Procedures	R: [redacted]	Operationalize the Asset Registry Standard (ARS) (TD-9212S), establish governed procedures for

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Asset Registry Standard Implementation	As-Built/Data Ingestion Asset Registry Systems Metadata Management Systems of Record	A: [redacted]	managing the Asset Registry, identify and close SOR gaps, formalize process to execute Asset Registry enhancements, and establish methodology for ARS conformance monitoring.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Develop and communicate new Asset Registry procedures to address ARS governance gaps. • Develop plan to address Asset Registry gaps.		• Ongoing identification, prioritization, and remediation of Asset Registry gaps.
MyCatalog Document Management	Standards and Procedures	R [redacted] A	Enable and improve access to comprehensive governance library, including all electric GIS critical guidance documentation.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Evaluate possible expansion of MyCatalog library to include all AKM critical guidance documentation.		• Implement MyCatalog to include all AKM guidance documents, if feasible.
Enterprise Data Management Program	Data Management Oversight Data Quality Maturation and Stewardship Metadata Management	R: Not yet identified A: [redacted]	Enterprise-level coordination to establish standards, tools, processes, and programs to improve data management practices.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Define and establish an operating model with tools and practices for data profiling and quality monitoring. • Improve operational efficiency with data quality management and expand data quality management.		• Establish and share best practices and successful approaches to data quality management with industry peers.
EO Business Data	Data Quality Maturation and Stewardship Data Quality Monitoring	R: Not yet identified A: [redacted]	Identify and develop Data Stewards in EO to support critical data management initiatives.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Stewardship Program	Data Quality Remediation Metadata Management Systems of Record Central Data Platform		
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Define and standardize the BDS roles and onboarding process. • Define and standardize the BDS engagement model, including regular (minimum: annual) review of data quality and ontology objects under their purview. • Onboard BDSs to support data management for targeted critical data assets based on risk prioritization. • Expand BDS model to address non-Asset Registry data.		• Develop annual goals for BDS to include in annual performance objectives.
Asset Data Quality (ADQ) Program	Metadata Management Data Quality Monitoring Data Quality Remediation	R [redacted] A	Improve the definition, identification, and measurement of critical asset data. Define/apply data quality rules to systematically measure the quality/condition of critical data across data quality dimensions.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Expand ADQ to cover all risk-prioritized critical asset data. • Improve tools and processes to standardize the ADQ Program. • Develop long-term ADQ roadmap.		• ADQ coverage of all data related to top enterprise risks (e.g., WF and NWF electric asset failure).
Data Management Program	Data Quality Remediation Systems of Record	R [redacted] A:	Intake, prioritization, and management of AKM's portfolio of data initiatives, and establish consistent project management practices.
	Near/Mid-Term Objectives		**Long-Term Objectives**

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Management Office	• Improve operating model and tools for prioritized, efficient data quality issue backlog management to reduce backlog queue. • Ongoing development of project initiation and project management and governance processes, roles, and responsibilities, and coordination across teams for efficient project execution. • Complete ADQ integration into Front Door. • Improve Data Management PMO portfolio metrics and automate dashboards in Power BI. • Support development of "fast track" data issue resolution path. • Complete AI-11 POC contributing to WMP data quality commitment efforts. • Finalize communication plan and establish automated communication flows.		• Improve DQ issue management operating model to systematically improve remediation of highest-priority data quality issues of CDEs. • Improve backlog grooming process so it does not continue to grow. • Establish single point of accountability and coordination for EO DQ issues. • Establish a cohesive, end-to-end process once the initiation phase is rolled out, making sure it fits the rest of the gating process frictionlessly. • Improve governance around Electronic Document Routing System (EDRS) approvals to avoid slowing down project execution. • Define steering committee to be involved in projects based on scope, and budget to eliminate waste around unnecessary leadership engagement on less-complex projects. • Continuously improve program managers' (PMs') skillsets via trainings to enable them to define and solve problems.
Map Correction Program	Data Quality Remediation	R: [redacted] A: [redacted]	Processes and tools for validation of data between the Asset Registry and the field, typically by personnel who perform field activities.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Begin using new, centralized Request for Work (RW) Tracking System (RWTS) to manage RW map corrections through the life cycle.		• Enhance RW map correction submission tools such as Inspect App, MAPs +, and WebViewer to automatically organize and prioritize work.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
	• Implement RW process improvements, including prioritization and quality to improve cycle time and error rate. • Implement minimum required information to reduce IDOCs/ rejections and improve cycle time. • Improve system-based workflows for IDOC/rejection resolution.		• Incorporate minimum data requirements (minimum required information) into submission tools to reduce IDOCs. • Implement new "Direct Link" feature to allow direct update of low-risk features/attributes by field personnel.
Substation Asset Registry Program	Data Quality Remediation Systems of Record	R [redacted] A:	Establish a consolidated Asset Registry for substation assets and equipment; improve the quality of data and spatial accuracy of substations and substation assets.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Capture business needs in terms of strategy, operations, maintenance, engineering, and construction to develop a cohesive Asset Registry strategy for the future system. • Develop a general architecture for how the Asset Registry can drive inventory, attributes, electric connectivity, and spatial location for the operations and work management system. • Design and deploy a POC to determine feasibility of a GIS Asset Registry for substations in the Utility Network Model.		• Capture requirements, develop, and deliver GIS Substation Asset Registry along with supporting business process enhancements and system integrations. Asset Registry to house inventory, attributes, electric connectivity, and spatial location of substation assets to drive installation, operation, maintenance, and retirement of assets. • Plan and deploy a pilot of GIS Asset Registry for Substation in the Utility Network Model. • Deploy a minimum viable product GIS Substation Asset Registry in the Utility Network Model as part of the NextGen GIS, along with the supporting business process enhancements and system integrations. • Iterative development and enhancement of the GIS Substation Asset Registry in the Utility Network Model to bring further functionality and system integration.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
As-Built Program	As-Built/Data Ingestion	R: [redacted] A: [redacted]	The As-Built Program is designed to ensure timely and accurate updates to the Asset Registry for installed, replaced, removed, relocated, and abandoned equipment.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Establish and deploy standard metrics and analytics for calculating cycle time and aging orders. • Work with initiators to identify process improvement opportunities on priority issues/Corrective Action Plans (CAPs) for resolution (e.g., major emergency order process). • Establish a change management framework and practice for As-Built process improvement projects. • Establish framework and update priority guidance documentation (standards, procedures, bulletins).		• Identify and initiate metrics and analytics data quality improvement initiatives. • Lead and resolve process improvement initiatives for risk-prioritized issues/CAPs. • Identify issues for resolution resulting in updates and training of guidance documentation (standards, procedures, bulletins).
Mobile Digital Job Package Program	As-Built/Data Ingestion	R A: [redacted]	Develop technology that allows for the collection of unambiguous, traceable, verifiable, accurate, complete, and compliant [with procedures] (UTVACC) digital information that describes the scope of work performed on an order and the assets installed, removed/retired, replaced, or altered in that scope of work.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Pilot Distribution Mobile Digital Job Package app for the 10K Undergrounding Program.		• Expand Mobile Digital Job Package deployment to Distribution Overhead, Transmission Overhead, and Substation asset families.
	As-Built/Data Ingestion	R: Supervisors A: [redacted]	AKM GIS Production Mapping performs the following functions:

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Production/Base Mapping Program			• ETGIS and EDGIS production data maintenance • Program work management: As-Built, Map Corrections, GIS tags, Landbase • Resource and contract management • Production, quality, and cost management • Operations Emergency Center (OEC) on-site and remote support
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Continue base mapping support for key strategic programs (As-Built, Map Corrections). • Enhance mapping support of OECs with new procedure for standard work, onsite, and remote support of OECs with PG&E and contract mapping resources. • Implement various Power App production management tools (As-Built, Map Correction, Circuit Map Change Sheet) • Implement IDOC process improvements to improve As-Built and map correction cycle times.		• Implement Production Mapping portion of the following: ○ Next Generation GIS ○ Mobile Digital Job Package ○ ADMS ○ Replacement for GIS tag system ○ Landbase and asset updates from County Conflation project
Electric GIS Systems Program	Asset Registry Systems	R: [redacted] A:	This program delivers a trusted source of electric asset and non-asset data which clients effectively and efficiently use to make informed decisions.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Understand the needs associated with the current system. • Ensure value by adjusting the program to align with current needs and trends.		• Near/mid-term objectives applied to Utility Network system.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
	• Define how the existing technology compares against other technologies available in the marketplace. • Define how PG&E is doing compared to utility peers. • Assess PG&E's potential to change. • Assess how much required work can be completed. • Assess PG&E's risk associated with proposed changes. • Create the program team's book of work.		
SAP Permissions Control Program	Asset Registry Systems	R: A: [redacted]	Realignment of SAP roles and permissions; SAP equipment create and change access is not aligned with best practice because equipment records are maintained via GIS integration.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• SAP Permissions project was successfully deployed on 8/18/2023. Mass role assignments have been completed. Post-deployment activities are underway. The system is actively being monitored during this stabilization period.		
M Program (Synchronization Monitoring)	Asset Registry Systems	R A: [redacted]	The EO "M Program" ensures accurate data synchronization between GIS-SAP at the class record level (M1 and M2) and for the recognized CDEs (M3).
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• All GIS-SAP reporting will be performed daily with Foundry. • Build Foundry dashboard detailing daily M reporting. • Accept remaining M1/2 classes; continue accepting M3 attributes.		• All M3 CDEs reported daily. • Foundry dashboard becomes "self-service" for daily corrective actions.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
Utility Network Model Program	Asset Registry Systems Systems of Record	R [redacted] A	Enable the transition to a new geospatial platform, Esri's UN Model, that will support the PG&E of tomorrow, allowing for real-time data access, process and system improvements, and support decision-making. This includes the ability to access current and historical information, connect multiple systems and data sources, visualize trends, and create efficiencies and improvements while maintaining existing operations without disruption. Through this effort, PG&E envisions a phased deployment of the new geospatial platform for implementation by 2028, and in line with Esri retiring their current ArcMap product. PG&E is keen to leverage this opportunity to make game-changing investments that will support their growth and grid modernization ambitions, in alignment with California's path toward a smarter grid.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• PMO Document • Benchmarking • Strategy White Paper • Proof of Concept Success Criteria, Plan, and minimum viable product (MVP) • Business Case • Requirements Documentation • Project Plan		• New data gathering where needed. • Configuration of UN Model (existing and new data). • Co-create and/or configuration of internal GIS processes leveraging Next Gen GIS opportunities (existing and new). • Co-create and/or configuration of external business processes with PG&E stakeholders to leverage Next Gen GIS opportunities (existing and new). • User engagement and use case testing (pilot).

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
			• MVP sandbox active. • New processes and applications deployed across the program.
Non-Asset Data Program	Non-Asset Data	R: [redacted] A:	Ownership and data management procedures for non-asset data layers.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Establish ownership and data management procedures of 18 non-asset data layers, with 6 more pending. • Comply with internal procedure for any new or revised non-asset data layers.		• Further evaluate the establishment and management of potential additional non-asset data layers and develop plan. • Continue complying with internal procedure for any new or revised non-asset data layers. • All PG&E's master data is fully integrated, centrally managed, and delivered as needed for multiple functional business areas/business purposes.
Data Ontology Program	Central Data Platform	R A: [redacted]	Integrating critical data sets in the Asset Inventory and Condition Database.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Established operating model to standardize approach to data and product development work. • Integrate Asset Operating History and Condition data into Foundry for targeted assets. • Deliver unstructured data (image and LiDAR) into Foundry.		• Expand scope of Foundry data on a risk-informed basis to include asset data types beyond Asset Registry, Operating History, and Condition. • The Asset Inventory and Condition Database contains the geospatial path of each transmission and distribution circuit (including locations of poles and lines which deviate from the average direction), as well as each

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
			transformer and switch gear in accordance with the GIS reporting standards published by Energy Safety. • Deliver As-Switched grid configuration historical data into Foundry to enable time series analysis.
Data and Analytic Product Development Program	Product Development	R [redacted] A	Standardized, reusable analytics product development.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Established operating model to standardize approach to data and product development work. • Deliver high-value products supporting True North Strategy objectives, including IGP, Waste Elimination (e.g., Work Bundling, Regionalization, Wildfire/Safety). • Expanded the Data Products and Analytics organization to include GIS Analytics team, providing specialized geospatial analytic capabilities. • Develop and deploy ED Work Visualization and Bundling tool with EO team – 600+ users in work coordination, work analyses, and execution. • Develop ET Work Visualization and Bundling tool.		• Expand portfolio of high-value products supporting True North Strategy objectives, including IGP, Waste Elimination (e.g., Work Bundling, Regionalization, Wildfire/Safety). • Create a full-3D, engineering-grade digital twin of transmission system. • Develop data sets and tools to support consistent/programmatic asset health management capabilities as part of IGP.
Asset Conflation	Data Quality Remediation	R [redacted] A	Conflate location of structures for ET, ED, Gas Distribution (GD), Fiber, Landbase, and accompanying features in WF and NWF.
	Near/Mid-Term Objectives		**Long-Term Objectives**

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
	Pilot and Validate County Conflation: • Develop conflation and data acceptance testing (DAT) processes to be used for pilot work. • Conflate six polygons (system-wide representation) and validate conflating processes. • Validate DAT – Quality Control (QC)/Quality Assurance (QA) process. • Finalize list of features and their attributes in scope. • PG&E approves and posts the version for delivery to test QA environment. • Determine tools for tracking and visualizing conflation production progress. • Adapt conflation and communication schedule for implementation. Post-Pilot: • Conflate ED, ET, GD, Fiber, Landbase, non-asset data, and identified feature classes in NWF and WF. • Updated tracking attributes and conflation tracker to identify which support structures were conflated, from where, when, and by whom. • RW map corrections are created for Asset Registry data changes based on an effective conglomeration of work; batch updates to attribute data (e.g., latitude/longitude) are completed by mappers. • DAT conflated data. • Share potential inserts (LiDAR without corresponding GIS points) with mappers for 100% review.		• Collect LiDAR and imagery for identified county features in 49 counties/296 jurisdictions for 2.445M identified ED structures. • Conflate identified ET, ED, GD, Landbase (LB), Fiber, and non-asset data. • Identify feature gaps (inserts/deletions) between LiDAR and GIS; review with AFOs and update the SOR accordingly. • Validate integration of conflated data into SAP and other downstream systems. • Identify and incorporate LiDAR data for assets/ features structure attachments.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
	• AFOs and mappers validate a sample of the production data (PG&E validation specs to be determined in pilot). • PG&E approves and posts the version for delivery to production (RW map correction would be processed). Collect LiDAR data for counties to be conflated in 2025+.		
Propel Program – SAP S/4HANA Upgrade	Asset Registry Systems	R: Not yet identified A: Not yet identified	Scope of impact to Asset Registry and enhancements to Asset Registry management practices have not yet been identified.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• AKM objectives not yet identified.		• AKM objectives not yet identified.
GIS Quality Review Program (QRP)	Quality Management Oversight	R: [redacted] A:	Planned/periodic reviews of internal GIS QMT&P products and services to ensure adherence to internal and ISO 55001 and ISO 9001 standards. Review results are published and corrective/ preventative actions are monitored to evaluate effectiveness of actions taken.
	Near/Mid-Term Objectives		**Long-Term Objectives**
	• Complete high-risk quality reviews, per the annual plan. • Support and facilitate corrective action to the findings. • Perform effectiveness review to actions taken.		• Complete quality reviews per the annual plan based on risks, focusing on critical-to-quality and critical-to-customer processes to maximize effectiveness. • Streamline the quality review process to improve cycle time.
Data Quality Remediation Strategies	Data Quality Remediation	R: [redacted] A:	Improve the data quality dimensions in the GIS SOR. The data quality dimensions are defined as: Completeness, Conformity, Synchronization, Uniqueness, Consistency, Timeliness, Accuracy.

Program	Strategies Supported	Responsible (R) Accountable (A)	Summary Description
	Near/Mid-Term Objectives		**Long-Term Objectives**
	Improve the data quality dimensions in the GIS SOR through various projects: • County Conflation increases accuracy of structure locations. • Transmission AIC completes asset information. • Misassigned Customers aligns customers to their appropriate transformers. • East Bay Underground corrects mapping errors of underground structures. • Distribution Secondary Overhead corrects asset features as open or closed. • Various other projects that improve data quality.		Continue to improve the data quality dimensions in the GIS SOR through various projects: • Continue county project. • Develop substation data improvements. • Various other projects that improve data quality.

Appendix E – Strengths, Weaknesses, Opportunities, and Threats for Asset Data Management

Table 31. Strengths, Weaknesses, Opportunities, and Threats for Asset Data Management

Dimension	Master Data Management/ System of Record	Master Data Management/ As-Built	Data Quality Management	Data Governance	Asset Data Access and Integration
Strength	• Digital SOR defined and implemented for all Distribution and Transmission asset types • Establishing procedures to standardize the approach to adding new assets to Asset Registry (e.g., Remote Grid, Line Sensors)	• Established process owner, processes, and metrics to track effectiveness of As-Built process	• Field validation of 99% of primary structure asset data in WF areas; 10-year plan for validation of NWF assets • Field team enabled to provide asset data corrections found-in-field through their tools (e.g., Inspect App) • Established portfolio management (intake, triage, prioritization, project tracking) for DQ issues • Established processes to manage execution of DQ remediation projects • Established capability for bulk data quality updates where appropriate	• Published Asset Registry Standard (TD-9212S) applicable to all physical asset families; drafting supporting procedures • Established foundational data management capabilities for risk-prioritized Asset Registry data (inventory of critical data, data steward program, data quality monitoring) • Robust controls and governance programs over Asset Registry data model changes	• PG&E deployed best-in-class enterprise data and analytics platform (i.e., Palantir Foundry), which can provide access and integration of critical data • 60+ disparate data systems have been pipelined to Foundry, creating pathways to bring critical data into the system • Asset Registry data for assets driving 86% of asset failure risk is in Foundry; condition and operating history data was added in 2023 • Strong AKM and IT development teams and sufficient funding to integrate prioritized data into Foundry

Dimension	Master Data Management/ System of Record	Master Data Management/ As-Built	Data Quality Management	Data Governance	Asset Data Access and Integration
Weakness	• Full field validation of Asset Registry has never performed; 10-year plan • SOR not defined for Substation and Streetlight asset families • Asset Registry data not fully synchronized with downstream transactional data systems (e.g., SAP Work Management) • No SOR for non-tabular asset data (e.g., LiDAR, still imagery, video) that integrates with asset tabular data	• As-Built process spans multiple functional areas, making alignment and timely delivery challenging • Process is not fully digitized; full digitization is not funded • Asset failure data not systematically collected or effectively enabled	• Large backlog of Asset Registry data quality issues; slow throughput for Asset Registry DQ projects • Unclear responsibility for non-Asset Registry data quality management	• Upstream engineering controls on data entry are not robust or extensive • AKM-wide alignment on “critical data assets” is evolving • AKM data governance role regarding asset data outside of Asset Registry and non-asset data layers is not well-defined (e.g., work management data, risk data) • Data steward time and resources are insufficient to significantly expend data management capabilities to other asset data types	• Strategic planning process to prioritize data sets for integration into Foundry

Dimension	Master Data Management/ System of Record	Master Data Management/ As-Built	Data Quality Management	Data Governance	Asset Data Access and Integration
Opportunity	• Upgrade of Asset Registry system to next generation technoloty • Integrate core databases (GIS, SAP) during system upgrades to reduce system interfaces • Establish Asset Registry for new asset types (e.g., Remote Grid, Line Sensors) • Establish SOR for non-tabular data (e.g., LiDAR, still imagery, video) that links to Asset Registry • AKM to partner with EDM and IT to align on approach to unified semantic data model	• Digitize the As-Built process to increase efficiency, accuracy, and timeliness of data entry • Create tools and processes to improve field data collection for asset failure events	• Formalize a standard approach to project-based remediation of DQ issues • Create “fast-track” process for low- and mid-priority backlog projects to reduce backlog (requires resources) • Identify and onboard accountable parties for non-Asset Registry asset data (e.g., work management, notification data)	• Create broader internal alignment on “critical data” definition and inventory; align on expansion • Integrate data management program into upstream and downstream data processes (from issue identification to issue closure) • Expand data management capabilities to work management and risk management data assets • Partner with EDM and system owners for critical data outside of Asset Registry to clarify roles around data governance	• Initiate planning earlier in IT development cycle to ensure developers understand PG&E’s priorities for data integration • Integrate “supplemental Asset Registry” data into Foundry representation of asset data (e.g., pole loading calculations)

Dimension	Master Data Management/ System of Record	Master Data Management/ As-Built	Data Quality Management	Data Governance	Asset Data Access and Integration
Threat (External)[1]	• Core Asset Registry system (Esri ArcGIS) will not be serviced after 2027 • In 2023, GRC proposed a decision to cut funding for Next Generation GIS project	NA	• Flight risk: Data remediation efforts often depend on long-tenured personnel with deep knowledge of data systems and history of data migration	NA	NA

[1] This AMP does not address threats related to cyber security threats or direct system operations/maintenance, which are centrally managed by the IT Functional Area.

Appendix F – Profile and Status of Key Initiatives

Table 32. Profile and Status of Key Initiatives

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
Data Quality Maturation and Stewardship Data Quality Monitoring Data Quality Remediation Systems of Record Central Data Platform	EO Business Data Stewardship Program	Identify and develop data stewards in EO to support critical data management initiatives.	At Risk	12/15/23	Med	175
Asset Registry Systems	SAP Permissions Control Program	Realignment of SAP roles and permissions; SAP equipment create and change access is not aligned with best practice because equipment records are maintained via GIS integration.	Complete	12/29/23	Med	175
Standards and Procedures	Asset Registry Standard Implementation	Implement the Asset Registry Standard (ARS) (TD-9212S), and publish an Asset Registry Procedure (ARP) to operationalize the ARS and implement changes to Asset Registry (e.g., add new asset family, asset class, change the data model, and addresses data ingestion, system of entry/record, and synchronization).	On Track	Q1/23	High	35

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
Data Quality Remediation Systems of Record	Asset Data Fill Rate Completion (WMP Commitment)	Object: Support structure and others. Property: Installation Date and possibly others. Some values for PG&E-owned poles and other equipment are missing. Need to complete the data or show why it is missing.	At Risk	12/31/25	High	14
Data Quality Remediation	Asset Conflation	Project scope is to conflate ED, ET, GD, Fiber, and LB features and attributes across the service territory (WF and NWF).	On Track	12/31/25	Med	70
Data Quality Remediation	ET Missing or Suspect Pole Age Data	ET poles with missing or suspect ages; for example, poles older than 90 years – some poles are older than 90 years, but are there really 423 poles that old?	On Track	3/31/24	High	20
Data Quality Remediation	ET Main Work Center Assignments for Structures	Transmission structures are assigned to a main work center responsible for inspections and maintenance. The work center assignments are not made geographically, but rather by line. Work center designations in ETGIS are made by mappers by hand, and if the mapper does not know how to assign the correct work center, then it could be mis-assigned. ETGIS does not have an automatic process in place to assign the correct work	Off Track	9/30/23	Med	125

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
		center for structures and OH line segment features. There is an auto-updater and it makes assignments, but sometimes makes the wrong assignment.				
Systems of Record	Link Conductor to Pole in GIS and SAP	Enhance Asset Registry data model to create logical relationship between conductor and pole in GIS and SAP. Tiffany Pazdan and Brian Nugent raised this issue to Maria Delgado on 9/27/21. Asset Strategy has a temporary workaround in the pole loading database using an algorithm, but the attribute should reside in the Asset Registry.	On Track	12/15/23	Med	175
Asset Registry Systems	M Program (Synchronization Monitoring)	Synchronization for all Distribution and Transmission non-critical attributes. Also includes reporting of variances for critical and non-critical attributes. NOTE: This project compliments #197 focus on synchronization of critical attributes.	On Track	12/12/25	NA	640
Data Quality Remediation Systems of Record	Substation Asset Registry Program	Establish a consolidated Asset Registry for substation assets and equipment in the relevant system. Improve the quality of data and spatial accuracy of substations and substation assets.	On Track	06/20/24	High	35

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
As-Built/Data Ingestion	As-Built Metrics Dashboard	Create As-Built dashboard to show the following: • As-Built cycle time for overall process and sub-processes • As-Built cycle time for overall process and sub-processes for in-flight orders • Impact of errors (CDOCs [Clerical Incomplete Documentation] and IDOCs)	On Track	12/15/23	Med	125
Data Quality Remediation	Distribution WF Primary Structure Manual Conflation	Improve spatial accuracy of Distribution primary poles in EDGIS.	Off Track	12/31/23	High	35
Asset Registry Systems	Distribution/ Transmission Record and Attribute (M2/M3) Sync	Project outcomes: All required M2 features and M3 attributes are synchronized. All required M1 and M2 features and M3 attributes are maintained via weekly programmatic maintenance and updates.	On Track	10/31/23	Med	125
Systems of Record	Wildfire Consequence Rank	Beginning in 2023, the frequency of the detailed OH inspection for distribution structures is now based on asset's wildfire consequence rank which is derived from the Wildfire Distribution Risk Model (WDRM) v3. Distribution Asset Strategy, System Inspection, and Digital Catalyst require the Wildfire Consequence	On Track	11/03/23	High	20

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
		Rank attribute be added to EDGIS for support structures to help inform when to inspect assets next. This data is vital in the success of tracking inspection plans. Currently, with data missing, there is a risk of missing the current commitment date due to inaccurate record status, as well as newly created assets.				
Data Quality Remediation	Map Correction Program	The Map Correction Program is one of PG&E's primary mechanisms to field-validate and improve its asset inventory data. Map corrections are initiated and processed to correct or update the electric asset inventory data through Request for Work (RW) notifications filed by front-line workers, mappers, and other personnel who identify discrepancies between the asset in the field and its representation in PG&E's asset inventory database.	Ongoing	NA	NA	NA
As-Built/Data Ingestion	As-Built Program	The As-Built Program is designed to ensure timely and accurate updates to the Asset Registry for installed, replaced, removed, relocated, and abandoned equipment.	Ongoing	NA	NA	NA

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
Data Management Oversight Data Quality Maturation and Stewardship Metadata Management	Enterprise Data Management Program	Chief data and analytics officer-centralized Enterprise Data Management Program established in 2022. Objectives include establishing enterprise standards, tools, processes, and programs to improve data management practices across functional areas within PG&E and to systematically identify critical data, capture metadata, develop and apply data quality rules, and measure progress in improving data quality.	Ongoing	NA	NA	NA
Data Management Oversight	Electric Data Governance Forum	Monthly forum to operationalize electric data governance to systematically prioritize and effectively address asset data governance issues with involvement from affected stakeholders.	Ongoing	NA	NA	NA
Data Quality Monitoring Data Quality Remediation	Asset Data Quality (ADQ) Program	PG&E instituted this program in 2022 to identify CDEs for electric asset-related data on a risk-prioritized basis, establish BDSs, and define/apply data quality rules to systematically measure the quality of its critical data. The program will be used to identify critical data quality gaps for remediation projects and track progress on those projects.	Ongoing	NA	NA	NA

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
Data Quality Remediation	Distribution Secondary Overhead Type and Trace	Improve secondary tracing and conductor type data in asset inventory database (GIS) for WF areas.	On Track	12/15/23	High	7
Data Quality Remediation	Distribution WF/NWF Idle Facilities Mapping	Correctly identify and assign idle facility status to assets in WF and NWF areas.	On Track	10/31/23	High	50
Data Quality Remediation	Customer-Owned Poles with Mis-Attributed Ownership	Perform desktop review of 1,876 poles identified as having a high likelihood of being mis-attributed as customer-owned when they are PGE-owned. Update ownership in GIS for those confirmed.	Off Track	12/31/23	High	50
Data Quality Remediation	New Pole Installations/Dates Deleted/Reverted by GIS Sync	Address ~800 identified asset inventory support structure records whose GIS installation date records appear to conflict with data gathered by the PT&T team.	Backlog	12/15/23	Med	125
Data Quality Remediation	Distribution Underbuild	Identify ED underbuild structures on PG&E-owned transmission structures and link them in distribution (EDGIS) and transmission (ETGIS) asset inventory databases.	On Track	11/30/23	Med	125
Data Quality Remediation	T-Line Critical Component Asset	Develop capability in asset inventory system (ETGIS) to house new transmission-critical component data	Consolidated	8/31/22	Low	999

Strategy	Project-Based Initiatives	Description	Status	Target Date	Risk	Priority Score
	Registry Enhancements (AIC)	to enable risk analysis and asset management.				
Data Quality Remediation	Transmission AFL Build 2022 (AIC)	Asset feature lists (AFLs) build workstream within the asset information collection multi-year project aims to collect critical component data in NWF areas for transmission assets, build conservative assumption logic where data is unavailable, and inform useful life calculations.	On Track	11/30/23	High	7
Data Quality Remediation	2020 Fire Hardening Rebuild	This project aims to fill data gaps in asset inventory relating to the 2020 fire hardening rebuild.				
Data Quality Remediation	Substation Asset Registry Conflation (Inside Fence)	Data collection effort to improve accuracy of existing asset inventory within substation fence lines.	On Track	06/20/24	High	35
Data Quality Remediation	Paradise Magalia Rebuild	This project aims to fill data gaps in asset inventory relating to the Paradise Magalia rebuild.	At Risk	12/31/23	Med	70

Appendix G – Program Metrics

Table 33. Program Metrics

Program	Metric Description	Target	2023 Result (12/20/23)
Asset Registry Standard Implementation	Physical asset types with defined and managed Asset Registry SORs	100%	TBD
As-Built Program	End-to-end cycle time to map As-Built orders (non-major emergency)	60 days	54
	End-to-end cycle time to map As-Built orders (major emergency)	120 days	113
	Aged orders: Number of remaining aged orders older than 60 days	0 orders	1,785
Map Correction Program	Asset Registry map corrections volume: RW tickets completed per week	Distribution: > 1,000 Transmission: > 65	Distribution: 2,612 Transmission: 106
Asset Data Quality (ADQ) Program	CDEs inventoried with metadata defined, data stewards assigned, and data quality rules applied	800	814
Data Ontology Program	Critical data sets integrated into Palantir Foundry	53	69

Appendix H – Glossary of Acronyms and Abbreviations

The following is a glossary of acronyms and abbreviations used in this AMP and related documents.

Table 34. Acronyms and Abbreviations

Acronym	Meaning
ACI	Area of Continuous Improvement
ADMS	Advanced Distribution Management System
ADQ	Asset Data Quality
AFL	Asset Feature List
AFO	Asset Family Owner
AIC	Asset Information Collection
AKM	Asset Knowledge Management
AMP	Asset Management Plan
ARP	Asset Registry Procedure
ARS	Asset Registry Standard
BDS	Business Data Steward
BI	Business Intelligence
CAISO	California Independent System Operator
CAP	Corrective Action Plan
CC&B	Customer Care and Billing
CDE	Critical Data Element
CDOC	Clerical Incomplete Documentation
COE	Critical Operating Equipment
CPUC	California Public Utilities Commission
D-Line	Distribution Line
DA	Design Authority
DAT	Data Acceptance Testing
DGF	Data Governance Forum
DMS	Distribution Management System
DU-Line	Distribution Underground Line
EAM	Electric Asset Management
EC	Electric Corrective
ED	Electric Distribution
EDGIS	Electric Distribution Graphical Information System
EDM	Enterprise Data Management
EDRS	Electronic Document Routing System
EFD	Early Fault Detection
EO	Electric Operations
EOC	Emergency Operations Center
EORM	Enterprise Operational Risk Management
EPSS	Enhanced Powerline Safety Settings

Acronym	Meaning
ERIM	Enterprise Records and Information Management
ET	Electric Transmission
ETGIS	Electric Transmission Graphical Information System
FDA	Facility Damage Action
FDC	Front Door Council
FERC	Federal Energy Regulatory Commission
FMEA	Failure Mode Effects Analysis
GD	Gas Distribution
GIS	Graphical Information System
GRC	General Rate Case
HFRA	High Fire Risk Area
HFTD	High Fire Threat District
IDOC	Incomplete Documentation
IFSS	Integrated Factors for System Safety
IGC	Initiation Gating Committee
IGP	Integrated Grid Planning
ISO	International Standards Organization
IT	Information Technology
KPI	Key Performance Indicator
LiDAR	Light Detection and Ranging
LB	Landbase
LC	Line Corrective
MAVF	Multi-Attribute Value Function
MDM	Master Data Management
MVP	Minimum Viable Product
NERC	North American Electric Reliability Corporation
NWF	Non-Wildfire
OEC	Operations Emergency Center
OEIS	Office of Energy Infrastructure Safety
OH	Overhead
PAS	Publicly Available Specification
PG&E	Pacific Gas and Electric
PM	Program Manager
PMO	Program Management Office
POC	Proof of Concept
PSPS	Public Safety Power Shutoff

Acronym	Meaning
PT&T	Pole Test and Treat
QA	Quality Assurance
QC	Quality Control
QMT&P	Quality Management Technology and Projects
QRP	Quality Review Program
R&Rs	Roles and Responsibilities
RW	Request for Work
S-MAP	Safety Model Assessment Proceeding
SAMP	Strategic Asset Management Plan
SAP	Systems, Applications, and Products in Data Processing
SCADA	Supervisory Control and Data Acquisition
SME	Subject Matter Expert
SOE	System of Entry
SOR	System of Record
SUBGIS	Substation Geographic Information System

Acronym	Meaning
T-Line	Transmission Line
TIL	Technical Information Library
TO	Transmission Operations
TU-Line	Transmission Underground Line
UG	Underground
UN	Utility Network
UTVACC	Unambiguous, Traceable, Verifiable, Accurate, Complete, and Compliant
WDRM	Wildfire Distribution Risk Model
WF	Wildfire
WFD	Wildfire Division
WMP	Wildfire Mitigation Plan
WRO	Work at the Request of Others
WSD	Wildfire Safety Division
WSIP	Wildfire Safety Inspection Program
YOY	Year-Over-Year

Appendix I – Change Log

Table 35 below summarizes changes to the publications of this document.

Table 35. Data Asset Management Plan Change Log

Year	Section	Change	Reason for Change	Implication of Change
2023	Entire document	Complete rewrite.	Improve readability, understandability, and alignment with PAS 55/ ISO 55001/data management approach; improve consistency in strategic and programmatic terminology.	Revised strategy and improved alignment of strategies/strategic objectives to programs/ program objectives and program owners. Alignment allows traceability from strategic objectives to program objectives and ownership.
2022	Entire document	Complete rewrite.	Improve readability, understandability, and alignment with PAS 55/ ISO 55001/data management approach.	Revised strategy and improved alignment.
2021	Entire document	Complete rewrite.	Improve readability, understandability, and alignment with PAS 55/ ISO 55001/data management approach.	Revised strategy and improved alignment.
2020	Entire document	Refresh for strategy yearly.	Yearly Asset Management Plan.	Updated strategy annually.
	1.1 Safety and Risks	Renamed to “Safety and Risk.”	Provide emphasis on safety in addition to risk.	Greater awareness of safety focus.
	1.2 Performance	Added data quality dashboard image and graphics for locational accuracy.	Improve view of data quality monitoring.	Greater awareness of data quality status.
	2.2 Asset Types	Added data condition overview to Asset Type table.	Provide detailed information on data condition at the asset type level.	Provides the ability to understand data issues for various asset types.
	2.3.4 Compliance Requirements	Added information on Wildfire Safety Inspection Program (WSIP).	Show relationship between WSIP activities and asset information.	Greater awareness of inter-dependencies.

Year	Section	Change	Reason for Change	Implication of Change
	2.3.5 Asset Management Data Requirements	Expanded information on EO asset family data requirements.	Provide a detailed view of the current data requirements for each asset family.	Improves awareness of asset information data needs of the asset families.
	3.1 Safety Overview	Added Safety Overview section to discuss any safety incidents and PSPS support and challenges.	Expand the discussion of safety issues and challenges.	Greater awareness of the role asset information has in safety incidents and supporting PSPS events.
	4. Desired State, Asset Objectives, Programs, and Risk Mitigations	Added project information to the Asset Objective table.	Provide a clear tie between the objectives and projects/programs focused on achieving the stated objectives.	Greater alignment between objectives and projects/programs.
2019	Entire document	New document.		