SECTION 01 40 00 – QUALITY REQUIREMENTS

1.01 GENERAL:

A. [A16]This Section contains the details referred to in Sub-Clause 4.9 (*Quality Assurance*) of the Conditions of Contract and defines the responsibilities of the Contractor in the management of quality in the design and construction of the Works. The Contractor shall be solely responsible for the quality of all aspects of the Works. [A16]

B. [A16]**Quality-Management System (QMS)**: The Contractor shall develop, establish, implement, and maintain a comprehensive and effective QMS to ensure that the Works comply with the Contract. [A16]

1. [A16]The QMS shall consist of plans, procedures, resources, and the organization necessary to ensure adequate quality planning, assurance, and control as well as ensure the quality of materials, equipment, workmanship, construction, fabrication, and operations covering both on-Site and off-Site work by the Contractor, including any Subcontractors. [A16] The QMS shall be compliant with the requirements of the quality-assurance methodology specified by International Organization for Standardization (ISO) 9001-2000.

2. **Training**: The QMS shall also include training for personnel performing activities that affect and ensure quality.

3. **Quality Manual**: The Contractor shall prepare a quality manual that documents the concepts, plans, procedures, organization, training, and all other requirements of the QMS.

1.02 REFERENCE STANDARDS:

A. The Contractor shall adhere to and be compliant with the following ISO standards. Although it is not mandatory that the Contractor be ISO 9001 certified, it is expected that the QMS dovetail and interface seamlessly with the Employer's ISO 9001 compliant processes.

IS0 9000-05	Quality management systems - Fundamentals and vocabulary
IS0 9001-00	Quality management systems - Requirements
IS0 9004-00	Quality management systems - Guidelines for performance improvements
IS0 10005-05	Quality management systems - Guidelines for quality plans
ISO 10007-03	Quality management systems - Guidelines for configuration management
IS0 19011-02	Guidelines for quality and/or environmental management systems auditing

IS0 10012-03	Measurement management systems - Requirements for measurement processes and measuring equipment
IS0 10013-01	Guidelines for quality management system documentation
ISO / IEC 17025-05	General requirements for the competence of testing and calibration laboratories

B. It is required that the Contractor adhere to the project quality-management guideline and best practices developed by the Project Management Institute and adopted by the American National Standard Institute in the reference ANSI-PMI 99-001-2004 as depicted in the Project Management Body of Knowledge (PMBOK). These standard guidelines are incorporated herein as part of the Contractor's quality management requirements.

C. The Contractor shall adhere to and be compliant with the following American Society for Testing and Materials (ASTM) International standard:

E-329–08	Specification for Agencies Engaged in Construction Inspection and/or Testing

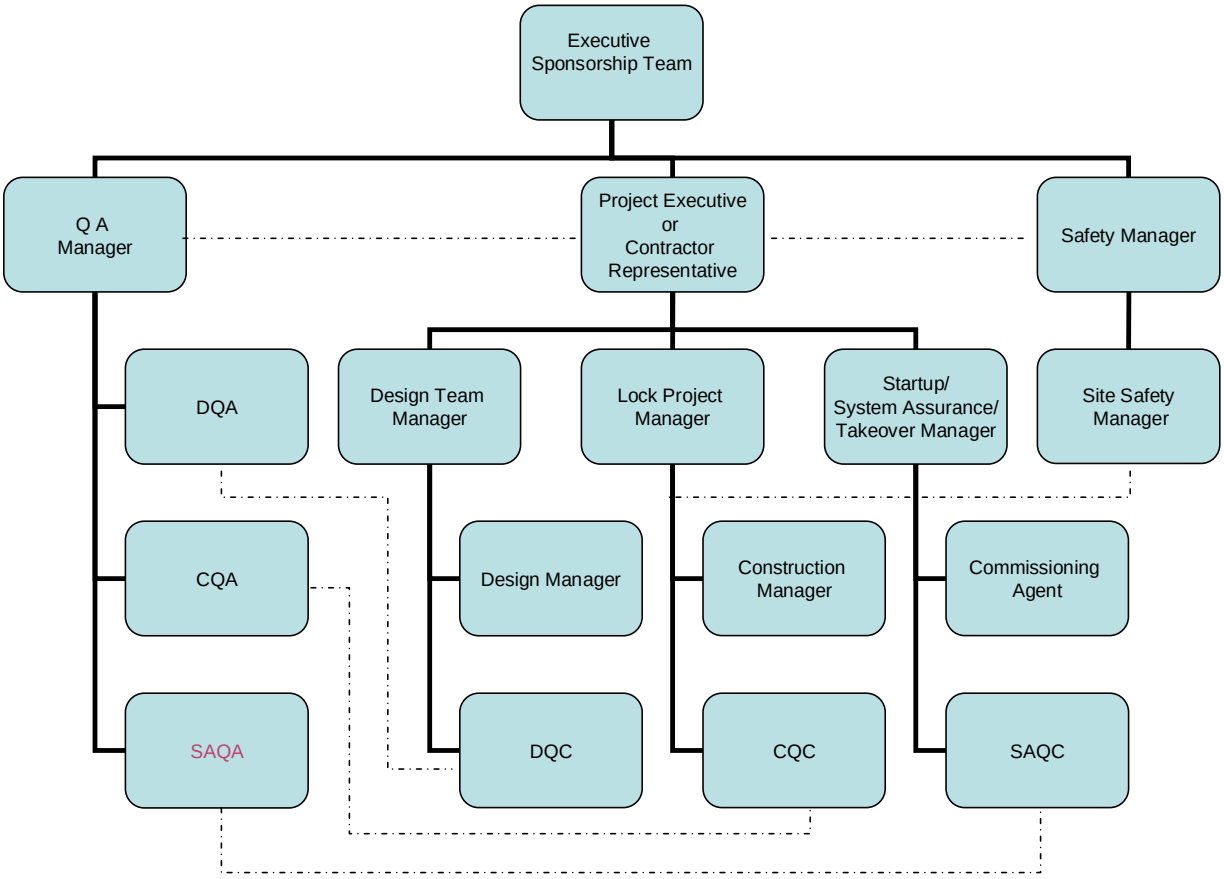
D. The Contractor shall identify in the QMS the additional standards to which he will adhere in order to comply with the Contract.

1.03 QUALITY MANAGEMENT ROLES AND RESPONSIBILITIES: The Contractor shall be the only responsible party for the quality of the Works. [A17]Quality shall be monitored by a combination of quality-planning, Quality Assurance (QA,) and Quality Control (QC) processes and activities, as well as by inspection, verification, checks, surveillance, and audit to be performed by the Contractor and verified by the Employer's Representative and independent assurance consultants that may be hired by the Employer. It is understood that these processes and quality-ensuring activities may use similar techniques and tools and there may be overlap between the Employer's team and the Contractor's design-build team.[A17]

A. [A16]**Organization and Role of the Contractor with Respect to Quality**: The Contractor shall organize the Contract structure in such a way that the quality-planning, QA, and QC functions are structurally separate and independent from the functions responsible for performing the Works subject to the quality surveillance. Managers responsible for quality planning, assurance, and control shall be peers to, or be hierarchically above, the managers responsible for the design and construction of the Works. The Contractor's construction organization executing the Works will perform the QC for the construction, and the Contractor's design team manager will be responsible for QC of the design and for monitoring and verifying the QA of the construction. [A17]It is specifically required that the QA function be performed by the Contractor's design organization in an independent, autonomous, and unencumbered way from the team tasked with managing and executing the construction portion of the Works (see structural diagram). The Employer's team will perform quality audits during the design and confirm compliance to the Conditions of the Contract and will conduct audits and spot inspections of the construction.[A17] It shall be the responsibility of the Contractor to monitor the Works to determine if they comply

with relevant quality standards and to identify ways to eliminate causes of unsatisfactory performance and non-conformances. The Contractor shall set process and monitoring standards, including appraisals and inspections. [A16]

Contractor QA/QC Organization



B. **Responsibilities and Role of the QA Manager**: [A17]The Contractor's QA manager shall report directly to the top-level executives in the Contractor's organization and shall be responsible for developing and managing QA and QC programs.[A17] The QA manager shall coordinate, manage, and supervise the Works quality-planning activities of the subordinate QA managers who are responsible for design, construction, and start-up/systems assurance. Each subordinate QA manager shall, in turn, coordinate with the corresponding QC manager to ensure compatibility between QA and QC functions. The overall QA manager shall establish the policy and procedures to be followed in the management of the construction QC function. The QA manager shall have effective authority, autonomy, and organizational independence to stop any and all non-compliant work that does not meet the standards, specifications, or performance or safety criteria established for the Works. [A9]The Contractor's QA manager shall work closely with the Employer's QA manager to ensure quality procedures, reports, records, and issues are properly addressed and implemented.[A9]

1. The QA manager shall have the following responsibilities.

   a. Quality planning for the Works and developing, implementing, and keeping up to date the quality management plan and forms, which shall include a quality baseline. [A16]Reviewing and approving all Contractors' QMS documents, quality plans and quality-document submittals before they are submitted to the Employer's Representative. [A16]

   b. [A16]Planning and implementing QA, QC, and inspection training and certification for all Contractor's Personnel. [A16]

   c. Managing and conducting audits on the Contractor's implementation of the QMS, including audits, checks, and surveys of key design sections and disciplines as well as construction to verify that work is being performed in conformance with the quality management plan.

   d. Developing roles, responsibilities, staff function, and qualification matrix for all QA and QC personnel.

   e. Auditing submittals and signing off on certificates of compliance.

   f. Maintaining quality records and archives.

   g. Instituting and implementing a quality awards program to recognize outstanding contributions to the success of the quality management program.

2. The QA manager shall have the combined knowledge, certifications, training, qualifications and experience necessary to execute the quality management functions. This shall include a minimum of 15 years of experience in design and construction QC and QA, with at least 10 of these years in a high-level quality-management function on projects with an annual construction value exceeding 100 million USD. The person shall have certification of successful completion of an IRCA (International Association of Certified Auditors) or equivalent training course for lead assessors or auditors.

3. This is a full-time position; no other duties other than QA shall be assigned.

4. [A17]The Contractor shall ensure that the proposed QA manager is the same person proposed in the Contractor's Technical Proposal. If the person changes, the Contractor shall, within 30 days of the Commencement Date, submit, for the review and approval of the Employer's Representative, the experience and qualifications of the newly proposed QA manager.[A17]

C. **Responsibilities of the Design Team Manager with Respect to Quality**: The Contractor's design team manager shall be responsible for managing and executing the design process. [A16]In addition, he shall be specifically and distinctly responsible for monitoring and verifying the QA of the construction of the Works, including quality auditing, inspecting, and testing the critical and key elements of the Works to ensure they

conform to the Contract. The QA program shall be guided by a trust-but-verify policy in which QA personnel will work in a collaborative, non-confrontational, results-oriented manner with the QC personnel. For the QA role, the design team manager shall put the objectives of the Contract and the Employer's Requirements first. The extent of the QA construction audits may range from occasional Site visits to full-time on-Site observation, inspection, and surveillance of every construction element, depending on its criticality to the overall performance of the Works. Audits and inspections shall determine if the Contractor is conforming not only to requirements of the drawings, plans, design, and specifications, but also to applicable generally recognized and specified standards, codes, guidelines and the requirements of the Contract. [A16] [A9]The design team manager's QA effort during construction shall include[A9] planned and systematic quality activities, including inspection, surveillance, and testing to ensure that processes needed to meet requirements are applied during the construction of the Works and that all systems and components will perform satisfactorily in service. The primary QA concerns of the design team manager shall be compliance, non-conformance prevention, and continuous-improvement processes. He shall actively participate in formal Contract-required partnering activities, recognize and respond to risk event triggers, and monitor construction activity via periodic inspections. As a minimum, the design team manager shall have the following specific quality planning and control responsibilities over the design.

1. Provide adequate and sufficient qualified staff and resources needed to execute quality work and quality planning and control activities.

2. [A17]Structure and organize the interface between the Employer's team and the Contractor's design team, enabling the QA activities of the Employer's team within the design process[A17].

3. Monitor quality through communication with design staff and discussions with the designated design QC managers.

4. Review deliverable documents periodically.

5 [A17]Promote peer and technology expert reviews of the design and specifications and facilitate Over-the-Shoulder Reviews of the design by the Employer's team.[A17]

6. Establish clear lines of communication and responsibilities.

7. [A16]Prepare instructions and the work plan. [A16]

8. Implement resolution process when there are technical disagreements between the design manager and those who check and review documents.

9. [A17]Participate in coordination meetings with the Employer's Representative, Employer's subconsultants, stakeholders, and others as required.[A17]

D. **Responsibilities of the Design Quality Control Manager (DQCM)**: The DQCM shall report directly to the design team manager and be responsible for design quality planning, as well as for developing and implementing the design QC program and verifying compliance with that program. [A16]The DQCM shall have effective authority,

management backing, and complete independence to stop any and all non-compliant design work that does not meet the standards, specifications, or performance and safety criteria required by the Contract for the Works. [A16]

1. The responsibilities of the DQCM shall include the following.

    a. Develop, update, and implement the design QC plan and develop and implement quality metrics.

    b. Manage the structure of and organize the inspection and QC personnel.

    c. Develop, document, implement, and update procedures for checking calculations, design inputs, design program and criteria, plans, drawings, models, specifications, and reports. Maintain a record of internal QC activities and submit a monthly progress report to summarize internal design QC activities.

    d. Develop and implement a color-coded review process, methodology and checklists for verifying and reviewing plans and specifications.

    e. Track non-conformities and identify and implement remedial actions to correct them. Issue non-conformance reports. Keep a design non-conformance log and a list of outstanding non-conformances of recurrent or repetitive errors.

    f. [A17]Review work performed by each Subcontractor which carries out any design of the Works[A17]

    g. Review and issue field design changes.

    h. [A16]Coordinate design inspections, checks, peer reviews, and facilitate Over-the-Shoulder Reviews with the Employer's Quality Verification Team. [A16]

    i. [A9]Circulate requests for comments (RFCs),[A9] releases of plans, specifications, reports, and other construction documents. Distribute the signed and sealed design documents for construction.

    j. Review and verify the accuracy and completeness of as-built drawings and specifications as part of the Works close-out and acceptance process.

    k. Participate in the Works commissioning process to review any design changes that are made as a result of commissioning activities.

2. This shall be a full-time position; no other duties other than QC for design shall be assigned.

E. **Responsibilities of the Construction Quality Assurance Manager (CQAM)**: The CQAM shall report directly to the QA manager. The CQAM shall maintain constant contact with the design team manager to ensure that design intent constitutes the foundation for construction QA efforts. The CQAM shall be responsible for construction quality planning, as well as for developing and implementing the construction QA

program and verifying compliance with that program. [A16]He shall have effective authority, management backing, and complete independence to stop any and all non-compliant construction work that does not meet the standards, specifications, or performance and safety criteria required by the Contract for the Works. [A16]

1. The CQAM shall have the following responsibilities.

   a. Develop, implement, and manage the construction QA plan and QA metrics.

   b. Verify and ascertain that the construction QC plan is updated and executed as planned.

   c. Cooperate, [A9]and collaborate with Employer's Representative,[A9] in the development of strategies to correct quality issues.

   d. Prior to start of each construction phase, meet with inspectors, [A9]surveyors and Employer's QA staff[A9] to review QC requirements for each component of the Works.

   e. Manage, structure, and organize all inspection and QA personnel.

   f. [A16]Be at the relevant part of the Sites during key construction activities and be available within 2 hours on the Pacific lock-construction site and within 4 hours on the Atlantic lock-construction site after being notified of the need to report in person to review a QA problem regarding any work. [A16]

   g. Oversee QA testing, laboratory equipment calibration, and inspection. Coordinate and schedule resources to provide appropriate QA inspection and testing for all construction efforts on a daily and weekly basis.

   h. Plan and implement relevant training for the Contractor's Personnel, monitoring skill levels in the work force and taking actions to remedy any shortfall in skilled labor.

   i. Monitor and spot check staking data. Audit field surveying activities by verification of actual surveying points. At established check points, certify that survey data has been located, checked, and verified.

   j. Make sure QA procedures are in place by issuing timely communications, conducting pre-activity meetings, and performing daily on-Site reviews.

   k. Make sure that all QC inspectors and support staff have appropriate skills and current certifications for the types of construction activities they will be overseeing.

   l. Manage the QC documents and records of the Works. Maintain a record of internal QC activities and submit a monthly progress report to summarize internal design QC activities. Prepare and update

construction QA forms and schedules.

m. [A17]Verify that all sampling and testing personnel have the appropriate skills and knowledge as well as certifications for the types of Materials they will be testing.[A17] Make sure that all material testing laboratories and their personnel are certified and that their equipment calibration and testing processes are up-to date.

n. Develop and implement a continuous-improvement process.

o. [A17](Reserved)[A17]

p. Review and check as-built drawings, falsework drawings, shop drawings and any other special drawings and specification documents and submit them to the DQCM for verification.

q. Maintain inspection information on utility and infrastructure relocation.

r. Develop and maintain a list of laboratory equipment available, recent calibration data, and dates of inspection. Perform tests on key materials and components within the laboratory or field environment and in accordance with applicable procedures.

s. Identify quality triggers and schedule quality check points, witness points, and milestones.

t. Provide monthly certificates of compliance of construction and materials for conformance with design requirements.

u. [A17]Coordinate with the Employer's Representative and independent assurance consultants on verification, testing, auditing, and inspection requirements.[A17]

v. Participate in the commissioning phase to act on all pending quality issues and non-conformances.

2. This shall be a full-time position; no other duties other than construction QA shall be assigned.

F. **Responsibilities of the Construction Quality Control Manager (CQCM)**: The CQCM shall report directly to both the Atlantic and Pacific lock project managers and shall be responsible for the QC of the construction of the Works. The CQCM shall have effective authority, management backing, and complete independence to stop any and all non-compliant construction work that does not meet the standards, specifications, or performance and safety criteria established for the Works.

1. Responsibilities of the CQCM shall include the following.

a. Develop, implement, and manage the construction QC plan and QC metrics.

b. [A16]Develop QC activity input to the Accepted Baseline Programme. [A16]

c. [A16]Manage, structure, schedule, and organize the inspection, testing and QC personnel and manage the inspection of all the Works during construction.[A16]

d. [A16]Be on the relevant parts of the Sites during key construction activities and be available within 2 hours on the Pacific-side lock construction site or within 4 hours on the Atlantic-side lock construction site after being notified of the need to report in person to review a QC problem regarding any work.[A16]

e. Manage sample taking and QC testing, laboratory-equipment calibration, and inspection. Coordinate and schedule resources to provide appropriate QC inspection and testing for all construction efforts on a daily and weekly basis.

f. Plan and implement relevant training for the Contractor's QC staff and key construction personnel. Monitor skill levels in the work force and take actions to remedy any shortfalls in skilled labor. Make sure all QC inspectors and support staffs have appropriate skills and current certifications for the type of construction activities they will be checking.

g. Make sure QC procedures are in place by issuing timely communications, conducting pre-activity meetings, and performing daily on-Site reviews.

h. [A17]Verify that all sampling and testing personnel have the appropriate skills and knowledge as well as certifications for the types of Materials they will be testing.[A17] Make sure that all material-testing laboratories and their personnel are certified and their equipment-calibration and testing processes are up-to date.

i. Maintain a non-conformity report (NCR) log.

j. Maintain a daily occurrence and inspection log.

k. [A17](Reserved)[A17]

l. Maintain inspection information on utility and infrastructure relocation.

m. Identify quality risk triggers and schedule quality hold points, witness points, and milestones.

n. Coordinate with the Employer and independent assurance consultants on verification, testing, auditing, and inspection requirements.

2. This shall be a full-time position, with no other duties besides construction QC.

[A13]G. **Responsibilities of the Systems Assurance Quality Assurance Manager (SAQAM)**: The SAQAM shall be responsible for managing and executing the systems assurance process as described in Paragraph 1.08. The systems assurance QA program shall include the performance of audits and reviews to ensure that all requirements of the

systems assurance activities are met. These include systems safety; ergonomic studies; reliability, availability and maintainability (RAM) activities; and preparation of all supporting documentation.

1. At a minimum the SAQAM shall have the following specific quality responsibilities over systems assurance:

   a. Provide adequate and sufficient qualified staff and resources needed to execute quality verification of the systems assurance activities;

   b. Interface both with QC and the Employer to ensure the adequacy of the systems safety plan, the scope and purpose of the RAM plan, fire protection plan and interface between the systems safety plan and RAM plan;

   c. Establish clear lines of communications and responsibilities;

   d. Participate in the systems assurance review meetings;

   e. [A16]Conduct audits of the systems assurance elements including activities required by Subcontractors; [A16]

   f. Prepare and submit a report at the end of each stage of the programme to cover the items listed in Subparagraphs 1.08 G. and H.

2. This is a full time position; no other duties shall be assigned.

H. **Responsibilities of the Systems Assurance Quality Control Manager (SAQCM)**: The SAQCM shall report to Startup/System Assurance/Takeover Manager and administratively to the SAQAM. The SAQCM shall be responsible for the QC of systems assurance activities as well as processes related to startup and takeover.

1. Responsibilities of the SAQCM shall include the following:

   a. [A16]Perform reviews of the design to ensure that the requirements for safety, reliability and maintainability for the Works are adequately considered; [A16]

   b. Review and approve the systems assurance plan and all associated plans, reports, and documentation;

   c. Participate in the systems assurance review meetings. Detail any new hazards and/or risks that may require revision to the systems assurance plan;

   d. [A16]Monitor the performance of each Subcontractor on a regular basis to ensure compliance with systems assurance activities identified in the systems assurance plan. [A16]

2. This is a full time position; no other duties shall be assigned. [A13]

I. **Works-Verification Inspectors**: The Contractor shall assign Works-verification inspectors who are responsible to the CQC manager and knowledgeable in design, construction, and QC procedures. [A17]They shall, through the QMS, control the quality of Materials and workmanship and ensure and verify that the Works are designed to perform as required and are constructed as designed.[A17] [A16]They shall also ensure that any proposed deviations from the design (which are not Variations) are approved, recorded, and subsequently incorporated into the design. [A16]

J. [A16]**Responsibilities of the Employer Quality-Verification Team**: The Employer will do compliance reviews, verifications, spot and regular inspections and testing of the Works, as well as auditing the QA [A13]and QC systems [A13] and performing QA on the Contractor's QMS and processes. [A17]The Employer will also perform Over-The-Shoulder Review.[A17A16]

1.04 REQUIREMENTS:

A. **Quality Management Fundamental Principles**: The following are the fundamental principles that the Contractor shall adhere to and implement with respect to the management of quality.

1. The quality of the Works, including the design and the management systems necessary to bring the Works into effect, shall be managed, controlled, and assured through the design and implementation of the QMS.

2. [A16]The QMS shall apply to the Contractor, Subcontractors and all other entities associated with the design and construction of the Works. [A16]

3. The QMS shall be in accordance and compliant with IS0 9001:2000 (or such later version as may apply on the Base Date) and in accordance with principles of the IS0 9000 series of international standards. It is to provide full documentary evidence that the Works comply with the Contract.

4. [A16]While it is not mandatory that the Contractor be or become accredited or certified for his project systems, it is mandatory that the Contractor's QMS be based on systems and procedures proven to be effective on projects of a similar nature, size, and complexity to the Works. [A16]

B. **The QMS shall**:

1. [A16]Establish quality policies, identifying how the quality of the Works is to be ensured and the key processes to meet the Employer Requirements and the Contract. [A16]

2. Establish the order, sequence, and precedence of processes.

3. Establish how to control processes.

4. Identify, budget for, and make resources available.

5. Measure and monitor the processes and document all procedures in a timely manner. Inspection reports and notices of non-conformance will be available by the morning of the next business day. Materials testing reports will be available promptly upon receipt from the corresponding testing laboratory.

6. [A16]Identify, manage, and assure the quality of the work of all Subcontractors.[A16]

7. [A16]Address management of the Works, identifying how to achieve the objectives of Contractor-Employer relationship management while satisfying the quality requirements of the Contract.[A16]

8. Identify what quality standards, conventions, references, and metrics are appropriate to the Works and how they will be used to monitor and follow-up on key quality success factors and quality risk triggers.

9. Identify how changes to the manner in which the Works are to be designed, executed, and completed are to be assessed, documented, recorded, archived, monitored, and controlled.

10. [A17]Develop the Works quality charter to reflect management commitment to quality.[A17]

11. Identify the quality management organization, including, team composition, lines of responsibility, authority, and communication.

C. **Project Management Plan (PMP)**: The Contractor shall develop a PMP [A9]as required in Section 01 31 00 (*Project Management and Coordination*)[A9] and multiple quality plans. The PMP and the quality plans shall be the operative instruments for planning, implementation, and controlling performance of the QMS requirements. The PMP is required to address all of the Contractor's management activities. Quality plans are specifically required to address QMS requirements relevant to all key activities with potential impact on the quality, safety, and performance of the Works. The PMP shall include a detailed quality management plan to describe the policies that will be followed in the development of all quality plans.

D. **Commissioning and Taking Over**: The Contractor shall ensure that all aspects of commissioning and taking over are in accordance with and coordinated with the QMS. [A17]See Sections 01 77 00 (*Taking-Over Procedures*) and 01 91 00 (*Tests on Completion and Tests after Completion*) for more information on these activities.[A17]

E. [A16]**Audits**: All of the activities of the Contractor, Subcontractors on Site or off Site, shall be subject to internal and external audits until the taking over of the whole of the Works.[A16] Such audits will be in accordance with a comprehensive audit program. [A17]Deficiencies in management procedures and the control of the quality of the Works, and associated work, shall be addressed by the Contractor through the prompt implementation of a corrective action process to eliminate the root cause of the deficiency and to reduce the possibility that similar deficiencies will re-occur. The corrective action

process shall provide full documentation and shall include a follow-up at a later date to verify that the process has been effective.[A17]

G. **Employer Auditing**:

1. [A16]Employer auditing may include monitoring the Contractor's adherence to the QMS documentation and the IS0 standards by review, surveillance, checking, inspection, and quality system audits of the Contractor's activities and those of Subcontractors. The Employer's monitoring of the Contractor's performance may further include reviews of the Contractor's documentation and records of achieved quality, as well as random sampling and testing. The Employer shall have access to all of the Contractor's audits and quality documents. [A16]

2. [A17]The Employer shall have the right to audit and the right to whatever access is needed to audit QMS documents at any time during working hours. In relation to the Conditions of Contract Sub-Clause 7.3 (*Inspection*), this shall include the Employer's access to facilities and places on Site or off Site and the provision of such documents and procedures as are necessary for the effective review of the QMS elements +concerned both before and during the Employer's visits.[A17]

H. **Quality Document Schedules**: These comprise all activities key to the quality and performance of the Works and the required QMS documentation related to them. [A16]The schedules shall identify the dates when the Contractor needs to have documents issued and available for the activities or task concerned in accordance with the Accepted Baseline Programme. [A16]

1. [A16]Specific quality plans shall be identified for the main activities and for all those activities and tasks that have relevant or potential impact on quality or on performance and progress of the Works. [A16] Quality document schedules shall be updated as inspection and test plans, procedures, and forms are being developed to meet requirements.

2. [A16]The Employer will identify from the quality document schedules the appropriate category of the documentation. [A16] These schedules shall incorporate columns for indicating Employer decisions and shall be updated regularly to reflect changes and to monitor the status of the documents concerned.

I. **Specific Quality Plans**: Specific management plans and quality plans shall be identified and detailed within the QMS for the activities and tasks, and these shall be listed in the quality document schedules. The schedules should be identified in accordance with the different types of plans identified in the Employers Requirements, as follows:

1. Management.
2. Procurement.
3. Budgeting.
4. Communications.
5. Risk.

6. Design.
7. Manufacture.
8. Construction.
9. Testing and verification.
10. [A16]Completion.[A16]
11. Demonstration and training.
12. [A17](Reserved)[A17]

J. **Quality Management Section of the Monthly Report**: The Contractor's monthly report to the Employer, required in accordance with Section 01 31 00 (*Project Management and Coordination*), shall include a section on quality management, which shall incorporate, as a minimum, the following topics. (Not all topics listed are required every month.)

1. A summary of the status of quality document schedules. This shall include the status at the end of the last period, with comments on progress, and the items anticipated during the next period.
2. Employer interface and satisfaction status for interested parties, including status of issues subject to Employer review and approval.
3. Analysis of product conformity, including a summary of inspection and test activities, results for the month, acceptability of results with reference to NCRs, and analysis of any trends.
4. Analysis of conformity with performance objectives, including a summary of outstanding issues relating to the Contractor's QMS.
5. [A17]A summary of non-conformances identified and corrected during the reporting period, outstanding non-conformances, and a description and status of the implemented corrective action processes.[A17]
6. The status of improvement initiatives.
7. The update of the Contractor's quality audit programme and status of audits.
8. The status of management review meetings.
9. Changes in key quality management personnel, independent quality testing firms, or approved quality plans, if any.

K. **Progress meeting reports**: In the regular progress meetings with the Employer, the Contractor shall report the status of the previous items as appropriate and discuss any quality issues causing problems in order to agree on preventive or remedial measures.

1.05 QMS and IS0 9001:

A. Since the Contractor's QMS must be compliant with ISO 9001, this paragraph is structured to reflect the main IS0 9001 requirements and to link them with the Employer's Requirements.

B. **Scope**:

1. ISO 9001 requirements shall be specifically adapted to the Works.

2. [A17]The QMS shall cover the quality aspects of all work performed, including design, Materials, components and Plant supplied, and services rendered. It shall extend to Temporary Works and Materials that may influence the acceptability of the Permanent Works or that may influence major risks as identified during risk assessment.[A17]

C. **Terms and Definitions**: The terminology of the Contract and the IS0 9000 series of standards differ, and the Contractor shall note that the following interpretations of the standards are applicable.

1. Organization: The Contractor.
2. Customer: The Employer.
3. [A17]Supplier: Subcontractors[A17]
4. Product: [A17]The Works, including design, Materials, and services.[A17]

D. **QMS Documents**:

1. **Description**: QMS documentation and the documentation required under Sub-Clause 5.2 (*Contractor's Documents*) of the Conditions of Contract are identified and described in the relevant parts of these requirements. [A9]All submittals shall comply with Sections 01 33 00 (*Submittal Procedures*) and 01 32 00 (*Project Communications and Document Management*).[A9]

2. **Document Control**:

a. All documents and revisions of documents shall be checked, reviewed, and approved by the Contractor to ensure conformity with the requirements of the Contract before they are submitted to the Employer. The Contractor's checks and approvals shall be documented and recorded and the review/approval status marked in a suitable manner on the document concerned.

b. The Contractor's document-control system shall include registers indicating the current revision and status of the documents with regard to checks, reviews, and approvals by the Contractor and by the Employer.

c. All revisions of documents shall be identified by a revision index and date. The changes shall be clearly indicated in the revised document by symbols, dashes, clouds, shading, or similar markings.

d. The Contractor shall implement and maintain the document formats, numbering, and coding systems approved by the Employer. The

Contractor shall clarify these requirements with the Employer as soon as practicable after the Commencement Date.

e. [A16]The Contractor shall check and ensure that Subcontractors' documents comply with these requirements prior to submission to the Employer.[A16]

f. The Employer reserves the right to reject documents that are incorrectly coded and/or numbered, without reviewing the contents. Time lost because of such rejection shall not be accepted as a basis for claiming delay or extra cost.

3. **Control of Records**: [A9]The Contractor [A13]shall[A13] manage all records in accordance with Section 01 32 00 (*Project Communications and Document Management*)[A9] and shall comply with the requirements stated later in this Section under 1.06 B.

E. **Management Responsibility**:

1. **Management Commitment**: The Contractor's implementation of his quality policies and quality charter shall be publicized, and the Contractor shall ensure that all personnel are conversant with the policies, charter, and QMS.

2. **Customer Focus**: The Contractor's top management shall ensure that feedback is obtained from the Employer on performance and satisfaction and that any Employer complaints are satisfactorily addressed.

3. **Quality Policies**: Quality policies and objectives shall be documented in the Contractor's PMP.

4. **Planning**: The Contractor shall divide the Works into a number of distinct tasks defined as main activities. Main activities will encompass both the Permanent Works and major Temporary Works. Quality plans shall be required for each main activity and shall be the Contractor's operative instruments for planning the QMS requirements relevant to these activities. The quality document schedules shall be used for planning the requirements for the QMS documentation and submittals.

5. [A16]**Responsibility, Authority, and Communication**: The Contractor shall include organizational diagrams in the quality plans, showing the roles and relations of personnel within the Contractor's organization, together with those of Subcontractors, authorities, and the Employer, as appropriate to ensure that roles and responsibilities are clearly defined.[A16]

6. [A16]**Management Review**: The Accepted Baseline Programme shall include QMS management review meetings to be held at intervals no longer than 6 months.[A16] The Contractor shall not be required to submit the records of such meetings to the Employer, but shall permit the Employer to inspect and review

the records when requested within the scope of Employer's surveillance or audit of the Contractor's QMS.

F. **Resource Management**:

1. **Provision of Resources**: The Contractor shall establish a programme for induction of all Contractor's Personnel to the QMS and provide periodic updates of system requirements to appropriate personnel at key points in the progress of the Works, such as when there are major changes in the phases of the Works or for the commencement of quality-critical activities.

2. **Subcontractors and Suppliers**: [A17]The Contractor's QMS shall include procedures for assessment of Subcontractors, for control and monitoring of Subcontractors, and for verification of supplied products and Subcontractor's work.[A17]

G. **Product Realization**:

1. **Activity Planning**: Detailed processes, verification activities, inspection and testing, acceptance criteria, records, etc., shall be identified in the inspection and test plans and procedures for relevant activities.

2. **Customer-Related Processes**: Administration and communication processes with Employer's Personnel shall be defined in the Contractor's system.

3. **Design and Development**: Design and development processes and planning shall be detailed in the design quality plans and procedures. [A16]These shall include procedures for checking and completing quality assurance prior to submittal to the Employer for approval.[A16]

4. [A16]**Product Verification**: The Contractor shall ensure that the Employer is notified about off-Site verification activities at Subcontractors' premises, as the Employer may want to attend and witness the activities concerned.[A16]

5. **Production and Service Provision**: The Contractor shall document and implement procedures to control the processes for production, including work instructions as necessary. [A17]The Contractor shall review his requirements for identification and traceability of Materials and products and apply appropriate controls to those Materials and products as would normally be expected from an experienced contractor for the type of work concerned.[A17] In particular, concrete and steel products require traceability in accordance with construction industry standards so that end-product conformance can be verified by earlier material testing.

6. **Control of Monitoring and Measuring Devices**: The Contractor shall ensure that he has calibration schedules for all monitoring and measuring equipment and maintains records of their calibration status.

7. [A16]**Configuration Management**: Configuration-management processes and controls shall be applied to appropriate systems and products and shall be consistent with the Employer's Requirements for systems assurance and for QA of the Works. [A16]

   a. For configuration-management requirements, the Contractor shall refer to ISO 10007.

   b. [A16]Controls shall include identification, documentation, change management, status accounting, and configuration auditing. [A16]

8. **Interface Management and Coordination**: The Contractor shall identify external interfaces requiring communication and coordination with third parties and internal interfaces requiring communications and coordination with all groups of the Contractor's Personnel. [A17]The Contractor shall incorporate an interface management and coordination narrative, which shall address both internal and external interfaces, into the project management plan in accordance with Section 01 31 00 (*Project Management and Coordination*).[A17] Applicable procedures for dealing with these interfaces and management of the coordination processes shall be established and maintained.

9. **Permits, Licenses, and Statutory Provisions**: The Contractor shall establish and maintain procedures and time schedules for his dealings with authorities regarding permits and licenses for which he is responsible. Such procedures shall include a requirement that copies of correspondence, minutes of meetings, and other documents relating to the Contractor's permits and licenses are to be sent to the Employer without delay when so requested. The Contractor shall establish and maintain procedures for identifying and implementing provisions contained in approvals, excavation clearances, permits, and licenses. These procedures shall describe how the Contractor will ensure that the provisions are adhered to during the design, execution, and completion of the Works.

H. **Measurement, Analysis and Improvement**:

1. The Contractor shall plan and implement processes for monitoring and analyzing the performance of the QMS, product conformity, and customer satisfaction and shall comply with the specific requirements stated later in this Section.

2. The Contractor shall identify actions for improvement based on the monitoring and analysis of performance and shall implement those actions.

1.06 QMS DOCUMENTATION:

A. [A16]This paragraph and its subordinate items identify the Employer's requirements with respect to the principal documents within the QMS and how they are to be managed. These documents shall be managed in accordance with Section 01 32 00 (*Project Communications and Document Management)* and Section 01 33 00 (*Submittal Procedures*). [A16]

B. **Quality Records**:

1. [A16]Pertinent Subcontractor or laboratory-testing service records shall form part of the record system. [A16] Although there may be a complete set of these records maintained by originating organizations, the Contractor [A13]shall[A13] ensure that the records needed for review are promptly submitted to himself and available to the Employer. The Contractor must ensure that a complete set of the relevant records are compiled within his archives upon taking over. [A9]These records shall be stored as required in Section 01 32 00 (*Project Communications and Document Management*).[A9]

2. [A16]To verify completion for taking over of the whole of the Works, the Contractor shall make summary statements of the records available, with diagrams, schedules, or tables to demonstrate that he has all the necessary records of inspections and tests, approvals, changes, as-built details, correction of defects / omissions, etc. for compliance of each individual part of the Works. [A16]

3. [A16]Upon taking over of the Works, the Contractor shall be required to submit packages of all records to the Employer for the whole of the Works or parts. The specific contents of each package shall be agreed-upon with the Employer. The packages shall be suitably indexed and labeled so that records for specific parts of the Works can be readily identified. [A16] [A9]These packages shall be completed as required in Section 01 33 00 (*Submittal Procedures*).[A9]

C. **Standard Forms**: Standard forms to be issued by the Employer and Contractor for required communication between them are illustrated in the following tables. [A9A17]The Contractor's forms shall be developed, standardized, and submitted as a part of the project management plan.[A17] They should be included in the Stage 1 submittal of the PMP as described in Section 01 31 00 (*Project Management and Coordnation*) for acceptance by the Employer. To the maximum extent reasonable, these forms [A13]shall[A13] be developed for use with the Employer's Document Tracking and Control System. See Section 01 32 00 (*Project Communications and Document Management*).[A9]

Employer	
Notice of Non-Conformity with Safety / Environmental Requirements	Notice of Non-Conformity with Quality Management System
Document Transmittal Notice	Conditions of Contract Sub-Clause 7.5 *(Rejection)* and similar (Site Notice)
[A16]Conditions of Contract Sub-Clause 3.3 *(Instructions of the Employer's Representative)*	Employer Instruction [A16]
Standard Forms for Construction Contractor	Stop Work Notice
Additional forms deemed necessary to effectively document execution of the Works.	

Contractor	
Request for Inspection	Material Inspection Report
On-Site Materials Report	Contractor's Submittal Form
Contractor's Technical Query	Contractor's Transmittal Notice

Contractor	
Contractor's Submittal Status Log	Contractor's Proposal
Contractor's Interim Payment Certificate	Contractor's Non-Conformity Report
Corrective Action Requirement	Stop Work Notice
Additional forms deemed necessary to effectively document execution of the Works.	

D. **Supporting Documents with Application for Interim Payment**:

1. [A17]The Contractor shall submit, as an attachment to each statement submitted under Sub-Clause 14.3.2 of the Conditions of Contract, a certificate stating that all design, construction, and/or testing activity conducted during this payment period have been completed in full compliance with the Contract, that all related quality documents and records are complete and correct, and that the Contractor's Representative is satisfied as to the validity of this certified statement.[A17] The QA Manager shall have available for audit a list of all related quality documents and records generated during the corresponding payment period.

2. The certificate shall be signed by:

   a. The QA manager, and

   b The Contractor's Representative.

E. **Quality Manual**:

1. The quality manual may be based on a corporate document or system in use by the Contractor. If so, it shall be reviewed and differences between the corporate system and the specific needs of the Contract shall be identified and described.

2. The Contractor's PMP shall identify these differences from the corporate quality manual that are specific to the Works and explain how they are managed within the Contractor's QMS.

F. **General Guidelines on the Quality Plans**:

1. [A16]The detailed quality plans shall define the procedures, practices, techniques, resources, and sequence of activities to accomplish the product requirements in compliance with the Contract. [A16] In general, each quality plan shall include, but not be limited to the following.

   a. Purpose and scope of the activities covered.

   b. References.

   c. Organizational charts illustrating the parties involved, their roles, main tasks, and their subdivision; responsibilities of key personnel; the reporting structure to be attained; and the quality management arrangements, including QA and QC supervision.

d. [A16]Definition of the interfaces within the team, including interfaces between design, construction, and Subcontractors.[A16]

e. General descriptions of the principal activities and how they are carried out.

f. Identification of the QMS policies, documents, and procedures required to implement the plan and the activities concerned.

g. Definition of what records are produced, when, by whom, and how these records are controlled and maintained.

2. The quality plans shall have a standardized format with a revision-control schedule and content index. [A9]At a minimum, the following data shall appear clearly on each page.[A9]

a. Page number.

b. Document/plan number.

c. Revision and status of the document.

G. **Details on the PMP**: [A9]Section 01 31 00 (*Project Management and Coordination*) presents the requirements for the PMP. The incorporation of quality and QMS into the PMP and its attachments are discussed in the following items, which must be included in the PMP.[A9]

1. The general management system of which the quality manual is a part.

2. The QMS to be adopted in the design, execution, completion, and commissioning of the Works.

3. Quality policies and objectives.

4. Structure and components of the QMS.

5. QMS differences from the quality manual, where applicable.

6. [A16]The duties, responsibilities, and authority of Key Personnel.[A16]

7. [A16]Procedures for procurement of Goods, equipment, and systems, and for assessing, selecting, and appointing Subcontractors.[A16]

[A13]8. Procedure for product identification and traceability.[A13]

9. [A16]Procedures for control of Subcontractors for obtaining, reviewing, and approving Subcontractors' documents; and for quality auditing of Subcontractors.[A16]

10. [A16]Procedures for managing Variations.[A16]

11. Control systems for definition of the QMS document schedules, monitoring progress, and updating the schedules.

12. Method and control of changes to the approved QMS documents.

13. Control of communications and documents.

14. Systems for submission of documents to the Employer.

15. General systems for control of records.

16. Systems for QMS monitoring, reporting, and performance improvement.

17. [A17]Control of non-conforming products and plans for implementation of associated corrective action processes.[A17]

18. The quality-audit procedure and initial audit schedule for the following 6 months.

19. Staff assessment, suitability, and training.

20. The required quality plans.

21. [A16]System for reviewing and verifying the quality, completeness, and applicability of operations and maintenance manuals and other technical documentation, special tools, and initial spare parts that are necessary for the proper operation and maintenance of the Works after taking over of the Works. [A16]

H. **Details Concerning Quality Plans**:

1. The quality plans shall define the procedures, practices, resources, and sequence of activities to accomplish the product requirements in compliance with the Contract.

2. Quality plans in general shall include the following.

   a. Purpose, goals, objectives, and scope of the work and activities covered, including a reference to the project quality charter.

   b. References, definitions, and applicable standards and conventions.

   c. Organizational charts illustrating the parties involved, their roles and responsibilities, lines of authority, management and reporting structure, work shifts, communication requirements, staffing levels, key decision-making positions, authority to stop work, and main tasks and their subdivisions and functions. The organizational charts and descriptions

must include the Contractor's internal quality-management arrangements, including QA and QC supervision.

d. [A17]Definition of the interfaces within the Contractor's internal project team and between the Contractor, Subcontractors and Employer's design team[A17]

e. General descriptions of the principal activities and tasks and how they are to be carried out.

f. Record, filing, and document management [A9]using DTCS in accordance with Section 01 32 00 (*Project Communications and Document Management*). This shall include[A9] document coding and access rights and restrictions; management of electronic files and signatures; document retention and control libraries; definition of what records are produced, when, and by whom and how these records are controlled and maintained; identification of the Contractor's QMS documents and quality procedures required to implement the plan and the activities concerned; document-control procedures, standards, and systems; document revision and updating procedures; and record safekeeping and backup.

g. Audit system, including schedule, structure, process, personnel, resources, and documentation.

h. Design-change management, including notices and control of design changes and quality checks.

i. As-built drawing management, including data and survey gathering procedures, QC checking, drawing format and conventions, and work and personnel scheduling.

j. Review and submittal procedure.

k. [A16]Investigation, surveying, and testing process — including procedures to ensure consistency of quality of materials and products supplied by Subcontractors; procedures to ensure quality and documentation of field and off-Site investigations; and procedures to ensure laboratory qualifications, certifications, and calibrations.[A16]

l. Training and certification requirements and procedures.

m. Post-construction documentation management. [A16]This includes procedures for verifying the accuracy, completeness, and applicability of operation and maintenance manuals and other technical documentation; special tools; and initial spare parts that are necessary for the proper operation and maintenance of the Works after taking over of the Works.[A16]

3. **Design Quality Plan (DQP)**: The DQP shall define the Contractor's structure, policies, procedures, and QMS documents for the QC of design activities for the Works. [A16]The DQP shall include quality-related actions and procedures such as conceptual-criteria reviews, intradisciplinary checks and interdisciplinary review reviews, drawing-specification cross-checks, multi-facility cross-checks, Subcontractor reviews, and reviews to determine if designs are constructible. The DQP shall include, as a minimum, the following. [A16]

   a. Specific allocation of responsibility, resources, and authority for the check, review, approval, and verification of the Contractor's designs by competent Contractor's Personnel. For interface management concerning design issues, the Contractor shall designate the personnel who will act in the role of design representatives during construction and shall define their functions.

   b. **Design-Quality Procedures**: This shall describe actions that will generally be followed in all specific procedures, including procedures for identification and review of design input, technical interfaces, design output, and design-verification requirements.

   c. Drafting-convention, plan-page, and layout formats, as well as computer-aided design and drafting conventions and standards.

   d. Design program, requirement and project-scope review processes and phase-approval schedule. This shall include design checking, as well as sequence and milestone reviews.

   e. A matrix of review and approval responsibilities for plans and design documents.

   f. Metrics to track non-conformances in plans and design documents.

   g. [A16]Procedures for the Over-the-Shoulder Reviews. [A16]

   h. Procedures for peer review checking of key elements of plans, specifications, and design documents. Peer reviews shall be documented, fully traceable, and performed by qualified specialists who are independent of the original work, but who have the expertise to perform the work.

   i. [A16]The design of the Hydraulic Systems and Lock Gates will require the performance of a review and certification by an independent checking engineer experienced with the design of hydraulic systems and lock gates. Qualifications of the independent checking engineer shall be submitted to the Employer's Representative for review. [A16]

j. Procedures and event triggers for creating corrective action teams. These temporary and often cross-functional ad-hoc teams, with specific talents and experience shall be tasked to find the root causes of problems, develop solutions, and ensure effective implementation.

k. **Error-Cause Removal Processes**. Formalized procedures shall give individuals a means of communicating to management about problems in order to ensure the quick resolution of problems and non-conformances.

l. **Follow-Up Procedures for Reviews**: [A17]Reviews shall be conducted as a part of any implemented corrective action process to ensure that they are effective and have not created new problems.[A17]

m. Plans, drawings, and specification-review checklists.

n. Submittal plan and procedures.

o. Identification of key opportunities for error.

p. Schedule of witness and hold points.

q. **Color-Coded Review**. A specific code system for documenting, checking, reviewing, and correcting plans and design documents shall be developed.

r. Design quality process flowchart and description steps.

s. Procedures for identifying statutory and regulatory design requirements and maintaining a status register.

t. **Risk Assessment**. This shall include processes for risk assessment of the design in relation to safe and timely execution of the Works and mitigation of these risks by including method statements and planned measures to contain the risks in the design output, as well as risk-assessment processes related to the operation and maintenance of the completed Works

u. Procedures for control of design changes, during both the design phase and the construction phase.

v. Identification of program training needs and a schedule of training.

w. Design of QA audits and certifications.

x. Process to certify design documents and input developed by others.

y. Structure and system design-certification procedures for design plans, design calculations, and computer design and modeling, including software verification.

z. Process to verify the accuracy and completeness of as-built drawings, specifications, and other construction documentation to foster the future ability of the Employer to locate utilities, make minor modifications, and enhance or alter the final constructed Works.

4. [A16]**Manufacturing Quality Plans (MFQPs)**: MFQPs from Subcontractors of long lead items such as the lock gates, pumps, valves, hydraulic systems, control systems or as identified by the Employer may incorporate pre-defined standard quality plans from the Subcontractor. [A17]Each Subcontractor quality plan shall be accompanied by a covering document incorporating by reference the previously stated general requirements and indicating the standard plan to which it is attached. The MFQPs, shall include the following.[A17]

a. [A17]The Contractor's staff members who are directly responsible for management of the interface with the Subcontractors.[A17]

b. [A17]The submittals that are required from the Subcontractors for the Contractor's review.[A17]

c. Controls for inspection and test activities and compliance criteria for the product, including inspection and test plans where appropriate.

d. The arrangements proposed for any quality hold or witness points and for verification of the product prior to dispatch.

e. [A16]The Subcontractors' systems for control of inspection, measuring, and testing equipment. [A16]

5. **Construction and Installation Quality Plans (CIQPs)**: CIQPs for main activities at the Site, as defined by the Employer, shall, as a minimum, include the following.

a. Construction quality management, inspection, and QC organization and responsibility, as well as identification of the Contractor's staff directly responsible for management, supervision, and compliance verification of the Works.

b. The specific methods of construction and/or installation that shall be followed together with an identification of the Contractor's method statements and risk-assessment requirements.

c. Coordination between construction QC and the design team construction QA function and with Employer quality verifications.

d. Surveying. Construction staking QC, including construction staking proof of compliance and tolerances for field survey verification and a coordination and interface procedure between surveyors for the Contractor and Employer.

e. Quality check points and witness points in which each activity, component, or construction phase is subject to at least 3 distinct phases of QC and QA inspections and verification, such as during the pre-construction phase, initial phase, and execution follow-up phase.

f. Inspection, test, and survey plan.

g. Environmental compliance and monitoring, including a monitoring schedule and environmental management documentation and records.

h. Supplemental drawings, such as shop and working drawings.

i. Identification of critical design/construction details and procedures for the design representative on Site.

j. Procedures for identifying and planning the statutory and regulatory requirements relevant to the Works being performed.

k. Submittals that are required with respect to the Goods that will be incorporated into the Works.

l. Requirements for control of inspection, measuring, and testing equipment.

m. Requirements and controls for any special processes.

n. Processes for verification of as-built information and incorporation of changes identified during construction.

o. QC staff training schedule and certification requirements.

6. **Commissioning, Completion, and Taking-Over Quality Plans**: [A9]These plans shall be reviewed by and coordinated with the commissioning team, incorporated into the the overall Commissioning Plan. [A17]They shall describe the systems for commissioning, testing, acceptance, and taking over in accordance with Sections 01 91 00 (*Tests on Completion and Tests after Completion*), 01 77 00 (*Taking-Over Procedures*), and 01 33 00 (*Submittal Procedures*).[A17] They shall include the following.[A9]

a. Inspection and test plans, procedures, and controls for commissioning, tests on completion and taking over of the Works, including the definition and documenting of the relevant systems and acceptance

criteria and a formal notification to the Employer that the facility is ready for the final stage of commissioning.

b. Procedures for completion of records and as-built information.

c. Procedures for completion of outstanding and remedial work.

d. Procedures and controls required for remedial work during the Defects Notification Period.

e. Identification of the various parties to be involved in the processes, including other contractors, relevant authorities, the Employer, and operators of the Plant and materials.

f. Processes relevant to the Contractor's obligations with regard to health and safety and environmental management during the commissioning, completion, and putting into service of the Works.

g. Identification of the Contractor's responsibilities and activities with respect to operations and maintenance requirements, including training.

7. **Inspection and Test Plans (ITPs)**: The ITPs may be in the Contractor's own format, but shall include the following as a minimum. [A9]They shall also be incorporated into the Commissioning Plan. [A17]See Section 01 91 00 (*Tests on Completion and Tests after Completion*) for additional information.[A17A9]

a. The series of activities, including the inspections and tests performed in a logical sequence, appropriate to the type of work.

b. Reference to the Contractor's and the Employer's procedure/instructions to control each activity.

c. The specification or standard reference.

d. The compliance criteria.

e. The personnel allocation for performing the activities, inspections, and tests.

f. The frequency of the inspections or tests.

g. The type of verification document or check sheet used to record the result of the activity.

h. A provision for the Employer to indicate his requirements to inspect or witness any activities.

[A9]I. (Reserved)[A9]

1.07 SYSTEM MONITORING AND PERFORMANCE IMPROVEMENT:

A. [A17]This item and its subordinate items identify the Employer's requirements with respect to how the Contractor shall monitor the functioning and performance of the QMS, identify problems, and initiate a corrective action processes in response to identified deficiencies or non-conforming Work.[A17]

B. The Contractor shall establish documented procedures for monitoring and analyzing performance in relation to objectives, product conformity, and the satisfaction of interested parties. The procedures shall identify the issues for measurement, define needs, and translate them into requirements. They shall identify what criteria are applicable, what measurements are made, and how the data will be analyzed. The issues for assessment shall include both achievement of performance objectives and satisfaction of interested parties.

C. The Contractor shall identify actions for improvement from the monitoring and analysis of performance and shall implement actions for continual improvement.

D. The Contractor's monthly progress report shall include a summary of the monitoring activities and results with an analysis of any trends and the identification of improvement actions.

E. **Monitoring and Measurement**:

1. **Satisfaction of Interested Parties**: Processes that shall be included in procedures for monitoring and measurement of satisfaction include the following.

   a. Defining the interested parties.

   b. Determining how to define the needs and the expectations of interested parties, e.g. contractual requirements, results of communications, feedback, and results of surveys.

   c. Measuring satisfaction by survey, questionnaires, and communication feedback, including complaints.

   d. Measurements by regular reporting, surveillance, and monitoring.

2. The Contractor's monthly progress report to the Employer shall include measurements that relate to the Employer and third parties/statutory authorities as interested parties. The Contractor shall consider the other interested parties in his internal reporting.

3. [A16]**Audit**: The Contractor's quality audit programme shall be documented as part of the Accepted Baseline Programme. [A16] The first version of the programme shall be submitted with the detailed Contractor's PMP; it shall thereafter be updated monthly and included in the Contractor's monthly progress report. The

audit programme shall be a rolling programme, covering at least the next 6 months. The monthly update shall include a marked-up summary of previous audits carried out up to the re-issue date. The Contractor shall permit the Employer's Personnel to attend and participate in his audits when requested. The Contractor shall notify the Employer Representative about quality audits that he intends to perform, with an indication of date, place, and subject of audits. The notification shall be provided in sufficient time for the Employer Representative to consider whether he wishes the Employer's Personnel to attend. For audits overseas, this shall be at least 30 days in advance; for audits in Panama, it shall be at least 14 days in advance, except in the case of impromptu audits when shorter notice is unavoidable. The Contractor shall permit the Employer to inspect and review all of his audit reports and related documentation.

4. **Monitoring and Measurement of Performance Objectives**: The Contractor shall implement monitoring and measurement performance objectives and processes in relation to the issues listed below, and they shall be included in his monthly progress report summary.

   a. QMS objectives — status of objective implementation and achievement.

   b. Time objectives — performance against time targets, i.e. programme.

   c. Cost objectives — cost control and changes in cost.

   d. Product-quality objectives — conformance requirements.

   e. Capability and performance of processes.

   f. Statutory and regulatory requirements.

   g. Performance of improvement actions.

F. **Control of Non-Conforming Product, Remedial Work, and Concessions**: [A17]This section is subject to Sub-Clauses 7.5, 7.6 and Sub-Clause 11 of the Conditions of Contract.[A17]

1. The Contractor shall implement a system of NCRs. [A9]Upon recognition of a non-conformance, an NCR shall be generated within the DTCS in accordance with Section 01 32 00 (*Project Communications and Document Management*) and with the Contractor's QMS. The item shall then be processed according to the established procedures.[A9]

2. [A9]The Employer may inspect and review NCR sheets and records when desired and as necessary for the Employer to accept remedial actions.[A9]

3. When the Employer notifies the Contractor of potential non-conformances in the Works, the Contractor shall investigate the matter and, where necessary, generate an NCR. Where the Employer considers that an item is in non-conformance and

notifies the Contractor in writing, the Contractor [A13]shall[A13] respond in writing within 7 days to confirm that he has either issued an NCR or to provide his reasons why it is not in non-conformance. [A17]Should the Contractor fail to respond within the time stipulated, the item shall be considered a non-conformance, reflecting non-compliance with the Contractor's obligations and requiring initiation of a corrective action process by the Contractor. The non-comformance will remain in effect until such time as the Contractor adequately responds to the satisfaction of the Employer.[A17]

4. When the Contractor proposes to carry out remedial work, he shall notify the Employer of the time and date of such work and request inspection of the defect and the work to rectify the defect. The Employer may elect to witness the remedial work.

5. [A17]If rectification cannot be accomplished by standard methods, the Contractor shall prepare a specific proposal for remedial action that shall be subject to his internal approval procedures, including the Subcontractor's approval if appropriate, and then submitted to the Employer for review.[A17]

6. [A16]When the Contractor considers that non-conforming work should be accepted without remedial action or when the remedial action cannot be accomplished without resulting in a deviation from specified requirements, he shall advise the Employer of his recommendations and request a concession for acceptance of the work concerned, giving his justifications for acceptability and such warranties as are necessary with respect to performance requirements which the Employer may in its absolute discretion choose to accept or reject. [A16]

7. [A17]No work will be allowed to occur onto the nonconforming item until the "use as is" or "repair" disposition has been approved by the Contractor and is approved by the Employer.[A17]

8. [A17]As part of the continuous improvement process, corrective action processes shall ensure that quality system failures, deficiencies within the existing quality system, inadequate administration of the existing quality systems, or series of related or repeating non conformances are identified and rigorous steps are instituted to preclude recurrence.[A17]

G. **Analysis of Data**:

1. The Contractor shall analyze data collected on the issues being measured and identify problems or items with the potential for improvement.

2. The Contractor shall analyze the data in appropriate categories and shall consider the suitability of time, cost, and quality objectives; the processes; the environment; and resources in arriving at possible solutions to problems and potential improvements.

3. Priorities of problems and potential improvements shall be identified to determine the order of action required. The assessment of priorities shall include consideration of the risks and the potential losses if an item causes non-conformance or detriment to the Works, people, or the environment.

H. **Improvement**:

1. The Contractor shall identify actions for improvement of his QMS leading to improvement in the design and execution of the Works from the monitoring and analysis of performance. The Contractor shall document and implement procedures for identifying and implementing improvements, communicating requirements, managing the necessary changes, and monitoring whether the improvements are effective.

2. [A17]Types of improvements considered shall include implementation of corrective action processes to correct and reduce non-conformances, preventive actions, opportunities for improvement not related to non-conformances, loss-prevention measures, and beneficial relationships.[A17]

3. A summary of actions taken to improve the QMS and their status shall be included in the monthly progress report to the Employer.

1.08 SYSTEMS ASSURANCE:

A. The Contractor shall carry out systems assurance to ensure that the requirements for safety, reliability, availability, and maintainability for the Works systems are adequately considered and that any modifications resulting from these considerations are included in the design of the Works.

B. [A16]The Contractor shall plan and implement this systems assurance in a systematic and logical manner that will demonstrate to the Employer that the requirements for safety and other issues identified in the Employer's Requirements and the Contract have been adequately addressed. [A16]

C. **System Assurance Activities**: Systems assurance activities shall include system safety; ergonomic studies; reliability, availability, and maintainability (RAM) activities; and the preparation of all supporting documentation.

D. [A16]Systems assurance shall be applied throughout the design, procurement, manufacture, construction, installation, on-Site testing, integrated-system testing, and the Defects Notification Period. [A16]

E. Prior to taking over, the Contractor shall provide the Employer with all systems assurance documentation, software, and procedures to enable the Employer to continue the process of managing systems assurance of the E&M systems.

F. The Contractor shall execute the systems assurance work in accordance with an approved systems assurance plan.

G. **Systems Assurance Plan**: The systems assurance plan and all associated plans, reports, and documentation shall be living documents and shall be updated as necessary, with the approval of the Employer, throughout the duration of the Contract. Within 90 days of the Commencement Date, the Contractor shall provide the systems assurance plan to the Employer for review and approval [A9]in accordance with Section 01 33 00 (*Submittal Procedures*).[A9] The plan shall demonstrate that the organization, resources, and procedures exist to manage all systems assurance activities. The systems assurance plan shall take the following matters into account.

1. The design of the system.
2. Interfaces within the Works and between the Works and civil infrastructure work.
3. Testing and inspection procedures associated with the Works.
4. Commissioning and taking-over procedures associated with the Works.

H. The subjects to be covered in the systems assurance plan shall include, but not be limited to, the following.

1. The scope and purpose of the system safety plan.
2. The scope and purpose of the system RAM plan.
3. The method for dealing with interfaces between the system safety plan and the system RAM plan.
4. The scope and purpose of the fire protection plan.
5. The scope and purpose of any ergonomic studies to be carried out.
6. A summary of all systems-assurance procedures proposed to be used by the Contractor, including those that the Contractor proposes to apply that may differ from or complement the requirements of the Contract.
7. The Contractor's proposals for internal and Subcontractor systems assurance and safety audits.
8. [A16]The systems assurance activities shall be included on the programme required in Section 01 31 00 *(Project Management and Coordination.)* [A16]

I. [A17](Reserved)[A17]

J. **Report**: A report shall be submitted at the end of each stage of the programme to cover, as a minimum, each of the items listed in Subparagraphs 1.08 G. and H. This report shall present an integrated approach between the different sections of the plan to demonstrate that the Contractor is addressing the requirements of each section concurrently.

K. **System Assurance Review Meetings**: Systems assurance review meetings shall be held weekly throughout the duration of the Contract to ensure that all systems assurance related activities are properly conducted at all times and to provide a forum for recording new hazards, reviewing tolerability of residual risks, and generally providing feedback to the Employer on progress toward a credible proof of safety for the operation of the locks.

L. [A16]**Audit**: The systems assurance plan of the Contractor and his Subcontractors shall be subject to audit by the Employer, with respect to the progress of associated activities in comparison with the programme. [A16]

M. [A16]**Subcontractors**: The Contractor shall be responsible for the review and acceptance of Subcontractor systems assurance plans to ensure consistency in approach with his own plan. The Contractor shall monitor the performance of each Subcontractor on a regular basis to ensure compliance with the systems-assurance activities identified in the systems assurance plan. [A16]

1.09 SUBMITTALS:

A. [A16]**Quality Manual**: [A17]The Contractor shall submit the quality manual including all other quality documents, as an appendix to the project management plan, to the Employer for review and approval.[A17] This shall be done as a part of the submittal process for the PMP, as stated in Section 01 31 00 (*Project Management and Coordination*) and herein. The manual shall include, among other things, the detailed quality plans, the DQP, MFQPs, CIQPs, and ITPs in accordance with the Accepted Baseline Programme and with Section 01 33 00 (*Submittal Procedures)*. [A16]

B. **Interface Management and Coordination Plan**: The Contractor shall submit this plan to the Employer for review and approval within 90 days of the Commencement Date.

C. [A17](Reserved)[A17]

D. [A17](Reserved)[A17]

1.10 QUALITY CONTROL AND VERIFICATION OF THE WORKS:

A. This item and its subordinate items identify the Employer's requirements with respect to how the Contractor shall control and verify that the requisite quality has been achieved.

B. [A16]QC and verification systems shall ensure and record conformance of the Works with the Contract and the documented quality plans. This shall include, where appropriate, quality monitoring of Subcontractors, Goods, services, Site conditions, and workmanship.[A16]

C. Inspection and testing shall be carried out on materials, workmanship, construction, finishing, functional performance, and identification systems to ensure conformance with the requirements.

D. Where Goods are supplied with recommendations or instructions as to how they are to be constructed, installed, assembled, handled, or operated, such recommendations or instructions shall be adhered to.

E. **Resources and Equipment**:

1. The QC and verification systems shall be implemented and operated by personnel competent to perform and supervise the necessary inspections and tests.

2. [A16]Equipment used for inspection, measuring, and testing shall be appropriate and fit for its purpose.[A16] Such equipment shall be operated, maintained, checked, and calibrated in accordance with the manufacturer's instructions. The equipment shall be maintained and used in a manner that ensures that any measurement uncertainty is known and is consistent with the required measurement capability.

F. **Inspection and Testing**:

1. Inspections and tests shall be carried out for Goods at source [A9]as specified by Contractor's quality plan.[A9]

2. Goods shipped or delivered to the Site shall not be incorporated into the Works before satisfactorily passing the required inspection and testing.

3. ITPs are required for all principal work activities, including design, manufacture, installation, construction, and commissioning. The contents of the ITPs shall comply with the requirements stated under QMS documentation.

4. [A16]Witness points and hold points shall be identified on the ITPs as directed by the Employer. A provision shall be made in each ITP for the Employer to indicate his requirements to inspect or witness any of the activities which make up the Works. Notwithstanding any other witness points that may be required by the Employer a witness point shall be established in accordance with the Conditions of Contract Sub- Clause 7.3 (*Inspection*) whenever the work is ready and before it is covered up, put out of sight or packaged for storeage or transport.

5. At witness points or hold points, the Contractor shall, at the Employer's Representative request, promptly present such documentation as necessary to verify that the specified requirements in the relevant quality plan or ITP have been met. [A16]

6. All inspection and testing personnel shall have appropriate qualifications. Testing of concrete shall be performed by technicians who are certified ACI Grade I, or equivalent.

G. **Works Inspection Requests (WIRs)**:

1. For each identified witness or hold point, the Contractor shall submit a signed WIR to the Employer. The WIR shall comprise:

   a. Notification of the witness or hold point having been reached;

b. A request for the Employer to attend a final inspection of the preparation or completion of a stipulated portion of the Works in a particular location before covering up the work or before proceeding with the next stage in such work; and

c. Confirmation that the work for which inspection is requested complies with the Contract, has been properly coordinated between all trades, complies with the design, and is or will be completed by the time stated, ready for such inspection and for the next stage of related work.

2. WIRs shall be dated and numbered and documented sequentially for each part of the Works to be inspected. Each WIR shall state:

a. The precise part of the Works to be inspected,

b. The time and date of the final inspection, and

c. The relevant drawing reference number and revision for the Works.

3. WIRs shall be produced [A9]and managed in accordance with Sections 01 33 00 (Submittal Procedures) and 01 32 00 (*Project Communications and Document Management*).[A9]

4. [A16]Without prejudice to the obligation to give reasonable notice in accordance with Sub-Clause 7.3 (*Inspection)* of the Conditions of the Contract the notification copy of the WIR shall be submitted to the Employer at least 48 hours before the time of the final inspection. For off-Site work on Goods abroad, a minimum of 14 days' notification shall be given.[A16]

5. The Contractor shall coordinate and advise the Employer of the precise time for final inspection if it varies from the time stated in the WIR. Before the final inspection, the appropriate Contractor's Personnel shall conduct an inspection and shall indicate that they have done so on the remaining copies of the WIR, thereby attesting that all trades have been properly coordinated and completed.

6. [A16]Should the Employer not attend the final inspection, the Contractor shall note this on the remaining copies of the WIR. If the Employer attends the final inspection, he shall sign the WIR attesting to being present and that a test did occur.[A16]

7. The Contractor shall take account of any comments made by the Employer and shall rectify any items as appropriate before proceeding with the next stage. Where the Employer has objected with comments, the Contractor shall request re-inspection by the Employer prior to proceeding to the next stage and shall submit a new request for inspection where necessary if more than 2 days have elapsed since the original inspection.

8. [A9]Unless otherwise required in Section 01 32 00 (*Project Communications and Document Management*), a copy of all completed WIR forms[A9] shall be forwarded to the Employer on a daily basis and within 3 days of completion of the work referred to therein. It [A13]shall be[A13] the Contractor's responsibility to obtain a receipted copy of the form to verify submission. Evidence of dispatch will not be accepted as evidence of submission.

H. **Factory and Site-Acceptance Tests and Inspection**:

1. [A16]During manufacture, the Contractor shall permit the Employer's Personnel to examine and witness any part of the Works being performed on the Contractor's premises off Site (including Subcontractor's premises). [A16]

2. At least 28 days before the Contractor intends to start the tests or inspections, the Contractor shall issue for review by the Employer a programme for the proposed factory tests and inspections. He shall, thereafter, regularly report progress and status to the Employer. This programme shall conform to the quality plans and ITPs for the products concerned. The Contractor shall include with the programme the proposed pro-forma documents for recording the results of the tests that the Contractor proposes to carry out. The tests shall include any statutory tests required.

3. [A9]Before dispatch of Goods, the Contractor shall, ensure that all manufacturers' factory inspections and tests called for in the specification and quality plans have been carried out.[A9]

4. For E&M Plant and the systems of which they form a part, the Contractor shall identify and give notice to the Employer of the following tests, according to the general requirements described above and elsewhere.

   a. Factory-Acceptance Test 1, which is the test performed in the factory for each Plant prototype.

   b. Factory-Acceptance Test 2, which is the test performed in the Factory for each system.

   c. Factory-Acceptance Test 3, which is the test performed in the factory for systems to be delivered under the Contract acting together and for which systems-integration tests are required.

   d. Site-Acceptance Test (SAT) 1, which is an inspection and test for the installation on Site of each Plant component.

   e. SAT2, which is the test performed on Site for each system.

   f. SAT3, which is the test performed on Site for all systems to be delivered under the Contract acting together and for which systems-integration tests are required.

   g. SAT4, which is the test performed on Site for all systems from all portions of the Works acting together under full load, and where Systems lntegration Tests are required.

5. A system is a combination of Plant elements that is required to act in unison or in a coordinated and interdependent manner in order to achieve a specific function or result. Systems integration shall ensure that systems operate together harmoniously in order to achieve the purpose for which each individual system and group of systems was designed, with systems-integration testing to determine whether systems work together as a proper integrated whole.

6. After all SAT3 tests for all systems have been performed and the tests have been accepted, a test plan for the SAT4 tests will be finalized by the Contractor and provided to the Employer Representative for approval. The draft plan shall be submitted to the Employer Representative 180 days prior to the scheduled system test.

7. [A16]The Contractor shall provide experienced staff to assist with all SAT4 tests in the resetting of equipment and alarms and the performance of similar tasks. [A16]

I. **Records and Reports of Inspections and Tests**:

1. The Contractor shall ensure that records and reports of all inspections and tests are maintained [A9]in accordance with Section 01 32 00 (*Project Communications and Document Management*,) and as required herein,[A9] to demonstrate conformance of the Goods to the Contract, applicable standards, documented quality plans, ITPs, and procedures.

2. The Contractor shall ensure that he has obtained and reviewed final inspection and test records or certificates for all Goods before incorporating any such Goods into the Works. He shall insert these certificates into his records system. For taking over, he shall obtain complete packages of the relevant off-Site records for his records.

J. **Laboratory Testing**:

1. [A17]Except where they are specifically indicated to be provided by another identified entity, the Contractor shall provide for laboratory testing of Materials and Plant to demonstrate compliance with applicable standards and the Contract and as specified or required by governing authorities.[A17] Laboratory testing shall be performed by a competent testing laboratory.

2. The Employer may require that [A9]the varied or [A13]additional[A9A13] tests instructed by the Employer under the Conditions of Contract Sub-Clause 7.4 (*Testing*) be performed by an independent testing laboratory designated by the Employer.

3. All off-Site testing laboratories shall be registered, licensed, or certified, for capability to perform the proposed tests, by government agencies or appropriate certification agencies in the country where they operate. Within Panama, they may be recognized government or university laboratories. Details of laboratory,

control systems, and capability/registration documents shall be submitted to the Employer for review, if so requested.

4. Any on-Site laboratories shall be established by independent testing organizations.

5. The Contractor shall arrange and pay for an independent quality-audit programme for his on-Site testing laboratories, which shall be carried out by recognized independent consultants or testing agencies whose details shall, if so requested, be submitted to the Employer for review. Independent audits shall be conducted for initial acceptance, after the first 6 months of operation of the laboratory, and, as a minimum, annually thereafter.

6. On-Site laboratories shall not be used for testing Goods and the Works until such laboratories have been subjected to the initial audit and approval for the appropriate activities by the Contractor's independent testing agent/consultant.

7. The Contractor shall notify the Employer of the timing for independent audits so that the Employer may attend as an observer. The Employer shall also be permitted to carry out such further audits of the testing facilities as he reasonably requires between the independent audits.

9. [A16]The Contractor shall set up a standard system of giving reasonable notice to the Employer of his proposed laboratory testing so that the Employer may witness tests as required. [A16] The Contractor's system shall include a means of identifying and notifying the Employer of all testing and hold or witness points expected in the coming week.

END OF SECTION

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